STUDENT PROPOSALS FOR THE DESIGN OF DEVICES TO IMPROVE MS. SANDI MUGFORD'S EXPERIENCE OF FUELLING HER CAR

ENGINEER 1P03, Fall 2013 — Engineering Profession and Practice
Professor Robert V. Fleisig, Ph.D., P.Eng.

McMaster University ENGINEERING

Abstract

Engineering Profession and Practice (ENGINEER 1P03) is a term-long course for first year engineering students at McMaster University. The course introduces the engineering profession, and includes ethics, health and safety, sustainability, design skills and team skills. The course is taken by every student in Engineering 1 (Level 1 Engineering). In 2013, there were 940 students enrolled, 28 teaching assistants, a course co-ordinator, and one instructor.

Each year the course culminates in a final design project where the students work together in teams of four or five to design a solution for a problem for a real-world client. The project lasts six weeks, and a two-hour tutorial session is dedicated each week to team project work. In addition to the in-tutorial work, approximately twelve lecture lessons are used to support the project, and include presentations by users, stakeholders and specialists.

In 2013, the 199 student teams designed devices to assist the client who had rheumatoid arthritis. The students worked in their teams to define the problem, generate the objectives and functions of the design, create a list of design alternatives and build a working prototype. The teams then presented their design and justified their choices, with the best projects presented in front of the client and faculty members at the annual showcase. This document is a compilation of abstracts belonging to the entire class.

Design Brief

Client

The project was designed with a specific client in mind. The client is a 60-year-old woman who has been affected by severe rheumatoid arthritis for over 50 years. She has recently purchased a new vehicle, and is having many problems adjusting to some of the car mechanisms. Due to the arthritis and a series of injuries, she is unable to move her neck more than a few degrees to either side, has limited motion and flexibility in the wrists, and can not lift more than five pounds with her right arm. Due to these injuries, tasks like moving the drivers seat or opening the trunk are difficult.

User

The user for this design project is a person who has hand and arm dexterity impairments, including rheumatoid arthritis, osteoarthritis, multiple sclerosis and acute injuries. This user is also experiencing some of the negative effects of aging, making tasks that they once could do much more difficult. The user is also the client.

Problem

A notable problem for the client are the various tasks required when pumping gas. The client's car has a newly designed gas cap that is easy for her to open, however she still struggles with the mechanism to open the gas hatch inside of the car. Once out of the car, the client often has to quickly swipe a credit or debit card in order to pre-pay for gas, which can be quite difficult when one is dexterity-impaired. Furthermore, most gas stations in her area have eliminated the latch mechanism on the gas pump, forcing the client to tightly grip the pump for an extended period of time.

We have chosen the problem of pumping gas due to the many obstacles that she faces when completing the task. After meeting with the client, we have determined that the issues that the students will have to identify and resolve over the course of the project are dexterity, portability, weight and affordability.

Showcase Winners

Finalists

In a class of 940 first year engineering students, there were 199 teams. From these 199, eight teams were selected to present their designs to a group of judges that including McMaster University faculty and the client. The top eight teams were:

1. F06-227-7 (page 103)
2. F07-124-3 (page 111)
3. F11-126-2 (page 183)
4. F13-124-5 (page 217)
5. F15-227-4 (page 243)
6. F17-126-1 (page 267)
7. F18-227-5 (page 293)
8. F20-126-3 (page 323)

Top Presentation

On December 5th, 2013, the team F20-126-3 (page 323) won the award for the best presentation. The team was comprised of:

- Pak Lui
- Eliad Moosavi
- Nathan Nywening
- Yixing Sun
- Christina Zeuner

Top Design

On December 5th, 2013, the project “Pumped” was selected by the showcase committee as the top design in the class. This project is described on page 268. The team members of the top design team, F17-126-1, are:

- Peter Do
- Rosa Luo
- Daniel Merlano
- Saif-ur Rehman
- Mackay Russell

Pump-Aid

Arthrotech Devices Inc.
F 01-124-1

This device is 37 cm long without the hand strap attached. The strap itself is 23 cm long.

Problem Description

The assignment is to design a device that enables Sandi Mugford to maintain independence and reduce pain at the gas pump. This device helps her to overcome the physical setbacks of rheumatoid arthritis. The team's design was focused on the pump's handle trigger which controls the flow of gas. The trigger requires more gripping strength than Sandi has available.

Design

The contact component of the design is the gas handle trigger actuator. This is a curved wooden block that is inserted next to the gas pump trigger. It is attached to the lever handle that is used to easily rotate the block and force the gas trigger upward, allowing gas to flow.   The handle was added to provide leverage and ease of movement. The device does not lock in place, the lever is simply held in position until the user has filled the gas tank with the desired amount of gas. The handle is then rotated back and the device is removed from the pump trigger. For temporary self-storage, a hand loop is attached to allow the handle to hang about the user's wrist.

The component breakdown for the device consists of a wrist strap hooked into a metal eye-hole that is mounted firmly into a foam handle. The foam is wrapped around the hand placement end of the lever, making it easier to grasp. The other end of the wood lever is attached to the actuation foot. The wooden foot is approximately the size of a fist, with one curved side. It is specifically sized to fit into the space between the gas nozzle trigger and the metal handle loop. The device has smooth edges and soft loop handle providing safety for the user. The total weight is about one pound making it a light-weight device to handle and carry. The total length of the device including the handle is approximately two feet long and is narrow.

Functionality

The device provides an easy alternative to hand pumping gas. The client cannot hand pump gas comfortably and this device is quick to insert and activate the gas pump trigger. It is also easy to store in the car when not in use, and can be hung from the wrist while completing the rest of the gas purchasing tasks. Therefore this device accomplishes the request by the user for easing the process of filling the client's gas tank.

Materials, Components, and Assembly

The design consists of four main components:

Hand Loop

The hand loop is a standard dog leash handle that can be found at any pet store and costs $2.50.

Eye-Hole Connector

This is a metal loop that connects the hand loop to the lever. This piece can be bought at a dollar store for $1.00.

Lever Handle

This consists of two paint sticks glued together and wrapped at one end with perforated foam. The wood can be found at any paint store and costs $0.25, while the foam can be found at a dollar store for $1.50.

Block Actuator

Two blocks of wood that are glued together and attached to the lever with epoxy glue. The wood and the epoxy glue can be found at a home building centre for a total of $3.00.

All wood components were coated with lacquer found at a home building centre and costs approximately $3.50.
The tools required to assemble the device include a wood saw, a coping saw, sandpaper, and file.
Time assembly is approximately four hours. Simple instructions could be given with an exploded view of the components. With these documents, it could be confidently assembled.

Use

1. As the client exits the vehicle, she takes the Pump-Aid from the trunk and hooks it onto her wrist.
   AFTER PUMP NOZZLE IS INSERTED IN GAS TANK
2. The client then removes the device from her wrist and inserts the curved block end into the lower nozzle trigger space.
3. Grasp the foam handle of the lever and push forward towards the car.
4. Maintain holding position until desired gas level is reached.
5. When desired amount of gas is reached, pull back on handle and remove from the trigger.
6. Hook loop back onto wrist until going back to the trunk of the car.

Benefits

The design has many benefits that were taken into consideration. The Pump-Aid Lever is inexpensive to build, costing only $11.75 for the materials. It can be assembled with four hours of labour, costing approximately $15.00 an hour. This design is lightweight, weighing only a pound, and can be easily stored in the car. It has a foam handle for comfort and the lever allows the user to use arm strength instead of hand grip strength to complete the task.

EZ Pedal

Medical Engineering & Trades
F 0 1 - 1 2 4 - 2

Problem Description

We aim to address Dr. Fleisig's task of assisting Sandi by designing and building a tool for use in any gas station which will make tasks on location easier with respect to her motor skill capacity; as required tasks at gas stations can be painful for people with her condition.

Design

Our design will be used to assist with keeping the handle up while pumping gas. It can be used very much like the gas pedal on a car. Once it has been set up, all the device requires is to be pushed down with the user's foot. Our design is very light, and when put away occupies roughly 128cm^3, which is very small.

Functionality

This device will allow Sandi to use her feet instead of her hands, thus alleviating a lot of the stress that is currently placed upon her at the gas station. With regards to the problems Sandi faces in terms of the gas nozzle, our device accomplishes her requests to limit the use of her hands. It does not address the issue of the weight of the gas nozzle, however Sandi has mentioned that that is only a problem for a short period of time, therefore it is not crucial that it is fixed. Because of this, we feel that our design successfully fixes the main part of the problem with reference to the gas nozzle.

Materials, Components, and Assembly

Our design consists of a bungee cord, a hook made from a clothes hanger, a piece of rubber, and a pedal that was made out of a piece of wood. The total cost for the design is $4.00 and all the materials were purchased at Dollarama or were previously owned. The tools that were used to build the design were: a metal lock to mould the hanger into the desired shape for the hook, a lighter to burn the ends of the rope where it was cut so it would not fray, glue to attach the rubber to the hook, and a screw that was used to make a hole in the wood. The building process was rather simple, however instructions to get the coat hanger into the desired shape may be needed. Our device does not require assembly after it has been built so no further instructions are required.

Use

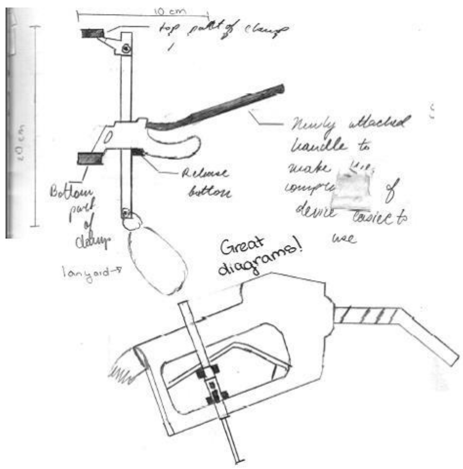
Sandi will use this device by attaching the hook to the handle on the nozzle, then wrapping the string around the top as depicted above, to create a pulley. The pedal will then be dropped to the ground where Sandi will step on it, which will pull down on the string, which will in turn pull up on the handle. The device can be stored in Sandi's car in the backseat, the trunk, or wherever she feels is most comfortable. Since the device is small and lightweight, it can easily be carried in one hand. It can be hooked around the door handle while Sandi is performing other tasks.

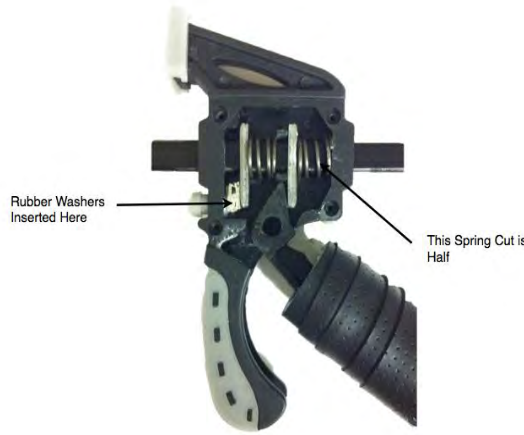
Benefits

Our design is better than existing solutions because it requires very little use of Sandi's hands. Given the similarity of our design to the pedals in a car, and Sandi's ability to drive her car, she will have no trouble using our design. She has mentioned that it is most difficult for her to use her hands; therefore we thought that it would be most efficient to eliminate the required use of her hands as much as possible. Many of the designs of our peers require the use of Sandi's hands in one way or another, some for the entirety of the time the device is in use. Our design is therefore better because it eliminates the necessity of using your hands, which Sandi finds most difficult.

Sunexo

Life Engineered
F01-124-3





Problem Description

Dr. Fleisig raised a problem to design a device for Sandi Mugford, a person that has physical limitations caused by Rheumatoid Arthritis, which allows her to use a self-serve fuel dispenser with less physical strain, time and more independence.

Design

The device has only two functions: lock the spreader if the lever is pressed, and release the spreader if the lever is released. It is important to note that the pressure required to keep the handle pressed is much less than the pressure required holding the lever of the gas nozzle. It is a very simple design and only has 3 main components: steel rod, plastic spreaders, and a nylon handle. It is 150 mm in length and weighs 500 grams.

Functionality

The device is intended to help the user with the fuelling process of her car at a gas station. It helps hold up the lever of the nozzle, where she will have to apply a minimal force compared to that of what she has applied before. It contains the aspect of the dead man switch as explained below.

Materials, Components, and Assembly

In order to build this device you need a #00 Phillips Screwdriver, a pair of wire cutters and scissors. The minimum amount of labor to build this device is 50 min. including drying period. The patron building the device must be capable of some fine motor skills as well as basic tool knowledge. Remove the four Phillips screws from the 4” ToolTech Clamp/Spreader (Appendix J) encasing and remove cover. Using scissors cut out three 5mmx5mm pieces from rubber washers and insert the washers between the release button and lock, causing lock to be in a permanent open state. Use wire cutters to cut spring on lever lock mechanism in half. Remove this half. Reinstall encasing and screw in the four phillips screws that were removed. Using scissors, cut legs off a standard staple. Adhere staple to main bar using the Cyanoacrylate at point where the bar will rest leaving a 2” gap between the two spreader heads at a standard position. Take a 1” to 3/4” Nylon Tube Hose Reducer and wrap with Tennis Tape Grip. Apply some Cyanoacrylate in the interior of the tube then insert it on the pump-able handle of the ToolTech body with the smaller (3/4”) side facing towards the device. Lastly, attach lanyard onto bar end.

Materials Required	*Location Purchased*	*Cost*
4” ToolTech Clamp/Spreader	Canadian Tire, 50 Cootes Dr, Dundas, ON L9H 1B6	$3.00
Rubber Washer	Canadian Tire, 50 Cootes Dr, Dundas, ON L9H 1B6	$0.49
1” to 3/4” Nylon Tube Hose Reducer	The Home Depot, 122 Martindale Crs., Ancaster, ON L9K 1J9	$0.89
Tennis Grip Tape	Canadian Tire, 50 Cootes Dr, Dundas, ON L9H 1B6	$3.99
General Cyanoacrylate (Super Glue)	Dollarama, 101 Osler Dr, Dundas, ON L9H 4H4	$1.00
Lanyard	Dollarama, 101 Osler Dr, Dundas, ON L9H 4H4	$0.59

Use

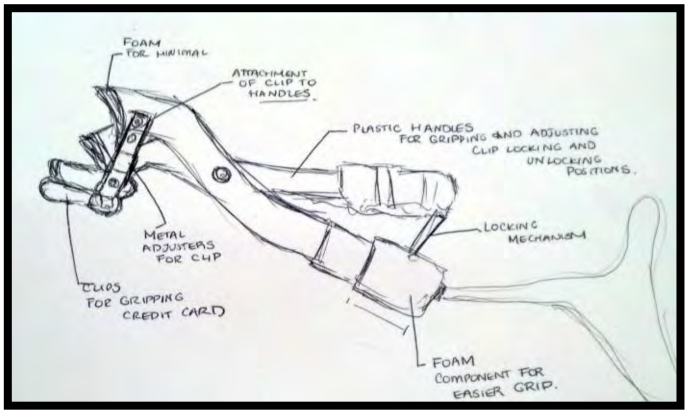
Once the user and/or client has arrived at the gas station, she will need to take the device out possibly from the driver side door pocket and bring it with her as she walks over to pump the gas. The device is attached to a stretchy band allowing her to carry it around her neck or her wrist for ease. She would then take out the gas pump and place the fuel nozzle into the cars gas tank as usual. Using the device, she will be able to pull the lever (gas trigger) up and allow the device to sit there. This will allow the gas to flow into the car. In order to keep the flow of gas going, Sandi must hold together the handles on the Sunexo. Once the handles are separated the device will release the gas trigger causing the flow to stop. Therefore, this step can be done whenever Sandi decides that the amount of gas is enough. Sandi will then have to take out the nozzle and put it back into its original rest area and she can then proceed with her payment as she normally would do. Since the device will be worn by her and is light weight, she will not have to worry about placing it back in the car when completing other tasks.

Benefits

With its ergonomic grip and easy-to-use method, the Sunexo puts less strain on Sandi's hands. Sandi no longer has to grip the gas nozzle handle for an extended period of time. The achieved gun grip on the Sunexo is designed perfectly to accommodate Sandi's specific physical condition. It is also, cost-efficient, durable, waterproof, time-efficient, weather-independent and portable.

Oryx – Rigel 2.0

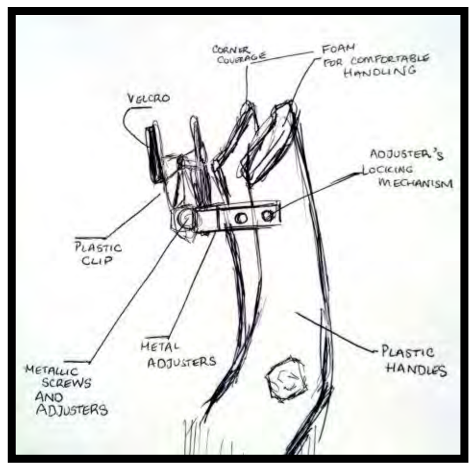
Tymar Engineering Inc.
F01 - 124 - 4



Top: A sketch of the device with labelled functional parts.
Bottom Left: Device in its early stages.

Top – Right: Oryx – Rigel 2.0
Right: Close-up detailed sketch of final design.

Closer view of the clip and the metal bars (adjusters).



Problem Description

The goal was to complete a final product that would allow the client to make a payment at the gas pump using her bankcard with more ease. The device will permit the client to insert and remove her card from the machine with less effort and wrist movement. This product will ultimately enable her to become more comfortable, itinerant and independent while at the gas pump.

Design

The design of the device itself is portable and this speaks volumes of its overall weight. Since it is portable, it also is normal hand-carry size. The client will not have to struggle to carry a massive device from her car and stay in fear of dropping it, breaking it or hurting herself in the process. In addition, the versatility of this device will allow it to be used in locations outside of the gas station and in any situations in which our client may need assistance inserting and removing objects, no matter where she may be.

Functionality

The Oryx-Rigel 2.0 implements and addresses any excessive actions that the client may take to fuel her car at the gas station. Although the device itself addresses concerns that involve insertion of her credit card and removal, in addition to the use of the keypad device, the device's ease of use allows for much more mobility and continuous versatility when being used. Due to the large handles on the device, users can simply use the palm of their hand or any other method required to grip the handles with little movement from any muscles. In addition, the locking mechanism allows for less strain as the client does not have to rely on her arms to grip the handles in an open position and then have to struggle to place her card inside the clip. Instead, the lock and base for the card allow for less handling and cause for minimal struggle while juggling many different objects all at the same time. Additionally, the clip's size and adjustability allow for simple movement when inserting the card inside the card slot.

Materials, Components, and Assembly

The construction of this device will require the following: quarter inch screws, two inch bolt and nut, plastic kitchen clip, one square inch of Velcro, masking tape, six square inches of plastic, a three-inch thin metal bar, Styrofoam, super glue, thin rope and two plastic rods (each one foot long). Construction does not require a high level of expertise however, the constructer must be capable of operating a power drill and comfortable using sharp objects. After drilling a hole in the center of the plastic rods, the nut and bolt will be used to secure them together in the center. Then the clip will be attached to the end of one rod, and the three-inch metal bar. The three-inch metal bar will be connected to the end of the second rod allowing for opening and closing of the clip. Styrofoam should be wrapped around the other end of the rods to cover the handles. Rope should be attached using masking tape to form the necklace. The main body of the device is now completed. To make the card-holder, cut the plastic into two pieces and form an "L" shape using the tape to hold it together. Use the super glue to connect Velcro to the outside of the clip and the inside of the plastic cardholder. A hole will be drilled into the side of the plastic rod; this is where the bolt will be inserted to form the locking mechanism. On the side of the plastic rod opposite to the bolt, drill a similar hole (about ½ in diameter) to act as the slot for the locking mechanism.

Use

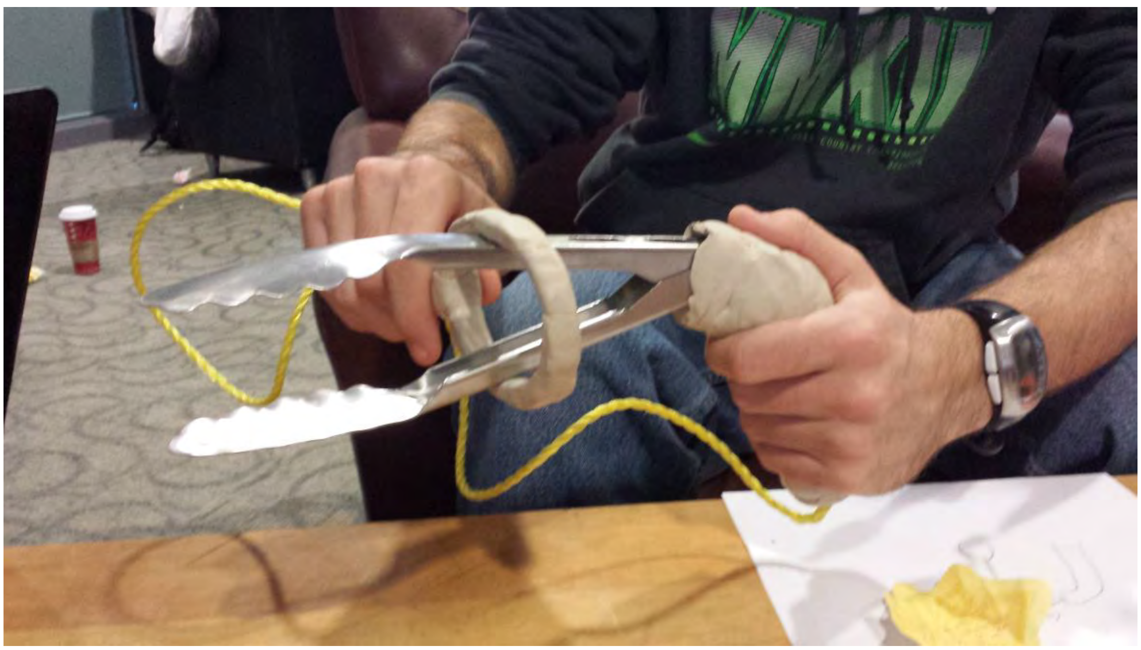
1. The device can be kept inside the glove compartment, car seats, backside of the inside of the car, or in any place compact and within reach of our client, Sandi Mugford.
2. The strap attached to the back of the Oryx-Rigel 2.0 acts as a strap that can be worn around any possible body part of our client, whether she chooses to strap it to her purse or perhaps even wear it.
3. The Oryx – Rigel 2.0 can then be taken off and held outwards. Our client will have to hold the device, with the clip away from her body.
4. The Oryx – Rigel 2.0 can then be used with the attachment of the lock in its specified position. This will allow the clip to lock in an open position with little effort from the client.
5. The extra piece of the Oryx – Rigel 2.0, the card base, can then be attached using the Velcro to the clip at the frontal of the device.
6. Then, Sandi must place her card inside the bearing of the open clip, with the card base acting as a barrier between the ground and the card.
7. Using non-excessive hand movements, remove the lock from its locking position so that the clip encloses around the card and prevents it from falling.
8. The card base can now be removed without worrying about the card falling through.
9. With little strain, the card can now be placed inside the card slot with simple insertion and no pain.

Benefits

This device allows Sandi to insert her card by using her forearm strength with little strain on her fingers and hands. The lightweight design and small size of the device allow for great portability. The client can effortlessly utilize her space with little effort and greater acknowledgement of her surroundings. The lightweight design combined with the neck strap makes it easy for Sandi to support the device on herself. The neck strap ensures that the user is not required to hold it all times; thus allowing space for multitasking other necessities.

Pump It Up!

Good Samaritans Engineering Inc.
F 01 - 124 - 5



Problem Description

Sandi, our client, requires a way to use a gas pump that is suited to her condition. This device will aid Sandi by making the process more efficient and reduce her pain.

Design

This device weighs roughly 3-4 lbs. and is to be handheld. It is portable and small in size, therefore will not interfere with Sandi's regular routine at the gas station.

Functionality

The device uses a constraining mechanism to push the trigger of the gas nozzle to allow the gas to flow. This device helps Sandi because it changes her hand's motion of pumping gas to a more comfortable motion that relies less on her joints. As well it gives her a mechanical advantage and therefore she needs to expend less energy to pull the nozzle trigger.

Materials, Components, and Assembly

The materials used for this device are thermal plastic ($25.00), one zip tie ($0.50), and metal salad tongs ($10.00), therefore $35.00 was the total cost of the device. The salad tongs and the zip-tie can be obtained from any hardware stores. The thermal plastic can be ordered online. The tools required for construction include a pot, wire cutters, and utility knife.

Firstly, the tongs were modified by removing the locking mechanism they came with. The handle seen in the picture place at the end of the tongs was molded out of the thermal plastic. The thermal plastic was boiled then a sheet of it was taken out and molded into the shape seen in the picture. The tongs and the handle were attached together using zip ties. Finally the ring and its handle were constructed from thermal plastic.

Use

1. Take out the device from the car's trunk
2. Position the device into the gas nozzle placing one tong over the nozzle and the other under the trigger.
3. Slide over the device to compress the tongs
4. When the gas is done pumping, let go of the ring handle for the device to disengage

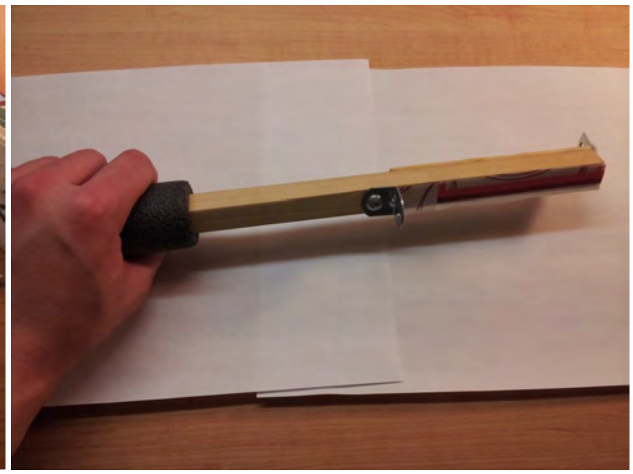
The device is hand-held and it will be carried by the user from its handle. As the device is portable enough, it can be kept in the trunk or in the glove compartment due to its small size.

Benefits

This device meets all of the objectives presented in the problem statement. In comparison to other designs, this device is very portable and simple to use. Also it meets all of the rules and regulations that such a device is constrained under such as disengaging once the user lets go of it. In comparison to other groups, this device is intuitive for the user to use

HandiPumper

HandiPump
F01-124-6



|------------------|
10 cm

Problem Description
To design a device for Dr. Fleisig and Sandi Mugford that reduces pain and effort associated with refuelling at a gas station. This device would be used by Sandi.

Design
The design of the HandiPumper is very simple and lightweight. It can be used to easily pump gas without straining Sandi's hands by utilizing the force of gravity rather than working against it. The HandiPumper is compact and can be used effortlessly, then, if necessary, can be stored in the narrowest of spaces because of its slim design.

Functionality
The HandiPumper is used to easily lift the trigger of a gas pump while refuelling a vehicle. It uses the force of gravity, and allows Sandi to avoid using her hands at all by giving her the option to use her wrist, forearm, elbow, etc. The HandiPumper is also safe, and will disengage if let go, negating the possibility of gas leakage in case of an emergency.

Materials, Components, and Assembly
The materials and components used are very commonplace at hardware stores. These materials include one thin wooden beam, two right-angled brackets, two screws, one paint stick, one silicon strip, one pipe insulator, and super glue. The cost of these materials sums to about $5.00, and many of the materials can be used to make multiple devices, lowering the cost for each device to about $3.00. A screwdriver and a saw are necessary in the assembly of the HandiPumper. The assembly process is quite simple, and should only take ten to fifteen minutes, and given the HandiPumper's simple

design, special instructions are not necessary for its assembly.

Use

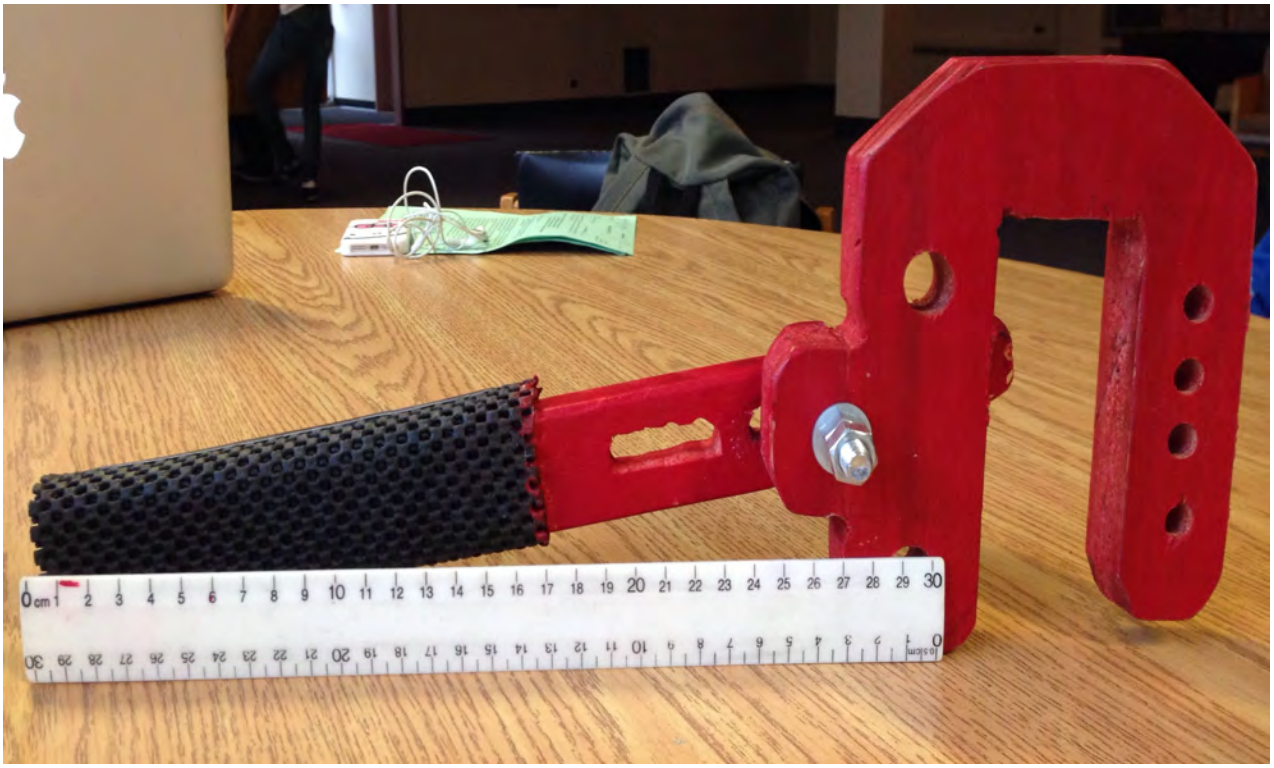
1. Device can be stored in the trunk, back seat, glove box, and any other small storage compartments in her car.
2. Carry the HandiPumper by the soft grip with one hand to and from the gas pump.
3. Slide the HandiPumper into gas pump sideways so the upward-pointing bracket is facing the car.
4. Turn the HandiPumper ninety degrees so that the same bracket it facing up.
5. When ready, apply a downward force on the soft handle until the trigger on the gas pump is pushed enough to pump a steady flow of gas.
6. When the tank is full, stop applying pressure, and turn the device so that the upward bracket is facing the car again.
7. Slide the HandiPumper out of the pump.
8. Put the gas pump back in its holder with one hand, while holding the HandiPumper with the other.
9. Bring the HandiPumper back to where it is normally stored.
10. Get in the front seat and drive away!

Benefits

The simple and lightweight design of the HandiPumper gives it the edge over other existing solutions. Since the device is so straightforward, the room for error and complications is made to be extremely thin, almost nullified. Even the construction of the HandiPumper is quite simple. Other products involve many complex instructions for use (having to set it up and pick it up off the floor) and for assembly (welding and use of large tools). In both situations, for both use and assembly, the HandiPumper far outclasses its competition.

The See Saw

Solutions Simplifed
F01-124-7



Problem Description
Sandy is an individual who suffers from Rheumatoid Arthritis and is struggling to fill and pay for gas at gas stations. Sandy and Dr. Fleisig are asking for a device that would allow her to complete these tasks exerting less pain and taking up less time, while maintaining her independence.

Design
The design is approximately 40 cm long when extended outwards and weights approximately 2 lbs. It is able to fit in the side pocket of the drivers side door of most vehicles. It features a lever mounted to a “n” shaped main body that goes over top of the gas nozzle

Functionality
The device is capable of squeezing the trigger of a gas nozzle by using arms strength instead of grip strength. It accomplishes the task of making the filling of gas a much less painful experience

Materials, Components, and Assembly
The main body of the design is made with a board of particle wood. The pivot of the lever is a large screw and 3 bolts. The grip is made of a mesh fibre and held together with electrical tape. All of the materials can be purchased at a standard hardware store. Construction of the device is relatively straightforward. The lever arm and main body were cut from the particle board using a table saw into their respective shapes. Both parts are

drilled with several holes to reduce weight and a slot is cut into the lever (for the sliding mechanism) and a large hole in both the lever and main body. The screw and bolts are threaded through this large hole and tightened. Then the handle was wrapped in the fibre mesh and held together with electrical tape. Finally the design was painted with a weatherproof red paint.

Use

In order to use the device, the lever must start in the position that is extended outwards. Then the main body is placed over the top of the gas nozzle. The lever can now be slid underneath the trigger and the device will be set up. Now in order to use the device the user simply needs to push down on the longer side of the lever and this will push up on the gas trigger and the gas will begin to flow. If the user stops applying a downward force on the lever, the trigger pushes it back down and the as stops flowing.

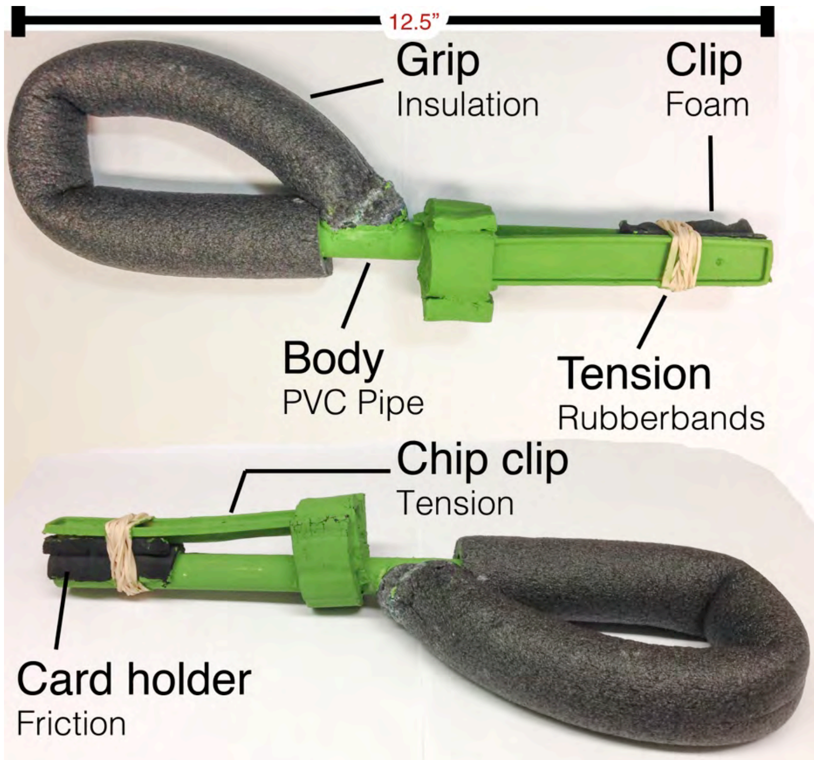
Benefits

The primary benefit of this device is that it uses the clients arm strength instead of grip strength. The client has much more strength in their arm and this reduces the paint caused by gripping the gas nozzle to almost zero. This design is superior to other designs for numerous reasons. One benefit is the use of wood which makes the design very strong and rigid. It is quite capable of surviving drops from a reasonable height, and will not fall apart on the user unexpectedly. It also has features that make the use of the design as comfortable to the user as possible, such as foam padding for the grip. It is also a relatively compact design that can fit exactly where the client wanted to store it (the driver's side door compartment). Another benefit is the refined look of the design. If the client is using this in public, it does not look as “scrappy” as some of the other designs that were presented.

Guide Glide

team innovation

Team Innovation
F 0 1 – 1 2 4 - 8



Problem Description

The goal was to design and build a device for the clients Dr. Robert Fleisig and Sandi Mugford to help the user, Sandi, who is suffering from rheumatoid arthritis. To reduce her pain and improve her experience at the gas station, the device reduces the time required to insert the card and it removes the need for fine motor control, while replacing it with the ability to use larger movement for the same tasks.

Design

The design is very lightweight because of the material used. The grip on the device was very light and soft so that no extra pressure was applied to Sandi's hand. The device is relatively small and compact like something one could keep in a glove compartment or other storage spaces in a car.

Functionality

This device allows the user to insert a credit card into the credit card machine with less force than the user would normally have to apply. It also allows the user to keep their hands in a comfortable position in order to have the least strain on their body. The most difficult of the three problems was that the user had difficulty with inserting the credit card because of the pinching motion they had to use in order to correctly insert the card into the machine. This device removes the need to use that pinching motion and allows the user to simply place their hand in the grip and slide the card into the machine with ease.

Materials, Components, and Assembly

The materials and components required to build this device are PVC conduit, insulation tubing, kneepads, plastic tubing, tape, chip clip, rubber bands, tape, and super glue. The costs of all the materials are around a dollar, leaving the device costing around $10. These materials can be obtained from any dollar store and any hardware store. The only tools required for construction were scissors. Construction will only take around under 30 minutes.

Instructions for Construction:

1. Obtain all the materials in the necessary measurements
2. Cut slit into 2” piece of plastic tubing and insert half into PVC
3. Insert plastic tubing over other half and apply super glue
4. Insert the plastic tube into the insulation pipe and PVC
5. Bend to form grip and secure with super glue
6. Attach a ~2” piece of the cut out knee pad to the other end of the PVC
7. Break the chip clip into halves length-wise and attach an identical piece of knee pad to the end of the chip clip
8. Raise the clip by adding knee pad to the other end of the clip to secure it to the PVC so it is slightly higher than the other side
9. Add rubber bands around the clip to create more tension between the clip and the PVC

Use

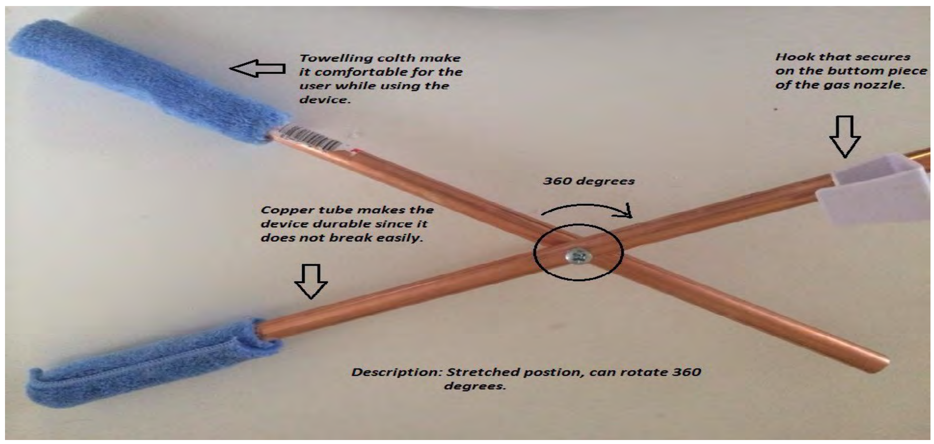
1. Retrieve device from desired storage area (The user preferred the storage space in their car door or other places of storage could be in the trunk, or in the glove compartment)
2. Place hand in the grip
3. Insert credit card into the clip
4. Insert card with device into the credit card machine
5. Remove hand from the grip, leaving device attached to the credit card in the machine, and complete other tasks
6. Place hand back in grip and lightly hold the clip down
7. Pull outwards to remove the credit card from the machine
8. Take credit card out of clip
9. Remove hand from grip
10. Place device back into desired storage area.

Benefits

This device is better than other devices because of the grip on the device allows for complete comfort. Also the simplicity of this device allows the user to have the quickest and easiest experience using the device. The device is also lightweight therefore it will have the least strain on the user and their muscles.

The Painless Scissors

Arthritis Accessories Limited
F 01 - 124 - 9



Problem Description

To help Sandi Mugford at the gas station by designing a functional device, that is to be evaluated by Dr. Fleisig and the 1P03 TAs, which reduces her pain, save her time and make her more independent while she is pumping gas using this device.

Design

The concept of the design is similar to a pair of scissors. A pivot point is at the middle of the two rods which connects them together. As one end of a rod goes up, the other end goes down, thus opening the rod so that it can secure the trigger in place. It weighs around 400 grams, which is about the weight of a soda bottle. It is about 40 cm long and that is about the vertical length of a long paper towel roll.

Functionality

The painless scissors allow the user to use the gas nozzle at the gas station without physically squeezing the trigger of the nozzle by a hand grip. It has a firm grip, which allows the user to feel comfortable while using the device. The device has a pivot point that is at a large distance from the position where the user applies a force. Therefore, the force required to rotate the device by creating a torque is very small. Hence, the pain in the finger joints is greatly reduced. By using this device, the user's problems regarding the challenges and the difficulties that they face while pumping gas are solved.

Materials, Components, and Assembly

Materials required to design this device include: a copper pipe, a screw and a screw cap, toweling cloth, plastic hook, grommets and bolts. The total cost is $11.25, copper pipe being the most expensive ($5.89). The above materials can be purchased at any hardware store (Home Hardware, Canadian Tire, Home Depot etc). The tools required include: super glue, pipe cutter, driller and wrench. The construction process takes about an hour, provided that all the tools are available. The steps followed in the construction process are outlined below.

First, using a pipe cutter, the copper pipe is cut into two equal halves. A hole is drilled through the middle of the two pipes. Through the hole, two screws are inserted and two bolts are also placed at either end of the screw. Finally, the design is stabilized using a wrench that further screws in the bolts. In order to provide insulation, a cloth is placed at the end of the copper rods, where the user would come in physical contact with the design

Use

1. Firstly, once the user arrives at the gas station, they open their gas tank.
2. The gas nozzle is inserted into the opening of the gas tank.
3. The device is inserted into the space between the trigger of the nozzle and the button piece of the frame. The pivot point of the device must be 6 inches away from the gas nozzle.
4. The device is secured in its appropriate position by hooking it onto the bottom part of the gas handle.
5. At this point, the user can leave the device in its rest position as they get ready for the process of pumping the gas.
6. The end of the device that is at the largest distance from the gas nozzle is pushed downwards.
7. The previous action raises the other end of the device, pulling the trigger upwards. At this step, gas starts to pump through the nozzle.
8. The device is held until the user is done adding the desired amount of fuel. In order to stop pumping, the user simply stops pushing and the device returns back to its rest position.
9. The device can now be easily unhooked and it can be stored again inside the car.

Benefits

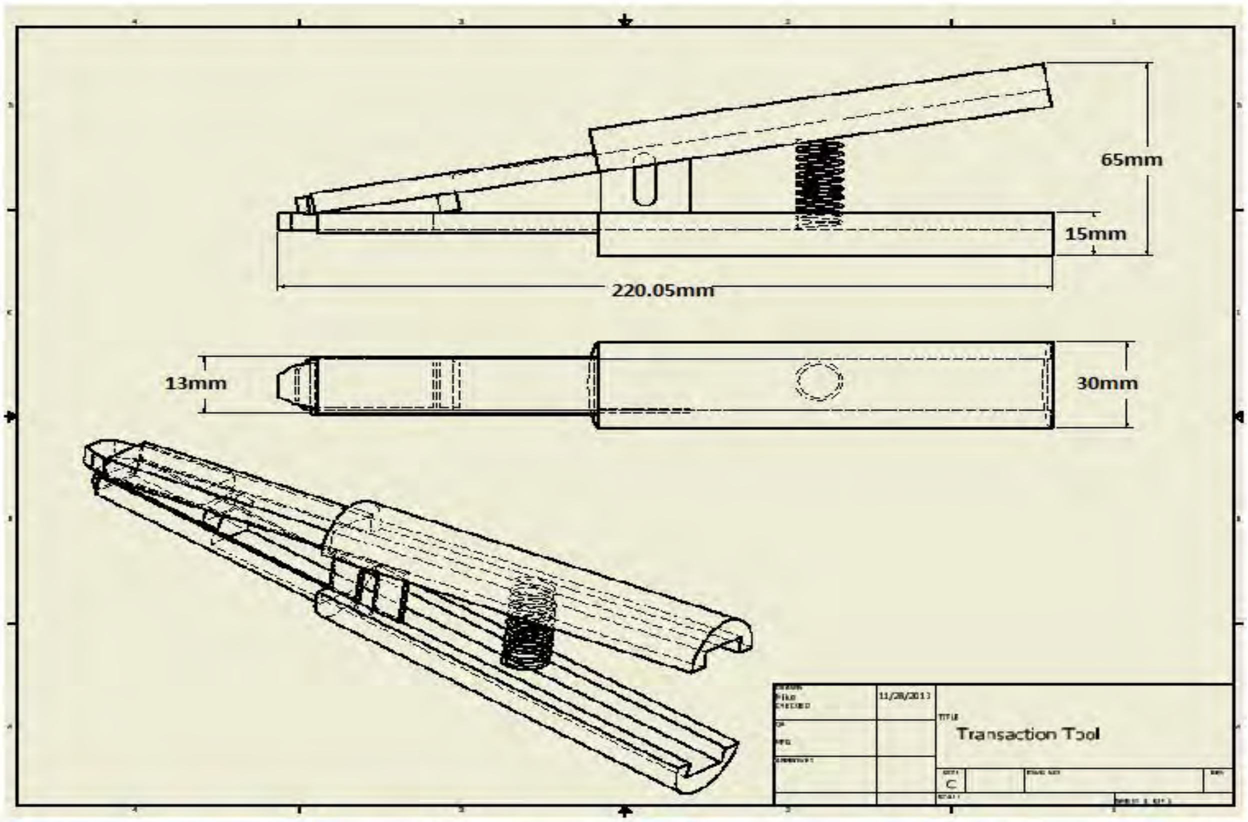
There are five major advantageous characteristics of the painless scissors that make it beneficial for the user. The device is very durable, since the design's materials last for a very long time. Since copper is an unreactive metal, it does not react with oxygen, so the tubes do not corrode. Although many teams had very smart ideas, their devices were not very durable because they used weak materials such as PVC or plastic. The device is also adjustable. It can make multiple 360° degree rotations without breaking and it rotates smoothly. It is light and portable. The device weighs around 400 grams only and due to its small size, it does not take up too much space. The device is very comfortable in its operation, since it does not require a firm grip by the hands. The device can be simply held by the hands. Moreover, the design is very easy to operate. The process of pumping the gas simply starts by pushing one of the ends of the copper tube, and the pumping stops once the user stops pushing.

Transaction Tool

POSAD

POWER OF SIMPLICITY AND DESIGN

F 02 - 126 - 1



Problem Description

Design a device that assists people with dextral impairments to perform common fueling tasks. These tasks include inserting and removing a payment card and typing payment information. This device will decrease the amount of stress on the user's joints and minimize fueling times.

Design

The Transaction Tool is roughly 22cm long. Its handles have a diameter of 2cm with a maximum separation of the handles being about 6.5cm. The overall weight of the device is about 1lb.

Functionality

The Transaction device grips the payment card for both easy insertion and extraction. The fine rubber tip point also allows the user to press the keypad with significantly less stress on the joints. The large handles make it easy to grip and compress while the soft padded handles ensure the user's comfort.

Materials, Components, and Assembly

Material	Source	Cost
BBQ tongs	Dollarama	$1.13
Foam tube	Home Hardware	$0.78
3; 1/8-1inch bolt+nut	Home Depot	$0.12
Duct tape	Home Hardware	$1.13
Rubber floor scratch Prevention	Home Depot	$2.50
Crazy glue	Shoppers Drug Mart	$1.25
Spring	Home Depot	$0.98
	Total Cost	**$7.89**

In order to build this device, one would need a hammer, a nail, pliers, a file, an exacto knife and tin snips.

To build the device, begin by removing the ends of the BBQ tongs (the end that holds the food) with the tin snips. Take the ends that were removed and hammer them flat. Now, cut the ends into a triangular shape. These will serve as the pivot point for the device. Set them aside and retrieve the rest on the tongs. With the tin snips remove the pin at rear holding the two halves together. Mark on both halves as well as the two triangle pieces where the holes are to be located (three holes on triangles [one in each corner], one half of the tongs should have four holes in it [2 on each side] and the other only two [one on each side]. The holes should be made such that the pivot points will be mounted about one inch off center toward the end that will hold the card. Mount everything together with three one inch 1/8 flathead bolts and nuts. Next slice the scratch prevention to proper size and glue into end. Then add foam handles and spring.

This device will take roughly two hours to create.

Use

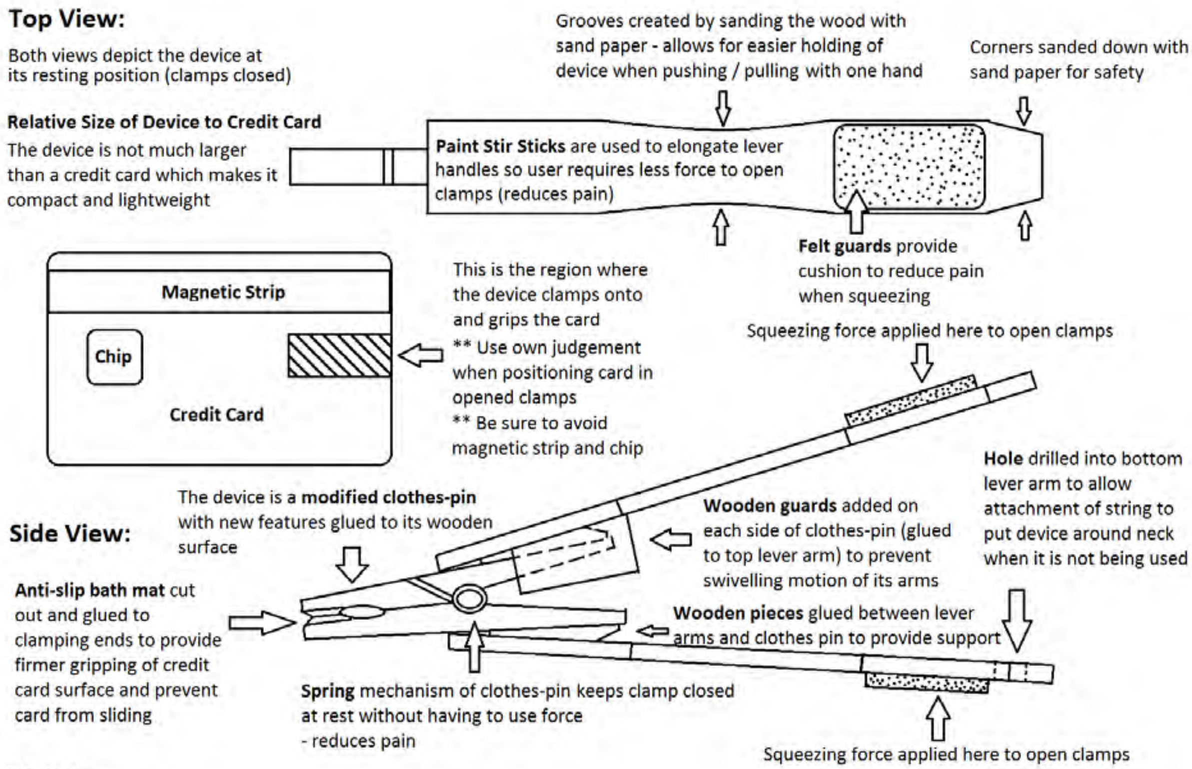
1. Obtain device from place of storage (door panel/ glove compartment/ purse) upon exiting the car.
2. Compress the two handles towards each other and insert payment card into open rubber tipped end (push card in until it hits the rubber stopper inside opening). For orientation of card, refer to diagram on gas pump and position card in device accordingly.
3. Release hand pressure on handles such that the device closes on the payment card.
4. Insert payment card into gas pump by holding the handles and guiding the card into the slot.
5. If gas pump asks user to swipe the card skip to step 6. Otherwise, compress the handles together again and release the card leaving it in the machine. Release hand pressure on handles.
6. Using the rubber tip at the end of the device, type in payment information on the keypad (how to hold the device is entirely the choice of the user, most likely what is the most comfortable).
7. If card is still in the machine, recompress handles together and guide the open end of the transaction tool onto the exposed portion of the card. Close the device around the card and remove the card from the pump.

Benefits

The Transaction Tool is a small, lightweight, easy to use advice. Its metal and rubber design mean that it is durable and can be used in virtually any weather. Even in the cold of winter when bulky gloves would normally create problems. It is fabricated from a variety of easily obtained items meaning that building/repairing this device isn't a problem. All the materials are very cheap and therefore results in a very inexpensive solution to a normally difficult problem. The large handles prevent the need to close tender hands very far to grip the device and the padding ensures a comfortable hand when the device is compressed. Due to the two in one design, this device eliminates the need to carry multiple devices to insert the card and press keypad. In conclusion this device is small compact, easy to use, easy to store, durable, inexpensive, easy to build and user friendly.

The Card Clamp

Team Name
F 0 2 - 1 2 6 - 2



Side Notes:
- The device is made of inexpensive materials and easy to build by simply glueing features to a wooden clothes-pin
- A wooden clothes-pin is used since glue does not adhere to plastic as well
- The device is protectively coated in a waterproof varnish to protect from outdoor conditions such as rain which makes it more durable

Problem Description

The clients, Dr. Fleisig, Abbey and Katie have assigned the task of designing a means to help the user, Sandi Mugford insert and retrieve her credit card with less pain at a gas station. As a team, ArthroAid shall help Sandi maintain her independence more so than current devices allow.

Design

The device is a modified clothes pin. It is made from a single wooden clothes pin with its lever arms elongated with paint stir sticks. The stir stick arms have grooves sanded into them and the corners of the arms are sanded as well. These arms also have felt pads stuck on to them which is where the user applies force. The clamp of the clothes pin has pieces of anti-slip bath mat glued to them. The device will be incredibly light weight, made from a single clothes pin and various pieces of wood. The entire device weighs less than two ounces and is not much larger in size than a credit card. The device is 6 inches long, about 1.25 inches wide and at rest 2 inches tall.

Functionality

The device designed was made only to aid Sandi in process of inserting/removing her credit card at the gas station. The device allows Sandi to operate the credit card insertion/removal system with minimal movement of her joints. The size and weight of the device allow Sandi to easily store the apparatus as well as freely manoeuvre around the gas station. The anti-slip bath mat on the clamps allow firmer gripping of the card. The spring from the clothes pin provides the necessary force to keep the clamp closed to grip the card without the need for Sandi to apply force which reduces pain. The elongated arms provide more leverage to easily open the clamp with minimal applied force allowing for reduced pain in the operation of the device. The felt pads provide cushion to further reduce pain when squeezing. The groove in the lever arms make holding the device easier and more comfortable.

Materials, Components, and Assembly

The materials used in the device are, 1 paint stick, used as the lever arms for its solid structure and reasonable length, paint sticks are free at local hardware stores. 1 clothespin, used to grip the credit card allowing for precise movements, purchased at Dollarama or a local hardware store for 1-3. Super glue used to adhere the pieces together, purchasable at Dollarama or local hardware stores for 2-5$, anti-slip bath mat on the inside of the clothespin for gripping purchased at Dollarama for 2$. Felt guards for cushioning purchased at Dollarama for $1. Tools required for assembly include scissors, sand paper and a drill. To assemble the device, the paint stick is cut in half with scissors and sanded with sand paper so the edges are smooth. Round grooves are sanded into sides of each half of the stick and the corners are sanded as well. The two halves of the stir sticks are then glued onto each of the lever arms of the wooden clothes pin. Pieces of the anti-slip bath mat are cut to the appropriate size and glued to the inside surface of the clamp. Felt guards are cut out and pasted onto the lever arms where the user will apply force. Finally a hole is drilled into the bottom lever arm to allow attachment of a lanyard or string. The entire process takes less than half an hour and requires no special instructions.

Use

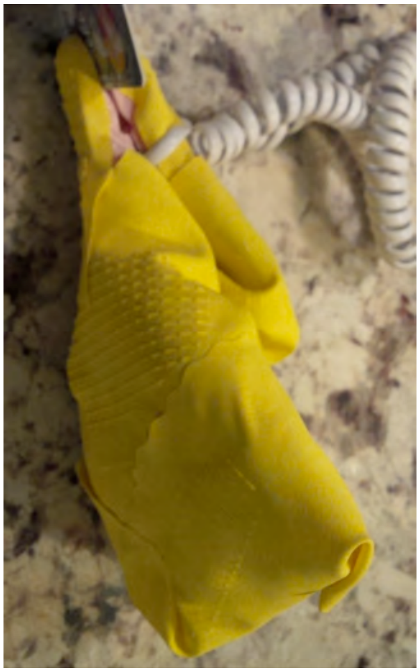
1. Pick up device using both hands, one on each lever.
2. Squeeze lever arms to open the device then grip with one hand.
3. Place credit card inside device with free hand so the device grips the card in the region specified in the diagram.
4. Release squeezing to close clamp and lock the card in place.
5. Using one hand on the lever (top or bottom) guide the credit card into the slot. Leave device on credit card while payment processes.
6. Remove the credit card using one hand on the device to pull and remove credit card.
7. Squeeze lever arms to open clamp and release the card.
8. Remove credit card from device.
9. Store the device in side storage compartment of car door, glove box, or purse.

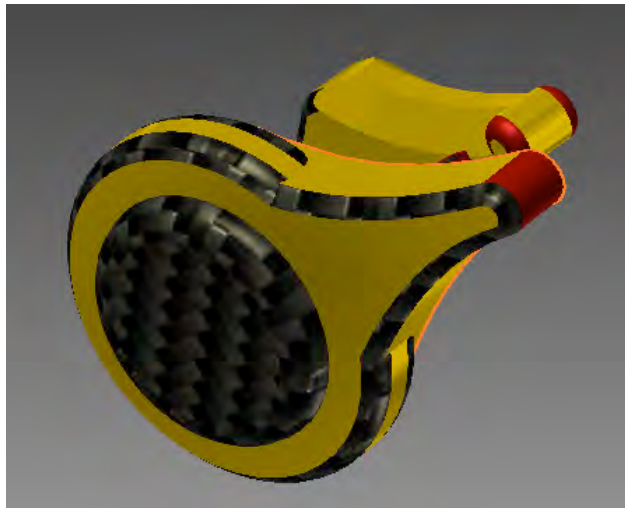
Benefits

This design is the best existing solution to Sandi's difficulty grasping and manipulating a credit card at a gas station due to its weight, size, manoeuvrability and its ease of use. The simplistic design of wood and glue eliminated the need for heavy and awkward materials such as steel and plastics, it can easily be stored in Sandi's purse, her car door or her glove box without hindering her ability to drive or go about her daily activities. Both its size and weight directly contribute to its ease of use, allowing Sandi to reliably insert and extract her credit card without excess pain.

EZ-Grip

Biotronics Engineering Inc.
F 02 - 126- 03





Problem Description

With respect to the clients and judges: Sandi Mugford, Dr. Fleisig, Abbey Desjarlais, and Katie, the task is to develop a device or device(s) that support user Sandi Mugford, (whom suffers from Rheumatoid arthritis), at the gas station to help her (1) insert and retrieve credit card from machine slot, or (2) push keypad buttons or (3) operate the gas nozzle, without causing her physical difficulties and allowing her to maintain her independence.

Design

The design is light due to its composition of mostly low density plastic, including thermoplastic rubber. It weighs approximately 18 grams. The fibre cloth is light and the fluff which fills the main handle is tissue paper. The size of the device is about the average length of human hand from the beginning of the hand to the fingertips. That length is approximately 5.5-6inches. The maximum width dimension is about 4 inches and the rest of the dimensions are less. These dimensions are made with the client's measurements in mind and can be adjusted to better suit the natural position of Sandi's hands.

Functionality

This device serves two main functions: (A) Insert and retrieve credit card from machine, and (B) operate as a device for which to push the keypad buttons instead of using fingers. With respect to the problem statement, the device solves 2 out of the 3 problems Sandi Mugford experiences at the gas station.

Materials, Components, and Assembly

The materials necessary for the construction of this device are: super glue, micro-fiber cloth, thermoplastic rubber, dishwashing gloves, scissors, clothespin, tissue paper, a nail, a fire-torch, and needle nose pliers.These items can be purchased at your local hardware store such as Home Depot or RONA. Approximately the cost of the glue is five dollars, the fibre cloth is five dollars, the thermoplastic costs forty dollars from McMaster University, the dishwashing gloves were four dollars, the scissors were three dollars, the clothespin was two dollars, the tissue paper is a dollar, the nail is two dollars, the fire torch is twenty dollars, and the needle nose pliers were seven dollars. To construct the device you firstly have to use the blowtorch to melt the centre of the tip of the clothespin through both sides and then bend the nail and attach it to the hole using thermoplastic rubber as support. Then you want to glue a small piece of fabric over the tip of the nail, after you have cut off the sharp end with the needle nose pliers. Then you want to melt two sections of the TPR and then mould one piece to the size of your thumb and the other piece to the size of the four fingers when together of one hand. After it is cooled you want to glue the microfibre all around the handles. Afterwards attach the handles to the short ends of the clothespin by melting the little ends of the handles and wrapping it around the clothespin handles. Then you want to wrap and glue tissue paper around the four finger handle and then glue the dishwashing gloves all over the tissue paper until it is fully covered. Afterwards you will want to borrow a drill with a 3/16ths drill bit and drill a hole to the credit card approximately where you would pinch the card if you were inserting it into the gas machine. Now the device is ready for use.

The length of time it takes to build this device is approximately 8 hours after each modification phase is added. You will need to be skillfull in handling the soldering fire torch and be aware of the fire hazards. Furthermore you will have to know how to operate a drill and change drill bits. You should take precaution when using superglue. Additionally to melt the TPR you have be careful of the boiling water as it can cause burns.

Use

1- While sitting in the car open the glove compartment where the device is stored and place card inside of the gripping device and lock it into the pin of the tip then attach wrist strap
2- Get out of the car and holding the main handle of the device, insert card into reader
3-press the small lever and release the card
4-use device pointer to push buttons and enter data
5-hang device on wrist while using hands to grab the gas nozzle
6-when needed to take the card out simply pinch the card without aiming for the hole and retrieve card
7- walk back to car with device hanging from wrist and drive away, if payment was completed

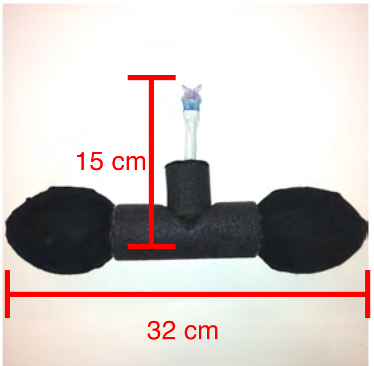
Benefits

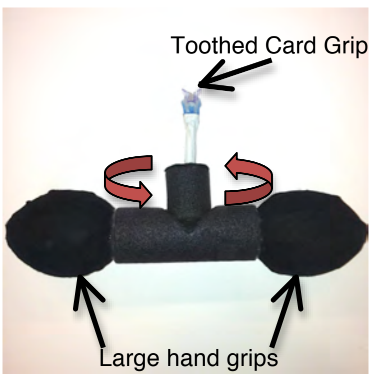
The design was made such that the user could not accidentally close the handles and therefore open the needle and let the card fall. Instead the device became a one hand, one-handle design, with an additional lever smaller in size to release the card. Additionally if the user closes the hooking needle in the wrong spot, they can pull the device backwards or forwards to lock it into the hole. When the card is in place the user can hit the card against any object and it will not easily fall. Additionally the design was tested at night such that the user does not have to actually line up the needle with the hole, they just have to close the tip approximately to the card and it will automatically lock in place. The device works flawlessly without having any difficulty to use and it is light and easy to store also it is water resistant. The reason why it may not get picked as a top design may be due to the aesthetic effects. This design also provides Sandi with additional advantages like applying a key-chain to her card so it is more accessible.

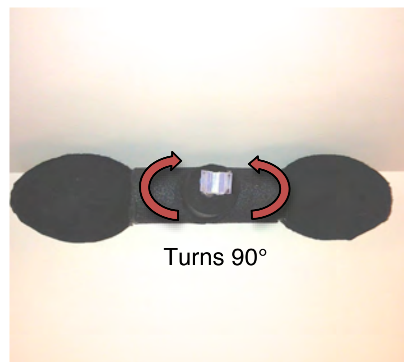
The T–Twist

UniTec
UNITED TECHNOLOGIES

F02 - 126 - 4







Problem Description

Create a device to aid the user, Sandi Mugford, at the gas station with inserting and removing her credit card to pay at the pump. Our goal is to allow her to keep some form of independence due to the limitations imposed on her by Rheumatoid Arthritis. All this is to be done to the specifications of the clients; Dr. Fleisig, Abbey, Katie and Sandi herself.

Design

Referring the images above, the t-shaped device is 32cm long from handle to handle and has a reach of 15cm from the base. The device is mostly constructed with foam, with a small wooden and plastic skeleton, so it is quite light. This is a major aspect of our device because being lightweight allows for the device to remain attached to the credit card when inserted into the pump. Also, it is comfortable to grip almoust anywhere because of its large girth aside from the actual card grip.

Functionality

The T-twist takes over Sandi having to strain herself with pinching her credit card and allows her to complete part of the fuelling process with less pain. After the user places their payment card into the toothed grip, they can then use the large grips to insert the card with both hands into the card acceptor of the pump. Using both hands helps with accuracy for T-twist's added reach. As stated by Sandi, this part of fuelling process is the most difficult and the T-twist completely solves this problem.

Materials, Components, and Assembly

To build the T-twist you will need:

- 2 foam t-joints ($1.99 each)
- 2 styrofoam eggs ($5.99 each)
- 1 wooden stick ($4.99 package)
- Gatorade bottle cap ($2.99 bottle)
- Bic Pen tube ($1.86 package)
- Black felt ($5.99 each)
- 2 toothed clips ($0.10 each)

Additionally, some tools of construction required to put everything together are scissors, a knife, tape, a hot glue gun, and super glue. All the materials and tools of construction can be purchased at Staples of Michael's with exception of the t-joints that can be purchased at Canadian Tire. With 3 people working together it takes roughly 45mins to build from start to finish. The device itself requires no instructions to use, but there are some special assembly instructions. To attach the cap to the base of the device (turning part in above images), a groove must be cut out to sit on the wooden stick firmly. Also, the top of the Gatorade cap must be trimmed to fit the foam tubing around it.

Use

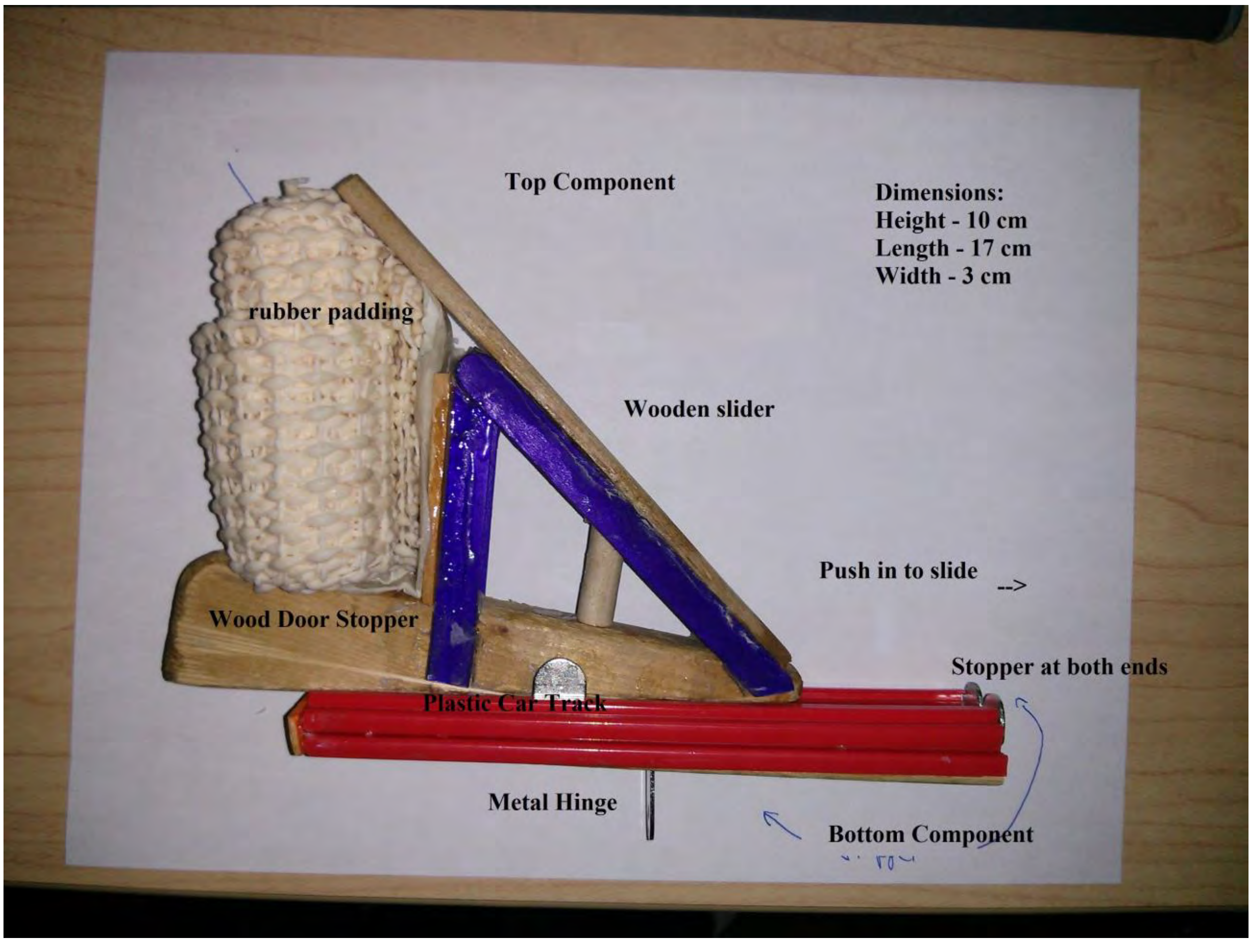
1. Take out device from trunk where it will be stored
2. Hold device at the intersection between black hand grips
3. With other hand, insert desired payment card into toothed grip
4. Place both hands on grips and insert card into slot of pump
5. Let go of device, leaving it attached to card
6. Completed business transaction and remove card with device
7. Remove card and place back in vehicle

Benefits

The T-twist is a unique product with no existing commercial products like it on the market. It is designed to be used in a way Sandi is familiar performing. Since she uses two hands to insert her card, the T-twist has two comfortable handles to mimic that same motion. Compared to plier-like solutions we have seen many colleagues build, the T-twist strays away from squeezing motion to hopefully reduce pain. The ability to turn 90 degrees allows use on various gas pump styles. Though not limited to one, 100% pump style coverage was not possible.

Slide Station

TK Team Kinetic
F 02 - 126 - 5



Problem Description

To create a device that client, Ms. Sandi Mugford, can use to help her at any gas station. She needs help with using the gas nozzle. Dr. Fleisig as well as Katlyn England and Abbey Desjarlais will be involved in this process. This solution is designed to reduce Ms. Mugford's pain at the gas station and promote her independence.

Design

The design is of moderate size. It consists of two main bodies, but is composed of many individual parts to make the two bodies. The top body consists of pieces of varnished wood, with four hinges at the bottom acting as the guard for which the top body will slide along the second body. The top body is designed with a large angle and has a maximum height of 10 cm.

The second body consists of a plastic frame which will act as a guard to keep the top body in place and allow it to slide across when it is being used. There are bottom hinges so that the device can sit on the gas nozzle. The bottom piece measures to be around 17 cm.
In total the device will weigh three hundred grams and in terms of general size, is relative to one's own hand. The beginning of the angled body is small enough to fit inside the handle when it has not yet been lited.

Functionality

The device is able to address the problem our client, Ms. Sandi Mugford, has introduced in terms of the gas nozzle. The device reduces the pain Ms. Mugford must undergo during the gas fueling process, as she no longer has to squeeze the gas handle to fuel gas. She no longer requires the use of her hands for a considerable amount of time, and she may use other body parts to aid in this process, freeing up her hands. The device enables the user to focus on the other problems she introduced, the credit card situation as well the number pad.

Materials, Components, and Assembly

Many individual parts are required for this device. Wood blocks and small shelf clips, both of which can be obtained at Home Hardware, cost $4.00 and $2.79 respectively. Epoxy glue, a plastic track, as well as a rubber mat material, can all be purchased at Dollarama, each costing $1.25, $2.00, and $3.00 respectively.
The tools required for the construction of the device includes a miniature hack saw to cut the pieces down, sandpaper used to smooth out the edges and surfaces, as well as varnish to seal the wood. Sandpaper can be purchased at Dollarama for $1.25, and the hack saw as well as the varnish can be found at home with no cost. The construction process can take up to two days, for the construction and for the application and drying of the second coat of varnish.
In order to construct the device, an instruction to keep in mind is to cover all parts that will not be glued with tape. This is done so that no glue can be in contact with any of these pieces, ensuring the smooth surface required. The pieces that will be glued must also have pressure applied, whether it be through hand pressure or clamp, to make sure that the pieces combine and settle properly in place.

Use

1) The device will be taken out of where it is stored.*
2) The user can carry the device in her hands.
3) The client will lift the device and place the base of the device onto the base of the gas nozzle, with the top body pushed outwards towards the user.
4) Using her hand or elbow, the user will push on the rubber top body to move the device inwards. This will push the gas handle up.
5) When the force is no longer applied, the top body will slide back out.
6) After completing the tasks required, the client may lift and remove the device, placing it back to where the client wants to store it.
* The device can be stored in the glove compartment or in the trunk of the car.

Benefits

This device is better than existing solutions due to the simplicity of the design and its ease of use. The design of this device requires two main body parts, with a simplistic idea that goes a long way. Minimal force is required to help fuel the car and this device has an anti-lock system to make sure the client can be free to do something else or walk away once the force is no longer applied. The device is very light weight and thus exudes portability, and although the device may be long, it is thin enough to be stored in small spaces. The device can also avoid the need for the client to squeeze the gas nozzle as well reduce the time the client uses her hands, as an elbow can be sufficient to apply this force. The device is relatively simple to attach and will stay on when inserted on the nozzle. Likewise, this device is protected against dropping, and is easy to carry around as the client does not necessarily need to hold it in her hands due to the string attached. The device is sturdy and weather resistant, and will last for a long time.

Hook'n Fuel

PROBLEM BUSTER

Team ProblemBusters
F02 - 126 – 6

Figure 1.0 Side view of device compared to a box of tissues

Figure 3.0 Device in use at the gas station.

Figure 2.0 Top view of device compared to a box of tissues

Problem Description

Design a device for the user, Sandi Mugford, who suffers from rheumatoid arthritis to help her refuel her car with ease. This device will be used at various gas stations to aid in using the gas nozzle trigger. This device will be designed to help Sandi maintain her independence while at the gas station.

Design

This simple design consists of a metal hook connected to a wrist brace made out of plastic pipe. The hook is used to hook around the gas nozzle and pull the trigger. The black tape around the hook is used to reduce sliding on the trigger, and the red tape is used to help visibility. This device is less than 5lbs and is approximately the size of a box of tissues as seen in Figure 1.0 and 2.0. The padding on the inside of the pipe is used for comfort and fit, and can be easily taken out. This simple design consists of 9 parts that are easily found

Functionality

The device's function is to aid the user in pulling the gas nozzle trigger with reduced pain or stress. This device can successfully be used at the gas station to help the user pull the trigger on the gas nozzle to refuel a vehicle. This device may not eliminate all the pain from refuelling but eliminates the use the hand and finger movements entirely when handling the trigger of the gas nozzle. Eliminating the need to use hand movements during the gas nozzle trigger process will result in reduced pain in the hands and an easier and efficient method of pulling the trigger of the gas nozzle.

Materials, Components, and Assembly

The materials used to construct this device can be purchased from Home Hardware and Canadian Tire and are easily found. The structure of the device consists of a 4" PVC pipe, 4" metal storage hook, and 2 pot holders. The fasteners used for the hook and padding are; epoxy glue, double sided mounting tape, VELCRO® brand fasteners, and duct tape. For visibility, red duct tape on the hook and wrist brace is used, and for reduced sliding on the hook, no-slip stair tread tape covers the hook. The tools used for assembly were scissors to cut the tape, and a hammer to flatten the end of the hook. Assembly of this device would take approximately 1 hour due to the set time for the epoxy glue. Some instructions that may be needed while constructing this device is that the end of the hook is flattened so that it lay flat against the PVC pipe.

Use

Use of this device is very simple and can also be modified by the user for what is the most efficient. The hook may be stored in the trunk or back seat since it is light and of portable size. Refer to Figure 3.0 for visual of device in use.

Instructions for use:

1. Park vehicle and get out of vehicle with the device.
2. Place the device close by like on top of the vehicle.
3. Complete the transaction as per usual.
4. Open gas cap and put the gas nozzle into the vehicle.
5. With the help of the hook, put device on the preferred arm.
6. Stand facing the gas nozzle.
7. Put hook under the trigger between the 2 red bands on the hook.
8. Place other arm or hand on the gas nozzle to keep it in place.
9. Lift arm, pull the trigger with the hook and begin refuelling.
10. When refuelling is finished, unhook the hook from the trigger.
11. Take the device off with the help of the hook and place it on top of the vehicle.
12. Pull the gas nozzle out of vehicle.
13. Close gas cap.
14. Take device off of top of car and store it where preferred.

Benefits

This design is simple, innovative and practical. The device also has a unique aspect of being easy to clean and adjustable. The padding can be put into the washing machine to clean, and the outside can be wiped down easily as well. The padding is removable since it is attached using VELCRO® brand fasteners therefore the user may add or remove as much as they desire. The device accurately does what it is intended to do and requires a simple arm movement to use. Additionally the user does not need to use any hand motion to use the device, which results in reduced pain.

The Christmas Cone

Sandi’s Little Helpers
F02 -127-7

Problem Description

Design an assistive device to fulfill the client, Dr. Fleisig and the TA’s specifications to assist the user Sandi Mugford (Rheumatoid Arthritis Patient) at a self-serve gas station by providing easier alternatives for independent car fuelling while reducing pain caused as a result of Rheumatoid Arthritis.

Design

The design of our device is very simple. It’s a cone with a nice soft grip that can be inserted under the trigger. As shown in the pictures it has a flat side which goes at the bottom and allows the device to be easily inserted. The round cone shape doesn’t allow the device to lock into the nozzle. With lack of pressure from the side, the device can easily come out of the gas nozzle. It’s easy to grab from the loofah part. Sandi’s fingers do not have to bend or clench to use it. She can also grab it various ways depending on her day to day condition. The device weighs less than 3 lbs, is small in size and can fit anywhere in Sandi’s car. She can keep it in the trunk where she keeps her purse or in any of the compartments in the front.

Functionality

This product will help the user easily use the gas nozzle causing less pain and requiring less force from the user. This cone shaped device inserts right below the trigger and as force is applied inward, the trigger is pushed up, allowing the user to fill up gas without pulling the trigger using hands.

This product doesn't resolve all the issues with regards to fuelling the car at a self-serve gas station, such as card insertion and keypad pressing, however it solves the most important problem out of all of them, fuelling the car. There has been many technological advances for credit card payments and keypad pressing, however there hasn't been much advancements when it comes to the gas nozzle, also the most painful part, which is why our product solves that problem.

Materials, Components, and Assembly

The design is very simple and doesn't require many components or materials. The list of materials includes glue, a loofah and thermoplastic. The cost of the materials needed totals to $ 24. These materials can be easily bought at many stores with an exception of thermoplastic which needs to be ordered online. Any other tools required for construction is something to cut the thermoplastic to build the device, like scissors or a knife. Also, while constructing the device, a container with boiling water is needed to make the thermoplastic malleable so it's easy to work with. There are not any special instructions that will be needed to build this device, however a set of instruction will be given to make sure the user is on the right track while constructing the device.

Use

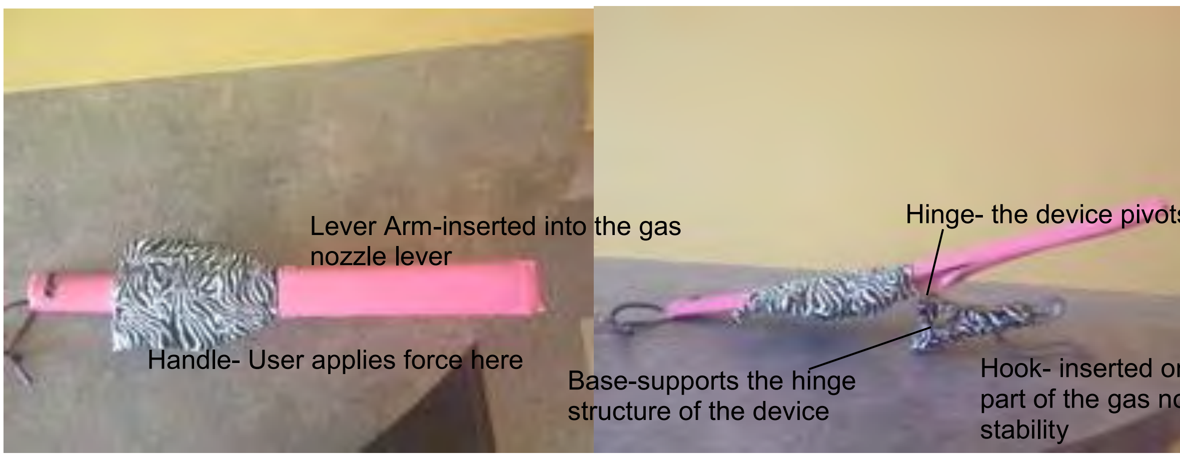
1. Sandi will keep the device in the trunk with her purse, and as she gets her credit card from the trunk to make a payment at the pump, she can retrieve the device as well and put it on her wrist as shown in the picture.
2. After card insertion and payment Sandi picks up and inserts gas nozzle into the fuel hole.
3. Sandi will hold the device from the loofah side and place her palm around the loofah to get a better grip on the device.
4. She will insert the small end through the space below the trigger, above the base of the nozzle. As she applies inward force, the trigger will lift, allowing for fuel flow.
5. She will apply a constant force to hold the device in place till she is done pumping gas.
6. By decreasing the force applied by her hands, the downward force of the trigger pushes the device outward. This fully removes the device from the nozzle.
7. The device can hang from Sandi's wrist as she puts back the gas nozzle.
8. She can then return the device to her trunk, along with her credit card.

Benefits

Our design is light weight, simple, inexpensive, requires less force and is easy to use. Existing solutions, including those of our peers, seem to be complicated which requires a long list of instructions to construct and use. Our simple device is just a cone shaped object with a round base so the user can easily grab and use it. It's light weight and small size, mean it can be stored anywhere in the car or even in user's bag. The Christmas Cone does not require a lot of material to construct which makes it affordable. There are no small mechanisms or moving parts which makes our device durable.

Heavenly Handle

Dire Designs
F 02 - 126 - 8



(For reference, the device is approximately an inch wide at its narrowest, and two and a half inches wide at its widest. The device is approximately 7 inches long)

Problem Description

Design a device for Dr. Fleisig, Abbey, and Katie to help Sandi Mugford maintain her independence by minimizing her discomfort and increasing her efficiency while fueling her car at the gas station. This device will accomplish this by assisting her with applying a force to the nozzle to fuel her car.

Design

This design is a compact (about the size of a forearm), lightweight (less than 2 pounds) device that is designed for ease of use. The hook on the bottom of the device was installed to allow the user ease of use with many different gas nozzles. The lever that applies pressure to the gas nozzle lever is long and allows the user to work with gravity and push on the device with any body part that is comfortable to use, and also has a convenient handle for pushing on a larger surface area. It also has a lanyard for ease of use, so that the device cannot be dropped and will never have to be picked up.

Functionality

This device allows the user to put gas into their car in a more efficient manner, and in a manner that reduces pain. The device makes pumping gas more efficient by allowing the user to apply less pressure to make it function, as well as allowing the user to use whatever body part is most comfortable to apply the pressure, which will reduce the pain of the user when using the device. This means that the user will not have to take breaks while pumping gas, which will save time. Also, due to its small size, it will not interfere with any other part of pumping gas.

Materials, Components, and Assembly

The device is made from thermoplastic ($0), duct tape (2 rolls at $1.25 each), a door hinge ($2.50), wire ($1.25), and a shoehorn ($3.25), for a total cost of $9.50. All of these materials were obtained from either Canadian Tire or the Dollar store. As for construction, pliers, scissors, a screwdriver and a pot with hot water are all that is needed to build the device. Assembly of the device took around 2 hours to complete. The most difficult part of assembly was screwing the screws into the warm thermoplastic, which would take special instruction, as well as bending the wire into the correct shape using pliers.

Use

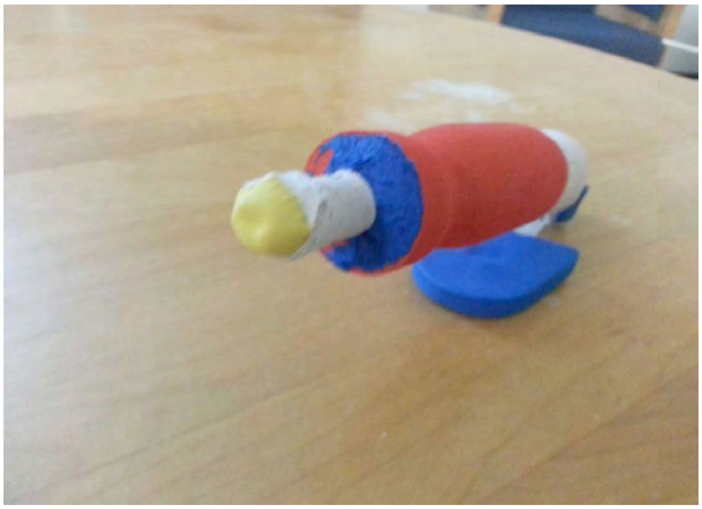
1. The device will be stored in the trunk and can be fetched when getting the credit card. At this time, the lanyard can be put around the neck to ensure the user's hands are free to perform other tasks at the gas station.
2. After putting the credit card in the machine, punching in the PIN, and putting the gas nozzle in the car, the lanyard can be removed from around the user's neck and placed around the user's wrist. In case the device is dropped, this lanyard can be used to retrieve it without the user having to bend down.
3. The user can then slide the hook around the bottom part of the handle and the device's lever inside the gas nozzle's lever.
4. The user can then apply a force on the wide section of the handle using any part of the body that is comfortable (hands, elbows, side of hands, etc.)
5. As pressure is applied downward on the device, the gas nozzle lever is raised. Pressure must be continually applied in order for the device to work.
6. To stop the device from pouring gas, the user must stop applying pressure.
7. Once the gas is done being pumped, the user can place the device back in the trunk of the car and complete any other tasks needed at the gas station.

Benefits

Our design is better than any existing designs for four main reasons: its stability, its durability, its aesthetics and its ability to be easily used. To begin with, this design is incredibly stable for pumping gas, unlike several other designs that have the same general concept. The hook, which is incorporated into the design, means that it is very unlikely that the device will slip out of the gas nozzle. This means that the device will never accidentally fall out and cause the user discomfort. As well, the design is incredibly durable, because of the materials used to construct it. Since it is made of thermoplastic, a metal hinge, a metal wire and a finished shoehorn, wrapped up in a layer of duct tape, the device will not easily rust, break or wear down, making it so it will last the user a long time. In addition, our device is better because of the aesthetics of the design. While many of the other devices are plain, this device has a bright colour scheme, meaning it will never be lost, will stand out in the crowd and will ensure that the user feels stylish while pumping gas. And last but not least, this device is better since it is very easy to use. Since this device need only be slipped onto the bottom of the gas nozzle and pushed down, it is very simple to use and requires very little instruction. It also is very small, meaning it will not hinder the user while they are performing other tasks, making it even easier to use. Thus, because of this device's stability, durability, aesthetics and its ability to be easily used, it is clearly the best option for the user to solve the gas nozzle problem.

Easy Handle

Easytech
F 03 - 227 - 1



Problem Description

Sandi Mugford the client is diagnosed with rheumatoid arthritis, an autoimmune disease which causes chronic inflammation of joints which leads to destruction of the cartilage, bone, and ligaments. Activities that require muscle movements and gripping objects such as inserting a credit card into a machine, and pressing the buttons on a keypad are very difficult because of impaired motor control and coordination. Designing a device that minimizes her muscle movements at the gas station will ease her pain is the goal of this project

Design

The device is a bright red foam handle with one end being a clothespin with a large blue surface to compress. While the other end is a tannish yellow shaft that is used as a button pusher. The device is very light, much lighter than a cell phone. This lightness is so the handling of the device does not cause Sandi any pain. The device's is quite small being about the size of 2-3 credit cards back to back. The actual handle of the device; the part Sandi will hold it from is slightly larger than her hand so she can hold it a variety of ways. The device's colourful nature is so it is hard to lose despite its small size.

Functionality

The device will allow the user an alternate method of pressing the keypad buttons and inserting and removing the credit card that requires far less joint and muscle movement. The device does not assist the user in handling the gas pump.

Materials, Components, and Assembly

The materials required for the construction of the device are as follows:
Hockey Tape: $ 2.00
Latex Gloves: $ 2.00
Foam Sword: $1.25
Clip: $4 for 50
Super Glue: $2.00
The materials can be obtained from any dollar store. For the construction of the device the only extra tool necessary are scissors. Construction will take around 10-15 minutes. To construct the device use the following steps:
1. Take out the blade section of the foam sword and cut off the excess plastic rod and leave about 2 inches attached on to the handle.
2. Take out the guard of the foam sword. Cut out two small strips enough to put on the middle of the teeth of the clip and glue on to the middle of the clip.
3. Cut out a piece on the flat end of the handle, enough for one handle of the clip to be placed. Put glue on the end of the clip and place it inside the cut. Use hockey tape and tape it on properly afterwards.
4. Cut about half the foam grip, and then make a slit on the wide end. Put glue on the other handle of clip and put it inside the grip foam.
5. Cut out a fingertip from the latex gloves and then use hockey tape to tape together the plastic rod from the handle and the latex gloves together.

Use

The following steps will be the
1. The device will be stored in the side of the car door for easy access.
2. The device will be retrieved when user exits the car. Device is small hand tool that will be carried when in use.
3. User will retrieve credit card from their wallet and insert card into the credit card side of the device by lightly pulling on the clothespin and pushing card into slot. The card will be blocked from going too far into the clothespin so that the machine will accept the card.
4. After card is inserted, the device can be removed from the card by pushing on the clothespin again and used as a button pusher using the alternate end of the device. Once button pressing task is complete the device can be reattached to credit card for preparation for removing the credit card.
5. Once credit card is required to be removed, the user simply pulls on the device and retrieves the card.
6. When device is no longer required it can attach to the users pocket or waist.
7. Once user is done at the gas station, the device can be put back into storage in the car door.

Benefits

The device is very small making it easy to store when not in use. The device is lightweight and requires very little force to operate. The device's operation is simple and has no complex steps. The device is comfortable to use and the clothespin can be opened many different ways depending on Sandi's condition. The device's colourful visuals make it hard to lose. The design is very cheap requiring an initial investment of $11.25 for one; however making subsequent devices will only cost $1.25 since only the sword is used completely per device. This makes construction of replacement or extra devices extremely cheap.

E-Z Strap

Engineers for Humanity
F 0 3 – 2 2 7 - 3

Problem Description

To design a device to help Sandi Mugford during the gas station pumping process at her main local gas station efficiently and as pain free as possible, while still allowing her to maintain her independence.

Design

The final design (Refer to figure 1) consists of a strap with 2 loops, one metal loop at one end and a loop made out of the strap at the other. The device itself weighs less than one pound and is roughly 56 cm in length.

Functionality

The device allows the user to go through the gas pumping process, in particular, by operating the gas nozzle in a pain free and efficient manner. The device solves the problem of finding an easier, pain free method for Sandi to use the gas nozzle.

Materials, Components, and Assembly

The materials that were required to create the final product were 80 cm of tree-winch strap, a metal U-bolt, a flat connector plate, 2 bolts, and around 40 cm of duct tape. The cost of these materials in were $18.97 and all components were purchased at Canadian Tire, however, all of the components can be found in any general hardware store. For its construction, the only tools required were a pair of scissors, for cutting for the duct tape and the tree-winch strap into smaller portions. The assembly for the final product is rather simple, bolting the flat connector plate in between the 2 bolts onto the U-bolt, cutting the tree-winch strap down to about 80cm and making 1 loop at the end of it and attaching the U-bolt to the other end. Finally, duct tape loose ends to secure the loop and U-bolt at the ends of the tree-winch strap. The whole assembly process should take no more than 15 minutes. No special assembly instructions are needed, as the whole process is rather simple and straightforward.

Use

Instructions for Using the E-Z Strap:

1) Place the loop made of the tree-winch strap through the gas nozzle trigger
2) Wrap the other end of the strap with the U-bolt overtop of the gas nozzle
3) Insert the tree-winch loop through the U-bolt
4) Place forearm through the tree-winch loop
5) Pull away perpendicular from the gas nozzle to pull the trigger
6) To stop the gas nozzle, return arm to original position, closer to the gas nozzle
7) Remove arm from tree-winch loop, and remove the device from the gas nozzle

Due to the flexibility and lightweight properties of the device, Sandi can easily store it in the glove department in her car, or even carry it around in her purse. While she is performing other tasks at the gas station, she can place the device on the driver's seat or in her purse. In the winter, Sandi can even place the device in her winter coat jacket, provided it has pockets.

Benefits

The primary benefit of the E-Z Strap is that it relieves much of the pain in Sandi's finger and hand joints. Since our final design does not require Sandi to use her hands, as she just has to pull away from the gas nozzle using her forearm to activate the gas nozzle, Sandi won't experience pain in her arthritic hand.

Unlike many other devices submitted, our device requires minimal use of Sandi's hands. Many of the other devices revolved around the concept of levers and wedges, which involved Sandi to apply a constant force using her hand and palm. This is impractical because the focus was to move away from using her hands, as they are arthritic and enflamed, causing her much pain when they are used. The need for Sandi to only use her forearms to pull the gas nozzle trigger is more practical for her condition.

Aside from the minimum use of her hand, the E-Z Strap is lightweight and is compact thanks to its build and materials. The device weighs less than a pound, and the tree-winch strap is extremely flexible, allowing it to be stored in even the smallest of spaces. Although the device itself is less than one pound, it can withstand more than 1000 pounds of force, making the strap extremely reliable. Replacing it won't be necessary, as the strap will never snap as long as it's used properly. The strap is also weather and water resistant, preventing Sandi's joints from aching from the device being damp or wet.

Several devices that were created from other groups required Sandi to be precise while performing its primary function. For example, students who created a credit card insertion device using clothespins and other pinching devices required Sandi to be precise with her movements while inserting the card. Again, this is impractical as Sandi has arthritis in her hand, and this would hinder her ability to be accurate. With the way our device is designed, as long as Sandi is pulling away perpendicular to the gas nozzle, the nozzle will still be triggered. It does not require Sandi to use maneuver her hands precisely, instead she can pull in whatever direction she finds most comfortable.

Easy Pay Gas Station Device

SharpCorp
F03 - 227 - 3

Final Design in detail (right) and with a ruler for scale (left)

Problem Description

Sandi is a 60-year-old woman impaired by rheumatoid arthritis, which causes chronic inflammation of the joints. For Sandi, the process of fueling her vehicle at the gas station has become very difficult because she struggles performing fine motor movements with her hands. This poses issues with inserting her credit card into the machine, pushing keys on the keypad and squeezing the fuel trigger. This firm will seek to develop a device or set of devices that will decrease Sandi's pain and fatigue, and maintain her independence at the gas station as her condition worsens.

Design

The device is a tubular body with a clip on one end and a blunt stylus end on the other. The clip is used to hold a credit card, while the blunt end is used to press buttons on the pump. The device is approximately 8 inches long and 1.5 inches in diameter. It weighs less than one pound. It is operated with either hand and the button to open the clip can be pressed with any finger. The user can use the device to insert/remove cards from their wallet into/ out of the gas pump and to press buttons on the pump.

Functionality

The device addresses two of the problems that Sandi Mugford encounters while fuelling her car. It enables Sandi to insert the credit card into the card-swipe area with less effort and discomfort. Sandi originally had to use both her hands with great difficulty to insert her card, however, the device can be used by one hand; any that she feels comfortable using. The device also tackles one of Sandi's major issues which is pressing the buttons of the keypad. The device's main function is to reduce the pain Sandi feels when she's fuelling her gas, also to provide Sandi with the independence she always strove for. One of the problems that the client requested wasn't addressed which was handling the gas nozzle.

Materials, Components, and Assembly

The device is composed of PVC tubing, a clothes pin, wood, foam pipe insulation, tennis grip tape, machine screws, glue and rubber grip squares. All materials can be obtained from a hardware store, with the exception of the tennis grip tape which can be found at an athletic store. Construction of one device takes approximately 2 hours. The only tools required are a drill and a hobby knife. Instructions may be required in order to properly attach the clothes pin and stylus end, but the simple nature of the device makes construction easy.

Use

First remove the device from the glove box of the car or other similar convenient storage space. Press button to open clip, insert the card and let go of the button with the card in the device. Remove credit card from wallet with device, and insert card into payment slot. Device can either be left attached during payment process or removed, according to user preference. If the device is removed from the card during payment, the stylus end can be used to press the buttons on the gas pump. Reattach (if necessary) the device to the card, remove it from the machine and return it to wallet. Remove the device from the card and return it to a convenient storage location, or temporarily place on exterior of car until fuelling is complete.

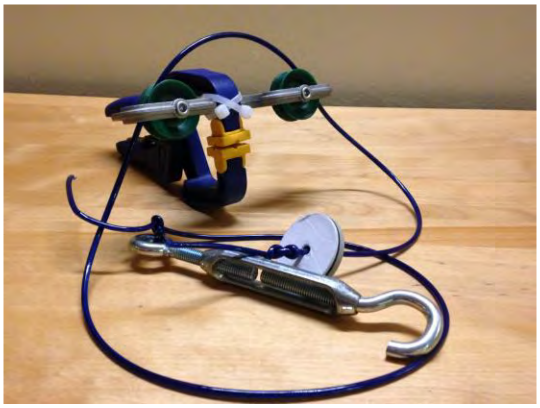
Benefits

The device has many benefits to Sandi. The device is very lightweight, increasing the ease of use for Sandi. It requires very little force to push the button to open the device to insert the card, drastically reducing the necessary effort for Sandi, and in turn the pain and discomfort that she feels. The device is small and easy to store in a coat pocket, or glove compartment of a car, so that it is easy to always have around for use when needed. The device can perform both the function of inserting and removing the card, and pressing the buttons, making it convenient to perform two tasks using one small device. Further for convenience, the device can be used with only one hand, and can be used with multiple different fingers from either hand. This leads to Sandi being able to put the focus of force on whichever finger is feeling best on a particular day. The device has a wide grip, made for the ideal width of Sandi's hand, and it is soft and comfortable to hold on to. Overall, the device greatly reduces the pain Sandi will feel during the process of refuelling her car, giving her independence at the gas pump.

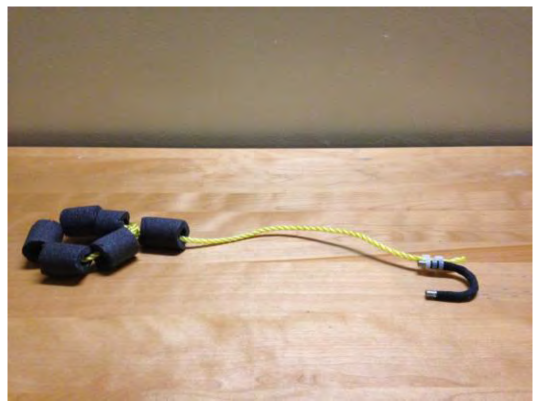
The Helping Hook

InnoTech
F 0 3 – 2 2 7 - 4

4 inches



Initial Prototype



Final Design

Problem Description

Sandi Mugford is in need of a product that will help her continue to function independently as her *Rheumatoid Arthritis* worsens. The design team is tasked with designing a product that will help her reduce pain and fatigue during her process at the gas station. The device should address any of Sandi's problems with the *gas pump, her credits cards, or the keypad interface*. She requires an original design that is specific to her needs, as there are no current products on the market that are useful to her.

Design

The device is simple, in that it is a rope attached to a hook using zip ties at one end, and a loop with a wrist support at the other. The user inserts their wrist into the support and the hook fits under the gas nozzle's trigger. There is friction tape on the hook to reduce sliding between the hook and the trigger, which prevents the need for increased force to pull the trigger. The wrist support is a part of the rope encased in pipe insulation, so as the user pulls their arm back the hook pulls the trigger up while preventing the rope from causing pain. The rope also has a small piece of pipe insulation that acts as a cushion for the user to comfortably hold onto. The device can be folded and can fit in very small spaces. Sandi will be able to easily manipulate its form to fit her needs.

Functionality

The use of the device is relatively simple, as its only function is to provide Sandi with an alternative to squeezing the gas nozzle trigger. It does this by using the hook under the trigger to pull the trigger when the rope is pulled by the user. The cushion was specifically inserted so as to provide a natural position for the user's hand. The device addresses Sandi's issue at the gas pump as it eliminates the need for her to endure long periods of discomfort while squeezing the gas nozzle trigger.

Materials, Components, and Assembly

The final design was built with a length of yellow rope, a U-bolt, zip ties, friction tape, and pipe insulation; which came to a total cost of $14.72 (+tax). The friction tape was purchased from *Canadian Tire*, and the rest of the components were purchased from *Home Hardware*. In order to construct the device, the only tool needed is a pair of side cutters to cut the rope and insulation, and trim the zip ties. Construction takes very little time, as the only steps are to cut the rope and insulation, attach the hook to the rope with zip ties, trim the zip ties, feed the rope through the insulation pipe pieces in the loop and for the cushion, and tie a slip knot in the other end of the rope, forming the loop.

Use

1. User inserts their wrist into the wrist support.
2. Hook is placed under the gas nozzle trigger.
3. User places their hand around the hand cushion.
4. User pulls their arm back to pull the trigger.

The device is small and is easily stored. Sandi can put it in her trunk, in her glove compartment, in her purse, or even under her car seat. Since the device's shape is basically a rope, it can be folded and easily carried with one hand. While she is not using the device, Sandi can leave the device around her wrist by hanging the hook from the wrist support. It is light enough that it would not cause her any discomfort, and small enough that it would not obstruct her other actions.

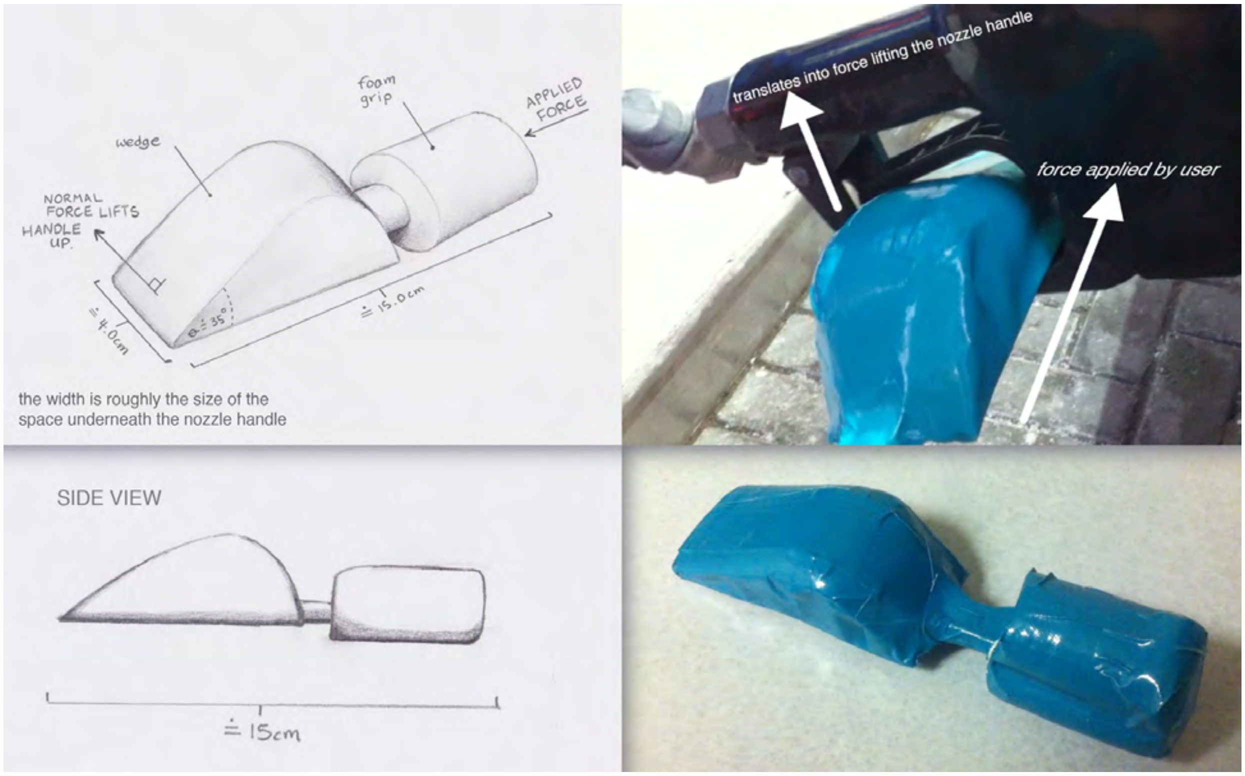
Benefits

The device will be helpful to Sandi because it not only eliminates the need for her to *squeeze* the gas nozzle trigger, but it also provides a comfortable alternative. By making use of the soft pipe insulation, the device offers a comfortable space for Sandi to put her wrist and hand while fuelling her car. Also, the device is light, small, and easy to set up; thus making her process at the gas station even easier. This device is superior to existing products because it accomplishes the objectives and respects the constraints with a simple, light, portable, and user-friendly design.

Magic Wedge

The Gastronomers

F 03-227-5



Problem Description

Our goal is to create a device for Sandi for use at a gas station which is able to aid her in using the gas nozzle. It is intended to address our client's problem of clenching the gas nozzle handle for long periods of time. It must reduce the pain and exertion she requires to pump gas, and prolong her independence as her condition continues to worsen.

Design

The device will be in the shape of a wedge. A foam handle will extrude from the wide end of the wedge for the user to grasp. The wedge will be inserted under the gas nozzle handle to raise it. It must be relatively light for the user to carry. The weight will be intentionally distributed near the handle so that the wedge falls out from beneath the nozzle handle when pressure is not being applied. The width of the device will be slightly smaller than the gap under the nozzle handle to ensure it fits properly. The length will be roughly 15 cm including the handle. The diameter of the handle will be around the same size of the client's grasp if they were to hold a tennis ball.

Functionality

For the user, the device will be able to lift the gas nozzle handle with ease. It will require less effort to raise the handle than conventionally lifting it with their fingers. The client requested a method to squeeze the handle with less pain and effort. The device relieves the stress put on the fingers, and disperses it to the palm of their hand as they push in on the handle.

Materials, Components, and Assembly

In order to construct the device, canvas, adhesive, a plastic colander, piping insulation and duct tape are required. The plastic of the colander is trimmed so that it is flat at the tip and resembles an open-top wedge. The top of the wedge is then covered with a rectangle of canvas and fastened with adhesive. The handle of the colander is cut in half and wrapped in several layers of piping insulation. Each layer is glued in place. The entire device is then wrapped in duct tape to hold it securely together and to weather-proof it.

The adhesive, colander, canvas and duct tape can all be purchased at a dollar store for $2.00 each. The piping insulation can be purchased at Home Hardware for $3.00.

For construction, a serrated knife is required to trim down and cut the plastic of the colander. The same knife can be used to cut out pieces of canvas and various sized pieces of piping insulation.

It takes roughly 5 minutes to cut the colander, 40 minutes to apply the adhesive and allow it to fully dry, then 5 additional minutes to place the foam handle and wrap duct tape around the entire device.

Use

1. Open trunk to retrieve the Magic Wedge.
2. Walk over to payment terminal.
3. While paying, store the Magic Wedge either on top of the vehicle, or under the arm.
4. Open the gas cap.
5. Pick up nozzle and insert it into the vehicle.
6. Retrieve the Magic Wedge.
7. Hold the device at the foam handle and align the tip of the wedge with the bottom of the nozzle handle.
8. Push inward on the handle of the Magic Wedge until the tip of the wedge slides in underneath the nozzle's handle.
9. Continue to push until the nozzle handle has lifted to the top.
10. Apply a slight pressure to the Magic Wedge to prevent it from sliding back out.
11. Wait for the vehicle to fill up.
12. Reduce pressure on the Magic Wedge and allow it to slide back out from underneath the nozzle handle.
13. Pull out the Magic Wedge.
14. Bring the device back to the trunk of the vehicle.
15. Remove the nozzle from the vehicle and put it back in place.
16. Close the gas cap.
17. Leave the gas station.

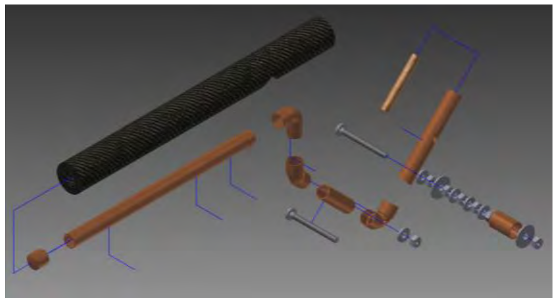
Benefits

The Magic Wedge does an exceptional job at reducing the pain in our client's hands. It accomplishes this by removing the stress placed on the fingers while squeezing the handle normally. The device requires only a slight push on the foam handle to keep the nozzle handle lifted, eliminating the need for clenching fingers for extended periods of time. Compared to other designs, the Magic Wedge is extremely lightweight and portable, weatherproof, and easy to store.

In Canada, it is illegal to use devices which hold up the nozzle handle on their own. The Magic Wedge has a smooth top which allows it to slide out from underneath the handle when no force is being applied to it, making it a simple, legal, and effective solution to the client's issue at the pump.

Ergo-Force

Team Name
F 03 - 227- 6



Problem Description

Professor Fleisig has presented the team with a problem involving Sandi, a senior lady who has suffered from severe rheumatoid arthritis since age ten. The two key issues addressed by this device include squeezing the gas nozzle trigger, and using the PIN entry keyboard. Squeezing the gas nozzle trigger is difficult since it necessitates strain on the light finger bone joints, which are especially susceptible to the disease. Sandi's grip strength is also weakened by the disease, which causes her to use two hands to squeeze, but the process still causes her pain, fatigue, and stiffness. The PIN entry keypad poses a problem since it is positioned inside a restricted space, and dexterity impairments hinder Sandi's ability to accurately enter her PIN. Her independence is important to her, and driving is a key component of this independence, which is why she wants to be able to refuel her car herself.

Design

The Ergo-Force is a device created with Sandi's comfort and wellbeing fully in mind. It is designed to be light and easy to carry. The final product weighs 286 grams, which is a light load, even for Sandi. The total length is 16.25 inches, with the effort arm of the lever taking up 12 inches of this, thus providing a large mechanical advantage. Usage of the device eliminates the need to apply a squeezing force, which causes much strain on Sandi's finger joints, since it uses a downwards pressure of the palms of the hands on the foam covered handle. Use of the palms spreads the reaction force of the lever over a larger area, thus reducing pressure. The center of gravity of the device is positioned midway along the bend in the handle that the gentleman in the above picture is grasping, so that the device is balanced for use with the keypad as a stylus. A rubber coating on the keypad pressing end provides a skid free grip on the keys. The Ergo-Force will not scratch the surface of the vehicle or cause injury to the user because of its generous rubber coat and thick foam handle. The foam handle insulates the user's hands from the copper tubing in cold winter weather, since it's low heat capacity allows little transfer of thermal energy, and also provides a safe and comfortable grip. This is a quality device with many beneficial features.

Functionality

The Ergo-Force was designed to help the user, Sandi pump fuel into her car, as well as helping her push buttons on the keypad when entering her pin. When the fulcrum pin is placed on the trigger guard, and the effort pin under the trigger of the gas nozzle, the handle of the device can be pushed downwards. This causes the device to pivot about the fulcrum, resulting in the other end of the device applying an upwards force on the trigger, activating it, and fueling the user's vehicle. When the Ergo-Force is held at the middle section of the device between the handle and the screws, Sandi may use the rubber coated tip of the device as a stylus to push buttons on the keypad.

Materials, Components, and Assembly

One of the benefits of the Ergo-Force is that it is constructed out of low price materials that are readily available from Home Hardware and Rona. The device is constructed from ½ inch nominal size copper plumbing parts, plumbing grade solder, lead free solder paste, a ⅜ inch diameter wood dowel, two ¼ inch machine screws, seven ¼ inch hex nuts, five plain and two wide ¼ inch washers, and Tundra pipe insulation, all available at Rona, as well as Plasti-Dip, found at Home Hardware. Excluding the Plasti-Dip and solder, the price is approximately $20.00.

Manufacturing the Ergo-Force takes a minimal amount of time and expertise, due to the simplicity of the design. Not counting the 4 hour period it takes for each coat Plasti-Dip to cure, the building process takes less than 3 hours. Additional time must be allowed for shopping. The tools required are a hacksaw, an imperial system ruler, soldering tools, a set of crescent wrenches, an adjustable wrench, a pair of scissors, a clamp, and a drill press. Basic soldering experience is necessary, as well as the ability to use a drill press and hacksaw, but the process on the whole takes little prior knowledge. Special instructions for dimensions, assembly, and hole placement come with the assembly drawings, (which are available on legitimate request from Sean Stel at stelsa@mcmaster.ca) and the label of the Plasti-Dip container has instructions for applying the rubber coatings.

Use

1. Take the Ergo-Force from the passenger seat, and exit the vehicle.
2. Place the Ergo-Force on top of the car, and insert the credit card into the machine.
3. After inserting credit card into machine, retrieve Ergo-Force, and use tip as a stylus to push buttons on the keypad to enter PIN.
4. Pull out the credit card and place into purse.
5. Insert gas nozzle into vehicle and obtain the Ergo-Force from on top of the car.
6. Place screws on the device under trigger of gas nozzle with handle pointing upwards, and away from vehicle.
7. Apply downwards force on handle of the Ergo-Force to dispense fuel into car.
8. Once desired amount of gas has been dispensed, stop applying force on handle, and remove Ergo-Force from gas nozzle.
9. Place Ergo-Force on top of car and return gas nozzle to holster on machine.
10. Return to vehicle with Ergo-Force, and place it back on the passenger seat.

Benefits

The Ergo-Force is a device that is designed to incorporate as many features as possible, and simply. The Ergo-Force is lightweight (286 grams) and durable. The device can be dropped on a hard surface from waist height with no damage to its functionality. It takes minimal maintenance, since the pipe insulation about the Some of this may be handle is the only part that will need to be replaced due to scratching damage if misused. This insulated foam makes it comfortable even during cold weather, which will help to prevent further joint inflammation. No squeezing force is required to operate the Ergo-Force, instead a small downward force is applied to the end of the lever arm. This downward pushing force is much easier on Sandi's joints. When the device is in it's active fueling position, unlike most existing devices, the Ergo-Force does not jam the gas nozzle in its open position. A minimal applied force is required to hold the trigger in the open position, which will makes long fueling periods a simple task. The Ergo-Force can also be used to easily press buttons on the keypad, which greatly reduces strain on joints by spreading the reaction force of the keypad over the palm of Sandi's hands.. The device's balance point is about the button pressing grip position making it much more accurate. The Plasti Dip coating on the button pressing tip increases friction prevents it from sliding onto other buttons.

Handi-Grip

.I.M

Convenience in Motion
F 0 4 – 1 2 4 – 1

Problem Description

Convenience in Motion has been hired by Dr.Robert Fleisig to design and develop a device for Ms.Sandi Mugford in order to reduce her pain felt and time taken during her experience at the gas station. The user's priority on independence is the driving force behind the project.

Design

The design is a ratchet clamp that has its quick release mechanism attached to a wrist strap as the means to remove the clamp and also acts as a safety feature. The device was made with considerations to the weight as Ms.Mugford cannot lift heavy objects easily. The device can easily fit in most purses and in the case that the device does not fit it can be easily stowed in the trunk space. The device can easily be operated by Ms.Mugford by allowing her to use both of her hands to clamp down the gas nozzle.

Functionality
This Handi-Grip deals specifically with the problem Ms.Mugford has with the gas nozzle at the filling station. The device reduces the force needed to be applied by the user and how long the force needs to be applied. Unfortunately this device can only deal with one problem prescribed by Ms.Mugford.

Materials, Components, and Assembly
The Handi-Grip is constructed using one MasterCraft ratchet clamp, one foot of thin rope, one small piece of Velcro, glue, packing tape, two zip ties, and one Progryp Gym Gear wrist support strap. The materials amounted to $28.80 however this was due to the fact that most of the materials came in bulk quantities, the per unit cost of a Handi-Grip is a fraction of the actual cost of production. The Handi-Grip is assembled by attaching the rope to the wrist strap and securing the other end of the rope to the quick release of the ratchet clamp by using a zip tie on the other end. The string is kept from slipping by putting another zip tie on the very end of the quick release and tape on the other end. Finally a small strip of Velcro is attached to the body of the ratchet clamp with glue. The overall construction process can be done in one day in the span of 2 hours.

Use
1.Open gas cap
2.Insert gas nozzle into car
3.Open trunk and remove device
4.Select gas
5.Remove wrist strap from Velcro and insert wrist
6.Clamp down on the gas nozzle trigger so that the Handi-grip is locked on the nozzle
7.Wait until the desired amount of fuel has been obtained
8.Pull wrist away from the nozzle to release open the clamp
9.Remove the strap and attach it to the Velcro
10.Place Handi-Grip in the trunk
11.Remove gas nozzle from the car and place it back on the resting location

Benefits
The Handi-Grip is a better design than those of the rival companies for many simple facts. The Handi –Grip is not only lightweight and simple but it is also very inconspicuous. The Handi-Grip is a very small device and weighs less than a pound. The device had a consensus among field experts that the Handi-Grip was easy to hold, very easy to squeeze, very light, and easy to put on. The Handi-Grip is very unnoticeable at a gas station and will not make Ms.Mugford feel uncomfortable while filling up her gas tank. The Handi-Grip is very easy to use, a demonstration takes less than 10 seconds and is often met with a very positive response of how simple the design really is. In conclusion our device is the best design because of its simplicity, its workable size and weight and its transparency which is very important to the user’s independence.

Captain Hook

Releva
F 04-124-2

The whole device. Length: 20cm Height: 10cm

Problem Description

Sandi Mugford has a difficult time holding the gas nozzle open due to her rheumatoid arthritis. Dr. Fleisig has outlined the problem to us, and we are to design a solution that would ease Sandi's time at the gas station within set constraints.

Design

The design is based off of a cable wrapper. It is a large hook that wraps around into itself, and can be opened and closed. It features a large, easy to hold handle grip, and a large lever to lock/unlock the hook. You can hold it in the palm of both your hands, and it weights about one and a half pounds.

Functionality

The main function of the device is to enable Sandi to easily hold the gas nozzle open for the duration of Sandi filling her car with gas, by letting her use muscles other then her grip strength to maintain the position. It is easy to hold, lightweight, and within size constraints.

Materials, Components, and Assembly

The materials of the device include one cable wraptor, hot glue, electric tape, a pair of gloves, and one sheet of thermoplastic, all of which costs $70. They can be obtained at Home Hardware, Dollorama, and the The Underground, respectively. The only other tool required for construction is a hot glue gun. Construction takes about 2 hours.

Use

Sandi stores her purse and other items in her trunk, and this is where she will store her Captian Hook as well. She exits the vehicle, opens her trunk, and grabs the device. She can hold it easily by putting her arm through the hole and having it just hang from her forearm. She will insert the gas nozzle into the car. She will take the Captian hook, and open it using the easy and large lever, and wrap the hook around the gas handle. After closing the hook, the device does not need her support to stay attached to the gas nozzle. She can use one hand to gently push down on the gas nozzle, and other to gently pull up on the device, rotating it. This closes the gas nozzle, letting the gas flow. All she has to do to hold the position is hold the Captain Hook rotated up using her hand and arm. When the gas tank is full, Sandi uses the easy lever to release the hook, take it off the gas nozzle, replace the gas nozzle and store the Captiain Hook back in her trunk.

Benefits

Our design is superior to alternatives due to its extreme ease of use. It doesn't require fine motor skills, it doesn't require very much grip strength, it is easy and comfortable to hold, and there is only one moving part. It is also lightweight and easy to carry. It alleviates the stress, while pumping gas, from Sandi's grip strength and transfers it to the device itself, only requiring Sandi to provided the force needed to hold the device rotated up. The bright color allows Sandi to easily identify if the device is in use correctly. Also, the device is fail safe: should Sandi let go for whatever reason, the weight of the device pulls it down, releasing the gas nozzle so that gas no longer flows.

EZ Pump

Sandi's Little Helpers
F04-124-3

60 cm long, handle is 10 cm and hook is 4 cm wide

Problem Description

To design a device that fulfills the requirements set by Dr. Fleisig to assist Sandi Mugford. It will be used at the gas station to keep her independent by reducing pain and discomfort associated with Rheumatoid Arthritis.

Design

The design the group came up with is very simple and lightweight. With an approximate weight of 200g, Ms. Mugford can easily use it. The design consists of 3 parts: a blue foam handle, an orange mesh nylon rope and a small metal hook. The design can easily be wrapped up to fit under a car seat or placed in a glove box. When fully extended, it roughly is the length from Ms. Mugford's shoulder to waist. The mesh nylon can be wrapped around to make it shorter if it is too long for Ms. Mugford.

Functionality

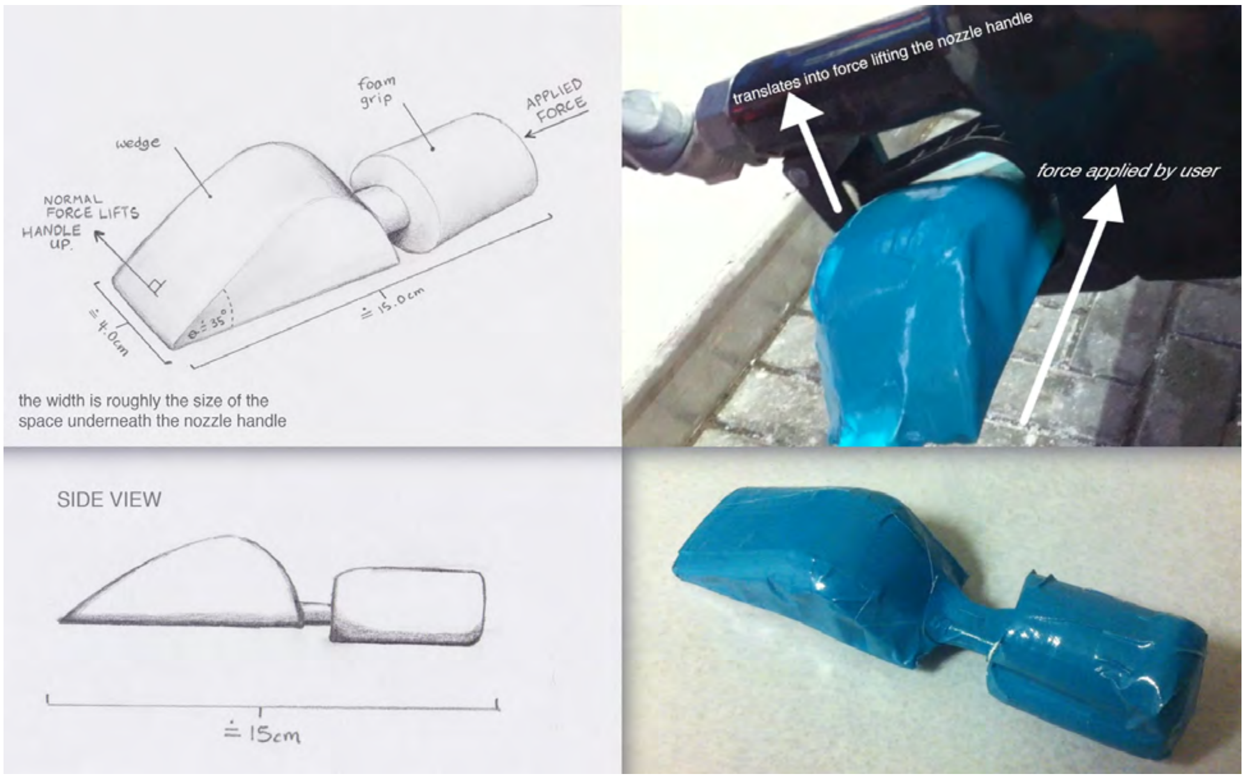
This device helps Ms. Mugford pump fuel by allowing her to reduce the force normally required to lift the nozzle lever up. It does this by moving the force from her fingers and hand to her arm by requiring her to lift instead of pinch. Furthermore, the force is reduced by allowing the mesh nylon to create friction with the nozzle by wrapping the nylon around the top of the nozzle. The friction between the nozzle and device greatly reduces the force exerted on Ms. Mugford's joints.

Since there were three different problems with Ms. Mugford at the gas pump, the group didn't accomplish everything the client needed. However, it did come up with two prototypes for her. The first one is for help inserting her credit card into the machine using tongs and a tennis ball for grip and the second one is the current design. Because the group

Magic Wedge

The Gastronomers

F 03-227-5



Problem Description

Our goal is to create a device for Sandi for use at a gas station which is able to aid her in using the gas nozzle. It is intended to address our client's problem of clenching the gas nozzle handle for long periods of time. It must reduce the pain and exertion she requires to pump gas, and prolong her independence as her condition continues to worsen.

Design

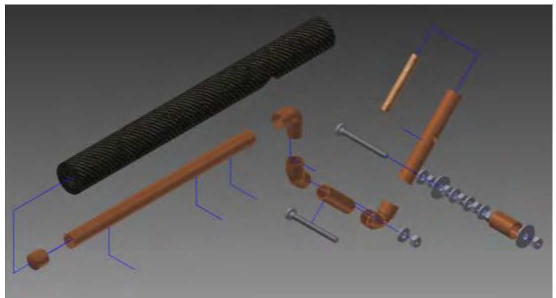
The device will be in the shape of a wedge. A foam handle will extrude from the wide end of the wedge for the user to grasp. The wedge will be inserted under the gas nozzle handle to raise it. It must be relatively light for the user to carry. The weight will be intentionally distributed near the handle so that the wedge falls out from beneath the nozzle handle when pressure is not being applied. The width of the device will be slightly smaller than the gap under the nozzle handle to ensure it fits properly. The length will be roughly 15 cm including the handle. The diameter of the handle will be around the same size of the client's grasp if they were to hold a tennis ball.

Functionality

For the user, the device will be able to lift the gas nozzle handle with ease. It will require less effort to raise the handle than conventionally lifting it with their fingers. The client requested a method to squeeze the handle with less pain and effort. The device relieves the

Ergo-Force

Team Name
F 03 - 227- 6



Problem Description

Professor Fleisig has presented the team with a problem involving Sandi, a senior lady who has suffered from severe rheumatoid arthritis since age ten. The two key issues addressed by this device include squeezing the gas nozzle trigger, and using the PIN entry keyboard. Squeezing the gas nozzle trigger is difficult since it necessitates strain on the light finger bone joints, which are especially susceptible to the disease. Sandi's grip strength is also weakened by the disease, which causes her to use two hands to squeeze, but the process still causes her pain, fatigue, and stiffness. The PIN entry keypad poses a problem since it is positioned inside a restricted space, and dexterity impairments hinder Sandi's ability to accurately enter her PIN. Her independence is important to her, and driving is a key component of this independence, which is why she wants to be able to refuel her car herself.

Design

The Ergo-Force is a device created with Sandi's comfort and wellbeing fully in mind. It is designed to be light and easy to carry. The final product weighs 286 grams, which is a light load, even for Sandi. The total length is 16.25 inches, with the effort arm of the lever taking up 12 inches of this, thus providing a large mechanical advantage. Usage of the device eliminates the need to apply a squeezing force, which causes much strain on Sandi's finger joints, since it uses a downwards pressure of the palms of the hands on the foam covered handle. Use of the palms spreads the reaction force of the lever over a larger area, thus reducing pressure. The center of gravity of the device is positioned midway along the bend in the handle that the gentleman in the above picture is grasping, so that the device is balanced for use with the keypad as a stylus. A rubber coating on the keypad pressing end provides a skid free grip on the keys. The Ergo-Force will not scratch the surface of the vehicle or cause injury to the user because of its generous rubber coat and thick foam handle. The foam handle insulates the user's hands from the copper tubing in cold winter weather, since it's low heat capacity allows little transfer of thermal energy, and also provides a safe and comfortable grip. This is a quality device with many beneficial features.

Functionality

The Ergo-Force was designed to help the user, Sandi pump fuel into her car, as well as helping her push buttons on the keypad when entering her pin. When the fulcrum pin is placed on the trigger guard, and the effort pin under the trigger of the gas nozzle, the handle of the device can be pushed downwards. This causes the device to pivot about the fulcrum, resulting in the other end of the device applying an upwards force on the trigger, activating it, and fueling the user's vehicle. When the Ergo-Force is held at the middle section of the device between the handle and the screws, Sandi may use the rubber coated tip of the device as a stylus to push buttons on the keypad.

Materials, Components, and Assembly

One of the benefits of the Ergo-Force is that it is constructed out of low price materials that are readily available from Home Hardware and Rona. The device is constructed from ½ inch nominal size copper plumbing parts, plumbing grade solder, lead free solder paste, a ⅜ inch diameter wood dowel, two ¼ inch machine screws, seven ¼ inch hex nuts, five plain and two wide ¼ inch washers, and Tundra pipe insulation, all available at Rona, as well as Plasti-Dip, found at Home Hardware. Excluding the Plasti-Dip and solder, the price is approximately $20.00.

Manufacturing the Ergo-Force takes a minimal amount of time and expertise, due to the simplicity of the design. Not counting the 4 hour period it takes for each coat Plasti-Dip to cure, the building process takes less than 3 hours. Additional time must be allowed for shopping. The tools required are a hacksaw, an imperial system ruler, soldering tools, a set of crescent wrenches, an adjustable wrench, a pair of scissors, a clamp, and a drill press. Basic soldering experience is necessary, as well as the ability to use a drill press and hacksaw, but the process on the whole takes little prior knowledge. Special instructions for dimensions, assembly, and hole placement come with the assembly drawings, (which are available on legitimate request from Sean Stel at stelsa@mcmaster.ca) and the label of the Plasti-Dip container has instructions for applying the rubber coatings.

Use

1. Take the Ergo-Force from the passenger seat, and exit the vehicle.
2. Place the Ergo-Force on top of the car, and insert the credit card into the machine.
3. After inserting credit card into machine, retrieve Ergo-Force, and use tip as a stylus to push buttons on the keypad to enter PIN.
4. Pull out the credit card and place into purse.
5. Insert gas nozzle into vehicle and obtain the Ergo-Force from on top of the car.
6. Place screws on the device under trigger of gas nozzle with handle pointing upwards, and away from vehicle.
7. Apply downwards force on handle of the Ergo-Force to dispense fuel into car.
8. Once desired amount of gas has been dispensed, stop applying force on handle, and remove Ergo-Force from gas nozzle.
9. Place Ergo-Force on top of car and return gas nozzle to holster on machine.
10. Return to vehicle with Ergo-Force, and place it back on the passenger seat.

Benefits

The Ergo-Force is a device that is designed to incorporate as many features as possible, and simply. The Ergo-Force is lightweight (286 grams) and durable. The device can be dropped on a hard surface from waist height with no damage to its functionality. It takes minimal maintenance, since the pipe insulation about the Some of this may be handle is the only part that will need to be replaced due to scratching damage if misused. This insulated foam makes it comfortable even during cold weather, which will help to prevent further joint inflammation. No squeezing force is required to operate the Ergo-Force, instead a small downward force is applied to the end of the lever arm. This downward pushing force is much easier on Sandi's joints. When the device is in it's active fueling position, unlike most existing devices, the Ergo-Force does not jam the gas nozzle in its open position. A minimal applied force is required to hold the trigger in the open position, which will makes long fueling periods a simple task. The Ergo-Force can also be used to easily press buttons on the keypad, which greatly reduces strain on joints by spreading the reaction force of the keypad over the palm of Sandi's hands.. The device's balance point is about the button pressing grip position making it much more accurate. The Plasti Dip coating on the button pressing tip increases friction prevents it from sliding onto other buttons.

stress put on the fingers, and disperses it to the palm of their hand as they push in on the handle.

Materials, Components, and Assembly

In order to construct the device, canvas, adhesive, a plastic colander, piping insulation and duct tape are required. The plastic of the colander is trimmed so that it is flat at the tip and resembles an open-top wedge. The top of the wedge is then covered with a rectangle of canvas and fastened with adhesive. The handle of the colander is cut in half and wrapped in several layers of piping insulation. Each layer is glued in place. The entire device is then wrapped in duct tape to hold it securely together and to weather-proof it.

The adhesive, colander, canvas and duct tape can all be purchased at a dollar store for $2.00 each. The piping insulation can be purchased at Home Hardware for $3.00.

For construction, a serrated knife is required to trim down and cut the plastic of the colander. The same knife can be used to cut out pieces of canvas and various sized pieces of piping insulation.

It takes roughly 5 minutes to cut the colander, 40 minutes to apply the adhesive and allow it to fully dry, then 5 additional minutes to place the foam handle and wrap duct tape around the entire device.

Use

1. Open trunk to retrieve the Magic Wedge.
2. Walk over to payment terminal.
3. While paying, store the Magic Wedge either on top of the vehicle, or under the arm.
4. Open the gas cap.
5. Pick up nozzle and insert it into the vehicle.
6. Retrieve the Magic Wedge.
7. Hold the device at the foam handle and align the tip of the wedge with the bottom of the nozzle handle.
8. Push inward on the handle of the Magic Wedge until the tip of the wedge slides in underneath the nozzle's handle.
9. Continue to push until the nozzle handle has lifted to the top.
10. Apply a slight pressure to the Magic Wedge to prevent it from sliding back out.
11. Wait for the vehicle to fill up.
12. Reduce pressure on the Magic Wedge and allow it to slide back out from underneath the nozzle handle.
13. Pull out the Magic Wedge.
14. Bring the device back to the trunk of the vehicle.
15. Remove the nozzle from the vehicle and put it back in place.
16. Close the gas cap.
17. Leave the gas station.

Benefits

The Magic Wedge does an exceptional job at reducing the pain in our client's hands. It accomplishes this by removing the stress placed on the fingers while squeezing the handle normally. The device requires only a slight push on the foam handle to keep the nozzle handle lifted, eliminating the need for clenching fingers for extended periods of time. Compared to other designs, the Magic Wedge is extremely lightweight and portable, weatherproof, and easy to store.

In Canada, it is illegal to use devices which hold up the nozzle handle on their own. The Magic Wedge has a smooth top which allows it to slide out from underneath the handle when no force is being applied to it, making it a simple, legal, and effective solution to the client's issue at the pump.

Materials, Components, and Assembly

It requires: gel dots, a clothespin, plastic tongs, rubber mats, craft glue, a ball, sponges, a gift card holder and foam blocks. Each individual material is $1.25. The entire device (including both the tongs and holder) is $12. All of the materials can be obtained from Dollar Tree or Dollarama. The only tools required for construction are scissors and glue. It will take approximately 20 minutes to construct. To begin, take the plastic tongs and cut enough rubber mat to cover the handles. Fasten the mat to the handles of the tongs using the craft glue. Then, take a clothespin apart and fasten one side of the clothespin to each side of the tongs. Ensure the clothespin is attached at the top of the tongs on the gripping semi-circles near the middle and that about an inch hangs off the top to act as an extension. Then take the gel dots and attach one to each clothespin to add grip, these should be cut to fit and fastened with craft glue. Finally, take the ball and cut a slit through the middle the size of the lock on the tongs. Fit the tongs inside the hole, and glue the two together. Next, the construction of the credit card holder. Take four sponges and glue them together. Then cut a slit through the middle large enough to fit the gift card holder and glue that inside. Then cut the rubber mat and fasten it to the bottom of the sponges to add grip. Finally, take two foam blocks, cut them in half and glue them together. Do this twice and glue the two pairs on the inside of the gift card holder – on either end to ensure the credit card will not fall over when inserted into the holder. Then cut small rectangles in the middle of each side of the gift card holder to make it easier to reach for the credit card using the tongs – these will act as a guide.

Use

1. Arrive at the gas station, pop open the gas hatch for her car
2. Open the glove department and pick up the tongs
3. Move the tongs to the credit card holder take them in one or two hands and push both of the handles together around the credit card
4. Once the credit card is removed from the holder and placed inside the tongs, pull on the ball to lock the tongs
5. Get out of the car and carry the device to the credit card slot
6. Line the credit card up in the slot, push it in and push the ball in to release the lock
7. The same process can be repeated for removing the credit card and it can be released back into its holder

The holder has a strap and can be hung up in her car - on her door or the clothes hook, or alternatively, stored in her trunk, glove compartment or cup holder. The tongs can also be stored in a glove compartment, her trunk or the side of her door. She will carry the device using the handles of the tongs and the strap on the holder. She can put the device on the roof of her car or trunk while performing the other fuelling tasks or leave it on the front seat of her car.

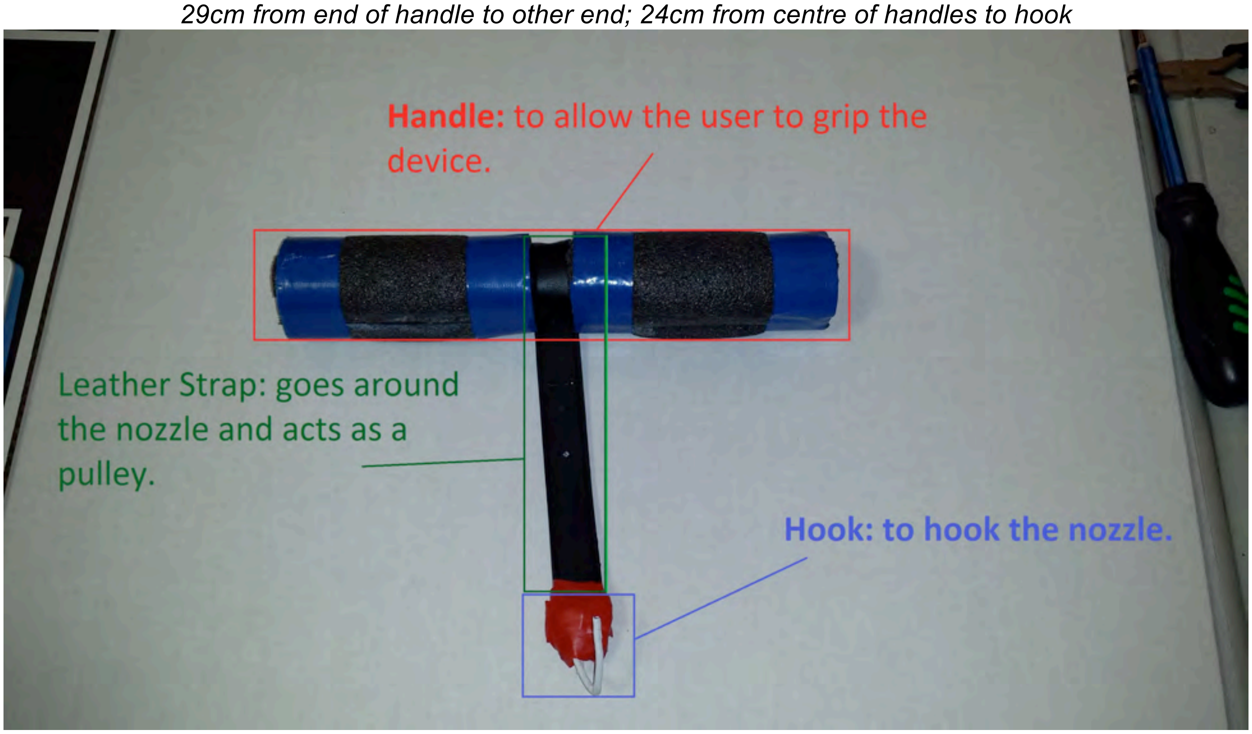
Benefits

Sandi currently has to use her hands to pay with her credit card. This device is better because it minimizes the pinching motion needed to grip the card, thus, minimizing pain. In addition, it makes it easier for Sandi to maneuver the credit card in a small space. This device is lightweight since it is under one pound and requires minimal force because it has a locking mechanism which means once locked Sandi simply has to carry the device around. The locking mechanism is also large so that it does not require a pinching motion, nor a large amount of force. It is portable because of its lightweight and easy to use since most of the actions are intuitive and do not stray from the regular refueling process. It is safe since there are no sharp edges and it does not pose a fire hazard. The device is stable, durable and simple. It also reduces time because accuracy is improved and the tongs are small enough to fit into tight spaces and provide a lot of grip thus requiring less force. This device is better than existing products, such as pliers because it does not damage the card, it requires less force and it is lightweight.

The T-Hook

Hephaestus-Epione Inc.
F04 - 124 - 6

29cm from end of handle to other end; 24cm from centre of handles to hook



Problem Description

To design a safe device for Dr. Fleisig that will assist Ms. Sandi Mugford in reducing the amount of time it takes her to fuel her car, and the pain that is associated with it, while simultaneously maintaining her independence. We've chosen to design a device for the gas nozzle because using the gas nozzle is the longest drawn-out process that would assumingly cause her the most discomfort.

Design

The dimensions of the device can be seen noted above the picture. The device in total weighs approximately 200 grams. The handles (with the blue ends) are made from pipe insulation tubing which was chosen due to its cushiony nature. The leather strap was chosen so that the device does not stretch as the user pushes down on the handle (which would lead to them having to strain themselves to apply a downward force). Lastly the hook is a nice bright red colour for the purpose of standing out against the colours of gas nozzles.

Functionality

The T-Hook can hook onto the trigger of a gas nozzle and with the help of the user's body weight the T-Hook can successfully hold the gas nozzle trigger in place allowing gas to flow without the user having to squeeze the trigger for a long period of time. However, the T-Hook cannot be used to place or obtain a credit card from a gas station pump or press the buttons on the keypad of said pump.

Materials, Components, and Assembly

The overall cost of manufacturing the T-Hook is approximately $8.50. Many of the materials used to make the T-Hook were purchased at a local Dollar Store. Examples of such materials includes; super glue, duct tape, pipe insulation tubing, hollow plastic tubing, clothes hangers, a leather children's belt, two screws and electrical tape. Using the tape, super glue and screws one could easily assemble this device within 25 minutes. One simply needs a screwdriver (to screw the belt at the desired length), pliers (to bend the coat hanger into a hook), and scissors to cut the tape. Everything can be bonded together with the super glue.

Use

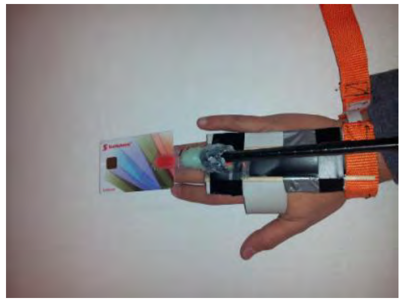
1. Remove the T-Hook from the trunk (where the user's purse is kept) for convenience.
2. Using the hook, hang the T-Hook on the door handle closest to the fuel tank door.
3. Proceed to pay for gas and choose fuel type and insert the gas nozzle into the fuel tank.
4. Grab the device and with one hand holding a handle and the other the strap, hook the T-Hook to the gas nozzle trigger on the side of the gas nozzle not facing yourself but so that the inside of the hook is facing you.
5. Give the trigger an initial squeeze while pulling the T-Hook up and over the gas nozzle
6. Now apply a downward force on the two handles using your body weight to keep the trigger up and the gas flowing.
7. When the desired amount of fuel has been pumped, release the T-Hook and the trigger will fall.
8. Unhook the T-Hook from the nozzle and hook it back on the door handle while the gas nozzle is put back and return the T-Hook to the trunk.

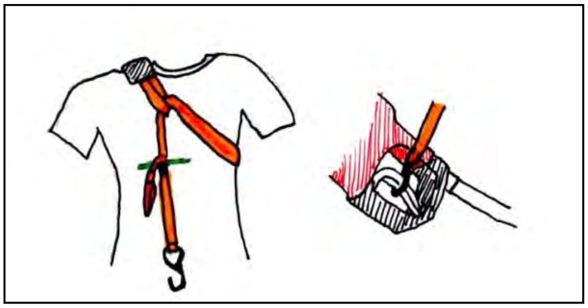
Benefits

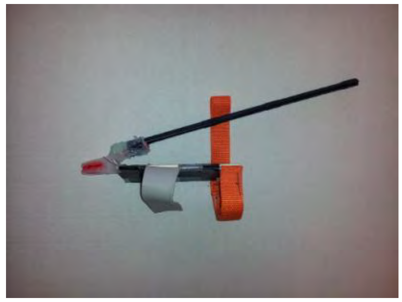
The T-Hook was specifically designed with the goal to reduce Ms. Sandi Mugford's discomfort; that is why the handles were designed to be cushiony and the device to be extremely lightweight. It is also very compact and easy to store, it has durable materials (in the case of rain, etc.), was very cheap and easy to make, and just as an added visual aspect, the hook is a bright red colour that will stand out when trying to attach it to the trigger of the gas nozzle.

Kling-On and Helping Hand

Biocorp Inc.
F 0 4 - 1 2 4 - 7







Problem Description

Dr. Fleisig introduced Ms Sandi Mugford and her problem of having issues pumping gas at the gas station. The reason the problem must be solved is because her rheumatoid arthritis causes her pain and limits her independence..

Design

Kling-On is the device on the left. It is designed to help Sandi hold the trigger. It is lightweight and easy to carry around. One can fold or scrunch up if need be.
Helping Hand is the device on the right. It is designed to help Sandi handle cards and press number pad. It is fairly light, can be stored in most car compartments. Removable stick allows for better storage.

Functionality

These two devices complete all three problems that Sandi faced at the gas station. Kling-On focuses on pulling the trigger, Helping Hand focuses on handling cards and pressing buttons.

Materials, Components, and Assembly

Materials used in total for both devices are: Strong strap, backpack padded shoulder strap, strap adjustor, hook, thermoplastic, clothes peg (clip), dowels, Velcro strips, hot glue, tape, thread (sewing).
Overall materials are inexpensive (most from Dollarama) and would result in a total cost of approximately $20.
Tools required for construction: Needle and thread or sewing machine, hot glue gun, tape.

Overall, construction would take approximately 40 minutes given all the materials necessary are present.
The long stick may be removed from the top of Hand Helper for easier storage (optional).

Use

Kling-On

1. Get folded Kling-On from side door compartment.
2. Step outside, unfold device.
3. Grab loop in one hand and place padding on shoulder.
4. Passing strap behind, grab with other hand and bring to front of body.
5. Pass hook and strap adjustor through.
6. Hook on to trigger.
7. Adjust length of strap to appropriate distance from trigger.
8. Place one hand on top of gas pump.
9. Lean back to begin flow.
10. Once done, push forward on the stick on the adjustor to loosen the strap.
11. Remove device by doing steps 3-5 in reverse.
12. Fold and store away.

Helping Hand

1. Grab Helping Hand from side door compartment.
2. Hold device in right hand and use loop to open Velcro fastener.
3. Slide right hand into device placing thick rounded part between thumb and index.
4. Close Velcro fastener.
5. Attach stick (optional if already on).
6. Get card ready on left hand, place stick under armpit and push up to open clip.
7. Enter card into clip.
8. Use device to insert card.
9. Let card loose by opening clip.
10. Use tip of clip to press buttons.
11. Once finished, using other arm open clip to get card from slot.
12. Use armpit to open clip while holding on to card. Put card away.
13. Put Helping Hand away.

The great thing about both devices is that one can have both of them on and not be limited in movement at all. One can have Kling-On on while doing other activities or using Helping Hand, and vice versa.

Benefits

Kling-On device is better than existing solutions because it is very inexpensive yet efficient at reducing the need to grip for long period of time substantially. Kling-On only requires one to lean back or step back to begin the flow of gas. No long periods of time where gripping is necessary.
Helping Hand device is thought to be better than existing solutions because it almost completely removes the need to use fingers. When pressing the lever to let loose the card in the slot one could use wrist or palm. Helping Hand is the only thing pressing the buttons, and it is being supported at the wrist and between the thumb and index. Another benefit of the Helping Hand is that it can be used with gloves, so one’s fingers can be covered in the winter time.
Both devices are very lightweight, very portable, and most of all, comfortable to wear. Both devices do not limit one’s range of motion and because they are both light, they do not come in the way of any unplanned event. Sandi is not limited in movement at all.

F-anta-Stick

Augmented Biotics
F04 -124 - 8

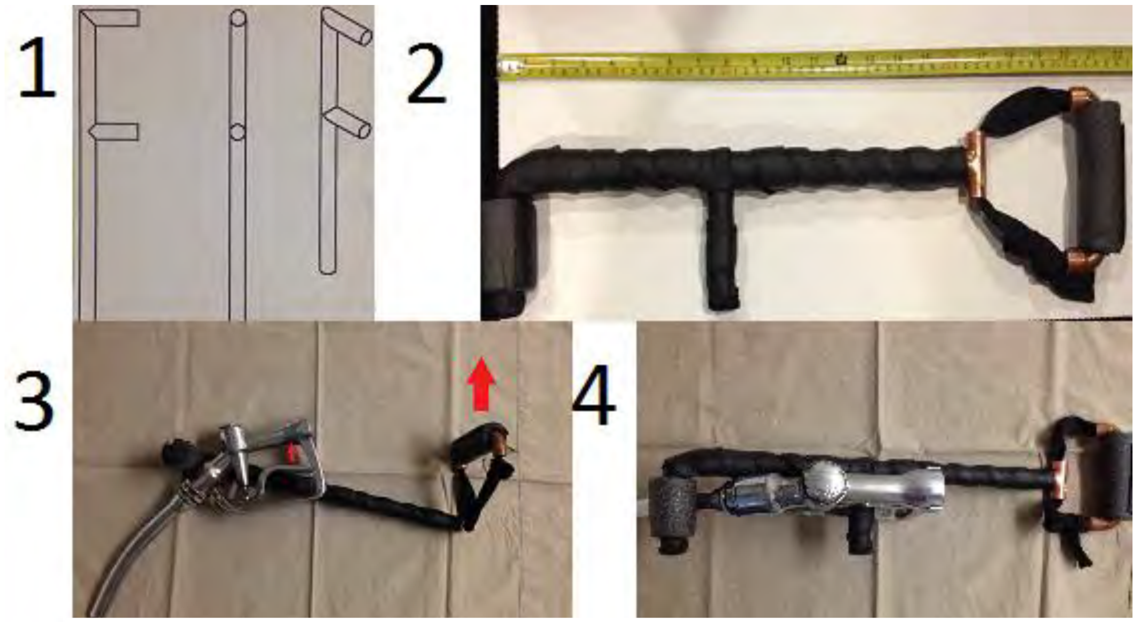


Image 1: CAD model of the initial design and current frame of the F-anta-Stick. Image 2: Photograph of finished device, with scale. Image 3: Photograph of device showing how the device works and how it is used. Image 4: Photograph showing how the device fits on a gas pump

Problem Description

Dr. Robert Fleisig wants us, the designers, to create a device for Sandi Mugford that makes her experience at the gas station less difficult by increasing her control, dexterity and precision and independence, while reducing her pain. Augmented Biotics has chosen to address Sandi's problems when using the gas nozzle, caused by clenching her hand around the trigger for an extended period of time.

Design

The F-anta-Stick, as seen in Image 2 of the visual, is a bar with 2 parallel prongs protruding from the main bar at a 90 degree angle. A handle is attached at the end opposite the prongs. The device resemble the letter 'F' with a handle on the bottom. It's frame is made of copper pipes which are wrapped in foam, while the handle is attached by a polyester strap. The device is approximately 22 inches long and 6 inches wide, and is designed to be stored in the trunk of Sandi's car. The device weighs approximately 600 grams, which is well within the range of weights Sandi can reliably lift.

Functionality

The F-anta-Stick acts as a lever pivoted on the top of the gas pump that lifts the gas trigger with the bottom prong when the back of the device is pulled upwards. Since the lever can be lifted without using finger or wrist movement, the device can greatly reduce the pain Sandi feels when using a gas nozzle. The F-anta-Stick accomplishes everything Sandi desired in a solution for her pain when using a gas nozzle, such as being comfortable, portable, lightweight and easy to use.

Materials, Components, and Assembly

The F-anta-Stick is constructed from approximately 2 feet of ½ inch copper plumbing pipe, in addition to 3 elbow joints, 2 T-joints and 2 caps, also ½ inch copper pipe. Also used in construction of the device are foam pipe insulation, a polyester strap and plumbing solder. The total cost of the device is estimated to be $30.00. All of the components can be purchased at a hardware store such as Home Depot. A blowtorch was required to construct the device, used when soldering the pipes together. The total construction took less than 15 minutes. The only instruction required would be instructions on proper soldering and a template of how the finished design should look.

Use

1. The device is stored in the trunk of Sandi's car
2. Sandi arrives at a gas station
3. After parking at a gas pump, Sandi retrieves the device and her purse from her trunk
4. The device is carried back to the pump by the handle and placed somewhere within reach, such as the roof of her car
5. Sandi places the gas nozzle in the car
6. Sandi retrieves the device from the car's roof and places it on the gas nozzle; the top prong of the 'F' shape going on top of the gas nozzle, the bottom prong going under the nozzle trigger.
7. Sandi places her hand on the top prong to stabilize it
8. Sandi lifts the back of the device however is most comfortable for her, using the device's handle or its grip
9. Lifting the device depresses the nozzle trigger, causing gas to be pumped
10. After the gas has been pumped, the device is removed and placed back on the roof of the car
11. The gas nozzle is removed from the car and stored in the pump
12. Sandi pays for the gas
13. After paying, Sandi brings the device and her purse back to the trunk of the car and stores them for future use
14. Sandi leaves the gas station

Benefits

The F-anta-Stick has several qualities that make it well suited to address Sandi's problems when pumping gas. Most importantly, the device will reduce the pain Sandi feels in her finger and wrist joints when pumping gas. The device is lightweight, which will make it easier for Sandi to use and carry. It is also strong, being made of durable materials, so Sandi will not need to worry about the device breaking. The device is also portable, being small enough to carry in the car's trunk or on one of the seats of the car. The device is also designed to be safe at a gas station, having no sharp edges which could cut Sandi and being insulated against static charge build-up that could be a spark hazard. The device is also very comfortable for the user, having a carrying handle, being padded with foam and being thermally insulated by foam, so the device is not uncomfortable to use during hot or cold weather.

The RAFA Vest

MASTER DESIGN INC
F 04 - 124 - 9

Problem Description

There are three major difficulties experienced in the event of the client visiting a gas station. The three major difficulties articulated by the client are paying debit, pressing the ATM's buttons and pumping gas. The client's original problem statement concluded to create a device which helps the client maintain independence at the gas pump. After evaluating the latter, Master Design Inc. assessed the procedure of pumping gas to be the most important issue to address for the client. This decision was influenced by the background knowledge of the client's history with Rheumatoid Arthritis. It was assessed that the client experiences the greatest degree of pain and stress when pumping gas.

Design

The design is about two pounds in weight but since the weight is distributed evenly on the user’s body it would not cause any stress. It is a small device in terms of storage but is relatively large when user wears it. The black mesh material was the best of all the possible materials to use for the body of the vest since it is both light and allows the product to be worn seasonally. Black was the colour choice for the material since the user would want to attract attention when pumping gas; which is an improvement from the first prototype which the design consisted of using a safety vest. The size is adjustable to allow the user to wear the vest over a thick winter coat if needed. There are adjustable Velcro straps which are located on either side of the vest which has a handle for easy detachment. The product is 70cm in length and 50cm in width as seen in the sketches for the measurements for the mesh fabric. In addition the placement of the rope was adjusted to her side rather than the shoulder to eliminate unnecessary motions which may be problematic to the user.

Functionality

Functionally speaking, the design can do everything the client requested with respect to the gas nozzle problem. Use of the device requires very minimal effort from the hands and it is completely hands free during the pumping process. The major issue of the client is that even small amounts of stress on her joints result in a large amount of pain. The RAFA vest bypasses this issue by putting the stress on the client's back and shoulders therefore fulfilling all functional requirements

Materials, Components, and Assembly

There are a minimal amount of materials that were used to construct the RAFA vest, including: Mesh fabric, super glue, rope and Velcro straps. The RAFA vest was made up of a rope attached to the left shoulder by a Velcro strap. The other end of the rope was attached to the right hip of the vest by another Velcro strap. This end of the rope also included a handle for the user to remove and attach the rope comfortably. On both sides of the vest, an adjustable strap was placed in order for the user to adjust the vest according to what they prefer. The cost to make the vest was $15. The Mesh Fabric was $8, Super Glue $2 Rope $3 and Velcro straps $2. These materials can be obtained at any local dollar store or hardware store (Ex. Home Hardware). The tools required to build this design are glue, scissors and sewing Machine. It was difficult to buy a vest that was light in material at a retail store. So, a mesh fabric was bought and had a group member sew a vest together using a sewing machine. These were the major tools used in the construction of the RAFA vest. The majority of the time was focused on the sewing part of the design process. This took several hours to complete. However, after the sewing was complete it didn't take that much time to design. Overall, it took 30 to 45 minutes to put the vest together (rope, Velcro straps) after it was sewed. A handle must be added to the rope so it eliminates the pinching done by her hands. This ensures comfort and increases the ease of using this product. Also, the vest has to be adjustable because in the winter, she may be wearing a winter jacket. This will make it increasingly difficult to put on and remove the vest. Lastly, the rope must be attached with enough super glue in order to withstand the force applied by the rope onto the nozzle. This can eliminate any injuries that can occur if the rope snaps off the vest.

Use

1) Sandi takes out the device from the storage location be it the center console, glove compartment and/or purse.
2) Sandi can carry the device easily by her hand
3) She lifts the gas nozzle out of it station and places it in her car.
4) She then places her wrist in the yellow cuff that is placed on her left waist
5) She then will remove the rope that is attached to her left waist from the Velcro by pulling the yellow cuff.
6) She then places the rope under the gas nozzle trigger and places it back to its original place, on her left waist.
7) Now that the rope is underneath the trigger, she can use her body to pull backwards and supporting the gas nozzle by placing her hand on it.
8) After pulling backwards now the gas nozzle will start filling up gas. She then can lean forward after she is done fuelling her car, to stop gas running.
9) The device is to be worn at all times while pumping gas, it can be taken off when she is done fuelling.

Benefits

What makes this device better than others is that it is very lightweight. As it is known that lightweight was an objective, since Sandi cannot lift any heavy objects. Moreover this device reduces Sandi's pain significantly, as there isn't much stress on her joints, since she uses her body motion while performing the task. Also the device meets the main objective, which is to build a device that will eliminate Sandi's pain and is safe.

Easy - Leve

Sun Star Systems
F04 - 124 - 10

Figure 1.

Figure 2.

Problem Description

To create a design for Ms.Sandi Mugford and Dr. Robert Fleisig which will help reduce pain and increase accessibility for Ms. Mugford at the gas station. This is necessary because of Ms. Mugford's arthritic pains and loss of strength and fine motor controls.

Design

The final design of the device is very similar to the original proposal. The device has an "L" shape configuration which allows it to pivot about its bottom edge [refer to figure 2]. When the user applies a force to the top of the device, pushing it downwards, the opposite end of the device subsequently rises. As the bottom of the device rises, so does a metal hook, which is connected at a pivot point [figure 2]. However, the hook is connected with an intermediate strip of plastic. When the hook is placed under the gas pump lever, it will pull up as the user pushes down on the device. For the comfort of the user there is soft padding surrounding the handle, which also provides a larger surface area for the individual to apply a force to. To ensure that the final device had enough leverage to lift the gas lever, the handle was extended to make it longer. The bottom of the final device was also modified to have a concave bottom, which allows it to sit nicely on the handle of the gas pump without it slipping off. As well, the bottom was coated with a material that would allow it to grip the surface of the gas pump much more easily.

Functionality

The device does everything that Sandi needs regarding her problem with the gas nozzle. It is used to pull the lever on the gas pump to allow the flow of gas into the fuel tank with minimal effort required. The device prevents Sandi from putting any extraneous forces on her finger joints, since she only has to apply a pushing motion to operate it. The device is also a "one size fits all" to account for the variety of pumps that Sandi may encounter. The device can work in any condition, whether it is extremely warm or cold. This allows Sandi to use the device all year round without any restrictions.

Materials, Components, and Assembly

The main material used for the device was two square feet of thermoplastic, since it is light weight, durable and can be easily shaped. Other parts included a metal hook, a metal bolt, 1/4'' wide by 1'' long and Styrofoam. The thermoplastic cost thirty dollars, the metal hook cost three dollars, the bolt was fifty cents and the Styrofoam was three dollars. All these materials can be purchased at a Home Hardware store, except for the thermoplastic which can be purchased off the internet or specially ordered. To build the device one must cut a long strip of thermoplastic, about one inch wide, and fold it in half to make it thicker. This part is known as piece 1 [figure 1]. Then the same is to be done with a strip that is about one and a half inches wide but bent 90 degrees, two inches from one end, and curled around the metal bolt at the other end. This part is known as piece 2 [figure 1]. Next, join piece 1 to piece 2, where the 90 degree bend was made so that piece 1 is centered in the middle and parallel to piece 2. Cut a third strip of thermoplastic and use it to create a brace that attaches from one end of piece 2 to the other end, so that it forms a right angle triangle [figure 1]. Use glue to reinforce all the joints. Cut a small strip of thermoplastic that is one inch wide and three inches long and create a hole at the top for the metal bolt. Then with the strip of thermoplastic on the bolt, glue the bolt onto piece 2 where the material was previously shaped to fit the bolt. Now the strip of thermoplastic can pivot about the bolt. Glue the metal hook to the strip of thermoplastic that was previously attached to the bolt. Finally, attach the Styrofoam to the top of piece 1, to add extra padding, as well as two thin strips to the bottom of the second piece to produce a concave shape. The majority of the device is fastened by glue and some tape, except for the thermoplastic connected to the hook, which is held in place by the metal bolt.

Use

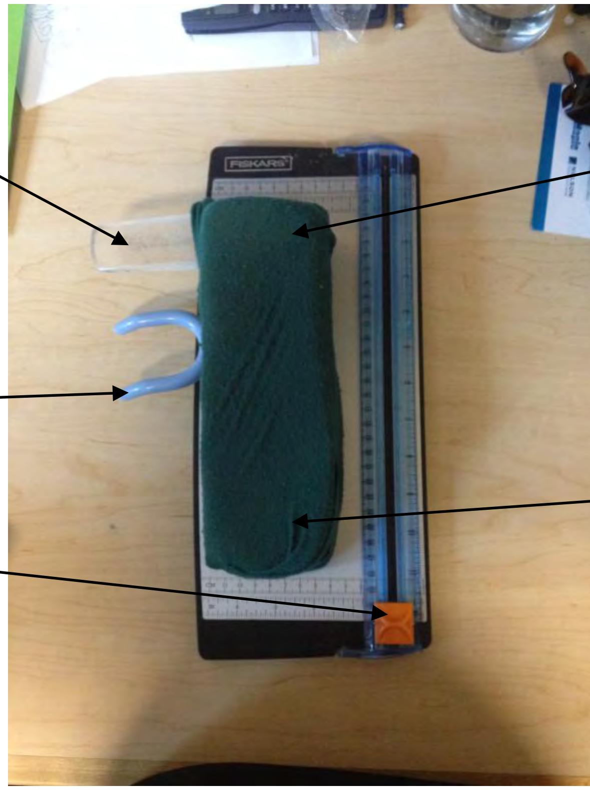
1. Insert the gas nozzle into car fuel tank.
2. Take the device and slide the hook under the handle of the gas nozzle.
3. Move the device overtop the nozzle.
4. Press down on the long end of the device to begin gas flow.
5. Maintain pressure to until the desired amount of gas is dispensed.
6. Release pressure, remove hook and store device where convenient.

Benefits

Our device is very light weight (under 5 lbs) since it is mainly made out of thermoplastic. It is small, compact and can be folded up to conserve space allowing it to be easily stored. However it is large enough to grip securely. It requires little force to push it down and once the gas starts to flow you need even less pressure. The device uses a pushing motion rather than a gripping motion which eliminates many sources of pain and discomfort for the user. It can be pressed down with palm or forearm to minimize or eliminate use of joints. It requires no setup to operate and requires little or no cleaning. It is very durable, able to withstand numerous drops and other damages. The device requires little to no long term maintenance.

The Upper Hand

Rheumatoidal Remedies
F 0 5 - 1 2 6 - 1



Problem Description

In order to increase Ms. Sandi Mugford's independence and ease the pain associated with her Rheumatoid Arthritis, design a device that will assist her at the gas station by making it easier for her to squeeze the gas nozzle.

Design

As shown in the picture above, the design is very simplistic. There is an "L" shaped Plexiglas, which is rounded off to avoid any sharp edges. Although it is not visible in the picture above, about a third of the way up the longer part of the Plexiglas (which is about 25cm long) there is a pivot that is bolted down, in which the blue hook as shown above is threaded into. This allows for a full 360° rotation (without becoming threaded like a screw would, but rather a pivot). The longer part of the Plexiglas is then covered in foam, as this will absorb the impact of Sandi's push and also hold the pivot more securely. The foam is covered in a green cloth which is then sewed shut. Instead of gluing the foam to the Plexiglas, it was just sewed, so the foam would not have to be replaced in case of needing maintenance. This final design is shown above, with a foam paddle about 7cm wide and 25cm long, a hook that is about 5cm wide and 7cm long and exposed Plexiglas which is about 4cm wide and 7cm long. Since the design is made up of mostly Plexiglas and foam, it is very light, even for Sandi's fragile hands. The dimensions are also wide enough that she can hold the device in one hand without having to squeeze her and into too much of a fist, as well as long enough for her to be able to carry it with two hands if she so desired.

Functionality

The design can assist Sandi with squeezing the gas handle trigger. It will convert the squeezing motion into a pushing motion, making it much easier for Sandi at the gas station. However, it does not assist her with inserting her credit card or hitting the keypad. Since the credit card and keypad technology is constantly changing, a device designed for those problems would become obsolete in the short term as the technology in those two areas will evolve greatly in very little time (for example, tapping credit cards and touch screen keypads). However, with gas nozzles, there have been very minor changes in their history and the device ca be used in the long term.

Materials, Components, and Assembly

The device only requires a few small and easily accessible items. All of the materials in the device can be found at a local Wal-Mart or Canadian Tire. These materials include: Plexiglas, Foam, Cloth, Hinge/Hook, Pivot, Nuts and Bolts. The total cost of the device above was $16.47 - however, this price can vary between $15-20 depending on where the materials are bought from. The construction of the device requires a saw as well as sand paper (or similarly, a band saw or belt sander). The total amount of time needed to create the device will range from about thirty minutes to an hour. The only instructions needed are to: construct the Plexiglas first, then attach the hinge and pivot components, place the foam around the long part of the Plexiglas and sew it shut. There are no special assembly instructions, as most of the assembly is pretty straightforward and can be done effectively in more than one way (for example, instead of sewing the cloth shut, one could also glue it shut). It would be recommended to follow the exact dimensions of the device as they are specifically measured to accommodate most commercial gas stations and nozzles, however small changes will not affect the overall functionality of the device.

Use

The device is relatively small, so it can fit in many parts of the car, such as the glove compartment, arm rest compartment, the backseat, or in Sandi's handbag. She can carry the device by the foam as it will be the least stressful on her hand. She can use one or both hands as mentioned earlier to hold the device. When she is performing other tasks, the device can be put back in her handbag, back in the car, or simply on the ground nearby. Using the device is relatively simple:

1) Slide the gas nozzle into the car.
2) Slide the blue hook of the device onto the top part of the gas nozzle so that the Plexiglas is under the gas nozzle's trigger.
3) Push the green padded part of the device - this will lift the Plexiglas under the gas nozzle's trigger and act as a lever arm, thus inserting gas into the car.
4) When the gas tank is full, to remove the device, simply slide it off just as it was slid on.

Note that the device can be slid on from either side of the gas nozzle as the gas nozzle is symmetrical. However, it is recommended to slide it on to the side away from the gas cover so there will be more room to maneuver the device.

Benefits

The Upper Hand is better than existing products as well as those of peers for many reasons, such as being affordable, easy and quick to use, easily accessible, durable reliable, compact and portable. However, the biggest reason should be chosen by Sandi is: it is simple. The simplicity and minimalistic nature of the design will reduce the amount of time that Sandi spends at the gas station as well as the effort she needs to exert. She will use less energy, feel less pain and save time. The concept of that design which is to convert the squeezing motion into a pushing motion will make it much easier for Sandi to pull the gas nozzle's trigger and fill her gas tank. Furthermore, the device has no complex movements. There are no mechanical or complex motions that the device, or Sandi, must do in order to fill her tank. All Sandi must do is slide and push the device. Using The Upper Hand is as simple as the implementation of it. As described in the very few and easy steps above, there is not much extra work Sandi must do as compared to other people to fill her gas tank, which will ultimately make her feel more independent, which is the main goal of the device.

Easy Grip

Team Name
F 05 - 126 - 2

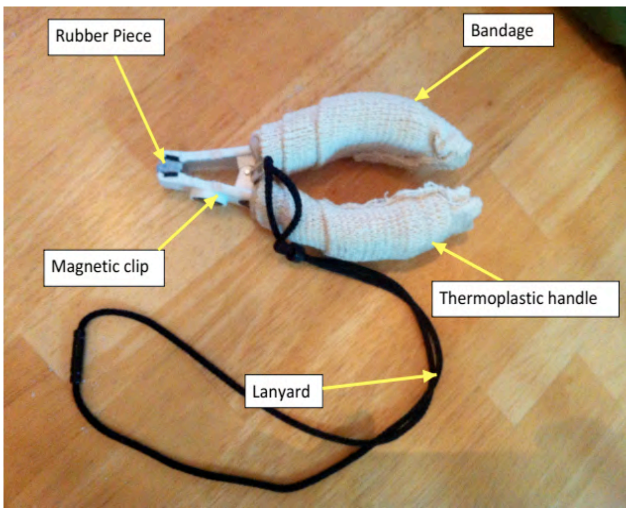


Figure 1: Labelled picture of the device

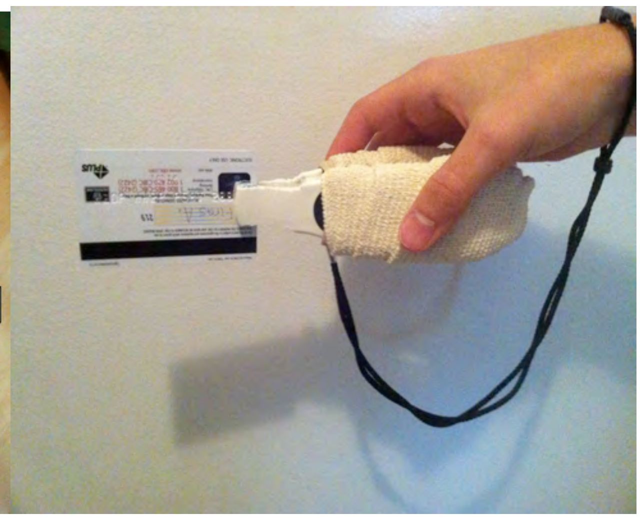


Figure 2: The device holding a credit card while the user wears the wristband

Problem Description

Create a device that facilitates the process of our user, Sandi Mugford, refueling her vehicle. The design should reduce Mugford's pain from inserting her credit card into the machine, thereby conserving her energy.

Design

The length of this device is 11.5 cm long and is 7.5cm wide. The weight of the device is approximately 250 grams. This device is light enough and large enough for Sandi to use without experiencing pain

Functionality

This device can help users insert and remove their credit card from the machines in gas stations quickly and effectively. If the users have joint disease, this device allows them to avoid bending their fingers, which will reduce their pain when they need to insert their credit card into machine slots. This device can be used anywhere that has a card slot.

Materials, Components, and Assembly

The materials used to construct the device are thermoplastic, super glue, magnetic clip, lanyard, rubber pieces and bandage. All of the materials are very cheap so that the total cost to construct the device is about $20.
The tools needed to construct our design are a saw, super glue and scissors
Our design has only one part considering it is hard for Sandi to assembly several parts together, it is time-consuming and hard to operate.

Use

1. First, remove the device from the storage area.
2. Insert wrist in the lanyard
3. Tighten the lanyard by pulling up the bead
4. Then, squeeze down on the handles in order to open the mouth of the device.
5. Place the credit card in the mouth of the device.
6. Reduce the force on the handles and allow the device to grip the credit card.
7. Insert the credit card into the machine while holding the device steady.
8. Finally, once the refuelling process is done, grip the card again with the device and remove it.

Benefits

There are a number of benefits involved with Sandi using our device at the gas station. One of the key issues faced by Sandi is the fact that the movement in her joints are very restricted as excessive movement would be very painful, our device tackles this issue as we have substituted the pinching motion of the credit card to the griping of our device. The pinching motion focuses on the use of two fingers while the gripping motion requires the whole hand. This means that the pressure that used to be on the two fingers is evenly distributed to her whole hand, reducing her pain in general.

Currently, Sandi does not have any device that helps her with the credit card insertion at the fuel pump. To help facilitate this process for Sandi, we have come up with a device that could be used to expedite and simplify the fueling process. This device is very lightweight, which does not require a lot of force to carry the device around. This is a great advantage for Sandi because the device can be carried around in her purse, meaning the device is very portable. Also, this device is very easy to grip and requires a very minimal force to operate. The increased grip will help decrease the chances of Sandi dropping the device. When a minimal force is required to operate the device, Sandi can use it multiple times during the day without feeling exhaustion in her hand. Another benefit of our device is the wristband that makes sure the device does not fall to the floor. This wristband can is very easy to adjust and can be removed without a lot of effort. The wristband is a great benefit to Sandi due to its function. The function of the wristband is to catch the device in case it falls from Sandi’s hand. In the case where the device falls from her hand, the lanyard will catch the device and it will dangle. Since the device is lightweight, it will not cause Sandi any harm if the device were to fall from her hand. Since the device is attached to the wristband, it will never fall to the ground, which is a great benefit for Sandi. Once the device is not in use, it can be placed on the fuel door, so Sandi does not need to constantly carry it around and she can focus on fueling her car. Finally, due to the compactness of the device, it can be stored in any location in the car. For example, it can be stored in the door of the car, the glove box, compartment between the two seats in the front, and in the trunk beside her purse or even in her purse.

EASY GAS

Team Name
F 0 5 - 1 2 6 - 3

Problem Description

The purpose of this project is to help the user—Sandi—when she fuels her car at a gas pump. The user has a condition—rheumatoid arthritis—causing hand and arm impairments, due to which she has difficulty lifting objects and maintaining an applied force for a prolonged period of time. As a result it is hard for her to tightly grip the pump for an extended period of time. The project attempts to aid her in the processes by reducing the amount of force required from her hand/fingers to use the gas pump, while having the attribute of portability and affordability.

Materials, Components, and Assembly

This device requires a number of materials and components in its construction. These include: a metal coat hanger, a nylon belt, two key rings, a PVC pipe, a number of zip ties, silicon taps, a foam tube, a carabineer, a sheet of Plexiglas, glue, electrical tape and thread. The total cost of these materials is around $40.00 and the assortment of items can be purchased at the following stores: The Dollar Store, Fabricland and Home Hardware. Unlike the materials, the tools required for construction are more expensive and are more difficult to find for purchase. The tools used include: a Dremel rotary tool, a heat gun, sewing needles and knives. Overall, total construction time should range from five to six hours. Instructions for construction cannot be included in this document due to the relative complexity of the devices design. If one wishes to construct the device then they may do so by using the provided visual.

Design

The device has a number of notable features. The hook is made of aluminum therefore it is lightweight. The hook is relatively small but was made with a loop to allow for easy grasping. The next notable feature of the device is the modified PVC pipe. This component is also lightweight as it is only composed of plastic and silicon grips. Attached to the end opposite to the hook is a specialized carabineer which was modified to be wider so that it could be easily opened. It is made of aluminum so it weighs very little. Two other important parts of the device are the attachments, one of which is made of foam for an easy grip while the other is a foot board that provides a sturdy base to press on. Overall the device is light, small, and weighs a total of 256g.

Functionality

Despite its seeming complexity compared to other devices, the premise of Easy Gas is simple. It uses a basic pulley effect to pull the lever on the gas pump to pump gas for the user. The device also allows the user to use two different attachments which each provide their own way of "activating" the device. The handle piece allows the nylon belt to be pulled with the hands while the foot pedal allows it to be pulled by pressing down with one's foot. Despite the attachment used, both accomplish the same task of pulling the hook up and activating the pump. Furthermore, each component requires a very low force to activate the device as requested. Overall, the device can do everything that the client requested with regards to the problem addressed.

Use

The following are step-by-step instructions of how to use the Easy Gas device:

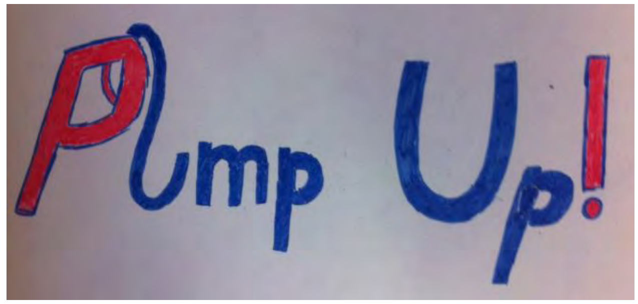
1. Set the modified PVC piping (the white component) on top of the pump that is directly above the farthest end of the gas lever.
2. Place the hook around the gas lever.
3. Pull down with the handle and use hands to minimally assist pulling up on the lever. If instead the foot pedal is used, proceed with the same process except push down using a desired foot.
4. Hold the handle or foot pedal until the gas tank is full.
5. Remove the device from the pump and return it back to its storage location.

The device itself may be stored in the provided container and the container may be placed in trunk of the car. It is advised that the device be stored inside the car at all times so that it does not need to be carried around. While completing other tasks of the fueling process (such as payment) the device may be stored in place on the gas nozzle, see Appendix S.

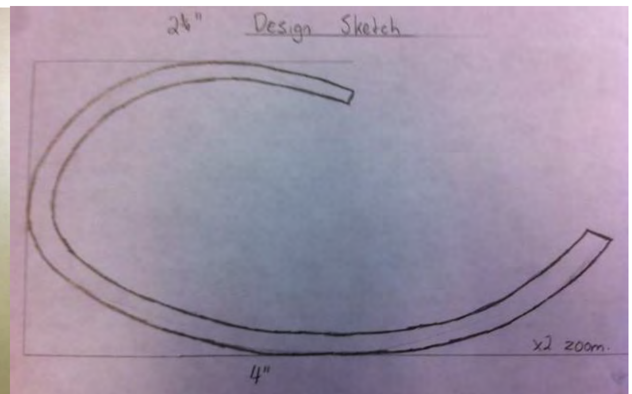
Benefits

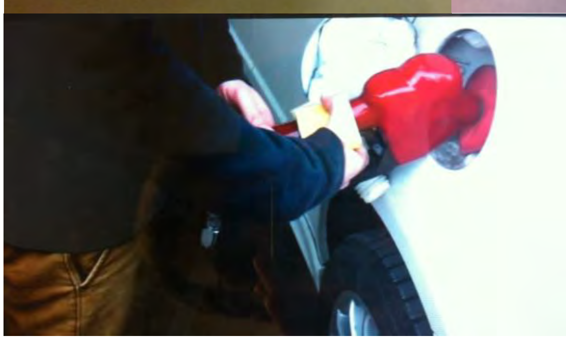
There are a number of features in the device that make it better than pre-existing solutions and the solutions of other groups in 1P03. Firstly, the device is small and lightweight making it portable. Aside from this, the device is durable due to the high quality of materials used in construction. This durability means that the device will last a lifetime. While portability and durability are important, it is of greater importance that the device is easy to use. The Easy Gas device fits this description based on its simplicity and the few steps required to work it. Finally, one thing that really sets the Easy Gas apart from other devices out there is its modularity. Easy Gas comes with two separate attachments which enable the use of the device with different parts of the body. The handle allows the device to be used with the hands while the foot pedal allows it to be used with the foot. This is useful for days when certain joints are not up to the task of pumping gas. It is for all these reasons that Easy Gas is a device better than other pre-existing solutions that might be found.

Pump Up!



Pump Pros
F05 - 126 – 4





Problem Description
The purpose of this project is to generate a product for the client Sandi Mugford that will reduce the pain and discomfort she feels when squeezing the lever of a gas nozzle at a gas station of her choice.

Design
The "Pump Up", has a small, light, compact design. It weighs less than 200 grams, and occupies a space of less than 20 cubic inches. It fits comfortably into the palm of anyone's hand, and is easy to hold due to the rubber handgrip.

Functionality
"Pump Up" aids the process of pumping gas by compressing the gas lever with very little external force from the user's hand necessary. The only time any effort needs to be expended is during the turning of the device; past that, the elliptical design does all the work. It fulfills all aspects of the proble of pumping gas by lessening the pain and effort of the user during the process of filling up their car.

Materials, Components, and Assembly

The “Pump Up” is made from only three different components: a 2x7 inch piece of thermoplastic, a 2x7 inch piece of rubber, and craft glue. The thermoplastic will cost about $1.65 from worbla.com. Both the glue and the rubber gloves where the rubber is from can be purchased at Dollar Tree, the gloves costing $1.25 and the glue $1.99. The only tool required for making this product is a sink full of +50 degrees Celsius water. Mold the thermoplastic into an elliptical shape of length 4 inches by height 2 inches, as seen in the pictures above. Allow it to cool either by air or by dipping in cool water. Once the thermoplastic has hardened, apply the craft glue to its outer surface. Paste the rubber strip onto the surface and allow to dry. The “Pump Up” is now ready to use.

Use

1. The “Pump Up” can be stored in the glove box, cup holder, side door pockets or in the the user’s purse.
2. Upon arriving at the gas station, remove the “Pump Up” from its place of storage.
3. Insert the “Pump Up”’s U-shaped end over the top of the top handle of the nozzle. The shallow, open end of the device should rest just below the gas lever.
4. Turn the “Pump Up” through an angle of 90 degrees. This will compress the lever and allow gas to flow.
5. Apply gentle pressure to keep the “Pump Up” in its place. Once finished, rotate the device 90 degrees in the opposite direction.
6. Remove the “Pump Up” and place either back in the purse or in pocket: it will fit in both. Pay and drive away!

Benefits

The “Pump Up” is the simplest design and the most effective solution to the biggest problem the user experiences. The majority of its structure is one piece of thermoplastic; the only other component is the handgrip, which ensures that it is easy to hold. It is incredibly lightweight, and small enough to fit anywhere in the car, purse, or even on the person such as in pockets. The thermoplastic’s slight flexibility makes it virtually unbreakable, as well as it being rain and water resistant. Because it is unbreakable, it cost nothing to repair or maintain, and even costs very little to produce in the first place: under $5.00 for all components of the product. The components bought can even be used multiple times, there being enough rubber from the gloves and glue in the bottle to make several “Pump Up”s. The handgrip makes it very easy to hold and, even when dropped, the bright colour of the rubber grip makes it easy to find against any background. It is not only a simple design, but also simple to use; there is not set up required, merely slot the “Pump Up” over top of the gas nozzle handle and turn 90 degrees. There are no parts to arrange and almost no instructions to follow. The simple design works very efficiently, doing its job of pumping gas with only a finger’s pressure of assistance from the user to stay in place. If that finger is removed, the “Pump Up” will even pop off the nozzle, preventing an over flow of gasoline.

Gas N' Go

Team Name
F 0 5 - 1 2 6 - 5

Problem Description

A device needs to be created to aid Sandi Mugford when pumping gas into her vehicle at a gas station. Due to her rheumatoid arthritis, she has difficulties holding up the trigger on the gas nozzle and experiences a great amount of pain and energy loss when doing this. The purpose of this device is to ease her pain and energy consumption when pumping gas as well as helping her maintains independence.

Design

Our design is made of a hockey stick and two foam handles. The foam creates a much more stable and smooth surface on the device making it easier to hold or lift while pumping gas. Also, the foam assists in maintaining the objectives of being user friendly and comfortable for Ms. Mugford. The rigid hockey stick behaves as a
weightlifting object by using one hand to hold the middle part of the stick while the other hand will be used to hold the upper end of the stick. Minimal force is required to lift the hockey stick upwards towards the body while slightly rotating it over an appropriate distance (length of hockey stick) which maximizes the torque applied in order to rotate the hockey blade.

The rigid material of the hockey blade is a flat shaped base which is wide enough to fit in the spacing between the handle, making it easy to push against the trigger of the gas nozzle, initiating the flow of gas. The rigidity of this material helps maintain the durability.

The hockey stick has a great power to weight ratio, which means that strength and stiffness can be maintained by a light weight plastic stick. This device is light weight because of the small amount of lightweight materials that were used to construct it, and will reduce energy use and pain in the joints. The hockey stick is very simple and is only one part, making it easy to store and maintains the objective of being lightweight and portable. It is made of strong material thus it will last for a long time, and will not have to be replaced so often.

Functionality

This device fulfills one of the requirements asked, it helps pump the gas. Our device eases Ms. Sandi Mugford's task of filling her gas tank by lifting the gas handle for her. By applying a torque upward on the device, Ms. Sandi no longer has to grip onto the trigger, thus the pain and stress in her finger joints is reduced.

Materials, Components, and Assembly

Very few materials are required for this design. It consists of only a junior sized hockey stick which costs $5 and a pool noodle which costs $1. The hockey stick can be obtained at any sporting goods store or even Canadian Tire or Walmart. Pool noodles can be obtained at any pool store, department store or Dollar store.

The construction of this design is fairly simplistic, as well. Depending on the length of the hockey stick, one may need to cut it shorter so it is easier to store and easier to use. This can be done by unscrewing the blade of the hockey stick with a screwdriver. After the blade is removed, 4 inches can be measured from the bottom of the shaft and cut off with any type of saw. The blade of the stick can then be reattached using the screws that were removed earlier.

Using scissors, cut a pool noodle into eight one inch wide strips that are approximately six inches in length. The pieces should all have their rounded inner edges cut so there is a flat edge to glue to the shaft of the stick. The first four strips will be glued at the top of the stick, one on each side. The second set will be glued in the same fashion about twelve to eighteen inches away from the first set and set it to dry.

This whole process should take no longer than half an hour.

Use

How Our Device Works:

1. Hold the rubber end of the device with the right hand and the center with the left hand. The fingers must be on the top and the blade of the device must be on the left side pointing away from the user.

2. Insert the blade of the device into the lower region of handle of the gas nozzle.

3. Lift the device upwards and towards the user's body using both hands.

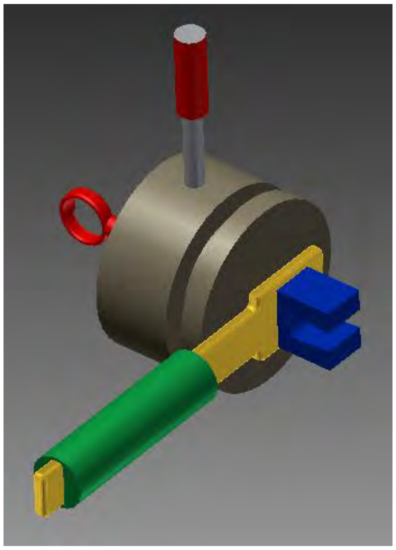
Benefits

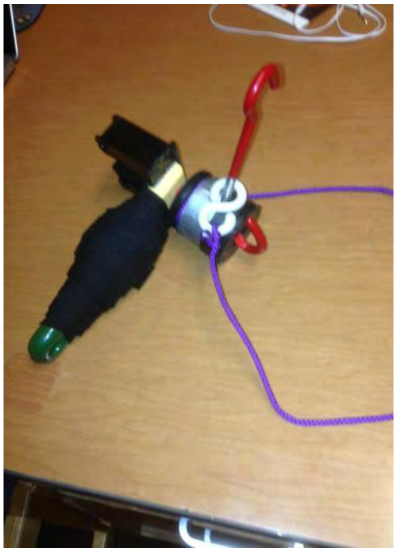
This is the best solution to this problem for many reasons. The device reduces energy use, reduces pain in joints, and is easy to use. This device is very simple and has only one part, making it easy to store, as well. Also, this is made of strong material, so that it will last longer, not needing to be replaced so often, thus saving money. This device takes a complicated problem and solves it in a simple manner, giving it a huge advantage over many other devices. Its simplicity outweighs its disadvantages and makes it one of the most effective devices.

EzGrasp

MiracoBiotech

Team Name
F05-126-6





Problem Description

Our client suffers from a condition known as rheumatoid arthritis, limiting the mobility of joints in her hands and feet. In turn, she has difficulties at gas stations as it requires the flexing of such joints to pump gas. She has turned to us to design a device that will help her pump gas with ease.

Design

It is based on a pulley and handle layout where a clamp on the other side enables the device to mount onto other surfaces. The device is primarily constructed of lightweight plastics and can be stored easily in most glove compartments of vehicles.

Functionality

The design utilises a pulley and a large handle to maximize the turning power with less effort from the user. The motion required from the user is nothing more than a push/pull action that requires little movement of joints in the hand and wrist. The design incorporates a strap in the handle to prevent the device from falling to the ground if accidentally dropped. Also, since most parts are plastic or rubber composites, they act as insulators for temperature such that the surfaces the user must touch won't turn cold in the winter and risk any further discomfort.

Materials, Components, and Assembly

Most of the parts used in the device's construction can be found in a typical hardware store (in this case, Home Depot). The layout primarily consists of plastic a plastic pipe for the pulley axle, plastic couples for the pulley, a paint scraper for the handle, a wall clamp, and some string cord. All of this should total to a cost of approximately $26. There are no particular tools that are needed to complete the construction provided the parts obtained are of proper size. Cement glue is the main ingredient in binding parts that don't already fit. A lighter is also recommended for deforming and reforming certain mouldable plastic parts if needed. The construction should take roughly 2 hours, that's including the time it takes for the glue to dry. Special instructions/tips for assembly may be needed to further clarify the layout, if the CAD model is not clear enough.

Use

1. Unstrap the Velcro strap on the handle and re-strap it twice around your wrist.
2. Retrieve the gas pump and place it into the gas port of your car as you usually would.
3. You can now push the device onto the top of the gas nozzle with the clamp side facing down, making sure the device is completely clamped. You can choose to either remove the device from your wrist and clamp it using both hands or push down using your for arm to clamp it onto the nozzle.
4. Take the WHITE HOOK that is on one end of the purple cord and fish it through the gas nozzle such that it rests on the lever (where you would usually apply pressure with your fingers to pump gas).
5. Use the white hook to hook onto the RED handle located on the PULLEY.
6. Slide the white hook as towards the pulley as close as possible.
7. Now, using your palm your can push/pull the RED handle on the pulley around until the gas lever is squeezed, this should only take one rotation.
8. Maintain the RED handle in the current position until you have filled enough gas.
9. Once there is enough gas, simply release the RED handle and the device will release the gas lever, and the gas will stop pumping.
10. Now you can either remove the device by pulling directly upwards to release the clamp before returning the gas nozzle and re-store the device in your car or leave it clamped onto the gas nozzle body while running other errands.

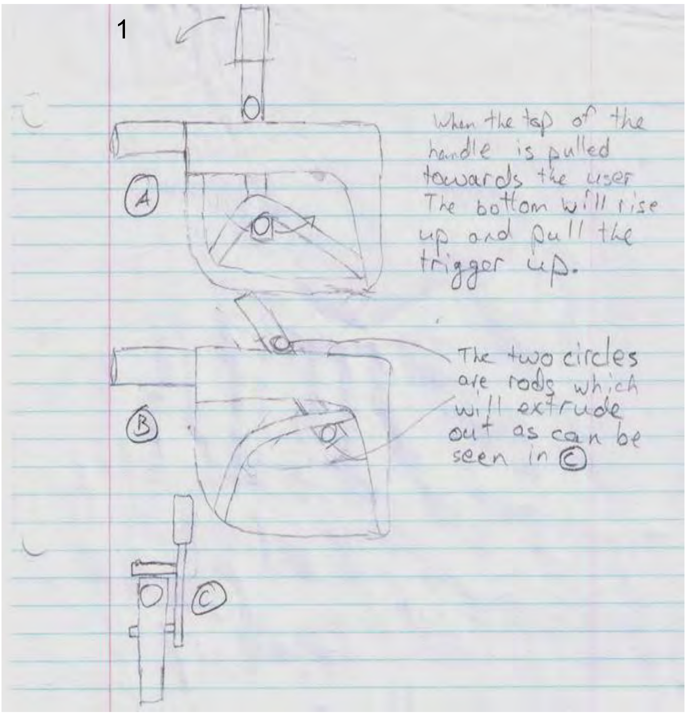
Benefits

The device layout and function requires little minimal joint movement in the hands during usage. This is because there is little or no actual grasping the user has to do when setting it up or using it, and when in use the motion is only push or pull from the rest of the fore arm and elbow. The device is able to do this because the long handle on the pulley can maximize torque applied in squeezing the gas lever without straining the user (much like a tire iron). The device also features a soft thick handle so the user does not have to bend their fingers too much to hold onto it. Furthermore, the device is mainly composed of plastics used for plumbing applications, making them lightweight and extremely weather proof.

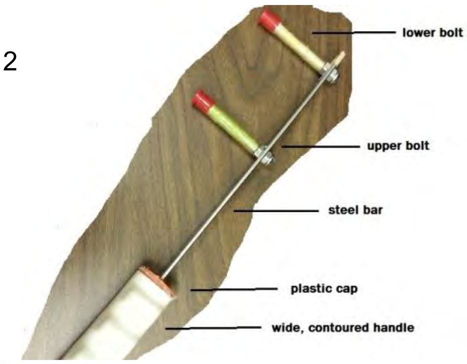
The Sixth Letter

Seven-11 Design Works
F 05 - 126 - 7

1

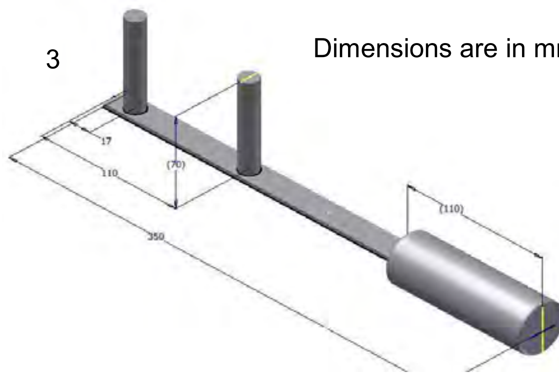


2



3

Dimensions are in mm



Problem Description

A device must be designed to relieve the pain Sandi Mugford experiences due to her rheumatoid arthritis and allow her to maintain her independence when using the nozzle at the gas station. It must also fulfill the goals set out by Dr. Fleisig and Dr. McDonald.

Design

The Sixth Letter is a steel bar with two bolts attached to form a shape like the letter “F”, as can be seen in diagrams 2 and 3. The two bolts are encased in rubber tubing which increases the friction between the device and the nozzle, preventing it from slipping out. Two plastic caps secure the rubber tubing in place. The different coloured tape used on the two bolts informs the user which bolt goes on top of the nozzle and which goes under the lever. The wide, contoured handle is made of a soft rubber with foam inside. This makes it comfortable to use and operate. A larger plastic cap secures the handle into place. Overall this design weighs 300g or 0.7 pounds and is only 13” long with 3” long bolts.

Functionality

The Sixth Letter is able to lift the gas trigger up with ease and little effort. The lower bolt pushes the lever of the gas nozzle up and the upper bolt rests on top of the nozzle and acts as a fulcrum. The Sixth Letter rotates about this upper bolt. Sandi only needs to push the handle towards her car. It involves no contraction of the finger joints, allowing Sandi to encounter less pain when refuelling her car. Therefore this device is able to address everything the client has requested with regards to the gas nozzle problem.

Materials, Components, and Assembly

The materials required to construct The Sixth Letter include a steel bar 1/8”x3/4”x36” costing about $5.00, two ¼”x3” machine screws and four ¼” machine screw nuts that cost $2.00 each, rubber tubing, two plastic caps with a diameter of 1.5 cm and another plastic cap with a diameter of 3 cm for about $1.00 each, a wooden dowel costing $0.50 and a rubber handle that costs about $5.00. The steel bar, screws, nuts and wooden dowel can be purchased at any hardware store such as Rona or Home Depot. The rubber tubing and plastic caps can be found at any dollar store. The rubber handle is specifically designed to assist people with arthritis and can be found at any pharmacy that carries devices for healthy living. The tools needed for construction include a handsaw, a file, an electric drill with a ¼” drill bit, a flathead screwdriver, a 3/8” wrench and a glue gun. The steps for construction are as follows:

1) Use a handsaw to cut steel bar to 13” in length
2) Drill two holes 3.5” apart on one end of the bar
3) Feed the screws through the holes using the flathead screwdriver
4) Tighten two nuts on either end of each screw using the 3/8” wrench
5) Cut rubber tube into two 3” tubes
6) Slip tubes over the screws
7) Fit smaller plastic caps in open ends of tubes
8) Cut a ¾” slit into the larger plastic cap
9) Slip larger cap and handle into place on the opposite side
10) Cut wooden dowels into six 4” pieces and wedge in handle
11) Glue the larger plastic cap to the top of the handle

The assembly process takes approximately 30 minutes.

Use

1) Insert the device vertically into the gas nozzle with the green bolt below the lever and the brown bolt on top of the nozzle. Please refer to diagram 1 for insertion details.
2) Push the device towards the vehicle (counter-clockwise) using the wide handle; the handle can be gripped or can simply be pushed with a flat palm.
3) When finished, push the device back to the vertical position and pull out.
4) Return the Sixth Letter to the trunk, passenger seat or rear seat where it is stored.

If other tasks need to be completed prior to returning the Sixth Letter to the car, it can be placed on top of the trunk or the hood, or it can be hung from the nozzle when it is still on the stand. The device can easily be carried by the handle.

Benefits

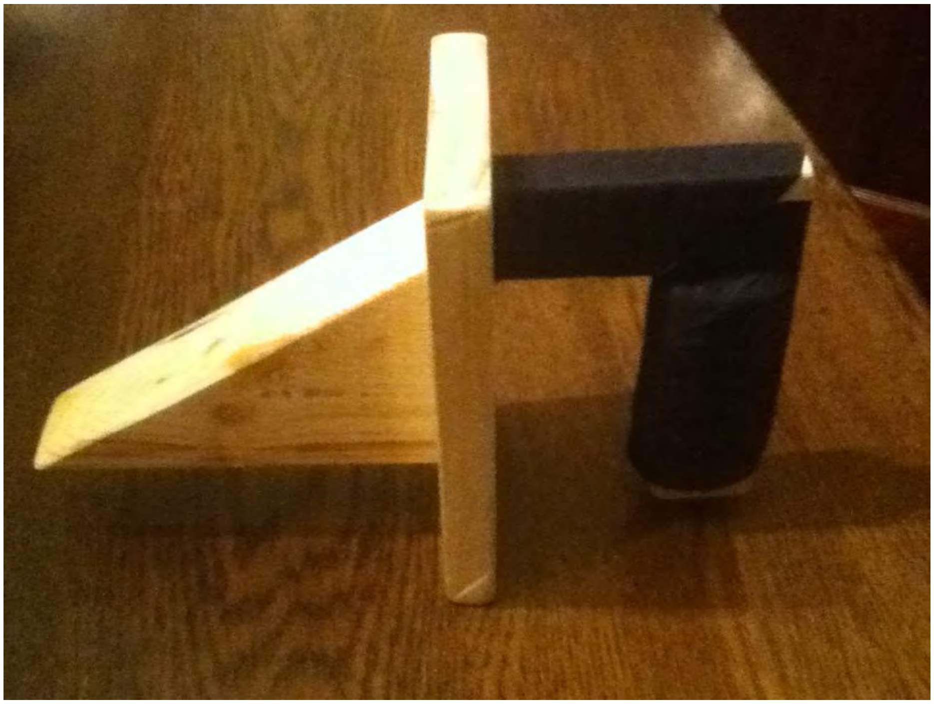
The Sixth Letter is a simple device to use with four easy steps. It does not require a clamping motion like most of the other devices, but rather a simple push, even from a flat hand. This places no pressure on the joints, thus making the fuelling process much more comfortable and safer. Furthermore the device is small, lightweight, and portable meaning that it can be stored virtually anywhere in the car. Sandi can store it with her purse in the trunk, or just beside her in the passenger seat. It is made from strong, durable steel allowing it to easily survive falls from various heights. The wide, contoured handle allows for easy use and transportation. It provides a soft point of contact while the device is in use and also for when Sandi must carry the device into or out of her car.

Safety at the gas station is another important issue that the Sixth Letter addresses. Any device that clips onto the nozzle is illegal because if it is left on the nozzle, gas spillage can result. This poses a potential fire hazard and is therefore impractical. The Sixth Letter does not lock into place but can easily be held in place by the user. The biggest advantage of this design is in how easy it is to use and the rubber contoured handle which provides a soft point of contact.

Each of these points addresses the major objective for Sandi to be able to maintain her independence. Its ease of use and storage will allow Sandi to transport and operate it without any difficulty or pain. She will be able to continue driving for many years with the confidence that if she needs to refuel, she can do so without exerting copious amounts of energy or experiencing any pain.

Gas Nozzle Device

8 Ball Solutions
F05-126-8



Problem Description

The client, Ms. Sandi Mugford has stated that she experiences difficulties while refueling her car at the gas station, because of her arthritis. The team's goal is to design a device which will increase Ms. Mugford's independence and reduce her pain. This pain is caused by the fatigue of squeezing the trigger of the gas nozzle.

Design

The design consists of four parts. The handle provides easy grip and handling. The strap catches the device in case it is dropped; so that Ms. Mugford does not need to bend down to retrieve it. The wedge lifts the nozzle trigger as it is pushed, and minimal effort to keep engaged. Once released, though, it falls back out, abiding by the laws. The backboard stops the device from going through the nozzle. The device weighs about 450 grams. The device is 25 cm long, 9.5 cm wide, and 16 cm high.

The device is designed to be handled easily by Ms. Mugford specifically. The handle of the device is made somewhat wide and soft, so that Ms. Mugford does not need to squeeze a lot to hold and operate it. The varnish on the wedge also makes it smooth, and therefore quite easy to push in and pull out. This makes it comfortable for Ms. Mugford.

Functionality

The device makes the pumping of gas much easier for Ms. Mugford. Earlier, she had to apply constant pressure on the trigger to pump gas. Of course this caused great pain and fatigue to her. This device lets her do this same action with minimal effort, and therefore fatigue and pain.

She only needs to push the device with little force to keep it engaged on the nozzle.
The most important thing that Ms. Mugford indicated is that she wants to maintain her independence, which can be blocked by the pain and fatigue caused by pumping gas. This device achieves this goal, which we know is very important to Ms. Mugford. It lessens or completely eliminates the pain associated with pumping gas for Ms. Mugford.

Materials, Components, and Assembly

The device is mostly made of wood, specifically pinewood. We chose this material, because it is a very light wood, very soft. The wood is joined by screws, which are hidden inside the wood, so they are harmless. The handle uses a bicycle handle for additional comfort, and is covered with hockey tape to have increased grip and be waterproof. The rest of the device is also covered with varnish to be waterproof and smoother to use.

The cost of the pinewood used was about $0.50, the hockey tape used was $0.80, the screws were $0.20, and the varnish needed cost $1.00. On average, one model would cost about $2.50 to construct The wood, screws, and varnish were obtained at Lowe’s, while the hockey tape comes from Canadian Tire. To construct the device the tools needed are a drill and a saw. It takes about 1 to 1.5 hours to construct this device.

There might need to be instructions for the first use, but since the device is quite simple there need not be any further instructions. There is also no assembly whatsoever by the user. The device is presented fully finished, and the user does not need to assemble anything.

Use

1. Retrieve the device from the trunk of the car.
2. Place the device on top of the car near the gas tank.
3. Select gas type, and place the nozzle in the tank.
4. Place the strap around your wrist.
5. Place the device such that the nose of the wedge is between the trigger and the bottom of the nozzle.
6. Push the device into the nozzle.
7. Keep device in place with little pressure required.
8. When done pumping gas, pull the device back out of the nozzle, and place it back on top of the car.
9. Finish the transaction.
10. Put device back into the trunk of the car, and you’re done!

Benefits

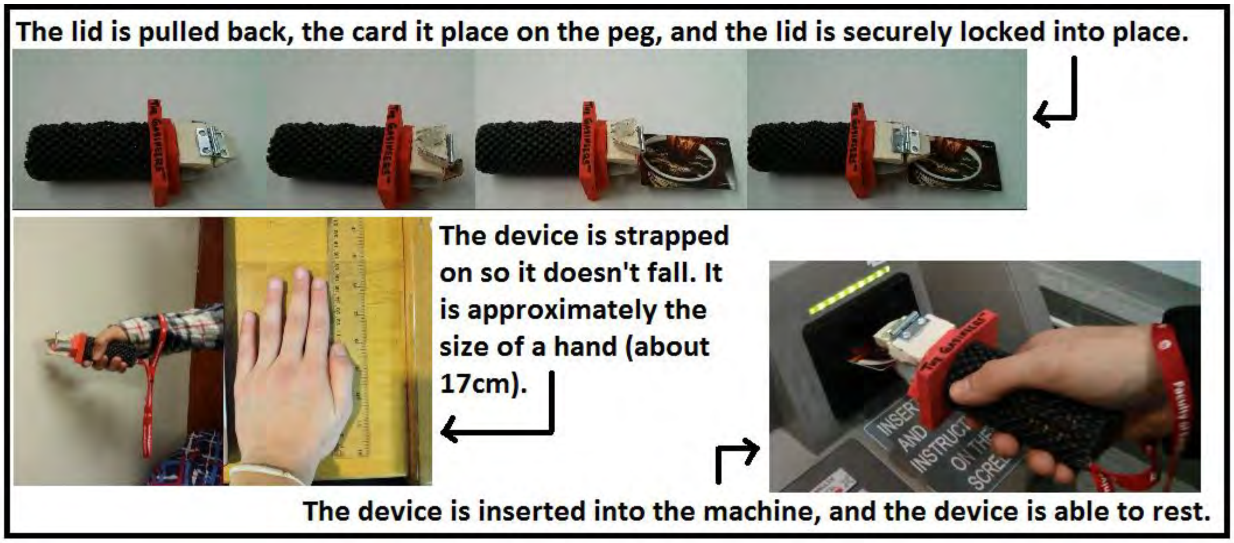
Comparing our product to those of our peers, we have a much simpler design than most of them. Several devices are large and bulky to carry around, not very easy to handle. Some of these utilize a foot pedal idea, which may destabilize Ms. Mugford. Our device is a small handheld device, which could be stored anywhere, and is very easy to handle.

There are also some designs using pneumatics or hydraulics to get the trigger up. Some other devices use some kind of mechanism such as a rope or a lever to lift the trigger. Unlike these devices, Our device has no moving parts whatsoever, therefore its chance of failure is much lower.

On the market, there are several gas clips which hold the trigger engaged, but they all require the user to lift the trigger first. In Ms. Mugford’s case, this is very tough, because she needs both hands to squeeze the trigger. It would be very hard for her to use such a device. This device lifts the trigger, and keeps it up as long as it is being pushed.

McMaster-Card

The Gasineers
F 05 - 126 - 9



Problem Description

The Gasineers' goal is to design a device that will give Sandi and others with the same or similar conditions an independent, precise, and simple way to insert and remove their card of payment into the gas pump payment machine without the pain which accompanies pinching the card tightly.

Design

The McMaster Card is surprisingly light, lighter than one would expect before they put their hands on it. Overall it weighs less than 1 pound. Much lighter than the typical coffee mug. The McMaster Card is 3 inches by 2 inches wide, 6.25 inches tall without a card inserted and 9 inches tall with the card inserted. About the same length as a butter knife. The overall design is a device which holds a hole punched credit card by pushing a pin through the hole thus locking the card in place horizontally. A hinge system is also used to lock the card in vertically. Half of the device is dedicated to this locking mechanism feature while the other half is a very graspable, soft handle for easy holding of the device

Functionality

The McMaster Card is able to successfully enclose the hole punched credit card within the device to prevent the card from falling out of the device while it is in use. The prototype's handle is able to distribute the force applied across a large surface area while being wrapped in a soft yet graspable material to alleviate Sandi's pain and making it easy to hold. The device is able to easily insert the credit card in and out of the card slot at the gas station thus achieving the main goal for the functionality of the device. The prototype is able to satisfy the client desires by designing a device to prevent her direct interaction with the machine.

Materials, Components, and Assembly

The tools necessary for the construction of the prototype are a saw, a hot glue gun, and hot glue sticks. The following materials are required to build the prototype: Plywood ($3), foam sword ($3), anti-slip mat ($2), a single pencil from a pack of pencils ($1), a lanyard ($1) and a metal hinge ($5). All of these Materials are purchased from Dollarama, with the exception of the lanyard being bought at McMaster and the metal hinge at Home Hardware. To construct the device begin by taking the foam sword and sawing its blade down to a stub as well as sawing the excess hilt off of the sword. Wrap and glue the mat around the hilt of the handle. Cut two small triangular wooden pieces from the plywood. Cut one triangle through its center and glue the metal hinge between these two halves. Glue one wooden triangle on one side of the blade and the hinged piece on the other. Chamfer the end of a pencil and saw that end off. Glue the pencil to the tip of the non-hinged piece and create a female mould of the pencil on the tip of the hinged wooden piece. The construction of the device should take no longer than an hour and a half.

Use

1. While sitting in the driver seat of the vehicle, the user will reach into the glove compartment and obtain the McMaster-Card, the user should also obtain their pre hole punched credit card from their wallet of from storage
2. The user should place their hand through the lanyard and grab the McMaster-Card by the black handle of the device
3. Than with the users free hand open the locking mechanism by applying a diagonal force upwards using the palm of their hand
4. The user should place the hole punched credit card on the chamfered pin
5. Then using the base of their free hand, the user should apply a downward diagonal force on the locking mechanism to lock the credit card in place
6. The user should then get out of their car by opening the door with their free hand
7. The user than places the credit card in to the ATM using the device, the user should than dial their credit card pin while the device stays stationary in the ATM
8. Once the gas is paid for the user should remove the device and place the lanyard around their neck or arm and let the device freely hang as they continue with the other processes of fuelling their car
9. Once all other aspects of fuelling the car are done and the user return to the driver seat, the user should unlatch the locking mechanism using the palm of their hand (similar to step 3) and then place the device in the glove compartment and the credit card in their wallet

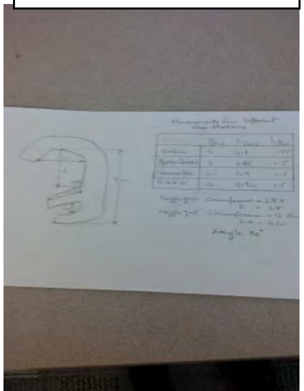
Benefits

What makes the McMaster-Card better than other products is its weight. The use of foam and plywood helped make the device very light, lighter than it might seem. This ensures that the device is very easy to hold and use. It also will not cause any strain on the wrist when strapped on. Many other devices failed to achieve this goal because the light materials couldn’t support the device’s body, or simply couldn’t function while being so light. Another benefit of this device is the handle. The handle’s texture is coarse and bumpy, allowing easier grip, and minimal chance of the device slipping out of the hand. At the same time, it is very soft and will not harm the hands when used repeatedly. Other devices either made gripping too soft or too rough, making their device either very easy to drop or cause pain while in use. Lastly, the device is entirely waterproof. This allows the device to be used in multiple weather conditions, such as rain, and to be cleaned if needed. Other devices do not have this feature, and may be a burden to clean or use when raining.

Pump King

Team Name
F 05- 126 -10

CAD drawings



The “Pump King” device

The user lifts up the lever and holds it there so there is room to put the device in

The user can then easily fit the device in between the lever and top of nozzle

Problem Description

The problem that is being set out to solve is to design a product that will assist Ms. Sandi Mugford and others who are in a similar condition as her to refuel their cars by allowing them to easily operate the fuel nozzle to allow the flow of gas enter their gas tank. While doing this, the goal is to reduce the pain and energy consumption that Ms. Mugford and others go through while pumping gas. By completing these goals, Ms. Mugford and others in similar conditions will be able to feel independent.

Design

This design is very simple and effective. There are two main parts to the design. The first part is a piece of cedar wood that has been cut and crafted precisely to easily fit around the lever of the gas nozzle. The second part is a piece of string that is used to fit around the user’s wrist for added support.

This design is very useful in that it is very portable. The whole product is very light; it does not weigh more than three pounds. As well, the design is small and does not take up much space to store. It can easily fit in the user’s purse or glove box. Finally, the materials used in this design (cedar and string) allow for the product to be easily maintained. The cedar wood will not break easily, like if it is dropped on the ground or in a puddle. Also, the string is fairly sturdy and will only break if intentionally cut. Thus, the sturdiness of the materials used allow for the user to not have to worry about breaking the product.

Functionality

This design allows for the user to physically pump gas easier than just using two hands to manoeuver the pump, grasp the handle, lift the lever and hold the pump until the tank is full. By using this device, the user will use much less effort to pump gas.

Essentially, this design allows the user to apply a minimal force when lifting up the lever and holding the pump. Once the nozzle is in the gas tank and the device has been clipped on to the lever, there is not much work left for the user to do. After this, the device pulls up the lever for the user and continues to hold it up until the tank is full. Once the tank is full, the device stays on the lever until it is easily removed from the lever by the user. This action allows for the user to not need to grip and hold down the lever for a long period of time.

This design does not address the issues raised from the client's issues with pressing the keypad and the credit card insertion. As a group, it was decided that the most important problem to be solved was the issues around the client physically pumping the gas. With just looking at this problem, the product designed solves the problem very well.

Materials, Components, and Assembly

This design requires two different materials: cedar wood and string. The cedar wood was chosen because wood is sturdy and firm which is important because a strong material is needed to be able to withstand the pressure given by the gas lever. As well, cedar wood is water proof which allows for the design to be easy to use in many different weather conditions. The design is simple in that there are only two pieces to it; the wood that allows the gas to be pumped and the string that can attach to the user's wrist so they will not drop it.

The costs of the materials were $10.00 for the piece of cedar wood and approximately $1 for the 30cm of string used. These materials can be easily obtained at any hardware store such as Home Depot or Home Hardware.

When the device was being constructed there were a few tools needed to create the specific design. A hack saw was used to cut off smaller and precise pieces of wood from the cedar wood block while a chisel and hammer were used to cut out larger pieces. The whole construction of the device took several days to be able to create the accurate precision and detail needed to make the finished product. When this item was assembled, many drawings and dimensions were needed to get the accuracy needed for the block to fit in the lever without sliding. This required careful performance. However, no assembly instructions are needed because the device is just two simple pieces.

Use

1) Insert gas nozzle into fuel tank
2) Take out device from wherever it has been stored and tie the string on the end of the device around wrist.
3) Carefully insert the device on to the nozzle by matching up which hole goes through which part of the pump. The smaller hole goes in between the lever while the larger hole attaches to the top of the pump.
4) Stay by pump and wait for device to finish fueling up the tank. If the user does not want a fuel tank, they can pull the device out at any desired time by pulling their wrist back.
5) If the user would like a full tank, wait until the gas is done pumping and pull wrist back to remove the device when done.
6) Put gas pump back in holder
7) Store the device in an easy accessible place

Benefits

This design is the best design available to Ms. Sandi Mugford or other people with similar conditions because it is lightweight, portable, easy to use and does the required function very well. The small amount of wood and string that make up the device are materials that do not weigh very much, thus making it light. As well, the device can be stored almost anywhere, such as the users purse, glove box or other places in their car that are easily accessible. This ease of storage makes the product portable for the user. Also the device requires minimum effort to use, the only effort needed is clipping it in and taking it out, therefore it is easy to use. Finally, the function that this device does is it pumps gas for the user without them using much force. This product has been tested and it can be concluded that it completes this function very well. In conclusion, this design is the best design available because it is light, portable, easy to use and does the required function. There is no better way to pump gas.

Vesh

Simple Stations Engineering
F 06 – 227 – 01

Problem Description

Simple Stations Engineering have been assigned the task of designing and producing a device or devices for its clients Sandi Mugford, Dr. Fleisig, Abbey and Nina to help their user Sandi, independently operate a gas station for the refueling of her vehicle while reducing the pain she feels throughout the process.

Design

Vesh is a tool designed by Simple Stations that assists in refueling the car. The device has a very 'G' –like shape to it and has a wooden dowel attached to one end of it. Fiberglass insulation foam strips and electrical tape is wrapped around the dowel to provide a large comfortable grip. Also, a rope is attached in a loop to a hook to provide a method of carrying the device. Vesh weighs approximately 1.2 lbs, relatively same as a half-litre milk carton, which makes it very easy to carry. Also, Vesh is a relatively small and compact tool, easily fitting inside any string/school bag, or vehicular storage compartment. The approximate size of Vesh is 30 cm long by 10 cm wide by about 5 cm high. The size, weight, and shape of the tool make it very easy to carry for any user.

Functionality

The purpose of Vesh is to assist the user with the gas nozzle problem that exists when Sandi goes to refuel her car. Vesh helps by taking the pain away from joints that is received when squeezing the lever. With Vesh, the user is able to apply tiny mechanical downwards force resulting in a powerful squeeze on the lever with great ease and comfort. The device also helps to minimize the time spent at the gas station, since the tool is very quick to set up and use.

Materials, Components, and Assembly

The materials required are a sheet of plywood, a one-inch dowel, wood glue, fiberglass insulating strips, electrical tape, a hook, and a rope. In sum, all these materials cost $40 and is enough to manufacture at least 4 instances of Vesh. The materials can be easily obtained from any local hardware store such as The Home Depot or Home Hardware. The builder will also need the following tools to construct Vesh: a jigsaw with a wood saw blade, a workbench, a sander, at least 4 clamps, a pair of safety googles, a respirator and a marker. The first prototype may take up to an hour to construct, but with practice, one prototype can be easily made within half an hour. The builder only needs the instructions on where to cut the plywood. These instructions can be easily obtained by tracing a copy of Vesh, then following that outline to cut a new piece. For the assembly, the builder just needs to simply attach the wooden dowel to the cut out plywood. Then warp the insulating strip and electrical around the dowel for a comfortable grip. A total proper construction of Vesh will take about 2 hours of work and 2 nights of waiting for the wood glue to set.

Use

1. Retrieve the device from storage. It may be stored in the trunk, the driver's side door compartment (if sufficiently large) or the passenger/back seats, wherever Sandi feels most comfortable placing it. The driver's side door compartment may be the best option due to the close proximity to Sandi.
2. The device may be hung around the users arm by the strap while the gas cap is removed and as the user is paying/selecting fuel type.
3. Once ready, place the gas nozzle correctly in the fuel tank
4. Place the device on top of the nozzle handle, to the hooks fit around the highest part of the trigger.
5. Make sure the hook is lined up with the trigger and, while holding the handle, press downward, turning the device so that the shorter end of the claw moves downward. This should lift the trigger up and begin fueling.
6. Once the gas tank is filled to a satisfactory level, allow the handle to come back up, releasing the trigger.
7. The user may then remove the device, place it back around their arm, and continue with other necessary activities.
8. Return Vesh back to storage.

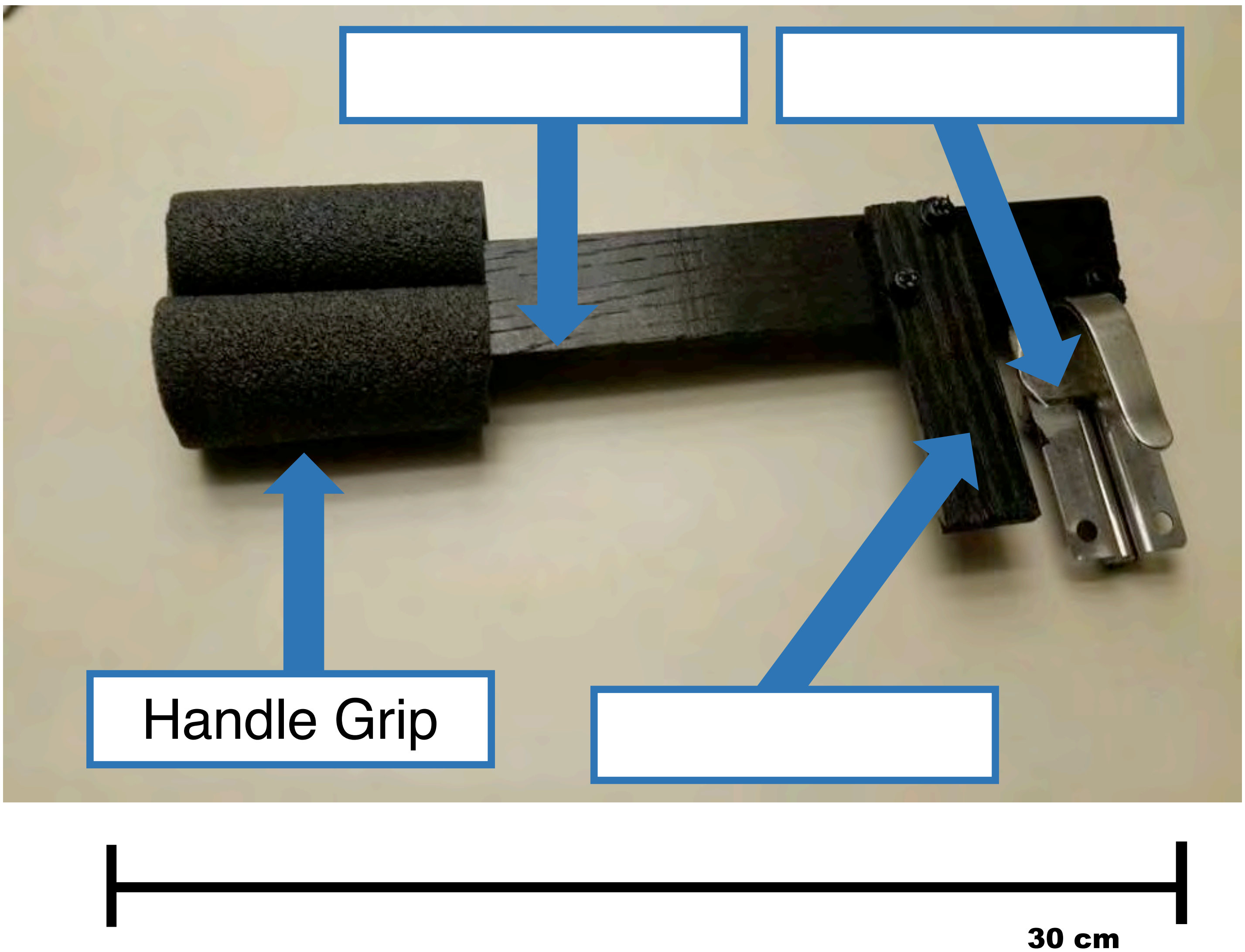
Benefits

There are many benefits of using Vesh in comparison to other devices made. Vesh is a tool designed for simplicity, comfort and ease of use. The materials were carefully selected to create a very lightweight and compact design that can be stored almost anywhere in her car. Also, Vesh is very easy to operate. There are 2 instructions clearly labelled on the device, going by “Place” and “Turn”. Vesh can be used by right hand or left hand users, making it available for everyone. This feature also allows Sandi to switch hands on some days if her hand is sore. The user can also use their palm, fingers, or body weight to push down the tool. The weather stripping/insulating foam on the dowel assist in providing a very comfortable grip for using the tool. The device is also very durable since it is made out of two sheets of plywood, totaling to 10 individual sheets of wood within that. If made in bulk, the overall cost of producing one unit of Vesh is approximately $10, making it very cheap compared to other devices.

Gas Nozzle Device

E-Z-Gas

Global Innovations
F 0 6 - 2 2 7 - 2



Problem Description

The designed device will assist the user Sandi Mugford, who suffers from Rheumatoid Arthritis, while carrying out the task of refuelling at all gas station, thus maintaining her independence; this includes the gas delivery. This project is requested by clients Dr.Fleisig, Sandi Mugford and the teaching assistants, Abby and Nina.

Design

The device is made primarily of wood, and a metal hinge with bolts and screws. The device has one long lever arm made out of wood that is attached to a pivot – the metal door hinge and hook. At the end of the lever is a wedge, which is also made of wood, and is perpendicular to the lever arm. As well, the device is about 500 grams in weight, and approximately 30 cm in length.

Functionality

The device can reduce the pain that Sandi would suffer from pressing the gas nozzle when refuelling her car. It allows Sandi to use her palm to operate the gas nozzle instead of her fingers. With regards to the gas nozzle problem, it fulfills everything that the client has requested. The client has asked for a device that can be used so that she does not need to sustain a prolonged grip on the nozzle, which is what our device does; it does this by the inclusion of a lever and handle, which instead requires the user to push up on the device instead of gripping it.

Materials, Components, and Assembly

The device is constructed with oak wood, metal screws, bolts, metal door hinge and metal hook. To construct the device, an individual will need two narrow pieces of half inch thick wood, a metal hinge of any type(preferably one that will fit around the gas nozzle), along with multiple screws, rubber tubing and some tape. All of theses components can be found at a local hardware store (such as home depot or home hardware), and it is relatively inexpensive to make; the total cost for our device was under twenty dollars (the two planks of wood were three dollars, metal hinge was eight dollars, screws were two dollars, tape was two dollars, and tubing was two dollars, totalling to under twenty dollars). To build the device, screwdriver and super glue are used. It is build by screwing two pieces of wood together; one piece is long and the other is short – this piece will be used as the wedge, which should be screwed in perpendicular to the lever arm. Next, the metal hinge is screwed into the lever arm and it is positioned slightly below the wedge. Lastly, the rubber tubing is cut into cylindrical strips, and is taped onto the end of the lever arm, opposite of where the wedge and hinge are – this acts as the user grip. It will take about half day to build it. And fortunately, no expertise in any field is needed since anyone who knows how to use a screwdriver can construct the device.

Use

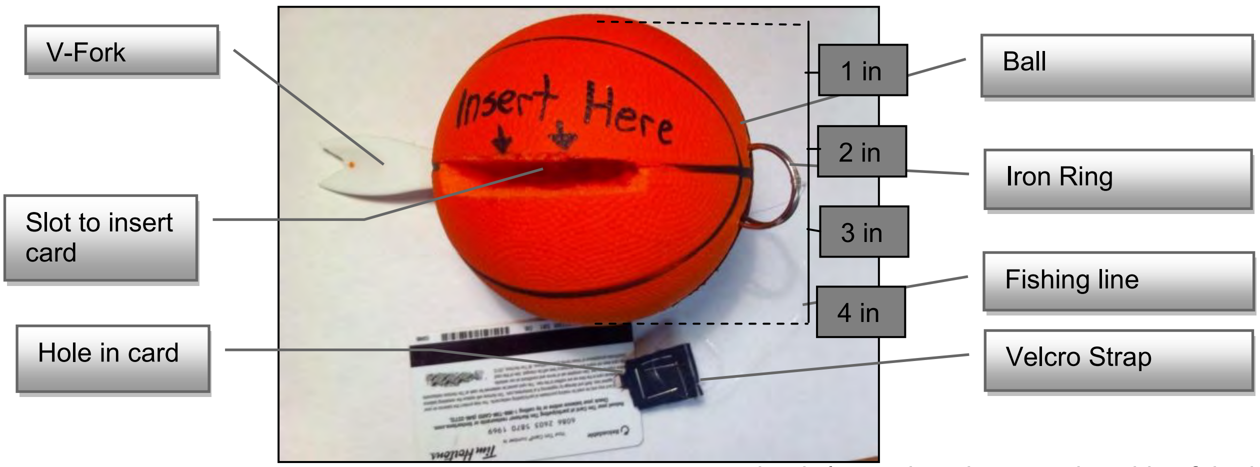
1. The Middle of the device is placed around the rail of the pump. 2. By pressing down on the handle, the lever would moves up. 3. The wedge is pushed up due to the lever moving up; this in turn moves the trigger up on the gas pump. The device can be stored in the bucket on the car door, which would be optimal for her as it is a convenient place to keep it – the device is only used during her trip to the gas station, and it is common sense for Sandi to keep this device with her in the car that is easily accessible to her. In addition, she can leave the device in her car after use.

Benefits

What Sandi does currently at the gas station causes her pain and discomfort, due to her condition. The device created is designed to eliminate these issues, and make Sandi's experience at the gas station much easier for her. Sandi's current issue with the gas pump handle is that it requires consistent force to be applied to it; this causes the pain, as she cannot maintain a grip for a long time. The designed device eliminates the need for the constant applied force, by allowing the user to push on the device to lift the pump, instead of using a grip. The designed device has small and narrow size and it weights light, so that it is convenient to carry and store. Moreover, it is easy to use – only two steps are needed to operate the device.

Fast Feed

Team Name: Helping Hand Inc.
F06-227- 03



Problem Description

The task the team was assigned to design a device for Sandi Mugford in order to drastically reduce pain while maintaining her independence when fuelling her car at a gas station. The device must also satisfy the requirements set by the clients: Dr.Fleisig, Abbey, and Nina.

Design

The design of Fast Feed is relatively simple. The main component of the design consists of a large ball used for insertion of the card into the machine. It is easily portable and can be held effortlessly by using Sandi's hands. An iron key ring hooked on the ball is used as an anchor to tie a one foot fishing line in length. The end of the fishing line has an attached Velcro strap that Sandi may pass through into a card and can be firmly closed through the use of her elbows or forearms. This process eliminates the pinching motion that is conventionally used. Another component of the design includes a teaspoon that is located on the opposing side of the iron ring. It is cut into a V shape such that provides Sandi with an easiness to complete the full insertion of the card. The size of the whole device is approximately half a meter and weighs one hundred grams. As a result, Sandi will require minimal effort in terms of carrying and moving the device around.

Functionality

Fast Feed is able to achieve many things in terms of functionality for Sandi. The device focuses on completely removing joint stress and pinching that is involved in the payment process. First, the lightweight foam ball allows it be held with ease during the insertion process. The multi-functional V-Fork has two main functions. It allows the card to be completely inserted into the machine after the initial insertion from the ball. Furthermore, it can be also used to detach the Velcro strap from the card. Likewise, the fishing line allows Sandi to release the device during the payment process and also provide an easy removal through the motion of pulling on the ball. Next, not only can the open slot in the ball be simply used as an aid to insert the card in the machine but it can be used as a storage place to keep the card while not in use. It has a wide enough slot of fit at least two to three cards. Overall, Fast Feed achieves most of the goals that were set out by Sandi in terms of addressing the card insertion problem.

Materials, Components, and Assembly

The materials used and the cost of each material in the process of building this device can be seen below in the Bill of Materials Table.

Material	Cost
Foam Ball	$ 4.00
Teaspoon	$ 2.00
Iron Key Ring	$ 1.00
Fishing Line	$ 2.00
Velcro	$ 1.00
Super Glue	$ 1.00
Total	**$ 11.00**

The materials can be easily obtained from Home Hardware and Dollarama. The tools that were required for construction include a scissor, knife and stapler. The construction time is estimated to be between 20 to 30 minutes. To assemble the device the instructions are not overly complicated. The main parts for the construction of the device include: cutting a slot in the ball 1cm x 4in wide and 2 in deep, hooking a metal key ring and securing a fishing line by tying a knot onto the fishing line, attaching a Velcro strap on the fishing line and gluing a teaspoon after cutting a `V` onto the ball.

Use

The device will be stored in the trunk of her car in her purse. Upon retrieving the device she may then follow the subsequent instructions for desired use:

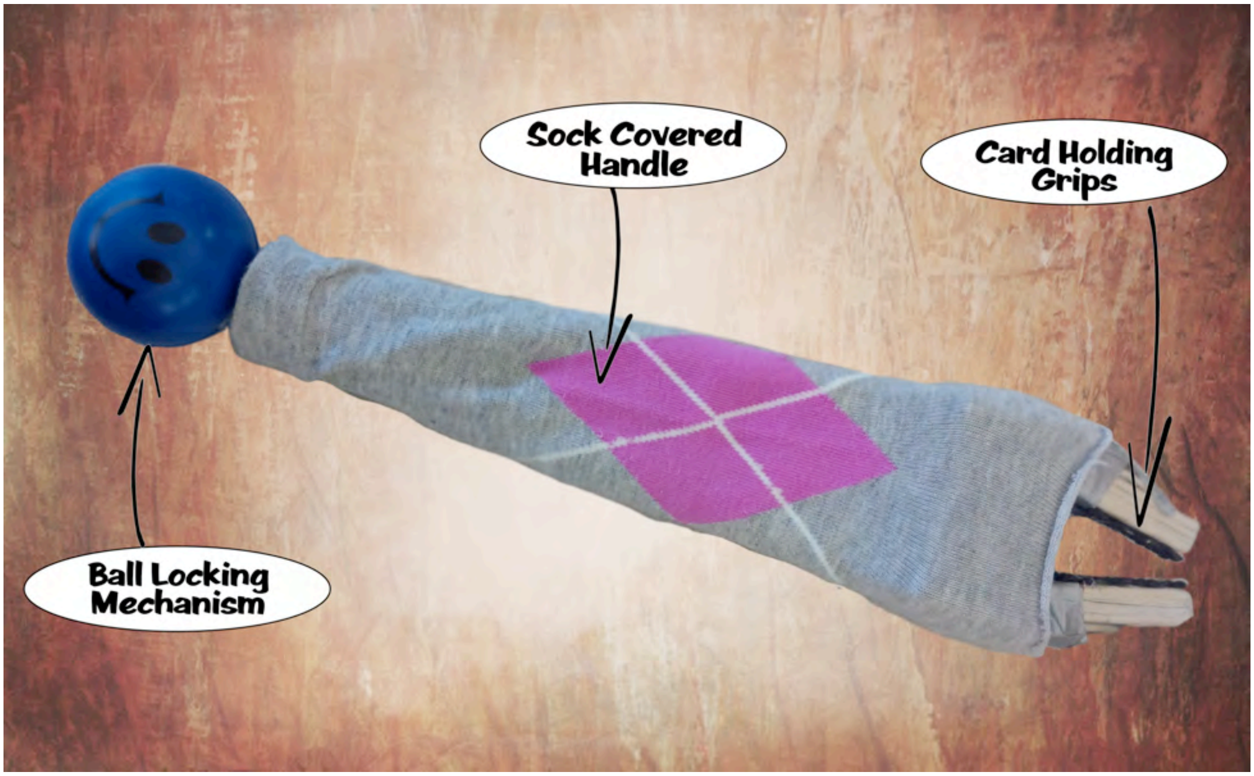
1. Place Fast Feed on the top of the trunk.
2. Slide the Velcro Strap through the card and seal it firmly.
3. Insert the card in the `Insert Here` slot.
4. Carry the device to the gas machine.
5. Insert the card partway in the card slot.
6. Remove the ball from the card and use the V-Fork to push the card in completely
7. Let go of the device as it hangs while the payment process is being carried out.
8. Upon payment, remove the card by simply pulling the ball out.
9. Store the device in a secure location as preferred.

Benefits

The design of Fast Feed focuses on the mobile and strong parts of Sandi's hands such as her elbows and palms. Furthermore, the issue of pinching the card is completely eliminated as no direct finger pressure is required. This design is also better than existing products because of many reasons such as being lightweight, cheap, easy to construct and being durable. Also, the design is inclusive of many versatile components and functions such as the V-Fork and fishing line which tackle numerous functions. Moreover, the device stays on the machine while the payment process is being carried out. Last but not least, the preparation time is under 30 seconds.

Card Croc

Ingenium Incorporated
F 06 - 227 - 4



Problem Description

The goal is to create a functional prototype for the clients, Dr. Fleisig, Abbey and Nina that would help the main user, Sandi Mugford. The prototype would help Sandi use the credit card machine at the gas station. The device should allow Sandi to maintain her independence in everyday basic activities regardless of her disabilities.

Design

The device is essentially a modified pair of tongs. The handle of the tongs is covered by a grey sock, providing comfort and protection from cold weather for the user. There is a stress ball attached to the end of the device, which is used as a locking mechanism for the tongs. The grip at the top of the tongs has been modified with thermoplastic and some black gripping mat has been glued on to the thermoplastic to provide further traction. The weight of the device is estimated to be approximately 300 grams. In addition, it is 40.5cm in length, 8 cm at its widest part, 4cm at the base of the handle and the locking mechanism is 5 cm in height.

Functionality

The device is able to grip and release a credit card without using a pinching motion. It uses a pulling force to secure the card between two pinching grips. The device addresses Sandi's problem with pinching a credit card and being unable to insert it into the machine. It allows her to use force from other parts of her hands rather than her fingers which are not dexterous.

Materials, Components, and Assembly

The device is made with a variety of materials including locking tongs, thermoplastic, duct tape, a stress ball, hot glue, gripping mat material and a sock. The cost of all the materials and components is relatively cheap, all the individual items cost $5.00 or less. All of the materials are available at the dollar store, excluding thermoplastic which can be purchased online. Tools required for construction are a hot glue gun, scissors and a knife. The construction of the device would take approximately an hour. Instructions would be needed for construction and assembly. The device is made very simply, first cut a slice into the stress ball with a knife, pump hot glue into the slice and place the ball on the end of the tongs securing in place. Trace shape of trapezoids onto thermoplastic, heat up as required to cut thermoplastic and re-heat to mold pieces together. Then duct tape thermoplastic to end of tongs, using hot glue to attach the gripping material to the thermoplastic. To restrict the amount the tongs are able to open wrap a piece of tape around the middle of the handle. The final step is cutting the end of a knee high sock off, sliding the sock over project and securing with some tape.

Use

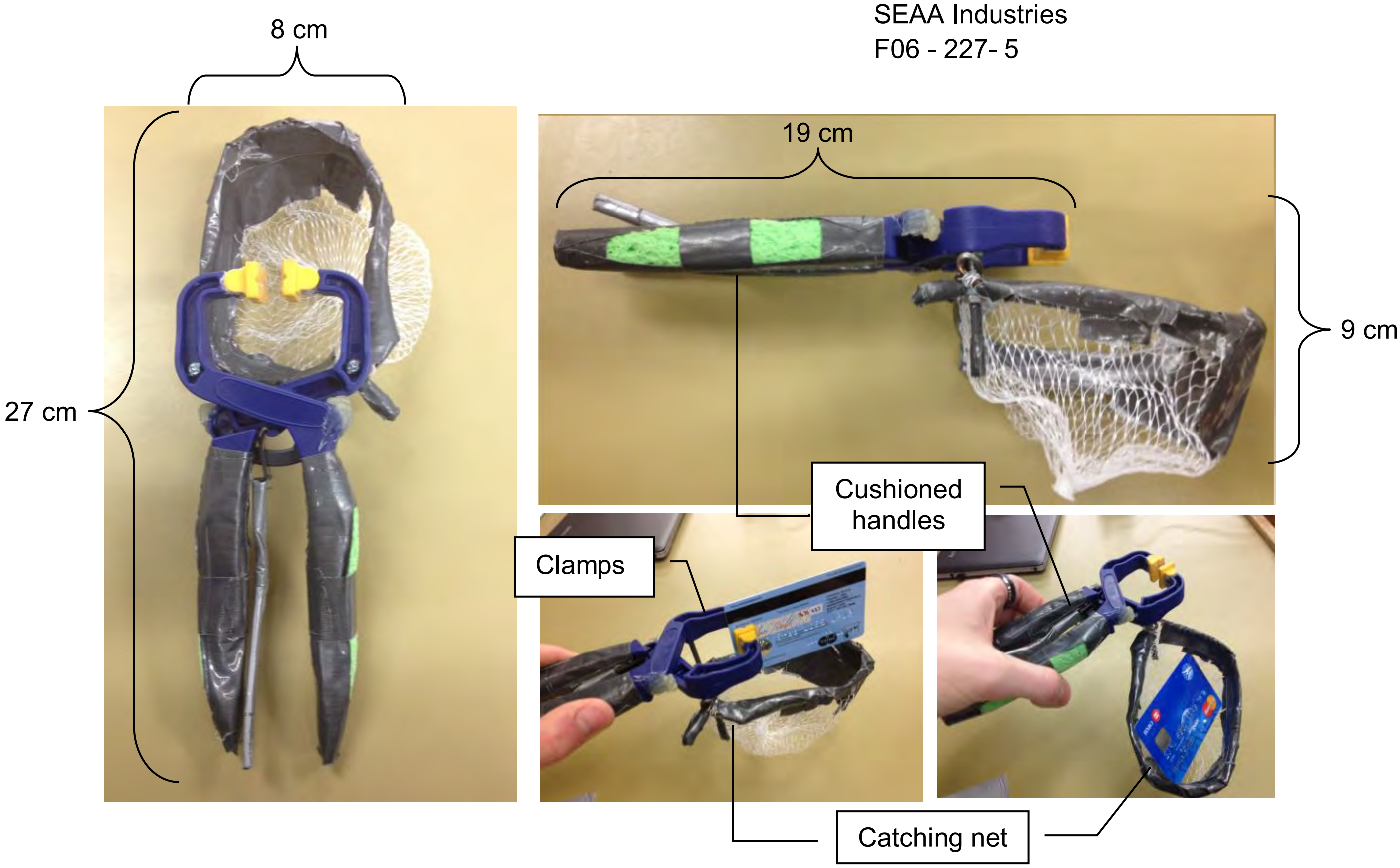
1. First retrieve the device from either the trunk where her purse is kept or in her glove compartment. (This step can be chosen by Sandi depending on what she prefers)
2. Take her credit card out of her purse, which is in her trunk.
3. Hold the device by the handle with one hand and the credit card in the other.
4. Insert the credit card into the tong end of the device and apply a small amount of force to clamp the tongs together, therefore holding the card in the tongs.
5. Once the card is held securely and in the position she wants, pull on the ball to lock the device in place so that the card can't move.
6. Placing the device between her open palms, insert the card into the machine until it activates.
7. At this stage, Sandi has two options. The first option is to leave the device attached to the card in the machine and hold it with one hand while she uses the keypad. The second option is to release the device from the card by pushing in the ball and holding the device in one hand while she uses the keypad. She could then reattach the device by pushing it back onto the card and relocking it by pulling out the ball.
8. At this stage, using either option, the device would still be attached to the card and in the machine. To remove the card from the machine, she would use the same method as inserting the card but pulling out instead.
9. She could unlock the card by pushing the ball in and would finish using the device by returning it back to her trunk along with the credit card into her purse.
10. Sandi would resume pumping gas after it is put away.

Benefits

There are many aspects of our device that is more superior to other existing solutions of the insertion and removal of the credit card. One major advantage of our design is that we do not permanent attach the device to the client's card; As a result, the client does not have to worry about finding a new storing place for her card with the device. This is compared to other devices which have either permanently attached cards or the card is attached to the device in a way where she can't get the card out by herself. Also, if our client is using our device properly, only a small force is needed to attach the device to the credit card. Once the device is attached, the client can easily insert the card by holding and pushing the ball (which fits her hands perfectly), then remove her card by pulling the ball when she is done. This will highly reduce the pain in her hands and joints because Sandi will not be using a pinching motion to insert and remove the card from the machine. Another benefit of our device is that the weight is relatively light compared to some of the groups which will result in less of a task in using the device.

The Griplock

SEAA Industries
F06 - 227- 5



Problem Description

The objective is to design a device for the clients Sandi Mugford, Dr. Fleisig, Abbey, and Nina. The device will aid the user, Sandi Mugford, in paying with a credit card at the gas station. This will minimize discomfort and reduce pain related to rheumatoid arthritis while maintaining user independence and reducing time at the gas station.

Design

The final design consists of a locking clamp whose handles have been extended with lobster tongs, and cushioned with sponges. Connected to the clamp is a catching net that swings around on a pivot as seen in the visuals above. It weighs approximately four ounces, and is 27 cm long, 8 cm wide and 9 cm tall. Depending on the orientation of the catching net, the length and width of the device will change.

Functionality

The device fulfills its primary function of allowing the user to easily insert and remove a credit card from a card reader while reducing her pain. The device eliminates the need for the use of her fingers since the device is fully operational with her palms, thus meeting the needs of the client.

Materials, Components, and Assembly

The materials needed for the construction of the device are as follows: an easy clamp, lobster tongs, duct tape, hot glue, a sponge, screws and nuts, a net from a marble bag, and a metal coat hanger. With the exception of the easy clamp, duct tape and the screws and nuts purchased from Home Depot, all the materials needed for the construction of the prototype can be purchased at a dollar store. This makes the device very inexpensive with the total cost being estimated at $15 if all the parts needed to be purchased. A drill is required to make holes in the clamping arms and a hot glue gun to apply the hot glue. Also used were a screwdriver, a pair of pliers, a hobby knife, and a pair of scissors. If all the tools were on hand to make the prototype, it would take roughly an hour to construct, although the builder must be experienced with a drill. Assembly instructions would be required, specifically when disassembling the lobster tongs to specify which parts to remove and add to the device.

Use

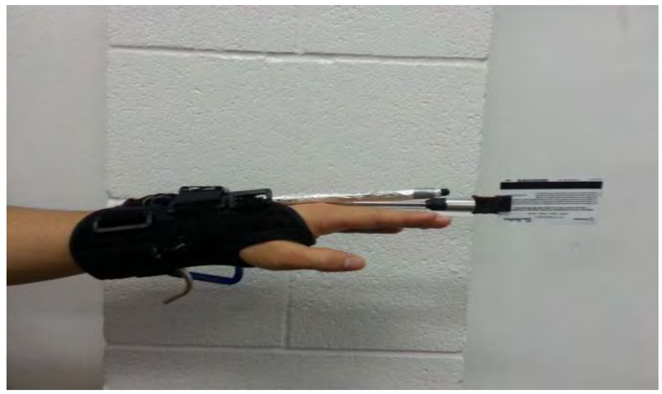
1. The device can be stored in several locations, including: Sandi's purse, the door pocket, the glove compartment or the trunk
2. When ready to be used it will be easily removed from one of these locations
3. To use, pressure is applied to the handles of the device closing the clamping ends
4. These clamping ends close on the credit card
5. A locking mechanism keeps the ends closed on the card without applying further pressure
6. The card is then inserted into the card reader
7. Exerting a small force on the release lever then releases the card
8. If the card could not be fully inserted into the card reader then remove the device, leaving the card partially inserted and fully push the card in utilizing the flat surface on top of the device
9. When not in use the device can be easily stored on any nearby surface
10. When the card is ready to be removed, reapply a force to the handles to once again grip the card and pull it out of the card reader
11. The card catching net can then be swung into place, and when the release lever is used, the card will be caught in the net for easy access

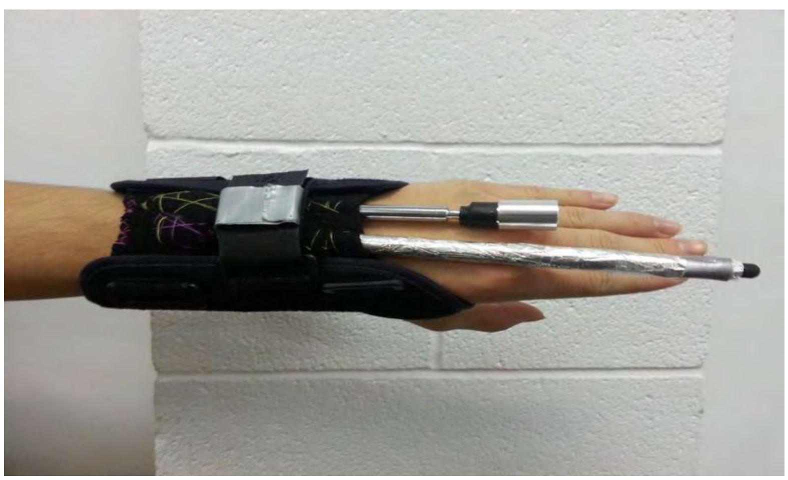
Benefits

The device benefits the user by reducing her pain associated with rheumatoid arthritis. It has the ability to be used almost entirely with her palms and is very lightweight due to its simple design. This reduces the strain on the smaller joints in her hands and allows her to save time and effort while paying at the gas station. However, durability was not compromised when making the device simple as it can resist shock if dropped. The devise is also smaller than most of our peers' devices which allows it to be easily stored in a variety of places, including the car door pocket. It also is very inexpensive with most of the materials being common household items.

The B.E.S.T. Device

Engineers of the Star Table
F 0 6-2 2 7-6





Problem Statement

The main function of this design is to increase the independence of the user, Sandi Mugford, by reducing the pain she experiences while pumping gas at the gas station. This will be accomplished by helping her complete three tedious tasks: inserting the credit card into the machine, pressing the buttons on the keypad, and clamping the gas pump. This device will be evaluated by the clients: Sandi Mugford, Dr. Fleisig, and teaching assistants.

Materials, Components, and Assembly

The brace has many components fastened to it. Firstly, a knitting needle wrapped in aluminum foil with a stylus tip glued to its tip is used to push buttons on the keypad (touch screen compatible). Beside the knitting needle is an extendable magnetic rod, with shrink tube attached to the top (for comfort) and WD-40 applied on the rod to increase ease of use. Both the rod and the knitting needle were sewn on top of the brace. A paper fastener was attached to the credit card so that it

Design

The brace is of a small size and has several components attached to it. The weight of the brace is 191.92 grams, which weighs less than half a pound. This is convenient for the user as the brace will take less of an effort to use, and also the weight of the device is not focused on one certain part of her hand. It is spread out proportionally throughout the device. As mentioned above, the brace is quite compact, which is convenient for the user because it ensures portability. However, if the brace is too small for Ms. Mugford and causes discomfort, the brace used could be in a larger size. All of the other components of the brace will not be affected by the change in size, meaning that the device will still function properly even if the brace size is altered.

Functionality

The B.E.S.T. device aids the user by helping her complete tasks involving pumping gas in a convenient and safe manner. This brace inserts her credit card into the machine, pushes buttons on the keypad, and squeezes the gas nozzle. The device decreases the amount of pressure applied to her joints while completing these tasks and therefore makes gas pumping experiences less of a painful task. As a result, this device does aid the client in all aspects that were requested.

Benefits

This device is better than most existing products because it keeps the user's arm insulated, and supports the user's wrist. Also, it is very convenient due to its size and the fact that it does not need to be stored away between tasks. Another benefit is that the small clip attached to the credit card does not need to be taken off after each use, and is small enough to fit in the user's purse. Furthermore, the brace is touch screen compatible. This device is better than those of fellow peers because it addresses and completes all of the user's difficulties, while still being versatile and therefore a marketable product.

would be attracted by the magnet. A wooden block was placed between the card and the magnetic rod to increase the distance between the two and eliminate the magnetic field's effects. Paper fasteners and duct tape were attached to the brace's strap (used to secure device to arm) in order to make sure that it did not unfasten. A D-Ring was attached to the strap to increase options for securing the device. The D-Ring is covered in tape in order to prevent the user from touching metal, which could cause discomfort. An aluminum hook is attached to the bottom of the brace in order to squeeze the gas nozzle. The hook (also covered in tape to ensure comfort for the user) can also be used as an aid when putting on and removing the brace. The cost of the device is $67.18, and materials can be found in Dollarama, Shopper's Drug Mart and Home Depot. The main tools needed to construct the device are super glue and a sewing kit, with the construction taking 1 hour. Instructions concerning the placement of each object are needed, but other than that, the device construction is simple.

Use

1. Slide on device and secure it with D-Ring.
2. Grab shrink tube attached to the top of magnetic rod and pull outwards to extend it, then pick up credit card and insert into machine using rod.
3. Pull device to the side to detach card from brace; use stylus tip to push buttons with keypad.
4. Attract the card with magnetic rod, pull straight outwards to extract the card from the machine and place it back in purse.
5. Select gas type and insert gas nozzle into the tank.
6. Attach aluminum hook around gas nozzle (so that the nozzle is between the brace and the user's body) and pull upwards for gas flow.
7. Release the hook after gas is transferred, and return gas nozzle to original place.

The device can be stored in the trunk of a car, and the user does not ever have to remove the device during the gas pumping process.

RingA

PumpENG
F 06 - 227 - 7

Problem Description

Sandi Mugford is our user who has Rheumatoid arthritis and struggles with fuelling and paying at the gas station independently. Our mission is to design a device, on behalf of the clients, Dr. Felisig, Abbey, Nina and Sandi, that will ease Sandi's time at the gas station in order to maintain as the arthritis worsens.

Design

The device is a wooden ring 8" in diameter with a small clamp glued onto it. The clamp has another lever arm glued to it to make the clamp easier to open. The wooden ring is rounded off and has many holes drilled into it to reduce weight. All surfaces are covered in foam and wrapped in electrical tape to secure it. The green at the tip of the clamp is fluorescent nail polish which makes the tips easier to see in low light conditions.

Functionality

The device reduces the amount of pain caused while inserting and removing the credit card from the card reader. The device also minimizes the amount of movement of small joints meaning that this device requires the moment of larger joints, which leads back to reducing the amount of pain Sandi has during this process. Finally, the device is easy to use, storage and move. The device having these functions means that the device is simple and lightweight and can be stored in the glove box of a vehicle. As these were all the requests Sandi had for this problem she had addressed meaning the device does exactly what Sandi needs.

Materials, Components, and Assembly

The materials required for this device are ½” MDF wood, ½” wooden dowel, a small clamp, electrical tape, weather stripping foam and epoxy glue. The cost is about $22.45 and all the materials can be obtained from any Home Depot. The tools required from the construction are a router, drill, and an orbital sander.
The construction instruction you will need goes as follows: a ring shape with a 1 ½” spur will be cut from ½” MDF wood on a router. A small clamp should be glued to the spur, which will be used to hold the card while the device is being used. A lever arm must be shaped out of ½” dowel using an orbital sander. The lever arm is glued to the clamp using epoxy. Holes are than drilled in the ring to reduce weight and the ring was also rounded off with sandpaper for the same purpose. The ring was wrapped in soft, light foam to make it comfortable to grip, and the foam was secured to the ring with electrical tape. Fluorescent nail polish should be applied to the jaws of the clamp to make them more visible in low-light conditions. The total time for construction was approximately 10 hours.

Use

1. Remove the device from the glove box as the device is small enough to be stored in the glove box
2. Use palm of hand or elbow to open clamp
3. Insert card into with chip facing away from the device and with the clamp sitting on or near the number on the card
4. Push the card into the card reader
5. While doing the transaction, allow the device to hand from the card in the reader, it will rest on the gas pump.
6. Complete transaction
7. Pull the device out of the reader using either your hand or arm
8. While pumping your gas and completely the rest of the tasks required for fuelling the car allow the device to rest on your arm much like a bracelet.

Benefits

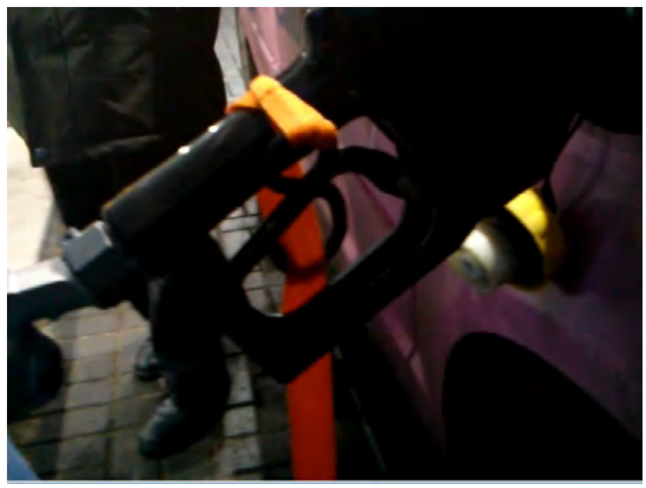
What makes our design better than existing solutions is a number of reasons. One of the major reasons is that we tried to minimize the movement of joints but particularly small joints, which is the most painful for Sandi. However, that is not the only reason why our design is better, our design is better because it is light weight and comfortable because we drilled holes in the body of the wood to make it light and then wrapped the body in weather stripping (foam) making it soft and comfortable for Sandi to use. We also took into consideration that Sandi’s hands become stiff when it is colder outside (during the winter) and when it rains, therefore our prototype allows Sandi to remove the credit using her hands/wrist to remove it or using her whole arm. With using her full arm, we took into consideration that during the winter is may use this more often so our device’s handle is big enough to be able to use it while wearing a winter jacket. Finally, our device is very cost efficient as it only costs around $20 and it will last a very long time and our device is also ergonomic.

Gas Pedal

Sturdy Wings
F D06 – 227 - 8

Device Overview:

Device when attached to gas nozzle:



Problem Description

To create a device that is presentable to the client, Dr. Fleisig and aids the use, Sandi in refuelling her vehicle, typing in her pin, and retrieving her credit card at the gas station in a manner that allows her to remain independence even if her condition worsens.

Design

As shown in the above picture, the device is a length of belt with a hook at one end and a large loop at the other. The device will weight approximately 300 grams, with the weight distributed near the ends. The length of the device can be adjusted form about 1 meter to about 10 centimetres, the diameter of the large lower loop.

Functionality

The goal of the device is to provide the user with a way to pump gas without reliance on the use of hands for long periods of time. The device allows the conversion of the user's weight into squeezing of the gas nozzle trigger, without the use of hands. This device does not address all the problems mentioned in the problem statement, only the problem of Sandi holding down the gas nozzle trigger.

Materials, Components, and Assembly

The device is created with the following materials: a ratchet strap, coat hangers, and duct tape. These items can all be purchased at Dollarama, 101 Osler Dr, L9H 4H6 Dundas, for a total cost of $4.50. Duct tape was used to fasten different pieces of the device together. The estimated construction time for the device is about 20 minutes. Creating this device takes no special training meaning almost anyone can construct it. The only tool required in the devices construction is a pair of scissors. To build this device, start by cutting the ratchet strap to a length of one meter while still keeping the metal hook attached at one end. Next, tie the side without the hook to itself about 30 centimetres up creating a loop at the opposite end of the hook. Then take a metal clothes hanger and bend it into a circular shape and place it inside the loop previously created by the strap. Finally duct tape the coat hanger to the strap to insure the foot loop remains open for easy use.

Use

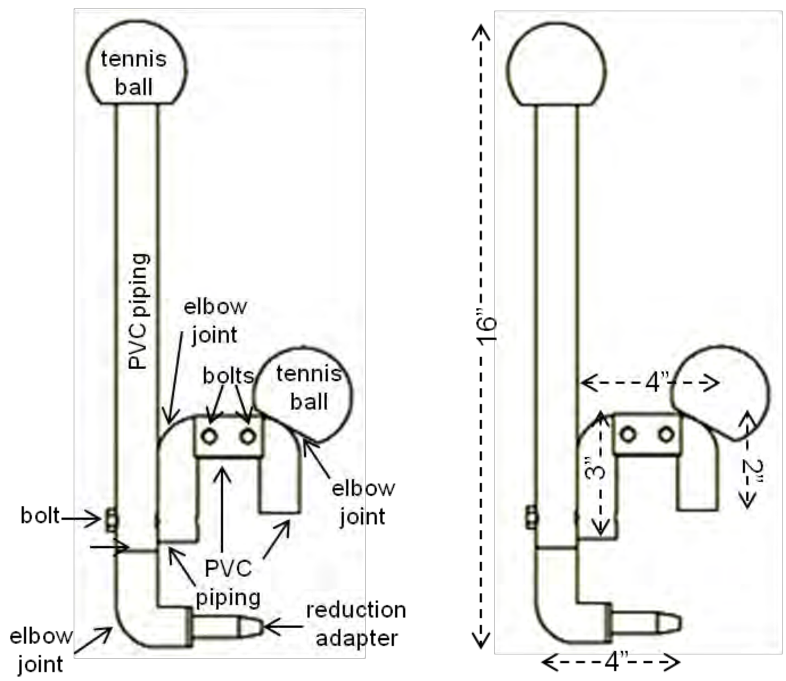
1) Remove device form storage space, side door compartment is highly recommended.
2) Place device on the top of the trunk of the car, the roof, or any other place that is convenient while completing credit card payments.
3) Remove gas nozzle from the station holster and place securely into vehicle.
4) Place a section of belt over the handle of the nozzle.
5) The hook end of the device should then be placed through the loop formed by the nozzle lever and the base of the nozzle. The length of belt hung previously should now be easily hooked with the hook, forming a loop. The foot slot should now dangle a distance away from the floor.
6) Place foot through dangling foot slot.
7) Apply pressure, using body weight, downwards squeezing the trigger. When trigger is squeezed to its maximum, the foot slot should he comfortable on the floor. If this is not the case, length of rope should be adjusted.
8) When pumping is finished, remove foot from the foot slot and remove hook, opening the loop formed.
9) Device can be then be stowed away back into the side door compartment.

Benefits

The current existing solutions all depend on some form of locking mechanism, allowing he user to walk away from the gas nozzle while it is still pumping gas. This is considered illegal in Canada. The device above is designed not to lock and, and will not allow the user to walk away from the gas nozzle while it is still pumping gas, making it legal in Canada. While other's projects usually involve some from of complexity, this device is very simple in its concepts and construction, leading to a more durable and reliable device. Although other devices relieve the use of Sandi's hands, they do not remove the dependence entirely, and still rely on her hands to hold down for example, a large lever. The above device takes advantage of gravity and Sandi's weight to hold down the lever instead of her hands, removing the pain and stress in her hands completely in the duration that the gas nozzle is pumping gas.

Eezy Squeezy

Degrees of Independence
F 0 7 - 1 2 4 - 0 1



Problem Description

Design a device for Sandi that allows her to independently, comfortably and safely perform the tasks associated with refuelling her car at a self-serve gas station. The specific target is the user's long-term independence that can be achieved by reducing the pain she experiences because of her health condition (rheumatoid arthritis).

Design

The Eezy Squeezy is composed mainly of a lever system. The lever arm is attached to an open-base rectangle that sits on top of the nozzle, and at the end of the lever arm is a smaller extended arm that fits below the trigger. When the lever is either pushed or pulled, the smaller extended arm rises and presses the trigger. There are two tennis balls, one at the end of the lever arm and the other at the outer corner of the rectangle, to assist in gripping. The device is approximately 3.1 lbs and 16 inches long. The exact measurements of each part are given in the annotated diagram above.

Functionality

The Eezy Squeezy will assist Sandi in applying pressure to the trigger of a gas nozzle. It reduces the pain involved in applying this pressure by taking a small range of motion and amplifying it to a larger motion. It is easy to grip, lightweight and portable, and easy to store.

Materials, Components, and Assembly

The materials required are as follows:

- approx. 2 feet of 3/4" PVC piping
- 3 elbow joints of the same diameter
- 1 reduction adapter
- plumber's glue
- epoxy putty
- pro-grip spray paint
- spray paint
- 2 tennis balls
- nuts and bolts of appropriate length and diameter
- approx. 2" by 3" foam padding

The total cost of acquiring these materials is $58.98, but the unit cost is only $33.34. These are all materials that can be found at any hardware store. Necessary tools are a drill, handsaw and wrench. Construction requires a maximum of two hours, with 24 hours drying time for each of the spray paints. Basic instructions on dimensions and assembly may be required to achieve maximum motion amplification by the lever arm.

Use

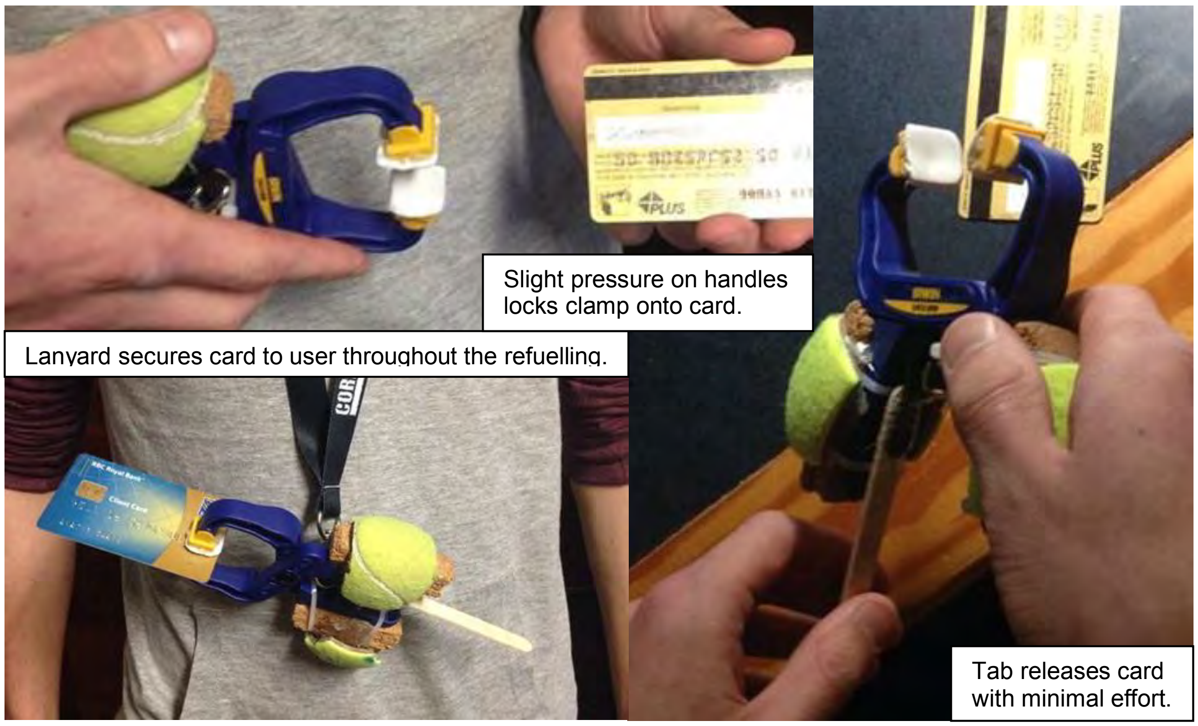
1) Remove the Eezy Squeezy from the trunk or rear seats of the vehicle. It can be held/carried easily from any part of the device.
2) Place it on top of the vehicle while obtaining the gas nozzle and inserting the nozzle in the vehicle.
3) Place the Eezy Squeezy on top of the fuel nozzle, ensuring that the extension of the lever arm is underneath the trigger. The lever can be on either side.
4) Place hands on the tennis balls and pull or push the lever to raise the lever arm extension. This will press the trigger and fuel the vehicle.
5) Once needed amount of gas has been filled, remove the Eezy Squeezy from the nozzle and place it on top of the vehicle.
6) Return the gas nozzle to its holder.
7) Return Eezy Squeezy to trunk/back seat.

Benefits

The Eezy Squeezy follows the gas station regulations. It does not lock in place, is weather-resistant, non-conductive of electricity, lightweight and easily storable. It reduces Sandi's pain and extends the amount of time she can exert force on the nozzle by reducing the amount of force required. She does not have to directly interact with the nozzle unless moving it. The Eezy Squeezy solves the issue Sandi has at the gas station in a cost-effective and minimalistic manner. It has been tested on a Ford vehicle that has the same type of gas cap as her vehicle and has been proven to fulfill its function efficiently and as expected.

Precision Clasping Device

Team Name
F 0 7 - 1 2 4 - 2



Problem Description

To provide Sandi with an alternative means of holding, inserting and removing a card from the terminal card slot that minimizes the pain, discomfort, and fatigue caused by her rheumatoid arthritis.

Design

Weighing approximately 500g and measuring 19.5 cm long and 7 cm wide, the PCD is a light and compact design that allows for easy storage and portability.

The lanyard is attached to the PCD for securing both device and card around her neck. As the above picture of the final design shows, the handles are padded with cork board, and covered with quartered strips of tennis balls, all of which are bound together to the handles of the original Irwin clamp with zip ties and hot glue. The cork padding increases the grip radius to accommodate for Sandi's limited hand flexion, while the tennis ball felt and rounded surface provide a smooth and soft handle to increase comfort and facilitate grasping.

The built-in release tab is elongated with a popsicle stick so that it extends beyond the ends of the PCD handles. The extended length creates a mechanical advantage over the release tab, allowing the user to activate the release with little force. This extension also displaces the location of the release tab from between the narrow confines of the clamp handles, increasing its accessibility.

The last component of the design is the contact end of the PCD which holds the card. Each contact surface is small enough to fit into the allotted finger space of card slots, and padded with a thin layer of eraser polymer to increase its friction coefficient.

Functionality

The car trunk acts as a staging area for the card and device; it prevents items from falling to the ground while she orients the PCD onto the card.

Secured around her neck, the lanyard ensures against dropping the card while she goes through the refuelling process. This removes the need to make repeat trips to her car to stow the card and device as the lanyard carries both items, keeping her hands free to interface with the terminal buttons or fuel nozzle. The lanyard is of sufficient length to ensure that Sandi can comfortably respond to the terminal's touchscreen prompts after having inserted the card. The lanyard also lessens fatigue as she would no longer need to tightly grasp the card to avoid dropping it.

The clamping mechanism is ideal for minimizing the energy expended to hold and carry the card; it only requires a one-time exertion of force to clamp onto the card, and will remain locked in this position until a simple press of the release tab relinquishes the card. Due to the built-in mechanical advantage, little force is required to clamp the device onto objects.

The design of the handles focuses on comfort and control. Since most of her hand flexion came from her proximal and intermediate phalanges, the design incorporates padded handles so that Sandi can grasp the PCD using these parts of her hands. Lined with the shell of a tennis ball, the rounded, felt surface is comfortable to hold against the palm of the hand, without being slippery. With less energy spent forcing uncomfortable joint movements to hold the card, Sandi can thus focus her efforts to directing the card into the slot.

Materials, Components, and Assembly

For assembly, the PCD requires the following items: lanyard, Irwin clamp, cork board, zip ties, tennis ball, popsicle stick, tape, hot glue, and a polymer eraser. All required items can be purchased from dollar stores or hobby shops for under a dollar, with the exception of the Irwin clamp, which was procured from Home Depot for $3.00. The majority of the PCD assembly can be done by hand, while scissors, tape and a glue gun are required for some of the construction. The design can be assembled in about 30 minutes, with the most difficult part being the handle assembly. Although affixing the cork padding and tennis ball to the handles may require a few attempts, the simplicity of the design makes for easy construction.

Use

1. After parking the vehicle next to the gas terminal, make note of the orientation of the finger space of the card slot before proceeding to the trunk where the clamp is stored.
2. Using the car trunk as a staging area, orient the clamp to the corresponding area on the card (where the allotted space on the card slot would be) and clamp the device onto the card.
3. Take the lanyard that is affixed to the PCD and secure it around your neck, where it will remain for the duration of the refuelling process.
4. Insert/remove the card from the terminal slot using PCD handles to complete the transaction, then move onto the next stage of the refuelling process.

Benefits

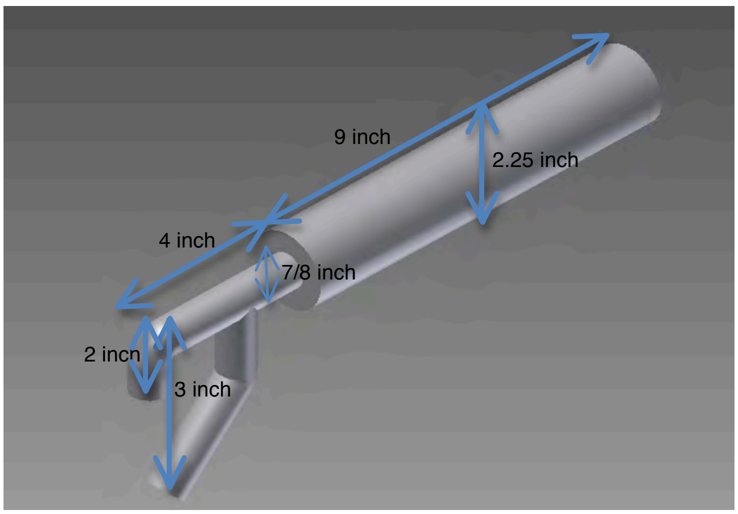
Many of the competing design solutions did not address Sandi's tendency to drop items. While the PCD accounts for this with the lanyard, other designs required Sandi to carry the device until the insertion and removal task was completed.

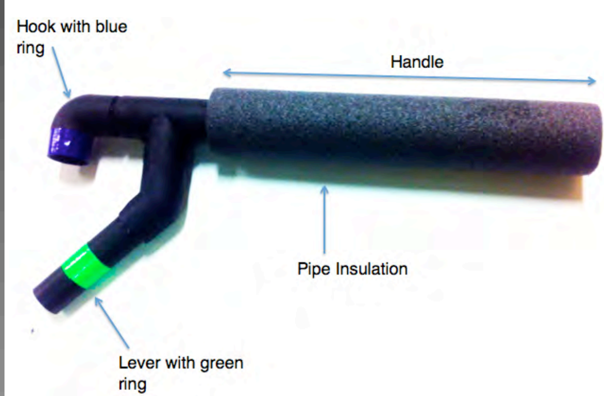
The PCD was also smaller and lighter than other exhibited designs, allowing for easier portability and storage.

Lastly, unlike other designs that had clamps with default open or closed states (such as tongs and clothespins), the PCD can sustain either state without the user having to constantly apply a force; this attribute is crucial since Sandi can thus focus her energy into orienting the card to the clamp or directing the card to the slot. The user only needs to set the desired state, whether by squeezing the handles or using the release tab.

The Gas Buster

F 07 - 124 - 3





Problem Description

Arthrotep's main focus is to design a device for the client/user, Sandi Mugford, which reduces the client's arthritis-related pain and the amount of energy consumption while pumping gas. The device should conform to all of Ms. Mugford and Dr. Fleisig's requirements and should ultimately help Ms. Mugford to maintain independence at the gas station. Arthrotep chose to focus on the issue of fuelling a vehicle with limited strain and pressure on the client's hands and wrists because it requires the greatest exertion of force and takes the longest time at the gas station. Implementing a solution for this issue would therefore, be most beneficial to the client in terms of comfort and time.

Design

The device is a lever that inverts pressure and adds leverage when triggering the gas nozzle. The padded handle is where pressure is exerted and was designed to be of a large enough diameter to be easy to grip when carrying and comfortable when pushing the handle. The design is composed of hollow PVC piping to maximize the strength and durability while minimizing the weight of the product. The PVC has added bonuses of being chemically inert, strong, and weather resistant. The design we are proposing is quite light, weighing no more than a couple of pounds overall. The design is less than a foot in width, about four inches in depth and a bit more than an inch in height. The device is quite easy to carry and store

Functionality

Arthrotep focused on reducing Sandi's pain as our primary function for the device. To do this, Arthrotep put its effort into allowing the user use the device with any body part except the user's hand. More specifically, Arthrotep wanted to let the user use the device with her wrist, forearm and/or elbow. By doing so, it would reduce pain in the arthritis-affected hands and be more useful to the user. Another function of this device is to reduce time spent at the gas station through the simplicity of the model. The user will not struggle to apply the intended pressure to the gas nozzle trigger. In reference to the targeted gas nozzle problem, the device meets the client's request to relieve pain and fasten the gas pumping experience. It also meets the safety requirements that we laid out. The Gas Buster, however, does not fulfill the problem of moving the entire gas nozzle from the pump to the fuel tank of the car. It also requires a slight amount of finger movements to attach the device to the gas nozzle.

Materials, Components, and Assembly

The design we are proposing requires no more than two feet of ¾" PVC piping, a small bottle of PVC bonding agent, a sleeve of ¾" pipe insulator, as well as one of each of the following ¾" PVC pipe fittings; a tee bracket, 90 elbow and 45 elbow. The cost to manufacture one product is $18.95, not including tax or labour. All of the materials can be bought at any home improvement store, as there are no custom or special parts required. A pipe cutter, hack saw or other implement that can cut plastic is required, the cost of which is quite low. The bonding agent has it's own applicator but additional supplies (gloves, mask, etc.) could be bought for safety purposes. The time required is split up into a 10 minute or less (it took approximately five for us) window for one person to build it and a 15-minute period for the bonding agent to set. The assembly does not really require instructions beyond cutting lengths for the pipe components, and even those can have a margin of error. As long as the person assembling the product has a visual of what it looks like, it is doubtful that assembly instructions are really necessary due to how easy and intuitive it is to build. Builders will need to know proper procedure for applying the solvent but those instructions are already on the side of the bottle.

Use

With no moving parts, Sandi will find the Gas Buster is quite simple to operate. Instructions to use the Gas Buster are as followed:

1. Hold the Gas Buster so that the foam handle is in the vertical position with the coloured rings as the base of the device.
2. Slide the blue ringed hook on to the side of the gas nozzle's handle.
3. Keeping the hook in place, rotate the foam handle downward enough so the green ringed angled bottom slides under the trigger.
4. To activate the gas pump, apply a constant downward force using the body part of choice (most likely the wrists, elbows or forearms). Force can be applied with one side or both sides of your body.
5. When the gas tank is full, slowly lessen the amount of pressure exerted until the Gas Buster is again in its natural position. To remove the Gas Buster, rotate the foam handle upward so the angled bottom slides out from under the trigger and keep rotating until the foam handle is once again in the vertical position. You can now remove the blue ringed hook from the side of the gas nozzle and store the Gas Buster away.

The Gas Buster is compact and lightweight for Sandi's convenience. The Gas Buster can be stored in the trunk of Sandi's car for easy access and can be obtained while Sandi gets her purse. Sandi can either grasp the device with her hands or can comfortably clutch the device under her arm. During other fuelling tasks, Sandi can choose to either clutch it under her arm, or can place it down on the top of her car.

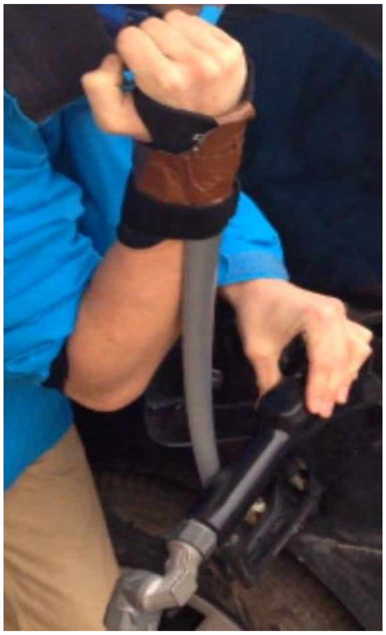
Benefits

Our design is durable, light, and simple to use. The device is made completely of PVC, and due to the fact that our product has no moving parts, it should have a longer life span compared to those of my peers. Our product is also smaller than other designs without sacrificing the quality. It's very cost efficient. The total cost of our prototype is $18.95, and only a quarter of PVC pipe was used.

Hand - E Hook

√74 Design Ltd.
F07-124-4

(Approximately 45cm long and 7cm high at the wrist-guard)



Problem Description

The problem statement used for this project is as follows. “To design and create a product for our clients, Dr. Fleisig and Sandi Mugford, to assist Sandi (the user) in maximizing her independence and ability for motion while minimizing her energy usage and pain at the gas station.” This problem statement effectively described the desired outcome of the project. More specifically however, the task of solving the Gas Nozzle problem only, was undertaken. The problem at hand was that the user (Sandi) had issues filling gas due to the extended period of time she had to close the handle and manoeuvre the nozzle as needed. This problem was what √74 Design Ltd. focused on in long run for this project.

Design

The design consists of a hand guard connected with a long piece of plastic (shoe horn) and with a hook on the end. Duct tape is used as the adhesive that connects he hand guard and the shoe horn. A Velcro strap is attached to the hand guard for stability when being worn. The weight of the design is about 150g, and the size is approximately 45 cm high, and 8 cm wide at the wrist guard.

Functionality

The Hand-E-Hook performs the functions of pulling up on the gas nozzle handle, supporting the user’s wrist and forearm, and having the ability to be carried. It performs these functions whilst achieving the objectives of reducing pain and energy usage by delegating the force required for the device to stronger parts of the user's body. The support to the forearm provided by the wrist-guard portion of the device makes it very safe and comfortable, and the simplicity of the materials and construction makes it a very affordable cost. The device also maintains the user's independence by fulfilling the objectives of being easy to carry, simple to store in any car, and extremely straight-forward to use.

Materials, Components, and Assembly

This device simply requires a wrist guard that's conveniently already designed for comfort and maximal wrist support, a medium-sized lightweight shoe horn with a hook on one end, and a strong adhesive such as duct tape.

These materials are very cost efficient, totalling to less than twenty dollars. A wrist guard can be purchased for twelve dollars, at any snowboarding or sports equipment retailer such as SportChek, and most superstores such as Canadian Tire or Wal-Mart. A five meter roll of duct tape can be purchased for three dollars and a shoe horn for five dollars, both at any hardware or superstore such as Canadian Tire, Home Depot or Wal-Mart.

Construction of this device is extremely simple, and no tools or special instructions are required. Holding the shoe horn to the bottom of the wrist guard, it can be firmly secured to the wrist guard with duct tape. Assembly should take less no more than ten minutes.

Use

The device that was designed, the Hand – E Hook, was designed to optimize Sandi Mugford's gas filling experience. Its use, from start to finish can be defined by these simple set of steps:

1) First, Sandi must remove the device from her trunk when she also retrieves her device of payment.
2) Second, Sandi can undo the Velcro and simply slip on the wrist brace part of the device.
3) After that, she may move the nozzle into the side of her vehicle. (The device allows the use of her hand while being on her arm to pay and move nozzle etc.)
4) Then she can simply slip the hook part of the device (created by the shoe horn) under the handle of the nozzle by leaning slightly forward with her hand up and elbow by her side.
5) Next, she may proceed to place her free hand on top of the nozzle for support.
6) Then she can straighten her posture causing the hook to do work on the handle lifting it approximately 2 inches to the closed position and allowing gas to flow into the tank.
7) Once she is finished filling gas she may proceed to pay and remove the nozzle from the vehicle. Once everything is back in place she can remove the device by undoing the velcro and slipping it off, carrying the device by its larger end back to the vehicle.
8) Lastly, she can place the device and her method of payment back in her trunk and proceed to leave the gas station.

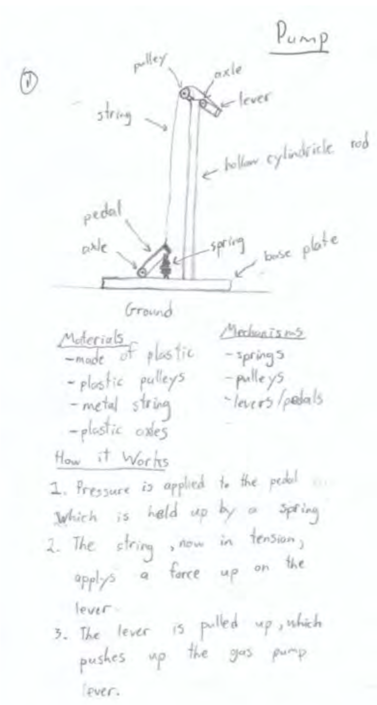
Benefits

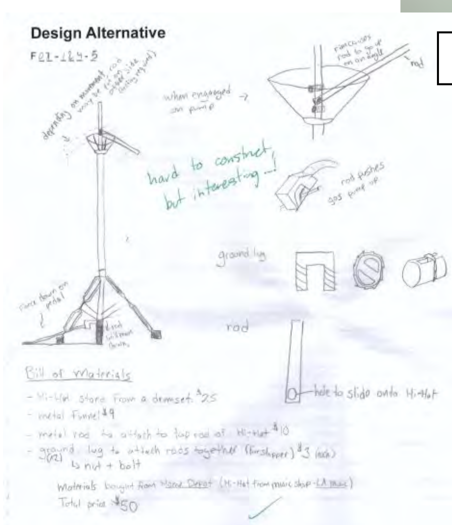
The design of the Hand – E Hook makes it a great choice for Sandi. First of all, it reduces pain and strain in her arm and hands by removing her hand completely from the task and using the posture of her stance to make the hook do work on the handle instead of her arms.

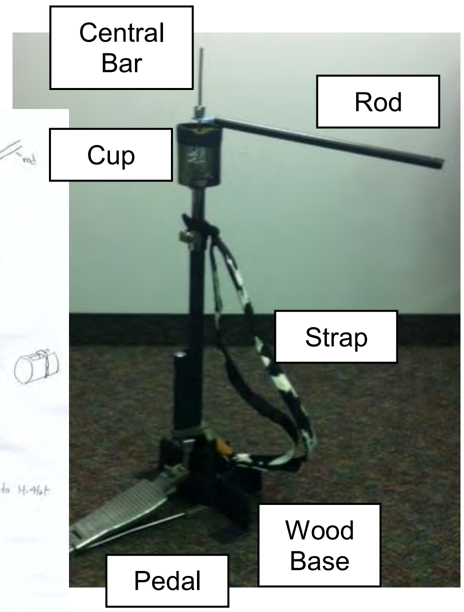
There are many other prototypes that use a lever system or pulling system to solve the problem. Including a previous prototype that would have caused a lot of strain on Sandi's arm due to the angle of the hook. However, the new Hand – E Hook design is highly focused on simplicity, affordability, and its light-weight components, as well being easy and comfortable to use. Instead of putting strain on Sandi the new Hand – E Hook, channels the power in her posture into lifting the handle rather than her own arm strength. These attributes make the Hand – E Hook a great step towards a solution for Sandi's problems and a far better solution than others presented regarding this problem.

The Pump Pal

Pump Pals
F07 - 124 - 5







Problem Description

A specific user/client is easily exhausted and physically strained from performing tasks at the gas station. A device that reduces the strain and allows for user independence is to be made for said user/client (Sandi Mugford). The design process to create the device will be overseen by another client (Dr. R. Fleisig).

Design

As shown above, the design is relatively large, as it needs to transfer motion from the ground to the height level of the gas intake. This means that it will be just under half the size of Sandi, but will still fit in the trunk of her car. It will also need to be very sturdy, resulting in it being as heavy as approximately 10 pounds. Although, the strap allows the device to be easily slung over Sandi's shoulder.

Functionality

The design accomplishes all of the main requirements that were laid out by the client pertaining to this problem. The device effectively activates the gas nozzle without the use of Sandi's hands. Instead, the device makes use her feet and body mass, allowing gravity to do most of the work. When Sandi presses down on the pedal, a central bar moves downwards with it, and this brings the top rod down as well. Once the rod passes the rim of the cup, the cup pushes upward on the rod, and the rod activates the nozzle of the pump. The device also comes with a strap, making it easier to carry between the gas tank and the trunk. In addition, the support stand allows the device to wobble so that it can be bumped into, however; it will not fall over. This ensures that Sandi will not hurt herself if she accidently knocks the device. Furthermore, the hockey tape that covers most of the device acts as protection against bad weather conditions, and also shields Sandi`s hands from the metal in the winter.

Materials, Components, and Assembly

The device is comprised of a Hi-hat from a drum kit, metal "L" brackets (2" wide, 2" in length), one stainless steel water bottle, three rolls of black hockey tape, 3/4" pan head screws, 3" wood screws, 4' length of ½" x 4" piece of lumber, one guitar strap, and the handle of a feather duster. The majority of these items may be purchased at a local hardware store, however the Hi-hat and guitar strap may be purchased at a musical instrument retailer and the bottle, tape and handle of a feather duster from the local Wal-Mart. The rough estimate to the price of the materials is about 55$. This price will vary depending on the location of purchase. For example, used materials may be bought. The tools needed to construct such a device are as follows: hack saw (with both woodcutting blades, as well as a metal cutting blade), screwdrivers (Philips, slotted, red Robertson), drum key, rubber mallet, power drill (1/4" drill bits), and vice grips. Finally, building the device requires a large list of specific and special instructions. In short, many modifications were made to the Hi-hat to make it lighter and more useful to Sandi. There were also other items added to it to make it more functional as well. In summary, this device would take a dedicated individual about 4-5 hours to build, and it is not a device that Sandi could build on her own.

Use

Below is a step-by-step process that outlines how Sandi will use device.

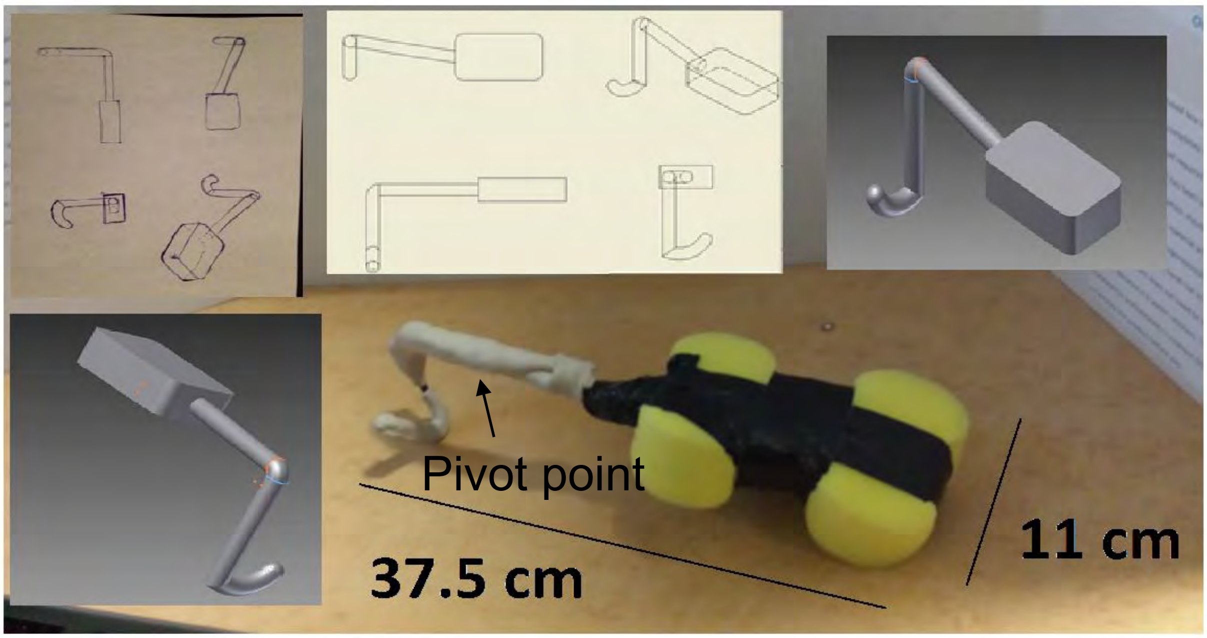
1. Device is to be stored in trunk of Sandi's car, next to her purse.
2. Device can be retrieved while putting card away and before beginning pumping gas.
3. Sandi can sling device over her shoulder using the strap that has been installed.
4. Set device next to where the pump is to be inserted into the gas tank.
5. Sandi can adjust device using the grips so that it sits in the nozzle handle.
6. Sandi steps on device pedal, which will activate the top rod, and activate the nozzle, pumping gas into the tank.
7. If Sandi needs to, she can place one hand on top of nozzle, firmly securing it from any possible dislodgment.
8. Once done pumping gas, Sandi will retrieve the device using the straps, and place it back in the trunk.

Benefits

The device removes the use of Sandi`s fingers by replacing them with larger muscle groups, and prevents the prolonged stress on hands. This will allow her to stand comfortably at the pump, while not having to strain to read the numbers on the display. Furthermore, a user activation requirement makes the device perfectly legal, unlike a clamp or block. In addition, the vertical rod design is made to be sturdier than anything requiring a string or hydraulics to function, making it more reliable than other pedal designs. The protected covered metal will also allow it to be able to withstand bad weather conditions. Lastly, the design has an advantage, because, due to its simple driving mechanism, it can be remodeled, and designed to better suit Sandi's needs.

G.N.A.T.

Keep It Witty
F 07-124-6



Problem Description

Design a prototype for Dr. Robert Fleisig that helps Miss Sandi Mugford by reducing pain during the car fuelling process and helps her stay independent for a longer time.

Design

As seen in the picture shown above, there are two main parts. The first part includes a sponge and duct tape. The second part consists of the hook and lever. The total product weighs 1.8 pounds with most of the weight coming from the thermoplastic on the end. The product is approximately 37.5 cm by 11 cm for length and width respectively. The sponge is 17 cm by 11 cm by 5 cm in length, width and height respectively.

Functionality

The final design's function is to assist Sandi with activating the gas nozzle and holding the trigger in this process. It achieves the goals that the client requested with regards to the problem. The wide enough sponge- handle makes gripping the least painful part of her visit to the gas station. The Design follows a basic lever mechanism and takes least amount of force needed to lift the trigger up which would need more force otherwise. It also converts the painful pinching motion into a painless “push-down” motion. Furthermore, Sandi simply uses her bodyweight to keep the gas pumping instead of trying hard to keep her grip on the trigger.

Materials, Components, and Assembly

What materials and components does it require? What are the costs of the materials? Where can they be obtained? What tools are required for construction? How long will it take? What instructions might be needed? Does assembly need special instructions?

Construction of one unit of the G.N.A.T. requires the following items: three clothes hangers, a large sponge, duct tape, and a small piece of thermoplastic (roughly 100cm^2) with a cost of $2, $4 for 5, $2 and $20 respectfully. All of the materials, with the exception of the thermoplastic, can be found at most dollar stores or hardware stores. Thermoplastic can be bought online. The total cost to produce one unit is $28. However, this cost can be reduced greatly by replacing the thermoplastic, where the bulk of material costs comes from, with a cheaper alternative. The function of the thermoplastic is to add more rigidity and durability to the structure and cheaper plastics, clay, or epoxy could be used instead.

The only tool required to build the product is a pair of scissors, and assembly takes no longer than twenty minutes. Manufacturing this product does not require much skill and no expensive machinery. Creating a G.N.A.T. is as simple as bending coat hangers to form the hook, melting and moulding thermoplastic around it, slicing it into a large sponge, and wrapping it with duct tape for added protection. The only additional information is that the thermoplastic requires hot water in order to be pliable enough to mould with it.

Use

Include step-by-step instructions of how the device will be used. The instructions should be in a numbered list. Include where the device will be stored, how she will carry the device, where she will keep the device when performing the other tasks, etc.

1. Sandi grabs the handle of the device, which is stored in the trunk or between the back seats during the paying process.
2. She carries the device by holding on to the handle and approaches the gas nozzle.
3. She then places the curved side of the device under the nozzle trigger and moves to one side while lifting it up so the hook part is able to control the trigger.
4. She crosses the handle part over to one of the sides of the nozzle with the pivot point resting on top of the nozzle.
5. She pushes the handle down on the pivot point and the device acts like a lever. The other end lifts up the nozzle and the fuel starts to pump.
6. The pressure is applied until desired fuel level is reached. Then, in reverse order, she undertakes steps 1-5.

Benefits

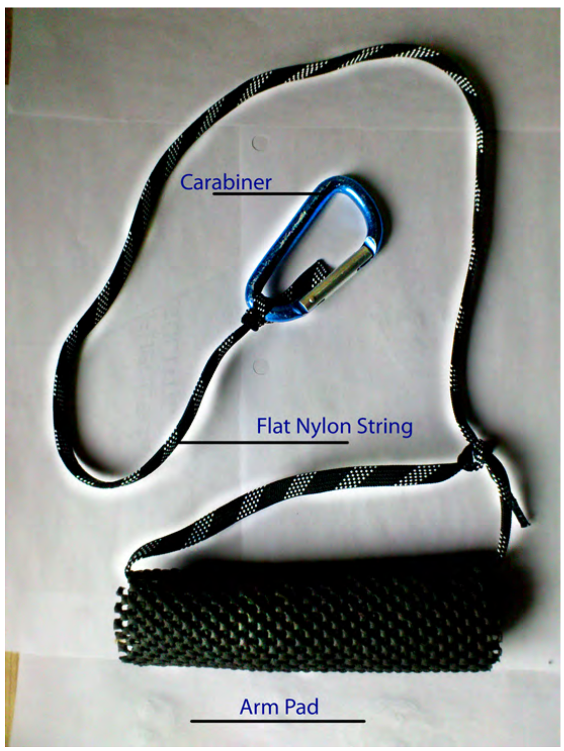
What makes your design better than existing solutions, including those of your peers?

The final design addresses all the objectives in great deal. It is safe, durable, easy to make and reduces our client’s pain to the lowest possible level. It reduces our client’s pain as it completely takes away her issue of pinching or grabbing hard on the nozzle. The lever mechanism takes least amount of input for activating the nozzle and her bodyweight keeps it pumping. It is portable, easy to use and very ergonomically friendly for Sandi. This is because the product is very light weight and is easy to carry. The sponge at the end not only provides a wider area to grab onto but it also gives a soft grip. It is very easy to make within a budget of less than $50.

Gas Nozzle Device

The Gasso

Fuelled Solutions
F 07- 124- 7



Problem Description

The original problem was to create a device for Dr. Fleisig, which aids Sandi Mugford in being independent at the gas pump. This device will reduce the amount of energy required and pain experienced at any gas station of Sandi's desire. This device will allow her experience to be more tolerable so she may be able to go on with her everyday necessities with less difficulty. The Gasso addresses the specific problem of gripping and applying prolonged force to the gas nozzle by allowing the user to utilize their larger muscle groups, as opposed to the smaller muscles in the hands, wrists, and forearms.

Gas Nozzle Device

Design

The design is essentially the design of a lasso, as the main component is a lace with one end tied into a loop. The other components of the design are a padded handle and a carabiner. The carabiner is what allows a second loop to be formed around the gas nozzle. This is achieved by clipping the carabiner back onto the lace once it is fed through the gas nozzle. Lastly, the padded handle was added for the user's comfort, so when the loop around the user's arm tightens, the lace doesn't cause any pain. The device weighs less than a pound, and is very compact. The largest part of the device is the padded handle, however it can still easily fit somewhere as small as the user's purse.

Functionality

The device functions as a lasso would. As the user pulls one end of the lace the other tightens around an object. The Gasso functions the same way. As the user pulls the arm loop of the device, the loop created around the nozzle will tighten, squeezing the trigger and dispensing gasoline to the vehicle. This device is very affective at its task and also causes less strain on the user.

Materials, Components, and Assembly

The gasso is a relatively simple build and uses cheap and simple materials. The gasso consists of a hockey lace, a carabiner, a rubber mesh, a nylon mesh a piece of foam and cardboard. The hockey lace and carabineer can be bought at Canadian Tire where as the nylon mesh rubber mesh and cardboard can be bought at Michael’s. The entire cost of all the products is under $11 the most expensive product being the carabineer which is 3. To begin the project of constructing one must start with a hockey skate lace and a carabineer and must tie a knot to the bottom of the clip in order to attach the rope to the clip itself.. Then a slipknot must be tied on the string, this is relatively easy to learn because there are many instructional videos on YouTube as to how to actually do it. Once one has confirmed the proper tightness for the slipknot the handle made of foam, cardboard, nylon mesh and rubber mesh must be added to the inside of the loop of the design. This handle is made in a certain way, first a layer of rubber must be placed on a table, followed by a nylon mesh, then a piece of foam and finally a piece of cardboard. The layers of materials must then be rolled together like a sushi and sealed closed by stitching the rope through the mesh. As stated earlier the construction is relatively simple and could be done by any average person, this means that no expertise whatsoever is needed in order to create the Gasso just time and patience. Another advantage of this device is that no devices are needed in order to assemble it; all that is needed is one’s hands. The average time taken to make this build is 11 minutes due to its simplistic nature. The best part of all is the overall cost to make the Gasso is only 11.31 dollars.

Use

Compared with what Sandi does currently, this device allows her and other users to operate a fuel nozzle using less energy and larger muscle groups.

1. The user slides the loop up their arm
2. They slip the carabiner underneath the gas nozzle and clip the carabiner back onto the rope by using the tension of the rope. This forms a second loop around the nozzle
3. The user then pulls on their end of the rope, and the force of tension coming from this tugging motion holds the leaver up.
4. Place hand on the gas handle to keep it in the car.

This device can be stored in everywhere due to its flexibility and simplicity a few examples are in a purse or glove compartment. When the user is not using the device during the fueling process it can be looped around the users arm and dangle.

Benefits

The Gasso is very simple in nature and easy to use this is key. It also is lightweight unlike some of the competitors, which was one of the main goals, the device in total, weighed less than 1 pound. Another main point of the Gasso is the freedom it gives the user. It allows the user the possibility to pull in any direction while putting les strain on the user. The Gasso is the device for you because it gives you ease and comfort and overall improves the experience at the pump.

Gas Gateway

Gas at Last
F 07 - 124 - 8

Problem Description

Our client, Dr. Fleisig, needs a device to assist Sandi Mitford, the user, at the gas station. Sandi is limited by her abilities and seeks more independence through a safe and effective device that does not affect her disease long term.

Design

The device, the Gas Gateway, is a strap wrench with a rubber strap attached to it with nuts, bolts and washers which can be seen in the figure on the left. This device is 53 cm in length, 10 cm in width and 3 cm in height. In the step-by-step instructions visual on the right, the relative size of the device can also be seen. The device weighs less than 1 kg, and can fit in small spaces. Even though the device is long, it is small in width which does not make the device bulky. It will not cause any pain to carry even when gas is not being pumped as the device can be held on the wrist using the wrist strap.

Functionality

Due to the user's inability to exert pressure on the gas nozzle for sustained periods of time, she is unable to fill up gas in her car. To solve this problem, our device can be used. When the device is looped around the nozzle, and a pulling force is applied, the trigger is compressed and thus, allows the flow of gas into the car tank. Since only a pulling force is required by the user's arm, this doesn't affect the joints at all and also doesn't require the user to spend too much energy. The device is small and lightweight so it will be easy to carry and store

Materials, Components, and Assembly

The construction for the Gas Gateway can be followed by a simple breakdown of steps described in this paragraph and can be completed within a few hours. All of the materials needed for construction can be purchased at Canadian Tire. These materials include: A Strap Wrench ($7.99), a rubber bungee cord ($1.00), and nuts and bolts ($1.00). In addition to these, a drill is needed in the construction process and can also be purchased at Canadian Tire. Before the assembling process begins, a hole must be made at the end of the strap wrench using a drill, big enough to fit a small nail through it. By removing the hooks found on the rubber bungee cord, two holes exists on each end of the wrist strap'. A bolt and nuts are used to attach the two ends of the wrist strap to the hole in the strap wrench. This is done by lining up the three holes with the strap wrench sandwiched between either ends of the rubber bungee cord/wrist strap. This creates a wrist band for the user to operate the device with. Washers are then used to secure the nuts and bolts. Other alternatives such as a butterfly nut can be used depending on user preference. No special skills or expertise are needed to construct this device as it follows a very simple procedure. The materials are easy to attain and have a low total cost of $9.99.

Use

Refer to the picture found on the right side of the first page:

1. Remove the rubber strap from the plastic slit in the device and loop one end of the device through the gas nozzle
2. Feed the rubber strap back into the plastic slit found on the lightweight plastic component
3. Insert wrist or arm (whichever is preferred by the user) into the wrist strap
4. Use arm to exert a small force to tighten the strap wrench and in turn, squeeze the gas nozzle.
5. Use free arm to help support the nozzle or support the plastic component of the device as gas flows into the vehicle.
6. Device will deactivate completely once the user lets go of the device. Remove the device from the nozzle and return it to the pump.

The device is lightweight and small in size. These aspects allow for easy storage and a variety of storage options. Since Sandi keeps her purse in the trunk of her vehicle, it may be ideal for her to also store this device in the trunk. Other options could include: the empty space between and passenger and driver seat, the small storage pocket found on the inside of the driver-side door, and the glove box.
Not only is the device easily stored and lightweight, it is also portable. It could very simply be worn as a sort of bracelet during the performance of other functions. This would result in the device being out of the way of Sandi's performance and a have negligible effect on her range of motion because of its lightweight characteristic.

Benefits

The user, Sandi, currently struggles with the prolonged gripping motion required to fill up her vehicle causing both short term and long term pain in her joints. Our device will remove any short term pain by pumping gas along with avoiding any long term pain or damage. Our device eliminates this pain by removing the required gripping motion. The gas nozzle is activated by a simple pulling motion of the Gas Gateway with her arm. Once our device is in action it takes minimal effort for Sandi to perform its designed function. It is made with very simple materials and can easily be made with the required materials. It is portable and does not require any special storage or maintenance. The cost of all the parts for the device was only $10.00, making the device cheap and inexpensive. It can also be worn as a bracelet while she performs other functions and it should not bother her.

Card Shark

Team Rheumatoid Arthritis Devices
D 07- 124 - 9

Problem Description

To assist the client Dr. Fleisig with producing an improved payment process solution for the user Sandi Mugford. This device will assist her with the gas pump experience by reducing her energy consumption and physical pain without constraining her independence and also giving her the opportunity to use the device to complete payments also anywhere.

Design

Ergonomic curvy hourglass shaped handle made out of one layer of thermoplastic. There is a hole punched through the thermoplastic near the bottom of the handle for the lanyard to be pulled through. A second lanyard is tied to the first lanyard, end to end, to extend the length of the lanyard. An alligator clip is hot glued and bolted to the thinner end of the handle. A thermoplastic lever is hot glued to a wire and the topside of the alligator clip. Pieces of standard lead eraser are adhered with super glue to each side of the inside of the clamp of the alligator clip. The device is 16 cm long, 5 cm wide and 3 cm high.

Functionality

This device holds the card in place tightly from the center of one side, which prevents any interference between the device and the machine while using it. Also, it provides a handle that fits comfortably in the user's hand. This device fulfills all the user's needs because it reduces pain and energy consumption, and makes the paying procedure much faster and more comfortable for the user.

Materials, Components, and Assembly

The materials and components that this device requires are: thermoplastic, an alligator clip, hot glue, super glue, a standard lead eraser, a lanyard, 6 cm of lead wire, and a 1/8th inch diameter nut and bolt.

The costs of these materials are: thermoplastic - \$5.00/square foot, alligator clip - \$0.10/piece, hot glue - \$0.10/stick, super glue - \$3.00/4 mL tube, standard lead eraser - \$0.30/eraser, lanyard - \$0.50/lanyard, lead wire - \$0.01/cm, and 1/8th inch diameter nut and bolt - \$0.05/nut-bolt pair. The total cost for materials for this device is \$9.11 approximately.

The majority of the materials necessary for this device can be found at one's local hardware store (ex. Canadian Tire, Home Depot, Home Hardware). The thermoplastic can be found at one's local hobby shop or at Walmart in the craft section.

The tools required for the construction for this device are: a hot glue gun, a sharp knife, a hand drill with a 1/8th inch drill bit, and a screwdriver with a Philips screw drive.

The construction of this device will take one to two hours, depending on one's competency with the tools, materials and instructions to build the product.

<u>Instructions on how to build:</u>

1. Heat thermoplastic in boiling water for 2-3 minutes.
2. Trim thermoplastic using a sharp knife into a handle that fits comfortably in one's hand, and a lever of length 5cm and width 1cm.
3. Cut two slim pieces of eraser and super glue those pieces onto the inside of the clamp mouth of the alligator clip.
4. Wrap the wire around the lever and the shorter side of the alligator clip.
5. Drill a 0.5 cm diameter hole near the top of the handle, and align it with the hole of the alligator clip.
6. Insert a bolt through the hole made in step 5, and fasten a nut to the extruding bolt.
7. Use hot glue to secure the lever and the handle to the alligator clip on the short and long side of the clip respectively.
8. Drill a 1 cm diameter hole near the base of the handle to thread the lanyard through.

Use

1. Take device out.
2. Press and hold the lever on the top of the device to insert the card and align it in the middle of the device.
3. For additional range of mobility and lessened pain, insert wrist through the entry on the lanyard and position it around your elbow.
4. Use the device to insert the attached card into the machine.
5. When finished take the device out by either pulling out the handle or using the attached lanyard to pull the device out.
6. To take card out press and hold the lever and remove card from clip.

The device can be stored anywhere, with a convenient length of 16cm and width of 5cm it is the size of a slightly longer than the average smart phone. It can fit in many areas, including pockets, purses, and backpacks. The device remains in the storage area the user desires so they can keep it with them at all times. When the device is in use the there is no limit to the movement of the user unless it is worn. The only instance when it would limit the user is if they have their arm in the loop of the lanyard that allows them to minimize the pain of taking the device out of the machine. The length of the lanyard was designed to keep in mind the needs of the user and very minimally affects their arm movement while in use.

Benefits

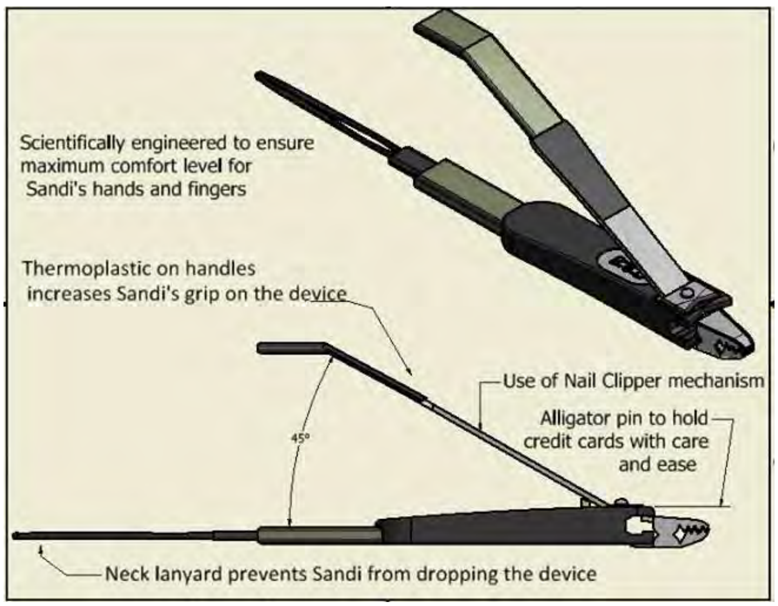
This device is very lightweight (15 grams), which reduces the amount of energy required for the user to use the device.

Also the product is compact enough for the user to easily store it in her purse. This characteristic of the product makes it all the more convenient whenever the user needs to use her credit card for payment.

In terms of cost, the device is quite cheap considering the price for materials comes to approximately \$9. This figure is substantially low compared to related products.

The Grippin' Clip

Problem Solving Designers
F07-124-10



Problem Description

The problem that was focused on is based solely on the user Sandi Mugford, a rheumatoid arthritis patient of 50 years. She has impaired fine motor control and several joints fused. As a result she has difficulty fuelling her car, especially the payment process using her credit card. The design will keep the interests of the public in mind by adhering to all standard gas station regulations. The goal is to design an assistive device that will reduce Sandi's pain and effort required to insert and remove her credit card while paying for fuel in order to maintain her independence.

Design

The design is fairly small and lightweight. It weighs less than 5 pounds and it will fit in Sandi's hand. It is slightly longer than her hand but it can fold up to fit in her purse without taking up excessive space. This design takes advantage of the easy use of a nail clipper to produce a pinching action. An alligator clip was incorporated into the nail clipper design as shown in the visuals above so that the pinching action of the nail clipper would be used to open the teeth of an alligator clip. Thermoplastic was used to help bind the alligator clip to the nail clipper, as well as the neck lanyard at the end of the handle. Thermoplastic was also used to add thickness to the gripping handle, making it easier to hold in Sandi's relaxed, open hand while greatly adding to the durability of the device. The rubber tubing was super glued – using glue specially designed to adhere to metal – around the teeth of the alligator clip to increase the devices grip on Sandi's credit card, as well as prevent any damage to the card from the serrated teeth of the clip.

Functionality

The product can do exactly what the client requested because it is a solution to the discomfort she experiences when she has to use her cards to pay. The product eliminates any need for the client to pinch with her individual fingers to grab a credit card. This product will do that work for Sandi and it will ensure that the pain and effort normally required to grab her credit card is greatly reduced. Once the card is attached to the alligator clips, Sandi will be able to insert the card in the slot using this device, then let it hang at rest from the neck lanyard while she performs the other tasks associated with fuelling her car. When finished paying, Sandi can use the device again to remove her card and place it back in her wallet without any pinching required. The alligator clip with the added rubber tubing provides a very secure grip on the credit card, which allows Sandi to freely manipulate and move the card without fear of it falling out of the device.

Materials, Components, and Assembly

The skeleton of the device is a toenail clipper with blunt blades, an alligator clip on the tip with rubber tubing on the teeth, and thermoplastic as the handles as well as a binding substance to secure the alligator clip. The necessary materials can be obtained at any hardware store. The toenail clipper costs approximately $15, the required amount of thermoplastic costs around $10, and alligator clips, rubber tubing and super glue cost about $5.00. The only tool required for the construction of this device is a grinder to make the blades of the toenail clipper blunt. The only instructions that might be required would be where to put each part, and a note should be made to ensure that the alligator clip is secured tightly. The construction process takes around two to three hours.

Use

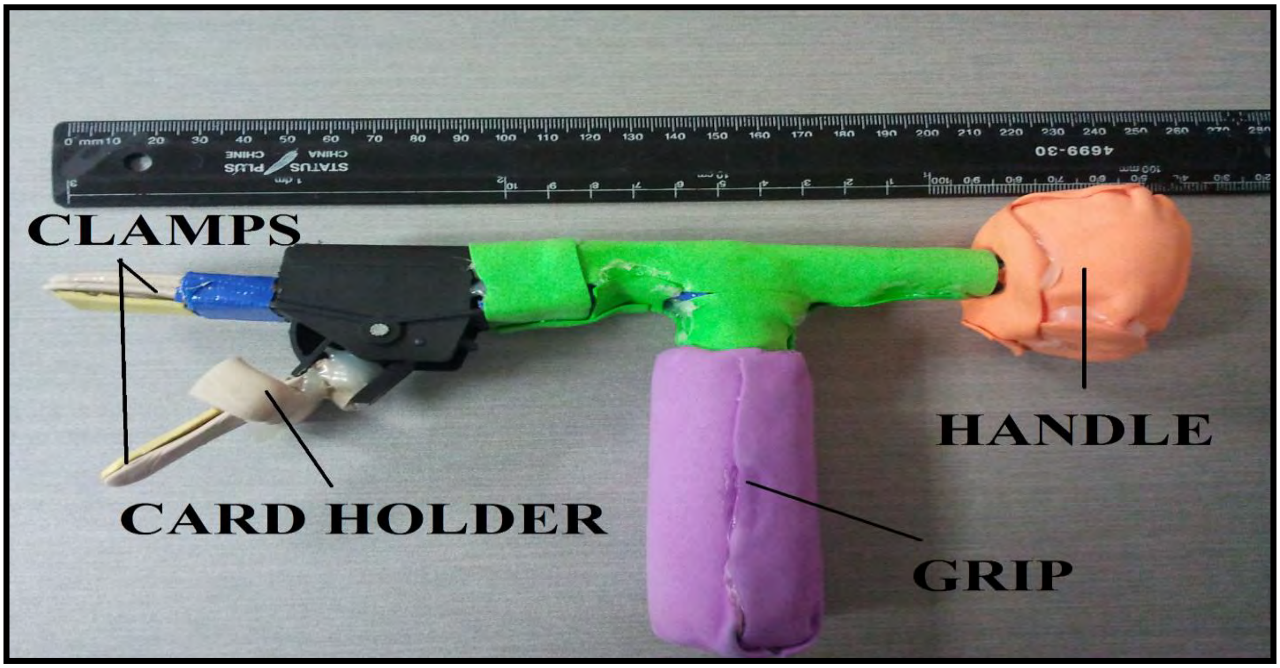
1. Place the lanyard over the head and around the neck.
2. Gently squeeze the handles to open the alligator clip.
3. Grab hold of the desired credit card with the opened alligator clip, then release the handles.
4. Hold the device in the most comfortable position and use it to guide and push the credit card into the target slot.
5. When payment is finished, pull the card out using the device as described in steps 2 & 3.
6. After the payment, the device can be stored in Sandi's purse for convenience. During the fuelling process, if she does not have any immediate need for the device, she can hang it around her neck in order to prevent it from getting in the way when she uses her hands for other things.

Benefits

The main advantage that our product has over existing solutions and those of our peers is that it is very practical and simple. This means Sandi will not feel awkward or uncomfortable when using our product, and it is something very simple which requires almost no instructions. The product is lightweight so Sandi will not have trouble holding it. Our product is also compact and portable since it can easily fit into her purse for use anywhere. The product requires Sandi to squeeze with her full hand for just a minimal amount of time, so Sandi will only need to compress the handles when she is grabbing one of her cards. The product does the rest of the work. It also ensures that the card will not drop since it is held tightly by the alligator clips and rubber tubing. The neck lanyard ensures that she will not have to worry about dropping the product itself. This product also removes any pinching motion that she had to do initially to remove her card and so this removes the most excruciating pain she had to deal with when paying for anything. The thermoplastic handles ensure that the product provides a big grip and this adds further convenience and comfort for Sandi.

Miracle Grabber

Innotesco Engineering Inc.
F08 - 126 – 1



Problem Description

The main objective is to assist our client, Sandi Mugford, in maintaining her independence while fuelling her vehicle. Due to her rheumatoid arthritis, the mechanism should significantly reduce physical pain, especially in the hands, and should improve efficiency and mobility while carrying out the fuelling process.

The card problem was brought to the attention of Innotesco Engineering Inc. for a number of reasons. Firstly, Sandi had personally stated that the insertion of her credit card into the card terminal causes a tremendous amount pain. Secondly, this is a problem that would arise for Sandi at any card terminal, therefore a device would help her in similar situations outside the gas station. For the reasons mentioned above, Innotesco Engineering Inc. decided to solve this particular problem.

Design

Many issues had to be considered while designing the final prototype. One factor was that it had to be light, for Sandi to easily wield it. This was accomplished by using lightweight materials, resulting in the final device weighing approximately 4 lbs. Another issue that was taken into consideration was portability, to allow the client to effectively use and transport the device. This was done by making the device compact, being 24 cm long and 10 cm high. Therefore, the Miracle Grabber can be easily stored inside of a vehicle due to its small structure.

Functionality

The Miracle Grabber is successful in performing its intended functions. The main function is to insert and to remove the credit card from a payment terminal, which is achieved by constructing clamps that can fit into the terminal space to push the card in and out.

Another function is to stabilize the card while it is being inserted. This is necessary, to allow for the process to be easily accomplished. It is also important for the removal of the card, as the device must have a firm grip on the card during the above processes to prevent the card from being dropped. This function has been achieved by having a grip for support, attached on the main body of the Miracle Grabber, while having another handle at the rear of the device. One hand is used to steady the device by holding the grip while the other hand operates the device with the handle. This function is crucial in assuring that the device is easy to use.

Overall, the final prototype works well with high success rates. It is able to remove the card from the payment terminal easily and effectively. Occasionally, the grip on the card is not sufficient enough to pull the card out on the first attempt; nevertheless, the card can still be removed, but with an additional attempt to loosen it enough before the card can be pulled out from the terminal.

Materials, Components, and Assembly

The materials used to construct the device include thermoplastic, duct tape, hot glue, a paint roller, foam, and a store-bought reacher. All of the materials are very affordable, minimizing the total cost to construct the device to nine dollars. The first component of the device is the front card holder and clamp. The second part is the pivot point, body and the attached support grip. Lastly, the rear of the device consists of a spherical handle that operates the device. It can be easily assembled in two hours; where the store-bought reacher is reduced in length, its front clamps are removed, and its rear trigger is removed. Next, two thermoplastic clamps and a card holder are added to the original clamps of the reacher. Afterwards, a support grip constructed from a paint roller sponge, duct tape and foam is attached to the middle of the body. Finally, a thermoplastic ball is affixed to the plastic piece extended from the aluminum rod. The thermoplastic ball is wrapped in foam and glued in place, completing the construction process.

Use

Instructions of how to use the Miracle Grabber:

1) To open the clamps of the prototype, hold the bottom grip with one hand and push forward on the spherical rear handle with the other hand.

2) With the clamps in its open position, place the debit card into the card holder attached to the bottom clamp.

3) Grip the card by pulling the rear handle back to close the clamps.

4) To insert the card, use the device to guide it into the machine slot and push forward on the rear handle of the device to open the clamps, and release the card.

5) To remove the card from the machine, pull the rear handle to close the clamps on the card then pull the entire device backwards.

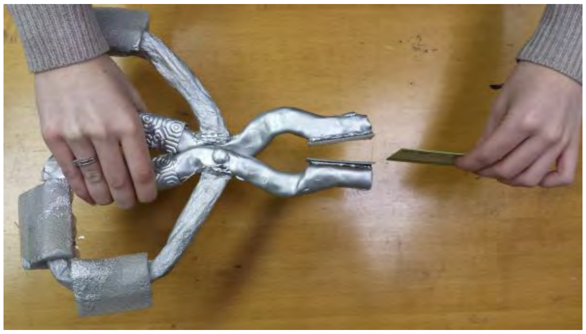
The device can be stored with Ms. Mugford’s credit card, which is kept in the trunk of her car. It can be held, and easily carried by the rear handle or the front grip. While Ms. Mugford is fuelling her car, the Miracle Gabber can be placed on the roof of her car or on the driver’s seat.

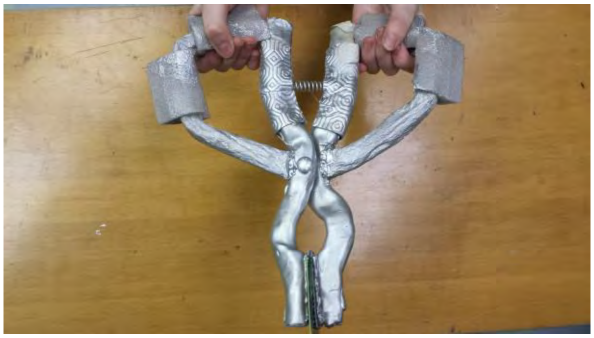
Benefits

The design of the Miracle Grabber demonstrates many benefits. Firstly, the device is very portable because it is lightweight and short in length. The two handles on the design both have wide diameters and provide cushioning to allow optimal comfort for the user. Furthermore, because it is a two-handed device it implements maximum stability. A linear motion of the arm is required to open and close the clamps instead of having to rely on hand muscles gripping the card, which significantly reduces the pain experienced by Ms.Mugford. Rubber on the bottom and top clamps provide additional grip to the debit card. Furthermore, there is a card holder on the bottom clamp to provide accuracy and precision for the insertion of the card. In conclusion, the Miracle Grabber is beneficial to Ms. Sandi Mugford as it improves the current situation of her payment process at the gas station.

Alicatte

Libera
F08-126-2





Problem Description

To design a device for the clients Dr. Fleisig, the Teaching Assistants and Ms. Sandi Mugford, who is also the user with Rheumatoid Arthritis, to independently complete the process of fueling her car while minimizing the amount of pain and difficulty she experiences at a self-serve gas station. As stated by the client and user, Ms. Mugford, her biggest challenge in the fueling process is the credit card insertion and removal. For this reason, along with other influencing factors such as versatility, Libera's primary concern is to satisfy Ms. Mugford's priority and build a credit card insertion and removal device

Design

The design consists of two elements made of thermoplastic pivoted at a point with a bolt and two curved paper mache arms attached from it to the lower end of each element. The device is 18cm in length and 18cm at its widest part and weighs less than one pound.

A spring attached below the pivot point maintains the two elements in a compressed position forcing the upper ends to be closed. The card is placed at the upper ends by compressing the spring when an inward force is applied on the lower part of each element. The paper mache arms allow for flexibility in holding positions.

Functionality

The Alicatte's primary function is to aid Ms. Mugford in the process of inserting and removing her credit card into and from the card slot as she fuels her car at a self-serve gas station. It fulfills this function by holding the card in place between the two main compressed elements as she inserts or removes it into or from the slot. Furthermore, it fulfills Ms. Mugford's request of relieving the difficulty and pain she experiences from pinching the card by providing a wide grip, multiple holding positions and a small required force to compress the spring and place the card in its place.

Materials, Components, and Assembly

To build the Alicatte, few materials were required at a low cost. Thermoplastic was provided to team members through the course package, and therefore was considered free of cost for this specific design task. The thermoplastic is used to mold the two main components of the device that will hold the card in a compressed position by submerging it in hot water for two minutes and then molding it to the desired shape. Then a bolt is used to pivot the two components and a spring is glued below, which cost $0.20 and $0.50, respectively, at Home Depot. To perform such tasks a screwdriver, pliers and a lighter are required to heat up the metal, cut the hole through the thermoplastic and cut the spring to the desired size, all of which were free of cost from a pre-owned tool box. The curved outer arms were built out of newspaper, toilet paper and a glue-water mix, all of which added to a total cost of $2.00 from the Dollar Store. The newspaper was wrapped into the desired shape and then covered with layers of toilet paper and the glue-water mixture and left to harden. Lastly, the non-slip shelf liner and plastic ruler were glued to the upper end of the compressed elements, as well as, parts of a cut-up foam sword to the paper mache arms, to allow more comfort for Sandi, using a pre-owned hot glue gun. These added to a total cost of $2.75 from the Dollar Store. For aesthetic purposes, the device was also covered with silver spray paint from Home Depot for a cost of $8.00. Ultimately, building the device shouldn't take any longer than two hours.

Use

Sandi will use the credit card insertion and removal device by:

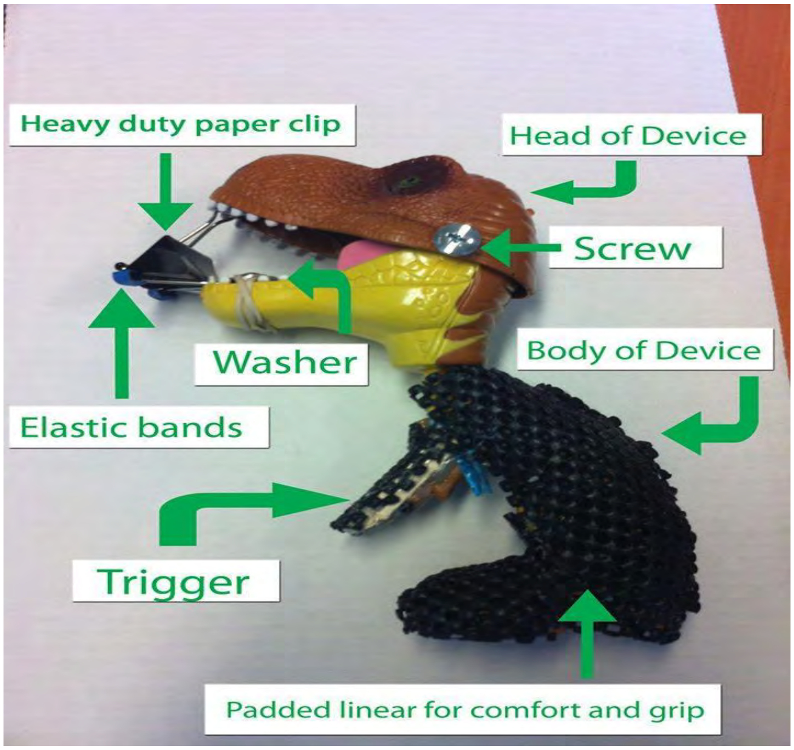
1. Pulling out the device and credit card from her preferred location to store them, such as her purse, glove box, back seat, etc.
2. Take the credit card in one hand and proceed to clamp the device with her preferred hand by compressing through the inner-most arms as shown in left figure on page 1.
3. The spring will compress allowing for the clamp to open
4. Once the card is in place, she can let go of the clamp and it'll compress on the card. The device will maintain a compress position, throughout the process.
5. Sandi may now decide how she prefers to hold the device to insert the card into the card slot (one hand/ both hands as shown in both figures on page 1)
6. Once the card is in place, she can either leave the device attached to the card or remove it and put it down wherever she feels is most accessible later on (ex: hood of the car)
7. After the process of fueling is completed, she may re-clamp onto the card (if she so chose to remove it from the card at the beginning of the process)
8. Finally, she will pull the device towards her, allowing for the card to be removed

Benefits

The Alicatte successfully fulfills the team's objectives, constraints and metrics while performing the desired functions in a manner that competitively places the device above other team's devices. To start, the Alicatte is very lightweight, putting no strain at all on Sandi's joints as she holds it and performs the task of inserting and removing her card. The device can also be used with both hands and held in different positions, which allows Sandi to ultimately choose the most comfortable grip for any given day. Versatility was another concern in the building process. Therefore, the team ensured the device can be used almost anywhere where the process of inserting and removing a card is necessary, such as an ATM and stores, not only making the fueling process easier for her but also daily tasks less painful. Another advantage is provided by the constantly compressed position of the Alicatte. Since it is naturally closed, it allows for a better hold of the card and no force required to maintain the card in its place during the insertion and removal. Furthermore, the device is cost effective and durable, being able to withstand several drops. It has long handles which increase torque and therefore minimize the force required to compress the spring and open the upper clamp. Lastly, since it is made of only two main elements, it is of very low complexity to operate and easy to repair or adjust in the case that such actions are required.

Gaiasaurus

Team Name
D08-126-3



Problem Description
The purpose of the device is to provide Dr Fleisig and his team with a solution on how to provide Sandi Mugford the ability to maintain her independence at the gas station for inserting and removing credit card while minimizing pain and conserving her energy.

Design
The device has been designed to fit inside the user's glove compartment or a medium sized handbag. Also, the device has been padded on the main body and the trigger for extra grip, comfort and to absorb shocks in case it falls, therefore making the device more durable. Also, because of the padding the device is protected on a rainy day and the user doesn't lose his/her grip. The device weighs less than a pound which is lighter than the maximum load of 5lbs the user can lift.

Functionality
The Giasaurus can safely insert and remove a card from an ATM machine at the gas station. The jaws of the device have a very strong grip to hold the device which will not let the card slide,

to remove a potential harm to the card the jaws are covered with elastic rubber bands giving it extra grip over the card. The device makes it easier for the user to insert her card. The user just has to pull the trigger to use the device, instead of twitching her fingers. This saves the user a lot of time and energy. This allows the user to be independent and she does not have to rely on someone to pull the card out for her thereby, giving her independency.

Materials, Components, and Assembly

The materials required to construct the device are; the dinosaur toy for its pulling mechanism, heavy duty paper clips for gripping onto the card, elastic rubber bands on the paper clips so that the card does not damage by the grip of the clips, padded linear, washers, and Popsicle sticks for extended triggers. All the parts are sold in bulk at a dollar store. The total cost to make the device is around $12. Some extra material is used were super glue and hot glue gun as adhesive material, and bolts for holding the jaws together. The total cost for that is around $12 and can be bought from a hardware store. It takes around an hour to assemble the device. While assembling the device the user has to be careful about putting the threads connecting the jaws and the triggers at the right place. These places are marked inside the device.

Use

- The trigger is pulled resulting in the jaws made out of paper clip to open.
- The card is inserted in between the jaws.
- The card is then inserted in the machine and pushed inside the machine with the close jaws.
- Once the card is ejected, open jaws by pulling the trigger and clamp on to the card.
- The trigger is then released, resulting in the jaws to close and the card is pulled back out.

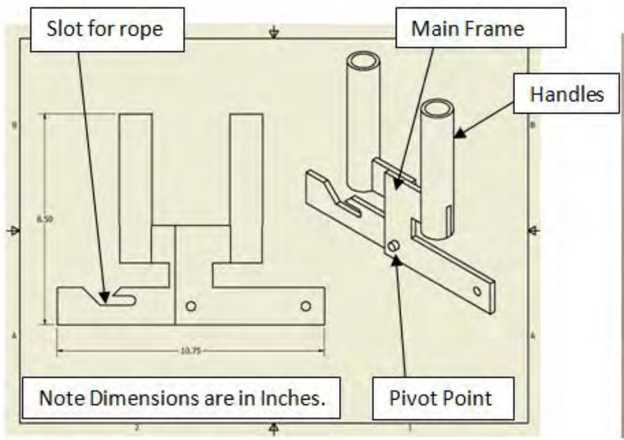
The device is small enough to fit inside the glove compartment of the user’s car or a medium sized handbag.
While the user is performing other tasks and not using the device she can put the device on top of the car the padding on the device won’t let it slip off the roof of the car

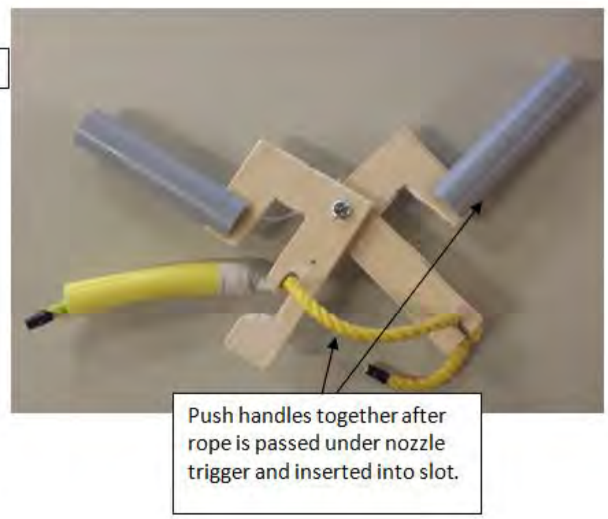
Benefits

Our design is much lighter in weight in comparison to other devices, furthermore it is made out of cheap and yet durable material. The Gaiasaurus is not only compact but also very simple to use, it can absorb shocks from falls and it will not making it more durable. It can work in any weather conditions, the jaws of the device hold the card very firm, reducing the probability of the card to fall or slip out from the jaws. Our device has extra grip added onto it and has a thick body structure, the user can hold onto the device and use both of her hands or just one. The head of the device can also rotate making it even easier to insert or extract the card from the device.

Gas Pumper 9000 D

Perigee Technologies
F 0 8 - 1 2 6 - 4





Problem Description

The client has trouble during the process of fueling her car at gas stations due to her Rheumatoid Arthritis. This degenerative disease causes reduced fine motor skills and swollen joints. This causes her pain when she is using the gas pump. By assisting our client at the pump, we help her to maintain her independence.

Design

The lightweight design weighs just under two pounds, which won't be a hassle to carry around. In regards of the size of the device, it is less than a foot long, three inches in width, and an inch tall. Hence, it has high portability as it is compacted and lightweight.

Functionality

Functionality was one of Perigee Technologies' major objectives going into this project, and they believe it has been achieved. The device allows a user to pump gas without having to make a tightly closed fist at any point during the fueling process. It is light and easy to use. The device went under extensive testing by the team at several different gas stations including the one shown in a lecture early in the semester. The device worked well and was even easily activated using a device for limiting hand motion developed by the team.

Materials, Components, and Assembly

The materials required for the gas pumper 9000 D are: 1" PVC piping, ¼" ply wood, 1 nut, bolt and washer, nylon rope, foam cylinder and super glue. Overall the total cost for all materials came in around $20, however we were able to purchase 10' of PVC piping, 4 square feet of ply-wood and lots of left over rope. The team estimates that 7-8 devices can be made for the price of $20. All supplies may be obtained at a local hardware store. The tools required for construction are: Jigg Saw, Dremel with a sanding disk and a plastic cut off disk, and a power drill with a ⅜" bit. With a basic knowledge of these tools the device can be constructed in about an hour. To build this device contact Perigee Technologies for technical drawings.

Use

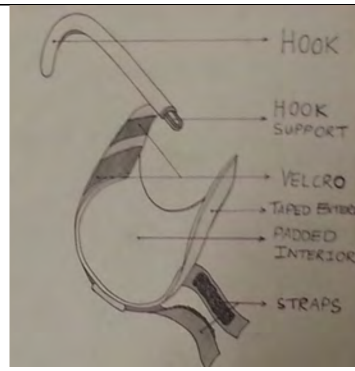
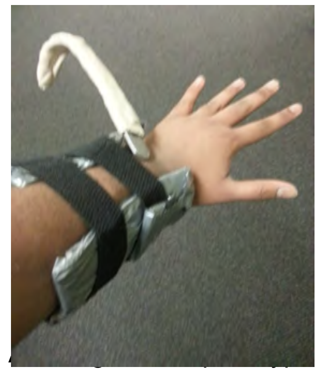
1. The device will be stored in the trunk along with her purse.
2. She will carry it from the rope or handle to the nozzle.
3. The device will then be placed in the open position on top of the gas pump.
4. The unattached end of the string will be placed in between the trigger and the bottom of the gas pump.
5. Attach the loose string to the hook/holder.
6. In order to use the device to pump gas, the user must bring the handles closer together. By bringing the handles together, the slack is reduced, which causes the rope to exert an upwards force on the trigger and releases the gas.
7. When the gas is done pumping, the user may release the handles and remove it from the gas nozzle
8. After usage, the device may be stored in the glove compartment, or trunk for the vehicle.

Benefits

- This device is safe, it generates no sparks as it does not use an electric motor.
- It reduces pain. You no longer have to use a tight grip to maintain gas flow but simply push on the handles (using flat palms or any position that is most comfortable). This moves the required muscle groups from the hands to the chest.
- It is lightweight. Weighs under 2lb.
- Easy to make. Less than 1hr to build.
- Simple to use.

Hook ‘N’ Go

CeaseFire
F08 – 126 – 05

 An image of the prototype when not in use (above).	 A labeled hand sketch of the prototype (above).	 secured to a hand; both are similar in size (above).
 The prototype is used to pick up the gas nozzle (above).	 The prototype is used to place the nozzle in the tank (above).	 The prototype is used to squeeze the trigger and pump gas by lifting the hand (above).

Problem Description

The clients of this design project, Dr. Fleisig, Ms. Mugford, and TA Abbey, have demanded that a device be designed for the user and primary client, Ms. Mugford. This device should help maintain Sandi’s independence while fuelling her car at the gas station as she ages. The device will aim to maintain Sandi’s independence by reducing the pain and time associated with lifting the gas nozzle and squeezing its trigger to pump gas.

Functionality

The device redistributes the weight of the nozzle away from the joints and towards the forearm when it is lifted. More importantly, the device eliminates any need for grip strength when squeezing the trigger of the nozzle. Instead, a more comfortable push and pull motion is used to squeeze the trigger. This device efficiently addresses both problems of the nozzle being too heavy to lift and the trigger being too resistant to squeeze.

Materials, Components & Assembly

The device is made out of thermoplastic, fabric padding, duct tape, metal and Velcro. All these materials can be obtained at a local hardware and dollar store and will cost Sandi a total of $15 CDN. A stapler is the only tool required for putting together the prototype. Construction and assembly of the components is simple, straightforward and can be guided by five simple instructions.

First, heat the thermoplastic and mold it to the left arm. Second, let it cool slightly, then wrap the cast with fabric padding and staple it to the warm mold. Third, fashion a hook out of thermoplastic and mold it to a piece of metal (i.e. the handle of a butter knife). Fourth, staple the hook and Velcro straps to the warm cast. Finally, wrap the entire device with duct tape.

The device can be constructed and assembled in less than an hour. However, it is unlikely that Sandi alone can assemble the device due to the nature of her disease

Design

As seen in the visual X above, the device closely resembles a forearm splint, but with a hook on it. The device was almost entirely wrapped with duct tape, giving it a metallic silver appearance. The prototype is very light, weighing less than 5 lbs. As seen in visual Y above, it is also small; with respect to Sandi, the device is about the size of her forearm.

Use

1. Slide your left arm into the device.
2. Secure the device using the Velcro.
3. Hook the device between the gas nozzle’s top and trigger.
4. Lift the nozzle and place it inside the fuel tank of the car. Unhook the device.
5. Hook the device between the gas nozzle’s trigger and bottom.
6. Lift your left arm to squeeze the trigger.
7. Unhook the device after use. Follow step 3 to place the nozzle at the pump.
8. Unsecure the device using the Velcro.
9. Store the device in the trunk of our car.

The device can be worn throughout the entire process of fueling a car.

Benefits

The “Hook ‘N’ Go” is a brilliant design whose functionality surpasses those of all existing designs. This device is portable, durable, lightweight, eco-friendly, all-year-round, easy to use, simple to build, inexpensive, and most importantly, effective.

Recall that the gas nozzle poses two problems to Sandi; first, it is too heavy to lift, and second, its trigger is too resistant to squeeze. Most competitive products were able to solve only one of these problems. The “Hook ‘N’ Go” is able to solve both these problems by redistributing weight for easier lifting and removing the need for grip for easier squeezing.

Due to its portability and lightweight, this device can also be stored anywhere when not in use and worn when Sandi is using her credit card and the keypad to pay for her fuel. Other products can be big and bulky; failing to offer the convenience and comfort the “Hook ‘N’ Go” does.

As mentioned in above, this device is also easy to build. Its components are easy to find and inexpensive, meaning that Sandi can easily have the “Hook ‘N’ Go” rebuilt in the case that she loses it or breaks it. The latter is highly unlikely; this device is very durable and can be used throughout the year without wear and tear.

Should Sandi misplace the device, its components are also recyclable. Any individual who finds it can dispose of it in a recycling bin. If the device is not found, its components are also chemically stable and will not harm the environment around it.

The Helping Hand-le

Innovatus
F08 - 126 - 06

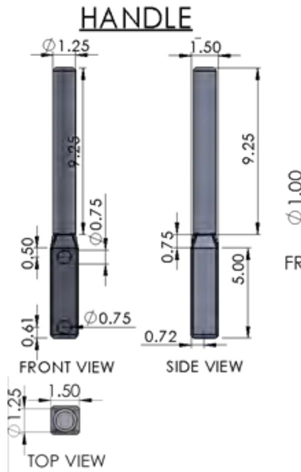


Figure-1: Solidworks drawing of the device's handle

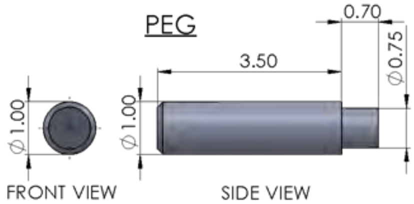


Figure-2: Solidworks drawing of the device's pegs

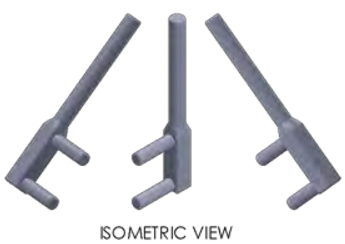


Figure-3: Isometric views of the device

Figure-4: Solidworks rendition of the device in use

Figure - 5: Images of the Final Prototype

Problem Description

Design a device that reduces pain in Ms. Mugford's joints and time spent pumping gas, which will increase Ms. Mugford's overall independence at the gas station despite the obstacles posed by rheumatoid arthritis. The device will assist Ms. Mugford with holding down the trigger to pump gas. The final product must meet the expectations of the clients, Dr. Robert Fleisig, the TAs and Ms.Mugford.

Design

The device is based on the principle of a first class lever. It is very sleek and light weight, which allows it to fit in a small space as it is only 1.5 inches wide at its thickest part as seen in Figure 1. The device also includes a long handle that gives the user a mechanical advantage thus requiring the application of a lesser force than otherwise needed to pump gas. The foam handle makes the device more comfortable for Ms. Mugford to hold and the polyurethane grip allows the device to adhere to her hands which will give her a good grip on the device even when held lightly. The wrist strap provided can be easily adjusted to the user's liking and it can also be replaced or removed by simply unhooking it from the device. The pegs are removable which allows the device to become more compact for storage in very small places.

Functionality

The device is to be used by Ms. Mugford to pump gas by helping her lift the trigger of the nozzle to fuel her car. The device is able to fuel a car faster, which increases Ms. Mugford's independence, while the pain felt in doing the task is minimized. The device enables Ms. Mugford to be able to fuel her car painlessly, because she needs to apply less force in a more convenient manner. The device is able to perform everything Ms. Mugford has requested with regards to the problem statement.

Materials, Components, and Assembly

This device consists of three main components: a handle and two pegs. The parts were machined from wood and the device was built in the JHE student machine shop at McMaster University. Other materials used in the device include a wrist strap, hook, dish sponges(foam), and a tennis racket overgrip. The materials used were purchased from Home depot-wood and hook; the Dollar Store- dish sponges and wrist strap; and Canadian Tire-tennis racket grip.The total cost of the device is about $13.00.The designs for the device were created using Solidworks and this allowed the team to visualize the prototype and further refine the design before a prototype was built. The device took approximately 10-12 hours to build.

Use

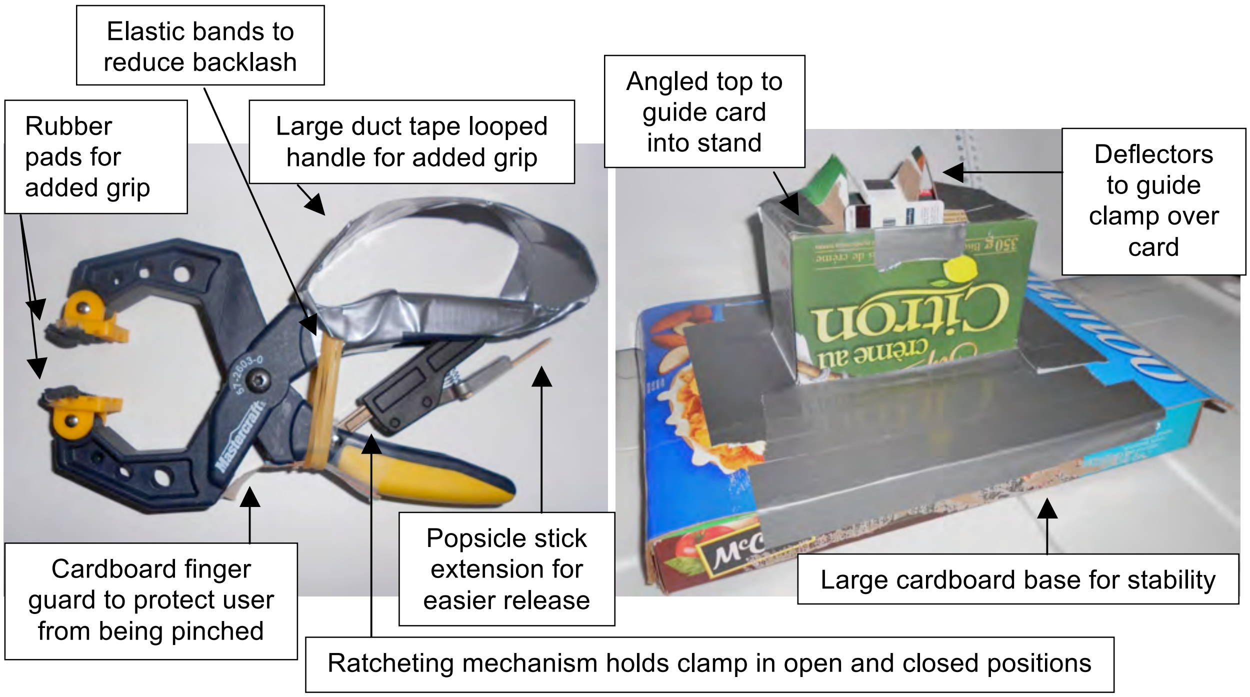
1. Ms. Mugford will take out the device from where she stores it and puts on the wrist strap so that her hands are free when she performs all other tasks related to fueling her car.
2. She then inserts her credit card into the fuel pump and then takes out the nozzle and inserts it into her car.
3. Once the nozzle is inserted into her car, she inserts the two pegs of the device into the nozzle (refer to figure 4). One will sit over the nozzle handle and the second one goes under the trigger. The device can be inserted from any side.
4. Ms. Mugford then pushes forward (if handle is facing upwards) or pulls towards herself (if handle is facing downwards).
5. This will cause the trigger to be pressed and fuel to flow into her car.
6. Once she has filled enough fuel, she simply lets go of the device. She then removes the device and lets it hang from her wrist while she replaces the nozzle to the pump and pays for the gas.
7. She replaces the device to its storage location for use the next time Ms. Mugford need to fuel her car.

Benefits

Currently, Ms. Mugford is required to pull the gas trigger up with both hands and it causes her a great deal of pain because she is using smaller, weaker finger muscles that lack strength and range of motion especially in poor weather conditions.This device allows Ms. Mugford to use bigger muscle groups such as her biceps, triceps, and shoulders which act on joints that are less affected by her Rheumatoid arthritis. Existing products that address the trigger squeezing problem use a locking mechanism and allow the user to walk away from the gas nozzle while it continually pumps gas which can expose herself and other users to great danger. However, this was a major constraint on the design, as the law requires any assistive device that is used should not have a locking mechanism. Our device is more effective than the device created by other groups because it is simple, aesthetically pleasing, cost effective,robust and very lightweight.

Painless Pay

Iuvo Design
F08 – 126 – 7



Problem Description

Develop a device under the direction of Dr. Fleisig and Abbey to aid Sandi Mugford in pumping and paying for her gas in order to maintain her independence and reduce the pain she experiences as her arthritis progresses.

Design

Our design is easily stored in the trunk of a car. The stand has a weighted base of approximately 1lb. It stands about one and a half feet from the bottom of the trunk so Sandi need not bend over too far. It requires 8” x 11” of space in the trunk. The clamp itself weighs less than 1lb, and reaches a maximum length of 8”, width of 4½” and thickness of 2”. The device as a whole stores easily and is very accessible in the trunk of a car without taking up too much space.

Functionality

Our device was designed to assist its user in paying for their gas at the pump. The Painless Pay does a fantastic job of this and its functionality is unprecedented. The device restricts any energy that must be used to the initial clamping of a credit card. Once the card has been clamped, the user is not required to sustain any force on the device. This is accomplished with a special mechanism that maintains the pinching force of the clamp. This mechanism comes with an easy release that can be engaged with any free hand, arm or elbow. Another great feature is the looped handle which allows for the user to hold the device without a strong grip. Due to the clamp’s lightweight design, the user’s hold of the device can be released if the user needs to complete other tasks while in the middle of the paying process.

Our clamping device is used in coordination with our credit card stand. The stand allows for simpler use of the clamp as they work together to simplify the entire paying process. The stand holds the credit card vertically so it is in an ideal position to be clamped. It also has deflectors that guide the clamp to the ideal position on the card to be gripped. The stand was also designed with an angled top that guides the credit card into the holding slot so there is no need for accuracy.

When the devices are used together, the process of paying for gas at the pump is simplified to few simple motions. The devices work together to virtually eliminate the need for any fine motor skills. The functions of these two devices reduce the pain that someone with rheumatoid arthritis would experience; therefore the painless pay system is ideal for Sandi.

Materials, Components, and Assembly

To construct the device a clamp, rubber, non-slip pads, popsicle sticks, duct tape, cardboard, elastic bands, scotch tape and hot glue are needed. These materials can all be purchased from Canadian Tire and Dollarama and will cost a total $16.00 plus tax. To build, a pair of scissors, utility knife, a hot glue gun and approximately three hours will be needed.

First, use a utility knife to narrow and point the ends of the clamps. Next, glue rubber, non-slip pads to the pinching surface of the clamp near the tip. While the clamp is open, tape a short piece of popsicle stick onto the easy release tab such that it extends past the end of the handle. Close the clamp completely, align the ends of the clamp, and glue into position with hot glue. Stretch several medium strength elastics over both handles of clamp.

To make the handle, start by forming a loop of duct tape (sticky side out) large enough to comfortably slide a hand through. Stick the loop to the clamp handle that the release tab is pushed towards. Next, carefully cover the exposed sticky portion of the duct tape loop with a second piece of duct tape. For added protection, tape a strip of cardboard to the other handle of the clamp to prevent the user from being pinched when the clamp is released.

For the stand, angle one end of a cardboard box such that it will guide the card into a narrow slot. Use tape to hold the cardboard in place. Cut the box down to the height of a credit card and attach it to a weighted base. Lastly, fold and cut a piece of cardboard to guide the clamp over the card and tape onto one side of the angled top. Be careful to position this such that the clamp pinches the middle of the card's edge.

Use

1. Place card in stand.
2. Slide hand through looped handle, and use other hand for added stability and control.
3. Use guide to position clamp over card.
4. With two hands close clamp, pinching card.
5. Remove card from stand and insert card into machine
6. Let go of the device.
7. Input pin and select dollar amount.
8. Slide hand back through looped handle.
9. Pull on device to remove card from machine
10. Slide card into stand.
11. Release tension.
12. Store device in the car.

Benefits

Currently, there is no unique or customized product to solve the client and users' problem of inserting and removing her credit card, on the market. This is where Painless Pay comes in. It takes a general device (i.e. a clamp) and customizes it to better suit the needs of the client. Its looped handle allows the client to hold it with a loosed grip, it has a dampened release to limit the stress on the client's hand when the device is opened, and it has a special gripping surface to allow for a stronger grasp on the card.

Our device is superior to similar devices that try to solve the same problem in many ways. Our device has a looped handle which allows the user to not have to worry about dropping the device as easily as some of the others. Also our device is larger than most of the other devices designed by our peers which means that it requires less fine motor control to operate while still being small enough to be convenient and portable. Most of our peers also did not effectively solve how the user would store her card and then get the card into the device as we have with our card storing base that fits inside the trunk of the user.

Hand-E-Pump

Team Name
F - 08 - 126 – 8

Problem Description

Design a device for the client, Sandi Mugford, who suffers from rheumatoid arthritis, which aids in the use of self-serve fueling. The device should help Sandi with working the gas pump by relieving the pain caused by her squeezing the trigger to pump gas. The device should be designed to adapt the user's worsening condition.

Design

The final design for the Hand-E-pump is made to be lightweight, compact and easy to use. Made out of thermoplastic, wire coat hangers, a pool noodle, a wrist strap, and duct tape. The design was made to be compact enough to be easily stored anywhere she wanted in her vehicle. Its total dimensions are a height of 8.5cm, a width of 5.7cm, and a length of 28.5cm. The weight of the final design is approximately 4 pounds.

Lightweight design of the device allows her to manoeuvre the device easily and efficiently to get the job done.

Functionality

The functionality of the final design is, in its current state, excellent (as engineers there is always room for improvement). The final design addresses all the issues brought up by the client. Her desire for something that would help her remain independent, Sandi wanted something that was lightweight, easy to use, and would adapt to her worsening condition. The Hand-E-Pump does just that. By having a thick grip on the handle, it is very easy to manoeuvre and fits snugly into the hand. Designed to be flexible, which means that there are many different ways to flex the device and make it pump gas. On good days, Sandi can work out her hands and arms by applying the force through her arm. On bad days the device can also be flexed by her using her own bodyweight pushing into the device.

Materials, Components, and Assembly

The beauty of the Hand-E-Pump lies in its simplicity. Made out of everyday household such as duct tape, wire coat hangers, wrist strap, and pool noodles, and thermoplastic which can be bought online or at specialty stores. It also requires few tools to be made, including wire cutters and pliers to bend and cut the wire coat hanger and tongs to pull the thermoplastic out of the warm water required to make it mouldable. Simple enough to be made, it can be constructed easily within an hour. The instructions needed are as follows:

1. Have the 2 wire coat hanger cut to a length of approximately 30cm each (this leaves room for error).
2. Bend two hoops, one at each end of the wire so that its total length is about 12cm. Make one of the holes 1cm in diameter and the other one between 4cm in diameter. make sure to cut off any excess wire.
3. Warm up the thermoplastic and cut out a rectangle of 12cm x 5cm approximately.
4. Attach 2 piece of wire coat hanger about 11cm long to the rectangle thermoplastic. These coat hanger pieces with act as a brace to prevent bends of the thermoplastic.
5. Securely duct tape the hooped wire to rectangle of thermoplastic with the hoops facing away from the thermoplastic.
6. Warm up and cut off a piece of thermoplastic to be rolled into a cylindrical rod that is between 27cm-29cm and 0.9cm in diameter.
7. Warm up and cut out a 15cm x 10cm rectangle from the thermoplastic and wrap it completely around one of the rod along the length of the rectangle. This will be used as the grip.
8. Stick the rod through the big hoop of the wire and fasten the end of the rod at the tight hoop with duct tape so that the rod can’t slip out.
9. Using the excess wire, bend it into a square U shape and fasten it to the middle of the flat side of the thermoplastic base, sticking out. Looking at the device from the side, this piece should now look like a square C.
10. Attach the wrist strap to the handle of the device, and this will be used as a bracelet.
11. Cut a 9cm wide piece of pool noodle off, and cut a straight line down the length from one end to the other so that it can be wrapped around the grip.
12. Take three strips of duct tape and fold them on themselves so that both sides of the tape is sticky. Wrap this double sided-tape around the thermoplastic grip so that is covers the width of the grip.
13. Wrap the cut off pool noodle around the duct taped grip and squeeze tightly to ensure that it is properly taped.

Use

The instructions for how to use the Hand-E-Pump are as follows:

1. Retrieve the device from the side door compartment.
2. Put the wrist strap on around wrist
3. With the device hanging on the wrist, insert credit card, choose gas, and manoeuvre the pump nozzle as needed
4. Upon inserting the nozzle into the car, insert the device between the gap of the trigger and the trigger guard until the hook catches the guard
5. Apply a force through the handle to cause flexion to press against trigger until the tank is filled to satisfying amount.
6. Remove device from the nozzle and leave hanging on wrist while finishing the procedures of gassing up.
7. Upon returning behind the wheel, return the device to the side door compartment.

Benefits

Our device is a better solution compared to our competition because our device is lightweight, compact, and easy to use. We allow the user to use their body weight in different ways as opposed to straining their joints. The device is also adaptable to the worsening conditions of rheumatoid arthritis. The device will allow the user to continue to use a gas nozzle and limit pain and prevent the arthritis from worsening.

Pain Free Pusher

N.O.W. Engineering
F 08 - 126 - 9

Dimensions:

Height: 4.5 in

Width: 1.75 in

Length: 4.75 in

Problem Description

Design a device that reduces pain for Sandi in pressing buttons on a keypad that at the same time allows her to maintain independence. The device must meet the requirements set by Dr. Fleisg, Abbey and Nina as well as the needs of the client Sandi Mugford.

Design

The device will be roughly the same height as length (refer to dimensions above) and roughly be the size of an average hand. Thanks to its ergonomic design, Sandi only needs to hold the device in the natural hand position and apply minimal force to press the buttons. The device has a strap on the end to wrap around her wrist, or since it is small it can be easily stored in places such as her handbag. In the aforementioned, the device does not necessarily need to be carried as it has a strap to wrap around the wrist or can be placed elsewhere. As previously stated, the device can be put away thanks to its small size so that Sandi can perform other tasks.

Functionality

The device can be used to push buttons on the keypad, this is its only function

Materials, Components, and Assembly

Most, if not all items that need to be purchased can be found at dollar stores. The items necessary include a key holder, a stylus, a lanyard and a bottle of super glue. Comfort tape (hockey tape) may be available at a sports store. Since the items can be purchased at dollar stores, the total cost would not exceed $7.Regarding the actual construction of the device, construction time should not exceed 20 minutes, drying time included. There is no need for any prior skills or tools needed for construction. Begin by screwing in the screw into one end of the stylus. Wrap this end in bright coloured tape. Next, by using super glue to attach the stylus to the key holder such that when the key holder is in hand, the end of stylus with the screw juts out parallel to one's fingers. Proceed by wrapping some comfort tape around the key holder as this provides the extra grip. There should be a small hole to string the lanyard through. If not, use the super glue to attach the lanyard to the bottom. Ensure that entire device is rigid.

Use

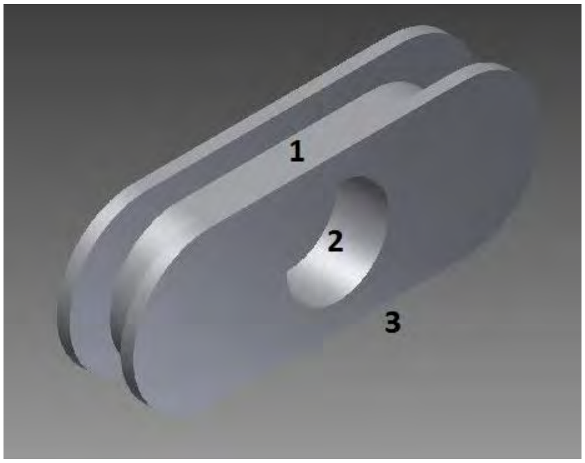
- Put hand through the attached wristband.
- Remove device from custom holder stored in the door of the car, trunk or purse.
- Hold device as depicted above with either hand, or both.
- Place the red tipped end on the desired button
- Apply pressure to the top of the device in the direction of the button.
- Replace device in the holder when done

Benefits

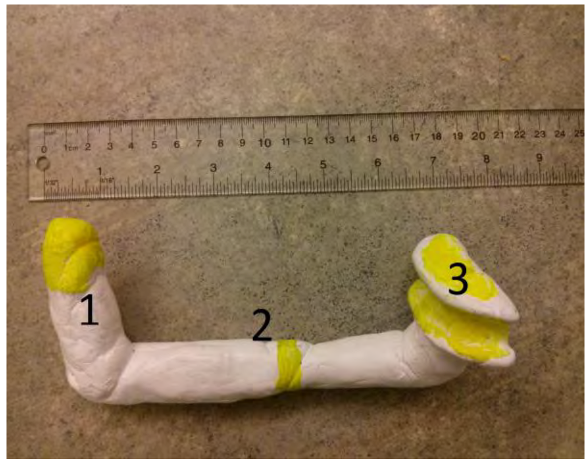
This device allows the user to transfer the strength of both hands into the pushing of a button. When compared to pushing the button with a single finger, the device spreads the work needed over a much larger range of joints and muscles. In addition, the device sports a padded 1.5 inch diameter handle, the client's preferred size, which makes it easy to hold and manipulate with minimal fine motor adjustments. Another important feature of the device is its durability. To begin, it is durable in its simplicity. The device has no moving parts such as springs that could fail and is itself made of only 4 separate parts. These parts are firmly secured to each other as was observed by the team after a series of drop tests; important due to the likelihood the client's poor grip would result in a drop. The device is also water and rust resistant. The outer casing is completely sealed and made of plastic and galvanized metal, allowing it to be unsusceptible to the elements. The maximum price below of the device is roughly $7.00. The final and possibly most important feature is how it restores independence and quality of life to the client. This was accomplished by having a device that is no bigger than her hand and barely noticeable from the side. The client will not feel out of place using the device and will not attract any unwanted attention. It has been designed to fit a custom built holster that can be mounted in the trunk of the client's car, or the car door and even the purse thanks to its compact and light-weight profile. The final weight of the product is only 200g. Also, the device was constrained to be portable and storable while at the gas station. In short, it is cheap to build, easy to build, easy to use, inconspicuous, durable and extremely light weight.

The EZ Egg

Prestige Worldwide
F08-126-10



CAD Visual
[1] The indented trough allows for easy frictionless movement along the trigger of the nozzle.
[2] A hole was created in the center of the "egg" device to attach to the main handle.
[3] The "egg" is purely symmetrical, which means it may be used with either hand on either side of the nozzle.



Final Product
[1] A smooth crafted handle allows for easy grip and a painless push
[2] Long lever allows for extended torque, putting less pressure on the user.
[3] The main component of the device: the "egg", which is depicted in the CAD visual.

Problem Description

The problem statement was to design a device for Sandi Mugford, which would essentially aid her experiences at the gas station. As the project proceeded, the problem description became more defined, and a specific problem at the gas station was to be solved. The group chose to do the gas nozzle situation, which involved Sandi having troubles with pumping the actual gas with the nozzle. This device must fulfill the attributes of reducing her pain, increasing her mobility, which will lead to maintaining her independence.

Design

The EZ egg was designed for the maximum comfort and functionality of the user. Versatility was the main focus during the design processes and was ensured to be operated in different ways. For example, the EZ egg was designed perfectly symmetrical so the user could operate it from either side of the fuel nozzle. This was very important because depending on the user's current or future vehicle, the fuel hatch could be located on either side. Also, the symmetry allows the user to perform whatever action feels most comfortable depending on their current physical situation. A trough was designed along the top of the EZ egg for stability while operating. The trough allows more grip on the trigger of the fuel nozzle, eliminating the chance of slipping out of position while rotating. The EZ egg was designed entirely out of thermoplastic making it very tough and durable because it is one solid piece. Another advantage of the material used is it does not react with temperature and will be comfortable to touch no matter what the climate is like outside.

Functionality

Functionally, the device helps the user pump gas with ease, reduced pain, and independence.

The device does everything that was requested by the client. It helps the user pump gas, is easy to operate and reduces pain, and allows the user to maintain their independence. The device is also unobtrusive and inconspicuous, and does not attract unwanted attention to the user, maintaining their privacy. The device is also lightweight, and cheap to make, benefiting the user.

Materials, Components, and Assembly

The EZ Egg is made entirely out of thermoplastic. Thermoplastic is a plastic that becomes malleable at a certain temperature and becomes rigid again once cooled forming its new shape. Thermoplastic costs approximately $20 for a sheet but not a whole sheet is used in the construction of the EZ Egg. To construct the product all that is needed is a pot and water. Heat up the water, not necessarily to a boil, place the thermoplastic in the warm water and wait for a few minutes. After it has been heated, take it out of the water and mold into the design quickly before it sets. Repeat the process as many times as need if it must be modified further. The whole process takes less than 20 minutes. There are no instructions needed only an illustration of the product to know the proper dimensions.

Use

1. The device is held upright, with the bent handle pointing upwards.

2. The oval (‘egg’) part of the device is inserted into the handle of the gas nozzle, with the lever pointing up. The egg can be inserted through either side of the gas nozzle.

3. The lever can then be pushed forwards, or pulled backwards, which rotates the egg and triggers the flow of gasoline.

4. The flow of gas is stopped by rotating the lever back to the upright position, and removing the egg from the gas nozzle.

The device can be stored inside a glove box, the trunk of a car, inside a purse, or a backpack. The device, due to its size, can easily be carried inside a purse, and only taken out when it needs to be used. While performing other tasks before fuelling, the user can keep the device inside a bag, on top of their car, or hanging from the gas cap.

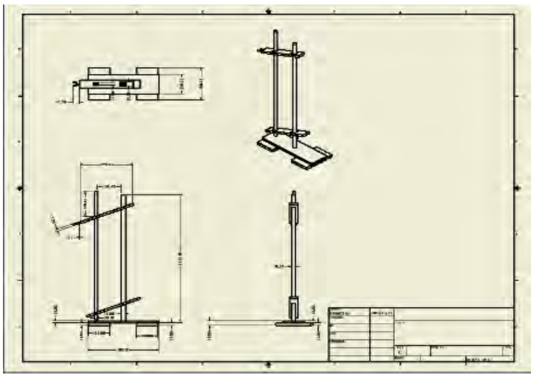
Benefits

This device surpassed the criteria of the problem statement well beyond the desired objectives, and towered over the other designs in terms of portability, weight, simplicity, and effectiveness. In terms of completing the problem statement, the device successfully completed the desired tasks, in a simple manner, rather than using complicated methods and techniques, as some other devices of other groups did. In addition, when many groups did not attempt to think about Sandi’s conditions, such as her fused knee, their designs would ultimately not work for her in many situations. The EZ Egg’s lightweight capability allows Sandi to utilize the device without pain, which is one of the main goals of the project. Effectiveness is without question, a necessity, and the EZ Egg fulfills all standards, thus resulting in a final product that undoubtedly surpasses all other devices.

"Step to Fuel"

Bio-ENG

F09-227-1



Problem Description

Rheumatoid arthritis, the most common inflammatory rheumatic disease, affects most of joins in human body, and causes pain, stiffness, fatigue and impaired physical movements. Our client and user Ms. Sandi Mugford has been suffering from severe rheumatoid arthritis. It has caused inflammation of the joints on her hands and affected her daily activities like filling the gas for her car. There are several tasks involving in gas filling that Ms. Sandi has trouble with, and holding the trigger open on the gas pump nozzle is the one causing her the most pain since it creates huge amount stress on her fingers and joints.

So, as we can see, our team need to work on the problem that Sandy needs to have her hands, especially fingers free from forces. What we do is trying to transfer the forces from being produced by her fingers to her feet.

Design

The design is physically available because it has been built using light materials such as foams, light wood boards and only two metal pipes. It weights less than two pounds. It is movable, stable, and durable.
The primitive function of this device is to relive stress from Sandy's hands joints as she is pumping gas by readjusting the point of force applied from her hands to her feet.
To build the device, we decided to

use cheep & light materials to make it adoptable. First we build a wide base to make it stable, then we drill holes on the pipes and used screws to put the pedals on them, make it possible for the pedals to rotate around the axles. Then we put a long screw half in the upper board and parallel to the pedals. Thus, when Sandy is using the device, all she needs to do is to step on the lower pedal, as the upper pedals is attached to the lower one by a metal pipe which is movable. Once the lower pedal has been stepped on the higher side, as it rotates, the lower part of it goes up, and so the pipe does. Then, the pipe will also force the lower part of the upper pedals to go up. As the screw is stuck in the upper pedal, it goes up too. As long as Sandy put the out part of the screw under the trigger of the nozzle, when she steps, through the process above, the trigger would be pulled up by the screw and it starts to fuel.

Also, this device is safe because once Sandy removes her foot from the paddle, it will fall down as the result of gravity and the screw leaves the trigger, then the fuelling process stops.

Functionality

The function of this device is to remove the stress from Sandy's hands to her feet to make the fueling process not as painful as it was before to her.

Materials & Assembly

Base: Wood Boards
Paddles: Wood Boards
Other parts: Screws, Foam, Tapes, Metal Pipes, Magic glue.
Drill a hole in the wood base and insert the pipe through.
Screw three pieces of wood into the base for stability.
Drill a screw into the pipe through the wood for stability Cut out a piece of wood for the pedal.
Attach the pedal to the center pole. Attach another piece of wood at the top of the pole with a hook attached to it.

Benefits

1. Minimizes the amount of movement in Sandy's hand
2. Reduces the quantity of force applied to Sandi's hand joints
3. The light weighted nature of this device reduces the stress that Sandi experiences during the preparation and removal of the device.
4. Allows comfort to Sandi's arm during pumping as she can rest her arm on the device.

Use

How do the user use "Step to Fuel" is very easy.
1. The user going to keep this device in her trunk boot.
2. The user will carry it out by hold the rod which is covered by foam.
3. After paying, set up the nozzle, and place the device beside the nozzle.
4. Place the hook below the trigger and step the pedal.
5. Keep step on until the fueling is finish and release the pedal to stop.
6. Take off the device and nozzle. Carry the device into the trunk boot by carry the rod.

Black Flamingo

Potassium Carbonate Professional
Engineering Firm Inc.
F09-227-2

Problem Description

During the process of fueling her car, the client Sandi Mugford experiences pain and hassle due to her rheumatoid arthritis. This pain results from gripping the fuel nozzle, manipulating the keypad and also from the process of inserting and removing the credit card. They decrease her feeling of independence at the gas station. The team’s objective is to design a device that will help aid Sandi pump gas. The device will perform the task of reducing the amount of force required to release the gas pump lever. It is lightweight, portable and compact in size, easy and comfortable to use and install, and durable. It is an ideal solution to one of the client’s problems.

Design

The design uses a simple lever mechanism to operate. It allows the user to apply a downward force on a cushioned platform attached to a wooden dowel that pivots around a bolt, moving the other end of the dowel upwards. This upward force releases the gas trigger on the nozzle. This device weighs 0.8lbs. The length of the device, from one end of the dowel to the other will measure 22cm and be 7/8” in thickness. The platform will have measurements of 7.5cm x 6.4cm x 1.9cm. The block of wood that will hook onto the nozzle and rest against the side gasp pump will have measurements of 12.8cm x 6.4cm x 1.9cm.

Functionality

The device lessens the amount of force required to pump gas by providing more torque about the pivot. The device addresses the problem that the client faces when pumping gas, not with manipulating the keypad or inserting and removing credit cards. This will help aid in her feeling of independence as she will not have to rely on help from another person to pump gas.

Materials, Components, and Assembly

The materials required to build the device include; pine wood board, screws, nuts, bolts, sponge window/door frame sealer, a 7/8" wooden dowel, metal hooks, rounded plastic clamps, black spray paint and a clear semi-gloss sealer coat spray paint. The total cost to purchase these materials is $29.06. They were all obtained from Home Depot, in Burlington. Tools required for construction include a power drill with varying drill sizes, screws and jig-saw pieces to make rounded holes in the pine board. It took under an hour to assemble. Assembly does require special instructions.

Use

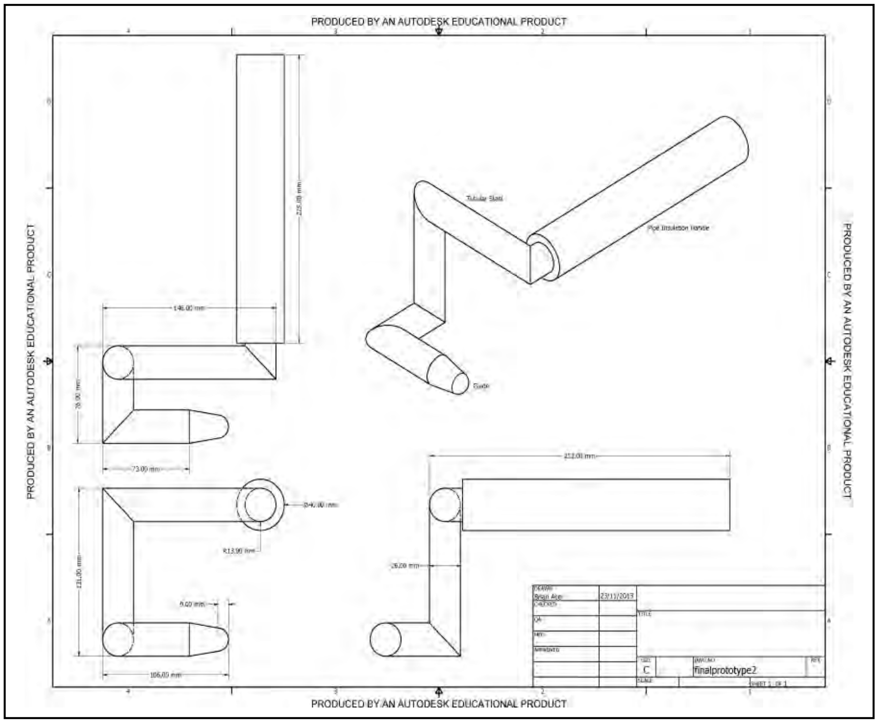
1) While the user retrieves the gas pump nozzle and places it into her car, there is the option of hooking the device onto the gas door.
2) Once the gas pump nozzle is inserted into the car, the user must place the shorter end of the dowel underneath the gas trigger.
3) As the user is placing the end of the dowel underneath the trigger, they must simultaneously ensure that the two hooks wrap around the top of the gas pump nozzle.
4) The device is now ready to use. The user must now apply a small force onto the cushioned platform to activate the device.
5) The user must maintain an applied force throughout the duration of the gas fueling.
6) Once the car has been fueled to desired amount, the user simply has to unhook the device and move it away from the gas nozzle. The option of hanging it on the gas tank door of the car is still available as the user removes the gas nozzle from the car back to the gas pump.

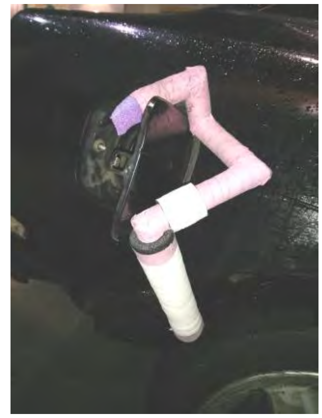
Benefits

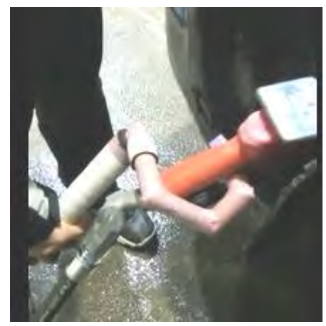
The main benefit of this device is that it reduces the client's pain when fueling her car by reducing the amount of force required to pump gas. It utilizes the pushing motion which requires very little effort, which can be done with either her hands or her elbows. In addition, it is very lightweight and compact. It can be stored in small spaces, such as a glove compartment or a medium to large sized purse, as opposed to the trunk. It is easy to install onto the gas nozzle, no heavy lifting or complicated set-up required. The apparatus also does not lock, and is therefore a legal and better alternative to other devices such as the 'Gas-Bud-E'. Additionally, it does not require the use of her legs so there is no risk of falling or any other injury. The hooks can be used to hang off the door while the client installs the gas pump into her car. It is also durable, since it can withstand falling to the ground and inclement weather due to the clear semi-gloss sealer coat of pain. Overall, it is very simple, comfortable and safe to operate.

The Pump Rocker

Hammer Innovations
F 09 - 227- 3







Problem Description

The client and user, Sandi Mugford, suffers from rheumatoid arthritis. She is seeking a device that assists her with the entire gas pumping process. The device will reduce the pain she experiences and the amount of energy required to pump gas. The device will be used at the gas station on the gas nozzle and will be kept inside of her car.

Design

The Pump Rocker is a simple gas pumping device that is very easy to use. The device is simply a lever that once hooked under the gas nozzle handle requires a small amount of force applied to pull up on the handle as seen in the pictures above. The Pump Rocker is very light weight and only weighs approximately one pound. The dimensions of the Pump Rocker are found in the CAD model above and can be compared to the size of a pocket sized umbrella.

Functionality

The device aids in the use of the gas trigger, reducing the amount of energy needed to squeeze the trigger, and refuel a vehicle. The clients concern's in regards to the gas trigger were that the motion of squeezing is painful and the amount of energy required to complete this action for the period of time to fill the tank is too taxing. This device changes the squeezing motion to a downward pushing motion. This allows the user to use different parts of her upper extremities to aid in this motion, saving her hands on especially bad days. The design of the Pump Rocker uses a pivot point with a large handle that both reduce the amount of energy required to pull the gas trigger and hold it open for the duration of the refuelling process, without ever clamping the trigger closed. The device is also lightweight so as to not cause the user any extra energy requirements to carry and set up the Pump Rocker for use.

Materials, Components, and Assembly

The materials required to construct the Pump Rocker are steel piping to provide the core of the device, hockey tape to provide protection against sharp edges and a non-slip surface for the device to rest against the gas nozzle. Pipe insulation is also used as the handle to give the user a larger and softer grip to help reduce pain. The total cost to build the entire Pump Rocker was approximately fifteen dollars. The cost breakdown for the project consists of $2.00 for the pipe insulation, $3.00 for hockey tape, and $10.00 for the steel pipe. These materials can be obtained from a hardware store and a sports store. A welding machine is required to fuse the steel pipes together and an angle grinder is needed to cut the pipe at the desired dimensions. Assembly time can range from two to three hours approximately. Instructions to the construct the Pump Rocker are essential as one must know the angles and the dimensions to cut the steel and how to use a welding machine.

Use

1. Remove gas nozzle device from storage (on passenger seat, floor, or in trunk).

2. Open fuel tank door. Device can be temporarily hung off of fuel tank door, or placed on top of car during payment procedure.

3. Insert gas nozzle as usual. Position device by first sliding purple pointer guide under gas nozzle trigger. The device should wrap around the gas nozzle as shown in the diagram above. Ensure that right side of device is flush with the gas nozzle handle.

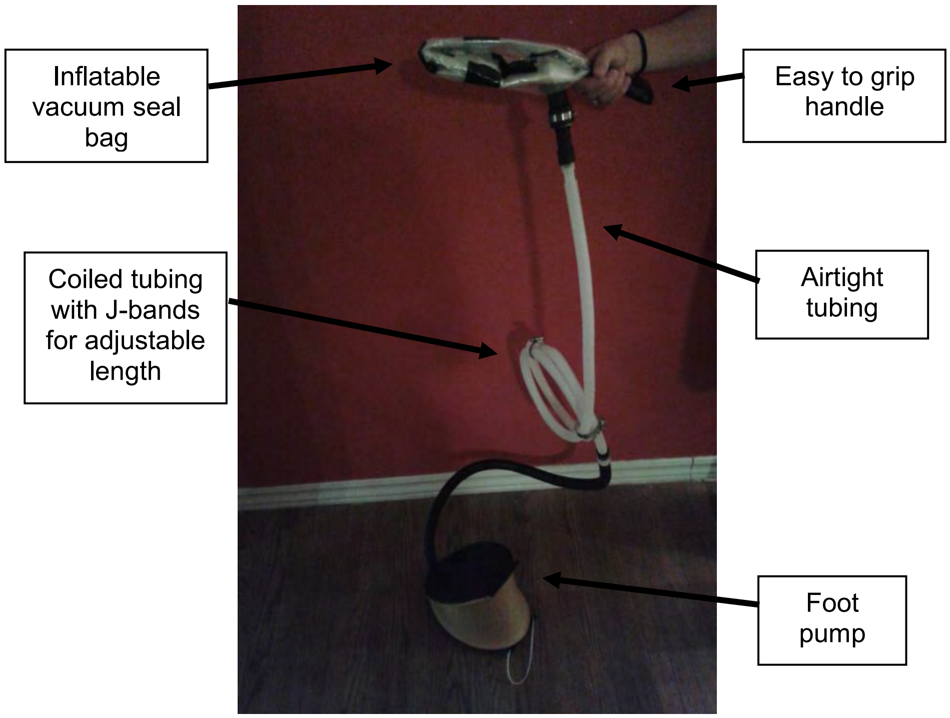
4. Begin fuelling by simply pressing down on the foam handle. When fuelling is complete, release pressure off of the device, remove the device, replace the fuel nozzle, and store device in original location.

Benefits

One of the key design features of the Pump Rocker is that it is simple and easy use. The Pump Rocker requires no extra time spent on setting up the device as other competitor devices do. As well, the device only requires one simple downward motion to activate it. The Pump Rocker is more durable than some of the existing products on the market as it is made of steel piping that is welded together, however, it is still lighter than most of the other devices as it only weighs approximately one pound. The device is user friendly and the small size of the Pump Rocker makes it possible to store it on the passenger seat in the car or in the compartment on the driver side of the door and , therefore, there is no need to place it in a trunk like most devices. While performing other tasks at the gas station, Sandi is able to store the Pump Rocker on the gas tank door of the car due to its unique weight distribution. The Pump Rocker is covered with hockey tape, so there is no possibility of causing a scratch on the car and also helps in keeping the device in place while on the gas nozzle, unlike many other devices.

The Airflow

Spartan Engineering
F09 - 227- 4



Problem Description

Sandi Mugford needs a device to assist her in refuelling her independently, due to her rheumatoid arthritis. The device must reduce physical pain and stress, protect afflicted joints and minimize the amount of energy to execute the task. Spartan Engineering has designed a viable device, “The Airflow”, that will be able to deliver gas to Sandi Mugford’s car and take the stress away from her hands.

Design

The AirFlow uses air from the pump, which travels through the tube and into the vacuum bag to lift the trigger of the gas nozzle. The device is lightweight, less than five pounds. This is due to its light materials and hollow apparatus. It is very compact and although the tubing is long, it can be easily rolled up. Sandi will be able to stow the device in her car, either under a seat or in the trunk.

Functionality

The Airflow will be able to effectively deliver gas to Sandi Mugford’s vehicle, while taking stress away from her muscles and joints. By powering the device with her feet, it will enable her to easily pump gas into her car without putting too much stress on her body.

Materials, Components, and Assembly

The materials and components that it requires are a Broadstone Air Step Air Pump, dishwasher tubing, a vacuum seal bag, duct tape, masking tape, and lastly, epoxy. The air pump can be found at Canadian Tire, the dishwasher tubing at Home Depot, and the vacuum seal bag at Dollarama. The epoxy, duct and masking tape can be found at any hardware store. In total, the bill of materials is approximately $26.50. The only tool required for assembly is scissors, in order to redistribute the rubber of the dishwasher tubing to fit together with the vacuum seal bag. Assembly will take approximately15-20 minutes. Parts of assembly that may need special instructions are where the rubber sections must be cut in order to fit everything. Lastly, one difficult part is increasing the circumference of certain tubes, to do this, wrap masking tape around the tubes. In order to make it airtight, apply the epoxy around where two pieces of the device meet.

Use

The device should be stored under the rear seat, on the side of the car where the gas nozzle is for convenience. While performing other tasks at the gas station, the device should be placed on the rear seat closest to the car's gas cap. When the gas nozzle is inserted:

1. Place the pump on the ground
2. Hold the device by the handle
3. Place the vacuum bag under the trigger of the nozzle
4. Begin pumping the air pump with foot
5. Keep Pumping; when bag is inflated, the handle no longer needs to be held
6. Once tank is full, stop pumping and remove foot from the device
7. The decrease in pressure will cause the vacuum bag to deflate
8. Remove the bag from the nozzle
9. Place gas nozzle back on gas pump
10. Pick up the foot pump
11. Carry by placing arm in the looped tubing
12. Place back in car

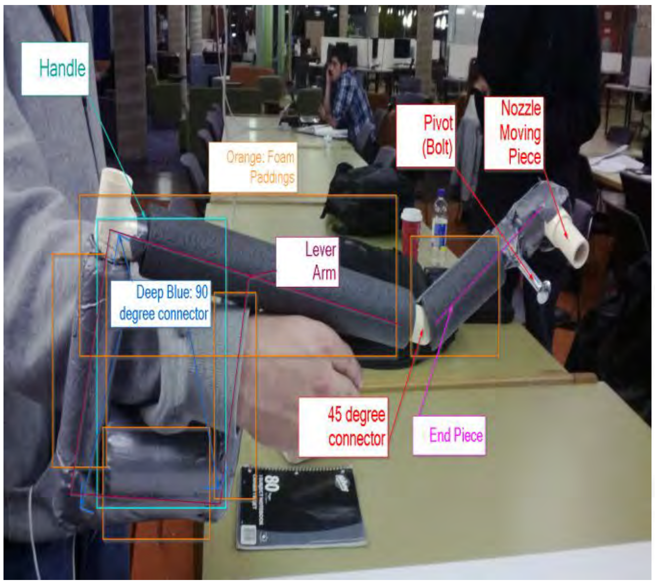
Benefits

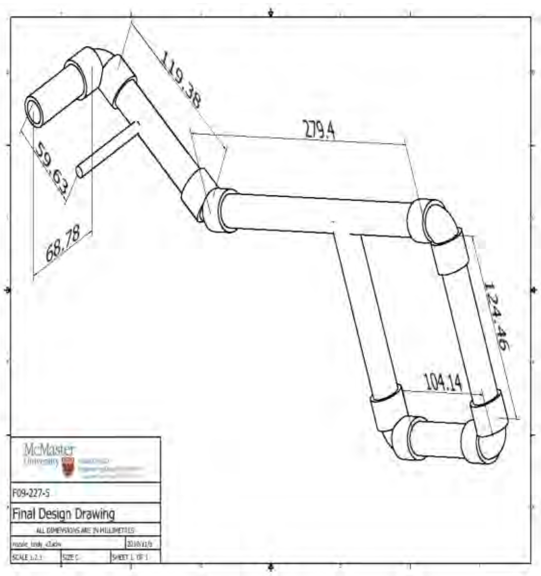
"The Airflow" is better than current solutions because it completely removes the stress away from the hands and allows the user to use gravity to their advantage. Using bodyweight to push down on the foot pump is much more efficient than using smaller parts of the body such as the hands, especially when the user suffers from rheumatoid arthritis. Moreover, it is better than other designs because no stress is put on the joints Sandi's hands, a huge priority. "The Airflow" is extremely light and easy to use, in addition to being compact. Additionally, it meets all constraints, as it does not break any safety regulations and it can be easily made by Sandi. The device does not act as a clamp, and will deflate upon a loss of force. The length of the tube is also adjustable. All of these features make the device very versatile, and the materials are also very durable to weather and temperature. Overall, "The Airflow" is a viable solution to Sandi's problem and also has an advantage over many of the pre-existing devices, in addition to the other devices developed for the purpose of helping Sandi.

Complete Versatile Pivot

3 – POINT ENGINEERING INC.

3-Point Engineering
F09 - 227 – 5





Problem Description

The clients Sandi Mugford and Dr. Fleisig requested a device to be built that would help someone that suffers from Rheumatoid Arthritis pump gas. Squeezing the trigger to pump the gas, the credit card transaction, and the interaction with the pump are all tasks that are challenging. As designers we must design a device(s) that Sandi can use at a gas station to keep her independence and reduce the pain she suffers while pumping gas.

Design

The device is approximately 0.5 ~ 1 kg in weight. The device consists of two major parts which will be the 280mm piece and the 120mm piece. The second piece is roughly as the same length as the user's forearm. The square ring shape is designed for the user to put her arm through. We expected the device to work just like a spherical shape lever. The distance between the two cylinders was designed to be put in and hook the trigger of the gas nozzle by the user. The device could then work when the user pushes down on the handle, causing the bottom end of the device to rotate up, lifting the gas trigger in the process

Functionality

The device completes all of the requested functions needed for a gas pumping device. The device can be easily stored while driving; can easily be moved from the vehicle to either the roof of the vehicle or the gas door of the vehicle which is where it will stay while the payment process is completed. Then the device is used to aid in the pumping of gas with very minimal force needed by pivoting on a bolt when the user moves their arm down.

Materials, Components, and Assembly

The materials that are needed to construct this assistive device are PVC pipe (3/4" inch), hex bolt (**G5 CT 3/8 X2**), metal foam and duck-tape. The overall cost of this device is $ 35.00 where it is relatively cheap. $25.00 is for the main components/materials such as PVC pipe and hex bolt (**G5 CT 3/8 X2**). The other $10.00 is for the duck-tape and the metal foam where it can be used multiple times for constructing this device. These materials can be obtained mostly in hardware store such as Canadian Tire, Home Depot, Home Hardware and any hardware store where it relatively easy to find. The tools that required for constructing this assistive device are scissors, drill, paper, pencil and ruler. It only takes around 30 minutes to get the product fully functioning as long as all the materials and the tools are ready to use. The instructions that might be needed if Sandi need to construct the device would include what components/ materials are needed, what tools are needed and diagrams and arrow to show step by step how to assemble this device (for the assembly instruction). Due to only few components and tools are being used to construct this device, is relatively easy/simple to construct and very self-explanatory. Therefore there is no need for special assembly instruction.

Use

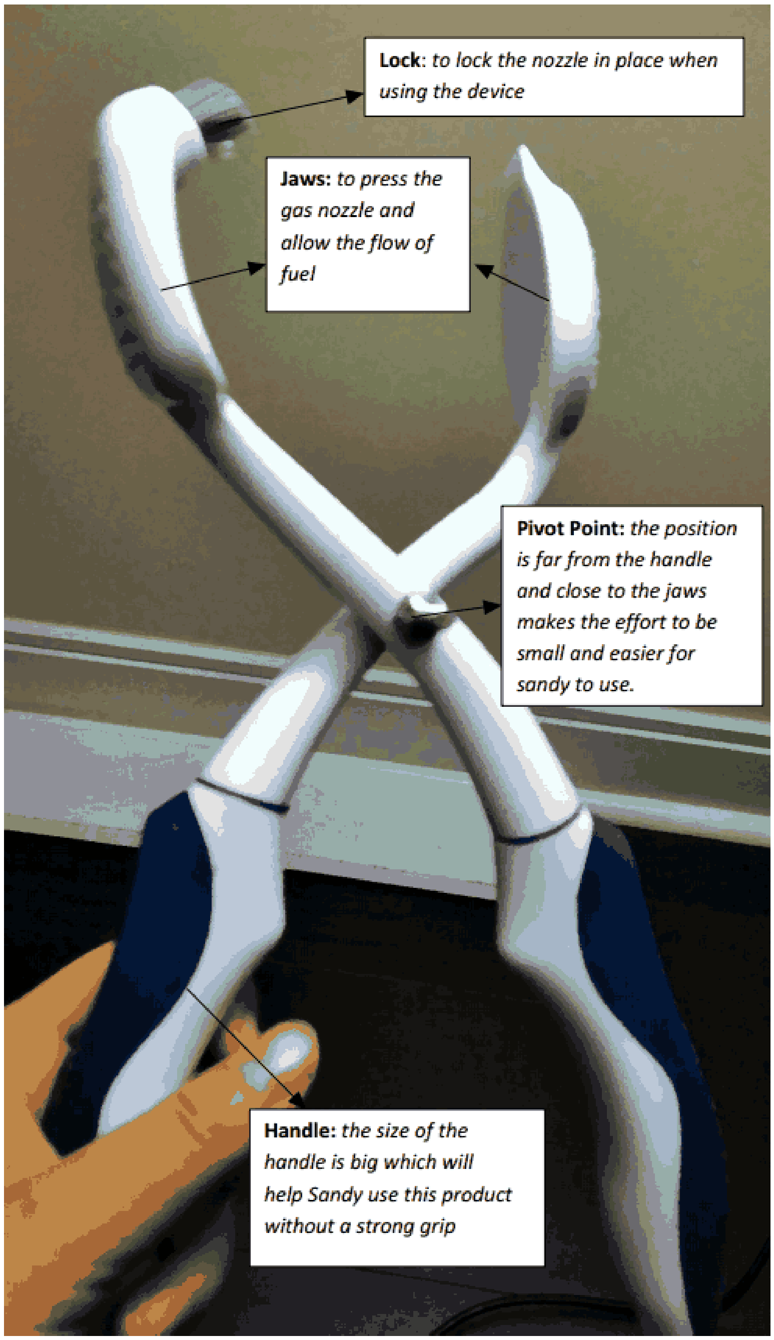
1. Once Sandi arrives at the gas station she would retrieve the device from her car. Since the device isn't very large it could be stored anywhere in her car and not be a nuisance during her day to day activities.
2. Sandi would then open her gas tank door and hang the device off of the gas tank while she prepares for the fuelling process. If she isn't comfortable with leaving it on the gas cap it could also be placed on her car since the outer casing is very soft and would not scratch her car.
3. Once the gas nozzle is in the car, Sandi would pick up the device and get ready to use it.
4. Sandi would slide her hand through the u shaped handle of the device resting the top of the shaft piece on the top of her arm and hand. If she wanted to she could grab the u shaped handle and guide it that way but this would require her to grip slightly.
5. Sandi would then guide the bottom of the device, the end with the screw and small cylindrical piece sticking out, underneath the gas handle on its left side. When in place the screw would be under the handle closer to Sandi than the other larger cylinder pipe piece.
6. Once in place, a downward force on the handle section would then pivot the end under the gas handle upwards. This would then let the gas flow out of the car.
7. Once the car is full, Sandi would take the device out and place it back on the gas tank door or on the car again while she puts the gas nozzle away and finishes up with the gas pump.
8. Once completely done, Sandi would grab the device and place it back into her spot of choice in the car. This concludes the gas pumping process.

Benefits

There are numerous benefits to this device but the most predominant one is that this lightweight device helps her maintain the upright position of the trigger needed to pump gas with little to no pain in her hands. This device is better than other solutions because it is easily transportable by Sandi and it is versatile, can switch from right handed to left handed use depending on the user. Another reason why this device is good is that it's practical, something that she can actually use day to day with little to no struggle.

E-Z Flow

Team Flare
F09-227-6



Problem Description

To design a device for the clients (Dr. Fleisig and Sandi Mugford) which will help Sandi (the user) to independently fuel her car. An ordinary task that is made difficult due to rheumatoid arthritis

Design

The final design uses the idea of a pair of scissors to aid Sandi in fueling her car. Two moveable jaws are placed around the gas nozzle and as Sandi presses the wide handles using both hands; the jaws close and press the trigger. This design uses minimal effort and converts it into a sufficient amount of force to press the nozzle. The final device is small and simple; thus is it is easy for Sandi to maneuver the device with simple motions. It is very light-weight and portable, thus adding no extra strain on the user. The device is constructed from 2 plastic brushes and basic tools, so it is very simple and straight-forward to construct. It is also very durable for its use and it is simple enough so that it could be easily re-assembled if it did break.

Functionality

EZ FLOW addresses the problem of actually fueling a car by simplifying the process of pressing the gas nozzle – a task that is very difficult for Sandi due to her deformed fingers and weak hands. The device allows the user to fuel her car without manually pulling on the trigger of the gas pump, a motion that causes her moderate pain. This device gives the user an easier and lighter motion to accomplish the same task.

Materials, Components, and Assembly

One of the most important benefits of this device is that it is cost-effective and simple to construct. The EZ FLOW could be assembled from a bathroom scrubber and some basic hardware. The plastic scrubbers could be purchased from the cleaning supplies section of any hardware store. Prior to assembly, any extra parts are removed from the scrubber so that all that remains is the hard plastic handles and the bristles at the end. These bristles will act as a locking mechanism. The two handles will be fixed together using a medium-sized metal screw, available at any hardware store. The plastic must be drilled through first and the screw placed in such a way that the handle still turn fairly easily. All of these supplies could be purchased from any hardware store. The two scrubbers cost around $5 each and the screw is less than $1, leading to a total cost under $11.

Use

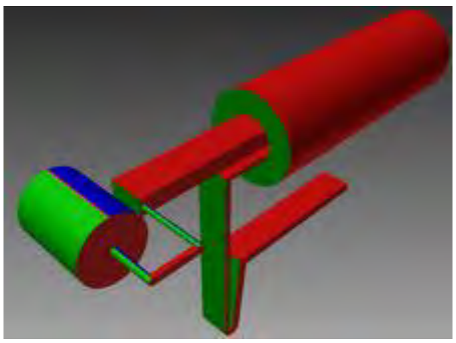
1. Grab device by handles.
2. Put device into gas pump handle so that one jaw of the device rests on the trigger and the other on the outside of the gas nozzle.
3. Squeeze the handles together thus pulling the gas pump trigger and allowing the gas to flow.
4. Store the small device in the trunk or backseat of the car or in a purse/carrying bag.

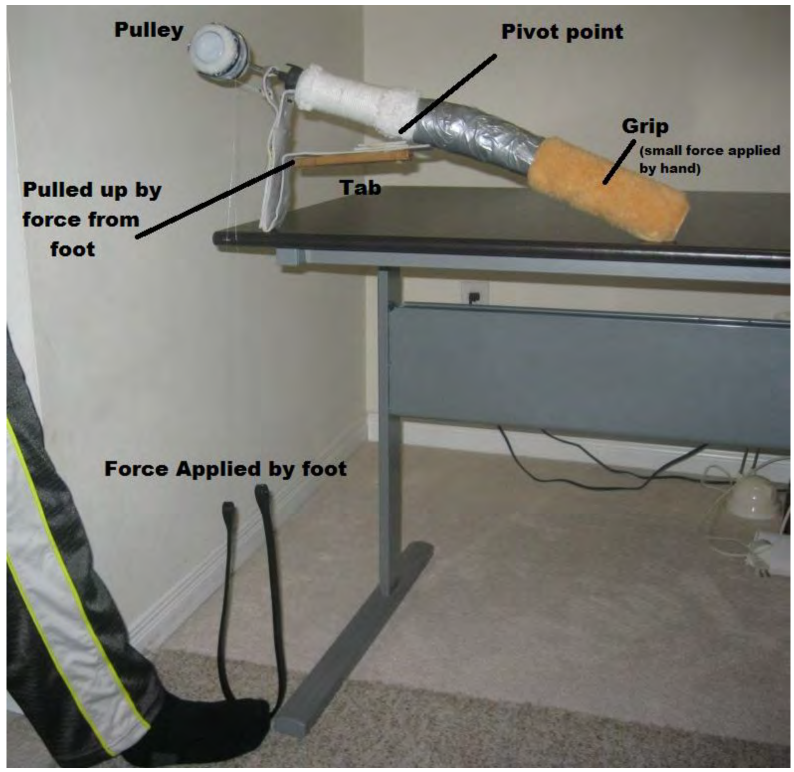
Benefits

EZ FLOW meets all of the requirements of the design project and aids the user with the task of fueling without adding any unnecessary complications. The motion of squeezing the device’s handles is much easier and less strenuous than actually pulling on the gas pump trigger. Furthermore, EZ FLOW is a very light-weight device and was designed with very light materials (plastic) is order to assure that it did not burden Sandi more than necessary during the actual fueling process. The product is also very small in size so that it could easily fit into most hand bags. These characteristics make EZ FLOW a very portable device that Sandi could carry with her wherever she needs. Secondly, the final product is a very simple mechanism that can be operated by anyone. The only task required from the user is to simply place the two jaws around the gas nozzle and then press the two large handles together. The simplicity of the device assures that the user will not struggle at all with the operation of the device, thus adding no extra strain on the already exhausted user. EZ FLOW is therefore a very good solution to Sandi’s problem since it meets all the objectives and constraints as well as efficiently aids the user with the task of fueling a car. In comparison to other products however, this product does not add any extra bulk or complication and is very easily maneuvered.

Newton's Pulley

The Fellowship
F 0 9 - 2 2 2 - 7





Problem Description

To help Sandi Mugford in the fuelling of her car at the gas station through the design of a simple, yet innovative device. The device will strive to aid her in the best manner possible while reducing the grip strength, energy, and pain required to complete the fuelling task. Along with main process that the device will achieve, the design will also aid Sandi in becoming more independent, and reduce the pain suffering at the gas station.

Design

The design will weigh approximately 3 pounds, with the dimensions of 60 cm in length, 4 cm in width and 6 cm in height (not including the stirrup part). It will be light enough to carry with one hand, but the size means that it is also very simple to hold with two hands, to have maximum control. The user will be able to fit the device in the backseat of a car or in the trunk, without taking up too much space.

Functionality

This device allows for a low-effort method of fuelling a car that focuses on removing stress on fine motor skills and grip strength. This will aid Sandi by enhancing her ability to grip the trigger with sufficient strength. It will be easy to hold, transport, and use, making it an enjoyable experience that reduces the common stress involved with fuelling a car with rheumatoid arthritis.

Materials, Components, and Assembly

The materials used for this device are very inexpensive and easy to acquire. The majority of the items can be easily acquired from any hardware store. The body of the device is created using a paint roller and two paint roller extensions. The stirrup is a strong stiff rubber band used in cars, and the wire used is fishing wire. All of these materials are easily purchased at a hardware store. Thermoplastic is used for the base of the device as well as the moving tab. There are no tools required for construction, although duct tape and super glue are needed to keep some parts together. With an idea of what to do, the total assembly time would be approximately 30 minutes. Various other items are used to make the design including pop cans and a wooden tab. The only tools necessary for the creation of the device are scissors, a stove and pan (to mould the thermoplastic), and a knife.

Use

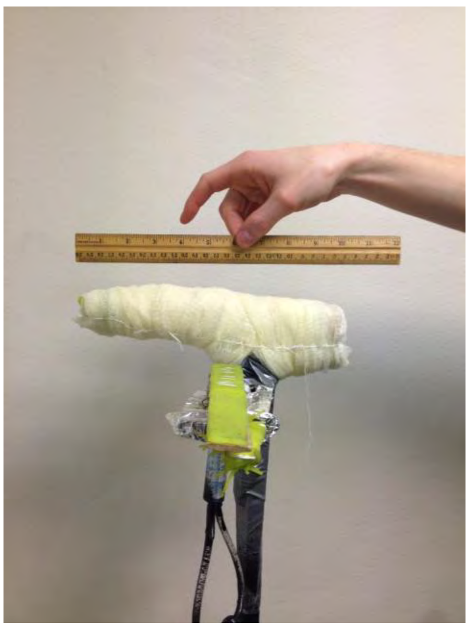
1. First the device will be taken out of storage in either the backseat or trunk of the car
2. After placing the device somewhere easily accessible outside the car, the gas nozzle will be inserted into the car
3. The device will then be placed on the gas nozzle, resting at the center point, with the lever tab underneath the trigger
4. The user will step on the stirrup, transferring force from the foot to the lever tab, which will begin the fuelling process.
5. Once the car is fully fuelled, the user steps off the stirrup, removes the device, and stores it away.

Benefits

The final design provides some important advantages that makes it better than competing products. First of all, the final design is extremely light. By prioritizing light materials in construction, the weight is kept down, something very important for Sandi’s rheumatoid arthritis. Also, the diameter of the top bar is large to fit Sandi’s hand. The final design is also small and easy to store, this being one of our objectives. It could easily be stored in the backseat of a car. An important advantage that the final design has is that it requires very low force from Sandi herself. The force required to pull the trigger of the gas nozzle is provided by the force of gravity on Sandi, rather than any force from her body itself. The final design is also advantageous because it is very inexpensive. By keeping the price low, the economic impact on Sandi using this device is reduced, and replacements (if necessary at all) would be inexpensive. In the winter, the cotton covered paint roll can keep Sandi’s hands warm and makes it comfortable to hold.

Odyssey

McMaster Mobility Engineering
F09-227-8



Problem Description
The client and user, Sandi Mugford, suffers from Rheumatoid Arthritis and seeks to fuel her vehicle with a greater degree of ease. Design a solution to reduce pain and exertion of energy while increasing mobility for Sandi as she fuels her car. The solution must not jam the fuel nozzle open, and must be produced by McMaster students.

Design
This design is built on a cane with a hydraulic system. The height of the device is approximately 1 metre, but the height is adjustable to meet the height of whichever car is being fueled. It also has a base, which would help the device stand by itself. There is also a shelving bracket attached to the upper part of the cane, and a hydraulic system is connected to both the base of the cane and the shelving bracket. The handle is wrapped with a luffa, which makes Sandi feel more comfortable when she handles the device.

Functionality
This device uses the hydraulic system to change the direction of force in order to help Sandi pump the gas into her car with as little pain as possible. The hydraulic system is connected along a cane, and there is a shelving bracket

connected to the cane to hold the gas nozzle. This shelving bracket also connects to the upper syringes in order to support the upper part of the hydraulic system. There is a platform connected to the end of the syringes, which would push up the lever on the gas nozzle and operate the gas. All parts of the device are connected along the cane, which makes the device easy and lightweight for Sandi to carry. Sandi only needs to step on the plastic bottle on the base to provide force into the hydraulic system to extend the upper syringes in order to operate the lever of the gas nozzle.

Materials, Components, and Assembly

The structure is built with a cane, a shelving bracket, dental floss, epoxy adhesive, isopropyl, nails and wood. With the wooden base, the device can stand on its own, and with the shelving bracket, it can hold the gas nozzle. The hydraulic system is built along the cane and base with a plastic bottle and syringes. Plastic tubing filled with isopropyl connects them.
On the top of the upper syringes, there is a platform made from thermoplastic, a wooden ruler, and part of a rubber silicone toy. There is also a luffa covering the handle of the cane.

Use

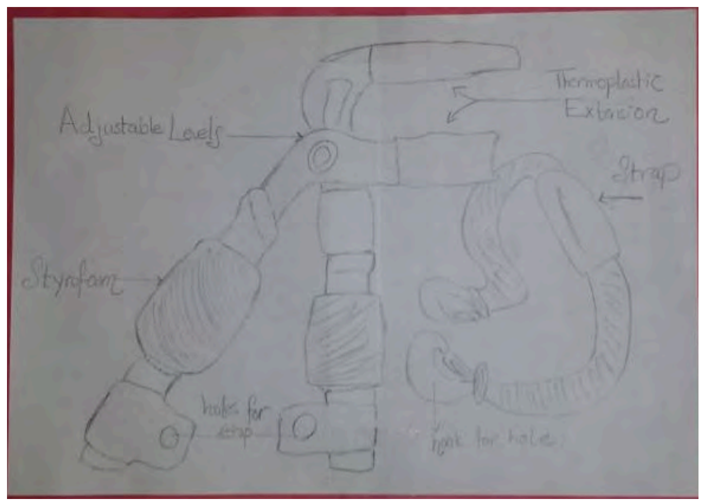
The device is easy for Sandi to use; all she needs to do is put the nozzle on the shelving bracket and step on the plastic bottle. When Sandi steps on the plastic bottle, there will be a force to push up the upper syringes, which are connected to the shelving bracket on the cane, and the lever of the nozzle would be operated. The cane can provide support for Sandi when she steps on the plastic bottle, which is connected to the base. The plastic bottle can provide enough force to push up the syringe when Sandi steps on it, and when Sandi takes her foot off the bottle, the lever on the nozzle would provide enough force to push the syringes back down. Sandi will always have full control of the system.

Benefits

Our device has similar objectives with many other devices and products from peers, which is to reduce Sandi's pain and save more energy. However, our device is also unique because there is no current product with a hydraulic system like our device existing in any of today's markets. We all think that the hydraulic pump system for pumping gas is one of a kind and a great solution to solving Sandi's gas pumping assistance. Plenty of existing products use handles with comfortable shapes, allowing Sandi to hold the gas pump more easily. However, Sandi still needs to provide force from her hands or arm, which would cause much pain since she is using her small joints. Our design frees Sandi's hands from exerting such force.

The Claw

Team Name
F 1 0 - 1 2 4 - 1



Problem Description

To satisfy Dr. Fleisig's request in finding a solution for Sandi's difficulties pertaining to her arthritis disease problem at the gas station. She faces challenges when inserting the credit card, hitting the key pad, and carrying, squeezing the nozzle gun. The objective is to make a design that can make Sandi's task less time consuming, more comfortable, reduces her range of motion, and allows her to work independently.

Design

The claw is a relatively large and heavy device. However, 3BY2 solved this problem through the strap mechanism attached to the claw. The size is not a significant issue, as the claw can fit in the glove box of any regular sized sedan, the passenger seat of a car, or inside the trunk where her credit card is also found.

Functionality

The Claw achieves the gas nozzle objective in an extremely simplistic manner. The claw solves all of Sandi's issues pertaining to squeezing the gas nozzle (pressure on her joints, inability to grip the trigger). The strap attached to the device transfers its weight to the user's shoulders instead of her hands, thus making if more comfortable to carry around.

Materials, Components, and Assembly

The device's main component, which is a power tool, is the VERSA-grip purchased at home depot for $19.99.

Due to its scissors-shaped structure, the grip could be modified using various materials to suit this project's needs. For instance, thermoplastic was attached to the clamp section of the device so that it would be able to wrap around the gas trigger and squeeze it. Since it was already purchased at the McMaster Underground Shop for the 1PO3 tutorial, it was considered free.

Cotton balls and Styrofoam were wrapped around the handles of the device so that Sandi does not need to bend her fingers extensively when holding the device. These materials can be purchased at a local dollar store for $1.00.

A strap was attached to the device by molding the thermoplastic into a ring-shape that would act as a connecting tool. The strap has two hooks that attach to the two thermoplastic rings on the device. The strap was taken from a laptop case that was free from Staples.

The building of the Claw took a total of approximately 3 hours. Instructions may be needed to show how to hold the device, secure it around the gas nozzle and moving the two handles towards each other to squeeze the gas trigger. In addition, instructions may also be needed to show where the thermoplastic rings should be attached on the device.

Use

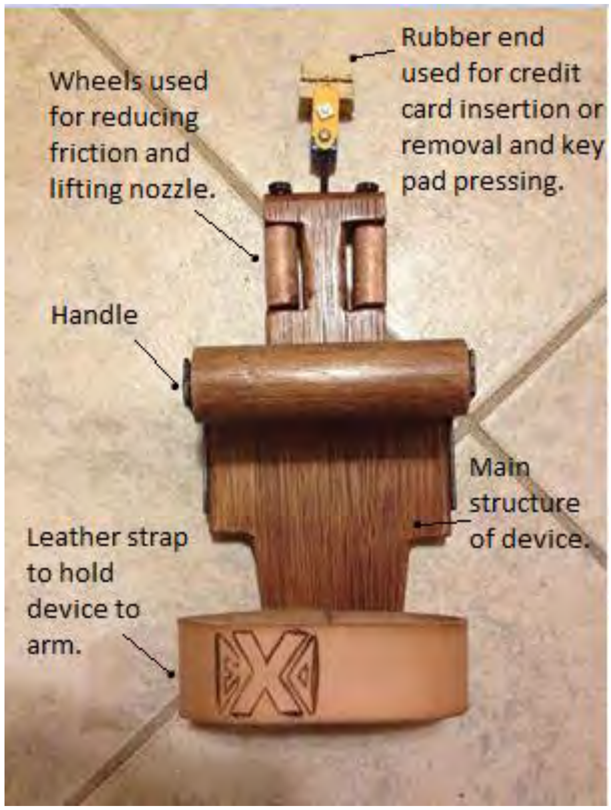
1. Pull the strap up and wrap it around the shoulder of the user. The device can remain wrapped around the user's shoulders while inserting the credit card into the slot and using the keypad.
2. Grip the handles of the device and clamp the device onto the gas nozzle from the outside, where the top of the clamp wraps around the trigger and the handles are located above the gas nozzle.
3. Using a scissoring motion, the user pushes the handles towards each other, squeezing the gas nozzle trigger.
4. Once the gas nozzle has pumped all the gas into the car, the user stops applying a force on the two handles, thus releasing the trigger
5. The device is detached from the gas nozzle and the strap takes on the weight again
6. The user can now take the strap off his/her shoulder and put it back into the car (can be fitted into the glove compartment or the passenger seat of the car).

Benefits

The clamp is a superior design against all other works presented by other teams because of its simplicity yet effectiveness in achieving the gas nozzle. When the device was tested at the gas station, it was found that the force applied at the two handles was very minimal, thus allowing comfort and ease of use. Due to its simplicity as a single object, it is easy to understand how to use the device. The device is also very durable and safe, the strap prevents the object from falling and breaking. Furthermore, the device does not violate the regulations and laws set against locking the gas nozzle.

Exo- One

F 10 - 124 -2



Problem Description

The objective was to help the clients, Ms. Sandi Mugford and Dr. Fleisig, achieve an improved quality of life; maintain her independence and reduce pain at the gas station using a functional device that addresses all three problems including pumping gas, inserting and removing the card and entering the pin.

Design

Exo-one is a very light weight wooden device which assists the user with fulfilling all tasks involved at the gas station. It is placed in the hand and extend to the arm in order to achieve full rotation and control. It is small, functional, practical and has an aesthetically pleasing design.

Functionality

The three functions included in the design are pumping gas, pressing buttons on the keypad and removing the credit card from the credit card slot. The user can slide their hand through the leather strap and into the device, holding the provided handle. To pump gas, the device is rotated while in the gas nozzle to lift the lever and initiate fuel release. Wheels that reduce friction are placed on the side and facilitate the rotating motion. The rubber cube at the end is shaped to allow button pressing while entering the information in the keypad. The rubber cube has a slit with a wedge which makes it easier for the user to grab or remove the credit card out of the device with minimal difficulty.

Materials, Components, and Assembly

A wooden plank is used for the main structure of the device. Using a saw, the excess portions of the plank are removed to give the device its form after measurements are taken. Using a coping saw the sides of the device are cut to give room for the wheels on the sides. Looking from the tip of the device, two holes are drilled on each end. Initially, a smaller hole, followed by a bigger hole. The two holes are for the hex tap bolts that will hold the wheels giving the tap enough space to be inserted in the wood while the thread can be screwed into the wood. Two T-shaped plates are cut into an L-shape while removing excess width. Holes are also drilled into the end of the plates. Both the wooden plank and the metallic plates are sanded to prevent chipping or rough edges. A thinner dowel is used to build the wheels on the sides and a thicker dowel to act as a handle. Once the dowels are cut to specific measurements, holes are drilled into the ends of the dowels making sure the holes are centered. The dowels are then sanded as well. Once everything had a smooth finish, the wooden portions were stained with a stain and polyurethane mix while the metallic plates were painted using spray paint. From a large piece of leather, a rectangle is cut out to create the leather strap. The strap is cut, sanded, the logo burned into it, oiled using mink oil followed by natural coconut oil and then stapled onto the device with pins and a nail. The rubber cube is cut out from a rubber cork and the dimensions of the slit are measured through trial and error and made visible using a black marker. Once the other parts have dried, screws are used to attach the side plates to the wooden device. The hex screws are inserted through the end of the device, through the smaller dowels and screwed into the wood providing the device with the wheels on the sides. The thicker dowel, is attached using screws on each side that pass through the end of the metallic plates. The rubber cube is attached by drilling a hole in between the two hex bolts and screwing in a long screw. This screw has a C shaped metallic bracket with two long yellow painted metallic plates assembled onto it. The plates are squeezed together using a small bolt and nut to squeeze the rubber cube into position. The rubber cube becomes stationary with the device. The device has a total costs of about 20$ depending on the price at the hardware store.

Use

1. The Exo-One is worn over the hand during the process of fueling the vehicle.
2. Insert the card in the rubber cube at the end of the device.
3. Insert the card using the device into the machine.
4. The device is removed by bending it down which causes the card to slide out but remain in the machine.
5. The device is now used to press the buttons on the keypad.
6. The card can be removed by pressing the rubber end over the card and pulling.
7. The device is inserted horizontally into the space between the handle and the gas nozzle and rotated so that the device is held vertically initializing fueling.
8. After fuelling to the desired amount, the device is rotated horizontally so that the handle is released.
9. The device can be stored in the trunk of the vehicle to prevent sun exposure and ease access when it is needed.

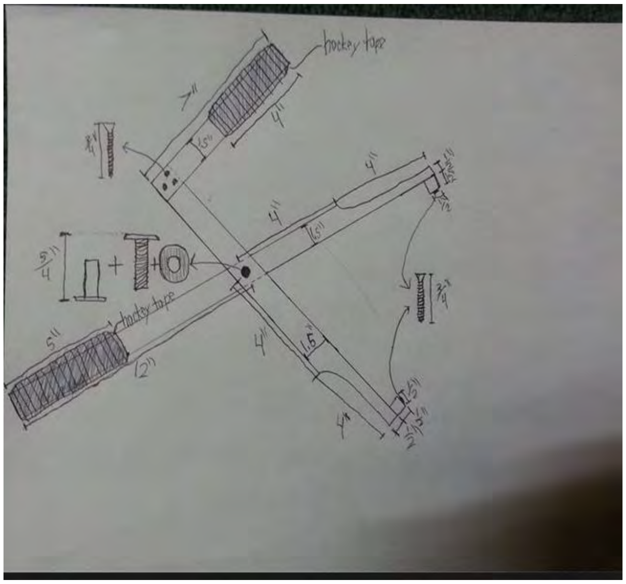
Benefits

The device reduces the stress applied to the joints since the device is light and doesn’t require much energy for any of the capable functions. Moreover the device follows the codes and standards at the gas station as stated by the law, since the device will slip out and stop fueling if the user leaves it unattended. It has been designed to fit the nozzle of any gas station without damaging them or the device itself. In addition it is weather resistant to heat, water, cold temperature and ice. It is also easy to use since the form makes the use of the device self explanatory. The device being small and light, can be stored anywhere in the vehicle without being in the way or causing a discomfort.

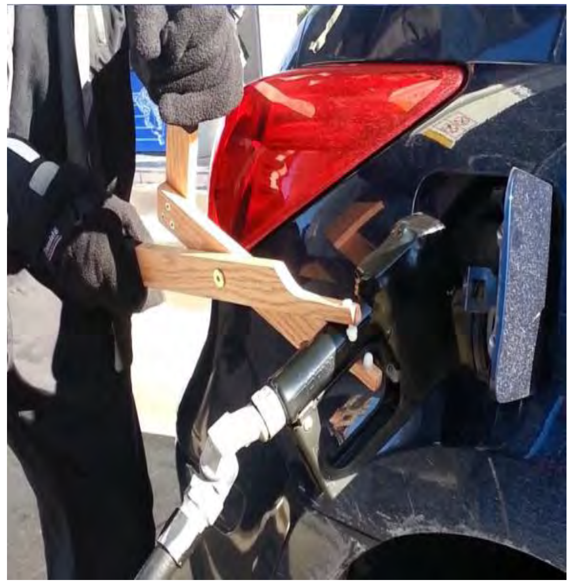
Jaws

Innovation Technology

10-124-03



-A sketch of the final design, with dimensional values



- The final design being implemented To hold down the lever of a pump

Problem Description

To create a device which attenuates the user's dependence on the phalanges and, more generally, reducing fine motor movement while performing the act of pumping gas at a station.

The device is to redirect forces from smaller, lighter bone and joint structures towards larger, more inertial structures. The device will aid the user in compressing the lever of a gas pump for the duration of the pumping process. The device is to be portable and lightweight, with an obvious implementation procedure. It should be able to be constructed inexpensively, and must be made to comply with safety standards and regulations.

Design

The device was constructed out of lightweight, weather coated pine. Its unique shape allows for the whole arm to be utilized in a flexion / extension motion which significantly reduces the strain on the user. The large comfortable grips on the handles reduce fine motor movements in the hands and fingers and redirect these forces to the broader shoulder joint and bicep. The inserted, clamping end is fitted with plastic studs which prevent the device from slipping out of position while in use. The device's dimensions were optimized to minimize the required force from the user and to keep the device as lightweight as possible.

Functionality

The device does not require any supporting structures or straps – is it completely portable. Its light weight, easily operable design makes it a suitable device for varying severities of rheumatoid arthritis. The device is easily compatible with any gas pump, requiring only a few centimetres (about 2) of clearance below the lever of the gas pump to function. It is invariant from season to season; functional whether winter gloves or thick jackets may be worn.

The device allows the user to perform the operation of pumping gas with very little effort and is suitable for long term use, even as the severity of R.A increases. By reducing the physical and mental stresses on the body, and promoting continuous, preventative, long term assistance, the user reaches a new level of independence. The device fulfills all the requirements of the user.

Materials, Components, and Assembly

The cost of the device is less than 20 dollars.

The device was built with a 2 * ½ * 6 piece of piece of pine, a steel washer, 3 screws, a nut and bolt, 2 plastic drywall studs and a roll of hockey tape. The construction required a hacksaw, hand drill and sand paper. The wood was treated twice with weather coating prior to the addition of tape (handles).

All materials and building equipment can be rented or bought from home depot. Construction of the device, with materials present, takes less than two hours. Assemblers should note that the design has already been optimized for performance and that the dimensions should not be differed too greatly. Otherwise, no special assembly guidelines or instructions are needed.

Use

1) Arrive at gas pump, and open the trunk of your car
2) Complete payment and initialization process and prepare the gas nozzle for pumping. Insert the gas nozzle into your car
3) Remove the device from your trunk and approach the pump handle from the side.
4) Place the (lower tong) of the device below the gas lever and the (upper tong) above the upper handle guard and pull back on upper arm of device (in an extension motion) down towards the lower lever arm and your body
5) Maintain the downright position until gas is fully pumped
6) Allow upper arm to retract back to its original position, tilt the device so as to not let the plastic studs interfere with the removal process, and remove the tong end of the device from the pump nozzle
7) Place the device back into the trunk of your car and return to the pump station to finalize the pumping process.

Benefits

This device eliminates the pain and discomfort caused by the method currently being employed by the client while at the gas station. It largely reduces the force required to depress the trigger, and relocates the motion from the user's hands to their arms, making the task easier to perform.

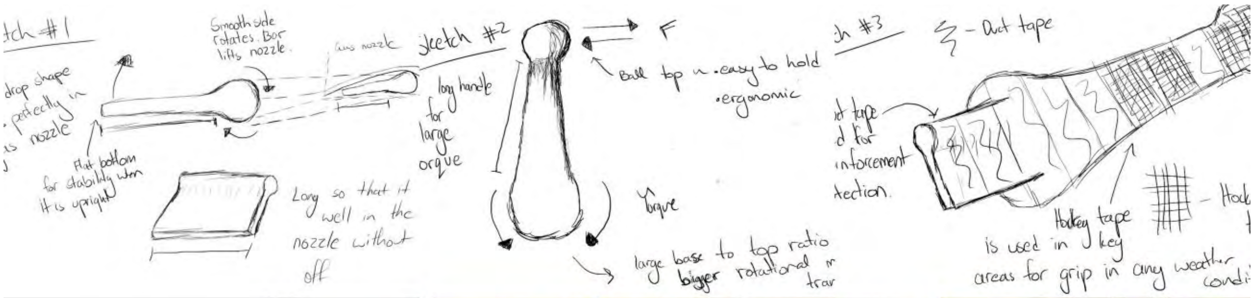
This device is lightweight and portable. It is simplistic and has very few components. It is made of minimal and simple materials and is inexpensive. The device performs the desired task with minimal effort, cost, and complexity. It is very easy to build and can be built by anyone who is able to use power tools.

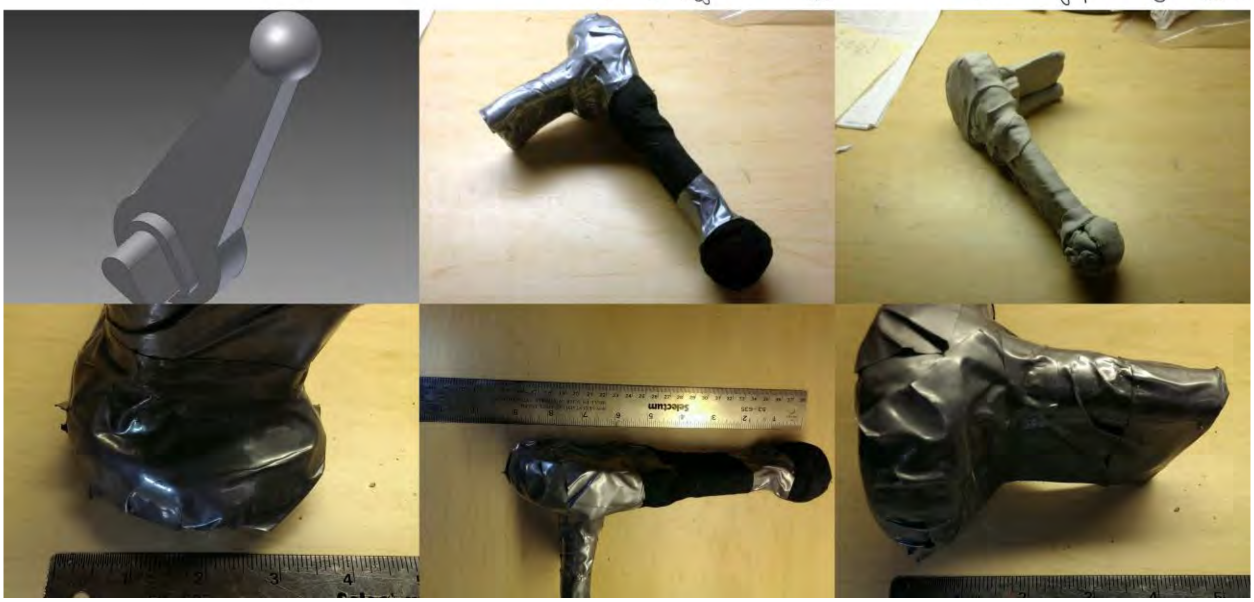
The main difference between this device and others is the versatility of this device. Our device will not undergo mechanical failure; will maintain its usefulness in any weather condition; will not easily break or deteriorate; and is a very simple solution to our given problem. There will be no issues with compatibility at the pumps, as it is designed to be applicable to any pump available.

Although perhaps more bulbous and less aesthetically pleasing than other devices, the device presented more than makes up for it in practicality and function. It is an extremely simple solution, and simplicity often has a way of emerging on top.

G-Shift

Mobilis
F10-124-4





Problem Description

Sandi Mugford suffers from rheumatoid arthritis, which makes the process of filling her car up with gasoline challenging and painful. The client seeks an effective solution to her problem that will make this process easier and more time efficient. By helping her decrease the amount of time, energy and pain when completing this process, her independence can be maintained.

Design

The device resembles a gear shift of a car. There are three important sections: the teardrop clip that rotates to lift the trigger, the long arm that provides the rotational torque and the spherical handle that allows Sandi to hold and use the device with ease. The device weighs roughly around 1.2 pounds. It is approximately 9 by 31/2 by 4 inches which is a great size that fulfills Sandi's requirements.

Functionality

The *G-Shift* was designed with the intention of specifically making the task of using the gas nozzle less painful, more time efficient and easy to use. To use the device the teardrop profile is guided into the gas nozzle. A forward force is applied on the spherical handle of the lever that triggers the teardrop to rotate, causing the gas nozzle to lift up, thus releasing gasoline. To accompany the *G-Shift,* Sandi can wear a pouch that was created to hold the device when she is not using it. The device addresses everything with regards to problem statement and gives Sandy independence at the gas pump.

Materials, Components, and Assembly

The device requires the primary material, thermoplastic and duct tape and hockey tape for exterior reinforcement. The pouch/carrying device was assembled using a t-shirt, staples and glue. In total, the cost of production is approximately $22.50 to buy the materials. When constructing the device, the only tools required are one's hands and a pair of tongs to manipulate the thermoplastic. A pot of boiling water is also required to soften it. The device can be assembled in approximately an hour and a half with a fresh piece of thermoplastic and the accompanying pouch can be assembled in less than half an hour. No special expertise is needed to construct the device. It can be built very easily by simply observing the sketches and images provided.

Use

1. The device will be stored in the carrying pouch when getting out of the car.
2. Once the user has placed the nozzle in the car, the user can put the *G-Shift* under the trigger of the nozzle. The device will fit in the nozzle from the right side with the spherical handle face up and the teardrop clip slides through.
3. To lift the trigger, the user must push the device towards the car by apply a horizontal force on the spherical handle. The device does not have to be pushed very far to lift the trigger.
4. The user must hold the device in place until the gas-filling process is completed. Once it is completed, the user can just remove the device and slide it back into their pouch.

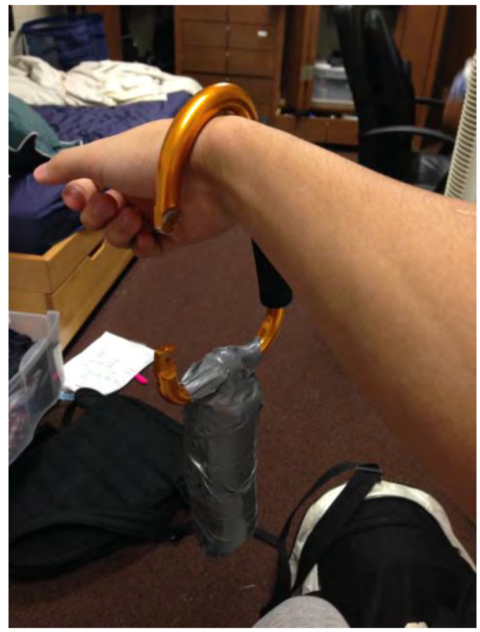
Benefits

The *G-Shift* has been designed with a great deal of thought and care so that it functions easily and has a multitude of benefits. The device makes Sandi's life easier by being lightweight, effortless, safe, portable, durable and easily repairable. The device is entirely molded in non-flammable, non-conductive thermoplastic material making it very light and safe. Building with thermoplastic also means that the device can be easily repaired by applying boiling water to a damaged area. The device has also been designed in such a way that it requires little to not force to lift the gas trigger. It is portable because it is simple and small. Thus, the *G-Shif*t would be an excellent, functional solution for Sandi.

Gas-sistor

Team 5: Premier Innovations
F10-124-5

Height: 36.5cm
Width: 12cm (at widest point)
Thickness: 5cm (at thickest point)



Problem Description

Develop a product that will assist Sandi in effectively fuelling a motor vehicle. It should increase the comfort for this action as well as decrease the time spent at the gas station. Successfully completing this objective will increase Sandi's independence, allowing her to attain a life similar to those without her disability. The design should also satisfy the requirements of the client, Dr. Fleisig.

Design

The product contains a lightweight design which provides stress-free use on a daily basis. It has dimensions of 36.5x12x5cm allowing Sandi to effortlessly transport the product in and out of her vehicle. The product is relatively thin but still provides Sandi with a thick enough handle bar to easily grasp.

Materials, Components, and Assembly

The design has three major parts; a hook, a rope, and a foam pipe (handle). The hook allows the device to latch onto the gas pump while the rope is utilized to connect the handle to the hook. The handle simply provides Sandi with a comfortable alternative to the gas pump. The hook, originally a clamp, cost roughly $7.99. The string is approximately $3.99 while the foam pipe is $0.79. In order to hold the parts together, duct tape was used ($2.99) which is cost efficient when compared to most adhesives. All of these materials can be purchased at Canadian Tire and most hardware stores. The construction of the product is far from time-consuming and does not require any special instruction to assemble.

Functionality

The product is able to relieve Sandi during the refueling process by replacing the need for her to squeeze the gas nozzle. The alternative method is to pull up using her elbows and shoulders reducing biomechanical stress and the risk of perturbation. The functionality of the design lies in the ability to fuel a vehicle while simultaneously providing an ergonomically sound product that is light, portable and pain relieving.

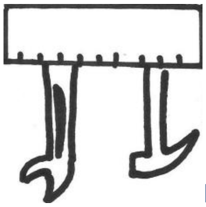
Benefits

This design is better than competitors because it is light weight and inexpensive. It’s easy use and accessibility provides those similar to Sandi with a simple solution. Compared to existing designs on the market, it does not create a Deadman's Lock increasing the product’s efficiency. It is an inexpensive solution that is friendlier to lower socioeconomic demographics. It effectively reduces Sandi's pain at the gas station and solves the everyday task of refueling, which lasts the longest and causes the most pain.

Use

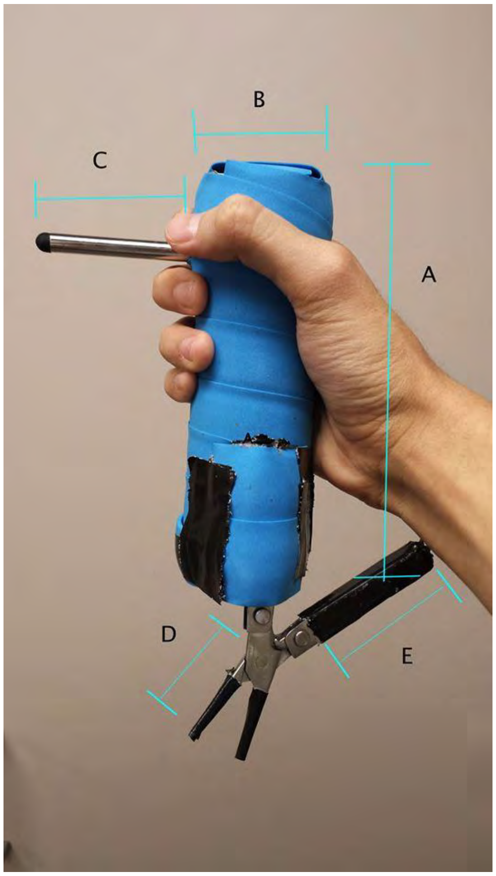
First the user will hook the device under the squeezing handle of the gas nozzle. She will then put the nozzle in the car and place her hand on top of the nozzle. From there, she can then bend her arm at the elbow and slightly raise her shoulder. The force generated from this action is enough to pump the gas. It is advisable for the user to have the hook assembled at the far end of the squeezing handle. This allows for a sufficient amount of torque to successfully pump the gas. When the product is not in use, Sandi can easily hook the device to her arm or place it under her arms. Due to its minimal size and weight, Sandi is able to store the product in her trunk or even in her purse.

The "Arthri-Tool"



Pinch Innovations

Team Name
F 10 - 124 - 6



Specifications
Dimensions
A- 15.5 cm
B- 5 cm
C- 6 cm
D- 4 cm
E- 5.5 cm
Mass
214.8 grams

Problem Description

The client, Sandi Mugford had initially addressed the issues that she faces when pumping gasoline into her vehicle at the gas station. Two of these issues were her limited ability in being able to insert and remove her credit card from the card slot on the machine, and her inability to accurately press desired keys on the keypad when paying at the gas pump. The primary objective is to assist Sandi Mugford in overcoming these issues and ultimately support Sandi in maintaining her independence despite her physical limitations.

Design

The final design of the prototype was a handheld, lightweight personal mobility device that satisfied the function of assisting Sandi in her physical limitations when paying for gas at the gas station. The specific functions that the device satisfies are assisting Sandi in pressing desired keys when using the keypad as well as assisting in the removal and insertion of credit cards into and out of the payment machines. The materials used in the construction of the prototype were 1 foot of PVC piping, a mobile touch screen device stylus, a 6 foot roll of bicycle handlebar foam tape, mini pliers, multipurpose duct tape and glue.

Functionality

The Arthri-Tool satisfies two major functions. It can be used to assist Sandi in pressing the desired keys on the payment keypad without the need for her to use her fingers. This will assist her in reducing the stress on her joints. The second function that the device satisfies is removal and insertion of the credit card. The mechanism of the device used for grabbing the card reduces the need for the user to perform any pinching movements. Sandi had previously mentioned that she had difficulty in acute hand motions involving her fingers, this device ultimately replaces the need for her to perform any uncomfortable motions.

Materials, Components, and Assembly

The primary materials used in constructing the device were 1 foot of PVC piping, a mobile phone stylus, a 6 foot roll of bicycle handlebar tape, mini pliers, duct tape and glue. Overall the total cost of materials accounted to just under 20 dollars. The PVC piping and the bicycle handle bar tape each cost 5 dollars. The roll of duct tape and the mini pliers cost approximately 3 dollars each. Finally the stylus cost 2 dollars. The piping and duct tape were purchased from Home Hardware, the stylus and mini pliers were purchased from the dollar store and finally the bicycle handle bar tape was purchased from a sports equipment store. The tools required for construction are safety scissors, a hot glue gun, a measuring tape, and a drill. Construction of the device will take approximately 1 hour.

Some important instructions to follow while constructing the device would be to strictly follow the measurements as the attachments to the device are strategically placed for ergonomic purposed. The stylus must be protruding 3cm from the top to ensure that the stylus is above the user's knuckles. Also, the mini pliers should be attached directly to the side of the handle so that user is able to grip the device comfortably.

Use

To use the device to operate the keypad the user must
1. Grasp the handle firmly, as if holding a water bottle
2. Pushes forward with the stylus resting on top of the user's knuckle, to press desired keys

To use the device to grab the credit card the user must
1. Hold the device in a horizontal position, as if shaking somebody's hand
2. Press down on the 'mini pliers' attachment handle with palm
3. The pliers clamp down on the card
4. The user can now direct where to release the card
5. The user releases pressure from the handle to release the credit card

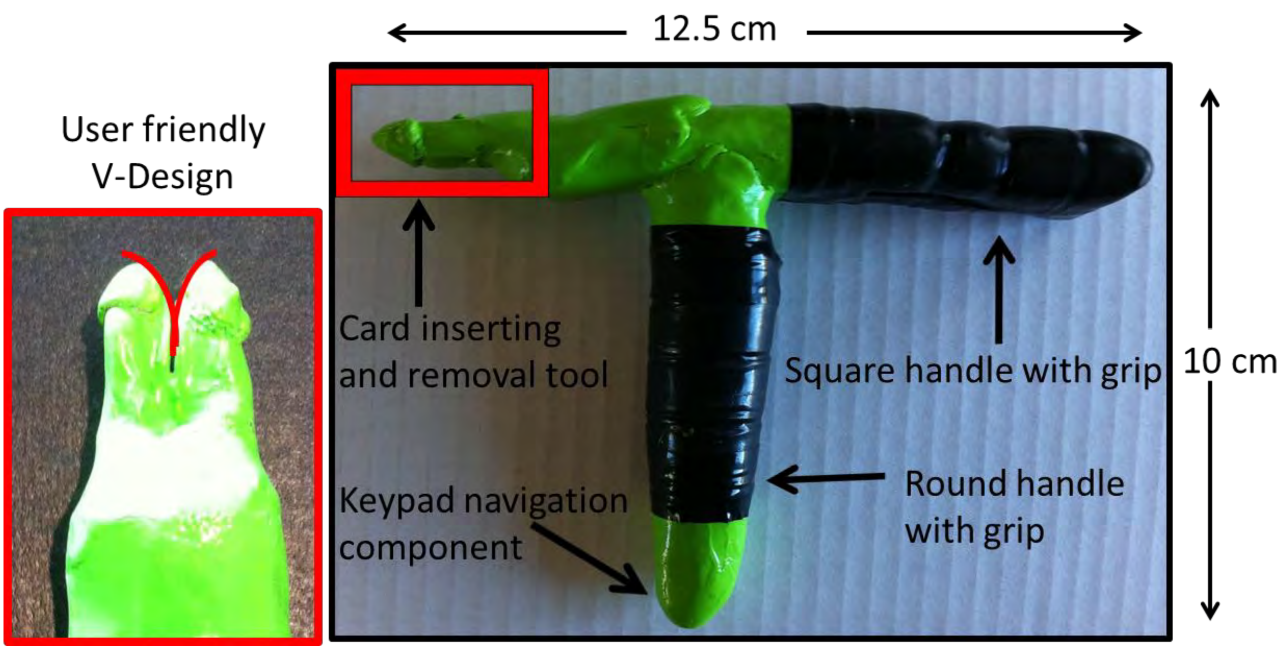
When it comes to storage, the size of the device is relatively small and can easily be kept in Sandi's purse.

Benefits

This design not only benefits Sandi, but is very universal and can be used by anybody with limited physical ability. The device combines a multitude of functionality in one device thus replacing the need to carry multiple devices that only serve one purpose. The device has been made from durable, lightweight materials while maintaining a high level of ergonomic comfort for the user. The cost of producing the device is very low, construction of the device amounted to just under 20 dollars. The device is user friendly, very little instruction is required to operate it. Finally, our device is aesthetically pleasing. Overall Sandi, as well as any user of 'The Arthri-tool' will no longer feel limited when paying for gas.

Solo Rod

Solo Innovations
F 10-124-07



Problem Description

Improve Sandi Mugford's independence at the gas station which has been affected by rheumatoid arthritis and osteoporosis. We have chosen to address the problem of credit card insertion and removal, as well as the problem of keypad navigation.

Design

The device takes a T-shape design with a square handle on one end and a round handle on the other, both are painted black. There is a card insertion and removal end opposite of the square handle which is coloured green. At the bottom of the round handle is the keypad navigation tool which is also coloured green. The device weighs approximately 0.3 pounds, about the same weight as a cellphone. The device has a length of 12.5 cm on one side, and it is 10cm on the other which is comparable to a length of a pen. The device has a consistent width/circumference of 4 inches around the handles comparable to a cane. The device gradually decreases in circumference to 1 inch as it approaches the keypad navigation end similar in size to a large human finger.

Functionality

The device can assist the user with inserting and removing their credit card from the gas pump. The device also assists the user when using keypads as it replaces the finger. Since a credit card can be used outside of a gas station, so can the Solo Rod. This device covers every aspect that the client wanted for resolving the problem of the credit card insertion/removal as well as the problem with keypad navigation.

Materials, Components, and Assembly

The device is composed entirely of thermoplastic, and is the layered with paint and electrical tape for visuals. The costs of the materials were approximately $10 for thermoplastic, and $1 each for the green paint, black paint, and electrical tape. Therefore the total cost of building the Solo Rod equals approximately $13. Thermoplastic can be bought from online retailers, while the paint and electrical tape can be purchased from a dollar store. The tools required for construction are, scissors, paintbrush, and a heat source to mold thermoplastic (heat gun/ hot water). To build the device it will take approximately 30 minutes. An instruction that might be needed would be to construct the device all as a hollow shell (reduces weight) and to use a credit card to mold the card insertion/removal end. No special instructions are required for construction.

Use

Card Insertion and Removal

1. Remove device from glove box/stored area and insert into pocket.
2. Remove device from pocket and insert the credit card into the card receiver on the device while gripping round handle.
3. Raise the device with credit card inserted up to the card acceptor on the gas pump and insert the credit card using the device (push motion).
4. Remove device from credit card after it has been inserted by pulling away from machine.
5. To remove credit card, insert device over credit card and press against credit card to secure it.
6. Slide the credit card out of the machine by pulling the device away from the machine.
7. Remove credit card from device.
8. Place device in designated storage area (glove box).

Keypad Navigation

1. Remove device from glove box/storage area and insert into pocket.
2. Remove device from pocket and grip device by square handle when ready to use keypad/touchscreen.
3. Press navigation tool end (pointer) against the buttons/touchscreen to select options.
4. After using keypad, insert device back into pocket, then place in designated storage area.

Benefits

The Solo Rod is the simplest, easiest, and most efficient multi-functional device. The device is lightweight, durable, comfortable, and easy to use. It can be easily customized to the client since it is composed of a mouldable material (thermoplastic). Its simple design allows for the client to easily use the device effectively without prior knowledge or extensive training/practice. The device is painted to signify key components of the device. The paint also serves another purpose of assisting with visuals when it is dark outside as the green paint will show up better in the dark. Operating the device requires little strength and no fine motor skills. Designs that made the device more user-friendly were added, such as; a more accepting card removal end (V-design) this allows for the client to easily slide the card into the device. Another design added to was ergonomic-oversized grips. These grips work well for the client since they allow for little joint movement and allow for use on days even when functions of the hand are restricted. The device is pain –free to use since it does not require many joint movements or strength like other devices. The device benefits the client even after leaving the gas station as it can be used whenever a credit card would be used (grocery store, ATM). The materials that the device was composed of do not carry the odor of gasoline, leaving the smell of the gas station at the gas station. Since the device is compact it allows for it to be easily stored in the vehicle, or with the client in her purse/pocket when not at the gas station. Since the device requires no mechanical parts, it is very reliable and will work just as well as it does in 10 years as it does today. Other devices only focus on one problem and rarely work effectively in solving that problem. Usually if they do solve the problem, the devices still cause pain, discomfort, and require much more effort than what Sandi was required to do previously. In conclusion the Solo Rod is the simplest multi-functional device which can be used outside of a gas station that works effectively and efficiently for both problems addressed with little effort, and no pain for the user.

Petro-Strap

Pure Design
F10 - 124 - 8

Problem Description
To assist Sandi by reducing pain and conserving her energy to increase her independence when fuelling gas into the car.

Design
The design, “Petrol Strap” should be approximately 200 grams to 300 grams. It is fairly portable and allows Sandi and all of its users to store or place it in a pocket or a purse.

Functionality
The device is able to help Sandi to lift the trigger of the gas nozzle without having to hold onto it. The hook of the device will hook onto the trigger, and all Sandi has to do is to pull the strap upward. It solves the problem of holding onto the gas nozzle, but not those with inserting credit card or pressing onto the keypad.

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Materials, Components, and Assembly

The materials used in the final device were a sturdy, thick, orange strap, and a black metal hook. Both can be obtained from various hardware or craft stores. The cost of the hook was $0.95 and the cost of the strap was $1.00. The tools required for the construction of the device are a ruler and a pair of scissors to measure and cut the appropriate length of the strap. Building this device can take 5-10 minutes. Assembling the device requires little instruction as it entails tying simple knots to connect the parts obtained from the store.

Use

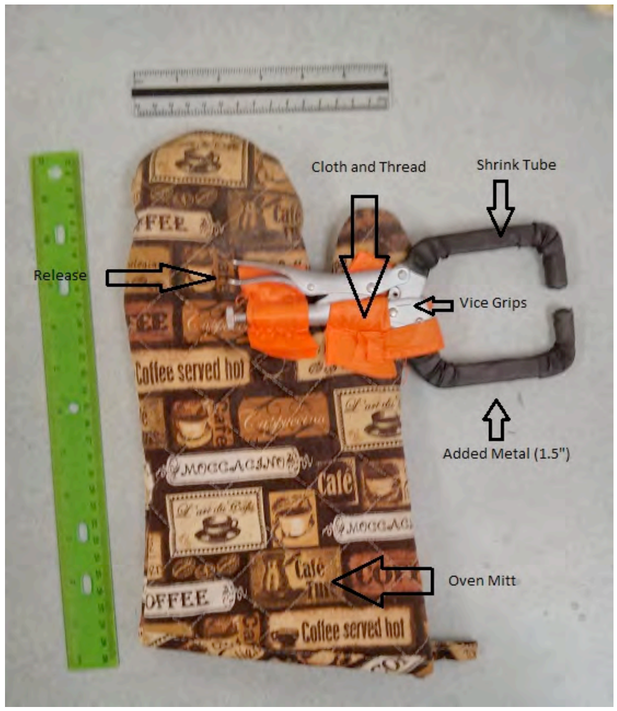
1. Device will be stored in Sandi's pocket or purse for easy access and convenience
2. Remove device from pocket (or purse)
3. Place dominant hand through the orange strap so it hangs comfortably on the wrist with the hook hanging at the bottom
4. Move dominant hand above the gas nozzle so that hook is just below the trigger
5. Place opposite hand on gas nozzle handle for more support
6. Pull up with dominant hand so that the hook pulls the trigger high enough for gas flow
7. Once trigger is up all the way, let go with opposite hand, but keep dominant hand up to allow gas flow to continue
8. If hand is held too high, adjust orange strap to make it smaller
9. If hand is held too low or strap is not long enough, adjust orange strap to make it longer
10. Once finished pumping gas, lower dominant hand to stop gas flow
11. Remove strap from dominant hand and place back in pocket (or purse)
12. Device will remain in pocket (or purse) while the user performs other tasks

Benefits

The device provides many essential benefits that other leading devices are unable to offer. It consistently delivers its functionality as it requires minimal strength in the finger allowing the user to be confident in the device. The device being in one piece enables the user to operate it easily and efficiently. Whereas having other external components that require an extra step increase the work load. This reduces energy and increases performance to ensure no complications are conflicted with the user. The convenience of this device makes it portable as it takes up little space for storage. The device is compact and with its durability it can withstand to prevent any damages from occurring. Most importantly, the device is inexpensive making it easily affordable in comparison to other alternatives.

Iron Fist

Project: S
F 10 - 124 - 9



Problem Description

To create a device that will allow Sandi to be more independent at the gas station. Sandi suffers from rheumatoid arthritis and has had hand and arm dexterity impairments for several years. Thus she needs a device to enable her to hold the gas nozzle to pump gas into her car. Most importantly this action should reduce her pain and energy consumption.

Design
The design consists of two main components; the oven mitt and the vice-grips. The purpose of the oven mitt is to provide a comfortable place for the user's hand to rest in, and force the user to stay at the pump while the device is in use. The major work is done by the vice-grip itself. The release is the only moving part, that works as the lock/unlock mechanism to equip onto the gas nozzle and pump the gas. The claws of the vice-grips have been modified to fit the gas nozzle with little to no-effort. The claws are also covered with shrink tube as a safety feature and eliminate any chance of conducting electricity. Finally, the cloth and the thread are used to attach the vice-grips to the oven mitt. The overall weight of the device is 0.8lb. When laid flat onto a table, the device fits in a 29.5cm by 27cm rectangle. When the vice-grip is unlocked it has a height of 14.5cm.

Functionality
What can it do, functionally speaking, for the user? Can it do everything the client requested with regards to the problem addressed?

Materials, Components, and Assembly
In order to build the prototype a few things need to be bought. Such as: a pair of Vice Grip C-Clamp locking pliers, steel (3/16" x 3/2" x ½"), thread, an oven mitt and cloth. The major part, the vice grips, cost $15. The oven mitt and cloth cost $2 each and the other things cost $2 in total. Thus, the total cost is $21 only. To build and assemble this prototype the vice grips need to be modified. This was done by cutting the clamps of the vice grips in half and welding a piece of steel in each clamp to make them 1.5" longer. The modified vice grips can then be sewn into the oven mitt using a needle and thread with the cloth. Then shrink tube needs to be stretched over the clamps and shrunk tight using a heat gun in order to avoid the conductivity. All the materials can be purchased at a hardware store, such as Home Depot, Home Hardware, and RONA. This process will take between 1 and 2 hours to complete. Some expertise is required to build this prototype. Someone with expertise in metal fabrication and access to a welder is required to modify the vice grips. Also someone with the ability to sew is needed to stitch the vice grips onto the oven mitt. The tools that are needed include a welder, a grinder with zip disks and grinding disks, a needle and a heat gun.

Use
1. Insert the pump nozzle into the car filler.
2. Take the device out of the trunk where it will be stored and put it on the right hand.
3. Hold right hand with palm facing the ground so that the vice grips can hang freely.
4. With the vice grips open place the opening of the jaws around the nozzle lever and the top of the pump handle.
5. Squeeze the pliers together using the other hand on the vice grip handle and allow the vice grips to lock in place.
6. When the tank is full the pump will stop and cause the vice grips to spring open and release the handle.
7. Take the device off and place back in the trunk.

Benefits
This design is better then existing commercial products especially products produced by other groups because the major piece of the device is a widely used commercially produced tool. This tool is made out of galvanized steel which is very strong and durable. This will ensure that Sandi will be able to use the device for many years to come. Our device is also very easy to use and makes it possible for Sandi to not have to apply any pressure to the device while she is filling her car as opposed to other devices that require her to hold it in place. The device also protects her hand from harsh weather due to the fact that it is a glove.

The Rocket

Top Notch Technologies
F 11-126-1

Length: ~40.5 cm
Width:~11 cm
Height: ~ 11 cm

Push/pull ball for closing/ opening clamps. Large diameter allows easy grip

Hook for hanging when not in use

Silicone clamps tightly grip card and easily fit inside card slot

Problem Description

People with arthritic diseases and those attributed to aging need assistance to maintain their independence while going about their everyday lives. Driving is a huge convenience and therefore refuelling should not be made a chore. The act of using pay machines at gas stations requires precise and intricate movements in the joints in which a person with RA would find difficult. We are attempting to design a device in order to help these people (Sandi) reduce the effort required to use these pay machines

Design

The Rocket, which is named for its shape and appearance, is medium sized (see dimensions on photograph) and very lightweight (~480 g). The large blue housing and ball will allow easy handling without much effort in flexion or

Functionality

The device eliminates the need to handle a credit/debit card with the users hand's and can grip it with effective force. The small nose with clamps can insert and remove the card from the payment machine without any pinching motions by the user. This will dramatically reduce the effort and energy needed to use self-serve payment machines.

Materials, Components, and Assembly

Made from a large flashlight housing ($10), a pylon ($1), silicone tipped tongs($1), a tennis ball($0.50) and held together with duct tape($1) and tennis over grip ($3) for a comfortable handle. The majority of these components can be bought at any local dollar or hardware store. Construction includes; disassembling and emptying the flashlight housing and cutting the pylon's broad end to fit the lens opening. The narrow end should be cut small enough to fit the tongs through. If necessary the silicone covers on the tongs can be shaped to reduce friction. A hole on the bottom of the housing was shaped with a flame and the bottom ends of the tongs were poked through where a tennis ball was attached. The pylon was attached with the narrow end around the clamps of the tongs and the whole thing was secured with duct tape. The tennis over grip was added onto the housing to finalize the grip and add extra comfort.

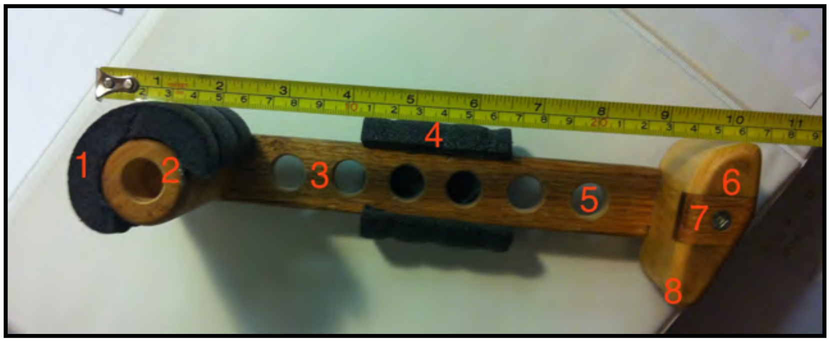
Use

1) Get the device and credit card out of car (most likely stored in trunk)
2) Hold The Rocket in one hand by the housing and the card in the other
3) Push down on rigid surface (ie. Back of car trunk) with the ball end and hold the card suspended above tongs
4) As the clamps close the card will be grabbed and locked in position
5) Direct the end of the device into the payment machine and pull on ball to release card
6) Hook the device on door handle, waist band or anything the user could feel comfortable with
7) When payment is complete and the card needs to be retrieved the clamps should be directed in the general area of the card slot while pushing on ball to lock back onto card
8) Remove and store again for next use

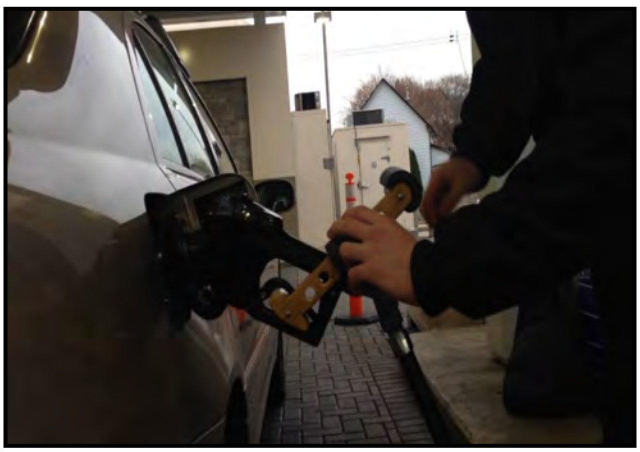
Benefits

This device has a wide base and therefore an easier grip for those with rheumatic diseases. It's easier to hold and handle than traditional clamps because it eliminates the pinching motion needed to close them. The sliding motion to close the tongs means that the flexion and adduction needed to hold the card is eliminated and leads to less energy being used. Less work is required to use the credit/debit card and there is no longer the need to awkwardly wrestle with the machine to insert and remove it.

The Wedge



Innovative Design Team
F11-126-2



Problem Description

To design a device for the user and client, Sandi Mugford, to fuel her car at any gas station. This device will help Ms. Mugford maintain her independence for a longer period of time by easing the pain, stress, and discomfort caused on her joints by rheumatoid arthritis from long-term operation of clenching the lever of the gas nozzle.

Design

1. Foam Grip
2. Handle
3. Shaft
4. Insertion Grip
5. Holes
6. Wedge/Cam
7. Reversible node for shaft
8. Chamfered Edges

"The Wedge" weighs between 1-2 pounds, is about 10 inches in length, and 4 inches wide. The handles are both large enough so that the client does not have to clench their hand in order to operate the device.

Functionality

"The Wedge" assists the client in operating a gas pump by reducing the force required to maintain gas flow. The application of the force is also much easier, a simple downward push, which is much less painful than clenching the handle shut, eliminating the need for hand positions that are uncomfortable for persons suffering from rheumatoid arthritis.

Materials, Components, and Assembly

Materials consisted of scrap wood, three screws, and two foam handles. These amounted to between $9 and $15. The wood, foam handles screws, as well as glue, a drill, and saw can be purchased at any hardware store. A drawing of the design and appropriate gas nozzle dimensions should be readily at hand. The shaft screws into the side of the wedge, and a handle is attached to the other end of the shaft. Additionally a waterproof varnish can be applied, and holes can be drilled along the shaft and through the handle to reduce weight.

Use

1. Grasp the device from its side foam gripped handle on the shaft
2. Insert the cam underneath the gas nozzle's lever
3. Apply a downward force on the handle to begin the flow of gas
4. Releasing pressure on the handle will cause gas to stop flowing

The Device can be stored easily underneath the car seats, in the trunk, glove box, in a purse, or even in the pocket of the car door. It can be carried by either of its two large grip handles, and it can rest in the gas nozzle or in the car while other tasks are performed.

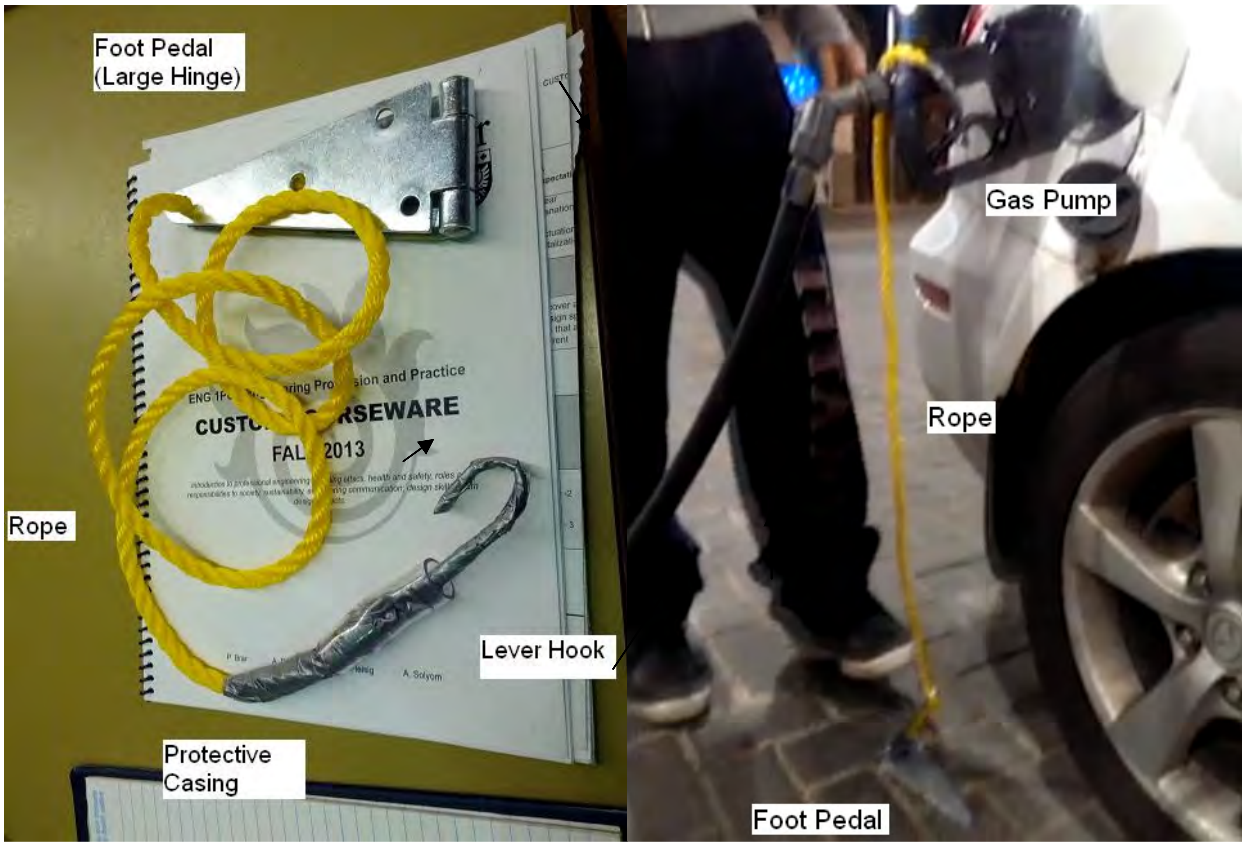
Benefits

“The Wedge” features many exceptional benefits, primarily requiring only a minimal mechanical force, and not an electric one. This means it can be operated without stressing any joints. It also is not dependant on holding a charge, and is additionally durable, lightweight and waterproof.

Large, wide handles provide comfortable grip for persons suffering from rheumatoid arthritis.

GAS PUMP PEDAL

Bio Modifications Inc.
F11 - 126 - 3



Problem Description

The task is to design a device to assist all people at the gas pumps who have hand and arm dexterity impairments. These impairments make a seemingly simple function of tightly griping the gas pump for an extended period of time more difficult. To assist with this task, Sandi has volunteered to be the client. She is a 60-year-old woman who has been affected by severe rheumatoid arthritis for over 50 years. She has limited motion and cannot lift more than 5 lbs. Her injuries make operating the car difficult. At the gas pumps, the client has difficulty with generating the force to squeeze and hold the nozzle for an extended period of time. For this problem, we will identify and creatively resolve the obstacles of dexterity, portability, weight and affordability. In order to tackle the obstacles, research in biology, aging, rheumatoid arthritis, the mechanics of the hand/arm, the act of pumping gas, and gas policies/laws will be thoroughly conducted.

Design

The Gas pump pedal uses a hook, rope and pedal system in order to lift the trigger of the gas nozzle with simply the user’s feet. Her hands are only required to set the hook and store the device. The hook is used to grab the trigger, the rope is used as a connection between the pedal and the hook, and finally the pedal allows the user to place tension on the rope pulling the hook upwards, pulling the trigger and pump gas. The device is less than 2 lbs.

Functionality
Her impairment with tightly griping the gas pump for an extended period of time is solved with our device. The obstacles of dexterity, portability, weight and affordability is solved by the gas pump pedal. The device is easy to handle, it is less than 2 pounds (pounds (lbs.)), and costs less than $12 to make. Best of all, the design eliminates the need for the user to user their hand for extended periods of time while pumping gas.

Materials, Components, and Assembly
In order to construct the Gas Pump Pedal, the following materials will be required: one large hinge with 3" to 4" flanges, 5/16” yellow polypropylene rope, one coat hanger, and duct tape. The following tools will be required: needle nose pliers, a hot glue gun, a measuring tape, and scissors. All of the tools and materials can be bought from any local hardware store. For the tools, one will require basic expedience with pliers, scissors, and a hot glue gun. Please note a strong hand is required when bending and cutting items with the pliers. Also, please wear safety glasses when using the pliers. To begin construction, fist, one will want to measure the height from the top of the gas pump handle when fully inserted into the car to the ground. Second, take the previous measurement and add 6", then cut a piece of yellow polypropylene rope at this length. Third, place 3" of one end of the rope through the hinge's hole at the point of the flange (the furthest hole from where the flanges connect to each other), and use the glue gun to fasten the rope to the inside of the hinge. The bolt of the hinge will also be on the inside of hinge. Forth, cut a 5" piece of coat hanger with the pliers, and use the pliers to bend the coat hanger in three places; 1.5", then 1", and then 2.5" to make a “U”. Fifth, bend the end of the 2.5" part of the coat hanger around the end of the rope’s free end, and use the glue gun liberally to finish the connection. Be sure that when holding the rope the coat hanger hook is in-line with the rope. Sixth, cover all exposed metal with duct tape. Optionally, one may add hot glue to the bottom of the foot pedal (hinge) for extra traction at the gas pump. Also, for improved control in maneuvering the hook at the gas pumps, one may a 3" section of 0.5" pipe insulation. The pipe insulation is used to set the hook on the gas pump handle, but it is then slid down to the foot pedal (out of the way) to pump gas. The total time to make the device is about one hour.

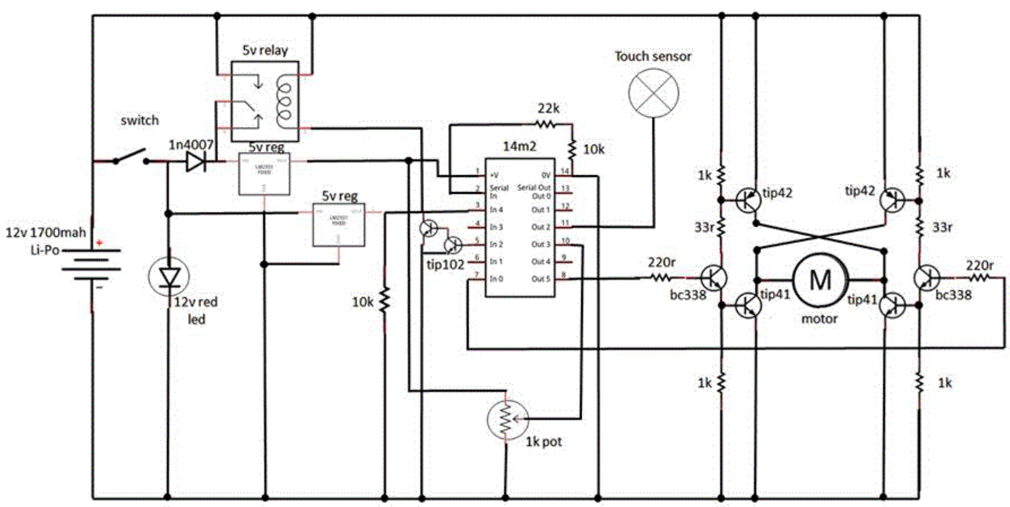
Cost breakdown:	**Price**
3’ of 5/16” yellow rope….	$3.97
1 large hinge…………….	$4.99
1 coat hanger……………	$0.99
3” of 3/8” clear tubing…..	$1.89
Total………………………	**$11.84 + TAX**

Use
The user will take out the device from her car. The user will hook the device around the gas tank lid, giving the ability to do other tasks prior to filling up the gas tank. Note that when the device is hooked onto the lid, the pedal will be on the ground [See figures]. Once the user has completed prior tasks, the user will then use the device to pump gas. The user will grasp the hook around the trigger of the gas pump nozzle and then place the pedal on the ground. At this point, the user will place their foot on the pedal adding tension to the hook and rope system causing the trigger to pull up and pump gas. Once she is done pumping gas, the trigger will loosen, and the user will lift their foot off the gas pedal. After, the user will take the hook off the trigger, and use the rope to pull up the pedal into her hand and then store the device as they please.

Benefits
Our design is the best since the users are hands free during the gas pumping. Additionally, the devices is small, easy to store, light - weighing in at under 2 pounds, and only costs $11.84 + TAX to make. The device reduces Sandi’s effort in pumping gas and allows her to have more energy for the rest of her daily activities.

Rhino-Raiser

Rheuma Rhinos
F11-126-4



Problem Description
Sandi Mugford is the client who suffers from severe rheumatoid arthritis, impeding her ability to do a number of tasks. When at the gas station, Sandi has trouble squeezing the trigger on the gas nozzle and experiences pain when doing this. A design needs to allow her to use the trigger without physical exertion in order to minimize the pain.

Design
The Rhino-Raiser weighs approximately 230 grams and is comparably smaller in size than the average tissue box. The Rhino-Raiser sports a hook like feature on the bottom which is used to pull the gas trigger upwards when activated. The design can be cupped with two hands and is touch sensitive, meaning very little effort is needed to operate it. All thats required is that the device simply rests atop the gas handle, while the user rests their finger on the sensor area.

Functionality
The Rhino Raiser can pull the trigger on the gas nozzle for the user, completely eliminating any need to squeeze the trigger manually. By doing this, the device solves a key problem the client was having involving maintaining a grip. By using the device there is no pain involved in pulling the trigger, since no force needs to be used to activate the device. Furthermore, the device rests atop the gas nozzle during use; meaning the user only lifts a fraction of the device's entire weight at all times during use.

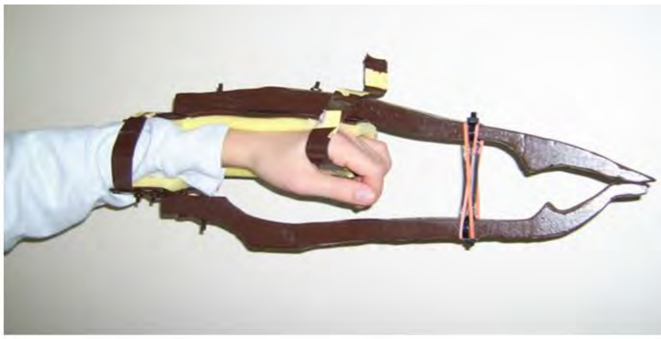
Materials, Components, and Assembly
The Rhino-Raiser at the most fundamental level, is composed of a motor, a touch sensitive switch, a main power switch, an LED indicator, a main 12V battery, and a complex circuit to connect the components, as well as super glue and solder used to attach the components. In order to build this device a more adept understanding of circuitry is required, which is assumed when building. The circuitry housed within the device can be built using the circuit diagram displayed above; with the sufficient assumed knowledge. The total cost is approximately $24, where the majority of he tmaterials are bought from a dedicated electronics and hobby shop called Sayal.

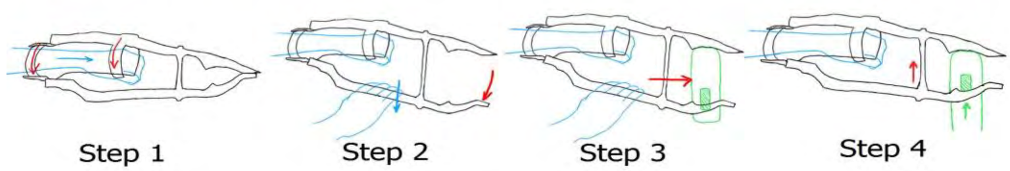
Use
1. When it is time to start pumping gas, the device will be taken out of its holder/charger in the car.
2. After inserting the gas nozzle, the device can be placed so that the hook piece is where a hand would normally go on the trigger.
3. The device is turned on by pressing the power switch, indicated by an LED
4. The device will cause the trigger to close when the button, indicated by a sticker, is pressed. Another LED will light up when the button is being pushed.
5. When finished pumping gas, take a finger off the button and the device will release the trigger.
6. Place the device back in the car, inside its holder/charger.
7. Occasionally plug in the holder/charger to charge the device.

Benefits
A key benefit to this design is its simplicity and ease of use. On the outside the controls are very simple and intuitive. Also, the device is quite durable while maintaining a very light weight.The button which the user presses to activate the device requires no force as it is touch sensitive, and so using the trigger on the gas nozzle becomes a very pain free task.

The Clampinator

MAAX ENGINEERING
F 11 - 126 - 5





Problem Description

Design a prototype to aid people suffering from rheumatoid arthritis to refuel their car at gas stations. The design must reduce pain and increase dexterity in order to allow our patient, Sandi Mugford, to use the gas pump comfortably.

Design

The Clampinator is compact enough to fit in the trunk of a car. It is made out of very light weight wood and so it is easy to manipulate. The thermoplastic is melded to the shape of the arm and the padding makes for a very comfortable fit. The spring does all the work and therefore Sandi doesn't have to do anything once the Clampinator is working.

Functionality

The Clampinator is a device aimed to aid Sandi Mugford in the fuelling process, by making it easier and safer. The device provides easy fuelling by the use of springs, which can do all the work needed without Sandi needing to consume energy. The device includes features that will decrease force exerted and reduce pain from the body, thus making the fuelling process easier and safer.

Materials, Components, and Assembly

The materials used in the making, including their cost of purchase are: thermoplastic: $49.99, 2 wooden planks: $4.00 each, two velcro straps: $1.00, a spring: $1.99, a door hinge: $1.99. To build the device the client will need a stove, water, a pan, scissors, a hand saw, screws, a screwdriver, and sand paper. It will take approximately four hours to build. Including the time it takes to form the thermoplastic to the user's arm. To build the device, shape the thermoplastic on the arm for the cast, attach the velcro straps on each end and cut 2 thin wooden planks, attach each one to the top and bottom of the cast respectively using screws, attach the spring between the wooden planks and add a sponge inside the cast for comfort. No special instructions needed.

Use

How to use Device: 1) Put device on arm and tighten velcro straps, 2) Align the top of the device with the top of the pump, 3) Use other hand to push down bottom part of the clamp, 4) Slide the device into position around the top of the pump and between the underside of the trigger, 5) Release the bottom clamp, 6) Wait until the fuel finishes pumping to remove device. When complete, the device can be carried to the car because of the lightweight feature and can be stored in the trunk of the car.

Benefits

The Clampinator is a device that has one purpose, to help those in need suffering from Rheumatoid Arthritis in the process of refuelling their cars. The MAAX ENGINEERING Company spent a tremendous amount of time in the design process in order to have a refined product. Many features have been included to give Sandi Mugford the easiest and safest way to refuel her car. Features that have been included are; weather resistant, lightweight, is easy to use, it eliminates the pain associated with the fuelling process, and cost efficient. The Clampinator can be used in various seasons and temperatures. A special coating has been used on the device in order to increase protection from either rain or snow. The device is very lightweight compared to its size which can be very helpful to Sandi as she carries the device from the car to the pump. This feature will decrease pain to her body and reduce energy consumption. The Clampinator is easy to use and does the required job without any issues. The instruction manual provided with the device is easy to understand from and will clarify any problems that could occur with Sandi. The device eliminates pain associated with the fuelling process as it is made with the finest and most comfortable material such as the thermoplastic and the sponge surroundings. The spring on the device will do the whole fuelling process for Sandi and will not require her to exert a force in order to use the device. Lastly, the Clampinator is cost efficient made with the best quality of materials and can be self-made. It does not require a lot of expertise, only a person skilled with managing their time and attention to detail.

U-Pulley

The Facilitators
F 11 - 126 - 6

Problem Description

To design a product that will assist Sandi Mugford at the gas station with fueling her car in order to restore her independence, conserve energy, and reduce pain caused by her Rheumatoid arthritis. Furthermore, the device should satisfy the expectations and guidelines set by Dr. Fleisig and Dr. McDonald.

Design

The device features a rope that connects to a hook on one side and a handle on the other. The handle hosts a grip that makes holding it a lot more comfortable. The hook is made to be wide to latch onto the handle.

Functionality

The problem that is addressed by this device is fuelling Sandi's car, which she has trouble with because it is a gripping activity that is done for a longer period of time than usual. This device latches onto the nozzle, and the rope is put around from the other side to create a pulley. To use the gas nozzle, the handle simply has to be pushed down and the lever will be pulled up.

Materials, Components, and Assembly

The materials needed to make this device are a handle, a rope, and a hook which all can be bought from Home Depot. The total cost of the items is $19.86. The tools that are needed to 'assemble the product are simply a pair of scissors or utility knife (to cut the rope), and fasteners like super glue and masking tape. The assembly/building time is just 60 minutes, with a chance of the process taking longer depending on drying time with the super glue. Not many instructions are needed for the assembly of this device. This is because there are simply 3 objects that need to be put together, and it is common sense that they should all be fastened by super glue. It would be more efficient to tape over the areas where super glue is drying to make sure that the two objects do not move excessively.

Use

How to use:

1. Latch nozzle onto lever of nozzle
2. Take rope and put it around the gas nozzle
3. Push down on handle to pull lever on nozzle

Storage and Transportation:
This device can be stored anywhere since it is compact. The device is small enough to fit in Sandi's purse (depending on how much space is free), in the glove compartment of her car, and if it is more convenient, even the trunk. Since filling up gas is the last activity at the gas station, the device can simply be stored in one of those locations and then retrieved when needed. In order to carry it, the hook can simply be attached to the handle, and the handle would just be used to carry it. Because of the hook's ability to latch on, it prevents the rope from dangling and posing any danger to Sandi when walking with the U-Pulley.

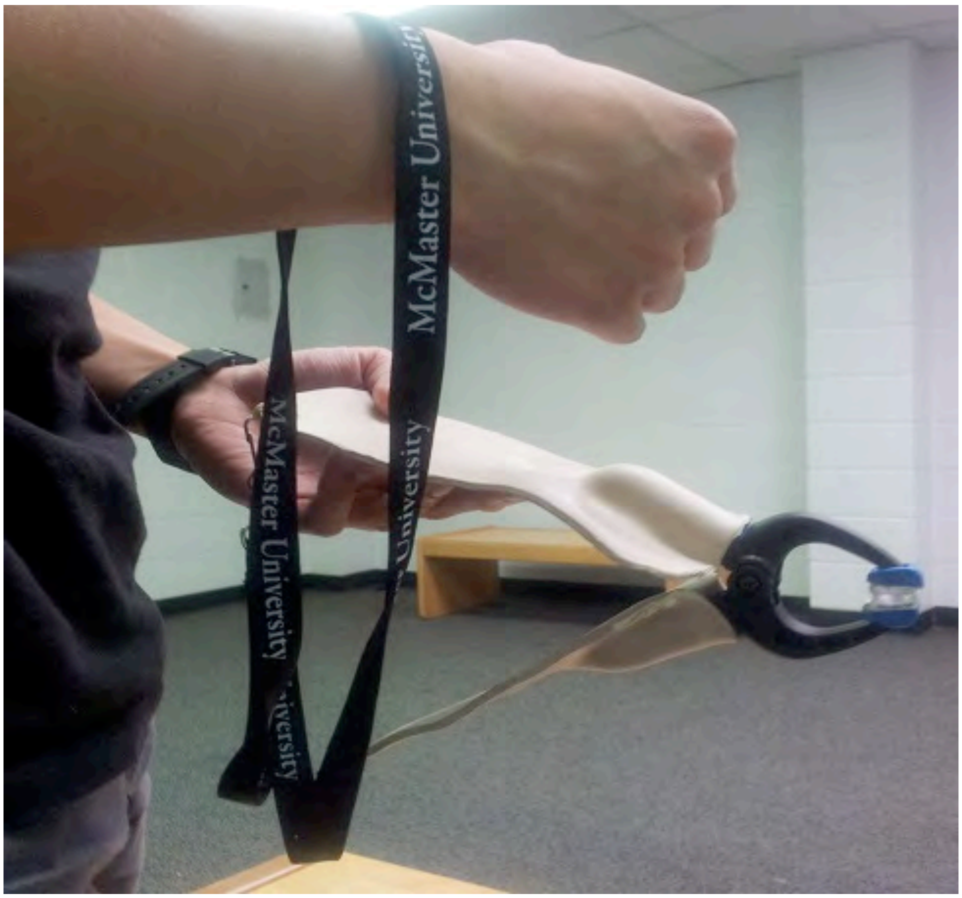
Benefits

This design is better than others because it is simple. The functionality and construction are very simple, and very practical. The pulley system that is used reduces force that is needed to actually operate the gas nozzle. Also, in exchange for a gripping motion that is traditionally used at gas pumps, this device transforms it into an activity where you simply have to push down. Along with that, if it is uncomfortable to use hands, the handle is wide enough to accommodate other parts of the body like the arm, and the rope is not so long that it forces the user to bend down very far. Due to this simple design, not much can go wrong with the U-Pulley, and so, it is an ideal choice.

Another reason why our device is better than others is it focuses on an activity that is irreplaceable; the insertion of credit card and pushing buttons can be avoided in totality if cash is used, but using the gas nozzle is definitely an activity that cannot be avoided. That is why this device makes a special effort to eliminate the difficulty of that activity, and does not compromise its functionality to accommodate another function.

TRAN Clamp

Team Name
F 1 1 - 1 2 6 - 7



Problem Description

The stakeholders, Dr. Fleisig, Dr. McDonald, and Nina, are looking for a device that will assist Sandi Mugford with the process of refuelling her vehicle. Sandi has rheumatoid arthritis, which reduces her strength and dexterity. Due to these restricted abilities, Sandi has difficulty using the narrow credit card slot. The device the stakeholders are interested in will aid Sandi in the accomplishment of this task while minimizing energy consumption and the pain she experiences.

Design

The design consists of a spring clamp and a cardholder. The cardholder is a small box with a piece of paper inside to ensure the credit card will always have a large enough portion sticking over the edge to grab. The small box is sitting on a larger box to provide more height for the cardholder. The spring clamp consists of a clamp with thermoplastic handles acting as an extension. In the jaws of the clamp there are two rubber pieces glued to pieces of paper that are stuck to the clamp. The clamp is three pounds and is 20 cm by 15 cm.

Functionality

The spring clamp allows Sandi to insert and remove the credit card from the slot with minimal force. This reduces the energy consumed to use the credit card and the pain experienced during the process. The spring clamp can perform all of the functions requested by the client in regards to the credit card problem. The clamp has a firm grip on the credit card to allow the client to easily insert and remove the card without having to grasp the credit card with her hands.

Materials, Components, and Assembly

The materials required for this device are a small spring clamp ($2), two small rubber pieces from suction cups ($2), the price tags from the two suction cups ($0), crazy glue ($5), one lanyard ($3), and a 30cm x 10cm sheet of thermoplastic ($15) for a total cost of $30.
Materials can be found at Canadian Tire but the thermoplastic must be purchased online. In order to assemble this device she will need another person that can put the materials together. The instructions to assemble the device are as follows:

1. Cut off tags for the suction cups and crazy glue them onto the inner jaws of the clamp.
2. While glue is drying, cut end of the suction cups off.
3. Glue rubber ends onto the paper tags with crazy glue and let dry.
4. Fill a sink with hot water and let thermoplastic bath in it.
5. Once thermoplastic has softened, cut into 2 pieces and round off the edges.
6. Mould the thermoplastic pieces around the handles of the clamp.
7. Punch a hole in the thermoplastic and attach the lanyard to the hole with an elastic.

The process should only take at most 1.5 hours.

Use

1) The spring clamp will be stored in the trunk of Sandi's car.
2) First remove the credit card from the purse and place it into the cardholder.
3) Place the clamp's lanyard over your wrist.
4) Apply pressure to the thermoplastic handles to open the jaws of the clamp.
5) Position the clamp around the credit card.
6) Release the pressure on the handles, allowing the clamp to close around the card.
7) Pick up the clamp with the credit card and push the credit card into the machine slot.
8) Remove the lanyard from your wrist to use the keypad, leaving the clamp on the credit card.
9) Once transaction has been processed place the clamp's lanyard around your neck.
10) Remove the clamp and credit card from the machine slot by pulling on the thermoplastic handles.
11) Leave the clamp around your neck while you use the gas nozzle or put the device back into the trunk before using the gas nozzle.
12) To remove the credit card, hold the card over the cardholder and apply pressure to the thermoplastic handles.
13) Retrieve the card once it falls into the cardholder and put it back into your purse.
14) Leave the device and cardholder in the trunk when it is not in use.

Benefits

The spring clamp is better than the existing products in the market because this clamp was specifically designed and created to help Sandi with her situation. Our device is better than the devices designed by our peers because the clamp allows Sandi to keep her independence without causing her additional pain and consuming her energy reserve for the day. The minimal required force to use the clamp reduces the strain on her joints. The clamp is also simple to use and allows Sandi to perform other tasks while the credit card remains in the clamp. This device has a low cost and is durable in all weather. There is no regular maintenance required to keep the clamp functional. The clamp is lightweight and a reasonable size; allowing for easy storage in the trunk of Sandi's car. There is no potential danger from the clamp because there are no sharp edges protruding from the handles and the materials cannot be shattered easily. The clamp is easy to carry as well because of the lanyard attached. The device can hang around Sandi's neck while she performs the other tasks of the refuelling process. In case the device is dropped, the lanyard will ensure that she does not have to bend down to pick up the clamp from the ground. For these reasons, our spring clamp meets the requirements outlined by the user and surpasses the existing products.

SqueezEase

MERC Incorporated
F11 - 126 - 8

Problem Description

To design a device that will aid Sandi, who suffers from pain, discomfort, lack of strength and poor fine motor skills due to rheumatoid arthritis while she undergoes the process of refuelling her car. This device shall assist her while operating the gas nozzle lever so that she may retain her independence and reduce the pain that she experiences throughout process.

Design

The design is comprised of two main components: the dog leash (including its mounted sub-components) and the wedge. The dog leash component has a ratchet with extended handles, a strap that is pulled by the ratchet, a cord secured to the strap and a guide for the cord to follow. The device weighs very little, less than 2 pounds and is quite compact, a little larger than the palm of a hand.

Functionality

The SqueezEase can do everything that the client could want in relation to squeezing the gas nozzle lever. It maintains the compression without any effort from the user and gets the device to the required compression which requires minimal effort. The levers on the device can be used with multiple parts of the body if preferred. Lastly, the device is very easy to use and store in order to make the user's experience as smooth as possible.

Materials, Components, and Assembly

The materials required for our design are as follows: a dog leash, a ski-boot ratchet, a rubber band, hockey tape, electrical tape, two plastic knives, screws/nuts, super glue and thermoplastic. In total, all of these materials cost just over $50 to acquire. Many can be obtained from most hardware stores. For construction a power drill is used in order to create the holes and screw in the screws. The total time of construction would be about three hours. The device comes fully assembled but needs to be reset after each use. This process is outlined in step 6 of use. No other instructions outside of basic instructions for use are necessary.

Use

The device is used in a series of six simplified steps, they are:

1. Attach the wedge to herself by putting her hand through the strap and resting the wedge in the palm of her hand.
2. Rest the groove on the bottom of the device on the top of the gas nozzle and feed the key through the space under the gas nozzle lever.
3. Let go of the key and grab it from the other side of the device. Then she can put it into the hole at the lower end of the device handle. She will then hold the device by the handle with the hand that is holding the wedge – this will lock it into place.
4. Continuously lift the black lever and draw in the cord until gas begins to flow.
5. When she has pumped all of the gas that she wants into her can she will let go of the handle, which pulls the wedge out and lets the cord go slack.
6. Reset the device by pulling on the red lever and letting the cord fall or be gently pulled out.

The device can be stored virtually anywhere within the user's vehicle. Suggested locations include the compartment on the side of the door or under/behind the driver's seat. The device can be carried using its handle. While performing the other tasks, the device can be stored back inside of the vehicle.

Benefits

There are many benefits that come with the design. It is quite sturdy; there is no chance of it breaking apart if it is handled roughly. It is strong; it applies a force that is much larger than necessary. This also makes it extremely effective and reliable. There will never be a concern as to whether or not it will be functional. It is very lightweight; approximately 2 pounds. It is also relatively inexpensive (especially in comparison to the quality of the product). In short, this is the best device for this task!

EVE

Advanced Design Alternatives of
McMaster
F12 - 227 - 1

The prototype seen in fully opened view on a table

The prototype used for pushing keypad buttons

The prototype in the pump, in the natural unturned position

The prototype in the pump, in the upright position, holding the trigger open

Problem Description

Sandi Mugford has significant difficulty accessing gas pumps without assistance. The goal is to create a solution that allows Sandi to independently pump her gas and enter her pin number with less pain, while being economically feasible.

Design

The design is made mainly of thermoplastic, with some foam and Velcro for padding as well as attaching the device to the forearm; we chose to use thermoplastic because it is light and malleable. It consists of 2 parts: a wedge to act as a lever to lift the trigger, and a brace to attach the device to the arm. The inside of the brace is lined with foam to make it more comfortable to wear, reducing pain for Sandi. There is a small protrusion at the end up the wedge, to allow for assistance in pushing the buttons on the keypad. There is also a piece of thermoplastic at the end of the Velcro to make it easier for Sandi to attach and remove the device from her arm. The weight of the device is less than 200g, and the device is small enough to fits nicely into most glove boxes.

Functionality

The device allows Sandi to very comfortably hold the gas trigger open and to press keypad buttons without any strain on her hands. It diverts all the force and pinching motion sway from her arms and converts it into a turning motion and gentle pressure on her arm. It also takes the small precise motion and pressure needed from her fingers and instead converts that into a simple thrusting motion from her entire arm, and once again diverting the force into but gentle pressure on her arm.

It does not deal with all three of the issues that the client brought up. It deals with two out of the three problems. It deals with the issues of pumping the gas and pushing the keypad only. It was decided that the issue of credit cards will be gone in the near future with “tap” technologies and with cell phone payment technologies also on the rise. It was decided to focus on issues that will be around for longer and will still present a problem in 5 years.

Materials, Components, and Assembly

The construction of the device requires thermoplastic, Velcro/foam (available both together in one form), and super glue. The materials all together cost roughly 25 dollars. The thermoplastic and Velcro/foam can be purchased online, and superglue can be acquired from any corner store or hardware store. The only tool needed is a hot water bath to mould the thermoplastic, and that is easily achievable in a standard kitchen. Additional tools for moulding and gluing can be of help but are not necessary. The making of the device will take approximately half an hour to and hour, depending on skill with moulding thermoplastic. Overall it is of very basic construction. There are no special instructions needed other than how to properly mould the thermoplastic and how to use super glue without endangering oneself.

Use

1. Open the glove box and retrieve the device
2. Attach the device to the user’s forearm and secure it with the Velcro adhesive
3. For pumping gas, place the wedge of the device under the lever of gas pump
4. Rotate the forearm up to prop open the lever
5. For keypad, point the end of the wedge at the numbers; simply press forward
6. Can be kept on the arm while performing other tasks
7. Remove the device from the user’s forearm
8. Store the device in the glove box

Benefits

The device is better than existing products as there are virtually no existing commercial products. It is better than those of other groups as it is much more robust than other designs, having no moving parts. It is also more comfortable, being padded on the inside, and very easy to use, requiring only one natural motion of the arm for both operations. It does not put any strain on the hands, compared to other groups’ whose designs tried to minimize strain on the hands, but the strain was still present.

EZ IN – EZ OUT

The Nerd Herd
F 12-227-2

zip ties used to help the user line up the credit card to the slot in the mini paint roller

zip ties ensure that the card will fit in the credit card machine properly

thermoplastic to keep the device from falling while it is in the machine

Problem Description

The goal of this project is to help the user, Sandi Mugford, maintain independence when she is at a gas station. We must achieve this goal for Sandi Mugford, Dr.Fleisig, Abbey, and Ross. The goal will be achieved by reducing the pain our user experiences, pertaining to the insertion and removal of the credit card.

Design

The device is 28 cm in length, allowing Sandi to use both hands to hold the device. It is also less than 1 lb. which is light and easy to hold. The width of the handle is 4 cm so that the user can easily wrap her hand around it. The diameter of the plush ball is 11 cm, giving a large area for the user to grip onto without bending the hand.

Functionality

The device grips a credit card, making insertion and removal easier. It removes the need for the user to pinch the credit card to remove it. Also the device provides the user with a big handle and plush ball that is easy to grip and use. This allows Sandi to use the device with minimal pain.

Materials, Components, and Assembly

The device can be easily assembled with parts obtained from local hardware stores and dollar stores. The materials used are a wine oxidation pump, mini paint roller, tennis grip, epoxy, zip ties, thermoplastic, and a plush ball. The total cost came to $31.21. The tools required for construction are epoxy and a sharp knife. The construction of the device is short, less than 45 minutes. Step by step instructions with detailed explanations of each step will be necessary.

Use

1. The device can be stored in Sandi’s purse, car door or trunk.
2. Sandi can carry the device with two hands; One hand on the plush ball and the other on the handle with the tennis grip.
3. Sandi can insert the credit card into the slit in the mini paint roller using the zip ties to guide her.
4. Once the credit card is in the device, Sandi can once again use two hands to hold the device and insert it into a credit card slot.
5. Sandi can leave the device with the credit card in the slot while she pays and pumps gas because the device is lightweight.
6. When Sandi needs to, she can remove the device with the credit card.
7. Sandi can then place the device back in her purse, car door or trunk.

Benefits

A major benefit of the device is that it can stay in the machine with the credit card. Sandi can leave the device in the machine, and simply remove the device with the credit card after paying for gas. Also, the device minimizes any pain Sandi may have felt. Currently Sandi has to pinch with two hands to remove her credit card, causing her a lot of pain. The device eliminates that pinch. The device is cheap, lightweight, compact and weather resistant.

Handy-Grip

Gasbusters
F 12 - 227 - 3

Figure 1: Shows size of Handi-Grip in comparison to an average card size

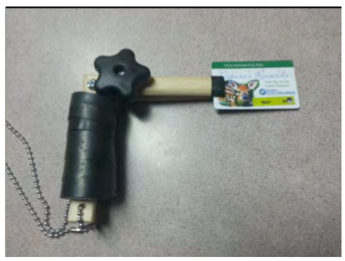


Figure 2: Shows the Handi-Grip holding a card, showing the functionality of the device.

Figure 3: Shows the mechanism that creates the motion and grip strength.

Problem Description

To produce the means to enable Sandi Mugford, who is suffering from an advanced stage of rheumatoid arthritis, to pump gas independently. The most painful aspect of the gas pumping process was explicitly stated by Sandi to be the insertion and removal of the credit card and that is the problem being attempted. The solution will be presented to Dr. Fleisig and Sandi to determine the best possible solution that fits the needs and desires of the user.

Design

The design of the Hand-Grip was decided on based on the specific needs of the user/client and the constraints set by our design team. In Figure 1, one can see the sizeable handle designed for an easier, more comfortable grip, which removes all painful fine, movements of fingers. The design is made of wooden, craft letters (as seen in Figures 1-2) to provide a solid and durable, yet lightweight design. In Figure 3, the mechanism that creates the movement of the device can be seen, it is made out of steel screws and springs for a lightweight, durable and safe design. All of the materials for the design were common items that were inexpensive resulting in a design under $30. The resulting design weighs less than 1 pound, is not much larger than a credit card and easily fits in hand.

Functionality

This device grips and holds the credit card in place. It does everything requested by the user for credit card insertion and removal because it eliminates the user proclaimed most painful aspect of fuelling. It can be applied and used for any situation where inserting/removing a card is necessary.

Materials, Components, and Assembly

The assembly of the Handy-Grip is very simple. It requires 2 wooden "L"s, 2 wooden "I"s, 3 bolts, a knob, plumbing pipe insulation and tennis grip tape. All of these materials can be obtained at Canadian Tire, Home Hardware and Michael's Craft Shop. The total cost of materials is approximately $30. For construction, the only required tools are a power drill and a hacksaw. The drill was used to drill holes for the bolts and tightening mechanism and the hacksaw was used to remove the excess bolt that stuck out from handle. Construction takes approximately 30 minutes to complete the Handy-Grip. No instruction is necessary for assembly because the Handy-Grip would come pre assembled. The only instructions necessary will be for simple use of the Handy-Grip.

Use

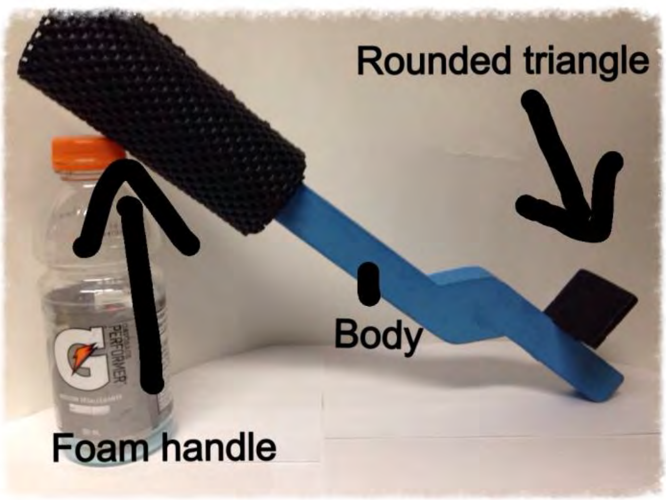
1. The Credit Card (or which ever desired card) will be placed into Handy-Grip and tightened.
2. Multiple Handy-Grips will be stored in the trunk of car along with purse like the user explained.
3. The device will be carried in hand/around the wrist with a chain/key-chain.
4. Before using the Handy-Grip, the Card must be aligned in the arms in accordance with the guides.
5. The card must be inserted between the arms of the Handy-Grip only as far as the padded grips on the arm.
6. The green indicator on the top arm must be lined up between the credit card number and the cardholders name on the face of the card.
7. While resting the device on a surface, with the card between the arms of the Handy-Grip tighten the arms as much as the user can with out causing herself or the prototype harm.
8. Test if the Handy-Grip has been setup correctly by gently tugging on the card to see if it has been tightened enough.
9. The Handy-Grip is now ready for use. Grip the Handy-Grip by the handle and push the card into the card reader on the gas pump.
10. Follow prompts on gas pump. If instructed to remove card from reader, pull on the Handy-Grip and the card will be removed. If prompted to leave the card in the reader, let go of Handy-Grip and it will remain in the card reader until prompted to remove.
11. When finished paying the Handy-Grip can be placed back into the trunk of the car.
12. Due to the multi-use capabilities of Handy-Grip the card can remain in the arms and used for any payments desired, for as long as desired.

Benefits

This product is the best solution to solve the issue of credit card insertion and removal. The Handy-Grip virtually eliminates any and all pain associated with the movement of the hand joints. What sets our design apart is that the only fine movements with the hand necessary are done once per card and after that there is no more fine movements. This design allows for multiple devices to be attached together like a key-chain, each holding whichever card the user desires. Not only does it tackle the issue at hand but it offers many possibilities for practical applications outside of the gas station. It is capable of being used anywhere, at any store, for any purchase using a credit card. The lightweight nature of the Handy-Grip design makes the product very portable and allows the user to carry it to wherever they desire. If the user has and uses several different methods of payment (credit card(s), debit cards, gift cards etc.) they can have a holder for each card and can quickly select and pay with the desired card without having to change or manipulate the card/device. Other devices and possible solutions are not as portable or as versatile. To perform the same function other devices would need to be changed or adjusted, causing pain and discomfort. This device gives the user the ability to maintain their independence in not only pumping gas but with many other aspects of their life.

The Nozzlator 3.0

Limitless Inc.
F 12-227-4



Problem Description

The purpose of the Nozzlator 3.0 is to reduce Sandi Mugford's pain and energy expenditures when fueling the vehicle, and maintaining independence by creating a device that can be utilized at the gas station. The device must be designed in a way to help the client who suffers from rheumatoid arthritis.

Design

The Nozzlator 3.0 is a device that utilizes forward force and converts it into lifting force. The handle (as seen above) is made of soft foam which is for comfort and grip for the user. The grip is exceedingly comfortable and offers an individual with rheumatoid arthritis to grip the device firmly and comfortably. The rounded triangle will be the piece which slides into the gas handle. When the client turns the handle the rounded triangle will lift the gas nozzle and fuel the vehicle. The Nozzlator 3.0 weighs 2lbs and under 0.5m tall. The Nozzlator will be held in the left hand, and is pushed forward to engage the gas nozzle. The Nozzlator is primarily made of wood, which offers durability, portability, and affordability.

Functionality

In regards to the functionality of the Nozzlator 3.0, it meets all the requirements set by the client with regards to the problem statement. The Nozzlator 3.0 reduces the amount of pain experienced by the client at the fuel pump. This is due to the fact that there will be no squeezing or clamping of the gas nozzle handle, but rather a push of the Nozzlator itself. The Nozzlator 3.0 converts a pushing force into a rotational force. Therefore, the user can use any part of her body (theoretically) to push the Nozzlator 3.0 forward avoiding using her fingers which cause her pain. The Nozzlator 3.0 will also reduce the amount of

energy the client needs to use due to the fact that there is no need to clamp the nozzle shut, but rather hold a small constant force on the Nozzlator 3.0.
With regards to cost, durability, and portability, the Nozzlator 3.0 meets all the functional requirements. In respects to the cost of the Nozzlator 3.0, it will be $11.50 to build and roughly an hour to manufacture by hand. The Nozzlator has the ability to be dropped multiple times and from various heights which makes the design very durable, but yet lightweight. The design is relatively small in size and fits in the side panel of the vehicle to increase portability. With all new designs, the Ontario law is always a factor. The law states that the gas nozzle must be attended at all times and must have an individual applying the force at all times. The Nozzlator is a legal product in the sense that if the force applied on the Nozzlator comes to a halt, the Nozzlator will return to an upright position and does not fall out of the gas nozzle. The Nozzlator is wide enough that it is next to impossible to wedge it shut so no force is required to fuel the vehicle.

Materials, Components, and Assembly

The materials used for the Nozzlator are primarily lightweight oak, screws, foam handle, and glue. Overall the materials cost roughly $11.50, and can all be purchased from a local hardware or dollar store. The Nozzlator requires a machine to cut the wood into the desired shape, and a drill to screw the pieces together. A sander and wood glue are used to finish the design by smoothing out all the edges and help the design work as smooth as possible. Construction of the Nozzlator 3.0 was roughly an hour to build and after production, the Nozzlator 3.0 needs no further assembly. However, the Nozzlator is designed to work only on the left side of the fuel tank because of the position of the fuel tank door.

Use

1. The device is designed relatively small so it can be stored in the side door panel of the front seat.
2. Before fueling, the client will transport the device to the gas nozzle and may lay it on the ground or can be carried with the user as they prepare the nozzle for fueling.
3. Once an individual has paid and the gas nozzle has been inserted into the fueling compartment, the Nozzlator 3.0 is designed to assist and reduce the force needed to fill the fuel tank. To use the Nozzlator, insert the black component into the gas nozzle handle to the **<u>LEFT</u>** side and make sure it fits into the nozzle comfortably
4. Now that the Nozzlator is inserted, apply a forward force on the handle and begin fueling.
5. There must always be a force applied to keep the Nozzlator fueling.
6. After the desired amount of fuel has been attained, bring back the Nozzlator to the start position and remove from the apparatus.
7. Return the gas nozzle back to the fueling station, and place the Nozzlator back to the side compartment of the driver’s side.

Benefits

The Nozzlator has many features making it better than any other exiting design. The Nozzlator 3.0 is extremely easy to use and significantly reduces the amount of energy an individual needs to fuel the vehicle. The lightweight design and the large foam handle optimizes the client’s comfort while using the device. The foam handle is soft which increases comfort while fueling the vehicle. In regards to ascetics, the Nozzlator has an attractive appearance with a blue and black finish. The Nozzlator is also genuinely uncomplicated, and user-friendly. It does not take much effort for a person with rheumatoid arthritis to slide the device into the gas nozzle. The device also has a comfortable fit in the gas nozzle. If the user discontinues holding the device, it will stay in the gas nozzle, preventing it from falling, and potentially harming an individual. Furthermore, if contact stops in the middle of the fueling process, the Nozzlator will not fall to the ground nor stay in the fuelling position, but it will fall back to the original upright position. The Nozzlator obeys all Laws set by the Ontario government, and does not depend on any outside sources maintaining the users independence while fueling the vehicle.

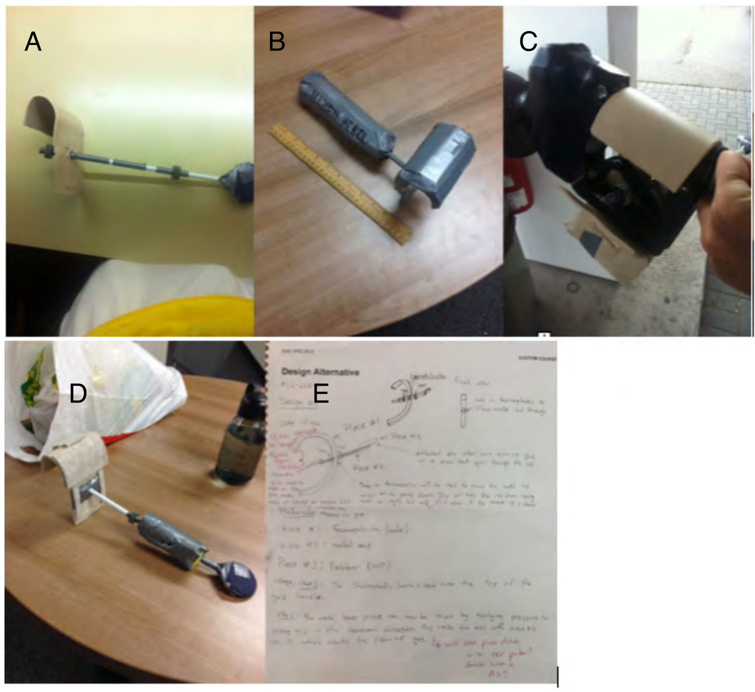
Gas Nozzle Device

Innovative Thinking

Haken-Hebel 2.0

Team Innovative Thinking

F 12 - 227 - 5



Problem Description

The intended users of this design are those who suffer from rheumatoid arthritis. According to data gathered from Mrs. Sandi Mugford, the refuelling process of a car can be a very painful and difficult procedure. Holding the trigger of the fuel pump down for extended periods of time is very painful on the joints, and requires a constant tension in the muscles that is not necessarily easy for her to maintain. This design addresses these problems in order to give the user a more comfortable refuelling experience.

Design

The design is best seen in visuals A, B and D, and can be seen in use in visual C. It is a relatively short object (almost exactly thirty centimetres long, as can be seen in image B) and it weighs only a half kilogram. This object therefore fits very easily into car doors or purses, and certainly could be placed in a trunk or between car chairs as well when not in use. And when this device is in use, it is small and lightweight enough that it does not interfere with the other processes involved in a visit to the gas station.

Functionality

The Haken-Hebel is useful in the fuelling process because it removes the need for the user to squeeze the trigger of the gas pump's handle, as can be partially seen in image C. This should reduce the pain caused by holding down the trigger on the pump, especially for extended periods of time. The device also serves to provide the user with a mechanical advantage over the gas pump. What this means is that, due to the lever arm design, it takes less downward force on the lever arm to initiate the flow of gas than it takes upward force of the fingers to do the same thing when no device is used. This advantage also makes it easier to use the gas pump, as the user does not have to worry about struggling to hold down the gas handle's trigger. In terms of the initial expectations, this design achieves the goals it was made to accomplish and addresses two big problems for the client: the amount of force applied and the amount of joint movement needed to work a normal gas pump.

Materials, Components, and Assembly

The design requires a metal rod (roughly 30 centimetres long), a roll of duct tape, a sheet of thermoplastic (approximately one square foot), felt rectangles that are sticky on one side and kitchen sponges (four to six). The total cost of this device is around twenty dollars. All of the pieces can be found in local hardware and dollar stores, save for the thermoplastic. The best way to find thermoplastic would probably be to order it online. A hot water bath is required for construction, along with a pair of scissors to cut the sponge and tape. Construction time should be no more than three hours after all pieces have been assembled. In order to put together the design the same way the original was made, an annotated drawing of the Haken-Hebel is would be enough reference material to accurately recreate the design. No special instructions are required.

Use

1. After arriving at the gas station, remember to take the Haken-Hebel out of the car, or leave it in a purse or other easily accessible area
2. Proceed as normal, selecting the amount of fuel and the octane of the fuel
3. Place the fuel nozzle into the gas tank when ready
4. Place the Haken-Hebel on the handle, by first fully pulling the lever arm towards yourself and then placing the hook over the top of the gas handle, approaching from the left side. (the right side is where the car's fuel door swings out to)
5. Maneuver the lever arm underneath the gas handle's trigger
6. push straight down on the handle of the lever arm, initiating the flow of gas
7. Wait until the car has been filled the desired amount
8. Release the lever arm and pull it backwards and out of the handle
9. Lift the hook off the top of the handle and return the Haken-Hebel to its initial location
10. Remove the gas pump from the car.

Benefits

This design is superior because it provides all the advantages needed to make the user experience as comfortable as possible, but is still both portable and easy to use. This is the perfect combination of attributes and make the Haken-Hebel the best design for the job

Easy Pump

INFINITE SOLUTIONS LTD.

F 12 - 227 - 6




Problem Description

The goal for our final project was to design a system that enables Sandi Mugford, a patient diagnosed with rheumatoid arthritis, to pump gas without assistance. While adhering to the processes expected by Dr. Fleisig and the teaching staff, we wanted our design to provide assistance and minimize pain when Sandi compresses the gas pump trigger.

Design

As the images above depict, the *Easy Pump* is comprised of 3 main parts: the hinged lever, which is inserted into the handle of the gas pump, the top plunger, which connects with the hinged lever, and the string, which is how the device is able to apply the upward force on the gas pump trigger. The *Easy Pump* weighs just over 0.5 pounds, well under the maximum weight the user can hold. As the pictures above show, the device is relatively small; both of the two main handles (top and side) are about the width of the user's hand. The device has large, comfortable handles for the user to hold easily but is not bulky, making it very portable.

Functionality

The *Easy Pump* will assist Sandi Mugford, and others who suffer from arthritis, to easily pump gas with considerably less pain and discomfort. As per the client's request, the device minimizes pain and is fully functional. The *Easy Pump* works at gas stations in the Hamilton and surrounding area so the user will be able to use it knowing that she will be able to independently pump gas regardless of where she travels.

Materials, Components, and Assembly

There are a number of simple, readily available materials required to build the *Easy Pump*. These include: a small piece of poplar wood (or other hardwood), two small wooden dowels, a small rope pulley, a small hinge, a strong and flexible string, sandpaper, deck stain, glue and some small finishing nails. The total bill of materials amounted to approximately $10.00. In addition, all of these materials can be found at any local hardware store or perhaps lying around the house. In order to actually build the *Easy Pump*, some power tools were used, however most of the work can be done with simpler hand tools, except for the drilling of the necessary holes. With some patients, basic wood working skills and proper preparation, our device can be easily and safely constructed. It should be noted that the availability of a drill press would greatly improve the process, both in terms of efficiency and accuracy. Finally, the use of a quality glue and exterior wood stain make the device very durable.

Use

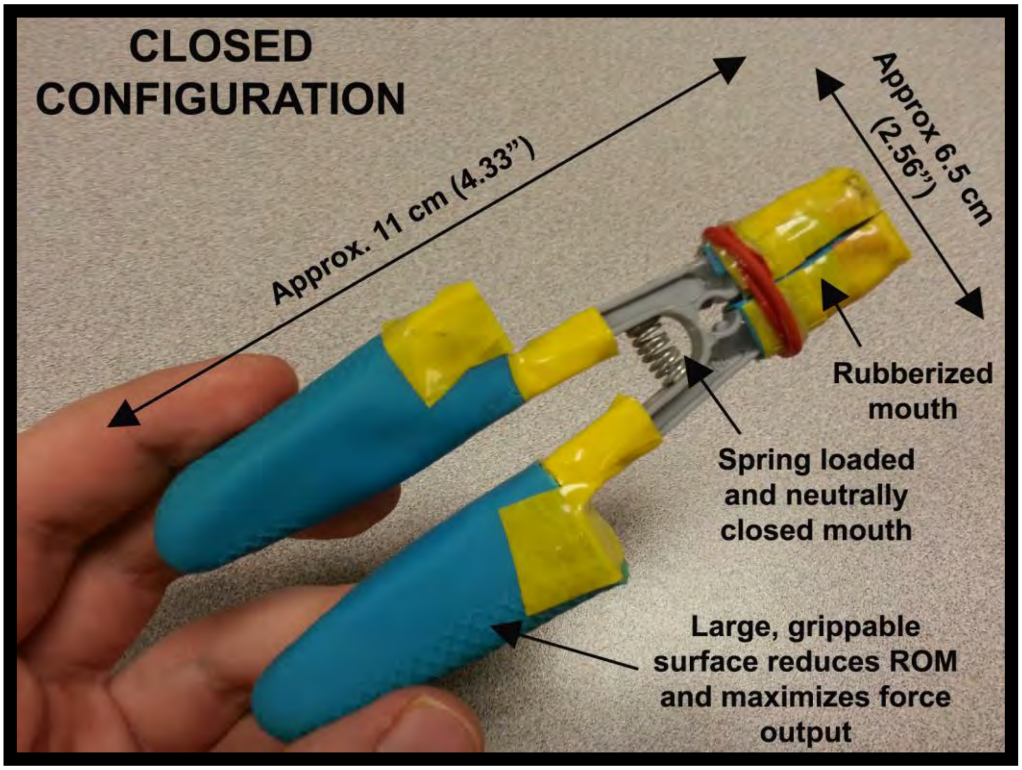
When the user arrives at the gas station they should take the *Easy Pump* and place it near the gas tank opening, atop the vehicle or back trunk. Once the gas nozzle is inserted into the vehicle, raise the top plunger handle of the *Easy Pump*, allowing the hinged lever to fall to it's horizontal position. With one hand slightly widen the space between the gas pump and the pump lever, and insert the hinged piece of the product through this space. The string will be pushed down and the hinged lever will rise to meet the smaller wooden dowel. When the smaller wooden dowel is in the hole of the hinged lever, the user will apply a small downward force on the plunger handle, using a relaxed hand or arm. When the gas tank is full, gently lift the plunger, releasing the pressure on the gas trigger. Simply fold down the hinged lever and remove the *Easy Pump* by gently pulling it by the comfortable side handle. The user can conveniently store the device anywhere in her car. Since Sandi prefers to store her wallet inside her trunk, this would be a good spot for the *Easy Pump* as well. It would also be easy for her to store it within easy reach in her vehicle, in an existing compartment or on the passenger seat.

Benefits

There are a number of reasons why the *Easy* Pump by *Infinite* Solutions is better than existing alternatives. Firstly, it should be noted that our design focuses on the dispensing of gasoline since this is the task that causes Sandi the most amount of pain and the current products and patents are not legal options in Canada. Since easy payment options such as Interac Flash quick pay already exist in many gas stations in Southern Ontario, we did not see a need for an alternate product for this task. Without our device, refuelling her vehicle was a long, painful process since she constantly needed to readjust her hands to maintain a continuous flow of fuel. The enlarged handles on the *Easy Pump* are easy to grip, even with arthritic hands, because of the ergonomic shape and the light over-all weight of the product. As a result, a strong and prolonged grip is not required. Neither is it necessary to exert her hands in order to actually dispense the gasoline. She simply needs to slightly push down on the plunger handle and the pulley and rope system will exert an upward force on the gas pump lever. Once the flow has started, the simple task of applying downward force with her relaxed hands or arms keeps the gas flowing. The design and wood construction of our device accounts for its strength, durability and low weight. The product is compact and can be stored anywhere in the user's vehicle without ever being in the way. In conclusion, with the development of the *Easy Pump,* we met the main objective of enabling Sandi to feel independent and pump gas in a way that is less painful than ever before. In fact, The *Easy Pump* meets all of our cost, weight, portability, functionality and safety objectives, and above all, offers many benefits to the user.

The Handi-Sandi

SENTIENT DESIGN INC.
F13 – 124 – 1



Problem Description

To design a mechanical device to assist Sandi Mugford in performing normally strenuous tasks associated with inserting and removing her credit card while interacting with the machine at the gas station.

Design

The team designed a neutrally closed, lightweight (7g), miniature extended clamp. It is small enough (approximately 11 x 7 cm) to promote easy storage (e.g. client's purse, glove compartment). It is robust enough at the long end to allow for the client, with limited range of motion and available energy or force output, to open and close the mouth for card insertion/removal. The device is durable, made of safe materials, and protects effectively against both the elements and any potential hazards present at the time of use.

Functionality

The device allows Sandi to perform the tasks with minimal extension, flexion or rotation at crucial joints about the hand and wrist. The rubberized surfaces at both the card insertion end and the hand grip allow for ease of card removal and ensure that the card is held securely in place while in transit. The device can in fact be left attached to the card while not in use. The tool's grip is enlarged and requires the user to produce a very minimal force to open the mouth of the device. With respect to the objectives, the device operates wonderfully; it allows the user to perform the tasks in a way that does not require high energy output or strenuous joint configurations while maintaining her independence, and has a sleek, simple design. The client can use the device to perform both card insertion related tasks and potentially keypad tasks by holding the device and pressing down on the keypad with the flat, squared tip of the device.

Materials, Components, and Assembly

The team used various tools and materials in production of the device. A hot glue gun, a utility knife and scissors were used for shaping and fastening of materials. The device's body itself requires few materials: namely two plastic clothesline pins, a stress ball, rubber glove and yellow electric tape. Using the knife, the stress ball and rubber glove were shaped to fit to the body of the device. Two clothespins were attached together to elongate the device's arms to promote ease of use (increasing torque about the spring). The device's 'mouth' was wrapped in rubber to promote friction between the device and the card. The remainder of the device was encased in rubber for grip. Reflective yellow tape was wrapped around the mouth and body. Total estimated cost for the final design only amounted to less than $4. Due to the device's simplistic nature and easy to use mechanisms, instructions are not necessarily required, as the client has stated that she has previously employed similar (but less user-friendly) tools in the past. Finally, there is no need for assembly, the device comes ready to use.

Use

1. Remove device from glove compartment, purse or otherwise.
2. Apply small force on grips to produce torque that opens jaw, simply place credit card on rubberized gripping surface.
3. Relax hand to close jaw.
4. Guide device to credit card slot. Push into slot.
5. Leave in credit card slot while performing other tasks, or remove device by applying small force to separate from card.
6. If removed, device can be used to punch keypad buttons while the card is inserted into the reader.
7. The tool can be placed back in the purse, glove compartment or elsewhere.

Benefits

Existing clamp and clip designs may damage the credit card by stripping it and rendering it unable to read, or are simply uncomfortable to use. The tool is rubber coated and can safely and successfully insert and retract a credit card from the reader. Similar designs may not be fitted appropriately to insert the card into the reader, and are often too heavy to remain attached while the user performs other tasks. Conversely, the device is lightweight and compact. Many designs have failed to take into account portability and comfort along with utility. The inclusion of an enlarged, extended grip means that the user only needs to perform a slight pinch grip at the time of use and may actually hold the device using a more neutral overhand grip. Similar designs require that a hole be punched in the credit card, which is simply not feasible in most cases as the user runs the risk of damaging the card. The device will not damage the credit card. The device requires negligible force output and little to no mechanical maintenance. Other devices use materials that are either not disposable or difficult to procure or replace (e.g. Thermoplastic). The device is non-absorbent and is fashioned out of recyclable materials. Perhaps most importantly, it is within a reasonable price range and requires zero assembly. The intuitive nature of the tool and its ease of use in any condition marks it as an excellent tool for many other applications for those suffering from arthritis.

The W-Edge

Painless Pumping
F 13-124 -2

Problem Description

To design a product for Sandi and Dr. Fleisig which assists Sandi in obtaining fuel at the gas station which is hindered because of rheumatoid arthritis, a disease which causes a decrease in strength and restriction in movement. A product is required to assist in independence, efficiency of movement and reduction of pain.

Design

The design implements a basic wooden wedge that is to be inserted into the gas nozzle lifting the trigger as shown. The product itself is lightweight and portable, due to its small size and light wood material. This allows for Sandi to carry the device with her when pumping the gas and paying for the gas.

Functionality

Functionally the product addresses the issues revolving gripping and exerting excess force on the handle of the gas nozzle by utilizing a wedge and redirecting the force required from upwards direction, which opposes gravity, to that of the side. The W-Edge also would allow for continuous gas pumping, decreasing the time filling the tank, in addition to the time spent outside. This successfully fulfils her requests preventing the negative effects of cold climate and changing atmospheric conditions revolving her condition of Rheumatoid Arthritis.

Materials, Components, and Assembly

The design calls for a simple wedge and an ergonomic handle. The materials consist of wood, a tennis ball, a strap, a cushion, stain and varnish, and glue. The materials cost approximately eleven dollars. The wood and stain can be procured at any lumber store. The rest of the materials can be purchased from the Dollar store. The construction requires a mitre saw, a band saw, a power sander (sandpaper will suffice), a paint brush, and a hot glue gun. The construction takes approximately five minutes, not including dry time for the stain. The handle and the wedge are made from the same piece of wood, to increase strength. The wood is sanded down to prevent chipping and reduce dangerous surfaces. The wood is stained in order to protect it from the elements. The design is meant to be simple, easy to make, and easy to use.

Use

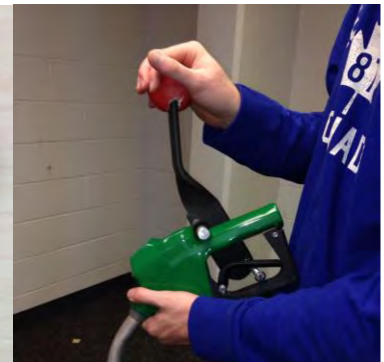
1: Sandi steps out of her car and opens her trunk
2: In the trunk is the W-Edge along with Sandi's Purse
3: Sandi will then pick up her purse and wrap the W-Edge's handle around her wrist
4: Once Sandi has paid for her gas she will insert the nozzle in to the fuel in take valve
5: She will then shove the W-Edge under the trigger on the nozzle and thus lifting up the trigger and allowing the gas to flow.
6: Once she has the desired amount of fuel she will remove the W-Edge from underneath the trigger.
7: She will lastly place the W-Edge and her purse back in her trunk ready for the next use.

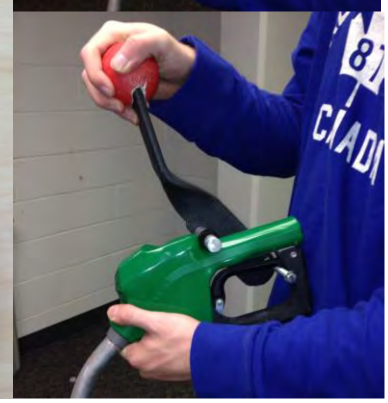
Benefits

The W-Edge assists Sandi with pumping gas into her car with through the shape and form of the device and competes with existing solutions through features that include comfort, conforms to the natural rest position of Sandi's hand, a shape that is small and portable, material that is lightweight and inexpensive and lastly is extremely simple to use. The product includes an adjustable securing band that allows her to hold the device while accomplishing other tasks such as paying without the need to put the product away. The securing band also prevents the device from falling and the need for Sandi to pick it up from the ground. The main defining features of W-Edge that surpass other devices is the simplicity of the product and the minimal use of parts in the device's design.

The Helping Hand

Metrix
F 13-124-3





Problem Description

To design a device for Dr.Fleisig and Sandi Mugford which will reduce pain and prolong Sandi's independence at the gas station. The desired device must assist Sandi with reducing the force needed to operate the fuel nozzle.

Design

The device weighs approximately two pounds. It's constructed out of aluminium wrapped in premium grip liner. It is around thirty centimetres in length, and halfway down the aluminum sheet there is a ninety degree twist.

Functionality

The device allows Sandi to operate the gas nozzle with minimal force. It acts as a simple lever to convert a squeezing motion into a forward push. A slight mechanical advantage is gained since the distance from the middle peg to the ball is greater than the distance form the middle peg to the lower peg. This device clearly addresses the problem of the gas nozzle, therefore she cannot use it to insert her credit card or push the buttons.

Materials, Components, and Assembly

To build the device takes approximately 2 hours and requires knowledge of cutting, tapping, drilling, grinding, and simple metal working techniques. A portable jig saw, a portable grinder, a tapping set, drill bits, a drill, a 36" pipe wrench, a bottle torch, a vice, and an x-acto knife are required. Materials needed include non-adhesive Grip Premium Liner ($3 a roll), double sided tape ($10.47 a roll), krazy glue ($4.99), a soft kids ball ($1.39) with a diameter of about 3½", a ¼" × 2" × 12" piece of aluminum ($3.99), a 3" long cylindrical piece of aluminum ($2.95) with a ½" diameter, a ¼" bolt that is 3" long ($0.45), a 3/8" bolt that is ¾" long ($0.45), a 2½" long 3/8" spring ($0.80), 2 - ¼" nuts ($0.15) and 2 - ¼" washers ($0.15). All items were purchased at Home Hardware except the aluminum, which was bought as scrap from a local machinist.

Use

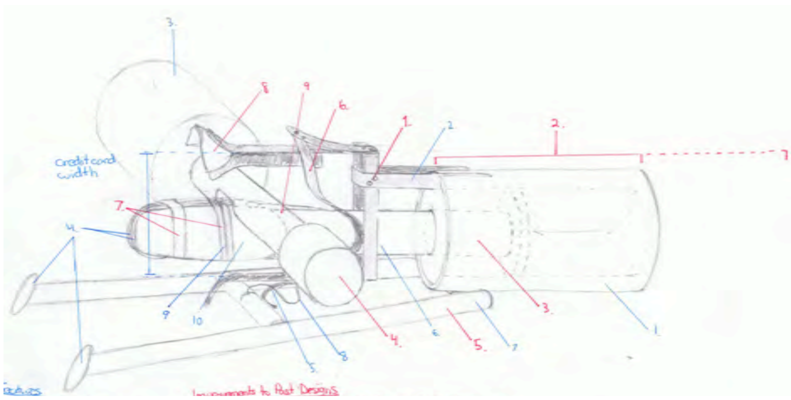
1. Sandi exits her car and retrieves the device from her trunk.
2. Sandi places the device on the garbage can and proceeds to pay for her gas.
3. Sandi picks up the gas nozzle and inserts it into her car.
4. Sandi picks up the device and inserts the lower cylinder (with the spring around it) underneath the trigger, and places the upper cylinder (closest to the ball) above the gas nozzle.
5. Sandi the pushes the ball towards the direction of the car, thereby fueling her car.

Benefits

This design is small, lightweight, and reliable. It is simple enough for Sandi to use, and durable enough to survive any weather condition or falls it may encounter. It allows Sandi to pump gas with significantly less force than what she was using before, which consequently allows her to prolong her independence.

Lock 'N' Load

Indepengineers
F13 – 124 – 4



Features
1. Large foam handle
2. Metal card guiding apparatus
3. Large foam slide handle
4. Vinyl friction pods
5. Truss lock
6. Free sliding shaft
7. Truss support
8. Truss tether
9. Elastic band
10. Finger splint (Card gripper)

Problem Description

To design a device that reduces Sandi Mugford's struggles and pain while using the credit card to pay at the gas station thus ensure her continued independence, as per Dr. Robert Fleisig's constraints.

Design

The device is lightweight (approximately 300 g), which can be easily held by user in one hand. Also, the device is relatively small in size which makes it portable for the user. The user can either store the device in the trunk or inside the car. User can easily operate the device with both hands. There is a fixed handle for user to hold the device and a sliding handle to push (pull) the credit card into (out of) the slot.

Functionality

In general, the device can assist the user with credit card insertion and removal at the gas station.

Firstly, The device eliminates the need for a pinch grip. The design of device does not include any clipping compartment since Sandi lacks the strength to grip object. The user does not need to apply any force to open and close the clipping compartment. User can simply insert the credit card into the gripper and it will secure the credit card.

Secondly, the device can improve the accuracy of user when inserting or removing credit card from the slot. The fixed and sliding handle design can significantly add stability through using both hands and thus improve accuracy.

Thirdly, the device can position the credit card properly itself. The device is designed in a way that the credit card aligns with the machine slot, which ensures it to be inserted with ease. When the user operates the device, the card fits well in the gripper so that it will not slide.

Lastly, the device has a self-supported design, which allows for unattended use. It enables the user to perform other tasks while the device stays in the machine slot. It can be taken out after the transaction is completed.

Materials, Components, and Assembly

The device is built by the following materials: finger splint ($ 3.29), 2 pool water guns ($ 3.00 each), table cloth clips ($ 2.99), vinyl pads ($ 3.29), wooden dowling ($ 1.49), fishing line ($ 3.99), suction cup ($ 1.79), epoxy, duck tape, aluminum rivets and elastic band. The costs of above-mentioned materials are shown in the brackets. The entire device only cost $19.84 in total before tax. The building materials can be easily obtained in grocery stores such as Dollarama, Home Depot, Home Hardware, Canadian Tire and so forth.

The handles are built by cutting and refining two pool water guns. The card-gripper is built by placing vinyl pads inside of a finger splint, with duct tape to restrict the depth of the card. The truss is built by cutting dowling with vinyl pads glued to the bottom, and uses fishing line as a tether. The card guiding apparatus is made from malleable strips of metal (table cloth clips). Holes are drilled at intersecting points in the metal and fastened together with aluminum rivets. The upper part of the guidance track needs to be glued with epoxy due to a lack of surface area for rivets. The guiding apparatus is attached to the main handle with epoxy and it, along with the truss support, are duct taped to the handle as well. The gripper is epoxied to the free-sliding shaft of the main handle, while the sliding handle, with its shaft glued in place, is subsequently epoxied to the top of the gripper.

To help with guidance, a suction cup, cut in half, is glued to the tip of the guidance track.

Use

The device will be used in following way:

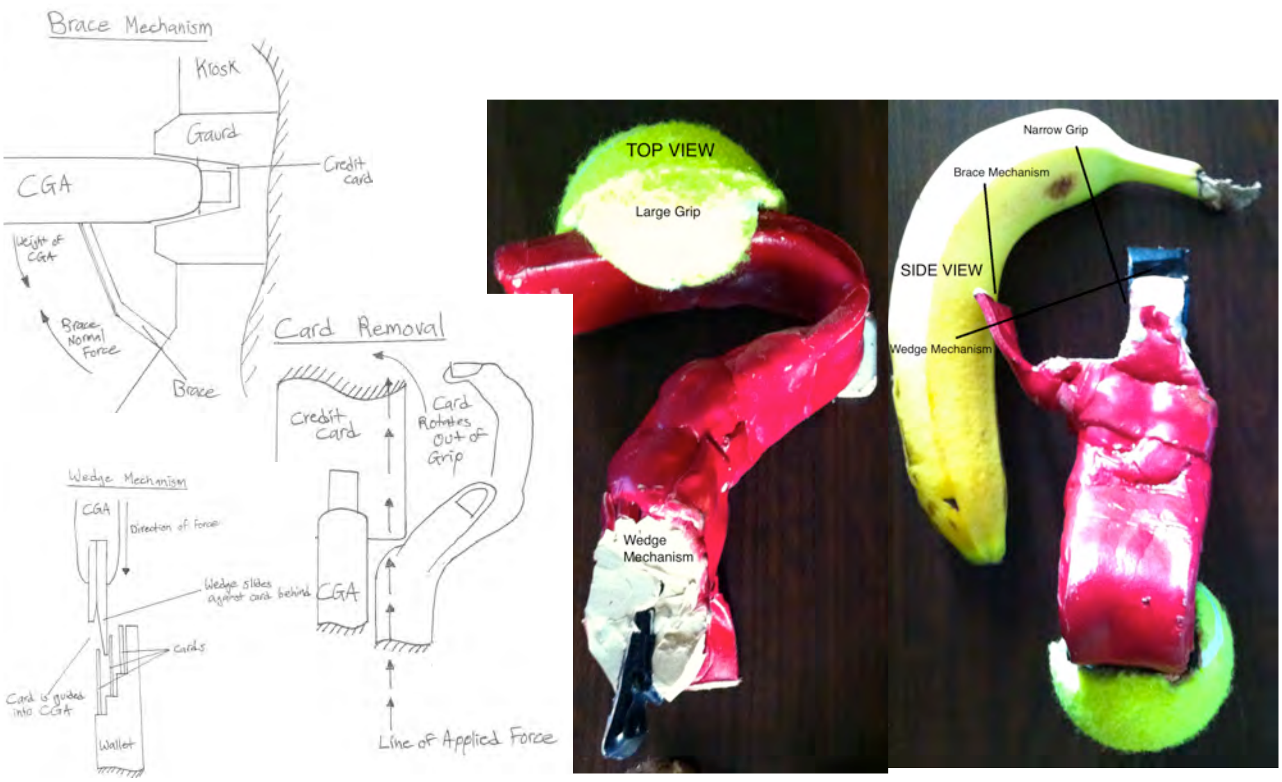
1. The device is taken out from the trunk along with the credit card.
2. The credit card is then inserted into the gripper.
3. The device is transported to the credit card machine.
4. The positioning guides are placed into the slot so that it aligns with the credit card slot.
5. By pushing the sliding handle forward, the credit card is inserted.
6. The user can perform other tasks while the device sits in the slot (unattended use).
7. After the transaction is completed, the card is then removed by pulling the sliding handle back.
8. The credit card is taken out of the device.

Benefits

The device has an additional sliding handle which improves the overall accuracy. Sandi can stabilize the device with two hands instead of one; it decreases the chance of slipping of the device. Thus, it reduces the energy consumption by user and helps complete the car-refuelling process with little or no pain. Apart from that, the gripper helps secure the credit card in the right position. This device is ideal for Sandi because it performs the function of gripping without the need of applying forces with her hands.

Card Gripping Assist (CGA)

Euler Biomechanics
F13 - 124 - 5



Problem Description

The goal of this design is to reduce the amount of pain and energy needed to use a payment card while at a gas station. This was done for the user Sandi Mugford who has Rheumatoid Arthritis on behalf on the client Dr. Fleisig.

Design

The CGA is small enough that it can be stored in a glove compartment box. As the photographs above show the CGA is no longer than a banana and weighs less than 2lbs. The CGA is shaped in the form of a question mark with the top being a soft but firm handle that Ms. Mugford will hold and the bottom being a secure grip for a credit card. The wedge mechanism allows for easy retrieval of the card from the wallet (See diagram), the brace allows Ms. Mugford to let go of the device while she is processing her payment (See diagram), and the large grip makes holding and using the device easy and pain-free.

Functionality

The CGA meet's the user's needs because it is operated by large body parts and simple motions thereby reducing the need for painful, energy-taxing actions. The CGA takes what used to be a painful and exhausting process for Ms. Mugford and makes it into a painless, easy and worry-free experience. By meeting the objectives that the user wanted such as being light, easy to use and being stored in her car the CGA not only solves Ms. Mugford's problem but also does it in that the device will be useful.

Materials, Components, and Assembly

The CGA is composed of thermoplastic, a mouse pad and a tennis ball. All together the cost to build the CGA was $2.60 CDN. The mouse pad and tennis ball can be bought at the dollar store and thermoplastic can be obtained from any OT clinic. To assembly the CGA one needs only a pot of hot water, a Xacto knife and superglue. Within an hour one can heat the thermoplastic and mould it. Then cut and glue the mouse pad and tennis ball. The majority of the construction is straightforward and requires no instruction. The only area that requires focus is ensuring the card-gripping end creates a strong grip. The same OT clinic that has the thermoplastic can also give tips about working with thermoplastic. This easy construction allows for repair and modifications to the CGA to be done easily, with few tools and by people with little experience.

Use

1. Ms. Mugford will remove the CGA from her glove compartment box or from her trunk where she keeps her purse. (The location of storage is up to Ms. Mugford's personal preference)

2. By holding the handle side Ms. Mugford will insert the CGA onto her payment card by using the built-in wedge feature (See "Wedge Feature")

3. Once the card has been securely attached Ms. Mugford will then insert the card into the slot in the gas kiosk.

4. Ms. Mugford can then release the device to use the keypad and the CGA will remain in its location (See "Brace Feature").

5. Once Ms. Mugford has completed the payment process she will loop her hand around the handle and use her palm to remove the CGA with the card from the gas kiosk.

6. Using her palm again Sandi will then push the edge of the card to loosen the device's grip and then will be able to return the card to her wallet. (See "Card Removal")

7. If Ms. Mugford would rather put the device away after she is done fuelling, the hook of the CGA can be rested on the tank panel while she operates the gas nozzle. Then afterwards Ms. Mugford can remove the card and put the CGA away.

Benefits

The CGA solves Ms. Mugford's problem the best for three reasons.

Firstly the CGA is user-oriented. It is encouraged that Ms. Mugford see the CGA as an extension to her own body. By having no moving parts, being very easy to use and fulfilling many other objectives such as storage, weight, and safety, the CGA offers Ms. Mugford a painless, relaxing and most of all *care-free* experience at the gas station.

Secondly the CGA is pragmatic. The CGA can operate in nearly any environment, can sustain wear and tear and can be used as Ms. Mugford's condition gets worse. For these reasons the CGA is a tool that Ms. Mugford's can truly rely on. Being such a practical device means that Ms. Mugford may actually use the device for years to come rather than just being an interesting educational activity.

Thirdly the CGA is synonymous with no compromises. When considering attributes that a good device would have such as being lightweight, durable, easy to repair, and safe, the CGA excels in every one. There is nothing that Ms. Mugford or the client have to give up to use this device. The CGA offers many benefits to the user while requiring few costs.

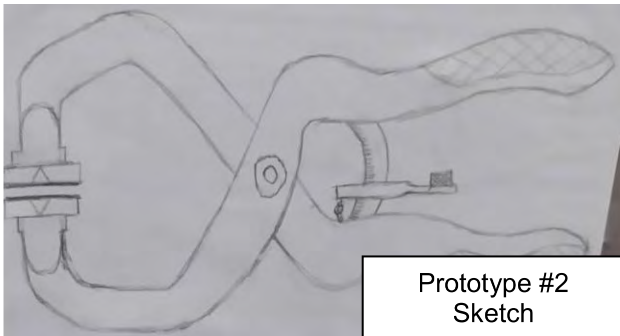
In closing, the CGA is an excellent device because it makes the user Ms. Mugford happy because she gets a practical solution to her problem that she can actually use.

The client Dr. Fleisig is left happy because his user is happy and he does not have to pay much for it.

Euler Biomechanics is happy because their hard work has made everyone else happy too.

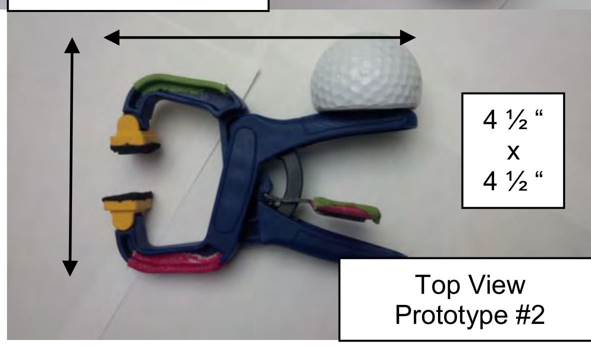
Quik Grip

Practical Design Engineering
F13-124 -6



Prototype #2
Sketch

Side View
Prototype #2



Top View
Prototype #2

Problem Description

Create a device for our client Dr. Robert Fleisig and Sandi Mugford help maintain independence to our user, Sandi Mugford, at the gas pump by increasing functionality and reducing pain throughout the entire process of fuelling her automobile.

Design

This device weighs around 100 grams or about ¼ lbs, it is around this weight because the user has a difficult time holding heavy objects for a long period of time. Its dimensions are 4 ½ “x 4 ½ “, this size is close to the size of our users hands. Since rheumatoid arthritis has damaged the users’ hands, a golf ball is put in place for an easier way to hold onto the device and a large rectangular bar is attached on the release trigger for a much easier way for the user to release the card. In addition coloured tape is put in place to show that green is up for good and red is bad for down. Also a rubber-like material is put on the ends of the clamps to allow for a better holding grip on the credit card.

Functionality

The devices main objective is to avoid any kind of pinching motion the user would need to perform in order to hold and credit card and insert/ remove it from the machine. The device designed for ease of use with hands specifically designed to avoid small, finite motion. Very little force required in order to hold the card in position. This device can also be applied outside of intended use to other functions. The prototype fulfills the clients request to help with the insertion and removal of a credit card avoiding the use of the fingers that create a pinching motion that greatly contributes to the inflammation of the joints from rheumatoid arthritis.

Materials, Components, and Assembly

This device requires few materials and components. It consists of a C-Clamp ($4.99), golf ball ($0.05), Copper Plate ($0.50), Colour Tape ($0.15), Rubber Ends ($0.15), and a single Screw ($0.05). The total cost of this design is $5.89. These materials can be obtained in Home Depot Hardware Store with the exception of the golf ball where that can be found at the Dollar Store. The tools required for construction are scissors, a spot welder and a grinder. The instructions needed to recreate this device are simple. The copper plate is cut to size which reference to the release trigger dimensions and the golf ball is sliced and screwed onto the end of the handle of the clamp. The assembly of this device does not need special instructions since it is a device that is simple and fulfills the needs of the user.

Use

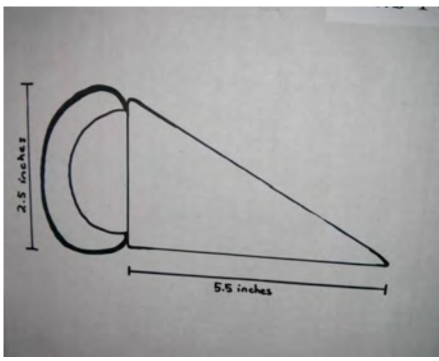
This device is specifically designed to grip and hold credit cards in a secure manner. The way to operate this device is fairly simple. First have the green side of the Quik Grip facing up. Secondly place the credit card on a table or in an area which the Quik Grip can reach. Third, grab the card with the device in a similar way just like using a pair of pliers, as she is using a pair of pliers as a temporary solution. Apply pressure to handle and the device will press down and hold onto the card. When finished using the device have the green side face upwards again, place device over table or over purse, and press down on the extended bar to release the card. The small size of the device allows it to be stored essentially anywhere. It can be left in a purse, in a pocket or stored in the car cup holders. This device is also lightweight, and Quik Grip can hold itself while it is in the machine. This makes it easier as motions do not have to be repeated, and the release trigger allows for the credit card to be easily placed or released whenever the client pleases.

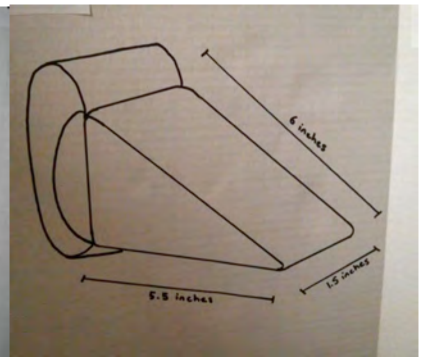
Benefits

This device is currently the best option for Sandi and the best from other designs. It is lightweight, the bill of materials is extremely low, strong materials offer durability and it is comfortable to use. Quik Grip™ is a small, compact device that can be stored anywhere and is easily accessible. This revolutionary device will make living with rheumatoid arthritis easier.

The Modified Wedge

Team Name
F 13 - 124 - 7





Problem Description
To reduce Ms. Mugford’s pain at the gas station and to increase her level of comfort and independence; by making a device that will eliminate Sandi Mugford’s joint usage. For the clients, Sandi Mugford and Dr. Fleisig.

Design
The design is a wedge-shaped object with a stress ball glued onto a flat face of the wedge and an elastic strap. The elastic strap will act as a back support for Ms.Mugford's hand, and the stress ball will be gripped by Ms. Mugford. It will be less than five pounds, and the design will be small enough for Ms. Mugford to put it anywhere. For example, Ms. Sandi Mugford can put the wedge in the glove compartment of her car, she can wrap it anywhere around her arm, or she can put it in her pocket. The loop of elastic, where Ms. Mugford will insert her hand into, will match the size of her hand yet still have the flexibility to accommodate changes in hand size due to swelling or if she were to where gloves.

Functionality
Functionally speaking, the modified wedge does everything that Ms. Mugford asked for within the constraints. The wedge can help Ms. Mugford fuel her car without the need for her to move her finger joints and without squeezing anything, which eliminates her pain and discomfort. Ms. Mugford only needs to push with her palm of her hand, which is rested against a round spongy ball, allowing her to have a natural hand position while using the device. This allows her to once again reduce the usage of her hand, arm and rotator-cuff joints. The wedge is slanted at a low angle, reducing the force needed for Ms. Mugford to push in order to get the device working and is also heavily weighed near the handle to reduce the force that Ms. Mugford needs to pull the device out of the nozzle trigger. This also means that if she where to leave the device unattended, the weight at one end would

cause the device to fall out of the trigger, thus adhering to fire regulations.

Materials, Components, and Assembly

Thermoplastic, wood, glue, an elastic strap, black spray-paint, nails, staples and a stress ball are required to make the design. A pack of two stress ball can be obtained from Dollarama for only $1.00 and thermoplastic can be obtained from the McMaster store. An elastic strap, wood, nails, staples and glue can be obtained from Home Depot or Home Hardware. In total, the building materials will cost about $13.10. A saw, glue gun, a knife, stapler, lighter, hammer, sand paper and a pot filled with boiling water will be required to create the design. It will take about 1 hour to create the design.

The wood will be cut into a right triangular prism 5.5inches long, 2.5 inches tall and 1.5 inches wide using a saw. Heat up water in a pot to about 79 degrees Celsius to bend the thermoplastic. Thermoplastic is a very firm structure, but when placed in hot water will become very soft and malleable. Cut the thermoplastic so that it can be folded around the wedge evenly. The thermoplastic will stick onto the wedge, acting as a layer, but in order for this layer to be sealed, a lighter will be used to heat the seams and mold them together seamlessly. The stress ball will be cut in half using a knife, it will assist Ms. Mugford in handling the device. The 2 ends of the elastic strap will be stapled onto the face opposite to the leading edge of the wedge, then the stress ball will be glued onto the same face. Once everything has time to dry, a couple coats of paint are applied to finish off the look. This assembly does not need special instructions, however building this should be done in a well-vented environment.

Use

1. While Ms. Mugford is paying for her gas as seen in the video, she can carry the modified wedge in her purse, around her wrist or even her pocket
2. After Ms. Mugford is finished with paying with her card, she will then grab the gas nozzle from the gas pump and then insert it into her car.
3. After inserting the gas nozzle into the car, she can then pull the wedge out and slip her hand inside the elastic sleeve
4. Once she has a hold of the wedge, she can then insert the wedge into the trigger of the gas nozzle, this will cause the trigger to go up and will allow the gas to flow
5. Once the gas is finished flowing, Ms. Mugford can stop exerting force from her palms. At this time the wedge should fall out by itself, it not, then Ms. Mugford needs to pull slightly to pull the wedge out
6. Ms. Mugford can then put her wedge back into her purse, wrist or pockets. Return the gas nozzle onto the gas pump. Close her fuel tank and then leave

Benefits

The modified wedge is the perfect solution for Ms. Mugford and is better than a lot of solutions available because of its simplicity. The wedge is a very simple device to use, only requiring her to do one action in order to use the device. It is so simple to use, that she can use either hand to use the device. The wedge is also very simple to store and requires no maintenance. Since the wedge is waterproof and weatherproof, due to the thermoplastic layered with spray glossy paint; the wedge would be very easy to wash if Ms. Mugford desired to do so. Ms. Mugford could store the wedge anywhere, because of its light and small structure. The wedge includes many features as mentioned above to decrease the pain that Ms. Mugford feels, as well as increasing her level of comfort. The wedge includes such parts as the spongy ball, used to provide a comfortable cushion to allow her to rest her hand in its natural position. An elastic sleeve, that allows Ms. Mugford to use the device even if she is wearing gloves, or while her hands are inflamed. The wedge as previously mentioned is also designed to optimally transfer her horizontal force into vertical force, which allows Ms. Mugford to use this device without exerting much force. In conclusion, the modified wedge is the perfect solution for Ms. Mugford because it requires so little out of her to use, while providing maximum comfort and reducing her pain.

Spider Gripper

Innovative Company of Engineers for
Independence, Comfort, Ease, and
Relief (ICE ICER)
F 14 - 126 - 1

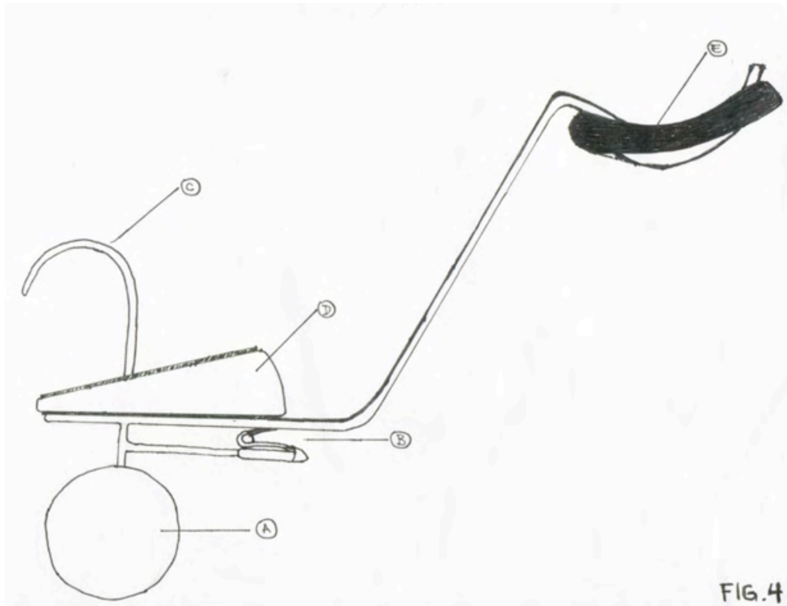


FIG.4

Problem Description

A device must be designed to help Ms. Sandi Mugford with her problems at the gasoline stations when refuelling her car. These problems, caused by her condition of rheumatoid arthritis, include Ms. Mugford having difficulties gripping onto the gas pump handle, maintaining the gas nozzle trigger in a compressed position for a period of time, having to step over the fuel hose due to her fused left leg, and having to twist her body and stand sideways while pumping gas in order to view the display due to fused vertebrae in her neck. The device must reduce the pain and effort required by Ms. Mugford to refuel her vehicle. Clients include Ms. Mugford, Abbey, Katie and Dr. Fleisig.

Design

The design has a hook on the top of the main frame (C), this is to hold the device in place while gas is being pumped. The lever is attached to the main frame by a hinge (B), which allows it to rotate through the desired in order to compress the gas nozzle trigger. A rubber doorstop is used as a wedge so that as that end of the lever rises on an angle, the surface that makes contact with the trigger is still horizontal (D). The lever is bent upwards and shaped so that it is at elbow level and the user does not need to bend down to reach the lever in order to press down on it. The device has padding to protect the user from the steel as it can be very hot or cold, depending on ambient temperature, and to make the device softer and more comfortable to use (E). A ball was attached to the bottom to aid in carrying the device using two hands without needing to curl or clench the fingers around the device (A). The device is carried by balancing it on the palms of the hand using the ball and the curved portion of the lever just before the padded end (E). The device has a mass of less than 1.4 kg is approximately the length of the user’s arm. When attached to the nozzle, the height of the device should be somewhere around the midpoint of the torso of the client.

Functionality

The device makes the process of pumping gas much easier for the user as it requires much less force since it uses mechanical advantage and its own weight to assist the user in compressing the gas nozzle trigger. It also converts what is normally a clamping and squeezing action by the fingers and hands when compressing the trigger into an action of pressing down, which is much easier to perform and can be done without strain on finger joints and without use of the hand at all. This significantly reduces the amount of pain and effort that the user must sustain in order to use the gas nozzle. The reduction in amount of force necessary to compress the trigger also means that the user will not need to take breaks from squeezing the trigger due to pain, so the refuelling process will be faster. The orientation of the device means that the user does not need to step over the gas hose from the left side to the right in order to compress the trigger; instead, the user can remain on the left side of the gas nozzle and comfortably pump gas. This eliminates what is an extra step in the process, which saves time and removes a potential tripping hazard. The user can also directly face the gas display by leaning down on the lever with her left arm, and thus, she will not have to stand sideways and twist her body or neck awkwardly to view the display.

The device is able to do nearly everything the client needs with regard to the specific problem addressed of the gas nozzle. One aspect that is not addressed is that it does not assist the user in lifting the gas nozzle itself and porting it to the car or address the stiffness of the gas hose itself. Altogether though, the device significantly reduces the amount of pain and energy expenditure experienced as well as reducing the time and effort required by the user during the process of refuelling her vehicle.

Materials, Components, and Assembly

The materials required for the construction of the device are steel, a foam ball, a hinge, a doorstop, shelf liner, a knee pad, Krazy Glue and foam wrap. These materials can all be obtained at a Canadian Tire Store or at most hardware stores. The final cost of the materials needed to produce this device is $36.25. The tools needed to construct the device were as follows: welder, grinder, drill press, wire brush, blow-torch, and vice grips. The lever and hook need to be welded to the hinge and shaped. The shelf liner and doorstop are glued to the metal lever. The device took about 5.5 hours to build. Dimensions need to be confirmed before building, as the length of the lever may change with respect to the height of the client.

Use

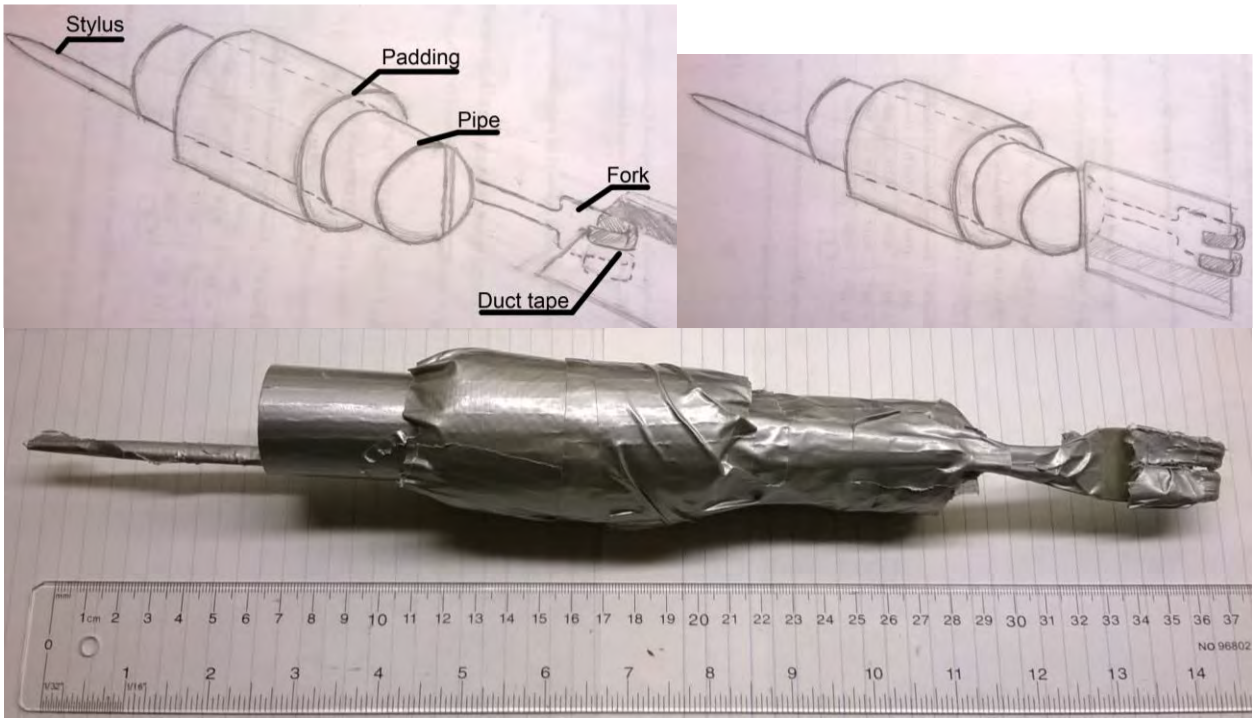
1. The device will be taken out of the trunk of the car where it will be stored after the gas type has been selected and paid for and once the gas nozzle is securely in the car.
2. The hooked end of the device will be slipped over the top of the device and the end of the lever with the doorstop will be slipped between the trigger and the base of the nozzle.
3. The user will rest her arm(s) on the top of the lever and press down on it. This will enable the flow of gasoline.
4. When finished, the user will simply stop leaning on the lever to stop the flow of gasoline.
5. The user will carry the device by grabbing hold of the foam ball on the bottom with one hand and letting the distal end of the level rest on their other hand and port it back to the trunk of her car for storage.

Benefits

This design is better than the existing solutions because it does not break the law and hold the trigger up; as soon as the client stops leaning on the lever, the trigger will release and stop the flow of gasoline. This device is better than other designs from the class because it is more durable the most of the other designs and takes very little force to enable the flow of gas. However, in making it more durable and efficient, the device ended up being heavier than most others. Effort was made to keep the weight down by punching holes in the frame and cutting down the size. This design is also one of the few that eliminates the need to step over the gas hose and allows the user to directly face the gas pump display while pumping gas, thereby making the process faster and more convenient in addition to reducing the pain and effort required.

The Trident

Supportive Design
F14 -126 - 2



Problem Description

The purpose of this assignment is to create a device which will be used by the client and user Sandi Mugford to help maintain her independence and reduce pain during her visit to the gas station. The device that we design will assist her in paying for her gas with a credit card as well as pressing the keys on the keypad. We will create a report and construct a prototype based on the design which will be assessed by the clients Dr. Fleisig, Abbey, and Katie.

Design

The design of the device consists of a handle with one end that serves the function of gripping the credit card, and another end used to press the keys on the keypad. The design includes padding at the area where the user will grip the device. On the end of the device that serves the function of gripping the card includes a metal fork with padding on the prongs to allow extra grip on the component that will come in contact with the card. The other end of the device has a stylus used to press the keys on the keypad. The design will be fairly lightweight, in the sense that the weight of the device will in no way hinder the movement of the user. The device will also be small enough to be held by one hand while being easy to use.

Functionality

The objective of the prototype is to assist the user with inserting/swiping the credit card and help with the use of the keypad. The fork prongs in the design help fulfill the function of gripping the credit card easily. The pipe provides a wide enough extension to limit excessive use of one's hands when using the device. The pipe is also a mean of combing the fork and stylus which allows our product to perform multiple functions. Area between the bent fork and the pipe is used to secure the credit card in place if one was to swipe into the machine. The stylus at the end of the device is used to navigate the keypad; it also assists with accurately pressing keypad with minimal force at the gas station

Materials, Components, and Assembly

The materials and components of the device are as follows:

Material	Source	Cost
Pipe	Home Hardware	$7.00
Duct Tape	Convenience Store	$5.00
Super Glue	Convenience Store	$5.00
Fork	Dollar Store	$2.00
Chopstick	Centro	free
Total:		$19.00

To construct the device, a pair of pliers was used to group the prongs of the fork together. Duct tape was then wrapped around these prongs, and pliers were used again to bend them back. The fork was then attached to one end of the metal rod by the handle of the fork with the use of duct tape. On the other side of the pipe, a chopstick was attached with duct tape so that the rounded end was protruding from the end. Based on the time it took to construct the prototype, process of assembling the device should be a fairly fast procedure. Most of the time being devoted to manipulating the fork ends; assembly should take at most twenty minutes. Special instructions may be needed to specify how to actually manipulate the fork prongs into its unique shape which allows precise grip and removal of credit card.

Use

1. Device would be kept inside the car when not in use
2. To use the device, the credit card would be held in one hand, while the other hand holds the device; Device would be held at the pipe to insert credit card into card slot.
3. The card is inserted by wedging it between fork prongs.
4. One would move the device to insert attached credit card into card slot
5. Device would be pulled out, leaving the card in credit card slot
6. Stylus on other end of device would then be used to input her information into the keypad
7. Device would then be place on top of car when not in immediate use
8. To remove card, wedge card inside the slot between fork prongs again, apply leverage and slowly pull card out of the machine.

Benefits

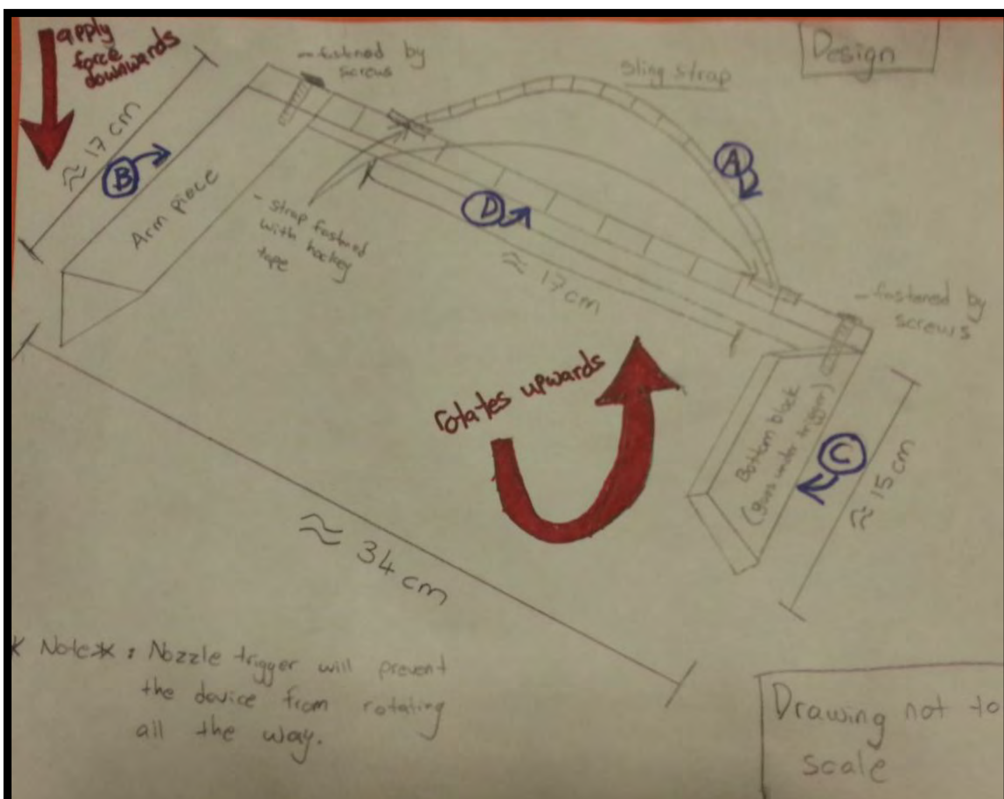
The device brings many benefits for the user. For instance, the device reduces the range of motion required by the user when using the credit card. The client also mentioned that accurately pressing the keypad with a finger was difficult; as the stylus eliminates the use of one's finger in the process, the device increases the accuracy of the user when pressing the keys. The device is also be considered a multipurpose tool as it covers both the credit card and keypad aspect of the problem as opposed to other designs which are limited to only one aspect. The design is also very versatile, as the device is not only limited for the use at the gas station, and may be used in other situations where a credit card or stylus may be needed. Furthermore, the overall design of the device is very simple, lightweight, and durable allowing it to be a very convenient portable device that can be carried almost anywhere.

Pump Pal

Accessibility Innovations

F14-126-3

(Final working version of the device with a length of 34 cm and width of 17cm)



(The sketch of the design is illustrated above.)

Problem Description

The goal is to establish a means of a design of a device for Sandi to ease the process of fueling up her car at a gas station by overcoming the many obstacles she faces during this process. Sandi wishes to maintain her independence while remaining comfortable. This will be achieved by working with the clients; Dr.Fliesig, Abby, and Katie.

Design

The device is roughly 34 cm in length and 17 cm in width, weighing approximately 2 lbs. The wood is sanded and wrapped in fabric tape to reduce chance of splinters and adds to the overall comfort of using the device. The blocks labeled B and C on the sketch are of different sizes and the device is reversible, allowing the convenient fit of different gas nozzles. The blocks are also wedged allowing the insertion under the gas nozzle to fit more easily.

Functionality

The Pump Pal specifically performs and achieves the objective of easing Sandi's fuelling process by solving the problem of operating the gas nozzle. Pushing the arm piece (labeled B on sketch) downwards will rotate the device causing the bottom block (labeled C) to wedge under and hold the trigger on the gas nozzle. The strap (labeled A) would make the device easier to carry. The arm piece delegates the task of squeezing the trigger with the user's fingers to any downward motion, allowing the usage of larger joints (such as her arm) causing less pain.

Benefits

The device does not require any grip onto the nozzle or device handle. Negligible force is required and enables the usage of larger joints allowing the client to use any downward force to incur gas flow. Manufacturing the device is inexpensive and requires very little time. The device is reversible, small, light weight, easy to carry and use is intuitive.

Materials, Components and Assembly

The device consists of 3 wooden blocks, 4 screws, hockey tape and a ribbon. Individual prices of each part are; wooden blocks of $7.00 in total, screws sum up to $3.00, one roll of hockey tape is $4.00, and the ribbon is $2.00. With a total cost of $16.00. All the materials were found in Canadian Tire. The tools that were required for construction, included: sandpaper for the smooth wooden surfaces, circular saw to cut the wood, a drill to fasten the blocks together. The estimated time to make the device is approximately 3 hours. The circular saw was handled with caution since it was a dangerous tool. The wooden blocks were marked before they were cut in order to get the accurate wedge dimensions. The blocks (B and C) were fastened to the support block (labeled D), in a slanted manner providing the user a more comfortable resting position.

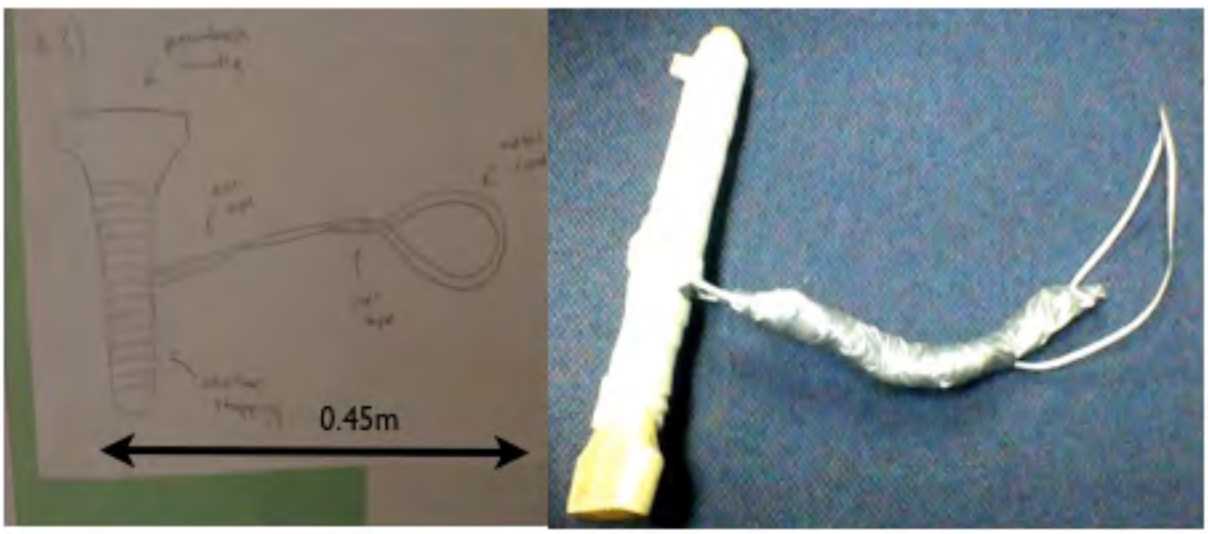
Use

1. Obtain the device from the stored location in the car (passenger seat)
2. Using the ribbon wear the device across the shoulders like a bag and continue with the gas price and selection of gas.
3. Take off the ribbon from the shoulders while holding onto the device and wedge either end of the smaller blocks under the nozzle trigger.
4. Once the block is wedged under the trigger, place either arm on the surface of the apparent top block and provide a large movement downward and hold that position.
5. As the arm is making the downward motion, the device will rotate and lift the trigger upwards.
6. Once the fueling process is finished, lift the top block upwards and wear the ribbon on the shoulders while placing the nozzle back.
7. Store the device back into the car safely (passenger seat).

The Pump It

Dynamic Engineering

Team Name
F14-126 -4



Problem Description
To build an artefact for user/client Ms. Sandi Mugford to achieve as many of the following goals of the gas pump as possible: pumping gas, inserting/removing her credit card when paying at the pump, and using the keypad. The group chose to address the problem of assisting Sandi Mugford in pumping gas. This was chosen because the insertion and use of the credit card, although challenging, will become less of a problem in years to come with the integration of Interac Flash, Mastercard Paypass, and Visa Paywave into fuel pumps.

Design
The Pump It, as seen in the visual, was constructed with a length of one and a half feet (.45m), when the loop is at it's correct size. The length of this device is perfect for Sandy to use with her car, and has a weight of roughly one pound (0.45Kg).

Functionality
The Pump It can reduce the use of gripping motion on the gas nozzle which significantly reduces pain for the user. The client will only need to push/pull the handle to lift the gas lever up, which requires little to no finger movement. This function satisfies the objectives determined by the client, Sandi Mugford.

Materials, Components, and Assembly
The Pump It is assembled with aircraft cable, a paintbrush handle, duct tape, and weather stripping, for a total cost of nine dollars. The duct tape and paintbrush were purchased from Home Hardware, and the weather stripping and aircraft cable were purchased from Home Hardware. Scissors and wire cutters were required for construction of the Pump It. The total assembly time was thirty minutes. The device was assembled by wrapping one end of the aircraft cable around the paintbrush handle, and securing it to itself with copious amounts of duct tape. The end of the aircraft cable was taped back on itself in a loop, it is wide enough to allow the paintbrush handle to fit through. The handle was wrapped in weather stripping to allow a comfortable grip for the user, thus increasing comfort in the cold Canadian climate.

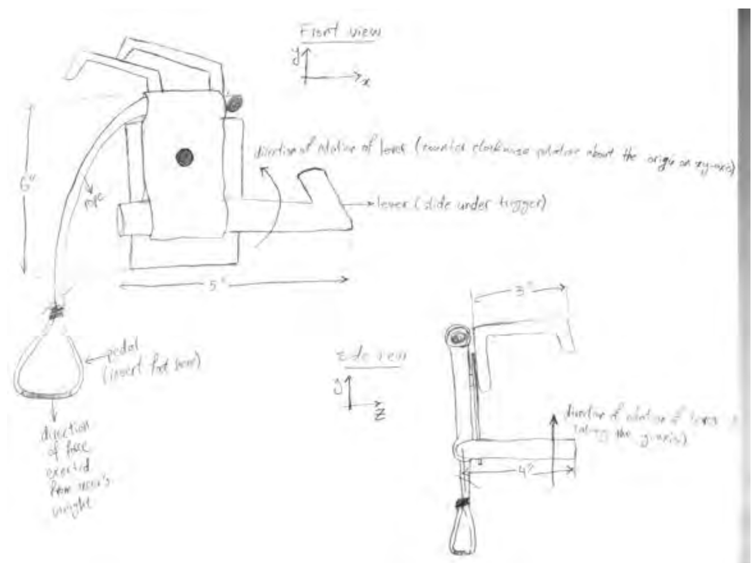
Use
1) Sandi will remove The Pump It and her credit card from the trunk of her car.
2) Sandi will push the handle partially through the loop at the end of the cable, creating a handle that allows her to hook the device over her arm.
3) Sandi will remove the gas nozzle from the pump, and insert it in her car.
4) Sandi will remove the device from her arm, and feed the cable through the opening on the handle of the gas nozzle. Following this, Sandi will insert the handle through the loop, enclosing the handle within the slipknot.
5) Sandi will apply a force straight upward, or straight downward, with a flat open palm (or two flat open palms) on the handle.
6) Sandi will release pressure on the handle, loosening the hold on the trigger, when the desired amount of gas has been pumped.
7) Sandi will remove the device from the nozzle by pushing the paintbrush handle through the loop, and then recreate the closed loop to put it over her arm while she completes the payment process.
8) After the fuel has been paid for, Sandi will return her credit card, and The Pump It to the trunk of her car.

Benefits
The Pump It was designed to be a superior device. Original constraints placed on the device are to ensure that the device is extremely durable, and very light. The final design accomplishes both of these constraints, with the aircraft cable requiring cutting tools to break. In comparison to similar devices, The Pump It is significantly less complex to use, as it is composed of no moving parts, and only requires Sandi's hands to be in their most comfortable position. As the Pump It is composed of durable material, normal wear and tear will not affect it as significantly as it affects devices incorporating moving parts. More complex or fragile designs would be affected by the frequent drops the device will ultimately have to survive. Other similarly submitted devices appeared to be assembled from heavy materials, something that makes a big difference in the operation of the device, considering Sandi already has trouble with the heavy weight of the pump. Given these factors, it is obvious that the Pump It, created by Dynamic Engineering, is the correct choice for the job.

EasyPump

ACS
ArthriCare Solutions
Arthritis care; better nowhere

ArthriCare Solutions
F 14 -126 -05



Problem Description

Create a device for the user Sandi Mugford that fulfills the requirements of the clients (Dr. Fleisig, Abbey Desjarlais, Katie England). The device will help make refuelling the car by using the gas nozzle an easier and less painful experience for Sandi, which will enable her to be independent.

Design

The device weighs approximately 4.4 lbs. and is 6”x5”x4” when placed on the gas nozzle (refer to the above sketch). The rope can be adjusted to the appropriate length for the user in order to minimize movement of foot and maximize her stability.

Functionality

The EasyPump device helps the user hold the gas nozzle's trigger for any amount of time the user needs without the use of her hands. This device solves the problems that the user had when fuelling her car using the gas nozzle which were irritation and pain in her hand. This device uses the user's foot and weight to apply the required force onto the trigger.

Materials, Components, and Assembly

The lever is a 9" long and 0.6" thick copper tube (costing around $2 and can be purchased at any hardware store) which is bent at the middle into an L-shaped lever. Now the copper tube needs to be wrapped with duct tape for insulation against hot and cold temperatures, also to increase grip.

The middle piece of the device is made of thermoplastic which can be purchased online or through any other retailer that has it; for this device one piece of 2"x10" thermoplastic is needed which will cost about $10. The thermoplastic needs to be heated first in hot water, once it has been heated enough where the material is clay-like; it needs to be folded from the middle with the lever inside at the position seen on the sketch above, and enough space at the top of the thermoplastic for the rope to go through. While the thermoplastic is still warm a whole 0.6" in diameter is poked through the middle, this is where the screw bolt are inserted to keep this piece attached to the hook and allow rotation. When the thermoplastic returns to room temperature the lever can be inserted at the bottom and the rope goes through the top where a knot is tied at the end and melted using a lighter to prevent the rope from slipping out.

The pedal is simple created by taking the other end of the rope, melted using a lighter and attached to a higher point higher on the rope where it is comfortable for Sandi's foot.

Lastly, the thermoplastic piece is attached to the hook (which can be purchased at any Home Depot location for $10) using a screw, bolt, and a small piece of the copper tube slightly longer than the thickness of the thermoplastic piece to allow rotation. The hook already has a whole in the middle, so the screw goes through the whole below the hook into the thermoplastic piece, and finally the small copper tube is inserted into the middle piece and the bolt is fastened tightly.

Use

1. The device can either be stored in the glove compartment or the trunk of the car. But it is suggested to keep the device in the trunk since that's where Sandi keeps her purse.
2. After she has securely placed the gas nozzle into the tank, Sandi lifts the device by placing her hand under the hooks; she then lifts the device and moves it over to the gas nozzle.
3. At this point the lever is hanging parallel to the car. She will need to slide the lever under the trigger and drop the device from the hooks on to the nozzle, where the hooks will be adjusted by themselves to maintain balance.
4. After she has placed the device onto the nozzle, the pedal would be hanging below the device, about 1.5-2 inches above the ground where she can slide her foot into the pedal, step down and stand normally while the trigger is being held up by the lever using her weight.
5. When she is done filling up her car, she can simply pull her foot out of the pedal, lift the device off the nozzle from the hooks and slide out the lever; now she can place the device back into the trunk of her car and enjoy a nice drive since she will have no joint pain in her hands from refuelling.

Benefits

For starters Sandi doesn't use her hands to operate the device which completely eliminates any pain she would otherwise experience from using the nozzle. The device is also light weight, making it easy for Sandi to maneuver. And lastly the device is easy to use and handle since it is very simple to place it on to the gas nozzle.

Slide N’ Go

ART (Arthritic Recovery Team)
F 14 - 126 - 6

The device is approximately the size of the user’s forearm.

Problem Description

To design a device that aids Sandi Mugford during the refueling process of a car at a gas station. The goal is to continue Sandi’s independence at the pump by reducing pain and energy output while she is inserting her credit card and selecting options with buttons. The goal is accomplished with the aid of Dr. Fleigsig, Katie, Abby and Sandi.

Design

The device is about the size of the user’s forearm, and weighs less than five pounds. The device slides up the bar to close and pinch the two arms together. The tips are wrapped with tape, to provide a greater frictional force to makes sure the card does not slide out. The opposite end has a ball for easier grip and control, as well as giving a large surface to grab if the device was dropped.

Functionality

The device increases precision and control when inserting the card into the reader at the gas station. As well, the client can slide the disk towards the tip end, and then use the tips to press buttons on the keypad. The device covers two of the problems, but does not address the issue with the gas nozzle unfortunately.

Materials, Components, and Assembly

The device is made out of a metal bar from an umbrella, a tennis ball, a thermoplastic disk and some duct tape. The device costs about ten dollars in total, since the umbrella and the thermoplastic was already available for us, however, with an umbrella and thermoplastic, the total cost would be around twenty to thirty dollars. The thermoplastic is the only material that is difficult to find, however it can be purchased from several websites. Other materials can be obtained from hardware stores or dollar stores. The only tool the user need is a pair of scissors. Construction took about thirty minutes and the only instructions needed is to remove an arm of the umbrella, and heat the thermoplastic to form a disk, then cut the disk from the sheet.

Use

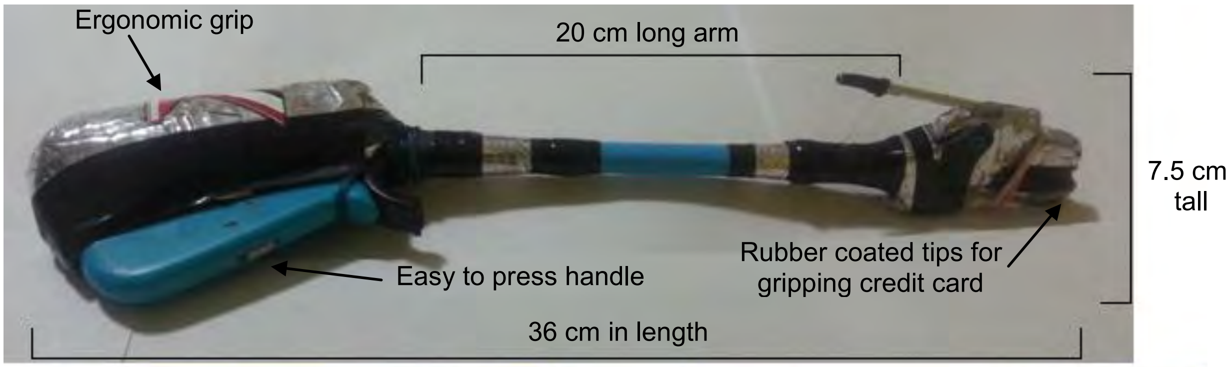
1. Remove the device from storage (car side door or trunk)
2. Place card on the dash/flat surface
3. Line up tip end on the card then slide the disk toward the card
4. Slide the card into the reader
5. After purchase is complete, slide the card out of the reader. If the user did not use the tips to press on the keypad, the device is already set up. If the user did, then follow step 3 again.
6. Slide the disk towards the ball, remove the card and store the device in trunk or side door. If possible, a large enough purse can be used. As well, the card can be left in the device.

Benefits

The device allows Sandi more control over her movements with the card, and is extremely less stressful. The device will not drop the card if she misses, and is simplistic to use, even easier than her current method of using two hands and sandwiching the card between them for stability. The device is lightweight, waterproof and weatherproof and is takes little to no effort to use and understand. The ball handle makes it easy to grip and makes it easy to pick up, if it were to be dropped. ART's design excels at all required objectives, being extremely lightweight and portable. As well, the device could be used by more than just Sandi. Anyone who has suffered an injury to the hand can benefit from the device as it performs the functions in the small areas. As well, the user could use the tips to press buttons on the machine to select payment forms, making it multi-functional.

The Goose Grabber

Team Paragon
F14-126-7



Problem Description

Abbey, Katie and Dr. Fleisig require a device or devices to aid in Sandi Mugford in fueling her car at gas stations. Sandi Mugford has rheumatoid arthritis in her hands and has difficulty when inserting and removing her credit card, pressing keys on the keypad, and pumping gas. The resulting device should assist Sandi while inserting and removing her credit card from gas station machines; reduce her pain and increase her independence.

Design

The design of the Goose Grabber was made to be both efficient in weight and size, and thus portable, as well as easy to activate and use for the function it was designed to accomplish. After completing many prototyping processes, it was concluded the final product had weighed about 160 grams and obtained a size that was about 36 cm in length, 7.5 cm tall, and about 4 cm thick at max. To the user and client, Sandi Mugford, the Goose Grabber is the perfect size and weight needed to achieve the act of inserting and removing her credit cards from machines at gas stations. Its extremely lightweight design and easy to press trigger provides a solution, yet no strain on Sandi Mugford's body.

Functionality

In regards to what was asked of the client, Sandi Mugford, the Goose Grabber was designed to not achieve all of the tasks asked of in specific, but instead specialize on the task of inserting and removing the clients credit card into and from the machine. Although the Goose Grabber was only designed to assist the Client in inserting and removing a credit card into and from a machine, it was designed to do so very well, and is considered a successor in the task.

Materials, Components, and Assembly

The construction of the Goose grabber is fairly simple and can be created at a low cost. Materials used and tools can be purchased from a dollar and a local hardware store. The materials used were: duct tape, electrical tape, dollar store grabber, cloths pin, garbage bags, rubber bands, recycled cardboard, and a hollow metal rod. The materials that can be purchased from a dollar store are garbage bags, rubber bands, and the dollar store grabber. The rest of the materials can be purchased from your local hardware store. The cost of the materials adds up to no more than 11 dollars to produce 1 Goose Grabber, and would cost less individually if multiple were made. The tools needed for the construction are scissors, glue, drill, and a pipe cutter. In order to produce one Goose Grabber, an accumulation of approximately 2 hours will be required.

Benefits

After reviewing the design of the Goose Grabber and assessing its functionality, it was determined that it was quite successful in achieving the task it was designed to do. With its lightweight and slim design, with easy to squeeze handle, the client can use the device comfortably and painlessly to insert and remover her credit card from gas station credit card machines. In comparison to other designs in other groups, Team Paragon felt that the device created surpassed the other devices due to its smart design and convenience. When other groups had been asked what the outcome would be if the client Sandi Mugford had dropped her credit card, it seemed as though the goose grabber was the only one that could achieve the task of picking it up again. Due to its extended arm length, if dropped Sandi would be able to successfully reach to the ground and pick it up again after propping it up on her foot, without bending over that much. The Goose Grabber as a result is extremely beneficial to Sandi Mugford and her struggles with her credit card, and noticeable surpasses other designs produced to solve the same situation.

Use

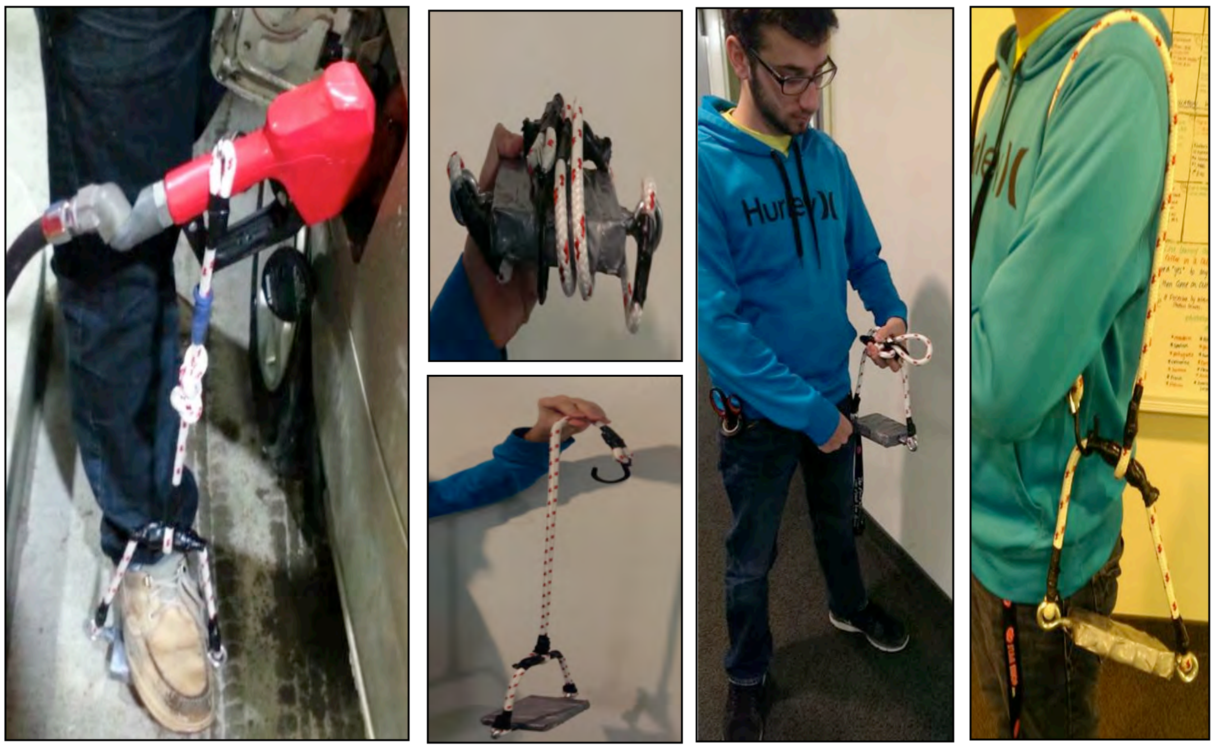
When the client, Sandi Mugford, first drives into a gas station, she must exit and proceed to fueling her vehicle. In the following order, the client will perform the listed tasks.

1- Exit vehicle, and proceed to trunk of car to retrieve goose grabber and credit card
2- Hold goose grabber in one hand, and credit card in other, while squeezing trigger
3- Position credit card gently in between claws of grabber and release grip on trigger to close claws onto the credit card.
4- Insert credit card into the machine until machine reads the card.
5- Gently squeeze trigger to release card from grip, and place grabber on the hood of car.
6- Automatically open gas cover to reveal cap-less gas tank opening
7- Fuel vehicle as desired be client.
8- Payment will be conducted by client while goose grabber rests on hood of car.
9- When fueling process is completed, the client will then retrieve card from hood of car, squeeze trigger to open claws over credit card, and release to close on card while removing card from machine.
10- The client can then proceed to trunk on car to put the goose grabber and credit card back in its place, and close the trunk

When entire process is completed, the Client may return to vehicle and drive away as desired.

Pedal To The Metal

MAGNA Corporation
D15 - 227 -01



Problem Description

People suffering from Rheumatoid Arthritis experience serious difficulty when using a self-serve gas station. Holding the gas nozzle for an extended period of time is extremely strenuous and, therefore, is an challenging problem for Magna Corporation to approach. Magna Corporation's goal is to create a means to help persons suffering from Rheumatoid Arthritis to use the gas station in a way that causes considerably less pain and takes substantially less time.

Design

Pedal to the Metal is lightweight and has been designed to be compactable for storage. The device weighs about two pounds. Furthermore, as seen in the model above, the pedal is sufficiently sized to accommodate large shoes and boots that may be worn in the winter months (width of 20.5cm and height of 17.5cm). The rope is thick in diameter (1cm), allowing for easy gripping and manipulation of the device when needed. Also, the pedal is the heaviest part of the device, which allows the hanging sections of the device to stay anchored in place, resisting forces from wind and limiting sway. When compacted for storage the device has dimensions of 20.5cm x 14.0cm x 4.30cm. These dimensions are very suitable for storage areas such as glove compartment boxes, center consoles, trunks or seats.

Functionality

Pedal to the Metal can assist the user in multiple ways when pumping gasoline. It can be used to transport the pump nozzle to the user's vehicle as well as to help engage the gas pump trigger using leg and body weight power. This allows users with Rheumatoid Arthritis to place stress on larger joints in their body, thus preserving the function of their smaller joints such as those present in the wrists and fingers.

Materials, Components, and Assembly

The materials used in the construction of Pedal to the Metal are very easy to acquire. They are as follows: 3/8" Dacron braided rope ($1.26), scrap metal (No cost), galvanized wire ($1.25), electrical tape ($1.50), duct tape ($1.50), adjustable hoop bolt ($3.79), wood (No cost), a stainless steel bolt and nut (No cost), and super glue (3.99). The device can be built for approximately $13.29 in total, which is relatively inexpensive. The materials can be obtained at Canadian Tire and from parts found at home (scrap metal, wood, and nuts and bolts). The scrap parts could also be requested at large hardware stores for no cost whatsoever. The tools required for construction are pliers, scissors, snips, and a hack saw. It takes approximately 45 minutes to construct the device; the majority of the time comes from waiting for the glue to dry. Constructing the device is quite straightforward and needs no special instructions or skills. The only component that needed to be done outside of the group was getting the scrap metal hook cut down to the appropriate size. This could be avoided by having a suitably sized bolt cutter.

Use

When the user reaches the gas station they will perform the steps as follows:

Step 1: Remove the device from their preferred storage area. The device is compact and can fit in the glove compartment, centre console, trunk, back seat, and floor.

Step 2: The hook part of the device can be attached to the base of the device and will form a shoulder strap that the user can wear while paying for gas.

Step 3: Once the user has paid for gas, she can place the nozzle on the base of the device and use it to assist them to carry the nozzle over to her vehicle.

Step 4: Once the user has placed the nozzle in the fill spout, she can proceed to place the hook on the trigger of the nozzle and send the foot pedal over the top of the handle and down to the ground.

Step 5: The user is now ready to pump gas. She will place their foot in the pedal and apply a downward force, which will pull the trigger upwards, allowing gas flow.

To end the flow of gasoline, the user removes her foot from the pedal. To take the device down all the user has to do is take the hook off of the trigger and reel the device back up. This is not difficult because the device is very lightweight and the thick string makes gripping easy for the user.

Benefits

Pedal to the Metal offers several features that give it an edge over other products. First, it is incredibly cheap to make. At $13.29, the device offers great value for the end user. It eliminates any excessive need of force from the hands and instead utilizes the client’s body weight and more functional limbs--the legs. This is crucial given the extent of the client’s injuries, especially in the area of the hands. Furthermore, the device is weatherproof, which is a very important feature considering Canada’s volatile weather. The product’s robust nature allows it to have further longevity over other products given the Canadian climate. The waterproof nature of the pedal keeps the process relatively clean, saving any sort of mess from being transported to the interior of the car. The nature of the device also allows the general operation of the pump to be sanitary because of minimal barehanded contact with the pump. The simplicity and low-key design of the device offers a process that is not only pain free, but also contributes to maintaining the user’s independence and dignity.

Credit Card Insertion and Removal Device

New Angle Design
F 15 - 227 - 2

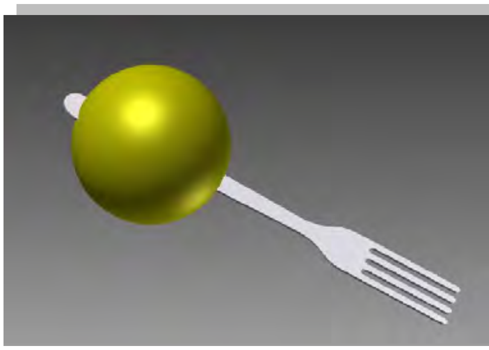


Figure 1 - CAD model of the device

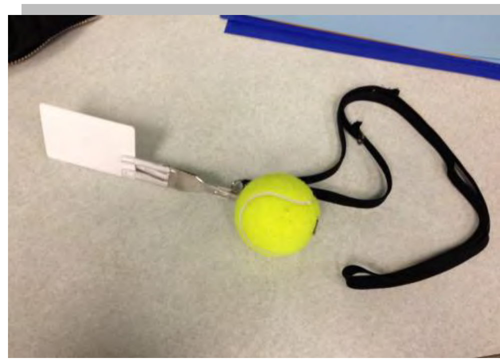


Figure 2 - Final device

Problem Description

The device is designed to assist the client, Sandi Mugford, with credit card insertion and removal at the gas station. The client has rheumatoid arthritis, making credit hard handling a challenge. The device is intended to reduce the pain she experiences, reduce the time it takes her to fuel the vehicle, all while maintaining her independence.

Design

As seen in Figure 2, the final device consists of a tennis ball, fork, vinyl tubing, and a lanyard. The device weighs about 0.4lbs or 185 grams. This is very light and therefore easily transported by the user. It is about 15cm in length, not including the lanyard.

Functionality

The device can hold a credit card in place and assist with insertion into the electronic payment machine. It can grip the card with enough force for easy insertion and removal from the machine. The product can remain on the card while transaction takes place, allowing the user to remove their hand and perform other activities. The device performs the desired functions to address the credit card insertion design problem.

Materials, Components, and Assembly

The materials used to produce the device are a tennis ball, a dinner fork, a lanyard, and clear vinyl tubing, all held together with hot glue. The materials are very inexpensive. The fork, lanyard and hot glue can be purchased at a local dollar store, the tennis ball at Canadian Tire, and the clear vinyl tubing is found at most hardware stores such as Home Hardware. The clear vinyl tubing cost eighteen (18) cents for the amount used, one tennis ball cost $1.47, the lanyard cost $1.00 and one fork cost $1.69. In total the device costs $4.34 in materials. A hot glue gun, pliers, scissors, and a box cutter are required tools to construct the device. The device takes approximately 1 hour to construct. The device is quite simple and should not require complex instructions for assembly, however an assembly drawing and some simple instructions may be required for construction in order to ensure the product is made properly as intended.

Use

1. The user will store the device in a personal luggage article such as a purse, or a compartment of the car such as the glove box. The user will remove the device from its place of storage and remove the protective cover.
2. Next, the user will place the lanyard around their neck.
3. Once the device is hanging around the neck, the user will then place his/her electronic payment card between the tines of the fork, as to secure it in place.
4. When the card is secure, the user will direct the card towards the payment machine and slide the card into the machine.
5. At this point, the user can now remove the card or keep it in the machine and the lanyard will remain on the user in order to free the hands for use with other tasks at the machine.
6. Once payment is complete, the user will remove the device along with the card from the machine.
7. Finally, the device shall be returned to its storage location.

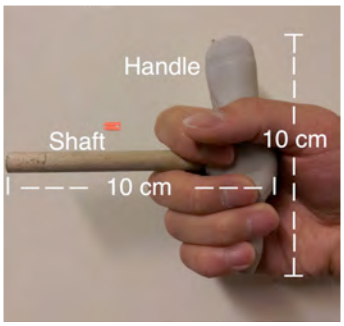
Benefits

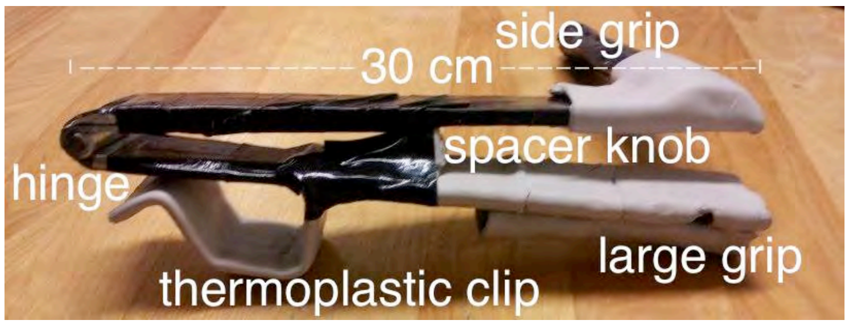
The EZ-PayGas card insertion/removal device is better than any existing solution for this problem. The device costs under $5 which is inexpensive in comparison to other minor daily purchases. It weighs less than half a pound so it is very easy to transport. It is light and small enough to fit inside a purse, bag, or in a car compartment such as a glove box. The device was designed for use at a gas station electronic payment machine, however it is versatile enough to be used anywhere that electronic payment is required such as a bank or a grocery store. It is safe in that it has no sharp edges or loose parts that could cause injury or pain. The product is very easily reproduced as it is made entirely out of inexpensive household objects and requires little tools, skill, or time to produce. Overall the product provides a very inexpensive and simple solution to a very relevant problem.

G. P. A. 12.0

Gas Pump Assistant 12.0

Prestige Worldwide
F 1 5 – 2 2 7 - 3





Problem Description

These devices are being designed for Sandi and Dr. Fleisig for the purpose of reducing the pain and fatigue that Sandi experiences during her visit at the gas station. The devices should help Sandi push the buttons on the keypad, push and pull the payment card out of the card slot, transport the nozzle to the gas chamber, and control the flow of gas out of the nozzle. The device(s) should enable Sandi to maintain her independence while refuelling her car as her symptoms continue to get worse.

Design

The keypad device weighs about 1 lb. and is about 10 cm by the handle and shaft. It fits comfortably in the hand and is able to fit in a bag, purse, or jacket pocket. The gas nozzle device weighs about 2.5 lbs. and is about 30 cm in length. Due to Sandi's arthritis, the bottom bar has a larger grip to reduce the amount she has to close her fist to hold the device. The device is fairly large (size of a forearm), but has the benefit of increased grip area and being lightweight. The spacer knob is present to prevent the top bar from dropping onto the bottom bar and damaging the fingers holding on.

Functionality

The keypad device will push the buttons on the keypad with increased precision and prevents painful physical contact between the fingertips and button surfaces. The gas nozzle device is able to control the gas flow out of the nozzle without having to use one's own hands. With regards to the problems addressed, these devices fulfill their role by avoiding painful motions associated with each process (fingertip pressing, and hand squeezing).

Materials, Components, and Assembly

The keypad device requires a wooden dowel, duct tape, glue and thermoplastic. The gas nozzle device requires a wooden bar, cardboard, mini wooden dowels, duct tape, glue, thermoplastic, and a metal hinge.

All materials except the thermoplastic and hinge can be bought from a dollar store. The hinge can be bought from any hardware store and the thermoplastic can be purchased online. Necessary tools for construction are scissors for cutting cardboard and thermoplastic, a knife for cutting the dowel, and a container for heating water for heating the thermoplastic. The total cost of the materials is about $35.

The keypad device will take about 15 minutes to assemble. No special instructions are required. The only requirement is the dowels must be attached in a T-shape. The gas nozzle device will take about 1.5 hours to assemble. Special instruction for this device are that the thermoplastic clip is attached close to the rotating end of the hinge and all thermoplastic wrapping is done at the end.

Use

Keypad Device:

1. Device is stored in bag/purse when going to the gas pump
2. User holds device in hand; handle in palm, between thumb and index finger and shaft protrudes out between index and middle fingers
3. Proceed to press buttons; store in bag/purse when finished

Gas Nozzle Device:

1. Device is stored in back seat (on gas cover side) while user completes pre pumping processes
2. Retrieve device from back seat; attach onto gas nozzle from the side via clip underneath the bottom bar
3. Lift top bar via side grip to ‘squeeze’ nozzle shut
4. Store in back seat again when finished pumping

Benefits

The keypad device is compact, lightweight and very portable. It also reduces the pain on Sandi’s fingertips since the pressure is exerted on the device instead.

The gas nozzle device is lightweight for its size and has an increased gripping area. This device doesn’t require Sandi to squeeze with her own hands, eliminating a painful motion. Unlike existing products, the device does not lock the gas nozzle into place, thereby adhering to Ontario gas station laws. The device also benefits from no additional set up. Other competitors’ devices require a cable or rope to be looped around the nozzle, or have something be set on the ground, like a pedal. Other devices also require Sandi to step down on a mechanism that will squeeze the handle. The motion of lifting the leg may cause Sandi to lose her balance and further injure herself.

Able Cable

No Constrains Inc.
F 15 - 227 - 4

Fig. 1

Fig. 2

Fig. 3

Problem Description

Using the direction of Dr. Fleisig, Ms. Sandi Mugford requires a solution to aid her while operating the gas nozzle while at the gas station. Her independence in performing these tasks is currently being threatened by the pain she encounters in her joints as her rheumatoid arthritis worsens.

Design

Able Cable is made primarily of PVC plastic. It weighs less than three pounds although the weight is only relevant while the user is transporting it from the trunk to the door handle. When it is in use the car and gas nozzle support all of the device's weight **[Fig 2, 3]**. The main lever is approximately 15cm x 30cm and the plastic used is ¼'' thick to make it easy for the user to grip. The cable can be wrapped around the lever so the entire device can be stored to fit in a 30cmx15cmx15cm space **[Fig 1]**; it can be easily stored in her trunk while leaving space for other items.

Functionality

By simply leaning on the device's lever, the gas nozzle is clamped keeping sustained pressure while requiring little effort and no use of the user's vulnerable joins. The device is lightweight, portable, and weather independent. Able Cable is also very durable so it can resist drops, being in the user's trunk with other items and can last a long time. There are no hazards brought on by the device as it is made of a non-absorbent material and does not have metal on metal parts that could provide a source of ignition around fuel. The user does not have to support the weight of the device while it is in use and can be easily operated without very much overall movement of any joints. Furthermore, Able Cable stops pumping gas as soon as the user releases pressure so there is no risk of overfilling the car even with misuse of the device.

Materials, Components, and Assembly

PVC plastic is the main material used to produce both the lever and clamp of Able Cable. Other components include metal fasteners, protective padding and a bicycle cable connecting the device together. Construction requires a band saw, drill press, milling machine, epoxy, and a screwdriver. Assembly takes under 20 minutes once the PVC is cut to size. Under limited production, Able Cable costs $43.00 to make but if the product was to be mass-produced the cost could be significantly reduced. Construction would need a detailed list of steps and annotated diagrams would help as well.

Use

Once the user gets to a gas station the steps for use include: 1. User gets out of vehicle and retrieves Able Cable from the trunk where the user may also store other objects such as payment for the fuel. 2. The user places able cable in its wound, compact form on the rear door handle of the vehicle. 3. User makes payment at pump and places gas nozzle into the vehicle. 3. The user then proceeds to place the clamp from the device into the gas nozzle **[Fig 2]**. 4. Using any part of the body the user applies pressure to the lever, which is supported by the door handle of the car. 5. Once user has filled the desired amount of fuel into their car, they simply release pressure on the lever. 6. User will remove clamp from the nozzle and wind the cable back around the lever. 7. The gas nozzle is put back into the station. 8. Able Cable is put back into the trunk along with the user's payment option. 9. Trunk is closed and user re-enters car concluding the refuelling process.

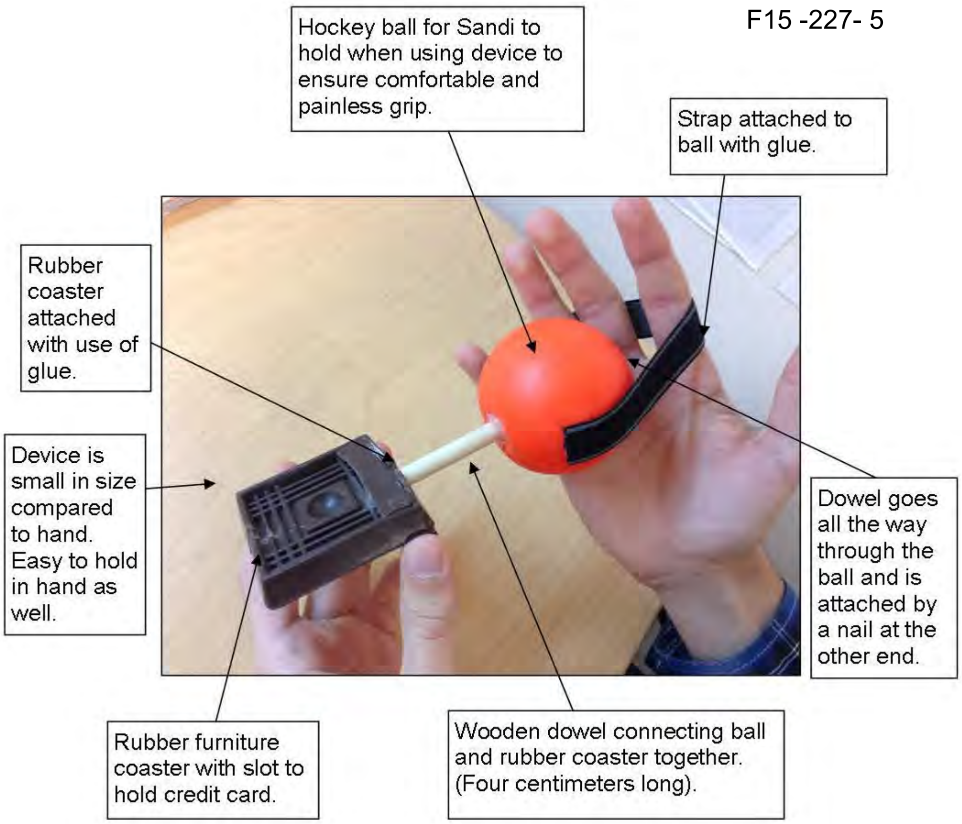
Benefits

Unlike other designs, Able Cable is light weight for the short amount the user even has to support it since it is made to sit on the car's door handle. If the user lets go of the device while using it, it will not fall to the ground forcing the user to reach down to pick it up. There is absolutely no strain on the user's hand and there is no requirement to use *any* muscles from the upper body to sustain pressure as it can be effortlessly leaned on at the hip. In addition, the device is completely independent from the ground so no adverse ground conditions can affect the performance of the device (i.e. curbs, ice, snow, etc). Also, since Able Cable is 100% mechanical, the user does not have to worry about any charging of heavy batteries between uses, and there are no electrical hazards such as sparks, electrocution or the possibility of the battery dying while in the middle of pumping. Since the device is constructed of non-absorbent material, any mishap of dropping in a puddle or being rained on will not affect it. Moreover, as a result of being constructed primarily of PVC, a non-conductive material, it will not be cold to the touch in winter conditions and because it is not operated via any sort of small button, it is still trouble-free to control with large winter gloves.

Solving the problem of squeezing the gas nozzle trigger is more useful than others because there are already products in place for helping with credit card payment such as the tap-to-pay style of card. One of the best ways to improve the keypad is to make larger buttons, so there is not much of an opportunity for creativity in solving that issue.

Grip-O-Matic

Fueling Independence Inc.
F15 -227- 5



Problem Description

The team must design a solution for Dr. Fleisig and the user, Sandi, who has rheumatoid arthritis and struggles to refuel her car at the gas station. The device would assist Sandi with the process of paying with her credit card at the pump. It is important for her to maintain independence and conserve energy while performing this task. Furthermore, the device should minimize the quantity of pain she experiences while paying for her gas.

Design

The design is fairly simple. The ball that the user must hold on to is attached to a dowel that connects the ball to a rubber furniture coaster that serves the function of holding the credit card. The dowel is only four centimetres long, increasing the accuracy of the device while remaining long enough so that the ball doesn't obstruct Sandi's view of the ball. The rubber material of the coaster provides optimal grip to achieve a secure hold on the credit card. There is also a strap that attaches Sandi's hand to the ball, relieving stress from her hand when holding the ball and preventing her from dropping the device. The device itself is very light and is small, equivalent to ¾ of a water bottle.

Functionality

Functionally speaking, the device allows Sandi to easily insert and retract a credit card into the credit card slot at the gas station. The device does everything that was requested of the user. Specifically, it is much easier to hold than the credit card itself. The ball provides a stress free way of handling the card. Also, the dowel and rubber material eliminates the problem of her struggling with pushing and pulling the card from the confined space of the slot with her fingers. The curvature of the ball allows Sandi's hand to rest comfortably in a natural position opposed to uncomfortably gripping the card between her fingers.

Materials, Components, and Assembly

Materials required for the device include a hockey ball, dowel, rubber furniture coaster, glue, rubber strap, and a nail. The total cost of the device is approximately twelve dollars. Each individual item can all be found at any local Home Depot or Dollarama. Specifically, the hockey ball costs $1.00, the wooden dowel $1.29 and the furniture leg coaster $2.99 with super glue, hot glue and the nail totalling $5.99. Tools needed for construction include an x-acto-knife, hot glue gun and a hammer. Construction of the device took approximately half an hour and the super glue must be left to dry for a minimum of a couple hours. Instructions for assembly would be first to retrieve all the materials then attach them together in the following order. First, a hole is punctured in the ball with the x-acto knife and the dowel is inserted into the hole until it reaches the other end of the ball. Glue is applied around the hole and a nail is hammered into the opposite end of the ball, connecting the ball and the dowel. Then the rubber coaster is attached to the dowel by puncturing another hole in the dowel and gluing the two materials together. The strap can be put on after, based on personal preference. When cutting the slit designed to hold the card, it is important to ensure that the cut is thin and centered on the coaster so it will hold onto the card properly. Other important assembly instructions include making sure the dowel is attached directly through the ball so it is straight and the rubber coaster is attached with extra rubber for improved strength.

Use

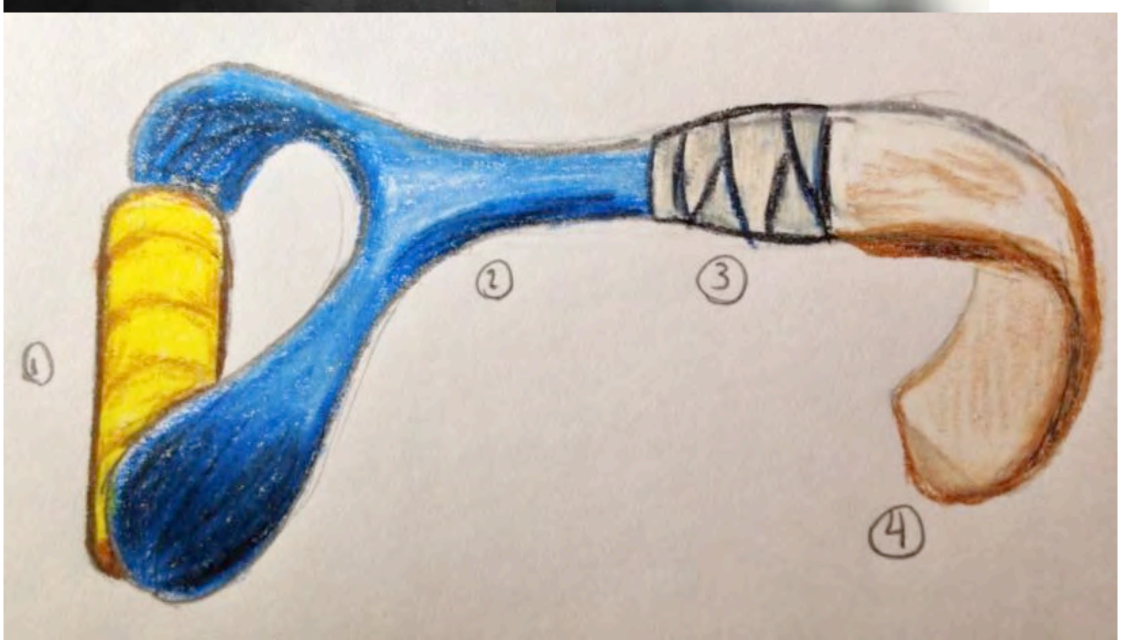
1. Park at a gas pump
2. Retrieve the device from its storage place (center console, glove compartment or purse)
3. Retrieve credit card from wallet
4. Slowly insert card into the furniture coaster by using the center console or lap as a support for the card
5. Slide hand onto ball, under the strap (both hands if necessary)
6. Push the ball with credit card attached and carefully insert the card into the slot
7. If using a debit card, remove hand from the strap and leave the device attached to the inserted card in the slot while entering password into the keypad. If utilizing a credit card, simply retract the card once it's been read
8. Remove the device from the slot by simply pulling on the ball
9. Place the device on the roof of the car, or back in its original storage space before fueling car.

Benefits

The main purpose of this device is to relieve stress on Sandi's fingers when she uses her credit card at the gas station. As such, Sandi would experience far less pain when using this device compared to using her fingers alone. While fully accomplishing this task, this device is also inexpensive, lightweight, easy to use, and easy to build. The ball-shaped handle and hand strap provide good grip on the device while requiring very little pressure from Sandi's hands and fingers, normally a major cause of pain. Additionally, the device is small, and could easily fit in Sandi's purse or in the glove compartment or centre console of her car. Furthermore, this device is weather-friendly. It has no metal parts that would become hot when left in a hot car, nor cold when used on a cold day. This device can also be used while wearing winter gloves. None of the parts of the device would degrade, deteriorate, or perform inferiorly when wet, making the device effectively water-resistant. All of the device's parts are also secured firmly, making the device robust and durable.

Petro One

Eh Team Innovation
D 16- 124 - 01



1. Handle of Pirate Sword
2. Handle of Lint Roller
3. Duct Tape
4. Thermoplastic

The handle for the pirate sword replaced the roller of the lint roller, duct tape was used to connect the thermoplastic to the handle of the lint roller.

The device is 16.7 cm wide, 26 cm long and 9 cm tall

Problem Description

Sandi Mugford is one many people in the world that suffers from rheumatoid arthritis. She is one of the many clients and users that is losing their independence as she has difficulties in the payment and fuelling of her car at the gas station. She is able to accomplish these tasks but is in a great amount of discomfort when she does so.

Design

The device is a simple hook like pivot, which lifts up the gas nozzle. It is made with a soft and comfortable handle for Sandi to hold and press down on when pumping gas. It is very small, as shown by the dimensions. Using very light material the device will be easy to carry and stress free for sandy to carry.

Functionality

Petro One can help Sandi with the action of holding down the gas nozzle while she pumps gas into her car. It performs the task with high degree of accuracy and consistency. With a dead-man-switch Petro One also does not break the violation of holding the gas nozzle in place.

Materials, Components, and Assembly

The device is made from a lint roller where some of the materials were replaced or additional parts were added to it. Some of the materials and additional parts include non-slip padding, duck tape, thermoplastic and the handle of a pirate sword. The cost of the materials goes as following: $1 for the lint roller, non-slip padding, duck tape and pirate sword and $3 for the thermoplastic, with a combined total of $7. The materials are mostly common household materials that can be obtained at Dollarama, Homesense and any hardware store. Only boiling water was needed to mould the thermoplastic and duck tape or glue was used to assemble the rest. The process of building the device is simple, takes less than an hour to make and can be made by looking at the device. No secrets on how to make the device, is straightforward and easy to make. Remove everything off the lint roller, place the handle of the pirate sword where the roller used to be, tape a j shaped hook made from thermoplastic onto the other end.

Use

1. Sandi keeps device in the trunk where she keeps her purse.
2. Sandi takes the device out of the trunk with her purse as she prepares to start paying for her gas.
3. She leaves the device on the top of her car, car hood, or trunk top when she is inserting her credit card.
4. When she is done retrieving the credit card she prepares the device by placing the hook under the gas nose, with the device handle facing directly up.
5. When she is ready to pump gas into her car, pivot the device 90 degrees so it is facing to the side now.
6. When she wishes to stop pumping gas, pivot the device back 90 degrees and facing up again.
7. Store the device and her purse back into the car trunk.

Benefits

The design is unique and different from the others such that it performs the necessary functions required for pumping gas into a car while being light and compact, durable, portable, easy to use and cheap. The Petro One differs from the others such that it is made from lightweight and affordable household materials, weighing less than 5 pounds and with a total cost of being under $10. Although it lightweight and cheap do not exclude the fact that it is durable; thermoplastic can hold its form unless put under extreme heat and is soft enough for Sandi’s comfort. Sandi needs a device that provides comfort, portability, durability and that can do the job, the Petro One provides all of these characteristics making it the best design.

TRIGGER LIFT

Team Name
F16 - 124 - 2

Problem Description

The clients for this project are Dr.Fleisig and Sandi Mugford, who is also the sole user. The function that we are trying to accomplish is to allow the user to fuel her vehicle in a more comfortable and efficient manner. The user will use the product at gas stations, in order for the user to maintain an independent lifestyle.

Design

The final design Lift Engineering came up with is the Trigger Lift. The primary function of this device is to convert the motion of a shoulder into lifting the trigger of a gas pump.

The device is made out of very few materials, the main body of the device is main out of polypropylene rope, while one end is made out of a black nylon strap covered in cushioning. The rod at the end, is made from a wooden rod and is also wrapped in cushioning, while the whole device is held together using duct tape. In total, the device weighs around two hundred grams, and has an overall height of fifty-seven centimeters when fully unwound. However when need be, the Trigger Lift can be compressed into a very compact size.

Functionality

Since our team decide put effort on solve gas nozzle problem, our gas nozzle is a device allowed user independently use no fingers with minimum energy consumption to pump gas nozzle fast, easy and comfort like normal person.

Materials, Components, and Assembly

The Trigger Lift requires only a few materials/components to make. A piece of polypropylene rope (about ½ m in length and $ 0.59), a piece of nylon strap (¼ m, $ 0.25), duct tape (½ m, $ 2.99), thin insulation sheet (¼ m, $ 0.69), and a wooden rod (10 cm, $ 0.09). In total the Trigger List costs $4.61 to build. These items can be purchased at Canadian Tire or most hardware stores. A pair of scissors are required for assembly. It will take approximately 10-20 minutes to make. A set of instructions such as this are needed:
1) Take the polypropylene rope and fashion a loop at one end about 12 cm in diameter using a piece of the duct tape.
2) Make another loop (handle) from the nylon strap and attach it to the other end of the polypropylene rope. (duct tape)
3) Take the wooden rod and fasten it to the end of the polypropylene loop.
4) Wrap a piece of the insulation around the part of the handle that will be held and another piece around the rod.

A diagram of the finished product would also be useful to someone wanting to build this product. Assembly doesn't need any special instruction.

Use

1. Sandi feeds the end of the device with the rod through the nozzle, and grabs the rod on the other side.
2. She feeds the nylon handle through the loop.
3. Placing her hand through the handle, she rests the handle grip on her palm. And places her other hand onto the pump for stability.
4. Sandi pulls the handle vertically, which in turn tightens the loop around the trigger and pumps the gas.

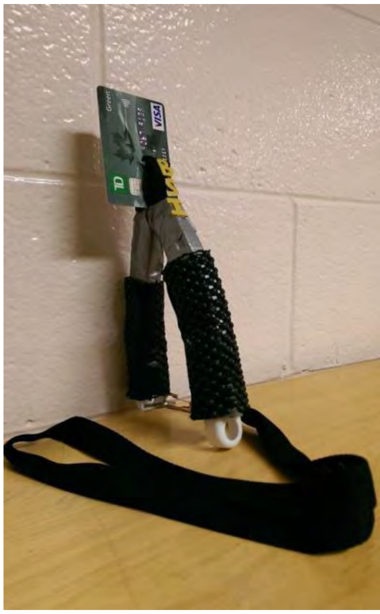
Since the devices is so compact, the device can be stored virtually anywhere, however the most ideal place to store it would most likely be in the glove box compartment of the car. Due to the Trigger Lift being extremely light weight, Sandi will be able to carry it, without pain, simply by holding it in one hand. When she is performing other tasks Sandi can either sling it over her shoulder, or put it in her purse, or put it on top of the hood of her car.

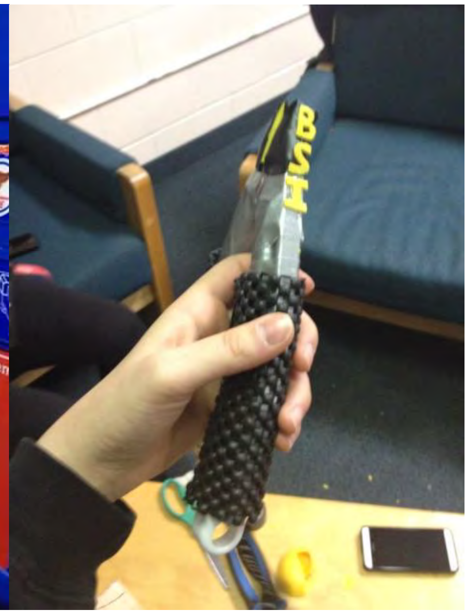
Benefits

We at Lift Engineering believe that our design for the gas nozzle is the best one out there for many reasons:
Comfortable:
The Trigger Lift utilizes Sandi's deltoid and traps (shoulder muscles) instead of her fingers, reducing pain & discomfort. It also includes padding on the handle for Sandi's hand to not get injured in the process
Time Efficient:
Sandi's average time at pump was around 12-15 minutes not using the Trigger Lift. However the average time at pump with Trigger Lift is around 8-10 minutes
Simple and easy to use:
It requires little effort to use the Trigger Lift
Lightweight and Portable:
Entire device weighs less than ¼ kg
Extremely Low Cost:
The Trigger Lift costs only $ 4.61

Easy Grip Card Clip

Team Name
F16-124-3





Problem Description

To build a device that relieves the physical pain caused by Sandi Mugford's rheumatoid arthritis that she experiences as she completes her gas station routine.

Design

The device is shaped like a pair of pliers, with large rounded handles and a wide end to increase torque. It is about two times as big as a child's pair of scissors. The device is mainly black, with yellow on the device's end to define where the card should go. The handle is covered in a soft bumpy surface and the logo and company name are inscribed on the end in yellow where the card is inserted. All edges are rounded.

Functionality

The device reduces the amount of effort it takes for Sandi Mugford to insert or remove the credit card at a gas station. It allows Sandi to grab the credit card with less pressure on her joints by replacing the action of pulling the credit card with her fingers to using the grip on the end to pull the credit card.

There is a lanyard attached to allow Sandi to hang it around her neck when she is not using it.

There are also bright yellow spots to indicate card placement and to aid vision in low light environments.

The device accomplishes everything the client requires. It is simple to use, cost-efficient and increases Sandi's independence by lessening her burden at the gas station.

Materials, Components, and Assembly

The device is made of a clothespin, two all-purpose brushes, silicone grip, popsicle sticks, non-slip multipurpose polyvalent sheets, epoxy resin, duct tape, electrical tape and a lanyard with a key ring. The materials cost roughly $16.50 if one buys the items as they are originally packaged (ie. clothespins in packs of 10 when it requires only 1).

The materials can be purchased at any larger dollar store, Canadian Tire or Wal-mart. The device also does not require any special expertise or tools other than pliers and scissors to create.

The device is easy to build according to the following general instructions, requiring 1 to 2 hours to build. First, snap bristles from handles and tape them to the side of the clothespin. Reinforce the structure with popsicle sticks and duct tape and glue the polyvalent sheets around the handles with epoxy resin. Cut silicone grip to fit clothespin ends and glue down. Attach a handle to lanyard with key ring and cut logo and company name out of silicone grip and glue to clothespin end.

Use

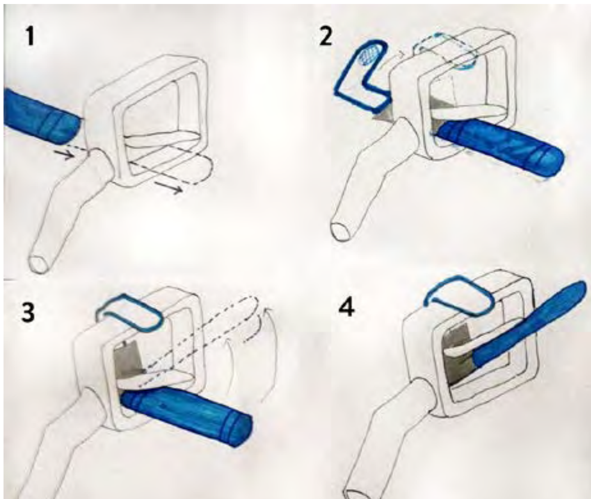
1. Open trunk.
2. Put device around neck using lanyard.
3. Put card in device by using one hand to squeeze device and one to insert card or place device against chest and push to open jaw and insert card.
4. Insert card into machine and using the palms of both hands, squeeze the device and release card.
5. Let lanyard hang from chain until card is exposed.
6. Use both hands to squeeze handles and grip the card.
7. Remove card from machine and release card from jaw by repeating step 3.
8. Put card away and store device back in the trunk or in the compartment of the car door.

Benefits

The design is the better than any of the competitors' designs because of its utmost simplicity and extreme versatility. It is very comfortable, sturdy and durable, yet also very lightweight because of the chosen materials. It is very effective at accomplishing its task because the substituted motion is much less painful and relies less on precise motor skills. Its simplistic design, combined with its practicality and user-friendliness, guarantees that Sandi will find the insertion and removal of the credit card to be the easiest when using the Easy Grip Card Clip.

Pain Re-Lever

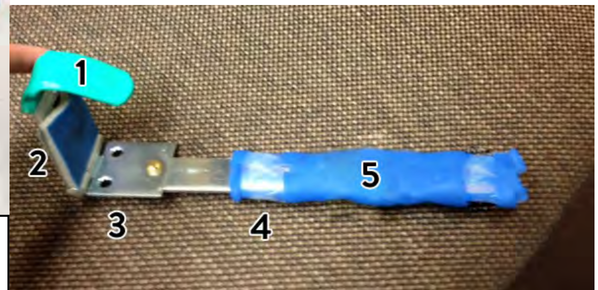
Radical Engineering
F 16 - 124 - 4



ABOVE- HOW TO USE
1. Slide handle into bottom of nozzle, below the latch
2. Hook device onto handle of nozzle to secure device in place
3. Lift the handle to squeeze the nozzle
4. Hold in place to pump gas

BELOW - CONSTRUCTION
1. Latex covering metal hook
2. Grit pad for additional friction
3. The hinge has minimal friction, creating an effective dead man's switch
4. The tape secures the foam to the handle
5. The foam sheet for grip

Dimentions: 24 x 6 cm



Problem Description

Aid Sandi in becoming independent while pumping gas at the gas station by reducing pain, the risk of further injury, as well as the time it takes her to get gas.

Design

The basic design is a metal lever attached to a hook by a hinge. The handle is covered by a sheet of blue foam. A grit pad is attached to the surface of the hinge, and the hook is covered by latex rubber. The device weights less than 1 pound, and is about 24x6cm when folded. It can be held comfortably in one hand or fit in a glove compartment.

Functionality

The Pain Re-Lever can decrease the load applied to pump gas (by increasing the length of the lever), and change the direction of force so that Sandi will not need to squeeze the pump with her fingers. This addresses Sandi's issues because it will lessen the strain on her muscles, as well as the stress on her knuckles and joints.

Materials, Components, and Assembly

The items used for construction were: a utility hinge, a metal hook, a flat metal handle, 2 bolts (3/16”diameter, 3/4" long), 2 nuts, a grit pad, electrical tape, latex work gloves, a sheet of foam, and super glue. The sheet of foam and the super glue was purchased at Dollarama, the rest of the items were purchased at the Home Depot. The total cost of the Pain Re-Lever was $18.03 + tax.

A pair of scissors, a flat screwdriver, and a wrench will also be needed to construct the device. To construct the Pain Re-Lever, use bolts to attach the hook and handle to opposite side of the hinge. Tape the foam sheet onto the metal handle. Cut and glue the grit pad to the surface of the hinge. Cut off a finger of the work glove, and glue it over the hook. Glue some extra foam onto the ends of the bolts.

Constructing the device should not take longer than an hour; however the super glue may take an additional 8-24 hours to dry. An additional set of hands may be needed to secure the bolts firmly; one person may need to hold the nut in place with a wrench while the other tightens the bolt with a screw driver.

Use

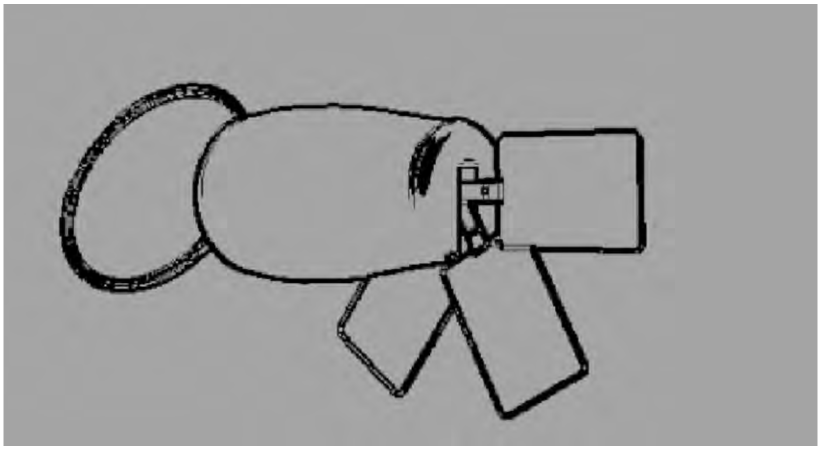
1. Open gas tank door from drivers seat
2. Retrieve Pain Re-Lever from trunk (or where Sandi chooses to store it)
3. Hook device onto gas door
4. Put gas nozzle into car tank
5. Take device& insert handle from opposite side
6. Hook onto handle of nozzle
7. Lift the handle to begin pumping gas
8. Once done, remove handle and hook back onto gas door
9. Return nozzle and finish/confirm payment
10. Retrieve device, close gas door
11. Return device to trunk (or where Sandi chooses to store it)

Benefits

The design of the Pain Re-Lever is simple; it does not contain complex mechanisms or electrical / motorized components. The device is also cost effective at less than 20$ for all the components. It effectively lessens the force needed to pump the gas by extending the length of the handle. It also eliminates the squeezing action for Sandi which causes her a lot of pain, by changing the direction of the action. The straight, flat handle lets Sandi use more parts of her body to operate the device as opposed to just her hands, such as her wrists or elbow. It is a sturdy, durable design that is small enough to carry or fit into a glove compartment. Finally, the device is safe; it will not ignite any fires (no electrical components) nor is it combustible, and it is not heavy enough to cause major injury if dropped.

Handy 180

Team Name
F 1 6 – 1 2 4 - 5



Problem Description

Our client Dr. Fleisig introduced our team to the problem related to Sandi at the gas station. Although Sandi can refuel her car at the gas station, she experiences pain and discomfort throughout the whole process, as a result of her rheumatoid arthritis. By making this process more efficient, Sandi will conserve energy for other daily tasks.

Design

As seen above, the Handy 180 is a very original design with high levels of practicality. The foam insulation allows the device to be extremely lightweight, while maintaining its strength and rigidity. Being made from a tin can gives it a compact, portable size. The device is the same diameter as a pop can, and is slightly longer. This is the perfect size to be stored easily, while

Materials, Components, and Assembly

Materials required to construct the prototype were: foam insulation, scotch tape, a tin can, popsicle sticks, two alligator clips, a cloth, hot glue sticks, aluminum screws, a rubber elastic, a plastic tube, and a wristband. The cost of these materials ranges from 50 cents to roughly four dollars, and the total cost of the prototype came to $22.48. Materials such as the foam insulation, the alligator clips, and the screws, were obtained from home hardware. All other materials were obtained from the dollar store. The only tools required for construction were; a hot glue gun, and a pair of needle nose pliers. The assembly of the prototype was relatively fast, and took approximately two hours. To assemble the prototype, a slit was cut into the tin can wide enough for the card to rotate in and out with ease. Next the rotating axis was cut to size and still being ergonomic, and comfortable to satisfy the users needs. The rotation of the card allows the device to be compact, while still remaining perfectly functional.

Functionality

The Handy 180 allows users to insert and remove credit cards from payment machines with great ease. It rotates out up to 180 degrees, and can swivel up to 360 degrees in along a different plane, allowing users to insert the credit card at virtually any position they feel is most comfortable. Due to the rigidity of the device, users are also able to leave the device in the payment slot while preforming other parts of the gas pumping process. Also due to the universal nature of the Handy 180, the user is able to use the device in any situation requiring payment by credit card. The user is not limited to just use at the gas station. The device satisfies, and exceeds the functionality requested by the user.

Benefits

The design of the Handy 180 stands out from other existing solutions for many reasons. It has a long list of benefits, including: lightweight, manageable size, wide range of motion, easy to use, lanyard safety feature, easily gripped material, protects card inside, thick handle, durable, and easy access to cards. Furthermore, this device stands far ahead of other designs because of its universality, and the eliminated risk of dropping the card. The device can be used anywhere, not just the gas station. As well, the clipped in card gives the user peace of mind when it comes to worrying about dropping their card.

then glued and spray foamed in, to hold it in place. After that, a Popsicle Stick was cut to size and glued into formation for the rotating device. Then the clips were glued to the end of the rotating device, and rubber pads were glued to the insides of the clips on the rotating device. Finally, the lanyard and cloth used for grip were attached to the tin can.

Use

A trusted friend or family member, as a **onetime only step**, would preferably perform the following two actions.

1. Pull the swivel from underneath the device to a comfortable angle.
2. Sturdily slide the card that will be used for payment into the clip, chip facing outwards.

3. Remove the device from storage in the users purse or cup holder of the car.
4. Insert wrist of dominant hand into lanyard .
5. Lightly grasp device in orientation where opening is facing downwards.
6. Use non-dominant hand to swivel out card to comfortable angle, up to 180 degrees.

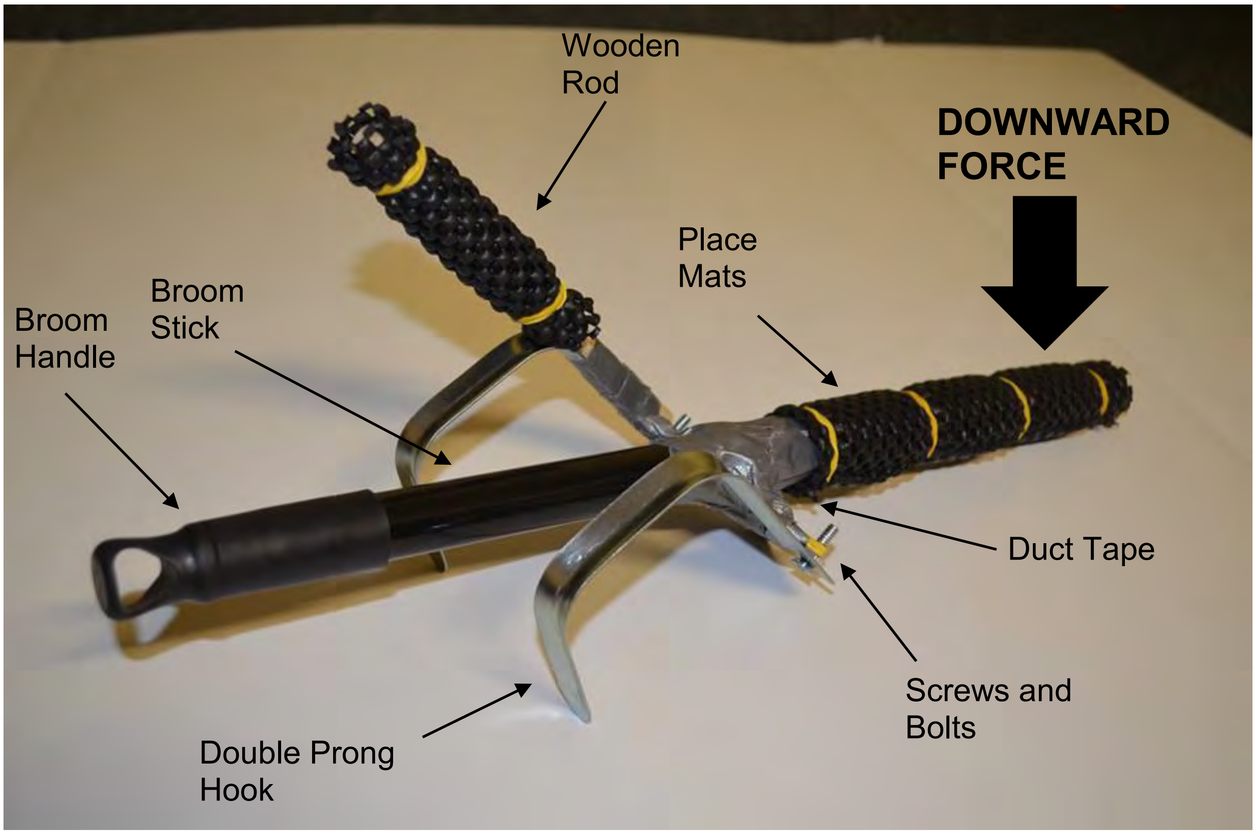
    5A. If more freedom is needed, you may rotate perpendicularly 360 degrees.

7. When appropriate drive the card/device into the reader using dominant hand.
8. Slide hand out of lanyard and proceed with other parts of the pumping process.
9. When appropriate slide wrist back into device, and drive the card/device out of reader.
10. Push swivel back into device and store the device back in purse or car cup holder for future use.

Instructions

E-Z Pump

Resilience
F 16-124-06



Problem Description

Design

Our client, Sandi Mugford, who is suffering from rheumatoid arthritis, has difficulties fueling her car at the gas station as it can be quite painful. Sandi desires a device that minimizes the discomfort that she experiences during this process. We plan to meet Sandi's objectives by designing a device that simplifies the process and reduces the amount of effort that she has to put into the process, consequently reducing the pain she experiences. Although Sandi is currently able to perform tasks, we are attempting to make her transition through the gas station a painless one.

Functionality

Its function is to ease the discomfort Sandi feels as she pumps the gas into her car at the gas station.

Materials, Components, and Assembly

The materials used to make the prototype are things such as elastics, screws and nuts, a broom stick poll, duct tape, place mat, double prong hook.
- Double-prong hook: $2.00 - screws and nuts: $2.00 - elastics: $1.00 - broom stick poll: $1.50 - duct tape: $6.00 and place mat - $2.00. These materials were obtained in the dollar store and home hardware. The tools required for construction are a wrench, and hacksaw. It took under ten minutes to construct the entire prototype. Cut the pole used for the broom in half and attach it to the double prong hook using duct tape and elastics. The place mat is then wrapped around the handle and secured with elastics. The assembly does need special instructions because the tape doesn't affect the movement of the elastics.

Use

Step 1) Sandi removes device from storage in her vehicle; either beside her car seat, trunk or on her back seat.

Step 2) Remove the gas nozzle and place it into the vehicle.

Step 3) Attach the device to the gas nozzle by pulling the double prong hook back and resting the device on the top surface of the gas nozzle while putting the lever underneath the gas release.

Step 4) Apply some pressure to the lever to release the gas into the car, and stop when the desired amount of gas has been reached.

Benefits

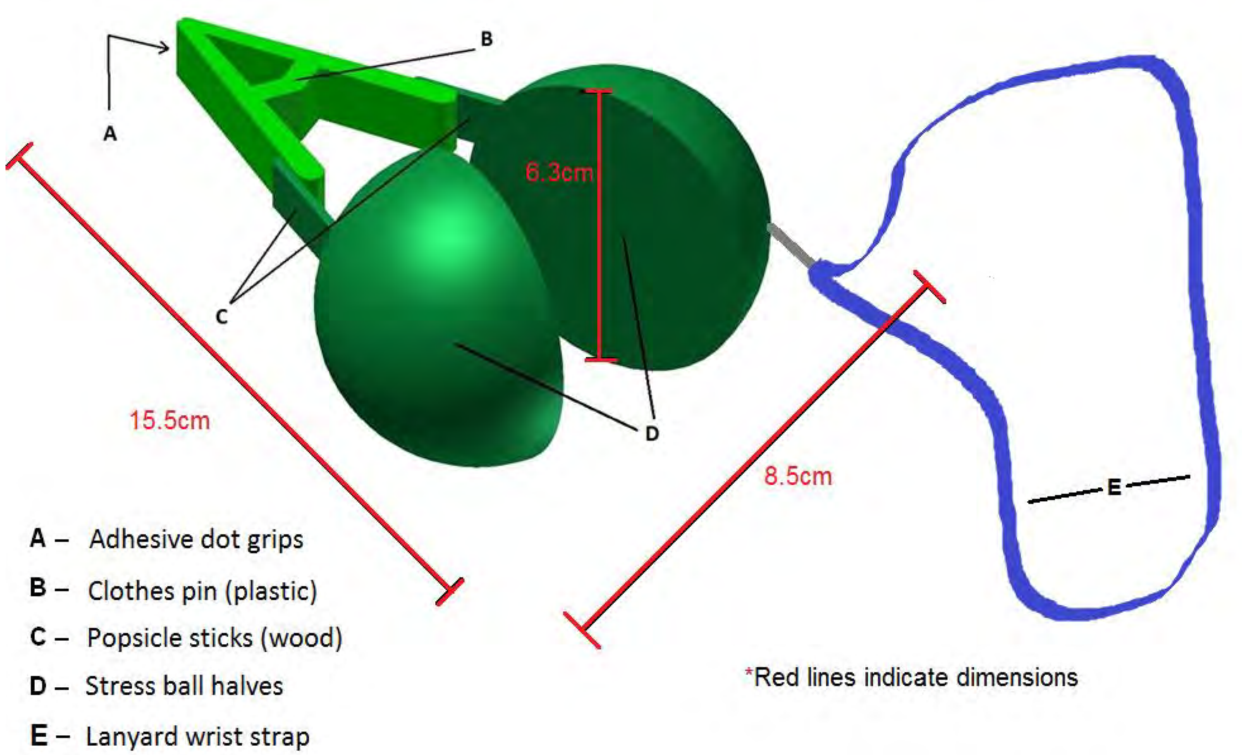
The design created is very effective due to its various benefits it has for Sandi. To be specific, during the time when Sandi is not at the gas station, the device proves to be very portable due to its lightweight materials and design, as well as its relatively small frame. Furthermore, since the device was made using low cost materials, the total cost of the device does not exceed $15. At the gas station, Sandi will be able to use the device to punch her pin number in the keypad using the end of the device. When pumping gas into her vehicle, the device secures firmly onto the gas nozzle without any issues of instability. Sandi will notice its ease of use and simplicity as she will not need to use much force to hold up the lever when using the device. Since only one hand is required to hold down the lever after it has been latched on, Sandi can use her free hand to hold the nozzle in place in order to further ensure that the nozzle will stay in place as the gas is pumped.

When compared with the devices of other groups, one will be able to quickly observe that this design is much simpler and easier to use. This is because of its simple design solution of using a lever to simply push down on one end by using her own body weight. It also takes very little time to secure in place and begin the task as the device makes the entire experience pain free. The pain is drastically reduced because the use of her fingers are not required when holding down the lever. Not only is it important to reduce the pain experienced when performing the task but it also reduces the total time spent at the gas station since Sandi will not have to stop pumping gas due to stiffness or pain in her joints and fingers.

Overall, the device proves to be effective compared to the other designs that attempt to solve the same problem because of its multi-use ability and effectiveness at the gas station. The force required to perform the objective is greatly reduced and thus decreases the pain experienced when pumping gas. As a result, when less pain is felt, Sandi will be able to save more time spend and conserve her energy to use later in the day. Therefore, since Sandi is looking to reduce her pain and conserve energy at the gas station, this device will prove to be very beneficial.

The Credit Claw

SANDi (Students Aspiring New Directions inc)
F 16-124-07



Problem Description

Sandi has been suffering from Rheumatoid arthritis since a young age. Now, due to her worsening condition, Sandi has a hard time using her hands when inserting and removing the credit card. Sandi wants a device that will ease her pain and effectively use her energy during the fuelling process.

Design

The Credit Claw is roughly 0.57 grams. From the tip of the clothespin to the end of the stress ball, the design is 15.5 cm. The wrist strap is foldable so the length of it is not added into the measurements. The tallest part of the design is the stress ball height, which is 6.3 cm. The width of the device when the mouth is closed is 8.5 cm. These dimensions and weight are ideal for Sandi's hand.

Functionality

The function of this device is to help Sandi insert and remove a credit card from the machine quickly and effectively, whilst reducing pain during the process. The device is universal and can be used with any card machine.

Materials, Components, and Assembly

The device consists of a clothes pin whose arms are elongated using Popsicle sticks.

Comforting each hand is half of a stress ball on each clothes pin arm. An exacto knife is used to cut the ball in half and to make slits in the ball where the Popsicle sticks are later inserted and glued. Two grips (made of adhesive dots) are found inside the teeth of the clothes pin. These act as grip when an object is placed inside, thereby, allowing objects to stay in the mouth of the clothes pin without falling out. Lastly, a slit in the back of the stress ball is created to slide in a lanyard which acts as a wrist strap. The overall cost to build the device is relatively low. The following is a list of the materials and their costs:

- 1 Clothes Pin: $1.00
- Hot Glue Sticks: $1.00
- Hot Glue Gun: $1.50
- 2 Popsicle Sticks: $1.00
- 1 Stress Ball: $1.00
- 1 Adhesive Dot: $1.00
- Exacto Knife: $1.00
- 1 Lanyard: $1.00
- 1 Can of Spray Paint (optional): $8.00

All of the materials listed can be obtained from a local dollar store, aside from the optional spray paint which can be purchased at any local hardware store. The only tools needed to build the device are a hot glue gun and an exacto knife. The only adhesive needed is glue from the hot glue gun. Construction time is roughly 30 minutes, where gluing takes the majority of the time (10 minutes). Once completed, the device does not need any further assembly, thus no special building instructions are needed.

Use

1. Gently squeeze the two stress ball hemispheres together to open the clothespin.
2. Place the credit card into the mouth of the clothespin and then release to close.
3. Holding the device, push the credit card into the card slot machine.
4. To remove from the machine, hold one stress ball hemisphere and pull out device.
5. Gently squeeze the stress ball hemispheres again to remove the credit card from the device.

The device can be stored in any place in Sandi’s car. Since the device is so small and compact, it can easily fit into her glove box, side door pocket or even in her purse if it is large enough. Considering how Sandi leaves her purse in the trunk of her car, it would be most efficient for her to leave it in her trunk. The device can be draped around Sandi’s wrist (using the wrist strap) when moving from the car to the gas pump interface. The device is extremely light weight (0.57 grams) so that it does not put significant amounts of pressure on her wrist. When performing other tasks like filling up the gas or using the keypad, Sandi can leave the device around her wrist, or place it back inside of her car (or purse) as soon as she has completed the credit card process.

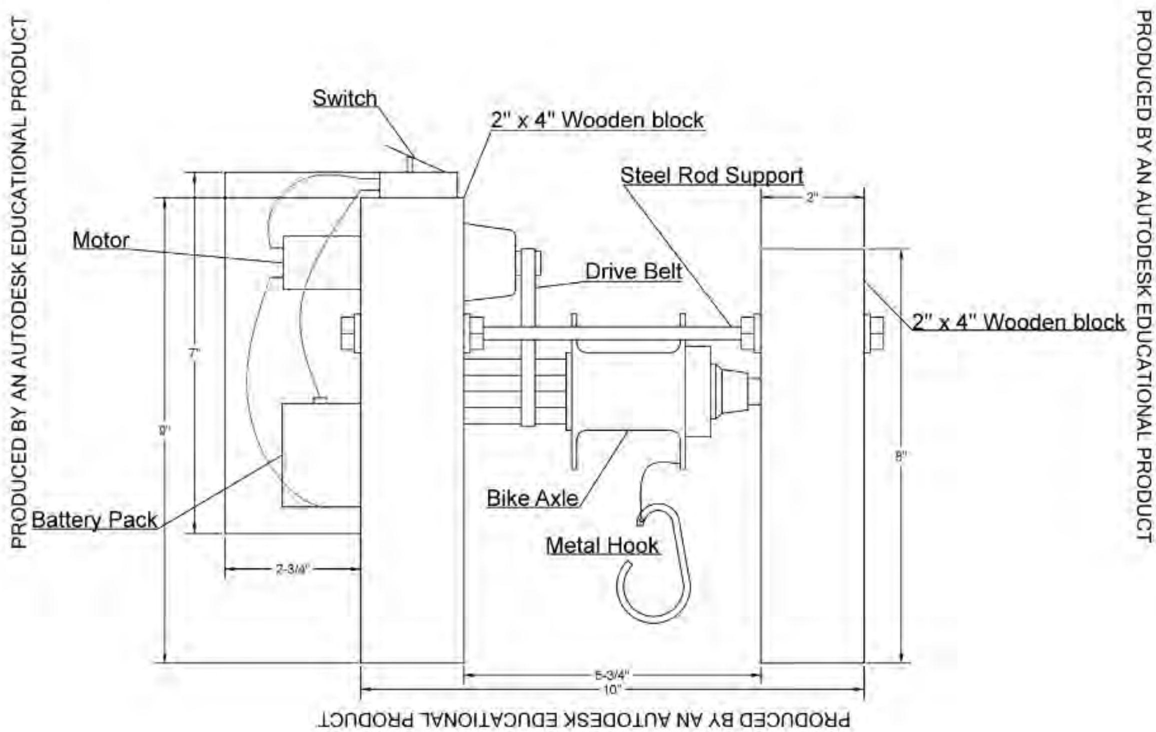
Benefits

The Credit Claw is better than other products for many reasons. Firstly, it is simple and compact. The design is not complicated at all and it can be stored almost anywhere in Sandi’s car (maybe even her purse). It is also lightweight so it will not cause any more discomfort that is already present to Sandi’s joints and wrist. The fluorescent paint makes the device easy for Sandi to see, especially during the night. The device is also extremely economical and inexpensive – the whole device can be made for less than $8.00 dollars (without paint), and since the resources are bought in bulk, multiple Credit Claws can be made so Sandi can leave them around her house and use it for multiple other uses. Lastly, it is universally compatible, meaning it can be used not only at the gas pump, but at the ATM or any other places that require manual insertion of credit cards.

The Credit Claw is also better than current designs because it uses Sandi’s full palm (which is used more often than fingers for people with arthritis). This spreads out the force needed to open the device. It is also an extension of the arm, so that Sandi does not lose any accuracy when inserting it, as she would from having an over-complicated device. The adhesive dots offer an extremely strong grip that will hang on to any slippery surface. Most importantly, the device opens and closes effortlessly and will definitely reduce the pain that is caused to Sandi when regularly trying to insert and remove her credit card.

Fuelling Assistant (F.A.S.T)

Helping Hands
F 16 - 124 - 8



Problem Description

To create a device(s) to assist Ms. Sandi Mugford with her challenges at the gas station operating the fueling mechanism for a prolonged period of time, operating the buttons, and manipulating her credit card, by limiting her pain, easing her use, and reducing her time at the pump

Design

Two wooden blocks 5-3/4" apart from the base of the prototype. They have cut-outs in the bottom to allow product to sit on the gas pump. The blocks are fixed in position by two steel rod supports fastened with washers and nuts. Between the two blocks is a rear-wheel bike axle. Fixed to the axle is a cable, which ends in a metal hook that is fastened to a support rod when the cable has been threaded under the gas handle. The motor is connected to the axle by the drive belt. The motor is powered by a rechargeable battery pack that is large and easy to replace. A switch controls the motor, the button must be kept pressed to turn on the motor. The circuitry is enclosed in a case to eliminate the risk of sparks, however there is easy access to the battery pack from the back of the casing. The product will weigh three pounds, and during operation it sits on the gas pump. It will be 10” long, 4” wide and 9” tall, making it large and easy to grasp.

Functionality

The device eliminates the stress and pain caused by the continuous squeezing motion of the gas nozzle by introducing an ease of use with a press of a button. It also requires less energy to operate the gas nozzle when using the device.

Materials, Components, and Assembly

In order to construct this device the following items need to be purchased: 2” x 4” wooden blocks (2 pieces, 9” and 8” each), a switch, an electric motor, a battery pack, 2 threaded steel rods 10” each, washers, nuts, a bike axle, a drive belt, a metal hook, wires and solder. These items can be purchased from Home Depot and any bike shop and will cost $45. Drill a hole the width of the motor into the 9” piece of wood at 2.25” from the top. Place the motor in the hole and glue it in place. Drill another hole on both pieces of wood 4.5” from the top the width of the bike axle. The wooden pieces are fastened together using two threaded steel rods, washers and nuts. Drill two holes into the wood 5” from the bottom and 1” from the side. Pass the steel rods through the holes on both pieces of wood and fasten them using washers, nuts and a wrench. Screw the battery pack to the wood under the motor and connect the wires to the motor, switch and batteries using a soldering iron and solder. Glue the switch to the top of the wood directly above the motor. Connect the hook to the axle using a wire. It will take about 4 hours to build this device. Expertise needed is knowledge of circuits and operating soldering iron and power tools. Tools needed to build this device are; power drill, soldering iron, wrench and glue.

Use

1. Store device in the trunk
2. Place nozzle into the gas tank
3. Take device out of the car
4. Place device on the nozzle
5. Pull the hoop through the trigger section
6. Hook the hoop onto a metal bar
7. Push down on the button
8. When done, remove device, place in car
9. Return nozzle to storage place

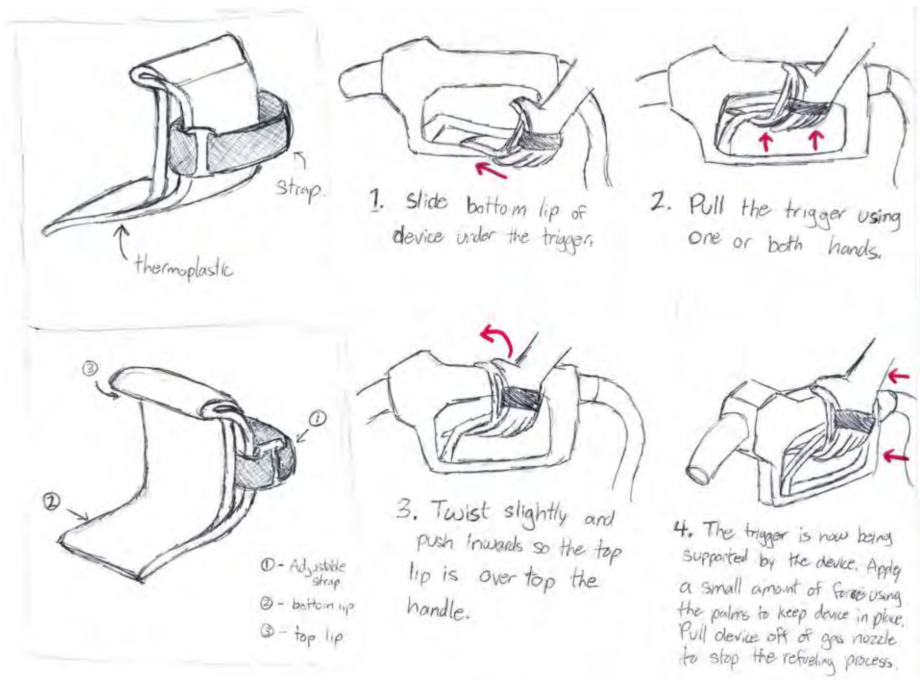
Benefits

Our design is the best solution for a number of reasons. First of all, it is a very simple device to operate. Set up is just one motion to hook on the rope. Then, with just the push of a button, the user can fill up their gas tank with ease. It sits easily on the pump, and stores easily in the user’s vehicle. This also means that very little fine motor skills are required to operate it, a key consideration for somebody with rheumatoid arthritis, which makes it very difficult to perform any motion of the fingers.

Our device also minimizes the pain caused filling up at the pump. Rheumatoid arthritis makes it very difficult to squeeze the pump for a long period of time. With our device, the pump can be filled with a simple downward pushing motion. This means that the user does not have to provide the force necessary to operate the pump, only the force necessary to activate the motor. Also, since it’s a downward motion, the applied force is with the force of gravity, instead of against gravity as would happen if operating the pump. Since it is a large button, the user’s hands do not have to be used to operate it, anything can be used to press it, such as the elbow or the forearm. This is very helpful for somebody with rheumatoid arthritis as they do not have consistent pain; different body parts can hurt or be stiff on any given day.

FuelAid

Arthritis Innovation Engineering
F16 - 124 – 09



The FuelAid is designed to fit into the palm comfortably with straps that can be adjusted to the size you need.

Problem Description

The main problem we are addressing is assisting Sandi in using the gas nozzle to refuel her car at the gas station by reducing her pain and energy consumption required to accomplish the task, while leaving the process as simple and quick to accomplish as it was before.

Design

One of the main goals of the design for this device was to make it light weight, small in size and yet comfortable to use and durable. Weighing about as much as a light cell phone the device is very light weight and will not be a burden to the user to carry. As seen in the pictures above, the size of the device was designed to fit into the hand. It is small enough to be carried in a purse or even in pockets when not in use. The device was designed with finger deviations in mind, with the device deviating as well to match the fingers and the curves of the device was designed to match the hands' natural curves making it very comfortable to use.

Functionality

The device was designed for aiding in using the gas nozzle and it does exactly that. The device changes the constant forced needed to be applied by the fingers into an instantaneous force need to raise the trigger and then a very slight force of the palm needed to keep the device in place. The device will then pop off of the nozzle when the small inwards force pushing it against the nozzle stops to prevent it from being a deadlock. Other functions the device can do includes aiding in holding shopping bags as it can prevent it from digging into the palms of the hand.

Materials, Components, and Assembly

The main material used in the construction is thermoplastic, durable material that is both light weight and cheap. The other component of this device is the adjustable strap. All the materials required to build this device is very inexpensive, with the thermoplastic being around $10 for the size piece that we used. The straps can be purchased at many different places such as dollar stores for around $1 - $5. The thermoplastic can be purchased from online sources, or from crafts and costuming (Coplay) stores. The tools for construction are simply a container of hot water. Tongs may be required to dip the thermoplastic into the water, but other tools are not required. The process of construction can take as little as 30 minutes depending on your ability to mold the thermoplastic. The steps for building the device is as simple as dipping the piece of thermoplastic into the hot water until it softens, then mold the thermoplastic into the desired shape, not special instructions required.

Use

1. The device is small enough to be store wherever needed, such as glove compartments, purses, or large pockets.
2. The device can be taken from its storage location and place in a pocket, on top of the car or other leveled surface temporary.
3. Insert the gas nozzle into the car.
4. Take the device and slip it on. The straps (1) may need adjusting for the first time use.
5. With one or both hands, raise the trigger of the gas nozzle and slide the bottom lip (2) of the device under it.
6. Raise the trigger into the pulled position, again with one or both hands, and slide the top lip (3) of the device over the top of the nozzle handle.
7. Keep the hand on the device as it refuels, removing the hand will have the device popping off.
8. The angling of the device can be adjusted slightly to allow for the trigger to be pulled at different levels.
9. When finished, remove the device by pulling the hand and the device away from the nozzle the same way it slid in from.
10. The device can be removed and place back into storage, in a pocket, purse or any leveled surface, while the user deals with other tasks. Just remember to retrieve the device before leaving if it was not returned into its storage location.

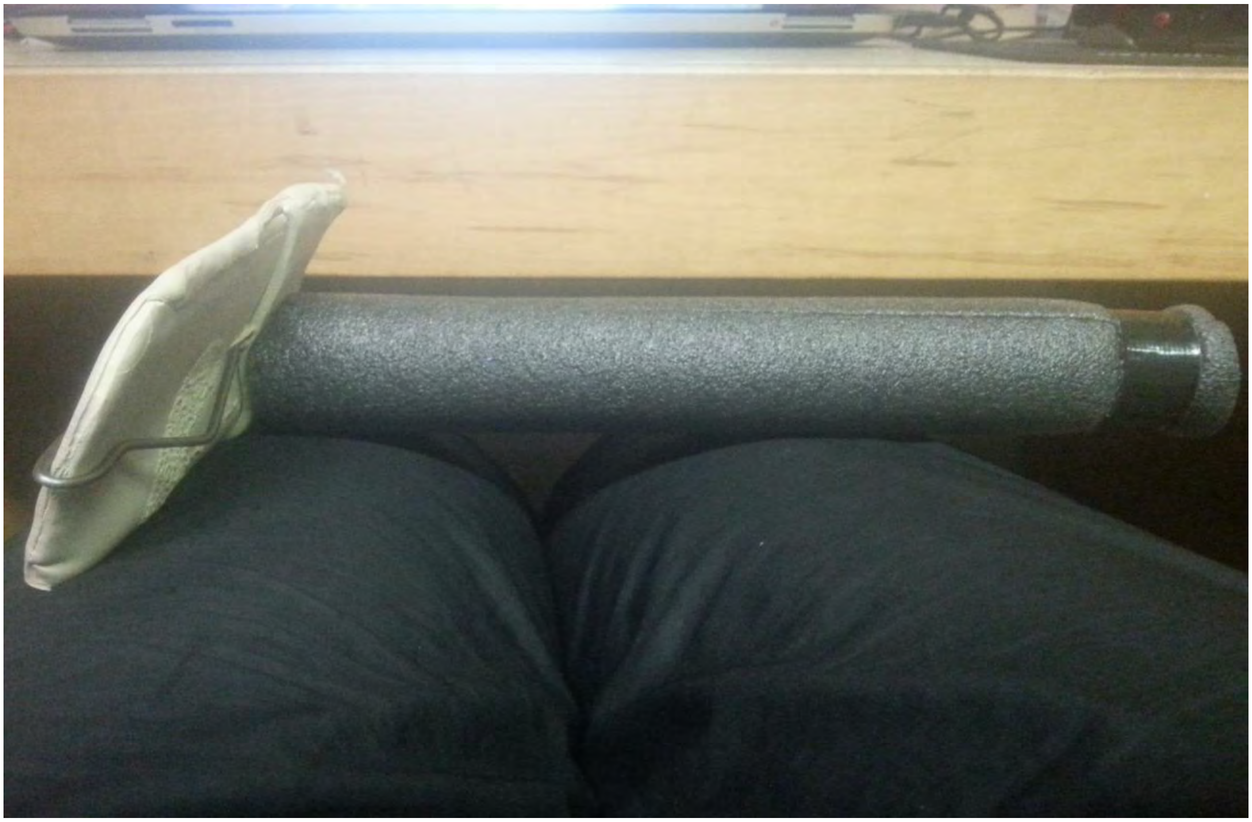
Benefits

This design is better than other existing designs because it was designed with the user in mind, every step of the way. It was design to be small and light weight so the user can carry and use the device without letting it become a burden. The device is designed to be simple to use and durable with dexterity of the hand kept in mind. Price is another thing we kept in mind with the device made to be as cheap as possible without compromising its strength and rigidity. Lastly, comfort is another point we kept in mind. The device was designed to fit into the hand comfortably with the finger deviations kept in mind to maximize comfort when in use. Our device also has an off use of being able to be used for carrying shopping bags, taking the stress off of the palm and fingers, making it functional in and out of the gas station. This is why our design is the way to go.

RAIN Stik

RAIN Engineering
F 1 6 - 1 2 4 - 10

Dimensions: 28.5cm length, 12.3cm width, 4cm diameter



Problem Description

Due to the kind of physical difficulties Sandi has that cause her pain, we are designing a device to reduce the time, pain, and overall effort interred by Sandi Mugford at the gas station while filling her car. We can accomplish this by increasing the easiness of handling the gas nozzle, the time it takes to insert and retrieve her credit card, and assist in using the keypad effectively.

Design

The device will be quite light, weighing in at about half of a pound (lb). This is due to the materials selected for the composition of the object, as they are all extremely light on their own. The device itself was made to be small enough to be portable and so that it could be stored in Sandi's trunk. Additionally, the diameter was kept large enough so that Sandi could hold it (4cm) but small enough that it doesn't impede handling of the device. In reference to the user, Sandi will be able to hold the device along with her purse and credit card while using the gas station. She can also store it in her pocket, purse, or the crook of her arm while handling the gas nozzle.

Functionality

The device is extremely effective at operating the gas pump while in Sandi's car, but it cannot perform the functions involving the credit card or the keypad. Sandi will use the device by first placing the gas nozzle in her car, and then placing our device in the section of the pump where the user usually places their hand. From there, all Sandi must do is press the lever forward, towards her car, using any part of her upper body. This will compress the pump using much less force than Sandi must normally apply, and from a more comfortable position.

Materials, Components, and Assembly

In order to construct the Rain Stik you will need,12" of ¾" aluminum tubing (broom handle), 12" of pipe insulation, 6" of wire, duct tape, and a 6.5"x 6.5" piece of thermoplastic. Our prototype was constructed using only a utility knife, a ruler, a mini torch, pliers, and a pot. Assembly of the device took roughly half an hour, so the same can be expected for anyone attempting to assemble the device for themselves. Assembly should not need special instructions, as the only instructions required would be to heat the thermoplastic until it is pliable and then put the aluminum pipe through the thermo plastic. Then wrap the pipe in insulation and secure with duct tape. Place the wire on the Thermo plastic after cooling.

Use

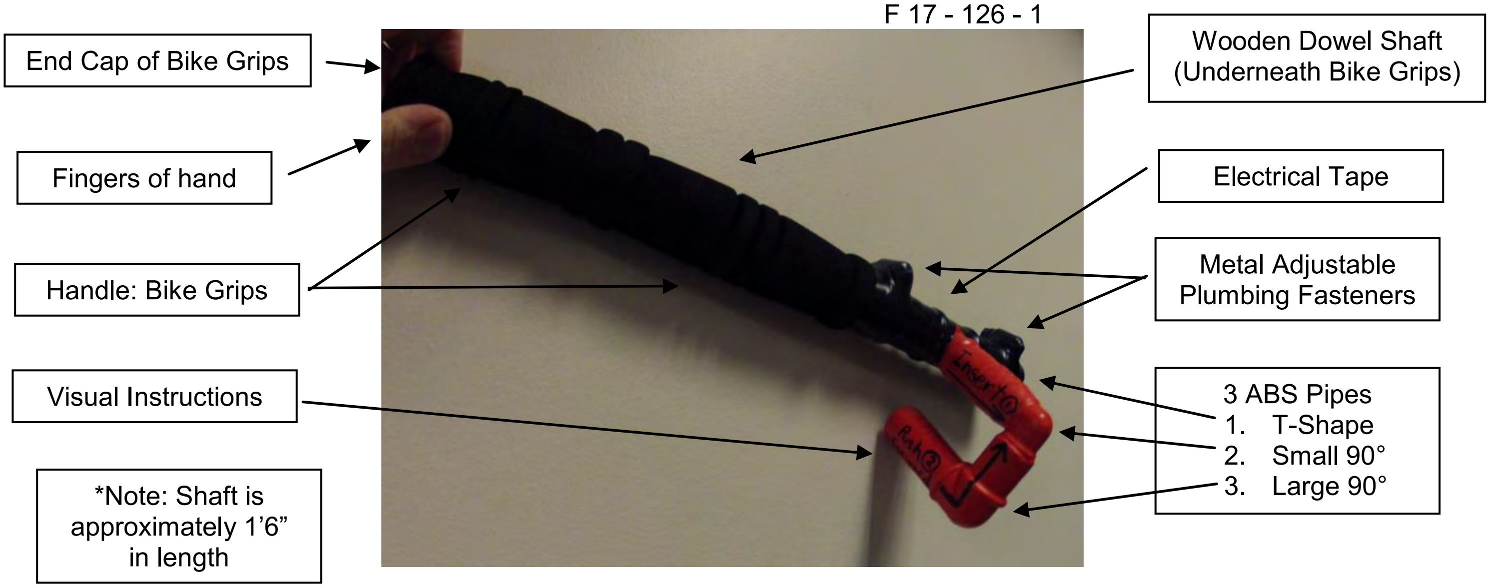
1. Sandi will retrieve the device from the trunk along with her purse.
2. The device may be carried as Sandi selects what type of gas she wants and placed in her purse while she carries the nozzle to her car.
3. Sandi puts the device in to the pump and operates it, filling her car.
4. Sandi pays for the gas after replacing the nozzle into the holster.
5. Sandi places the device back in the trunk of her car along with her purse.
6. The entire time Sandi may carry the device with her as it is light and portable.

Benefits

New positioning is allowed during operation due to our product which allows Sandi to operate it with any part of her upper body effectively. No squeezing is required, which is preferable for Sandi. Our device improves on old designs by being much lighter, yet sturdier, while also keeping the fuelling process customer driven and avoiding automation of the process. Our device is also quite cheap and easy to build, while being legal thanks to the lack of automation. Ultimately the cheap final cost of the device couple with how effective it is at pumping gas will make it a boon to Sandi at the gas station.

Pumped

Original Tech.
F 17 - 126 - 1



Problem Description

The user Ms. Sandi Mugford suffers from Rheumatoid Arthritis, and has trouble with the simple task of refueling her vehicle. To assist Ms. Mugford; clients, (including Dr. Fleising, Ms. Mugford, and Abbey) have assigned the task of creating a device to further Ms. Mugford's independence while refuelling her vehicle. The most challenging task for Ms. Mugford is effectively using the gas nozzle for extended periods of time. The device must take Ms. Mugford's disabilities in consideration and have the ability to use at multiple gas stations.

Design

Describe the design referring to the visuals. How heavy will it be? How big will it be? Describe with respect to the user.

Functionality

What can it do, functionally speaking, for the user? Can it do everything the client requested with regards to the problem addressed?

Materials, Components, and Assembly

The materials used for this design could be found at almost **any** utility store. The parts consist of a wooden dowel, three ABS pipe pieces, two metal plumping adjustable clamps, two foam bike handle grips, and electrical tape. If trying to model exact prototype, fluorescent orange spray paint is optional, but does not change the function of the device in any way. The only tools used to assemble this device was a saw to cut the wooden dowel to appropriate size, as well as a screwdriver to fasten the plumping clamps. Both of which can be done in the utility store, taking a total construction time of approximately twenty minutes, and can also be done by the customer service representatives that are more than willing for assist with the devices construction.

Bill of materials:

Materials	**Cost**	
abs pipe pieces	$4.99	
abs cement	$3.97	
cylindrical dowel wood (1 inch	$2.49	

diameter)		
electrical tape	$1.79	
foam bike handles	$4.99	
metal piping clamps	$4.99	
spray paint	$4.49	**Total Cost** $27.71

Instructions for Assembly:

1. Require Bill of Materials.
2. Cut wooden dowel down to 1’6”
3. Fully insert wooden dowel through T shaped ABS pipe so that the end of the wooden dowel can be just seen at one end.
4. Fasten metal adjustable plumping clamps on either end of the “T” ABS pipe to secure wooden dowel.
5. Attach the second and third pieces of ABS piping with ABS cement coated ends, so that the end piece makes a “C” that wraps back around pointing to the stem.
6. Slide bike grips onto top of wooden dowel and secure with end cap.
7. Cover any sharp edges at the bottom of the shaft with electrical tape
8. Spray paint end pivot piece for enhanced visibility.
9. Device is ready to use, but not recommended for use until the cement fully sets.

Use

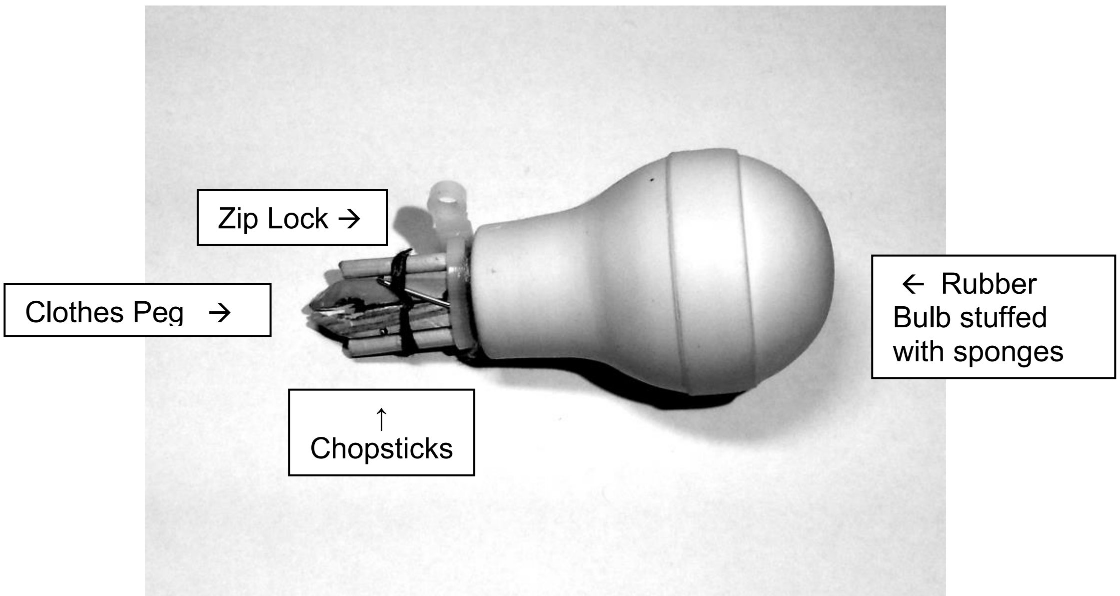
Include step-by-step instructions of how the device will be used. The instructions should be in a numbered list. Include where the device will be stored, how she will carry the device, where she will keep the device when performing the other tasks, etc.

Benefits

What makes your design better than existing solutions, including those of your peers?

The Easy Squeeze

BioBotics
F 17 -126 - 2



Problem Description

The device built by Biobotics addresses the credit card insertion problem. This task causes the user, M. Sandi Mugford, the greatest amount of pain and thus, solving this issue will allow her to regain her independence and efficiency at the gas station while reducing the amount of pain she has to endure.
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Design

The device built by Biobotics addresses the credit card insertion problem. This task causes the user, M. Sandi Mugford, the greatest amount of pain and thus, solving this issue will allow her to regain her independence and efficiency at the gas station while reducing the amount of pain she has to endure.

.Functionality

The device built by Biobotics addresses the credit card insertion problem. This task causes the user, M. Sandi Mugford, the greatest amount of pain and thus, solving this issue will allow her to regain her independence and efficiency at the gas station while reducing the amount of pain she has to endure.

Materials, Components, and Assembly

The materials used in the construction of this device were: A rubber bulb from a turkey baster, a clothes peg, sponges, chopsticks, zip locks, and small pieces of rubber. There are two main components of this device that are vital for its functionality; the rubber bulb and the clothes peg. The rubber bulb serves as the foundation of the device and will be the main component that Sandi squeezes in order to get the other main component to function. The clothes peg is the component that will act as the gripping device. Once Sandi squeezes the rubber bulb, the mouth of the peg will open and then close upon release.

The materials previously mentioned can be attained from any home hardware store, but in this case they were purchased from Canadian Tire and the total cost sums up to around $11. Only three main tools were used during the construction of the device which includes tape, a knife, and super glue. The assembly of this device took approximately two hours to finish, but by following a set of step by step instructions, the assembly should take half that time.

There are a set of instructions that the user must follow to build this device. These instructions are included in the report and can be provided upon request.

Use

1) Sandi will open the door of her car upon arriving at the gas station.
2) Sandi will remove the Easy Squeeze device from its storage place.
3) Sandi will take out her credit card.
4) By squeezing the bulb at the end of the easy squeeze, Sandi will open the jaws of the device, inside of which she will place her credit card. She will then release pressure, and the jaws will close, thus holding the credit card in place.
5) Sandi will hold the Easy Squeeze by the bulb and gently push it towards the slot of the machine. This will insert the credit card.
6) Sandi can now let go of the device, which will hold onto the card while it is in the machine.
7) Sandi will perform other tasks at the pump while her card is in the machine.
8) When ready to remove her credit card, Sandi will gently pull on the end of the Easy Squeeze, which will remove the card from the machine.
9) Sandi squeezes the end of the easy squeeze to release her credit card.
10) Sandi places her credit card and Easy Squeeze device back into her purse, pocket, or car.
11) Sandi may now get back into her car and exit the gas station.

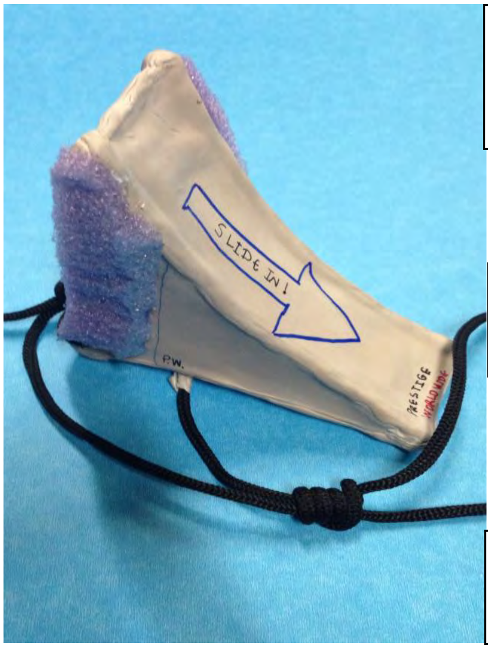
Benefits

The easy squeeze has many aspects that make it both beneficial and efficient. One of the characteristics of the easy squeeze that makes this device better than other devices is its extremely light weight and its small size. The small size of this device guarantees that it is easily portable anywhere. The user can carry this device in her car or even in her purse. Due to its light weight (of about 1 lb.) , the device itself will hold onto the credit card on the credit card machine and therefore, the client can focus on other tasks such as fueling the car and pressing the keypads rather than worrying about where to place the device while she completes the listed tasks.

The easy squeeze is very cost efficient. Its price of about $11 provides an opportunity for any user in any financial status to purchase and use this device. Most existing solutions/devices are either too expensive, thus unaffordable for many users, or are very complex and heavy (due to the heavy material that is used in its construction). The low price and simple design of the easy squeeze makes our product much more efficient and beneficial than most existing devices.

Thermo Wedge

Prestige Worldwide
F 1 7 - 1 2 6 - 3



Approximately 6cm wide, 12cm long, and 10cm high.

Fits in beneath the gas nozzle trigger.

String bracelet to prevent dropping.

Problem Description

The goal is to create a device for Dr. Fleisig to assist Sandi with pumping gas at a gas station. The purpose of the device is to reduce the pain and energy involved in the process, which will provide Sandi the independence she desires.

Design

The Thermo Wedge is a solid with a curved and inclined face and weighs less than 1 pound with the dimensions of approximately 6cm wide, 12cm long, and 10cm tall. This device will easily fit inside of an average size purse and is light enough to carry and use with a single hand. The string bracelet may be widened or narrowed to accommodate for any size hand or wrist, and can offer a method to secure the device.

Functionality

The Thermo Wedge allows the user to comfortably pump gas at a gas station without any assistance and does not require much energy to use. There are no safety hazards or pollutants associated with the device. The device does not require assembly which allows the user to swiftly accomplish the refueling process. The device should be placed under the gas nozzle trigger and pushed inward to lift the trigger and pump gas. This removes the strain on the user's hands by replacing the squeezing of the trigger with a less straining, pushing motion.

Materials, Components, and Assembly

The Thermo Wedge requires hot water, glue, scissors, some drawstring, foam and approximately three dollars worth of thermoplastic to build. The thermoplastic is heated using the hot water and molded into the wedge-like shape. The drawstring is fed through a hole made in the thermoplastic and tied to make an adjustable bracelet. Lastly, foam is attached to either side using glue to complete the device. The device can be assembled within an hour and can be made with a budget of five dollars. The drawstring and foam may be purchased from the Dollar Store, and thermoplastic may be bought online at http://www.tapplastics.com/product/plastics/cut_to_size_plastic/acetal_sheet_delrin/525.

Use

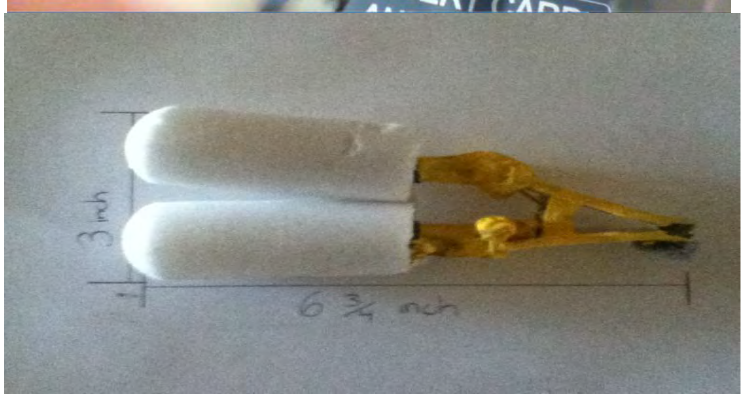
1. Place hand inside of drawstring bracelet and allow device to be hung off the wrist.
2. Insert gas nozzle into car.
3. Position the wedge beneath the gas nozzle trigger with the arrow pointing towards the gas nozzle.
4. Push the side of the wedge inward towards gas nozzle, and hold until the desired amount of gas is pumped.
5. Cease applying pressure on the device
6. Pull the hand inside the bracelet away from the gas nozzle to detach the device from the nozzle.
7. Remove hand from the bracelet and place the Thermo Wedge into a pocket or purse.
8. Remove gas nozzle from car and finish the refueling process.

Benefits

The Thermo Wedge is superior to other gas nozzle solutions due to its compact size and light weight. These qualities are represented in the device because it weighs around a 100 grams and is able to fit inside of a small purse. The device is also extremely safe because there are no hooks or sharp edges throughout the device and is also durable. The durability of the device is due to the resistance of the thermoplastic material to extreme temperature and rain. The thermoplastic can also resist changes in form with force applied. The foaming also provides material with high specific heat capacity, thus providing a comfortable area to hold when cold. The device does not use a motor so it can be used indefinitely without being recharged and no extra noise is produced with the use of this device. Finally, the device is relatively cheap to build, and can be assembled within an hour.

E-Z Hold

Delight Fuel Designs
F17 -126 -4



Problem Description

The group's problem is to design a functioning device that will reduce her pain and time spent at the gas station, thus maintaining her independence. This will be done by designing a credit card receiving/removal device that has integrated touch-screen capabilities and can double as a keypad device.

Design

The device is extremely lightweight and compact due to lightweight and cushioned material. The device measures a length of 7 ¾'', a height of 3'' and a width of 1 ½''

Functionality

The device's clamps can be opened with ease and can clamp down and hold the card reliably without slipping. It provides a nice fit into any card machine for insertion and retrieval of the card. The device's narrow clamps also provide a non-view obstructing, pushing structure for any keypad device. Any touch screen keypad encountered is also accounted for with the touch screen component at the end of the clamps.

Materials, Components, and Assembly

The device makes use of small paint roller sleeves, plastic clips, glue, zip-ties, rubber strips, touch screen gloves, aluminum foil and small PVC piping. The total cost of these materials is $15.06. These materials can be obtained from any hardware and retailer such as Shoppers Drug Mart and Home Hardware. Assembly of the device takes approximately an hour. Instructions that will be needed are to disassemble the clip's spring in order to hot glue and zip-tie the PVC piping to each individual clamp and preferably wait for the glue to dry. The last part of the instructions would be to glue on a small strip of aluminum foil leading to touch screen finger part of the glove to enable conductivity of electricity so touch screen capabilities are functional.

Use

1. She will squeeze on the handles to open clamps and insert her credit card between them.
2. She will release her to close the clamps onto the credit card and insert the card into the machine by gripping once again to leave the card in the machine.
3. She will then use the device to push any buttons the machine requires her to use or she may use the touch screen component where applicable.
4. She then uses the device to retrieve her card by inserting it into the card slot, opening the clamps, then closing them to grip onto the card and open them again to put her card away in a safe place.
5. She can then store her device back into her vehicle in the glove compartment or on top of her vehicle while she completes other activities at the station.

Benefits

The group's device provides many advantages over the solutions that Sandi is currently using. Compared to the pliers she uses, the group's device provides a comfortable grip and squeeze on the handles. The device is also sensitive to the consideration of weather conditions. The metal material of the pliers become painfully cold as temperatures drop, whereas the E-Z hold is made of a more heat conductive material. The metal material is also a hassle its weight, where the E-Z Hold is made primarily of plastic. She also described that the pliers she uses tend to break her card. The E-Z Hold has no sharp edges or potential to break the card due to soft rubber strips glued to the inside of the clamps as platforms for the card to fit between, thus a safer device for her to use. Other solutions such as the Multi-Task Hand Aid suffer from sharp edges, and the fine motor skills required in the case that it is dropped. The E-Z Hold can be picked up by the handles without clenching the fingers too much. Another solution such as the Control Enhancing Tweezers suffer from fine motor skills required to effectively use the device and increased risk of dropping the card itself because it has no platform for the card to rest between.

The group's device can do everything its competitors can do, even double as a keypad presser. What makes the E-Z hold more competitive than its peers through its simplicity. The E-Z Hold is more compact and shorter than its competitors. The design accounts for weather conditions and goes the extra mile by implementing touch screen capabilities with ease of integrating it into the device. The device is also more competitive in that it is more resilient to impact from dropping it. Much of the shock is absorbed within the handles and is a lot more comfortable to pick up.

Sky Touch

Team Name
F 17 - 126 - 5

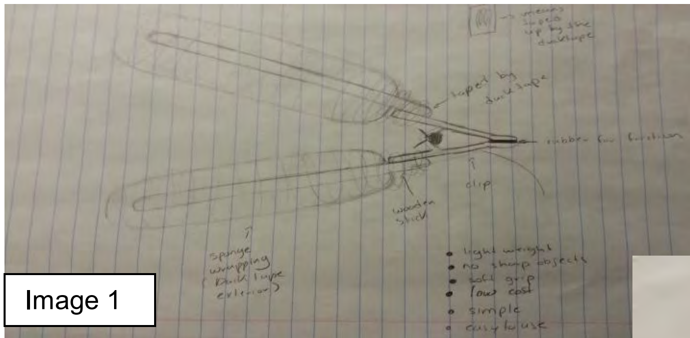


Image 1

Image 2

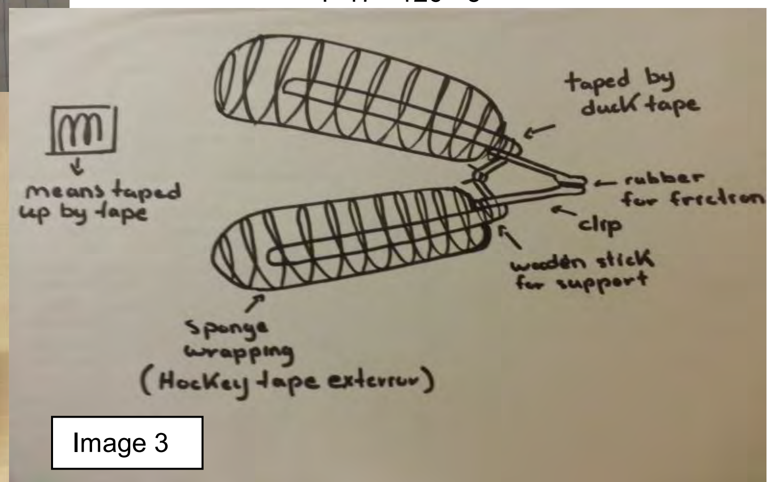


Image 3

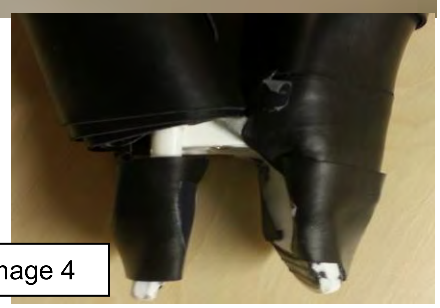


Image 4

Problem Description

Dr. Fleisig, Abbey and Sandi the projects clients have commissioned team Self-Assist to design a solution that will promote efficiency and reduce the pain of the user Sandi Mugford, who suffers from rheumatoid arthritis, during the process of pumping gas at a gas station. This will allow Sandi convenience at the pump and prolong the amount of time she can independently pump gas. Sky Touch is designed to tackle Sandi's Credit card issue. It will assist Sandi with the process of inserting and removing her credit card from the machine. This device will work with every gas station and every credit card.

Design

As seen above in image 3, the design is fairly simple but very efficient. It has sponges wrapped around a wooden shaft, which is then taped onto plastic pincer like clip. The device weighs less than one pound. It is 8.5 inches long, 7 inches wide when relaxed, and gets smaller as you get to the pincers as seen in the diagram above. Although it looks big, it is very light and fits very easily into one's hand, which is perfect for the user, Sandi Mugford. Even for her altered hands, this device should be light enough, big enough and easy to hold.

Functionality

Regarding the process of inserting and removing the credit card, Sky Touch performs the functions it need to, in a more than satisfactory degree. Sky Touch is able to insert and remove the credit card with ease while providing minimal joint movement, this in turn minimizes the amount of pain Sandi feels. It has a big grip, to accommodate for Sandi limited movement. The grip is adjustable so that Sandi can find a location that provides her with the least pain and most ease. As seen in image 2, there is more than enough space for the user, Sandi Mugford, to choose where to grip the handle. Sky Touch can also be used at any gas station and with any credit card. It can do everything the client requested in regards to the problem addressed, and does everything the user wanted.

Materials, Components, and Assembly

The only materials the device needs are pincers, sponges, tape and two short wooden shafts. The total cost of all the materials is $5.09 with taxes. All the materials can be bought from Dollarama and are quite reliable. A small hacksaw might be required, but this is not needed. The hacksaw would be used to cut the wood to an optimal length. A small wooden shaft can be bought at Dollarama, however, and would not need the use of a hacksaw. It takes a total of 20 minutes to construct with two people. The wooden shaft must be taped to the plastic pinches, and then the sponge must be taped around the wooden shaft-pinches device. This is to cover up the hard wood and provide a soft light grip. Assembly does not need any special extremely difficult instructions. It is simple, straightforward and easy to build.

Use

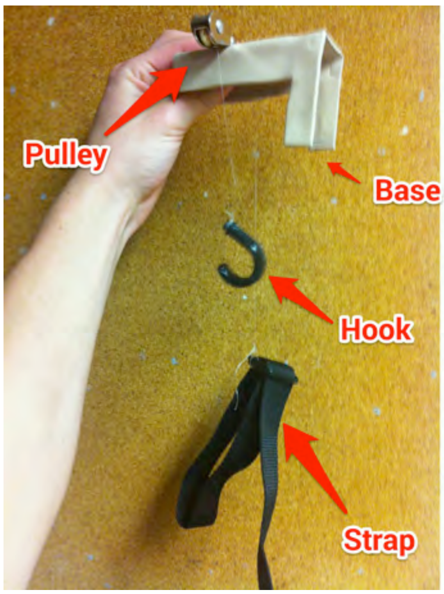
1. Remove device from car seat. The device can be carried with hands.
2. The device can be opened by either using both hands and pressing on the wide end (after the device opens up wide, one hand can let go of the grip), or one hand holds one handle, and the other handle is pushed against another surface. Look at image 4 to see the open state of the device.
3. The now free hand will be used to insert the credit card into device
4. Slowly lessen the force applied onto grip until device is closed and the credit card in secured
5. Proceed to insert credit card attached to device into machine
6. Device in relaxed state can now be put over side mirror, while fuelling vehicle. Look at image 2 for example of relaxed state.
7. Then remove the credit card using the device by doing step 2, and removing the credit card from the machine, and then the device.

Benefits

While other prototypes weigh more than one pound, Sky Touch weighs in less than a pound. The handles were intentionally kept long so that Sandi could press the handle to whatever length she finds convenient, given that Sandi has her own preferences. There are several different ways of opening the device to provide accessibility, depending on how Sandi's hands are on any given day. Unlike pliers, which Sandi was using before, Sky Touch does not damage the credit card with each use. On top of that, the device is reusable and works at every gas station. It has a softer and better grip than any other teams. Using Sky Touch makes the credit card easy to insert and take out. Sky Touch was also extremely cheap and easy to make, and its simplistic nature makes it very easy to use.

Hook n' Flow

Little Dym Lights
F 17- 126 - 6



Problem Description

The goal of this project is to create a device that will assist Sandi in the process of refuelling her car. The main goals of our device were to provide Sandi with a way she can pump gas that will reduce the amount of work she does and pain she experiences as well as restoring her independence at the pump.

Design

Our design removes the need for Sandi to squeeze her hands in order to pump gas. It uses a pulley to transfer the upward pulling motion into a sideways pulling motion that does not involve the squeezing or gripping motion of the hand. Our design can do everything the client requested with regards to the problem of making gas come out of the nozzle.

Functionality

Our design removes the need for Sandi to squeeze her hands in order to pump gas. It uses a pulley to transfer the upward pulling motion into a sideways pulling motion that does not involve the squeezing or gripping motion of the hand. Our design can do everything the client requested with regards to the problem of making gas come out of the nozzle.

Benefits

One benefit of our design is that it is fairly simple and is comprised of only five parts. Our device is very light and very small, as well as being very inexpensive. Our design is really easy to build and it does not take long to build it either. The materials used to build our design are easily found at hardware or hobby stores. Our design is easier to use than many of the other prototypes and the set up is quicker and less complicated than that of the other prototypes.

Materials, Components, and Assembly

To build our design, you must have the following items available for use, as well as sufficient funds to purchase these items and a nearby location or alternate location to make such purchases;

Cost and location of materials

Item	Cost	Location to Purchase
Hook	$1.25	Home Hardware
Piece of thermoplastic	~$10.00	The Underground
Pulley	$2.25	Home Hardware
Fishing line	$2.00	Canadian Tire
Super glue	$1.00	Dollar Store
Strap	$2.00	Canadian Tire

To construct our design you will need to have a pair of scissors to cut the fishing line to the appropriate length and to cut the extra material on the strap. Access to a sink or tub is needed to contain hot water in order to heat up the thermoplastic. Scissors will then be needed to cut the thermoplastic. Construction of the device should take approximately 2 hours. The instructions to building our device are as follows;

1. Cut out approximately 55cm of fishing line and then cut the strap so there is enough room to fit over the users arm easily, and then some extra slack.

3. Form thermoplastic base by placing it in water close to boiling temperature and cut out a piece in the shape of a 2 dimensional top hat.

4. Fold the sides of the top hat down so that the remaining piece is the desired width of the gas handle.

5. Super glue the pulley on the top surface of the thermoplastic so it hangs over the edge slightly. Then run the fishing line through the pulley and super glue the hook to the end of the line that goes through the pulley.

7. Super glue the strap to the free end of the fishing line.

These are the basic set of instructions, but they may need to be altered depending on the size of the intended gas pump handle.

Use

1. Remove device from trunk or glovebox. Place base of device on the handle of the gas nozzle.

2. Put hand in the strap (The strap does not need to be tightened). Place hook under the trigger of the gas nozzle.

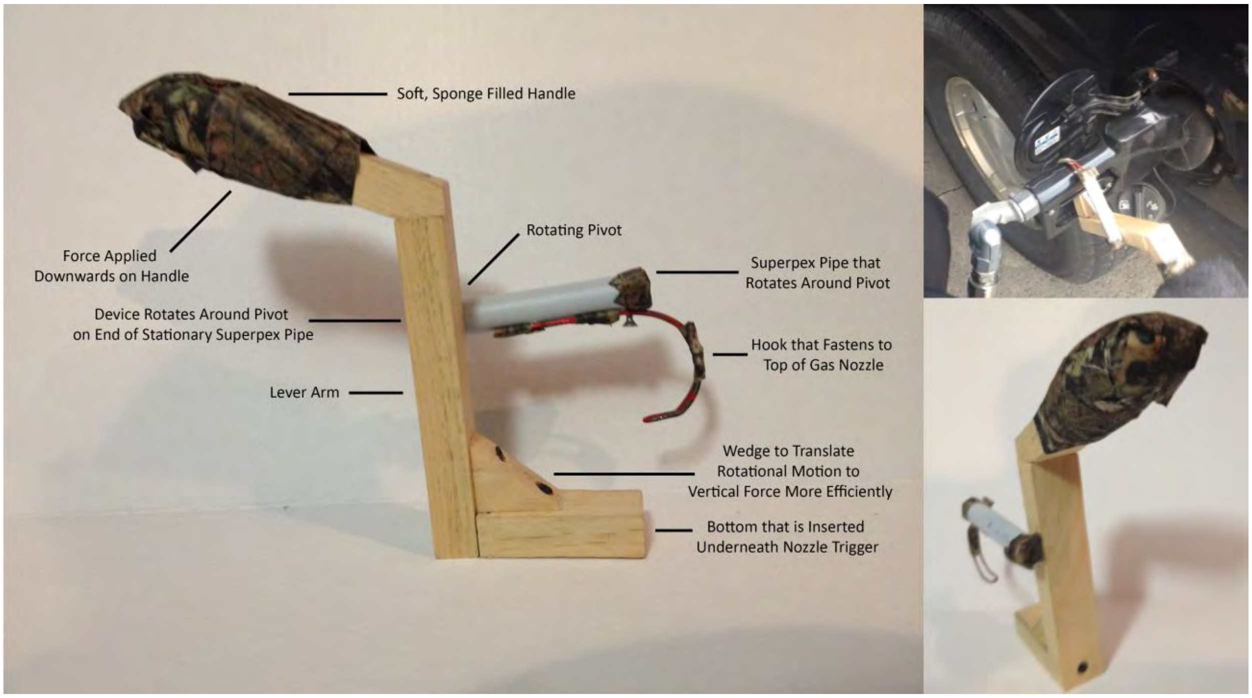
3. Move arm upwards or sideways away from the nozzle. This created tension in the fishing line and will begin to lift the trigger and allows gas to flow.

4. When finished pumping, return arm to a neutral position to give slack in the fishing line.

5. Remove the hook from under the trigger, take hand out of the strap and remove the base from the handle of the nozzle. Place device back in glovebox or trunk. Pay for the gas and then leave.

The Impact Lever mk. III

Meteor Solutions
F17-126-7



Problem Description

We are designing a product for Dr. Fleisig, Sandi Mugford, Abbey, and Shadi to be used by Sandi Mugford. She has been diagnosed with rheumatoid arthritis and is looking for a product that will allow for an easier and less painful car refuelling experience at a typical gas station. Our product should aid in the operation of the gas nozzle.

Design

The device has an “L” shape with another piece of wood coming off at an angle from the top. The Superpex arm is loosely attached to the wood so it can be repositioned. The Superpex arm also acts has a hook attached to the end of it to secure the device to the gas nozzle by hooking around the top of the handle of the nozzle. There is a wooden wedge between the bottom two pieces to provide structural support and translate force into vertical motion more efficiently. The device’s weight is less than a pound. Because the device is so light it allows for Sandi to use it and hold with ease. The volume of the object is less than 1000cm^3 and is about 17cm tall and 3cm wide. This allows it to be easily held and transported by Sandi, in her car and in carrying.

Functionality

The device is able to lift the trigger of the gas nozzle and pump gas proficiently. By pushing down on the top of the lever the bottom part is moved up, lifting the trigger. Sandi would no longer have to squeeze the trigger with her fingers, instead merely attaching the device to the gas nozzle then using her forearm and body weight to push down the lever and begin the pumping. This would greatly lower the difficulty and pain related to pumping gas for the user.

The device is able to address everything with regards to the gas nozzle problem that Sandi requested. It would help Sandi immensely with pumping her gas with less pain than before.

Materials, Components, and Assembly

There are a few different materials that were used in the construction of the device. Pine wood, Superpex, gorilla tape, sponges, screws, and a hook were all components. The cost of the materials was just under 20 dollars. All of the materials were purchased at home depot. The tools used were a miter saw, a drill, and a screw driver. In order to build the design to exact dimensions it takes around 3 hours to build. To build the device, cut 4 pieces of wood with the miter saw. Then drill the correct holes in the wood and Superpex with the drill. Next use the screwdriver to attach all the wood and Superpex pieces together with screws. Attach the hook to the Superpex with screws. Finally, gorilla tape a sponge to the lever arm. There is no assembly required once constructed.

Use

The steps of how to use the device is as follows:

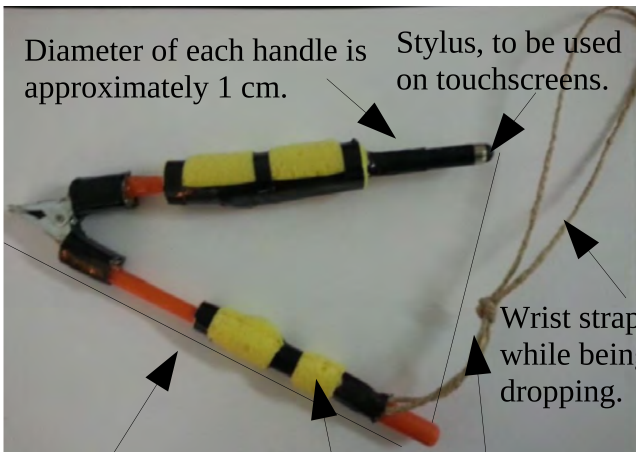
1. Open gas fuel door and insert the gas nozzle as normal.
2. Retrieve the device from the car. It could be stored in the front seat, back seat, trunk or other convenient place.
3. The device can be held the device with the hand or hands by the ergonomic grip handle.
4. Next, the hook attached to the swivelling arm is hooked around the far side of the top piece of the handle of the gas nozzle, if necessary adjust the hook to the correct position.
5. While hook is secure around top handle piece, insert the bottom piece of the lever between the trigger and the handle.
6. Push down on the top grip of the lever arm with forearm or most convenient, pain-free body part. This pushes down the handle and top part of the lever and raises the bottom of the device, which should be between the bottom and handle of the nozzle. The hook will keep the device secure as it raises the trigger and activates the gas pump.
7. After finishing pumping the gas, take the device out and place it back in car or automobile while completing other tasks.

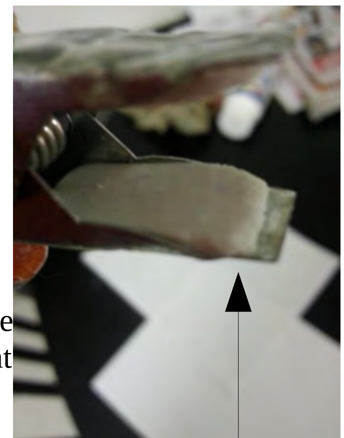
Benefits

The device has numerous benefits and there are several reasons why this design is better than existing solutions and those of our peers. To start with, without any assistance squeezing the trigger can be very painful. Using the device makes the squeezing of the trigger unnecessary which would greatly reduce the pain. Also, the device removes the need to use her hand continuously, instead allowing her to use her forearm to keep the trigger depressed. Currently she needs to take breaks because of the pain. The device can reduce the pain and prevent the need to take breaks which would speed up the time spent at the gas station. Furthermore, it is robust and very simple so this reduces the chance of the device failing. To add, it is easy to use and also cost effective to make. The design is much lighter and smaller than most other solutions proposed and only relies on the movement of non-vulnerable areas and not the hand or fingers. These benefits are why the use of this design is more advantageous than other designs or solutions.

Payment Pal

Transilence
F17-126-8





Problem Description

To help the client and end user, Sandi Mugford, and others with Rheumatoid Arthritis, pump gas at a gas station more easily while documenting and demonstrating the design process to Dr.Robert Fleisig. This will be done in two ways. Primarily, the project will reduce the pain Sandi experiences due to Rheumatoid Arthritis while pumping gas by developing a device that will aid her. Secondly, her effincency at the pump will be increased through this device. Both of these methods will allow the user to carry out a more independent and comfortable life.

Functionality

This device can be used to aid the user as they use the credit card machine and keypad at a gas station. By gripping the credit card in a strong clip, the device can be used to insert the credit card into the machine with ease, reducing the required effort by the user, and reducing pain as they operate the machine. The device has also been fitted with attachments to aid in the operation of the keypad. Various 'tips' can be used on different keypad configurations, such as touchscreen or traditional keypad, again to reduce the pain and required force from the user. Of the three problems presented by the client, this device addresses two issues, which were regarded to be the most important of the three, by the firm as a whole.

Design

This device was designed with the user in mind, ensuring that the device would be safe to use, functional, and practical for a person with severe limitations in their range of motion in their hands and fingers, to use. The device requires very little motion and energy from the user themselves, due to the nature of the spring inside the clip; they simply have to squeeze the handles together and insert their credit card inside the open clip. The erasers inside the jaws of the clip, as shown above, increase the amount of friction between the card and the device, ensuring that the user will not drop or lose their credit card while operating the device. A wrist strap, as shown above, also prevents the user from dropping the device while using it. The device itself is small, with the ability to fit inside virtually any storage space in a car, and can fit comfortably in the user's hand. Being just under 50 grams, the device is extremely light, therefore the user should not have any problems holding the device or maintaining the energy required to do so.

Use

1. Remove device from the trunk of the user's car. Remove the credit card from the trunk at this time as well.
2.Slide the user's wrist through the provided strap, and hold the credit card in the non occupied hand.
3.Holding the card so the chip end is pointing away from the heel of the hand, squeeze the device handles to open the jaws, and slide the clip over the end of the card, releasing grip to tighten the device's hold on the card.
4. Using the device, guide the credit card into the machine, and release the card by squeezing the handles.
5. Using the end of the device handles, enter personal information, using the attached stylus on a touchscreen, or the alternate handle end on a traditional keypad.
6. Retrieve card from machine in the same manner as outlined above, and squeezing the handles to open and close the device clip. After retrieving the credit card, the card and the device can be safely returned to the trunk of the car, and the user can continue on with the refuelling process.

Materials, Components, and Assembly

The device was made from inexpensive and simple components. The most complex piece of this device was the clip at the end that held the card, and was already pre-fabricated. The device met the objective of simplicity, being made of only 5 simple components; an alligator clip, two thin fiberglass rods, a stylus, and sponges, as well as various adhesives to bond the materials together, which could all be attained at any hardware store at a mininal cost. The total cost of this device was in the range of $11 to $14, an easily affordable price. To build this device, one simply needed a sharp knife or saw to cut the fiberglass rods to the appropriate length, and several clamps to hold the device together as the various adhesives set after being applied, thus making the construction of the device easily repeatable. The bulk of the time required for construction came from letting the adhesives set , so that they properly held the device together. Due to the simplicity of the design,assembly of the device needs few instructions and guidelines. Simply cut the fiberglass rods to length, fasten them to the clip using an epoxy, attach the stylus onto the end using an epoxy again, and leave those pieces to set. After setting, use duct tape to fasten the spong grips to the device handles, and use a strong glue to fasten small pieces of eraser to the inside faces of the clip.

Benefits

This device has several key benefits to the user that brings it above existing products. First, the device has been designed with the user and their possesions in mind. Previous machines, such as pliers, could easily harm the credit card and reduce its functionality. With this in mind, this device was created with a clip that ensured that the card would not be damaged while being used with the device. Additionally, the device's light weight has an appeal to the user, as they are limited in their ability to lift heavy obects. Weighing just under 50 grams, this device will not cause additional strain on the user as a result of its weight. Further,the device accomplishes two separate tasks, allowing the user to only transport a single device to perform both tasks, rather than having a separate device for each task.

The Relever

Federal Bureau of Innovation

F 17- 126 - 9

Problem Description

The problem the F.B.I is facing is assisting Sandi Mugford at the gas station by helping her to pump gas efficiently while reducing the amount of force she needs to exert. This problem was chosen because it is the most time consuming of all tasks. By aiding Sandi Mugford with this problem we are giving her an easier and a less painful experience at the gas station.

Design

The device works like a lever. One arm goes on top of the handle and acts as a pivot while the other arm goes under the trigger and lifts the trigger up, allowing fuel to flow. When Sandi extends her arm or leans forward towards the car, the device will rotate about the pivot arm and lift the bottom arm, fuelling the car. The device is thirty-two centimeters in length and thirteen and a half centimeters wide. The Relever weighs less than a pound and is less than a cubic feet square, making it a portable and lightweight device.

Functionality

The client requested a device that solves the problem of pumping gas, using the keypad or inserting a credit card. The F.B.I created the Relever to accomplish one of the user's requests perfectly. The Relever makes the process of pumping gas much easier. It allows the trigger on the gas pump to be lifted with ease, as it requires less effort and force. The user only has to push the handle forward. The process of pumping gas is made easier with our device as it relieves the user of a lot of the pain and strife, making the ordeal more enjoyable.

Materials, Components, and Assembly

The simple design of the Relever only requires small pieces of wood, braces, and screws, to construct. The straightforward design made the cost of production to be a very reasonable price of $12.80. The materials are available at every home improvement store as none of the parts are custom to the Relever. With basic instructions on where to cut the wood and place the braces only a saw, screwdriver and thirty minutes of your time is needed for the construction of the Relever.

Use

The device is very straightforward and after using it once you will never forget how to use it. In five simple steps the user will be able to easily fuel their car.

1) Hold the Relever handle so it is pointing up and towards the user
2) Place the bottom arm under the gas pumps trigger
3) Place the top arm on top of the gas pump
4) Push handle forward towards the car to lift the trigger
5) Slide out once the car is fuelled

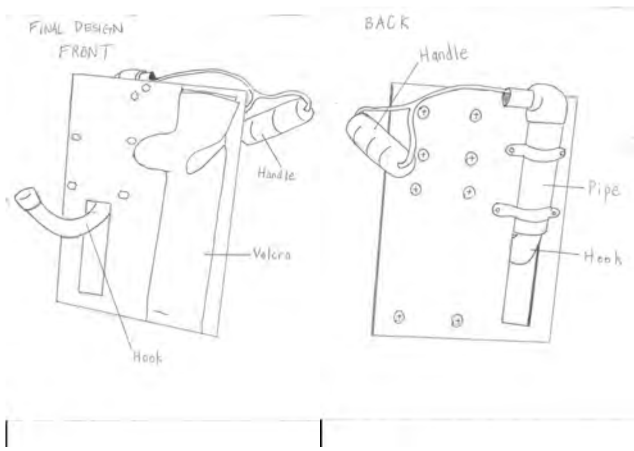
Once the car is fuelled the user is able to place it on their car while putting away their credit card. The Relever is designed not to slip or scratch the car so the user has no reason to worry. Once the user is done with the design they are able to transport it by holding it wherever they desire and then proceed to put it where they desire such as, beside the driver seat, in the glove box or in the trunk.

Benefits

The Relever is unrivalled by any other device as it is lighter, stronger, more efficient and easy to use. The device allows Sandi to exert less force to do the same task. Only a small amount of force is now required to pump gas and no hand strength is required. The user does not have to grasp the handle, as it could cause pain. Instead the user could simply place their palm on the handle and push forward. The Relever is lightweight and is ergonomically designed to prevent the user from experiencing additional pain. The only competition the Relever faces is that from groups in Engineering Profession and Practice classes, however they are unable to match the quality that the Relever has as most devices invented are not water proof and are heavier in mass.

Pull n’ Pump

MODISO
F 18 - 227 - 1



Sketches of the device


Back view of the device. Front View of the device.

Problem Description

To help Sandi become more independent by reducing the pain and energy required for her to pump gas. Specifically, we are trying to address the problem of squeezing the gas nozzle, reducing the stress put on her hands while squeezing and reducing the time it takes for her to fill her car with gas.

Design

The device is put together with Velcro and pipe, which are bolted onto a wooden board. The handle is connected to the hook with a cable which goes through the pipe and connects to the hook. The hook is allowed to move up and down by cutting a rectangular shape on the wooden board. According to the client, she can lift no more than 5 pounds. Therefore, the device was made to weigh around 2 pounds. It will be around 30cm x 13.5cm x 0.5 cm, length x width x thickness respectively.

Functionality

The Pull n’ Pump is used to aid in the process of pumping gas. It changes the direction and amount of force required to activate the trigger on the gas nozzle. It helps the user maintain independence at the gas station. As well, as reducing the amount of pain pumping gas can cause. The device creates a reduction in the amount of energy that needs to be exerted during the pumping of the gas. This device can aid in pumping gas by reducing pain and energy exertion and helps Sandi maintain her independence.

Materials, Components, and Assembly

To make the Pump 'N' Pull requires a lot of materials that are not common but can easily be obtained from any hardware store such as a Canadian Tire. The Pull 'N' Pump is made up of: CPVC pipe, copper pipe brackets, a piece of wood, clothesline, a foam handle, a bike hook, Velcro and come screws. To assemble the device all that is need is a screwdriver and a wrench to put in the screws. The entire device was assembled with the same screws all of which are Phillips head of the same diameter. This was done so that it will only take one screwdriver and one wrench not multiple sizes. To assemble the device will take between ten and fifteen minutes depending on how familiar the builder is with the design and their ability to use a screwdriver. Instructions on where to put the screws would be needed to help assemble the device. Instructions for use should not be needed but they would be included anyway to prevent confusion and damage to the product.

Use

1. Remove the gas nozzle from the gas dispenser and insert into the gas tank.
2. Strap the Velcro tape to the gas nozzle and secure it tide, and hook onto the trigger.
3. Use the credit card and select the fuel type.
4. Push the blue handle forward, and hold till the gas is shut off.
5. Remove the device from the gas nozzle.
6. Keep it in the storage compartment on the door.

Benefits

This design is better than what Sandi currently does to pump gas. It allows her to preform the same task more comfortably, using only one simple motion. This device is better than many of the other devices currently out there. It is lightweight, portable, durable, inexpensive and easy to use. Many of the other devices still require Sandi to grip part of it, where the Pull n' Pump allows pressure to be applied with an open palm. Pull n' Pump's unique design allows Sandi to remain independent at the gas station.

The Comfy Card Clamp

Sabbia
F 18 - 227 – 02

Problem Description

To help Sandi Mugford make payments at gas stations with much less pain and inconvenience than she currently endures. Our device will be used at self-serve gas stations and help her insert and remove a credit card at a gas pump. This project, given to us by Dr. Fleisig, will be completed under his and the teaching staff's guidance.

Design

The device will comfortably fit the user's grasp. It is about six inches long and is remarkably light. Its total mass is only 47 grams! The sponge handle takes up the most volume, relative to the other parts of our device. Looking at the visual picture, one can see the Comfy Card Clamp fits easily into a user's hand of any size. We asked individuals with small, medium, and large hands how well they could handle it; each subject reported that it was easy to use and very comfortable. The main handle will fit in a user's hand with a small part of the sponge handle extending past the hand, in case a user would wish to hold onto a smaller handle.

Functionality

Functionally speaking, this device will allow a user to insert and remove a credit card into the payment slot of a gas pump. The Comfy Card Clamp is very versatile so a user can manipulate the clamp with a variety of handgrips, depending on which is most comfortable for them. Our testing of the device has shown it to be effective at gas stations and this effectiveness, combined with nearly pain free use, combine to make a practical and functional product.

Materials, Components, and Assembly

This product requires several materials: a durable clothespin, small strip of aluminum, short section of pipe and a sponge. For adhesives, an industrial adhesive should be used to attach the clothespin to the pipe and generic glue can be used to construct the sponge and pipe handle. To add grip to the aluminium and to waterproof the entire system, duct tape can be used. The costs of the materials are not significant with the bulk of the cost coming from the industrial adhesive and the aluminium.

All these materials are available at local department or hardware stores. A few tools are required for assembly including a hacksaw, file and a pair of scissors. The assembly will take 3-4 hours from start to finish, but the majority of this time is to allow the adhesive to properly set. Assembly does not need special instructions and is fairly straightforward. As long as safety standards are followed, our device can be put together in multiple ways.

Use

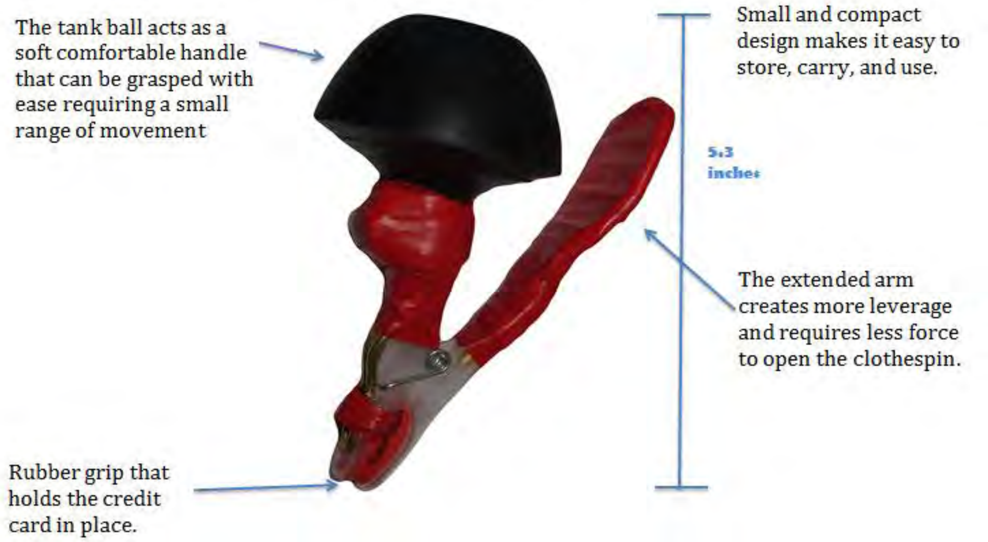
1. During driving, the device can be held in a glove box, cup-holder or door.
2. Compress the handle with one hand and slide the credit card into the holder with the other.
3. Release the grip and hold the sponge handle to insert the card into the payment slot.
4. During other operations, this device can be placed in the car, on the front of the car or even attached to the plastic shield that hangs over the receipt slot.
5. To remove card, simply compress the handle and release once the card is within the pinching area.
6. Remove the credit card.

Benefits

There are two common responses to the problem of a painful payment at a gas pump. One is to ask a stranger to help with the process. There are obvious practical issues and potential security problems with asking someone else to handle one's credit card. Not only is this not always possible because of a lack of gas station clients, there is also a significant risk of theft if one is to ask the help of strangers. A second course of action is to try to find a full-serve gas station in the area. This is problematic in Hamilton because there are not many full-serve gas stations. Having to drive across Hamilton to visit a particular gas station is a huge inconvenience for a client and is not always feasible. We believe that the aid made by Sabbia solves this problem and does not change a user's degree of independence or safety. Instead of making refuelling a great inconvenience, it will actually make the process easier. Sabbia believes their design is superior to other devices available because its ease of use. Compared to using one's hands or a pair of pliers, our device is extremely straightforward and simple. It allows for a variety of grips depending on which is most comfortable for our client.

Compact Card Clip

Magna Solacium Engineering
F 18 - 227 - 3



Problem Description

To help Sandi independently perform the function of credit card insertion and removal in self-service gas stations, which, in turn, will help reduce her level of fatigue and difficulty as opposed to her current state.

Design

The product was designed to make it easy to handle with one hand. The extended arm, rubberized card grip, and the rubber tank ball handle allows for a functional device even with minimal input force. Since majority of the device was made of plastic and rubber, the whole device weighs less than 5 lbs. This resulted to a compact, lightweight device that Sandi can easily use with one hand

Functionality

The device acts as an extension of the user's fingers. It simplifies the user's card insertion and removal procedure by providing automatic gripping motion on the card. Its small grip at the tip also eliminates the user's need to insert her hand into the credit card insertion slot by serving as an extension of the user's fingers.

The device's compact size makes it highly manoeuvrable and guidable, therefore decreasing the difficulty of having to guide the device and the card into the insertion slot

Materials, Components, and Assembly

The device was assembled using regular household items that can be bought in any hardware store. These items include a rubber tank ball, two brass float rods, one-half inch stainless steel hose clamp, Poly Clothes Pin with grip, Scotch Standard Foam Mounting Tape and electric tape. Since majority of these materials were bought in bulk, the total cost for the prototype building cost $28.82, however, the actual cost of the device on its own should cost no more than $15.00 to make.

For the actual construction of the device, no special tools are required aside from a pair of scissors and the materials stated above. The assembly of the prototype took approximately three hours to finish. It is reasonable to conclude that any reproduction of the prototype, with a given set of step by step instructions, will take less than three hours to finish.

Since the materials for this device were assembled together using household items that were modified to suit the means of the designers, step by step instructions need to be provided in order to assemble the device. These instructions are included in the report, and can be provided upon request.

Use

Usage Instructions:

1. The device can be stored in a variety of places including the purse, glove compartment, the pockets or even the trunk, depending on user preference.
2. Hold the device with preferred hand, the thumb must be wrapped around the ball area while the other four fingers are wrapped around the second handle
3. Open the device clamps on the other end by applying a slight squeezing force on the two handles
4. Placed credit card between the clamps and release the pressure on the handles
5. Using the device, insert the credit card into the insertion slot provided and lightly apply squeezing pressure on the handles to release the credit card (User may also simply leave the device attached to the inserted credit card)
6. While transaction is ongoing, the device may be stored in user's pocket or purse until it is needed again
7. After completing the transaction, hold the device again in the same motion as before, and apply pulling motion to remove the credit card from the slot.
8. Detached card from the device by applying the same squeezing pressure on the handle until it releases the card

Benefits

Majority of the proposed devices for credit card insertion perform on the same principle as the one devised by Magna Solacium. The device Magna Solacium came up with, however, has been improved in various aspects.

The placement and length of the handle allows for less squeezing resistance, making it easier to open the grips even for someone with hand disabilities.

A common problem with this design is that it becomes a problem to guide the credit card through the whole because the device inhibits the user's motor functions. This problem was significantly reduced by reducing the length of the device to such a point that it barely exceeds the size of the hand. The short length significantly reduces the difficulty in guiding the card through the hole

The squeeze ball handle and the foam cushioned handle, increases usage comfort level without compromising the device's weight or durability.

Credit Tongs

Platinum Standard
F 18- 227-4

Problem Description
Platinum Standard' goal is to aid Mrs. Sandi insert and retrieve her credit card, on behalf of the client Dr. Robert Fleisig. The goal is to design a device that will reduce the pain and the energy that Mrs. Mugford must exert to in order to refuel her car. Platinum Standard plans to find a permanent solution for Mrs. Mugford.

Design
The firm's design is based on a pair of locking salad tongs with the ends removed. The tongs are made of lightweight metal lightweight. The ends of the tongs are wrapped in Weather-stripping, grip mat and tape to give Mrs. Mugford the necessary friction to remove her card. The instrument is relatively compact; the entire device can fit in Mrs. Mugford's purse or pocket. The materials used for this project also make the device extremely durable and strong.

Functionality
The device functions as a card grasper, allowing Sandi to insert and remove her card from any gas station terminal. When it is not in use, the tongs are held open by a spring; to use the device the operator simply squeezes the handles.

Although the device does require an initial squeezing motion to grasp the card, the pressure required is minimal and only necessary for a brief period. Once the device has gripped the card, a locking mechanism can be engaged with a pulling motion to hold the tongs closed. Ultimately, the device performs its intended function quite well.

Materials, Components, and Assembly

Platinum Standard's device consists of pair of lightweight metal tongs with a modified grip. Originally, the tongs had rubber ends but these had to be removed because they did not allow the end effector to fit into the "finger hole" at gas stations. On the end of the tongs there is a thick layer of weather stripping and grip mat which provides the necessary friction to hold the card in place. The total cost for the device was $10.97. However, the team only used minimal amounts of the weather stripping, grip mat and tape so technically the price to build this device is much lower than $10.97. To build the device, Platinum Standard removed the ends of the salad tongs, wrapped sticky weather stripping around the ends and attached some grip mat on top with duct tape. From start to finish, the construction of this device took less than five minutes.

Use

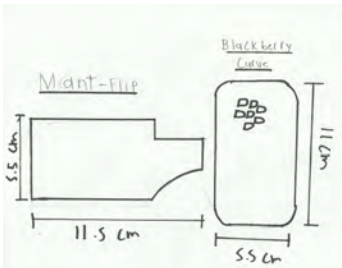
1) Remove the device from the user's glove box or purse and place on seat.
2) Remove card from purse.
3) Pick up device with free hand and insert card into apparatus.
4) Squeeze tongs closed with one hand and engage locking mechanism by pulling back the red ring with other hand.
5) Using the tongs, position the card in the slot and press in as far as possible.
6) Release the locking mechanism with free hand by pushing forwards on the red ring and then press the card the remaining distance into the slot (if necessary).
7) Slip the instrument back into the user's purse or pocket and continue with the transaction.
8) When it is time to remove the card, pull out the tongs and grasp the card.
9) With free hand, lock tongs in clamped position.
10) Pull card out with device.
11) Turn device around, grasp card and push red ring against gas pump to release grip.
12) Place device back in glove box or purse and put card away

Benefits

The design is compact and lightweight making it quite portable. The device is also extremely inexpensive and simple to build. Finally, the instrument's locking mechanism only requires Mrs. Mugford to use a minimal amount of pressure for a very brief period of time.

Manta-Flip

MANT Design
F18 - 227 - 5



Dimensions

Manta-Flip (card extended)

Manta-Flip (sleeves pulled apart)

Manta-Flip (card folded away)

Problem Description

Sandi a rheumatoid arthritis patient struggles to accomplish elementary tasks at the car pump station. A device is to be designed that will allow Sandi to maintain independence at the gas pump by reducing the pain she experiences while either operating the gas nozzle, pushing buttons and/or inserting/removing the credit card.

Design

The Manta-Flip is a credit card insertion and removal device that is shaped and sized like a wallet. As seen in the visuals above, the design mainly consists of a "sleeve" and a pivot for where the card would be attached to. The sleeve is made out of two wooden panels, covered in enough foam to allow the user to have a comfortable grip and also lower the amount of hand motion required by the user. A card can swivel on the pivot to be put away and extended out for use. The Velcro serves a temporary way to bind the two walls of the sleeve together. It is temporary as to allow the user to be able to change the card in the sleeve. The device itself is very light, weighing approximately 200 grams. To the user the device is easily carried, very light and simple to use.

Functionality

The main function of the Manta-Flip is to provide a larger, more comfortable grip to the credit card. It also has a secondary function of providing a carrying case for a single and credit card, which can be quickly accessed. The client, Sandi, requested for a device or multiple devices that would assist her at the gas pump. The areas that were to be focused on were the gas nozzle, credit card insertion/removal and the keypad. She requested something that would reduce the pain, and make the whole process easier and take less time. The device provides a solution to the credit card issue only. It makes inserting and removing the card much simpler by binding a grip onto the card, and reduces pain by providing a much nicer grip.

Materials, Components, and Assembly

The Manta-Flip is made out of foam, cedar wood, modelling plastic, copper tubing and Velcro. The foam costs $1 per sheet, the cedar wood is $1 per block, the modelling plastic costs $1 per sheet, copper tubing comes to 15 cents and the Velcro is $1.50 per strip. The total cost of the prototype came to $4.65. The foam, Velcro and modelling plastic can be found at a dollar store. The copper tubing and wood can be bought from any hardware store. In order to make the prototype the tools used include: a saw, scissors, a drill and a glue gun. The assembly involves cutting out the wood to an appropriate shape and then covering it in foam. A hole is drilled in one panel and a piece of copper piping is used on the other panel to form a pivot. The two panels are attached and Velcro strips are glued along the inside edge of both wooden panels. Velcro is also attached to the outside of both panels. A card must be hole punched to allow the card to function with the device.

Use

1. Remove the credit card from the sleeves by pushing on the plastic removal assembly
2. Insert the credit card into the machine
3. Proceed with pumping gas (the credit card can be left in the insertion slot with the Manta-Flip attached
4. Remove the card and push gently between the sleeves of the Manta-Flip and redo the Velcro to hold it closed
5. The Manta-Flip can then be stored in a purse, pocket or glove box until it is used again
6. For automatic transaction machines (ATM) or other card insertion payment processes use the steps above
7. For swipe machines the removal assembly can be adjusted to stop the card at different angles so as to allow a more comfortable grip while swiping

Benefits

Existing credit card insertion and removal devices are hard to find. In fact, Sandi said that she often used a pair of hardware pliers to preform that task. Many fellow 1P03 students designs were just that, pliers dressed up in foam. There devices do not offer much of a solution to the problem. The Manta-Flip actually offers a solution, it provides a large grip to allow a comfortable way of inserting and removing the card from the machine. Some of the other designs used cylindrical grips attached to various kinds of pins but these all required compression forces and were very large. The Manta Flip, on the other hand, is a small versatile design which takes aesthetics into account with its subtly coloured slanted foam design. Also competing student designs required that the credit card be inserted and removed from the device before and after the pumping process which adds to the time Sandi must be exposed to the weather and the energy she must expend. With the Manta-Flip when she is done paying the card can be simply folded away in the device until it is needed again. The Manta-Flip is also so light it can be left in the machine during pumping and can be used with one or two hands to improve accuracy depending on how Sandi is feeling. The Manta-Flip takes Sandi’s needs into careful consideration and fulfils every single one of them with perfection. It is a truly original, truly brilliant design that stands out against the multitude of products that are merely watered down versions of what other groups produced. The Manta Flip is perfect for Sandi and her unique physical capabilities.

Clutch

Optimize Prime
F 18-227-6

Problem Description

To help Sandi with the process of pumping gas and using the pay at the pump option at any gas station that she decides to visit. This includes reducing her pain and increasing her independence while completing this process. We will attempt to create a device that solves the problem of her inserting her credit card into the machine under the direction of Dr. Fleisig and the teaching staff.

Design

The design consists of a hollow tennis ball, a wooden dowel, a screw, clothespins, cotton balls, super glue, non-slip stoppers, a lanyard, and nail polish. The weight is about 120g, and the volume is about 540 cm^3.

Functionality

The device function is to provide an easy, painless way to grab the credit card and then to insert the card into the machine.

Materials, Components, and Assembly

In order to construct the Clutch, a tennis ball, some short screws, a wooden dowel that is ½ inches thick and a package of non-slip rubber stoppers need to be purchased. Also, some cotton balls, a tube of super glue, tennis grip tape, hockey tape, and a lanyard are required. Most of them can be purchased at a regular dollar store. The screws can be purchased at a home hardware store. The tennis grip tape can be purchased at any sports store that has tennis gear. The total cost comes to approximately $18, which is about $6 for each prototype. The assembly process can be completed in approximately an hour. Tools required are screwdriver, a simple hand saw capable for cutting wood, a small sheet of sand paper and a scissor. Basic saw and screwdriver operating skills are required.

Use

1. Put the lanyard around her neck or wrist
2. Grip the tennis ball in the most comfortable way
3. Extend the thumb to press down on the cushion to open the clamp
4. Insert a credit card then let go of the cushion to close the clamp when the card is in position
5. Line up the credit card with the machine and insert the card into the machine.
6. After the card is in the machine, open the clamp and pull the device away after the card is in the machine
7. When the card needs to be moved from the machine, open the clamp and line it up with the card in the machine and then pull it out She can let it hang off of her neck or wrist while she is completing her other fuelling tasks. And while Sandi is not fuelling, she can store the device in her purse or in a cup holder in her car.

Benefits

The design is better than existing solutions because of its comfort level, portable, easy to use, and durable. The basic function for the design is to create an easy, painless device, so a sphere shaped, light weighted tennis ball is used to maximize the comfort of using. The lightweight and the small volume also make sure the design is portable. Additionally, the use of tape and super glue make sure it’s durable.

Effortless Arthritis Card Holder (EACH)

Unlimited Design Innovations
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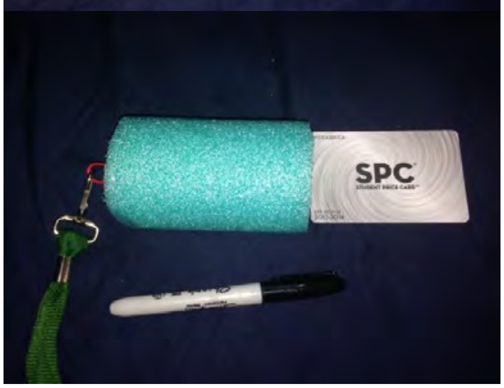

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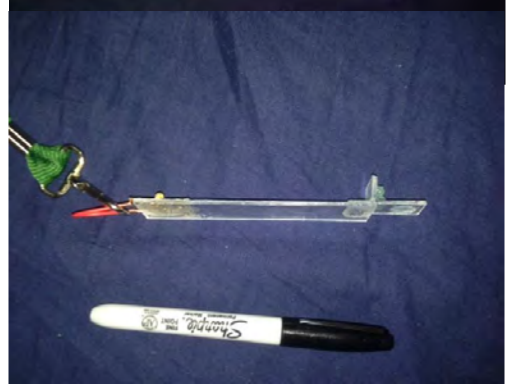


Problem Description

Design a device to assist Sandi Mugford with her gas refuelling routine to reduce the pain, energy consumed, and time spent at the gas station. Specifically, to assist with her ability to handle the credit cards for payment, lifting the gas nozzle, and to maintain continuous pumping of gas.

Design

The main design of the Effortless Arthritis Card Holder (EACH) consists of a piece of plexiglass that has a loop at one end to attach to a lanyard and another end that has a glue dot to attach to a credit card. This can be seen in photo 4. The device also has a casing around the main device that allows Sandi to grip, and use the device much easier than the small main device. The pool noodle is used as a casing because it is light weight, and just big enough so that Sandi can comfortably grip the device without it being so large that it makes the device awkward, or painful to use. The device completed fully can be seen in photo 1, 2 and 3. The device is about five inches long, and four inches in diameter. The size of the object can be seen in all of the above pictures. The overall weight of the object is no more than 100 grams, making it extremely easy on Sandi's joints. Weight was a main factor throughout the design phase and everything that has been used in the device has been chosen to be effective and reduce weight. The device is no longer than a pen, which makes it very easy for Sandi to use, and store.

Functionality

The Effortless Arthritis Card Holder can easily do everything that Sandi requires to aid in the insertion and removal of her credit card at the gas station. The EACH allows Sandi to easily attach her credit card with very little effort and allows her to easily hold and use the device to put her card into the machine. The device also allows Sandi to leave the device with her card in the machine because of its lightweight design. This means that using the device is very similar to her regular routine already. The lanyard at the end of the EACH allows Sandi to remove the device and her credit card without any griping action. This will reduce pain when using her card, time spent at the gas pump, and will increase Sandi's independence. In the end Sandi is easily able to place her card in the machine and remove it with little strenuous movement that could cause her a large amount of discomfort.

Materials, Components, and Assembly

The materials used to make the Effortless Arthritis Card Holder were items that were easily assessable. The materials used included: pool noodle (with hole inside), plexiglass, small cupboard hinge, electrical wire, a key lanyard, epoxy glue, and Glue Dots. The total cost for these products is around $15 for the amount used. The most expensive materials are the Glue Dots, epoxy and plexiglass. The plexiglass could be switched to a cheaper material like a plastic ruler (that could be cut to size). All of the materials can be obtained at a hardware store like Home Hardware or Home Depot expect for the Glue Dots which can be found at a craft store like Michaels. The tools required to build this product were an exacto knife, metal ruler, and sandpaper (800 grit). To construct the device it takes only around one hour to build, however it takes about a full day for the epoxy to cure fully. With instructions, assembly is very easy, however it does require special instructions.

Use

The device can be stored in many places for Sandi's convenience such as the trunk, glove box, cup holder, or even in her purse. This means that Sandi can have lots of independence with the way she uses the EACH. For the following step-by-step instructions the device is assumed to be in cup holder of the car. The step-by-step instructions are as follows:

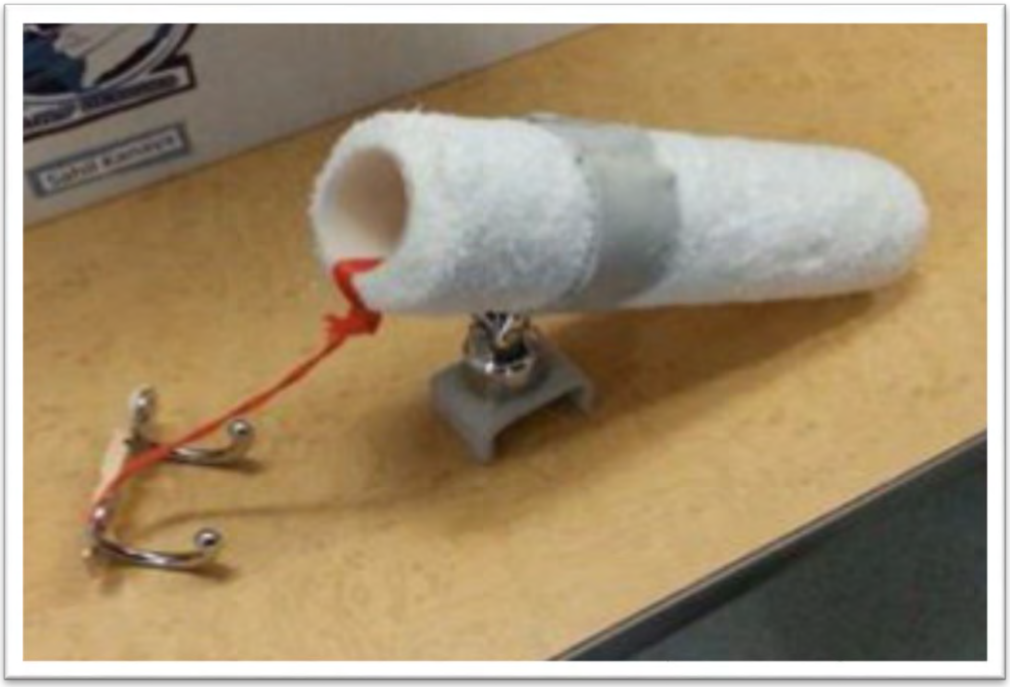
1. Sandi arrives at the gas station. She removes the device from the cup holder where she has the device stored.
2. While in the car Sandi will remove the protective casing off of the device and place it in the cup holder. She then continues her gas filling routine until she needs to enter her card into the machine. While she does this she will have the lanyard of the device around her neck so she does not have to hold it.
3. Sandi then takes the device off of her neck, and places her credit card at the end of the device on the glue dot. She will press it down to make sure the glue dot has a good stick.
4. Sandi will then slide her credit card into the machine. Once her card is in she can let go of the device. The glue dot will hold her card and the entire device in place.
5. Once finished payment, Sandi will either grab, or feed her hand through the lanyard and pull the device out of the machine using the lanyard. This allows Sandi to remove her card without any pinching movement required.
6. Sandi can then put her credit card away, get back in her car, place the protective case over top of the glue dot and place the device back into the cup holder. Then Sandi is on her way once again.

Benefits

The closest thing to the Effortless Arthritis Card Holder is a pair of pliers, which Sandi already uses. What makes our design unique is that it does not require any gripping, pinching, or holding actions in order to hold the card. The adhesive Glue Dots allow Sandi to place the card on the device without having to prep the device by applying pressure onto a clip, or use a plier like device. This means that she is able to completely remove the action of pinching the credit card out of her regular gas station routine. The pinching action is what causes her the most discomfort while using her credit card at the pump. Through the EACH's design that motion has been eliminated for Sandi which is what makes the EACH such an effective solution. This solution doesn't just stand out with commercial products but the products seen during the showcase. Many other products used the idea of a clip or clamp to hold the card. While many of these designs reduced the amount of strength needed to set the clip or clamp in place, no other completely removed it in the way that the EACH does.

OPTIMUS MARK IV

Real World Problem Designs
F19-124-01



The figure above is the one and only, Optimus (mark IV). Being around 9’’ x 4’’, Optimus works by clinging on the head of the nozzle. Attach the hook and with a gentle push of your arm, your car shall be fuelling and ready to go!

PROBLEM DESCRIPTION

Ms. Sandi Mugford suffers from Rheumatoid Arthritis and is having trouble in fueling her car at the gas station. Her fingers are deformed and her joints suffer from chronic pain that prevent her from locking the lever easily. By the request of the client Dr. Fleisig, we are to design and prototype a device that will aid the client/user Ms. Sandi Mugford with this process. The device’s top-most priority will be to reduce her pain and energy consumption during that process. Furthermore, this device should comply with the constraint of being a "dead man switch" or so to say, it will deactivate at the death of the user. The device built should avoid using her fingers as much as possible as this is where she exhibits the most pain and should also be as safe, efficient and portable as possible.

Design

The final design is basically a lever system whereby there is a piece of thermoplastic wrapped around a paint roller. This thermoplastic is then glued to a FLX socket and is then attached to another thermoplastic base. A double hook system is then attached to the paint roller using a double knotted rope for extra endurance. The double hook system is used as this allows for the hook that will be pulled to be positioned at a place where the least force is needed from the user to get the nozzle up. The function of this device is to help sandy with fueling her car at the gas station. Or to word it better, to turn the lever of the gas nozzle upwards in order to activate the nozzle and pump gas into Sandy’s car.

Functionality

The device will assist Sandi in exerting an upward force on the lever to completely close. Sandi must attach the device to the nozzle by simply placing the base coupling to the top face of the nozzle handle, just above the lever, and then attach the two parallel hooks to the nozzle lever. When this is complete, Sandi will use the device by pushing down on the device's lever, rather than pull up on the nozzle lever.

USE

Simply, the function of this device is to pull the lever of the nozzle in order for fuel to be pumped. Or to be more accurate, it is to aid or make the execution of the fueling process painless and effortless for Ms. Sandy Mugford. (Refer to Problem statement).

This device can be easily used in 3 simple steps, which starts off by

1.) Placing the lever to the gas nozzle.

2.) Attaching the hook to the lever of the gas nozzle.

3.) Pulling down the lever in order to raise the nozzle's lever.

Materials, Components and Assembly

The cost of our device includes only the cost of the materials that make up the device. Our expenses, and thus the expenses our client would need to make and thus, construct our design are listed in the bill of materials below.

ITEM	STORE	PRICE($)
Paint Roller	Dollarama	2.00
Hooks + Screws (x2)	Canadian Tire	1.10
Clothes pins	Shopper Drug Mart	3.65
14x61 Cable, PVC	Canadian Tire	5.04
3/8 FLX socket	Canadian Tire	3.86
	TOTAL ($):	**16.65**

The construction of the design is simple and easy to build. The materials required for the process would be a plastic coated cable, paint roller, 2 metal hooks, a clothes, a socket and some thermoplastic. Building this design only takes about 20-25 minutes after all parts have been assembled. First, the 2 metal hooks are glued into the clothes pin some distant apart. Next, one of the metal hook is then attached to the string so that the lever could be lifted using the hook. After, a socket is then connected to a thermoplastic plate whose base equals to the diameter of the nozzle. This thermoplastic plate is used as a support when lifting the nozzle. Lastly, another thermoplastic plate is attached to a paint roller which is then merged with a socket which at lasts, creates a lever system and then completes the final design. The cost of all the items mentioned above equals to a rough figure of $16.65. All the materials can be purchased from Canadian Tire. No professional expertise is required for the building of the design and hard glue is the only tool that might in handy to build the design.

Benefits

This product features:

- An ergonomic design;
  - Comfortable to operate & handle!
- A lightweight design;
  - Built to minimize the effort required to operate and transport the tool.
- Easy portability;
  - Wraps up and can be stored using very little storage space
- Built of durable materials;
  - In order to endure various weather conditions and frequent use over a long period of time.
- Cost effectiveness;
  - Quality materials available at an economically reasonable price.

Lift to Independence (LTI)

Life Innovations Inc.
F 1 9 - 1 2 4 - 2

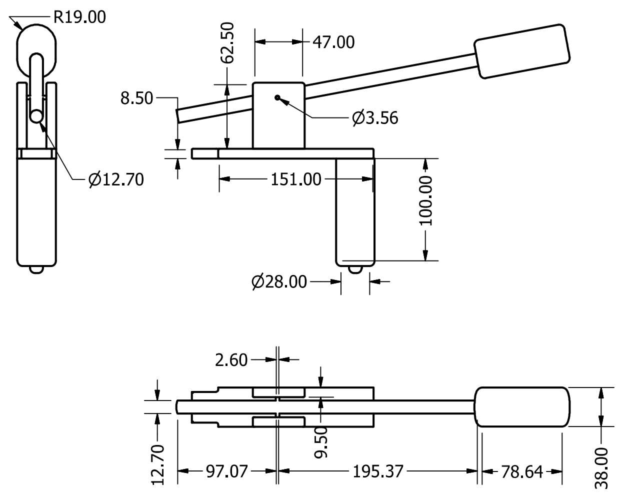


Figure 1.1 – CAD Drawing with Measurements

Figure 1.2 – Photo of Prototype

Problem Description

When using the gas pump, Life Innovations' client Sandi Mugford encounters great difficulties due to a lack of strength, accuracy, and dexterity because of rheumatoid arthritis. Ms. Mugford experiences pain and fatigue in fuelling her car with the gas nozzle. Life Innovations' goal is to design a device to help Ms. Mugford maintain independence at the gas station.

Design

The Lift to Independence is essentially a lever mechanism, as show in Figures 1.1 and 1.2. The device has two handles: the lever handle at the end of the aluminum rod, and the vertical handle attached to the base. The design weighs less than one kilogram, and it is approximately the size of a sheet of paper, as shown by Figure 1.1; thus, the device will be easy to hold and use.

Functionality

The primary function of the Lift to Independence is to accept a downwards input force on the lever handle in order to produce an upwards output force on the trigger of a gas nozzle. The LTI was design to significantly lessen the pain and energy consumption associated with using the gas nozzle, as it allows the user to compress the trigger by a pushing motion with the entire arm, instead of a flexion of the fingers.

Materials, Components, and Assembly

The materials required to build the LTI include: a 3/8 x 12 x 12 PVC board, a 1/2 x 6 aluminum rod, a 3/4 x 4 wood rod, a 1/2 x 3 insulation pipe, electrical tape, one #6 bolt, four #8 bolts and one #8 wood screw. Each item comes in a much larger (stock) size than required for the device, and thus one could construct multiple instances of the device; however, extra fasteners and tubing will need to be bought.

With these materials, approximately 6 devices can be built. Including the cost of extra fasteners and foam, the total for 6 devices comes to $37.66. Thus, the cost for one device will be approximately $6.28. All of these materials can be bought at a local hardware store such as Home Depot or Canadian Tire.

Life Innovations Inc. acquired all necessary materials to build the prototype for free at a local machine shop at McMaster University. All construction of the prototype took place at the Student Machine Shop in John Hodgins Engineering Building at McMaster University. Total time for construction took approximately 12 hours.

For a full description of construction instructions, please refer to Life Innovations' final report on the project, Appendix G.

Use

Instructions for Use:

1. Arrive at the gas station and exit the car
2. Open the gas latch to expose the gas tank on the side of the car
3. Remove the gas cap. In Ms. Mugford's case, this step is unnecessary as there is no gas cap.
4. Place the gas nozzle and insert it into the gas tank. Ensure that it is completely inserted into the car and it will not fall out.
5. Retrieve the Lift to Independence from the area of storage. Life Innovations suggests the following areas of storage: glove box, backseat or front passenger seat of vehicle, and/or large sized purse.
6. Hold the device with one hand on the vertical handle and the other on the lever handle while carrying the device.
7. Standing adjacent and towards the nozzle, slide the LTI's base, with the short arm completely downwards, underneath the gas nozzle trigger. Ensure that the device is secure.
8. Press downwards on the lever handle using the hand or forearm – whichever appendage will be most comfortable to use.
9. Hold the lever in this position until the desired amount of gas is transferred into the gas tank.
10. Lessen the downwards force on the lever handle until trigger has returned to its resting position.
11. Slide the LTI out of the gas nozzle.
12. Place the LTI back into area of storage.
13. Remove the gas nozzle from the gas tank and close the latch.
14. Proceed to pay for gas.
15. Refuelling car is complete.

Benefits

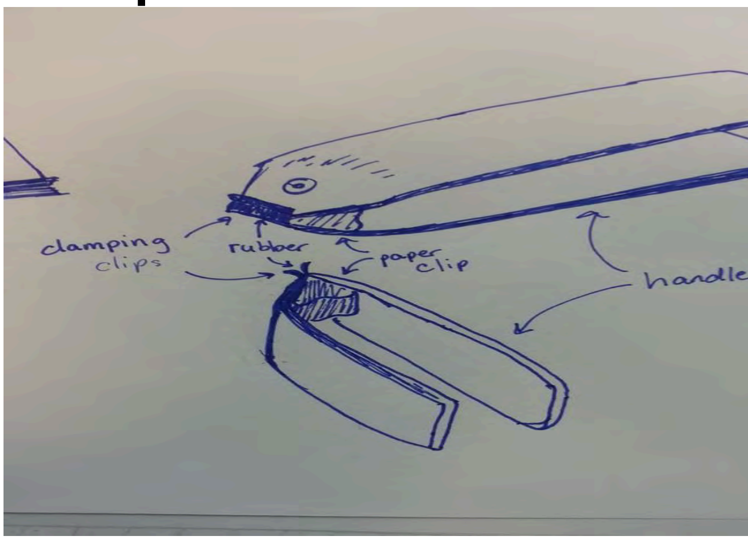
The LTI has many benefits making the device superior to the devices constructed by Life Innovations' peers. The benefits of the LTI include the physical properties of the device itself, its simplicity of use by the client/user, and the cost of the device.

Firstly, the LTI lessens the force required to lift the trigger on the gas nozzle, due to the mechanical advantage of the lever. Thus, Ms. Mugford does not have to exert a large force when using the device. Also, Ms. Mugford is able to use her hand or forearm if she so chooses, making the LTI versatile in use. As a result, Ms. Mugford will experience less pain in her joints when refuelling her car.

The LTI features additional benefits which raise it above other designs. The LTI is extremely durable – the materials used will not shatter on impact and will last for a long period of time. It is also very lightweight and easy to for Ms. Mugford to carry. The device contains foam around points of contact with Ms. Mugford, providing comfort and insulating the device for when colder weather sets in. Also, the device is very safe to use – there are no sharp edges on the device and the user is not likely to pinch herself with the device, as the lever does not exert significant pressure without an applied force.

Lastly, Ms. Mugford had requested that the device be inexpensive and have longevity, as many medical devices are expensive and must be replaced frequently. The LTI is made of very durable materials, so if the user were to drop the device, it likely would not break. In a manufactured version, the LTI's material costs would come to approximately $6.30. Thus, after adding other necessary expenses, its total cost would be less than $10, making it much less expensive than common assistive devices.

Slarm Arm and Card Clamper



TSM

Team Name

D19 - 124 - 3

Problem Description

To aid in reducing the pain and increase the independence of our client, Sandi Mugford, with regards to her filling up her gas tank. This process is hindered by her autoimmune disorder, rheumatoid arthritis, which principally limits the range of motion and greatly increases the amount of pain in the ligaments of her hand. The main components of the process which case discomfort are as follows; inserting and removing her credit card, maintaining a sufficient continuous force to the gas nozzle and using the keypad.

Design

Two independent design alternatives were developed in order to address the problem statement. The Card Clamper is composed of two pieces of aluminum with the top portions bent. Both of the bent ends have small metal attachments, which both had small pieces of rubber glued to. These bent tips were attached together by screwing both of them to a butterfly paper clip. The Slarm arm is a device that you turn to clamp the gas pump down, to apply constant pressure to the gas pump.

Functionality

The devices are substitutes for the client's own hands when inserting a credit card and handling the gas pump. For the Card Clamper, the open ends are gripped and loosely held in the hand of the user. A slight pressure is applied to the ends and that forces the small pieces of rubber to separate. This allows the credit card to be picked up and the stability of the device allows the card to be inserted into the machine with ease, and withdrawn easily as well. The device fulfils the requests from client because it is a working solution to allow the credit card to be inserted within the machine without outside assistance. Also by relieving the pressure on the client's joints within the hand, the device is successful in minimizing pain and increasing comfort. The second device, the Slarm Arm uses a twisting motion to fasten onto a gas pump, and it requires minimum force by the user. The device works similar to a fishing rod. The user holds the device such that the hook rests under the gas pump trigger. The design aims at reducing pain by removing the need for any type of clenching motion in the hand.

Materials, Components, and Assembly

1. Took a large gripped paper clip and grinded away towards the opening end, leaving the opening end narrow and the opposite side wide.
2. Drilled through the clip on both sides and filed away the rough edges on the clip using metal filer.
3. Cut a piece of aluminum measuring approximately 10 inches long, 1.5 inches wide, and 1/8 inches thick and cut it in half along the length and then drilled a hole on both pieces near the end.
4. Fastened the aluminum pieces to the sides of the clip using the screw.
5. Grinded the aluminum to be parallel with the clip, and grinded the opposite ends to make them round.
6. Put the aluminum one at a time into a clamp and bent it so the pieces would be parallel to each other
7. Filed the aluminum to get rid of the rough edges
8. Cut small strips of a rubber band the same length of the gripping end of the clip.
9. Glued the bands on to the gripping end of the clip.

Both the objects built required skillful use of metal grinder, drill machine, screw fastener, saw, metal punch, hammer and metal filer

Use

Card Clamper:

1. Grasp ends of device
2. Place credit card within vicinity of device
3. Use slight downward pressure on ends
4. Once the rubber tips are opened, grasp the credit card and insert the credit card into the slot.

Slarm Arm:

1. Take the device in hand and rest the bottom on the gas pump.
2. Once situated, crank the device to close the trigger
3. Once pumping is complete, simply release the handle and the hook drops due to gravity

While not using the device Sandi will be able to store the device inside the glove compartment of her car or inside her handbag. When she has finished using the device at the gas station, she can place the device in a purse or pocket, allowing her hands to be free to carry out the other tasks

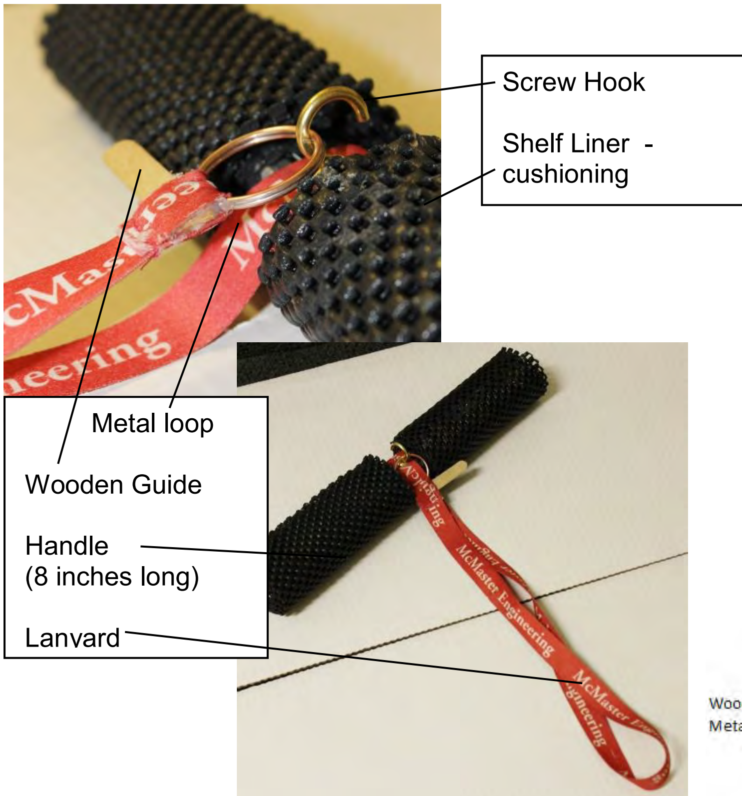
Benefits

Both the Card Clamper and Slarm arm are successful devices. They have many benefits for the client, especially in relation to decreasing pain and increasing ease of use and result in a positive experience at the gas station. The device allows the user to insert a credit card and pump gas without using hands directly, and it speeds up the entire process because there is no need for fumbling around and to manoeuvre hands in the small spaces. The devices both are simplistic in design, with minimal if any complicated moving parts. They are lightweight, sturdy and relatively inexpensive. For reducing pain, the devices require minimal fine motor movement, because there is not a need to twist the hands in awkward positions.

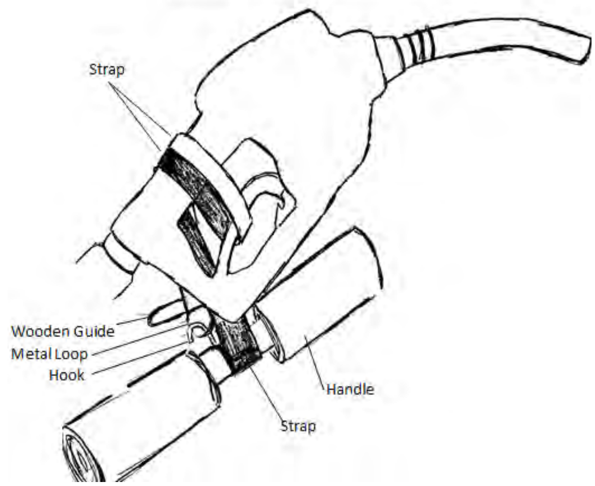
Ergo-Fueler

WELL - ENG

F 19 - 124 - 4



The Ergo-Fueler in position on the fuel nozzle



Problem Description

The ultimate goal of this project is to help users (individuals with rheumatoid arthritis) maintain their independent lifestyle. The problem at hand is to reduce the amount of pain Sandi, or other individuals with rheumatoid arthritis, will feel throughout the process of fueling their cars and also increase the efficiency of the fueling process. The specific focus of this project was to design a device that would help users more easily and efficiently operate the fuel nozzle while eliminating the pain it causes them.

Design

The Ergo-Fueler consists of a wooden handle which is about eight inches long. As seen in Figure 1 above, the handle is wrapped with shelf liner for added cushioning. The handle is attached to a strap which wraps around the gas nozzle and trigger when in use so when the user pushes down on the handle the trigger will rise, starting the flow of gas. The Ergo-Fueler weighs approximately 250 grams so it is very easy for the user to maneuver and transport.

Functionality

The Ergo-Fueler works by changing direction of motion needed to start the flow of gas from the nozzle. This allows the user to push down on the handle of the device rather than having to squeeze the trigger of the gas nozzle. This reduces the strain the user puts on their fingers as they do not have to grip anything for an extended period of time. Pushing down on the handle can easily be done with the palm the hand to avoid any gripping motion. This reduces the amount of pain felt by the user and therefore accomplishes its goal.

Materials, Components, and Assembly

The materials required to make the Ergo-Fueler were very minimal. The wooden handle was made out of a piece of a hockey stick but could also easily be made with small piece of wood from the hardware store. The cushioning for the handle (shelf liner), the metal loop (a key ring), the wooden guide (a popsicle stick) and the lanyard used on the device can all be obtained from a dollar store. The small metal screw hook used to anchor the metal loop to the handle once the device is in place can purchased at the hardware store. All of the materials required can be purchased for around fifteen dollars.

Once the piece of wood for the handle is the appropriate size, only scissors and glue are required for construction. The lanyard simply has to cut to make a long strap, the shelf liner cut into two long strips and both are glued to the handle. The key ring and wooden guide can then be secured to the end of the lanyard. The lanyard is then wrapped around the handle until it reaches the appropriate length and the hook screwed through the lanyard and into the wooden handle to secure it in place.

Construction of the device is a very short process and once the device is built there is no assembly required before each use

Use

Refer to Figure 3 above showing the Ergo-Fueler in position on the gas nozzle

1. While gas nozzle is still in its stand retrieve the Ergo-Fueler.
2. Hold the handle in one hand and wooden guide near the metal loop at the end of the strap with the other.
3. Feed the strap over the handle of the nozzle and then through the nozzle, on top of the trigger, so the metal loop returns to the same side of the nozzle as the user.
4. Bring the metal loop to the opposite side of the nozzle by feeding underneath the trigger.
5. Reach over top of the nozzle and grab the wooden guide and hook the metal loop to the hook in the center of the handle.
6. Make sure the handle is on the same side of the nozzle as the user will be.
7. Perform payment transactions and select fuel type
8. Insert gas nozzle into the car
9. Push down on the device handle to start the flow of gas
10. Release the handle to stop the flow of gas.
11. Because it hooks onto the gas nozzle, the user can leave it in place on the nozzle when performing other tasks and remove it when she is ready to leave the gas station
12. The Ergo-Fueler can easily be stored in the glove compartment of the user's car.

Benefits

Normally, Sandi has to maintain a tight grip on the gas trigger for the entire time the gas is flowing. With our device Sandi only has to use her fingers to grip while she is wrapping the device around the nozzle but for the majority of the process Sandi only has to push down with the palm of her hands. This reduces the pain that she would feel when gripping the trigger. While other designs will require her to hold up the device, our product hooks onto the gas nozzle so Sandi does not have to worry about dropping it or holding anything for extended periods of time while performing other tasks. The design is very compact and lightweight making it easy for her to transport. When it is not in use it can easily be stored in the glove compartment or the pocket of her car door.

The Pump Wrench

Ortho-Needs Engineering Firm
F19 -124 -5

Problem Description

The design team will be focusing on the development of a practical, functional product to help the client, Sandi Mugford, be independent at the gas station. The device should allow her to pump gas and/or pay with a credit/debit card with reduced pain and effort. It should be useable year round with any car at any gas station.

Design

The pump wrench is designed to assist Sandi in pumping gas. The product consists of a jaw and a handle. The main component of the device is a sink drain wrench wrapped in thermoplastic and black shelf liner.

The device is roughly 0.4cm thick, 23cm long and the prong has a width of 7.7cm. It is capable of being held in one hand. The device does have some weight to it because of the metal the wrench is made from; however, this weight is not noticeable when the product is in use.

The prong compresses the trigger of the pump for Sandi and the handle allows her to use the device comfortably.

Overall, the device is portable, functional, durable and practical.

Functionality

The team's design focuses on the issue of pumping gas. The problems Sandi was facing in this area include comfort and applying pressure to the trigger of the nozzle for extended periods of time. The pump wrench addresses these issues for Sandi:

When being held in place, the device will compress the trigger of the gas nozzle in order to pump gas. No force from the user is necessary in order to press the trigger. All the user has to do is hold the wrench in place for however long they wish to pump gasoline. Once finished fuelling, the user pulls the device out from the nozzle to stop the flow of gas.

The handle is designed to be comfortable for the user while they hold it in place to pump gas. Comfort also enables the device to be used for greater lengths of time.

Materials, Components, and Assembly

The pump wrench is composed of the following materials:

1) A sink drain wrench ($18.00)
2) Thermoplastic ($33.00)
3) Shelf Liner ($2.50)

The prices for the thermoplastic and shelf liner listed above are not accurate. For the entire product, the handle only consists of $1.50 worth of thermoplastic and $0.25 worth of shelf liner. This brings the total cost of the product to $19.75 + tax.

A sink drain wrench and shelf liner can be purchased from any hardware store, such as the Home Depot. Thermoplastic can be purchased and ordered online.

In order to build the device, thermoplastic must be heated in a hot water bath to make it malleable and then wrapped around the handle to the desired shape. The shelf liner must then be wrapped around the thermoplastic. Ideally, no construction on the user's part would be required, meaning that no assembly instructions would be necessary. The only instructions necessary would be the instructions on how to use the product.

Use

1) The device can be stored in Sandi's purse or the trunk of Sandi's car with her purse
2) When she arrives at the gas station, Sandi opens the trunk
3) When she is ready to pump gas, Sandi can place the gas nozzle into the tank, leaving it there to rest while she retrieves the pump wrench from her trunk or purse
4) The device is designed to be held in one hand so that Sandi can carry it to the pump
5) To use the device with the nozzle, slide the bottom prong of the jaw underneath the trigger of the nozzle
6) Turn the wrench upwards so that the top prong slides over the handle of the nozzle
7) The trigger is now compressed to allow gas to be pumped for however long the user holds the wrench in place
8) When finished fuelling, the user simply pulls the wrench out to cut off the gas flow
9) The wrench can then be returned to the trunk and the nozzle returned to its holder

Benefits

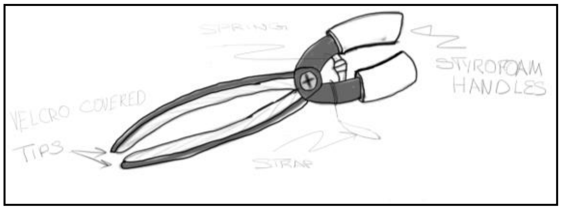
The pump wrench is a durable, functional product with a long lifespan. It is designed with the user and client in mind.

When Sandi normally pumps gas, she has to take frequent breaks due to the stress in her fingers and hands. The device eliminates the physical stress that regular pumping causes her and makes the fuelling process easier and faster.

The pump wrench is better than existing products due to its simplicity (both in its design and how to use it), its stability while being used, its durability and its relatively small size, making it easier to store.

TONG 2000

Sassy Sandi Savers
F 1 9 - 1 2 4 - 6



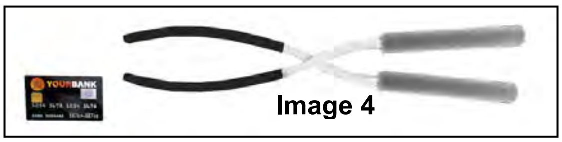


Image 4

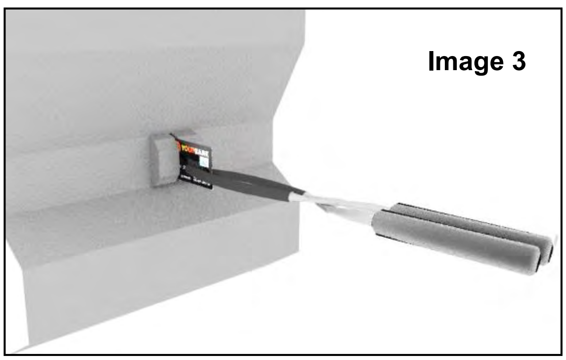


Image 3

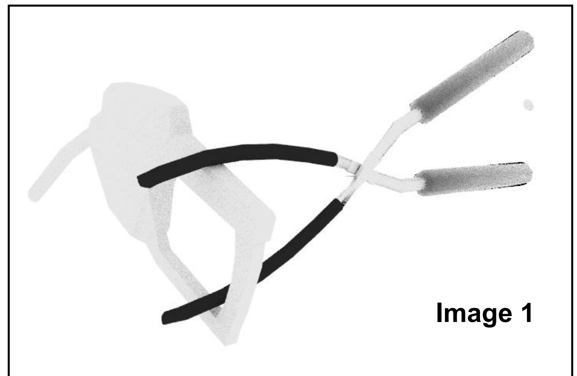


Image 1

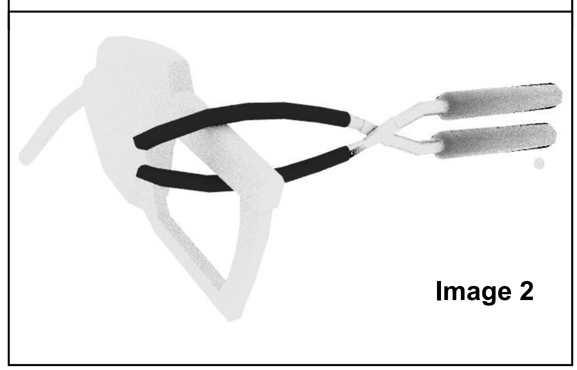


Image 2

Problem Description

Design a device to be used by Ms. Sandi Mugford, who suffers from rheumatoid arthritis, to aid her with the car refueling process. The device should make it less stressful when pumping fuel into her car tank, inserting/removing her credit card and/or pushing buttons on credit card machine keypad, thereby maintaining her independence and reducing the amount of pain and fatigue in the entire process

Design

The final design of the Tong 2000 is roughly the length of a large textbook when it is closed. It is about as wide as a credit card when it is closed, as you can see in image 4. Overall it is a very portable product, weighing in roughly about 250 grams, meaning that it is a very lightweight. This results in drastically lower fatigue and pain levels faced by the client when carrying out individual tasks, such as the pumping of gas and the insertion and removal of the credit card. The foam around the handles allows the user an easier grip and as a result, lowers hand joint movement.

Functionality

The device can assist the user with all 3 problems addressed by the client, namely the pumping of fuel in the car tank, the insertion and removal of the credit card and the pressing of the buttons on the credit card machine. It also cushions the user's hands when they use the device, so that it may reduce fatigue and pain faced.

Materials, Components, and Assembly

The materials required to build the device are: beaker tongs, fishing gloves, foam, and nylon strap. The beaker tongs cost $4.81 from the McMaster University chemistry department. The fishing gloves, foam and nylon strap cost $2, $1.25 and $1.50 respectively and can be found at any Dollarama. The only tool required for construction is hot glue gun which is used to attach the foam and nylon strap on the tong. The total time for construction can range from 20 to 30 minutes. The only special instruction required would be to bend the ends of the beaker tongs so that the foam can be attached. A simple way to achieve this is to clamp the ends so that there is a great amount of leverage being applied. This will allow the user to apply less pressure in order to bend the ends completely.

Use

1. Remove device from storage, i.e. bag, trunk, etc.
2. Strap the device to the dominant arm.
3. For the fuel pump problem, open the tong and slide one piece under the lever and one piece over the handle as shown in image 1.
4. Once it is in place squeeze the handles, as shown in image 2, to release fuel into the fuel tank.
5. For the credit card insertion and removal problem, open up the tong and place the credit card in between the tips as shown in image 3.
6. Squeeze the tongs and insert the card into the machine.
7. Do the same for the removal of the credit card, just grab and pull the card out of the machine.
8. For the mechanical keyboard problem, simply use the tips of the tongs as a stylus to press the individual buttons on the machine.
9. After using the device, unstrap it off of arm.
10. Place it back into storage.

Benefits

The major benefits of the device include the fact that it tackles all the problems addressed with the help of a single, easy to use, lightweight and cost effective device. It is long lasting due to the type of materials used while building the device and can withstand extreme temperatures. It can be used at virtually any fuel station under almost any weather condition. It successfully reduces the amount of pressure required to carry out specific tasks at the gas station and thus reducing pain and fatigue that the client suffers from when refueling her vehicle.

The Friendly Fueler

Friendly Fueling
F19 -124 -7

Top Left: Friendly Fueler being tested on gas nozzle *Note: Nozzle does not have plastic cover
Above: Front view of Friendly Fueler with 30cm ruler
Left: View of Friendly Fueler from above with 30cm ruler

Problem Description

Design a device that will reduce the amount of stress on Sandi's joints while she is pumping gas, specifically compressing the gas nozzle.

Design

The Friendly Fueler weighs less than 160 grams and has the ability to fit in a large purse making it easy for the user to maneuver and use. The device does not include any sharp edges or corners making it safe for Sandi to use.

Functionality

The Friendly Fueler is efficient and easy to use. The device allows Sandi to close the lever on the gas nozzle with reduced stress by changing the motion she must performs. The device changes Sandi needing to compress her fingers and close the handle to her pushing a lever forward without needing to grab anything. The device allows Sandi to regain independence at the gas station.

Materials, Components, and Assembly

The Friendly Fueler is relatively simple to build and does not contain an excess of materials. The device requires: one 0.75”X1.5” piece of wood, two coat hooks, racquetball racquet grip tape, one 0.75” wooden dowel, screws, and clear coat. The total cost of all the materials is approximately 15$. The materials can be found at any local hardware store such as home hardware or home depot and any sports store that carries grip tape. The Friendly Fueler takes about two hours to build and a day must be set aside to allow the clear coat to dry. To build the Friendly Fueler a jigsaw, screwdriver, paintbrush, and sandpaper are needed. The device does not need any special assembly instructions as any person with basic woodworking skills is able to build it. Some specifications are needed in order for the device to work properly such as how dimensions of how far the coat hooks must be place apart and how long the handle can be so it does not hit the car.

Use

1. Depending on size of purse the device can be stored in either Sandi’s purse or in the passenger glove box.
2. The device contains hooks as part of its components so it is able to be hung on to something when not in use (e.g. car door handle, gas pump, etc). The device may also be placed on the top of Sandi’s car.
3. Once the gas nozzle has been placed in the gas tank of the car the Friendly Fueler can be placed into the gas nozzle with the handle pointing upwards, one hook placed on the top of the gas nozzle and the other hook grasping the lever of the gas nozzle.
4. Pressure pushing the handle of the Friendly Fueler forward (i.e. towards the car) can now be applied which will compress the lever of the gas nozzle.
5. Continue applying pressure until gas tank is full.
6. Once the gas tank is full the gas nozzle will click which will be felt through the Friendly Fueler. Release the pressure being applied to the Friendly Fueler and remove the device by pulling the device perpendicular to the side of the gas nozzle.

Benefits

The Friendly Fueler is an exceptional device which makes compressing the handle of the gas nozzle much easier for Sandi and other people who suffer from pain when clamping objects with their fingers. The device is not only very light weight making it portable and very easy to transfer but also very durable. The device has been tested several times using the drop test from a height of 5 ft and no noticeable signs of failure (scratches, dents, cracks) exist on the device. This will give Sandi the peace of mind knowing that if she accidentally drops the device it will still be okay and not need to be replaced.

The Friendly Fueler is waterproof and weather resistant. The device has been coated with several layers of clear coat to make sure even if it is dropped in a puddle the device will not begin to rot away by any means. The device will be useable in all seasons and weather temperatures because it is made out of wood and rubber and the users hand will not freeze when she grabs the Friendly Fueler as it would if it were made out of metal. Sandi is also able to use the Friendly Fueler while wearing mittens as it is not required for her to close her hands when using the device. The device does not contain any electronics so Sandi will never have to worry about the device not working because of batteries needing to be charger or being electrocuted.

At a low price of 15$ the Friendly Fueler is one of the cheaper options for Sandi when compared to similar devices which accomplished the same tasks. Even if the device needed to be replaced because it has been lost or broken it would not cost Sandi very much out of her pocket.

The Friendly Fueler is able to fully clamp the lever of the gas nozzle allowing for maximum gas flow at all times. By using this device Sandi is not losing any of her valuable time at the gas station waiting for her gas tank to fill. The Friendly Fueler also works at all gas stations. Since the device is essentially a lever, the fulcrum point can be changed and adjusted on the top of the gas nozzle to adapt to different gas nozzle sizes allowing Sandi not having to worry about which gas stations she goes to.

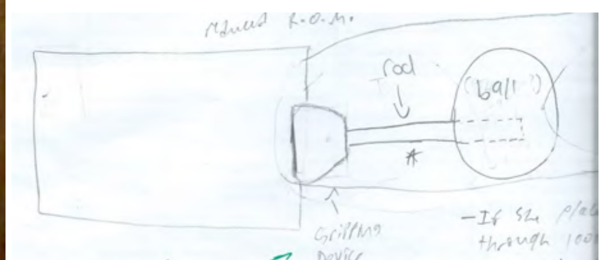
EASY-MOVAL

Engineers Helping Others
F19-124-8

Side View

Front View

Side View With Card



Design-Alternative Sketch

Problem Description

Create a product to ease the Sandi's pain due to her arthritis and give her more independence at the gas station This is to be done in the six weeks allowed by Dr. Fleisig using materials available at local stores.
The aspect of the problem addressed is the client's trouble with credit card insertion and removal at the self serve pumps.

Design

EASY-MOVAL consists of a ball, a shaft, and a gripping device on one end. The side view shown gives an adequate view of the profile of the device, and the side view with card shows the device in action. Front view reveals the means to grip the card: frictional slots. Flaps have been added to the gripping device to promote ease of card insertion into Easy-Moval.

Overall, Easy-Moval is relatively light weight, with the bulk weight contributed by the ball. Overall weight is likely on the order of two tennis balls. The size of the device, in terms of profile, is slightly smaller than the size of two tennis balls attached together. It can easily be fit into a purse, or if the user desires, left in her vehicle.

Functionality

Easy-Moval facilitates easy insertion and removal of a payment card at a gas pump. The device serves to reduce the client's hand pain by eliminating the pinching motion. To operate the device, the user lightly inserts payment card into the tip of the device and grips the ball on the other end. Easy-Moval meets the client's expectations of reducing pain. Inductively, the client's independence is also preserved because lower pain reduces reliance on other individuals. The client can easily insert and remove their payment card from the gas pump, which is a functional improvement over just using her hands.

Materials, Components, and Assembly

Easy-Moval is made up of one tennis ball, a carpenters pencil, a crutch tip. Super glue was the adhesive used to hold everything together. The materials used were inexpensive: three tennis balls for $3.99, six carpenters pencil for $2.99 and two crutch tips for $2.95. An adequate amount of super glue required for construction can be obtained for approximately $2.00-$3.00. The overall cost for one Easy-Moval comes out to be approximately $4.30 + tax,. The cost of the above materials sums up to be $12.93 + tax, however, three Easy-Movals can be made. The tennis balls, carpenters pencils and super glue can be obtained at Min-A-Mart, 1309 Main St. West, Hamilton. Crutch tip can be purchased at any Shoppers Drug Mart. The only tool required for construction is a cutting tool; scissors are adequate. Construction time is minimal; one Easy-Moval could be built in thirty minutes if all materials were supplied. Assembly requires a basic set of instructions: a hole must be made in one tennis ball, carpenter's pencil inserted into tennis ball cavity and crutch tip, super glue applied at tennis ball-pencil and pencil-tip interfaces. Slits are finally cut into the crutch tip for the card grip.

Use

The following list details the use of Easy-Moval.

1. Device obtained from storage location such as purse, vehicle, etc.
2. When user is ready to pay for fuel at a gas pump, user inserts payment card into tip of device.
3. User grips tennis ball of device, using the device to guide the payment card into the slot on the pump.
4. Easy-Moval remains gripping the card hands-free while user completes the transaction.
5.Once transaction is through, user grips tennis ball once again and pulls to remove card.
6. User removes card from device, puts away card.
7. User restores the device to where it was originally obtained from.
8. Remaining gas station tasks can now be completed.

Benefits

The design of Easy-Moval holds advantage over some existing solutions to the problem of the client. One of the most notable benefits of Easy-Moval is its small profile. This profile allows Easy-Moval to be very portable and convenient for the client to use. On the same note as portability, Easy-Moval can be used at other venues outside of the gas station. Since the component of the problem solved by Easy-Moval applies to other situation where payment cards are used, the device becomes an even greater benefit to the client/user. The low cost and simple construction of Easy-Moval also serve to make Easy-Moval a good solution. Since Easy-Moval can be easily built for low cost, it is very practical.

Grip⁺

Freedom⁺
F 19 - 124- 9

Figure 1: Grip⁺, a truly simple approach to solving a complex problem.

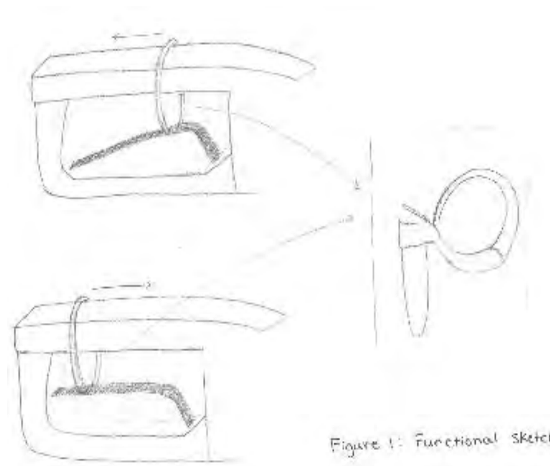


Figure 2: A diagram demonstrating how Grip⁺ works

Problem Description

Design a device for the client Dr. Fleisig that helps Sandi maintain her independence at the gas station by reducing the pain caused by the dispensing of gasoline.

Design

Grip⁺ is lightweight, compact and simple; everything one would need to simplify their experience at the gas station. Its dimensions are 12 cm by 26 cm, allowing it to fit in any purse glove box or back pack. It weights not a gram more than 156 grams, allowing for worry-free and effortless transportation.

Functionality

When we at Freedom⁺ were designing this, we wanted to make a device that helped, a device that would see people regain their independence one step at a time. Grip⁺ does exactly that, giving users a way to refuel their cars without the need to refuel their energy after this problematic task. It maintains their independence and allows users to feel one thing; free.

Materials, Components, and Assembly

Grip⁺ is made of 3 different materials, a cable wrapper, a hair brush and contact cement. The total cost of this device is $16.44, something so minimal if compared with the services it provides. It takes no longer than 30 minutes to construct, a proof of its ergonomic design.

Use

To demonstrate how easy Grip⁺ is to use; we have enclose instructions on how to use it.

1. Arrive to the gas station, exit vehicle and select fuel gradient.
2. Open the devices arm by pushing down on the lever.
3. Wrap the arm around the part of the nozzle that is smallest in diameter (as seen in Figure 2).
4. From there, Sandi must simply pull the handle of Grip⁺ away from the car.
5. In order to remove it, she can let go of the handle, it will return to the starting position and the arm can be unwrapped.

Benefits

Upon speaking to Ms. Mugford, it was fairly clear that the entire experience of going to the gas station was a tiresome and prolonged one. She had problems doing everything from swiping her credit card and using the pin pad, to gripping the gas nozzle to pump the gas. While all of these problems are equally stressful to Ms. Mugford, it must be noted that the only problem to which Ms. Mugford has not devised any alternative to solving was the one involving pumping the gas. In order to pay for the gas, Ms. Mugford was always presented with the alternative of using the payment options inside the gas station; meanwhile she had never found any alternatives to pumping the gas (the main purpose of coming to a gas station).

It is therefore clear that in order to solve Ms. Mugford's issues at the gas station, one must solve the most painful and complex sub-problem: the problem of refuelling her car.

Grip$^+$ is a device that focuses on an approach to solving all of Ms. Mugford's problems with one main objective in mind: ease-of-use. Seeing as our client has Rhumatory arthritis, the solution that would suit her most is one that would make her experience at the gas station natural, ensuring it becomes something she does not have to even think about. For this reason, the design of Grip$^+$ is simple, light-weight, ergonomic and most importantly discrete. Again, all these qualities of the product are there to make the process as easy as possible.

While a complex robot that would pump gas for our client would be at first considered an ideal solution, it must be taken into account that this solution is not pragmatic. The solution must make the user feel natural, worry free, and give them a painless gas experience. For this reason, Grip$^+$ is a solution that allows for an efficient and quick pumping experience.

The silicone grip on the handle of the Grip$^+$ is perfect for users with Rhumatory arthritis as it is form fitting, comfortable and weather durable. Most other materials tend to harden when winter arrives because of the colder average temperatures. However, due to the thick silicon coating, Grip$^+$ provides users like Sandy who have joint pain with a handle that will minimize the physical stress of pumping gas.

Another feature that was added to ease the experience of users was the extension of the lever used to open up the clamps that go around the gas nozzle. This lever allows for a larger surface area that is to be pressed, thus decreasing the need for precision and specific joint pressure. This not only makes the device easier to use, it also reduces the need for complicated locking mechanisms that are heavy by nature. It is another part of the design that is lightweight and sleek, making the device both discrete and convenient.

Those who suffer from conditions such as Rhumatory Arthritis pay thousands of dollars a year for medication and devices that are to help them live a comfortable life. With that in mind, the device that they are to use at the gas station must be as affordable as possible. The simplicity of Grip$^+$ allows it to be extremely price-friendly, something that is very beneficial to users who already pay so much to lead a healthy and easier life.

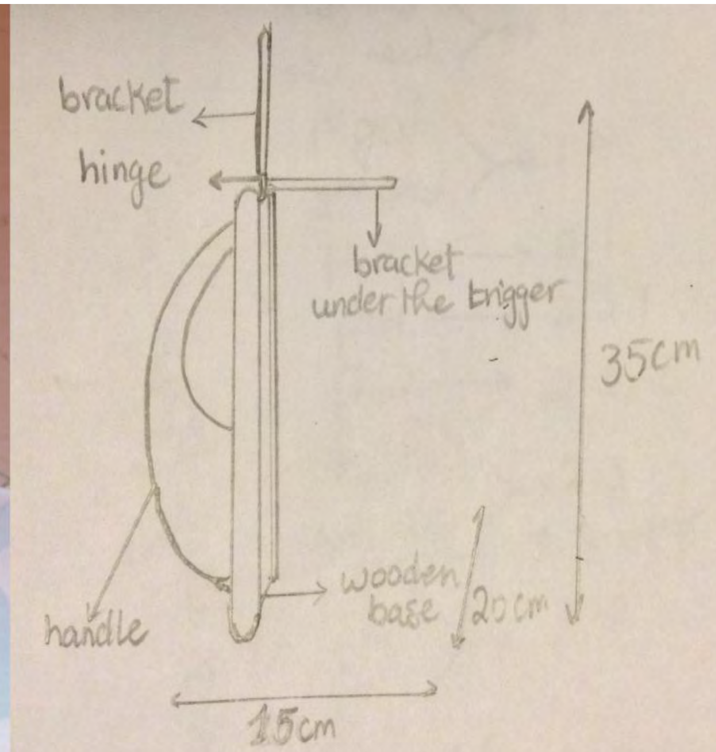
The simplicity of the design allows for the device to rarely experience any mechanical failures and to be extremely easy to repair, making for a basically maintenance free object. If a device is to help Ms. Mugford with her daily life, then it must be durable, consistent and reliable. With this in mind, the device is extremely resistant to the possible wear-and-tear that one would experience at the gas station, seeing that it may possible be dropped. She should not be worrying about potential device failure, as that would cause the device to be a nuisance rather than solving her problem.

Grip$^+$ has a compact and lightweight design that allows for storage where-ever the user so desires. For instance, Ms. Mugford tends to keep her purse in the trunk of her car, allowing for storage of the device inside her purse, the glove box, or even the mesh in the trunk of the car. This gives users more freedom and independence, something that Grip$^+$ is dedicated to doing.

Grip+ provides a sense of real, uninterrupted freedom. The functional and discrete design is there to make it feel less like a product, and more like a natural feature and extension of their daily routine. Grip+ is there to help as discretely as possible, enabling users to have more time and energy for all the other aspects of daily life.

Power Lever

Creatrix Vestibulum
F 19 - 124 – 10



Problem Description

The group was approached to design a device for the client (Dr. Fleisig) and the user (Ms. Sandi Mugford) to overcome her disability to grasp and apply forces to an object. The device has to overcome her inability to fuel her car due to deformity in her hands. Moreover, the design process, including prototypes and practical solutions to the problem, should be done within six weeks.

Design

The design depends mainly on the principles of leverage. Pushing down on one side of the shelf bracket brings the other side up. Placing the horizontal side of the bracket under the trigger and pushing down on the other one will activate the trigger with the least amount of force applied to the bracket. In respect to the user and her medical state, the “Power Lever” is very light as it weighs about 200 – 300 grams and it is 35 cm x 20 cm x 15 cm which relatively small to the place in which it will be stored (the trunk of the car). As illustrated in the visual, the device depends on simple mechanism in order not to complicate the way it operates so that it is easier for Ms.Mugford specifically and any other user generally.

Functionality

This devise is easy to use and answers every request with regards to the problem addressed. The Power Lever utilizes the principles of leverage to press the trigger of the gas pump, reducing the dependence of Sandi’s grip strength or the dexterity she possesses in her hands. The device’s function depends, instead, on the principle of leverage and the benefits that come from using levers to apply a force. In other words, a horizontal force is applied to one arm of the lever, which is translated into a vertical force at the other end of the lever that pushes the trigger of the gas pump. Furthermore, materials used in the manufacturing of the Power Lever were aimed to reduce damages and general depreciation of the device over time. Also, the simple design greatly reduces the amount of time needed to learn how to operate the device, as well as minimizes the amount of energy Sandi needs to use in order to fill gas; relieving a significant amount of the pain and trouble she faces at the pump. In fact, the Power Lever functions reliably when put to the test at the gas station.

Materials, Components, and Assembly

The materials and components required for the fabrication of this prototype were a shelving bracket ($1.09), a small piece of plywood ($0.79), fasteners (screws, nuts, washers and hinges; $1.88), spray-on rubber ($12.99) and a plastic handle ($3.99). The simple design of this device had resulted in an inexpensive product with an approximate price of $20.73. These materials and components are conveniently accessible at any hardware store, such as Canadian Tire, Home Depot or Rona. Furthermore, this prototype could be built in almost any environment once it's safe and the correct tools are provided. For instance, this device can be constructed in a garage with the aid of a saw (hand or electrical), a drill, drill bits, a screwdriver, a crescent wrench and sandpaper. The simple making of this device can be obtained by cutting the ply of wood to the appropriate and desired size, rounding/ smoothing the edges of the wood with sandpaper, attaching the shelving support bracket to the wood with fasteners, covering the wood with spray-on rubber and screwing on the plastic handle. This procedure shouldn't take more than forty-five minutes.

Use

1) Sandi will store the Power Lever in the trunk of her car, with her credit card;
2) When Sandi gets out the device, she will easily slide it onto her hand;
3) Sandi will pay for her gas, take the gas pump and place it in her car's gas tank;
4) Sand will place the lever of the device under the trigger and push down on the top lever with her arm while the other side of the lever pushes the trigger up;
5) When finished, Sandi will let go of the lever, allowing the trigger to drop down and come to a stop;
6) Sandi will remove the device from under the trigger, replace the gas pump, replace her credit card and Power Lever in her trunk and drive off happily, with a full tank of easy gas.

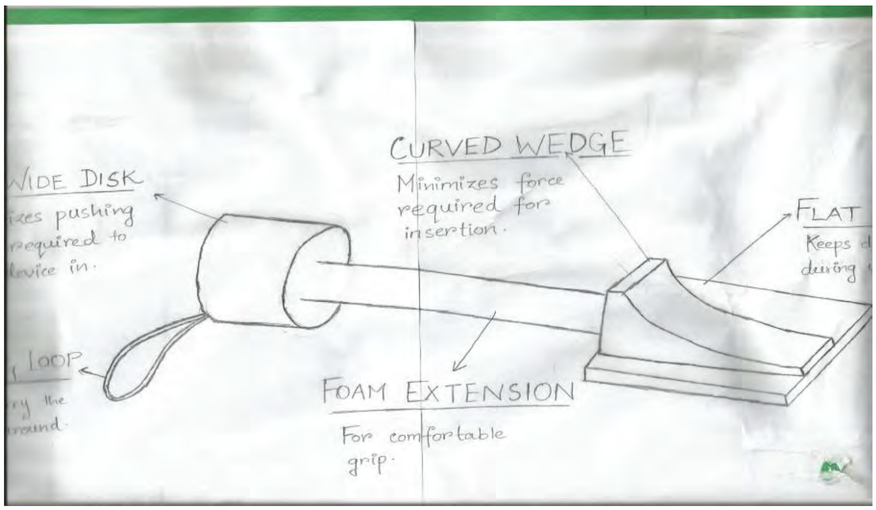
Benefits

The Power Lever design is superior to other designs based on its ability to minimize the amount of energy that Sandi has to use in order to fuel her car. Moreover, the device usage is not limited only to Sandi's hands; the same work can be done by using her forearm, wrist or almost any part of her arm depending on what's easier for her. Furthermore, this device is very light in weight, which decreases the amount of pressure applied on Sandi's hand. Also, the handle subtracts any discomfort in her hand from grasping the object, because it allows her to simply slide her hand in and the device will be positioned depending on the angle that she sets her arm.

The Gassistant

Carthritis Incorporated

Carthritis Inc.
F 20 - 126 - 1



Problem Description

The process of filling her car with gas causes Sandi to experience a varying amount of pain and energy consumption. We will reduce these problems by making it easier for her to use the small keypad, making it easier for her to insert and remove her credit card from the pump and be making the process of squeezing; and maintaining the squeeze hurt her less. This helps Sandi maintain her independence.

Design

The process of construction started with the Styrofoam being cut in the shape of a wedge with an increasing angle. It has a small slope at first and the slope get larger to make the end of the wedge high enough and unable to stick in the gas nozzle. Then, thermoplastic is used to cover the Styrofoam wedge in order to make it slippery and durable. After that, the handle of the umbrella is inserted, and glued with the soft disc attached at the end with glue as well. Finally, the pipe insulation is used to cover the whole handle and make the handle soft for Sandi to use.

Functionality

The device makes sure that Sandi, with all her disabilities, still successfully manages to fill her car with gas without depending on anyone. The design met all the objectives while following most, if not all the constraints. Granted that Sandi still has to carry the device out of her car before she can use it, the effort she has to make during the actual gas filling process has been reduced significantly. She no longer has to grip the nozzle trigger at all as she can maintain the force on it by just constantly pushing the device in..

Materials, Components, and Assembly

The device is partly using reused materials in the previous project, for example, the thermoplastic is used to make the wedge. For the construction, strong glue, thermoplastic, umbrella (for the handle), foamed plastic and tape are required. The process of construction started with the Styrofoam being cut in the shape of a wedge with an increasing angle. It has a small slope at first and the slope get larger to make the end of the wedge high enough and unable to stick in the gas nozzle. Then, thermoplastic is used to cover the Styrofoam wedge in order to make it slippery and durable. After that, the handle of the umbrella is inserted, and glued with the soft disc attached at the end with glue as well. Finally, the pipe insulation is used to cover the whole handle and make the handle soft for Sandi to use. The device is very simple to use, so Sandi won’t require any special instructions to use the device and its functionality should be quite obvious to her.

Use

- Sandi takes the device out
- Puts the string around her wrist (optional)
- Puts the tip of the wedge between gas trigger and handle
- Applies force and pushes wedge into gas nozzle which lifts the trigger
- Maintain small force (with hip or hand) to keep device in place
- Stores in her car door or trunk

Benefits

The device automatically falls out of the gas nozzle if the user is not physically contacting it which makes it safe and legal. It is also lightweight and has a relatively small size, this makes the device portable and easy to handle. It is very cost efficient and very durable. Another good thing about the device is it eliminates the need for prolonged squeezing. Lastly, it is a simple idea which makes using it easy.

Fuel Band

MAC Labs
F 2 0 - 1 2 6 - 2

Figure A: CAD Model of Device

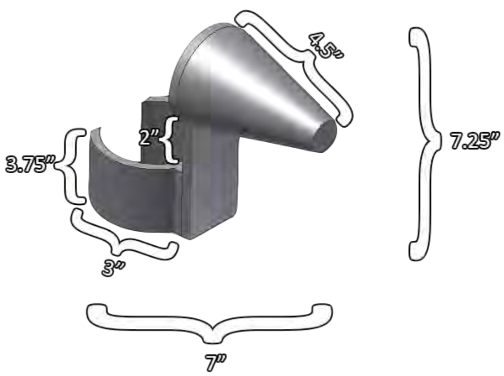
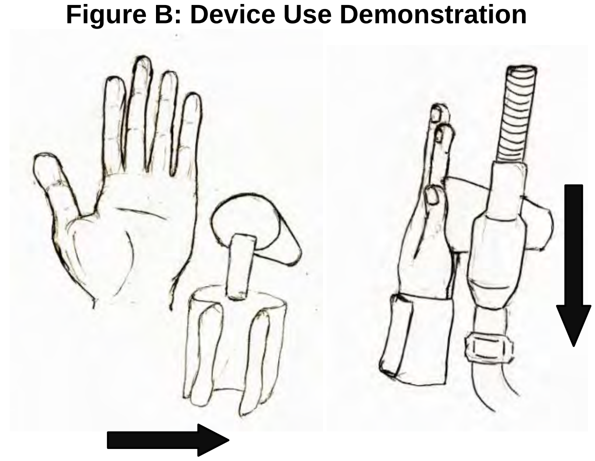


Figure B: Device Use Demonstration



1 **2**

Problem Description

The task for the final project is to design an artefact for use by the client Sandi that fulfills the expectations of the client, Dr. Fleisig and Mr. Desjarlais. This artefact must help Sandi painlessly exert pressure on the gas pump's handle to lift it. The artefact must help Sandi achieve independence by overcoming the hindrances caused by her arthritis.

Design

The design consists of an all-thermoplastic device that is composed of three components as shown in Figure A: a bracelet, a rod, and a cone. The bracelet is moulded to fit the user's wrist, while the cone is given a smooth finish to slide smoothly. The rod connecting the cone and the bracelet provides support and prevents the device from pushing on the wrist. The device weighs 240 grams and measures 7" by 7.25" with plenty of free space in between.

Functionality

The device is capable of allowing the user pump gas without any pain. Although the device can only fulfill one function, it fulfills it flawlessly. The device's design requires no hands; therefore it eliminates all pain experienced by squeezing the gas nozzle's handle.

Materials, Components, and Assembly

The device is made using a 12" by 12" sheet of thermoplastic purchased online from Amazon for $5.10. The building process takes approximately an hour to finish and the only items required to build it are hot water and an x-acto knife. To build the device, four pieces of thermoplastic are cut from the sheet. One of the pieces is 3.75" long and 8" wide is cut and will be used to build a bracelet., two 5.75" long and 1" wide strand are cut and will be used as the support rods, and one square of any size big enough to be used to form a cone. All the pieces are placed in the hot water until soft and malleable, and are then formed to their respective shapes. The bracelet is moulded to the user's wrist while the square piece is moulded into a cone. While still hot, the two thin strips are placed together to become thick to provide support and are then attached to the other two pieces. One end of the rod is attached to the cone while the other end is attached to the bracelet. The device is heated one last time to ensure all the pieces have moulded together properly.

Use

Figure B shows the basic steps required to use the device.
1. The device is worn on the user's wrists by inserting hands into the open slot in the device, as seen in Figure B1.
2. The device's cone is placed under the gas nozzle's handle, as seen in Figure B2.
3. The device is pulled back to the tighter area to force the handle upwards. This could be done by moving one's arms backwards or by stepping backwards.
4. When the fuelling process is done, the cone is slid back to the starting position and pulled out.

The device is extremely small that it could be stored in the car's glove compartment or the side of the door for easy access.

Since the device is held on using a bracelet, the user does not have to physically carry the device. The bracelet also allows the user to rotate the device around so that the cone is no longer facing the user's palms when performing other functions.

Benefits

The Fuel Band's design is inspired by many devices that are currently available where an object could be lodged under the gas nozzle to force it to pump gas; however, all the commercial products currently available allowed the user to leave the product unattended which is illegal by Canadian laws. The fuel band can be placed under the gas nozzle's handle, but still requires the user to keep it in place.

The cone shape of the device sets the Fuel Band apart from many other devices. The cone allows the device to be slid under the gas nozzle's handle without having to adjust its orientation. The amount of gas being pumped can also be adjusted due to the shape of the device. If the user want to slow the flow of gas, the cone can be slid out to the thinner part which will lower the gas nozzle's handle effectively reducing the flow of gas.

The device is simple and easy to use. Other devices have complex mechanisms and require multiple motions to operate. The device also eliminates all the pain the user experiences.

The device is extremely durable and can be dropped multiple times without breaking. The device weighs roughly as much as an average apple meaning that it would not strain the user's wrist after prolonged use.

Since the device is made using thermoplastic, it is fireproof. It is extremely important for the device to not be flammable since a flammable device is dangerous in a gas station. The thermoplastic also allows the device to be inexpensive and easy to build.

EZFlow

INNOVATIONS FOR INDEPENDANCE INC.

Innovations for Independence Inc.
F 20 - 126 - 3

Problem Description

Create a device to allow Sandi to use her credit card, push keypad buttons, and grip the nozzle with ease at the gas station. Provide a working sample of the design as proof of concept to Dr. Fleisig and for Sandi Mugford's use.

Design

EZFlow is a gas nozzle-gripping assistant for our client, Sandi Mugford. The device essentially converts the motion of gripping to pushing through the use of a customized lever. By changing the type of motion, EZFlow makes fuelling much easier for people with Rheumatoid Arthritis who cannot maintain a grip for longer than a few seconds. The materials that are used to construct EZFlow are specifically chosen for optimal strength and durability, while being lightweight and cost effective. The main body of the device is constructed of PVC electrical tubing and bound together using PVC cement, fusing the parts into one and making it very difficult to break. Chicago screws were used for the pins and a metal hook is attached to the end. The device has been painted in white for visual effects, and has a red non-slip material around the handle for ease in holding the device as well as on the inside of the rubber clip, to prevent the device from slipping. EZFlow weighs 0.595lbs, which is extremely light and very easy for the user to lift and operate. The device is about 21x21x6 cm in size, which could fit into the purse of the user, to make transportation easier.

Functionality

Everything that the client requested regarding the gas nozzle was accomplished using this device. EZFlow will reduce the users pain, time at the gas pump, and the amount of energy required to fill a gas tank. Finally, EZFlow is lightweight, durable, affordable, portable, and efficient.

Materials, Components, and Assembly

The construction of EZFlow requires the use of a drill, saw, screwdriver, hammer, and sandpaper. Superglue and PVC cement are used to attach certain parts, which require caution when being used. A mounted clamp is also used to help keep the device steady as parts were sawed and drilled. Constructing the EZFlow would require someone who knows how to use the tools mentioned above with precision and confidence. The construction of the device may be somewhat difficult, but it is made to last a very long time. It is very strong yet lightweight because of the materials that were chosen to be used. All the materials that were used to create the device cost $23.16. Finally, the construction of the device takes approximately 5 hours, including all drying time for glue and paint.

The actual construction process and all the parts used are as follows:

1. The parts were purchased from The Home Depot and the Dollar store.
2. 3 cm of tubing were cut off each end of the 90° PVC elbow.
3. The PVC coupling was cut in half, a side section was cut out, and the pin and screw holes were drilled.
4. The sides of the rubber coupling were cut off and a section of the side was cut out.
5. The 3/4” reducer bushing, 3/4” coupling, 1” coupling, 1-1/4” coupling, and blue cap were put inside each other and glued together with PVC cement, creating the handle of the device.
6. The handle was glued to the 90° elbow with PVC cement and a hole was drilled at the opposite end and in the center, for the hook and the pivot to attach to respectively.
8. The coat hook was shaped to align properly with the device.
9. The PVC pivot was screwed to the center of the rubber coupling and the attached to the center hole on the 90° elbow with Chicago pins.
10. The hook was attached to the end of the 90degree elbow with Chicago pins as well.
11. The red non-slip placemat was cut and super glued to the handle and rubber clip.
12. Finally, a piece of vinyl baseboard was cut and screwed to the handle of the device to make a waterproof strap.

Use

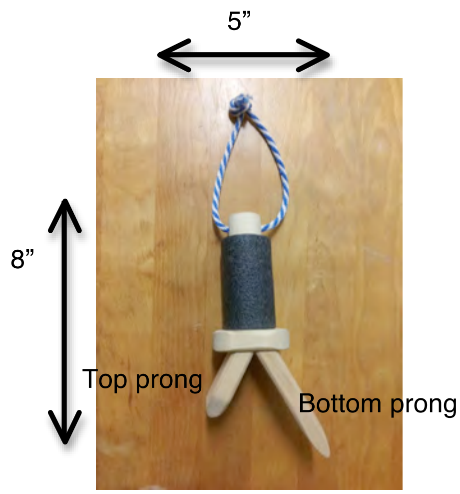
1. Sandi holds the device so that the hook is in line with the body.
2. Then she attaches the hook onto the trigger by simply moving it into place under the gas nozzle.
3. Moving the device down towards the handle of the nozzle, she then clips the rubber clip into place with the hook firmly attached to the nozzle's trigger.
4. Sandi pulls back on the handle of the device and leans on it to keep the gas flowing.
5. Finally, Sandi unhooks the device and stores it in her trunk once the fuelling process is completed.

Benefits

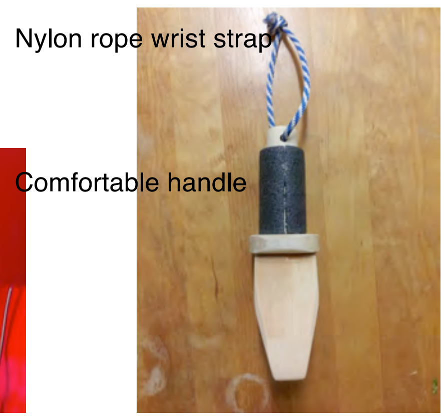
Our product reduces the amount of pain Sandi feels and increases efficiency at the gas pump. Currently, Sandi just needs to slowly pump gas by only holding the trigger for a few seconds, taking frequent breaks to rest her sore hands. With our device she can pump gas continuously because it avoids the painful action of gripping. The detail designs of our device are very considerable and customized for Sandi. The netlike sponge on the handle and inside the rubber clip is slip-resistant, making it easier to use and more comfortable. The strap provides an easy way for EZFlow to be carried. The large handle is more suitable and comfortable for Sandi’s hand to hold when she is implementing the device. Finally, all the sharp parts are replaced by smooth surfaces or curves, avoiding any chance of the product injuring the user.

Get A Grip

Rheumatoid Arthritis Team (RAT)
F 20 - 126 - 4



Device in place



Problem Description
Sandi Mugford is an independent and active individual. A big part of Sandi’s lifestyle is being able to use her motor vehicle without assistance. Although Ms. Mugford possesses the necessary dexterity to perform all the tasks while driving, pumping gas presents her with a task that strains her physical capabilities. The sustained squeezing action required to depress the gas trigger at the gas station causes Ms. Mugford pain in her fingers, and she is forced to switch hands or stop pumping entirely many times throughout a single fill-up.

Design
The proposed device is “Y” shaped. It has a height of roughly 8”, a width of 3”, and a length of 5”. It is extremely lightweight (280g) relative to its size and durability. One of the prongs (the bottom prong) is longer and pointed for effortless operation. The other prong (top prong) is shortened to minimize weight. The padding on the handle is firm yet comfortable, with a large diameter for easy, pain-free handling.

Functionality
The proposed device’s primary function is to enable Ms. Mugford to compress the gas nozzle trigger painlessly. It achieves this by converting the painful squeezing force usually required to pump gas into a vertical translation force that can be applied with virtually no finger involvement.

Materials, Components, and Assembly
This main structure of the device required one 1” x 10” x 8” board of white pine, which can be purchased at home depot for $ 5.00. After

cutting and sanding, the wooden components were attached with 3/16" and 3/2" screws and Epoxy Resin, which collectively cost $ 11.00. The handle was padded with pipe insulation which can be purchased at Home Hardware for $ 0.99. The lightweight nylon rope can be purchased at Canadian Tire for $ 0.58. To build, one 3"x3", one 2½" x 3", and one 2½" x 5" pieces were all cut from the white pine using the band saw. These were all smoothed and shaped using the belt sander. The two 2½" wide pieces were then attached (at 50 degrees relative to each other) to the 3"x3" piece using epoxy and 3/16" screws with the drill press. A 2" long 1-1/4" diameter handle was then created from the white pine on the lathe and tapered to ½" on one end. A ½" wide hole was then drilled and the handle was inserted and attached using epoxy, followed by a fifteen minutes drying period. A 1/8" hole was drilled in the side of the handle near the end, and the rope was fitted through and tied off to create the wrist strap. Lastly, the handle was covered in pipe insulation. The construction of the final prototype took a total of 4½ hours.

Use

1. Retrieve device from the glove compartment, passenger seat, trunk, etc.
2. Place wrist through the wrist strap.
3. Proceed through the gas station process (with the device hanging securely from wrist) unhindered due to the lightweight, compact design of the device
4. After inserting the gas pump nozzle into the gas tank, insert bottom prong (longer than top prong) perpendicular to and directly below the trigger
5. Apply an upward force to the bottom of the device's handle
6. Keep device's handle elevated until the desired amount of gas has been pumped
7. Let go of device; gas will stop pumping
8. Remove pump nozzle from gas tank and place back in holster
9. Return device to storage location.

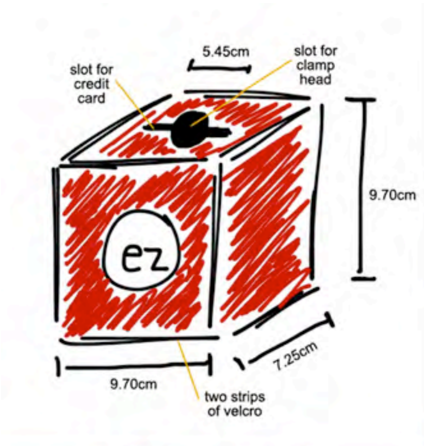
Benefits

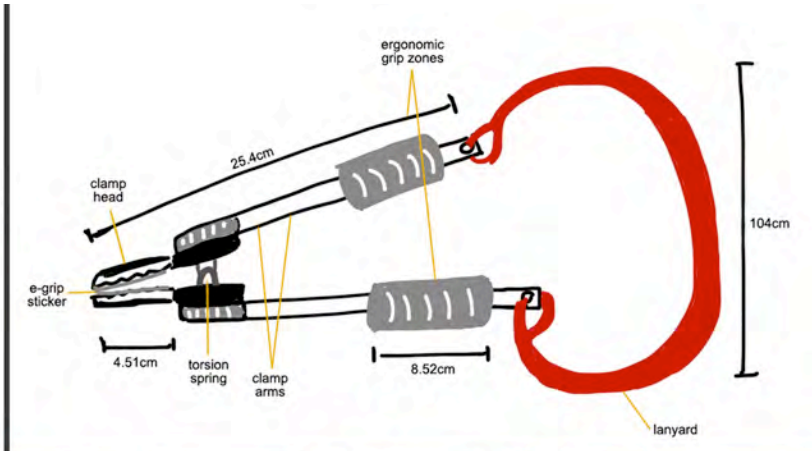
The proposed device has a plethora of qualities that make it superior to other alternatives. The combination of the device's lightweight build, compact size, and wrist strap make the device incomparably portable. Ms. Mugford can perform every task she needs to at the gas station unhindered while wearing the device on her wrist. The wrist strap also removes the risk of Ms. Mugford having to bend over to pick up the device, if by chance she drops it. The device is made of very durable materials, and has no hinges or moving parts, which eliminates the possibility of rusting or becoming misshapen or bent. The most defined characteristic is the extremely simply, easy, and stress-free operation of the device, which Dr. Fleisig referred to as "…incredibly simple."

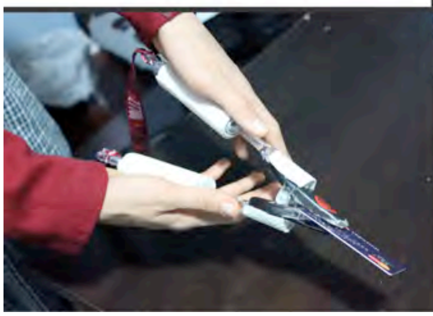
EZ Card Gripper

easywork
ENGINEERING AND DESIGN

EZ Work
F20 - 126 - 5







Problem Description

The goal of this project is to design a method, as validated by Dr. Fleisig and Ms. Abbey Desjarlais, to assist Ms. Sandi Mugford at the gas station in inserting and removing her credit card, thereby allowing her to maintain her independence.

Design

The design is functional, easy to use, and provides an effective solution to Ms. Mugford's current problem. The EZ Card Gripper is a clamp-like device with ergonomic grips on the arms. This device weighs only 0.44lbs, less than even a Smartphone. A lanyard is attached to the Card Gripper's arms to maximize portability and convenience for the client. The EZ Card Holder is a small red box that stores the client's credit card and remains in her car's trunk. The box is weighted and two strips of Velcro are attached to its bottom to ensure it does not topple over in the car. Please refer to the visuals above for detailed dimensions. The device eliminates pain and requires only the slightest applied pressure to the arms to open the clamp.

Functionality

This Credit Card Insertion and Removal Device design is exceedingly suitable for Ms. Mugford to use at the gas station. It will resolve the stress and pain she feels when inserting and removing her card as it does not require the use of acute finger muscles or finger dexterity, and in fact, can be operated only using one's palms. It is very lightweight and comfortable to hold. This device allows Ms. Mugford to insert and remove her credit card from the machine at the gas station with ease and comfort; it can pick up the card in exactly the correct position, insert it, and remove it despite machine resistance, thereby eliminating any pinching motions. It can do everything that Ms. Mugford requested with regards to inserting and removing her credit card from the machine at the gas station.

Materials, Components, and Assembly

In order to build the EZ Card Gripper, the following materials are needed: two icing spatulas, a fridge magnet clamp, a roll of shelf or drawer liner, an E-grip Anti-Slip sticker, and a lanyard. In order to build the EZ Card Holder: the following materials are needed: a cardboard box, two Velcro strips, five nails or an equivalent weight of 150g, foam tape, and super glue. All these materials can be purchased from the dollar store, Dollarama. The E-grip Anti-Slip Stickers, however, can be purchased online at flexibleinnovations.com/egrips. The total cost of the design, including both the EZ Card Holder and the EZ Card Gripper and accounting for taxes, is $16.30. The device takes from 2-3 hours to be built. Firstly, in order to build the EZ Card Gripper, the magnet must be removed from the clamp using pliers in order to avoid magnetic interference and data loss. Next, an E-grip Anti-slip Sticker is cut in half; each half is attached, using super glue, to one inner edge of the clamp head. The sticker's edges are trimmed using scissors to fit the clamp. After that, the rubber spatula heads will be removed from the spatula handles. Then, two strips of approximately 30cm of shelf liner will be cut. Each one of these strips will then be wrapped around one of the spatula handles and glued into place using super glue. Each spatula handle will then be glued to one outer edge of the clamp head. Finally, a lanyard approximately 104cm long will be looped through the holes at the ends of the handles and super glued into place. In order to build the "EZ Card Holder", a slit is cut on the top surface that is approximately 5.45cm. Then an oval shape is carved ¾ of the length into the slit. The box is then weighted with nails at it's bottom and secured in place using super glue or foam tape. A layer of cardboard is then quickly placed on top to even out the surface. Next, the box is padded with shelf liner or any other soft material, leaving a suitable amount of space for the credit card to enter and leave the box. The lid is then placed on top and secured in place using super glue. Finally, two strips of Velcro are super-glued to the bottom of the box.

Use

1. After parking, Sandi opens and walks to her trunk.
2. Sandi retrieves the device from the container in her trunk.
3. Holding it comfortably with both hands, Sandi applies slight pressure to the arms to open the clamp.
4. She inserts the EZ Card Gripper into the specified opening of the EZ Card Holder and picks up the card.
5. With the card securely in the EZ Card Gripper clamp, she walks over to the credit card slot.
6. Using the EZ Card Gripper, she inserts the card into the slot, and then removes the device from the card by once again applying a slight pressure to the arms to open the clamp.
7. She then hangs the device over her head an it remains there while she uses the keypad.
8. After Sandi has used the keypad, she retrieves the card from the slot using the EZ Card Gripper; the device is still hung around her neck while she does this.
9. Sandi walks to her trunk, opens it, and places the card back into the EZ Card Holder. She also places the EZ Card Gripper back into the container.
10. Sandi pumps gas.

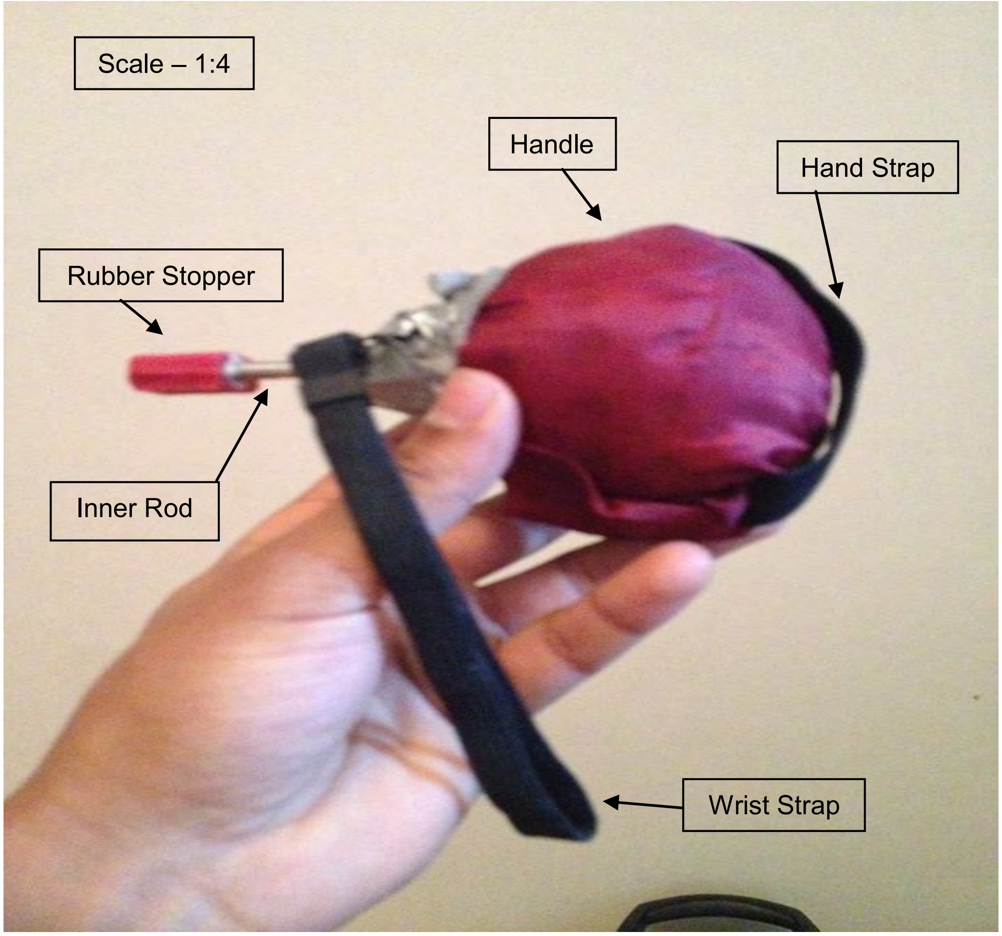
Benefits

The benefits of the design are that it eliminates pain, requires only the slightest pressure, does not require finger dexterity, accounts for every step of the fuelling process, is portable, has ergonomic grips, and that it is quite inexpensive.

Easy Touch

C.Φ.S

Corporation of Simplification
F 20-126-06



Problem Description

To design a device that will solve Sandi's difficulties at the gas station in regards to the issue of pushing buttons on a keypad, at the gas station or anywhere a keypad is present.

Design

In the visuals can be seen the design which is composed of a metal rod with a rubber stopper at the end, connected to a soft spherical handle. The device weighs approximately 50 g and the handle is just less than 3" wide.

Functionality

This device provides a solution to pressing buttons on a keypad. It simplifies the task for people with arthritis so that no pain is felt while using the keypad. This device solves all of the problems associated with the keypad. The user has more accuracy due to the metal rod, more comfort due to the memory foam material, more security due to the wrist strap, and less pain due to the great design.

Materials, Components, and Assembly

The device requires memory foam, a metal rod, rubber stopper, super glue, a door handle and waterproofing material for the handle.
The total cost of the materials is 60$ with the memory foam being the most costly at 30$.
All materials can be obtained from Walmart and the device requires only scissors and glue to be made. The device can be assembled within 30 minutes. The construction may require the use of a saw to cut metal rods of differing length.

Use

1. Retrieve device from ideal location of storage (trunk, purse).
2. Slip the hand on to the wrist strap.
3. Slip the hand under the elastic band with the metal rod pointing away from body.
4. Use the device to apply pressure to the keypad at the pump or any other location.
5. Drop the device and let the wrist strap hold it to open door or fuel cap.
6. Place the device back in location of storage before driving.

Benefits

The device reduces the work and dexterity required of Sandi. It reduces the pain caused by abduction and adduction of the hands, flexion of arms and thumbs and opposition of fingers. The weight of the design is minimized as well. It is lightweight with no compromise in durability and comfort. The design is simple and easy to comprehend; the spherical shape allows for much flexibility in how the device is held while making it obvious in how the device is to be used. This device can be used not only in gas stations, but also anywhere that requires the use of a keypad. Very few of the team's peers worked on solving the problem that the keypad presented, so little competition was seen. The device is water proof, proving useful in all weather conditions. Due to the hand strap and wrist strap, the device will always be secure and will never fall to the ground to break, if worn properly. The rubber stopper works as a shock absorber so that no damage is done to the keypad.

The Card Kast

Figure 1

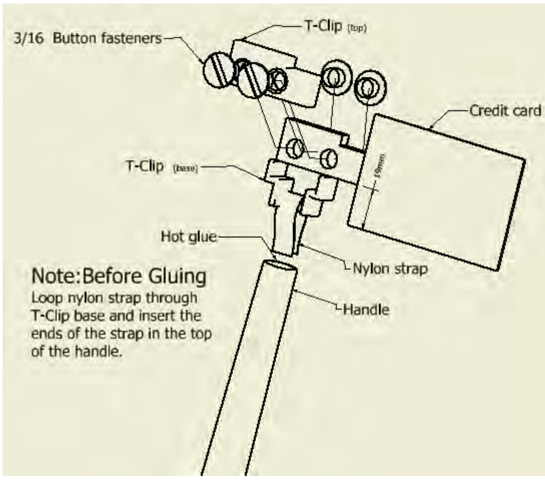
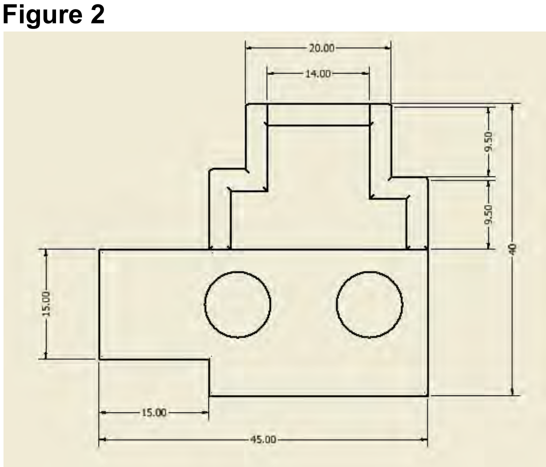


Figure 2



KASTRO Industries
F 20 - 126 - 07

Figure 3

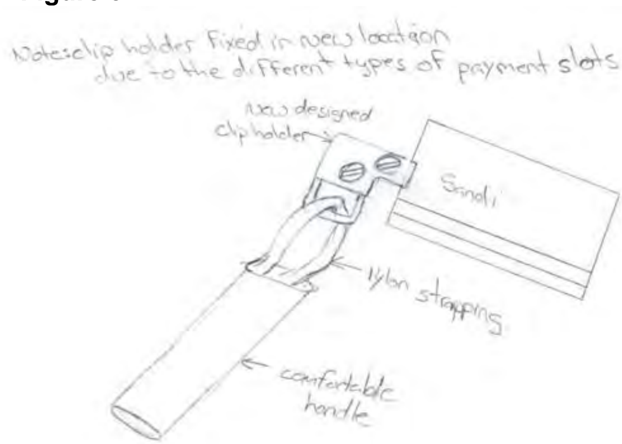


Figure 4

Figure 5

Problem Description

The goal for the final project is to design device(s) which maximize Sandi's independence at a gas station while inserting and removing payment card from the pump, operating the gas nozzle and using the number pad on the gas pump.

Design

The design requires very few pieces (figure 5) and is easy to assemble. It weighs less than one pound and is approximately 20 cm in length and the width of a credit card. It is flexible for easy storage. It has thick surface to grab onto for insertion (t-clip) and a thick soft handle for easy removal.

Functionality

The function of this device is to improve Sandi's experience at the gas station by giving her more ease of access to the gas pump when using her credit card. It addresses the main concern out of the three as laid out by the client: credit card insertion and removal. Not only does the device allow easier use at the gas pump, but it also assists her when using her card with a 'swipe' or 'tap' machine. This device makes it easier to find in her purse, easier to insert and remove card, easier to pick up if dropped, easier to access from pocket and ultimately minimize the pain and energy required to perform this task.

Materials, Components, and Assembly

The materials required to fabricate this device are: the T clip (must be constructed in a 3D printer which can be sent to a company that will print and mail custom designs for their clients. The cost of printing that particular piece will be about $5.00), the button fasteners (3/16 bought at any hardware store for under $1.00), the golf club handle (purchased from a dollar store for $1.00), and a nylon fabric strap (1/2" X .125" X 2 ½" purchased from a dollar store for $1.00). The tools required to construct device are a hot glue gun and a screwdriver. Once you have all the pieces it takes two minutes to put device together. Refer to Figure 1 for assembly diagram.

1. Place ½ cm of the edge of the card into the middle of theclip and tighten the screws to hold the card in place. Make sure the magnetic strip of the card is on the same side of the device as the breakaway point and that the clip is attached to the end of the card that does not contain the chip
2. Thread the nylon strap through the breakaway point and insert both ends of the strap in the top of the golf club handle.
3. Use hot glue to secure the strap to the golf club handle.

Use

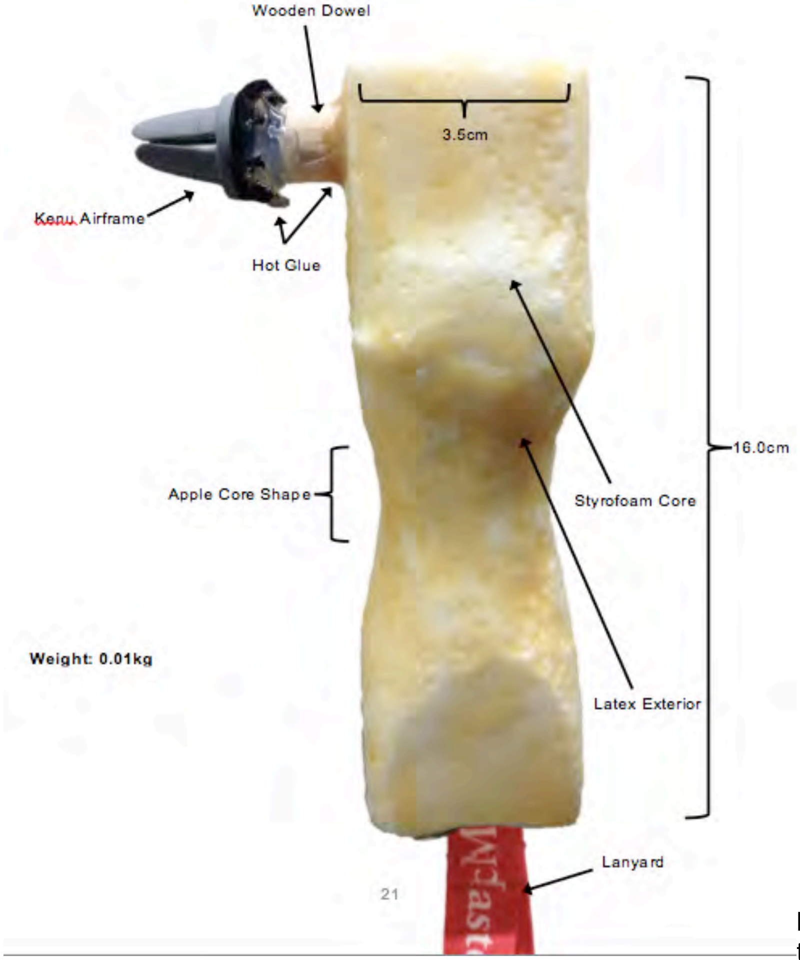
1. Sandi will locate the device in her purse which is in the trunk of her car. Grabbing the large handle she will remove the device and close her trunk
2. Hold onto the device on the 't-clip' (see figure 1) and insert the card into the payment slot
3. When she has finished typing in the options on the screen she will grasp the handle and easily remove the device
4. When finished with the card, place it in pocket while fuelling the car
5. When this is finished remove the card from pocket by easily grabbing the handle that is hanging out of the pocket
6. Return device to purse

Benefits

There are a number of existing devices which assist with the storage and use of credit cards; however, these products are not tailored to meet Sandi's requirements. Most of these products on the market consist of a case or clip which holds together credit cards and cash. Sandi does not have any strength in her fingers and gripping is a very painful task for her. Fitting materials were chosen, and the user's constraints were always taken into consideration. In comparison to designs of our peers, The Card Kast trumps in the sense that it is very simplistic, lightweight and practical. It simplifies the entire insertion and removal process beyond other designs.

GeckoGrip

PENG Solutions
F 20 - 126 - 8



Problem Description

As a sufferer of rheumatoid arthritis, the client Sandi has a difficult time filling her vehicle with gas. Due to pain and weakness in her hands, she finds it difficult to insert her credit card into the machine. Our job is to design a device that reduces Sandi's pain and fueling time and one that does not compromise the safety of Sandi and the public.

Design

The GeckoGrip handle is built out of soft Styrofoam, hand-sanded into an apple-core shape. Such a shape is extremely easy to hold, reducing pain. The device maintains a good size with a core diameter of about 3.5cm, and a height of 16cm. Such dimensions conform to the hand of the client very nicely and help minimize the effort required in closing the hand around the device. As it is built out of mostly Styrofoam, the entire device weighs only about 0.01kg. This is so light that the user can barely feel it in the hand. Despite being light however, the entire device is extremely strong and durable.

Functionality

Using a clip, the device grasps the card between two prongs, which allows the user to insert and remove a payment card from an automatic payment machine. To use the device, the user must grip the form-fitted handle, and press the clip onto the card, allowing it to grasp the card, which can than be inserted or removed. Such a device can do everything the client requested with regards to the problem statement.

Materials, Components, and Assembly

The device is easy to use and also fairly simple to construct. The core handle of the device is made of Styrofoam that can be purchased from any hobby shop or even Home-Depot for less than $5.00. The device itself is coated with a latex rubber material that can also be purchased at minimal cost from any hobby shop (i.e. Hobby and Toy Central). Depending on the quantity of rubber needed, the cost can range anywhere between $2.00-$20.00. Specifically, the production of the prototype device requires about $2.50 worth of latex rubber coating. The head of the device uses a ½" wooden dowel that can be purchased from Home Depot for $1.42. The most important part of the device that actually holds the card, called the Kenu Airframe can be purchased from the Apple Store for $24.95. Additionally, hot-glue is used to adhere the Kenu Airframe to the wooden dowel, and the wooden dowel to the Styrofoam, the cost of which, depending on the brand and quantity is about $3.00 and can be found at Home Depot or even a Hobby Shop. Lastly, a lanyard is required which can be purchased for less than a dollar at the dollar store. The cost of the device all together, depending on what materials can be found (i.e. Styrofoam), and what must be bought, brings the cost to somewhere between $30.00-$35.00.

Assembly of the device is quite easy once all the materials are found. Using a rough surface such as sand paper, the Styrofoam piece **(**16cmx5cmx5cm**)** must be sanded down into an apple core shape, with the head and bottom of the handle left slightly thicker as to allow for the attachment of the Kenu Airframe. Using a saw, a small piece of the dowel (3cm) must be cut. With force, the dowel is pressed into the head of the Styrofoam, making an indent for it to sit. Half the dowel should be inside the Styrofoam, and half should be exposed. Using hot glue, the dowel is adhered to the Styrofoam to ensure that it remains in place. Next, the Kenu Airframe must be placed onto the dowel. In order to do this, the grey clip must be broken off from the Airframe device. This requires the use of a saw, or force. Once the clip is taken off the Airframe, hot glue is used to adhere the clip to the dowel. Upon completion of this step, the main device is completed. As Styrofoam tends to break apart over time, it is important to coat the entire device. Using the latex rubber, the entire device, excluding the clip, is coated using a paintbrush or popsicle stick. The rubber is allowed to dry. Once the rubber is dry, a lanyard is pressed into the bottom of the Styrofoam handle, to allow for easy holding.

Use

1. Take the device from storage, which can be a purse, glove compartment or trunk
2. Take the payment card and set it onto the machine slot.
3. Using one or two hands (whichever is easiest) grasp the device and use the Kenu Airframe part seen in the diagram on page 1 to push the card into the machine
4. The device can remain inside the machine with the card, or be removed and carried by the user with the help of a lanyard
5. After payment is complete, push the device clip (Kenu Airframe) against the edge of the card
6. The device will grasp the card, which can then be removed from the machine
7. Both the device and card can than be place back in their respective storage compartments, or held by the user.

Benefits

It was mentioned that Sandi sometimes employs the use of pliers in order to insert and remove cards from gas payment machines. The GeckoGrip is much better than pliers because it automatically grips the card and doesn't require the client to pinch her hands, or fingers together, which can cause pain and discomfort. The device is also extremely light, safe and strong making it easy to carry at the gas station. Additionally, the handle is specifically designed to be easy to hold and comfortable, something that cannot be said about pliers. The material used also maintains a good temperature, not getting too cold, or too hot in the summer, which makes it easier to hold for long periods of time. For example, in the winter a device made of metal would get very cold, however the GeckoGrip does not.

Importantly, unlike many other solutions within the 1P03 class, the GeckoGrip is not permanent, which allows it to be used over and over again.

Helping Hand

Top Level Design

F 20 - 126 - 9

Problem Description

The goal is to design a device that allows the clients, Dr. Fleisig, Katie and Abbey, help the user, Sandi, maintain her independence in fuelling her car and paying for the gas. The device will aid Sandi with inserting and removing her credit card from various gas stations and card-accepting devices in a painless and easy manner.

Design

Helping Hand had two handles made of aluminum metal, which are covered with rubber piping, seen as the two black circular pieces in the annotated diagram. The body of the device is made from a single length of aluminum metal and bent in half and shaped into pliers. This is also annotated in the above diagram. The device weighs 0.4 lbs and is 11 and ¾ inches in length. This is approximately the length of the users'' forearm.

Functionality

Helping hand not only makes using credit cards at the gas station easier and less painful for the user, but it can also be used for any action that would require a pinching motion. This means that Sandi can use the device at multiple stores, with several small objects. The Helping Hand successfully addresses the concerns expressed by the client for the problems concerning credit card usage.

Materials, Components, and Assembly

The materials that must be purchased for the construction of the device are 1 foot rubber tubing, one piece of 2 feet of ¼ in aluminum rod, two pieces of 1 foot of ¼ inches of aluminum rod, nuts and bolts, duct tape, 2 inches of plastic pipeline tubing and 2 wire clampers. These materials can be bought from any large hardware store. The construction of the device takes about 4 hours and the total cost of the materials is $12.55. The tools needed to manufacture this device are hammer, screw driver, saw, scissors to cut the duct tape, and clamps in order to make it easier to bend the aluminum. In order to construct the device, a two foot piece of aluminum metal is bent in half and shaped into prongs. A second aluminum piece is shaped into a handle, covered with rubber tubing, and bolted onto a two inch plastic pipe. It is slid over the folded end of the prongs. A third piece of aluminum is shaped into the back handle and covered with rubber tubing. Then it's attached to the folded end of the prongs with wire clamps. Duct tape is added to ensure safety and improve aesthetics of the final product.

Use

This device converts pinching motion of the fingers, into sliding motion applied by the arm. It diverts muscle/joint use to larger body parts. First, Sandi would put her wrists through the two handles as she feels is comfortable. She would slide the middle handle outwards to close the prongs on the credit card and would insert it into the machine. To release the card, the outer tube would be pulled inwards. She can then place the device on her car and continue paying for the gas or, she can leave it handing on her hand. Finally, when she is done paying, she can grip the credit card once again using the prongs using the same sliding up motion and remove the card from the machine. Once she is done using the card, she machine back down, take hold of the credit card, and put it back.

Benefits

Currently Sandi uses either both her hands or pliers in order to insert her credit card in and out of the machine. This damages her card, causes her pain and is difficult to do when it is cold. This device has rubber tip for ease of grip and prevents potential damage to her card. There are large loops for handles that allow her to use her bigger joints to perform the sliding motion. The large looks also allow for use in the winter with large gloves on to keep warm. The device uses a unique motion to insert and remove the credit card without using the gripping motion. It also minimizes the use of her hands and diverts it her joints. The final prototype is lightweight; approximately 0.4 lbs. This allows for easy storage and conserves as much of Sandi's energy as possible.

CARD SHARK

Trust Enterprises
F20 - 126 - 10

Problem Description

The objective of the final design is to reduce the amount of the pain felt by Sandi, a client with rheumatoid arthritis, with the task of inserting the credit card into the machine into the designated slot. The main reason for the pain is due to the gripping motion associated with holding the card, which takes a very large strain in her joints. Creating a viable solution to this problem will enable Sandi a lot more independence in her daily activities, and overall improving her quality of life.

Design

The device is approximately 200mm in length and 180mm in breadth. It has an estimated weight of about 1 pound. As seen in the above visuals, the foam padding serves as the grips on the device. The foam padding can be easily adjusted to accommodate the width of the user's grip. It is very light so it won't cause any pain to the lift and will decrease pressure on the wrists. The device is portable.

Functionality

The device has a really light frame, and is also small in size. These qualities give the design a high degree of portability, which is very important to Sandi due to the difficulty she has with large and heavy objects. The main purpose of this device is to reduce the amount of pain felt in Sandi's joints, and is achieved in our design by using the foam padding as the grip handle. The large volume of the foam padding makes wider grip possible and, thereby lessening the strain felt in Sandi's joints. Also, the terminal end of the design (the part attached to the credit card) is just small enough so that it can fit inside the credit card slot without any difficulties.

Materials, Components, and Assembly

The card shack requires few materials and components to be built. The components include Foam padding ($10), binder clip ($5), wire coat hanger ($2), and sticky tack ($3). These components together have a total cost of $20. They can be bought from a wide range of vendors, including your typical dollar store. Adhesive material also include glue and tape. In the construction of this device, a pair of strong scissors or pliers is also required.

Using the scissors/pliers, cut off the corners of the coat hanger so that it looks 3-pointed star. Next, apply a thin layer of super glue to the surface of the coat hanger and then wrap the foam padding around it (the thickness of the wrap can be determined based on the size of the user's hand). A thin layer of super glue is also applied to the in between the outermost layer to prevent it from unraveling. Attach binder clip to the hook of the coat hanger, and hold it down with some tape. Cover cut edges of the hanger using sticky tack; this is to make sure there are no sharp ends on the device to cause any physical damage to the user (cuts, piercings) during use. The device is easy to construct or assemble and only takes about fifteen to twenty minutes to build.

Use

1. The **Card Shark** device is relatively portable and can be kept in a medium sized storage location (ie. Glove compartment, under the seat, etc.).
2. In order to remove/insert the credit into the device, the user must press down the clip and place the credit card.
3. After the card is inserted into the clip, the user can will grip both side of handles of the card shack and insert it into the machine. In the meantime, the device remains in position in the card slot, while the user deals in the necessary information required for payment.
4. When the user is finished, the device (with her card) can be removed from the card slot. This action can be completed with the card still clamped securely with the clip and without the card dropping or slipping off the device.
5. After completion of payment the user can finally deal with other tasks in the gas station by dropping off the device in the car.

Benefits

Currently, operating and using the credit card causes a great deal of pain and stress for Sandi. The design implements a very simple solution to reduce the pain/stress, as well as allowing her to perform the task without any added difficulties. This device is better than existing products because it provides a very simple solution to the problem that is most important to our user, a solution that only requires the use one device and is reusable every time. She doesn't need to readjust the card, or use external parts in order for it to work. The production of this device is cheap in comparison to what it does for the user. The device adheres to all constraints. This device is portable, easy to afford, and the functionality is well thought out.

Handy Dandy Wrist-Bandy

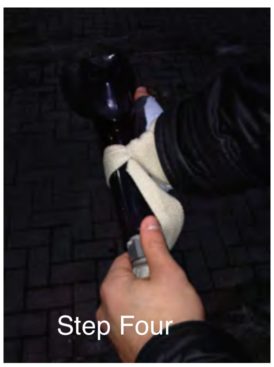
F21-1016 -1


Original Sketch


Step One


Step Two


Step Three


Step Four


Step Five


Prototype two


Final Design

Problem Description
Ms. Sandi Mugford does not possess the grip strength required to sustain the act of pumping gas for an extended period of time, due to her severe case of arthritis. Pumping gas causes her pain to increase, and it takes much longer for her than the average able-bodied human to fill her gas tank.

Design
The device is a glove with the fingers removed for easier removal, which also allows for use when Ms. Mugford is experiencing swelling in her fingers. It has a wide end on the strap to make for easier handling and threading, much like the aglet on a shoelace. The device is very lightweight and portable and is no heavier than the average winter glove. It can fit easily into her purse, glove box, or the door of her car to make for easier transportation and storage. The glove is made to fit on her right hand however the simple design allows for a left-handed glove to easily be made.

Functionality
The device can maintain the pressure needed on the trigger of the gas pump to keep a continuous flow of gas throughout the entire filling process. This will reduce the stress on Ms. Mugford's finger and hand joints, no longer forcing her to make a fist. She can pump gas with an open hand in a neutral position.

Materials, Components, and Assembly
The Handy Dandy Wrist-Bandy is of a very simple design with few parts. It consists mainly

of a fishing glove to provide friction. The second main component is a strap of woven material that acts as a lifting strap. The strap is then sewn onto the wrist of the glove to create as few moving pieces as possible. The last component is a piece of foam wrapped around the end of the strap to make for easier handling and gripping. The total cost of the device is no more than $9.00. The most expensive piece used is the fishing glove ($5.00), followed by the strap (estimated at $3.00), and finally foam, and a needle and thread to sew the device ($1.00).The entire device can be built with items that are readily available. When building this, the manufacturer must ensure that the strap is not sewn too tightly around the wrist of the glove, as it would be difficult for Ms. Mugford to put on and take off.

Use

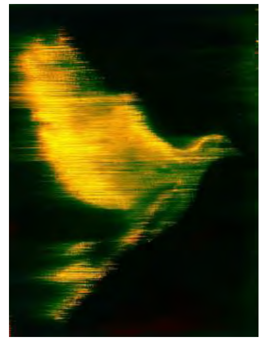
1. First Ms. Mugford will put the glove on and put the nozzle of the gas pump in her car.
2. Next she will take the easy to hold end of the strap and wrap it around the top of the handle to the side opposite of her hand wearing the glove and thread it through the space underneath the gas handle trigger.
3. Then pull it up until the nozzle is in the open position.
4. Next she will place her hand (with the glove) against the strap and the friction between the glove and the strap will hold the nozzle open.
5. When her gas tank is full/she is done pumping gas she will simply move her hand away from the handle and the friction will be removed and the strap will release.

The device can be stored in many places as it is very small and lightweight. It can be stored in her purse. She can also store it in her glove box, or the storage space in the door of her car or anywhere a single winter glove could fit. Ms. Mugford can choose when she puts the device on during the fuelling process. The device can be worn throughout the process without hindering her mobility or being conspicuous.

Benefits

This product is unique as there is currently no other product on the market that helps users with mobility problems pump gas. It is also unique within the designs thought of by the other Engineering Level I students at McMaster because it uses a lifting strap design that still remains quite simplistic and easy to use. It does not require extensive fine motor skills nor does it interfere with other necessary processes at the gas station. Ms. Mugford’s hand (using the glove) can remain in a relaxed neutral position throughout the entire process and the other hand only need make a closing action once. The second hand only closes once around the large easy to grip handle so it is not closing entirely only about 50%. This will reduce the overall pressure on her joints and help make refuelling an easier and less stressful process.

Gas Nozzle Device
i.e. E-Z Gas Hook



Team B & Y
F 21 - 1016 - 2

Problem Description
Sandi is a sufferer of rheumatoid arthritis and a device that can help her compress the trigger for a gas nozzle is to be made so that she may pump fuel for her car at whatever gas station she goes to.

Design
The device consists primarily of a rope which has a loop and a PVC pipe on one end, with two knots to hold the PVC pipe in place and to form the loop. On the other end there is a hook attached to the end of the rope. The total length of the device outstretched roughly should span the same length as Sandi's forearm. The weight of the device is less than 2 pounds for ease of use.

Functionality
The device, functionally speaking, enables Sandi to use her whole arm in the process of compressing the trigger for the gas nozzle. Initially, Sandi would use the muscles in her hands and fingers to pull up on the trigger however the device allows the muscles in her

arm and should to be used thereby lessening the strain on her joints over all.
This device, however, only addresses Sandi's request for an easier way to hold the trigger in place to allow fuel to flow into her car.

Materials, Components, and Assembly

The materials used and their costs are as follows:

Item	≈Cost($)
Plastic Tie	0.20
Hook	1.25
PVC Pipe	0.75
Nylon Rope	2.99
Liquid Electrical Tape	0.00
Total	**5.19**

Directions for making the device:
1. Use plastic tie to tie one end of the rope to make a loop
2. Put the rope through the PVC pipe, tie a knot at the end
3. Put the stainless steel hook on the rope, hammer down the end to make a closed loop
4. Use a plastic tie to secure the hook on the rope.

The device should take no longer than 20 minutes to build individually as a person.

Use

1. Sandi arrives at the gas station and proceeds to take the device out of her car.
2. She may have had it stored in the glove compartment or maybe she had it sitting right beside her but either way after finding the device she will proceed by putting her hand through the already made loop.
3. Sandi will then step outside and with her hand through the loop of the device and begin the process the fueling her car.
4. When she reaches the point at which the gas nozzle has entered the hole for the gas tank, Sandi will loop the hook end of the device through the space between the trigger and the bottom bar of the nozzle.
5. After having done so, she will then attach the hook onto the device itself thereby forming a loop.
6. Sand will then pull on the device from wherever she feels most comfortable, preferably the handle, which allows Sandi to use her whole arm when fueling her car.
7. When full, Sandi can lower the tension she places on the device thereby releasing the trigger for the gas nozzle.
8. Sandi detaches the hook from the device allowing her to just pull on the handle in order to reverse the loop that was created initially.
9. Sandi can then proceed on about her business with her hand still in the pre-made loop of the device or she can decide to take it off and leave it in her car for future use.

Include step-by-step instructions of how the device will be used. The instructions should be in a numbered list. Include where the device will be stored, how she will carry the device, where she will keep the device when performing the other tasks, etc.

Benefits

Our design has many benefits and features that make it a better product for Sandi. The loop with the PVC pipe on one end allows Sandi to apply the force according to her liking, either using her whole arm and forearm using the loop, or her hand using the PVC pipe. Moreover the majority of the device is made of a soft rope material, that is cushioned throughout and soft on the hands. The whole device is also of a weight less than 2 pounds, so Sandi can easily use it. An advantage to this device is also that also after Sandi applies the force she can put it in a locking position and the gas will flow without force.

Sandi's Magic Wand

MAC Design
F 21-1016-3

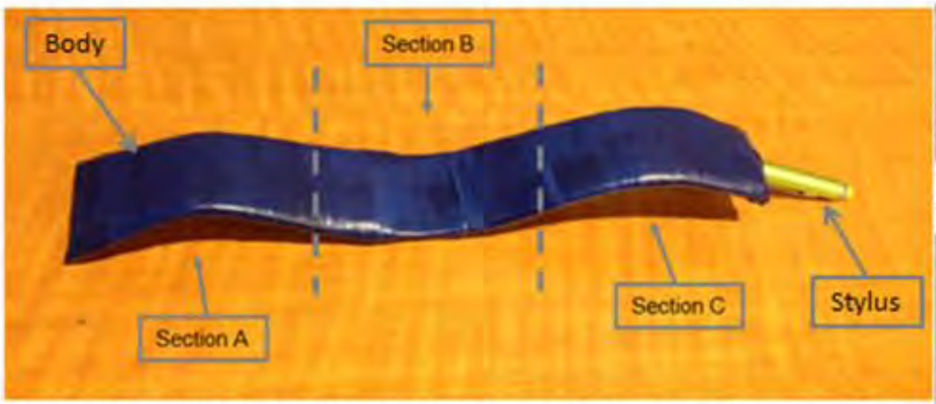


Image 1.0 Final prototype, with different parts and sections labeled. Length of device: approximately 1'.

Image 1.1 In use at the keypad.

Image 1.2 In use at the gas nozzle (wrists could be used in place of hands).

Problem Description

The user, Sandi Mugford, suffers from Rheumatoid Arthritis and as a result she has limited hand movement, dexterity and grip strength. People with similar limitations as Sandi experience some difficulty at the gas station. Specifically, Sandi has issues punching numbers into the key pad, and maintaining a grip on the nozzle. She cannot accurately press the buttons due to her swollen fingers, and the pressure from the buttons causes some pain to her joints. In addition, she finds it difficult and tiring to hold on to the fuel nozzle for the amount of time needed to fill the fuel tank.

Design

As seen in **Image 1.0** above, the design is extremely compact. It is lightweight (weighing less than 300 grams) and can be stored virtually anywhere. Sandi can easily carry it around with her in her purse if she needs to, and can also move around with it when doing other tasks at the gas station. It is compact and portable, which is important for Sandi as she would find it difficult to maneuver a bulky device. She can place the device anywhere (for example on the roof of her car) while she is doing other tasks at the gas station. She can also easily store the device in the glove compartment of her car, as it less than a foot long.

Functionality

Sandi's Magic Wand is capable of solving two of Sandi's issues. It assists with the use of the gas nozzle and with the entering of numbers on the key pad, without the need of grip strength or digit dexterity. Since the body of the device is fairly wide and soft, Sandi will be able to hold it with minimal difficulty and therefore be able to punch in numbers with the stylus with ease. She can also simply hold the device in between her two hands (as shown in **Image 1.1**) and proceed to punch in numbers in that way. As for the gas nozzle, the device will act as a prolonged lever. Once the device is inserted through the handle of the nozzle, the curved shape is designed so that the nozzle sits in Section B of **Image 1.0** and Sandi's wrists rest in Sections A and C. This will ensure that the device does not slip when in use. Sandi will then have to merely move her forearms up to fill gas, which eliminates the need to use grip strength. She will now be using a larger muscle group to do the task as opposed to just her hands.

Materials, Components, and Assembly

Sandi's Magic Wand consists of thermoplastic, felt paper, electrical tape, and a touch pad stylus. All materials are readily available at a superstore except for the thermoplastic which requires an online order. Total bill of materials fit under a cost of $40.00, with the felt (pack of 8 sheets) and tape costing approximately $1.50 each, stylus costing $20.33, and thermoplastic costing $15.00, (for the amount needed). Construction takes approximately 30 minutes to an hour to complete. The only tools required are a heat source to make the thermoplastic malleable. Special instructions consist of maintaining the warmth of the plastic while moulding it into shape. This can easily be maintained with the use of a hairdryer.

Use

Sandi's Magic Wand is easy to use in the following way:

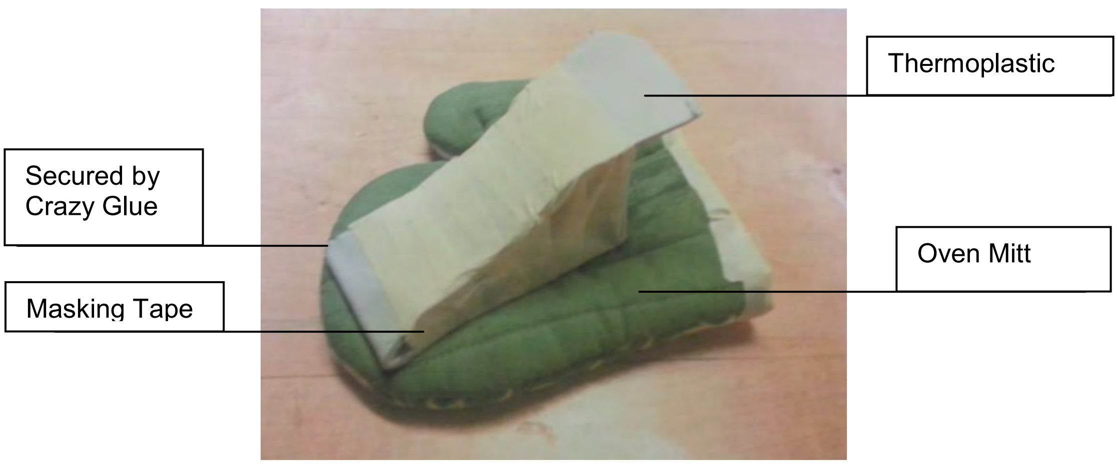
1. Sandi will take the device out of her car and place it on its roof.
2. After inserting the credit card into its slot, she will pick up the device and use it to punch in numbers. Numbers can be punched-in in two ways:
3. Sandi can hold the device in one hand.
4. She can hold the device in between two hands (as shown in **Image 1.1**).
5. After punching in the numbers, she will place the device back on the roof of her car and turn to take the nozzle out of its slot.
6. Once the nozzle is placed inside the car, she will pick up the device and slide it through the handle of the nozzle, ensuring that the nozzle lies in Section B of **Image 1.0**.
7. She will then place her wrists (or her hands as seen in **Image 1.2**) in Sections A and C of **Image 1.0** and move her forearms up to fill up the gas.
8. Once the fuel tank is full, Sandi will remove the device from the handle and place it back on the roof of her car.
9. She will place the nozzle back in its slot and then store the device back inside her car.

Benefits

This design incorporates a solution to two of Sandi's problems within a single device. It is lightweight, compact, easy to use and store, inexpensive and can be kept clean easily. It is very convenient to use and will definitely be very beneficial for Sandi.

MIGHTY MITT

Nighthawk Enterprises
F 21 – 126 - 4



Problem Description

Sandi Mumford suffers from rheumatoid arthritis which is a disability that restricts movement and causes physical pain. Sandi is unable to easily fuel her vehicle due to her limitations, therefore a device/solution must be designed which improves her experience at the gas station.

Design

The device is very lightweight as it is similar to the weight of a typical smartphone. The size of the device is fairly small as it can be stored in a typical purse. These qualities can be seen from the photo above.

Functionality

The device is able to aid the client in the process of fueling her vehicle with ease. The device requires very little effort and causes minimum stress while using the pump handle.

Materials, Components, and Assembly

The device only requires an oven mitt, crazy glue, masking tape, and thermoplastic to construct with the total cost coming to $7.50. The materials can be obtained at local hardware stores. The device can easily be constructed within 20 minutes without any special instructions or tools required. Instructions are simple, clear and can be obtained easily from one of the developers of the Might mitt.

Use

1. The device is put on the roof of the vehicle while Sandi inserts the fuel nozzle in the vehicle.
2. After the nozzle is inserted, Sandi obtains the device and puts it on.
3. Sandi inserts the device into the handle to allow fueling.
4. After fueling, Sandi carries the device in her hand and stores it in the glove box or her purse.

Benefits

What makes your design better than existing solutions, including those of your peers?

The Mighty Mitt is more superior compared to our peers' designs since it accomplishes the main task which limited Sandi, which was fueling her vehicle. The Mighty Mitt's design is extremely simple and easy to use compared to others which went to great extents to accomplish their goal. The construction is quick and simple with the cost of the materials being extremely cheap. The total cost resulted in being only $7.50 which is amazing since the device solves such a big problem for such little. Other designs were fairly expensive compared to this one and required complicated construction. This device is comfortable and very safe to use for Sandi. It does not stress Sandi's fingers or joints at all due to the padding and neutral position of her fingers. It also does not conduct electricity and is fire resistant for the most part. The Mighty Mitt is also very easy to store as is very light and small. The device can easily be placed in the glove box or stored in Sandi's purse and can be carried with one hand. Overall, the Mighty Mitt is small, comfortable, simple, cheap, safe, and accomplishes the goal of fueling a car with ease. Therefore, although all other device were well done, the Mighty Mitt is the best fit for Sandi.

EzPz

The E-Team
F 21 – 1016 - 5

Problem Description

Sandi Mugford is a woman suffering from Rheumatoid Arthritis. Unfortunately, this condition compromises her ability to insert and remove a credit card during payment at the gas station without pain. Sandi’s induced suffering is caused by the grip strength required to remove the card from the machine. Her lack of mobility is a result of the inflammation in her joints. In order to make Sandi’s experience more pleasurable and unproblematic, a device must be designed to help reduce her discomfort.

Design

The device’s design is simplistic and user-friendly. As specified by Sandi, the EzPz is lightweight, weighing approximately forty-seven grams. The E-Team’s main objective was to create a device of minimal mass in order to increase portability and reduce the client’s pain. Additionally, the dimensions of the EzPz are 7 x 2 x 2 inches. The convenient size of the tool allows for easy storage in places such as Sandi’s purse or cup holder. As a result of the invention’s small size, the user can pay for gas with ease as well as being discreet. The film that folds overtop of the credit card is transparent because the team aspired to make the device as subtle as possible. For instance, a solid color would draw unnecessary attention to Sandi and therefore make her experience while paying less comfortable. In addition to the screen protector’s inconspicuous nature, the thinness of the material allows the payment process to proceed smoothly because the card can slide in and out of the machine without any complications. The design is meant to have an adhesive material that holds the card in place during use so that Sandi does not have to worry about the card falling; thus, the screen protector fulfills this goal because of its tackiness.

The ergonomic handle is constructed to maximize Sandi's comfort while operating the EzPz. For instance, the handle is shaped like a plump hourglass because it allows for a natural grip while preventing slippage. Sandi mentioned in lecture that the easiest items for her to grip are one and a half inches in width; therefore, the E-Team designed accordingly. The handle is made with a soft, durable material for added comfort. The material resembles that of memory foam except it goes back to its original form after being released. Thus, the handle is created to address Sandi's various finger configurations with every use. The device is also waterproof which ensures that no dangerous chemicals will be absorbed and thus the EzPz does not compromise the client's safety.

There are additional features that can be added to the bottom of the EzPz because of the built in screw mechanism. These features include an extension rod and a bracelet.

Functionality

The EzPz assists Sandi Mugford with inserting and removing a credit card when prepaying for gas at the pump. Functionally speaking, the device allows her to perform this task with less pain and discomfort as a result of the object's design. Sandi's main concern is to remove the credit card with ease and the product created enables her to achieve this task. The E-Team, however, decided to exceed the client's expectations and invent a device that helps Sandi with payment processes at the gas station as well as any location that involves the insertion and removal of a credit or debit card.

Materials, Components, and Assembly

The materials that are required for the construction of the EzPz are an iPad screen protector which is $1.25, Model Magic clay at a cost of $3.00, a clipboard which can be purchased for $0.75 and a bottle cap from a used water bottle. All of these components can be purchased at any local dollar store or Michaels. The tools needed for the assembly of the product are a hot glue gun, super glue, a ruler, a saw or sharp knife and scissors. Excluding the drying process of the mouldable clay, the building of the device will take approximately thirty minutes to an hour to complete. The construction of this device is not difficult as a result of the object's simplicity. The only information that is not self-explanatory regarding the device's building process is the positioning of the closing mechanism. This portion of assembly would require special instructions as a result of the location being essential for the device to fully function.

Use

1. The EzPz can be stored in Sandi's purse, cup holder or most storage compartments in the vehicle. This section is dependent on user preference.
2. The client must pick up the device with her hand and open the folded screen protector.
3. Place the card face up in the EzPz. Close the device by sliding the clear material underneath the fastener.
4. Insert the product into the machine and proceed with payment. When instructed to, remove the EzPz from the machine.
5. The device can be placed back in the car or in her purse when she is finished paying. If Sandi acquires the optional bracelet feature, the device can remain on her arm while performing other gas related activities.

Benefits

As Sandi referenced in lecture, she often uses pliers or two hands to remove a credit card from the payment machine. The EzPz is a better alternative for these existing solutions because the client does not have to use her fine motor skills to grip the credit card. Although pliers do get the job done, the squeezing motion required is a quality that can be optimized. Overall, the EzPz should be used in place of these existing options because it promotes comfort and convenience as a result of the well-designed ergonomic handle. The group's innovative design is unique and efficient as a result of the invention physically going into the machine with the card. While meeting the client's needs and concerns, the E-Team also exceeded the expectations of the task at hand. Thus, prevailing over all other newly formed products regarding Sandi Mugford's improved experience at the gas station.

Helping Hand

123 Success
F21-125-6

Problem Description

Miss Sandi Mugford suffers from a disease called Rheumatoid Arthritis which makes it difficult for her to pump fuel into the car. She has limited range of motion with her fingers so she has a problem with pressing the lever of the gas nozzle. Sandi also has limited control of precise movements with her hands which make it relatively hard to grip on to the nozzle for a long time.

Design

As seen in the visual above, the design consists of two parts which is joined by a screw. The material used is plywood which is light weighted. The hook part can rotate and be adjusted in a way that suits the client and makes it easy for her to hook on to the lever of the gas nozzle. The only part of the design that gives it a little weight is the screw. In summary, the device weighs approximately 0.6 kg which is not even equal to quarter of the maximum weight that the client can lift, which is 20kg. The device is small and compact.

Functionality

Concerning fuelling process, the client, Sandi Mugford brought forth problems such as difficulty in gripping the gas nozzle. Due to her inflamed joint, she has a limited range of motion which means she cannot squeeze the gas nozzle lever for a long time, and she has to apply energy which results in a lot of pain. Also she cannot lift the nozzle for a long time because of its weight. The helping hand device solves these problems respectively. Its weight is approximately 0.6kg, which is relatively light. The client does not have to squeeze the lever which gives her pain due to the weak joints on her hand. The device takes care of that problem because she just has to push down on the handle for the hook to lift up the gas nozzle lever. Pushing does not require much force, which reduces Sandi’s pain. She also does not have to push with the palm of her hand; she can instead push with her arms. Moreover, the device is durable and portable.

Materials, Components, and Assembly

The materials used to build the device are plywood, metal-screw and bolt, metal hook, waterproof varnish and skateboard bearings. All the tools mention above can be found in any hardware store such as Canadian Tire.
Below is a table which shows the materials used and the cost, respectively.

MATERIAL	PRICE
Screws/Bolts	$0.99
Plywood	$4.99
Varnish/Undercoat	$10.99
Total	$16.97

A band saw, rotor table and sand paper can be used to make the shape of the device that is, the wooden part of the device, and the hole by which the screw is put to connect the two parts of the device can be drilled with the aid of a hand drill. It takes approximate one hour make the device. Firstly, the pieces of wood are cut and shaped for the two parts of the device, and this process would take about thirty minutes. Then the hole for the attachment of the hook is drilled and the hook is attached. Next, the hole for the screw which would join the two parts is drilled on the two parts, and the two parts are joined together. The construction process is not cumbersome. Be careful when using the band saw.

Use

The following are instructions on how the device can be used;

1.) Hook on the device to the lever of the gas nozzle.
2.) Lock the nozzle handle by securing the teeth on the device on the top of the gas nozzle.
3.) Push down on the handle of the device to press the lever and activate the nozzle.

The device is very portable and can be easily stored in the car trunk or even in the car door pocket. The device can be kept on top of the car or can easily hook on to the client’s pocket while she is performing other tasks.

Benefits

This device is better than existing commercial products such as Gas bud e-clip because the client would not have to leave the device unattended, which is potentially a fire hazard. Also this device is better than the devices made by other groups because it is rotatable and has teeth at the bottom of the handle which would form an anchor for the system on top of the gas nozzle. The rotating part is comprised of the hook which can be adjusted and hooked under the lever in a way that suits the client instead of trying to fit the whole device onto the gas nozzle as would be the case of other devices. The teeth prevent any unwanted movement that would affect the functionality of the system and enables usage for any type of gas nozzle, thereby functioning universally. Another benefit of the device is that it is water-proof, as it was coated with a water-proof varnish during construction, which makes the device fit for all weather types. Nevertheless, the device is portable and cheap.

Credit Card Insertion and Removal Device

Team Name
F 21 - 1016 – 7

Problem Description
Sandi needs to pay for her gas independently and effectively at the pump without straining herself. Currently she struggles with inserting and removing her credit card from the machine.

Design
This design features an elongated grip that clips onto a hole that was punched into one of Sandi's credit cards. The grip is large enough to fit into Sandi's hand but not too long as you can see from the picture it is roughly 10 centimetres long. This grip has a retractable cord running through it which is attached to the clip on the card and onto a bracelet which will be attached to the users' wrist. This device was designed with portability in mind, being less than 200 grams it is roughly the weight of most leading smartphones. This design can be folded up and placed into just about any purse and most coat and pants pockets making it the perfect portable pay assistant.

Functionality
In terms of function this design effectively provides Sandi with a grip to hold onto when inserting her card. This in turn eliminates the use of small finger joints to pinch the card. Another major function of this device is the removal of the credit card once the transaction is completed. This design comes equipped with a wristband that addresses the card-removal issue. Once the user has paid for their gas and wants to remove their credit card all they have to do is pull their fore arm backwards and down

and the card comes out and is conveniently hanging form their wrist. With regards to the card removal aspect of Sandi's problems at the pump this design effectively meets and exceeds all of these expectations.

Materials, Components, and Assembly

The materials used in this prototype can mostly be found around the house. The first thing needed is a hole-punch which will be used to punch a hole in the far right middle of the card (opposite the chip side). The next thing needed is a highlighter (any kind will do), which will then have to be dissected, this can be done quite simply by prying out the cap on the bottom of the highlighter and removing the marker inside. Next the tip of the highlighter needs to be cut off so that the entire shaft has the same diameter. All of this can be done using a regular pair of household scissors. Now that these two items are prepared it is time to purchase a retractable cord, a coiled bracelet and one key ring (if you don't already have one). This will cost fewer than five dollars and can be purchased at any Canadian Tire. After all these items are laid out the assembly process is quite simple. One key ring will be attached to the bracelet which will be clipped to the retractable cord. The cord is then threaded through the now hollow highlighter shaft. The clip that is on the retractable cord when it is purchased is attached to the hole in the credit card. Next a small slit is cut on the end of the highlighter closest to the debit card (this can be seen in the above visual). Lastly a grip can be attached to the highlighter shaft to protect the user from cold weather; an old lanyard was used for this prototype. This part is optional and can be done at the users' expense. To summarize, the materials needed are: a coiled bracelet, a key ring, one highlighter and a retractable cord. The tools that are needed are a hole-punch and scissors. This entire process can be done in less than ten minutes if done correctly and if used properly should provide the user with an enjoyable experience at the pumps.

Use

1. Device must be attached to previously hole-punched card by clipping retractable cord to hole
2. Store device in users' purse
3. When ready to pump gas place coiled bracelet around users' wrist and allow to hang while gas is being pumped
4. After pumping of gas grasp the grip of the device and insert the attached card into gas pump
5. While card is inside the machine the user will then enter their PIN number and complete the transaction
6. The card is then easily removed by pulling the wrist that is attached to the bracelet, away from the machine and downwards
7. Lastly the user will place the device with the card back into her purse

Benefits

This design is better than the competition because it is the only one of its kind that utilizes a bracelet. This greatly increases the effectiveness of the device. This is due to the use of the larger joints and muscle groups when removing the card. All the user has to do is pull their arm towards their side and the card will come out with ease. This completely eliminates the use of small finger joints to pinch and pull out the card which was the client's major issue when paying for gas. This design also increases the users' accuracy when inserting their credit card and eliminates any pinching because of the grip that is attached to the card. With this in mind our design trumps any of the other designs because of how effectively it performs the functions required by it.

Swivel-n-Swipe

WYNGS Engineering
F 2 2 – 1 2 4 - 1

Problem Description

To enable the user to perform credit card transactions with little to no pain while maintaining the objectives of a lightweight, durable and portable device.

Design

The design is very small and can easily be held with one hand. Contrary to its appearance, the device is very lightweight as majority of the handle is made of foam. This allows the user to wear it around their neck with a lanyard without causing neck strain.

Functionality

The device is constructed to solve problems related to the payment process while the client is fueling her car. It has the ability to perform both the insertion and removal of a credit card as well as the swiping function at a point of sales terminal. The device is designed to reduce pain and stress on joints affected with arthritis while performing these tasks. Compared with holding a credit card which requires a user to pinch the card, the device is relatively easier to hold as the device does not require fine motor skills to operate. An added feature to the device is a flashlight that adds visibility.

Materials, Components, and Assembly

Little expertise is required for the construction of the Swivel-n-Swipe. The total time to make the device should take less than two hours. All tools that are required can be found at a local department store or around the house which include a pair of scissors, a hot glue gun, a thick metal pin, a black Sharpie, a sharp box cutter and a pair of pliers.

The materials needed include: a key holder with an LED light designed for the elderly or individuals affected with arthritis; a 2" binder clip, two paper clips, a roll of red electrical tape, a roll of black electrical tape; 2 hot glue sticks; a rubber bracelet; two plastic club cards; and compact packing foam. All materials can either be obtained for free, on Ebay or purchased at Dollarama with a total cost of under $7.99.

The device is simple to assemble with the following instructions. The first step is to cut out four strips from the rubber bracelet and affix them to the binder clip. Use pliers to bend the ends of the binder clip slightly inward. Attach the clip to the key holder in place of two keys. Follow the instructions that come with the key holder from Dollarama while attaching the clip. Point the lever that tightens the bolt and nut in the direction of where the privacy covers will be attached. Then cover two plastic cards with red electrical tape. Cut a small hole into one of the plastic cards so that it does not cover the switch for the flash light. Cut another hole into the second card so that it is able to comfortably rest on top of the lever of the key holder. Use hot glue and electrical tape to fasten the plastic cards to the key holder. Next, cut out a foam handle to wrap around the handle of the key holder. With the remaining foam, use a box cutter to cut out a rectangle with dimensions 2.5cm x 2cm x 5cm. Then cut a small slit into the rectangle where the credit card will rest while attached to the clip. Secure the foam rectangle at the bottom of the two privacy covers by using hot glue. Attach the foam handle to the bottom part of the key holder's handle and secure with black electrical tape by winding the tape around the two handles like a spool. Once finished, cover the foam rectangle with black electrical tape. For the final step, use a thick metal pin to poke a hole into the bottom of the foam handle. Unwind two paperclips. Thread one of the two paper clips through the base of the foam handle. Tie the other paper clip to each end of the other paper clip and cover the exposed paper clip with red electrical tape. Finish by writing 'VISA' on the top left corner of the privacy cover with a black Sharpie.

Use

How to use the device:

1. Hold the device gently in a comfortable position by the handle.
2. Use forearm, wrist or fingers to swivel card out from the privacy covers.
3. If using a chip reader, only swivel the card out by 180 degrees and into the Chip Reader Position. If swiping the card, swivel the card out by 270 degrees and into the Swipe Position.
4. Insert chip, or swipe card.
5. To remove the card from a chip reader, simply grasp the handle in the most comfortable position and slightly pull.
6. Swivel the credit card back into the Close Position, where it is hidden by the privacy covers.

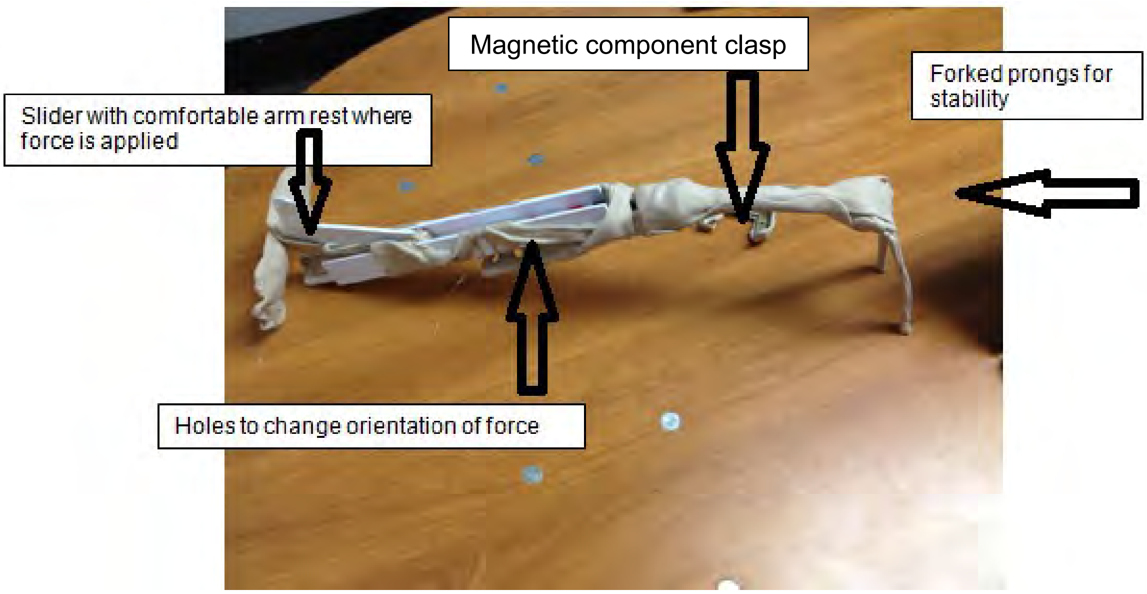
The steps above illustrate how simple and easy it is to use the device. The device can be stored in the user's purse or attach a lanyard or clip to the metal loop. The device has a large, foam cushioned handle that can be used to hold onto the device with little to no pain. The device can be held onto while swiping and even let go of once the chip has been inserted.

Benefits

The Swivel-n-Swipe provides the user with an easy, intuitive and practical method of completing credit card transactions. The large foam-padded handle makes it easy to hold. The lightweight and durable materials reduce stress on joints as the device does not does not require fine motor skills to operate. The materials used to build the device are inexpensive and allow for easy construction of the device. The privacy covers ensure that sensitive credit card information is protected. The device is aesthetically pleasing and due to the usage of the contrasting colours, red and black, it increases visibility. Moreover, the device is compatible with multiple point-of-sales terminals not exclusive to gas stations. The device is universally compatible with any credit card reader or chip reader.

The Grappler

Team Name
F 22 - 124- 3



Problem Description

Design/construct a product or device that will assist the user, Sandi Mugford, who suffers from Rheumatoid arthritis while carrying out the task of refuelling her car at a gas stations; thus maintaining her independence and confidence. This may include the process of paying and gas delivery. This project is requested by our clients Dr. Fliesig, Sandi Mugford, and Teaching Assistant Adam Moniz.

Design

The Grappler is heavier than most designs but nothing that Sandi shouldn't be able to handle especially since it supports itself when in use. It is about the length of Sandi's arm and the weight is evenly distributed. It has a comfortable armrest for applying force. The armrest slides horizontally allowing Sandi a more convenient direction of force. There's a forked prong at the front for resting on the gas nozzle providing stability for the device. There are holes for changing the angle of the direction of the force depending on the style of nozzle. The clasp is magnetic and allows for a force to be applied directly upwards avoiding losing any energy to sideways directions.

Functionality

The Grappler greatly reduces the force required by the user when pumping gas. It also changes the orientation of the direction of the force in such a way that is most convenient for the user as well as utilizing gravity. Yes it can do everything requested with regards to the pumping gas problem.

Materials, Components, and Assembly

For building the device the following purchases are required: thermoplastic(50$) and styroplastic(20$) from the student centre at McMaster University, fishing line(5$) from Bass Pro Shop, a ministick(1$) and magnets(1$) from Dollar Giant, super glue(8$) and metal door hinges(1$) from Home Hardware. Molds are needed for the thermoplastic and other than that most anybody can put the device together by hand in under an hour without any special instruction.

Use

The device will be stored in user's car, carried in any manner comfortable to the user and left on the hood of the car while positioning the gas nozzle.

1. The user will take device out of the car and put on the hood of the car.
2. The user will position the gas nozzle in the car.
3. The user will set the device over the gas nozzle.
4. The user will clasp the clasps of the device over the lever of the gas pump.
5. The user will set the device for use.
6. The user will apply force to the sliding portion of the device via their arm.
7. The user will release the device after the fueling process is complete.
8. The user will unclasp the device and return into to their car.
9. The user has successfully fueled their car.

Benefits

The Grappler is a very good solution to the problem. This is because it excels at reducing the force required to pump gas and has few downfalls. These downfalls are that it is bulkier than most solutions. But it makes up for it's bulkiness by reducing the force required better than any other design known of excluding electrically powered devices. Also The Grappler provides a comfortable position for applying the force required avoiding almost all exertion of joints which could cause pain for the user. Also the clasp of The Grappler is specially designed to convert all the force applied into vertical (or optimal direction changeable by the holes designed for this) force on the lever of the gas nozzle. This avoids any loss of energy to sideways pulling. So overall nothing that requires a force applied by the user requires less of a force than The Grappler and it's only downfall is it's size.

The Helping Hand

Marauder Solutions
F 22 - 124 - 4

Problem Description

To design a tool or device that will assist Sandi in fuelling her car with gas in all environments and seasons of the year with the least amount or no pain and strength.

Design

For the design of The Helping Hand, the handle is about 20cm long and fits in the palm nice and snug. It's not to small so it doesn't require a lot of the palm to bend. Next the metal rod is attached to the inside of the Helping Hand and tape covers up the hole on the top. Two nuts are then attached to the top two ends of the metal bar to act as a stopper for the credit card attachment so it won't fall off. At the bottom of the Helper Hand there is a cap to cover up the open end and to allow a softer end so a hand can push up against it without pain. A hook is then screwed into it and then a lanyard is attached so that if The Helping Hand does fall is won't fall on the ground. The Helping Hand is small enough to store easily and carry around.

Functionality

The Helping Hand functionally speaking allows the user to connect a card and to insert it into a machine so they can pay. It does this with the least amount of pain possible. Especially for someone with arthritis who has trouble griping small objects like a credit card. The Helping Hand meets all requirements that were established for the credit card insert and removal part. The requirements that were wanted were a big handle for better grip, easy to store and easy to use. The helping hand fulfills all of those requirements. It has a big handle for better grip, it is small and easy to store anywhere and is easy to use.

Materials, Components, and Assembly

The helping hands materials that are used in it are PVC pipe for the main handle and a metal rod to go into the centre of the rod. Two bolts are needed to go on the end of the rod, which will be held by glue. Foam and tape hold the rod in place in the PVC pipe. An end cap made out of PVC is then glued to make the end less sharp. Next a hook is screwed into the end cap and a lanyard is attached to the hook. All together the helping hand cost a total of $20.56 roughly. For each individual piece cost below $5, the PVC pipe cost a $1.49, while the end cap cost $1.99. The rod that was put in the PVC pipe cost $1.59 and the foam and tape that held the rod in place was $3.20 and $4.50. The nuts that were glued to the end of the rod were 50¢. The hook at the end came in a pack that cost $2.79. The Lanyard cost nothing because it was free on McMaster University. There were only a couple of tools that were required to construct the helping hand. Those tools would be a pocketknife, and some pliers and a saw. The pocketknife was used to start a hole for the hook to screw into, and the pliers were used to bend the metal rod so it could fit into the PVC pipe. The saw would be used to cut the PVC pipe took make it smaller, to fit in some ones hand. To fully construct this device, it should only take a couple of hours. The instructions that would be needed would be how to fit everything together when all the necessary parts are finished being cut or bent with glue. The tool doesn't really need any special instructions other then how to tape the rod on the inside.

Use

How The Helping Hand will be used when paying for gas.

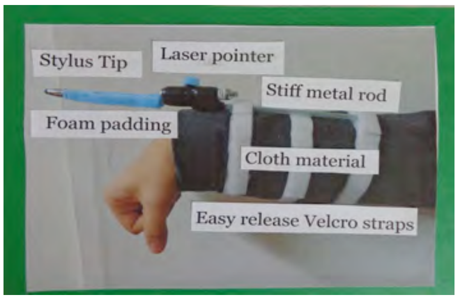
1. Grab the Helping Hand from storage, which can be in a purse or in the side pocket of the driver's door.
2. Get the credit card from you purse and attach it to the helping hand.
3. Go to the pump and insert the card to start the process of the paying. While paying the helping hand can be left attached to the card while paying if needed. It can also be detached and place on the car or garbage can by the pump and then reattached when needed.
4. Pull the helping hand to take out the credit card.
5. Detach the credit card and put it back in the wallet.
6. Put the helping hand back in storage in your car. When the helping hand is stored it can be placed in the side pocket f the car or it can be stored in a purse.

Benefits

The Helping Hand is much better then the other devices that were made and that is because of the details of our device. The Helping Hand has a bigger handle, which allows gripping without much pain as possible. With this tool, there is also a much less chance of the drop the card when putting it in the slot to pay. Another benefit is that she doesn't have to grip the card as much, all she has to do is to put the card on the helping hand and go through the process of paying for gas. Another benefit is when you want to take the card out, all you have to do is pull the helping hand and then unhook the card and then put the card back in your wallet and the helping hand back in the car and its done. Also the helping hand is small enough that it can be stored in the side pocket or storage area in the driver's door. It can even fit in a purse if needed somewhere else other then the gas pump. That brings up the next and last benefit. The last benefit that the helping hand has is it can be used in other areas like a debit machine or at a grocery store. It doesn't have to be used only at the gas pump. It's small enough to be carried around anywhere.

Easy Press Vambrace

Handy Solutions
F 22-124-5



The device covers half of the forearm with the stylus tip protruding out to the fingertips. The device weighs approximately half a pound

Problem Description

To help Sandi Mugford press buttons painlessly at the gas station

Design

The body of the device is made from a light weight fabric with velcro straps attached to serve as a fastening system for the original prototype. On top of the body there is a metal rod that is used to push the buttons. There is the tip of a stylus on the end of the metal rod to work with touch screens. Also a laser is attached centre to the metal rod to improve accuracy. The device is relatively light weight and small. It only weighs around half a pound and is small enough to easily fit into any cars glove box. The design's light weight will save her a lot of work and pain. She has trouble accurately pressing each button so the laser has been added to the device tl greatly improve her aim.

Functionality

The device allows the user to successfully press buttons on a keypad painlessly. The client has expectations of the device being comfortable, lightweight, painless and accurate. Our design fulfills each of these expectations. The material used for the brace is both soft and comfortable. The entire device weighs only half a pound making it easily supportable by the forearm. By requiring only use of the palm to both put on and remove, the device ensures no fingers or joints are used resulting in decreased pain. Finally to account for accuracy a laser had been equipped to the device which points directly at the desired button.

Materials, Components, and Assembly

The materials required to build this device are; a metal rod ($3), sponge ($0.25), glue ($5), Velcro straps ($2), Stylus pen ($5), Laser ($5), Tape ($1), Cloth ($5) and a Zip-tie ($1). All of these materials can be obtained from any local hardware store. The only tools needed for the construction process are scissors and sewing supplies. The entire device will take approximately three hours to construct. The only prior instructions needed are the instructions on sewing.

Use

1. The device is removed from storage location (i.e. glove box)
2. Adjust inner strap to fit the arm
3. Slide hand through the adjusted inner strap
4. Use palm to lower one side of the brace onto Velcro straps on the inside, secure tightly
5. Use palm to secure last wrap on top of the other, secure tightly
6. Adjust the position of the Vambrace to center the rod
7. Exit car and insert credit card into the machine
8. Turn the laser on by flipping the switch to either side
9. Aim with laser and enter keypad digits by applying a forward force to each button
10. Proceed with the fill-up process
11. Get back in the car
12. Pull the handles with palm within the loops attached to the outside of flaps to easily remove the straps
13. Slide arm out of the Vambrace
14. Store back in the glove compartment

Benefits

In comparison to products on the market today, the Easy Press Vambrace is designed specifically for patients suffering from Rheumatoid arthritis. It has been designed to be comfortable while also fitting on variety of sizes to account for swelling and different articles of clothing depending on the weather. In comparison to the other groups, The Easy Press Vambrace is both easy to put on and remove and requires no use of the fingers. An important element some groups overlooked was accuracy. To solve this problem, a laser was added to the device. The laser is no hassle to turn on and points to the desired button with great accuracy.

The Credit Claw

Progressive Ingenuity
F 22 - 124 - 6

Dimensions	
Length	38cm
Girth handle	12.5cm
Girth Sleeve	22cm
Weight	0.8lbs (0.363Kg)

Problem Description

Sandi Mugford desires the ability to pay for her fuel at gas stations with ease using a credit card. However, she has Rheumatoid Arthritis which can make it difficult for her to insert her card into the slot of the cardholder. This is due to the fact that Rheumatoid Arthritis causes pain in her joints and reduces dexterity as well as stability in her hands.

Design

The Credit Claw weighs approximately 0.8lbs or 0.363Kg which makes it lightweight and its length of 38cm with a maximum girth of 22cm and minimum girth of 12.5cm makes it very portable for Sandy Mugford.

Functionality

This provides a means for Sandy Mugford to insert as well as retrieve her credit card from the card slot of a gas station card terminal. This provides her with a solution to inserting her credit card without any stress on her finger joints.

Materials, Components, and Assembly

The Credit Claw is composed of a $1.00 pair of metal salad tongs, $0.50 for plastic, $2.80 plastic dip, a $2.00 roll of tape, $2.00 of thermo plastic, $1.50 sheet metal, and $0.50 hook from coat hanger. The materials can be easily obtained at hardware stores and novelty or arts & craft stores such as Dollarama. Assembly takes approximately an hour accumulatively in order to let plastic dip dry. Handle is made from sheet metal and thermoplastic, wrapped with grip tape. Sleeve is made from plastic wrapped in a cylinder, surrounded by thermoplastic to add thickness and wrapped in grip tape for comfort. The end of the tongs are folded inwards and covered in plastic dip to add grip as well as smoothening out the sharp edges of the metal. The Credit Claw can be assembled easily.

Use

1. Sandi Mugford drives up to the gas station. She gets out of her car, pops her trunk open, and grabs her purse, which is kept in the trunk.
2. From there, she takes out her card as well as grabbing the Credit Claw which rests next to her purse in her trunk.
3. She inserts her card in the card holder on the top of the device.
4. She pushes the sleeve upwards to close the opening of the device.
5. With the card safely secured in place, she grabs the device (with two hands). With the stability of two hands, she directs the card into the credit card slot.
6. She slides the card in until it cannot go any further, then she slides the sleeve back down.
7. Next, she would have the option of hanging the device off the gas door's ridge or in her pocket or anywhere near the gas pump.
8. She goes to the keypad, and pays for the type of gas that she selected.
9. After that, she grabs the gas nozzle, puts it in the opening to the gas tank and begins filling the tank with gas.
10. Once, she's done refueling, she uses the Credit Claw to retrieve her card in the same manner that she inserted it.
11. Sandi Mugford puts away her card and her device in her trunk and leaves the gas station.

Benefits

This device is very beneficial. The handle is built in a way to fit into the palm of the user's hand comfortably. Due to the fact that the user slides the sleeve up and down the shaft to control the movement of the clamp, this removes the pinching motion for the user. Therefore, there is less stress on the finger joints. The sliding motion of the sleeve offers little resistance which means that there is barely any strain during the motion. The Credit Claw is used with two hands which increases stability during use and offers a variety of ways to be used such as sliding the sleeve with your hand, arm, elbow, etc. Also, although the skeleton of the Credit Claw is made of metal, the external body of it is made from materials which will not be affected by changes in temperature such as cold winters or hot summers. This ensures that the Credit Claw is comfortable to use all year round. Not only is it lightweight and portable, the hook at the end allows the user to hang it in a place of their choosing while not in use. Lastly, the cost is extremely efficient in comparison to other products because of the fact that it is under $10.

Superball

Practicing Undergraduates of McMaster P03 (P.U.M.P.)
F 22-124-7

Problem Description

Help Sandi reduce pain and become more independent while paying at the gas station.

Functionality

This device allows Sandi to comfortably, without pain, remove and insert her credit card. She will also be able to enter her pin on the keypad.

Design

The design is in the shape of ball for the ergonomic purpose. There are two cuts into to the ball that acts as leverage for Sandi to use to pinch her card. Attached is a doorstop used to press the keypad. The lanyard is placed to prevent dropping and allows multitasking at the pump. The device will be able to fit in the user's palm and weighs about 1 kg.

Materials, Components, and Assembly

A list of materials include: rubber baseball from Canadian Tire for $3.00, super glue from Home Hardware for $3.00, two metal plates from Home Hardware for $2.00, a lanyard from Dollarama for $1.00, and a doorstop from Canadian Tire for $3.00

To assemble the device first one must make two insertions into the baseball: one straight to the middle of the ball, the second at a 45-degree angle to the first. On the reverse side from the initial cuts, cut twice more, one 180 degrees from the first going a quarter way through, the second slightly above/below it. Make a final cut in between the third and fourth cut in the middle of the ball about 2 inches in length. Super glue one metal plate on the ball where the third cut was made on the side without the final slit. Super glue the second metal plate inside the final cut above/below first metal plate. Above one of the metal plates, screw the doorstop in to the ball (if not rigid, super glue can be used). Finally, super glue the lanyard onto the ball.

Use

1. Put lanyard around wrist.
2. Hold ball and open the metal plates by squeezing down on the opposite end with respect to the metal plates.
3. Place card between metal plates and release grip.
4. Use the device to insert the card into the machine.
5. Squeeze ball again to release grip on card.
6. Use the keypad presser (door-stop) to type pin on keypad.
7. Squeeze ball to grip card and pull out from the card slot.
8. Remove card from ball.

This device Is able to store wherever there is space because of the small size.

Benefits

This device is the best-suited device for Sandi because it solves two problems in one. She will easily be able to use the device because it is very light and has an ergonomic shape. The lanyard is attached to prevent dropping. This device can be used all year round since it is weatherproof and is cost efficient as well as easy to make.

Pump Puller

Team Name
F 22 - 124 - 8

Problem Description

Arthritis has already been part of Sandi's life for a long time and as time passes by, it is becoming more and more difficult for her to maintain independence and do long term activities. Activities that may be an easy job for most of us like using the gas nozzle when fueling a car can be so difficult for her for a reason that her illness restricts her to do such thing. Not only it restricts her but also, it gives her pain, makes her illness worse, and may result to a serious injury. The gripping motion that is involved in the pumping of the gas nozzle can cause stiffness of joints because of the great force that needs to be exerted to accomplish the said activity.

Thus, we, the Motion Impairment Research Group, will help Sandi and satisfies all the teaching staff, teaching assistants, and Dr. Fleisig, by making a device that will maintain Sandi's independence as well as prevent join-pain while getting gas or using the gas nozzle from the gas station.

Design

The device looks very huge and heavy due to the PVC pipes, however, the device is actually very light (under 25 grams). Therefore it is easy for Sandi to hold the device even with one hand. Also, the handles of the device are covered with sponges for Sandi's comfort while using it. The device while being used is 6 inches long and while being stored is 6 inches which is one PVC pipe length. __________

Functionality

We, the Motion Impairment Research group, made a device for Sandi that meets her needs in terms of pumping the gas. Firstly, the device reduces the force or pressure exerted by her to the gas nozzle which implies that it also reduces the pain caused by the pumping of the gas. Furthermore, the large handle prevents Sandi use a gripping motion which is the main reason of the pain due to the stiffness of her finger joints. Moreover, since the handles are covered with foam, Sandi can use the device with comfort especially during winter because she does not have to worry about the device being cold when she is using it.

Materials, Components, and Assembly

The device, *Pump* Puller, is built with 2 x 1.25" by 6" PVC piping costing $4.36, 1 length of twine for $5.99, 1 length of gorilla tape for $11.99, 2 sponges for $6.99 per pack, 1 door hinge for $7.99, 1 handle (1 inch diameter maximum) for $1.99, and 0.25 ' of flexible tubing (diameter of 2") costing $2.99. Furthermore, these materials gives us a grand total of $42.30.Also, all of these items can be purchased at Home Hardware or Home Depot. It can be assembled very easily with scissors or a knife (to cut the string). Sandi will need help constructing this device because it uses scissors and the components need to be taped together tightly. The device can be made in less than half an hour. All the components can be attached together by attaching the components using duct tape in a manner using these steps.

1. Attach the each end of the door hinge to one end of each PVC pipe using duct tape. Wrap it around tightly.
2. Attach 2.5 ' of string to the end of one of the PVC pipes using duct tape.
3. Tie the end of the string to a handle less than one inch in diameter.
4. Attach some sponge or other soft material to the PVC pipes using duct tape to make more comfortable grips.

Use

The device can be handled through following these steps:

1. The pump puller can be kept in the trunk of the car when it is not used.
2. When performing the task, first, take the device from the trunk of the car and place it on top of car while performing the other gas station activity.
3. Then, take the pump puller and place it on top of the gas nozzle.
4. Take and remove the loosen end of the cord and loop or thread it through the trigger of the gas pump.
5. Hold the two pipes close to each other so the trigger is pushed.
6. Once done, unthread the string from the trigger of the gas nozzle.
7. Finally, put the pump puller back in the trunk.

Benefits

The device that is made by Motion Impairment Research group benefits the user, Sandi, in such a way that the parts of the device cost less making the whole device inexpensive and affordable. Also, the two handles of the device are designed to be large so Sandi can lessen her use of her finger joints and also to avoid joint stiffness from overuse and overexertion. Furthermore, the foam installed on the handles makes it more comfortable to Sandi since it is soft, temperature resistant, and is comfortable to hold on to. Lastly, the handles are also made long to allow Sandi exert an endurable force for a person with arthritis, due the lower amount of force she needs to exert to achieve the same torque.

The device is unique from other devices because it is made by a firm that has used a systematic method to create a very simple, user-friendly, realistic, and a stress (physically and mentally) free device. Not only does it reduce the pain Sandi feels during gas pumping; the device is built to reduce the force she is exerting, thus making the activity easier for her, especially for long durations.

InReposer

InDesign

F22 - 124 - 9

Problem Description

To provide Sandi with a means for reducing pain and conserving energy at the gas station while maneuvering her credit card, maneuvering the gas nozzle and hose, and using the keypad.

Design

The design of the device is very simple. It's a rendition of a pair of pliers where you would squeeze the handles to open the mouth as opposed to squeezing to keep the mouth closed. This device is designed to be extremely light and compact, so that it's easy to handle/hold, and also easy to store. Although it was never officially weighed, it is lighter than an iPhone 4s, meaning it weighs less than 140 grams. With wide and long handles, the shape of the device was tailored to fit the form of a hand in its natural position at rest. Duct tape around the handles is there to ensure a better grip as well as protecting and increasing the durability of the area, since it is the place exposed to the most usage. Also, the duct tape covers up any potential sharp edges on the handles, so that Sandi may grip the device without any risk of injuries. A band has also been included at the handles so that Sandi can strap the device to her wrist or anywhere else she wishes when the device is not in use. The mouth of the device is coated with silicone, which means it will grip the card without slippage, and the only way for the card to come out is by squeezing the handles. The silicone also makes it so that Sandi can securely clip the device onto her clothing while it's not in use, which is very convenient.

Functionality

This device was designed to help Sandi with her problem regarding the insertion and retrieving of her card at the card slot at the gas station. Out with the three main problems she outlined for her gas pumping process, she mentioned that the credit card problem is the one she would most like to be solved. Since her hand is affected by the deformities that come with rheumatoid arthritis, her pinch grip is very weak, and it also affects a number of fine motor skills which require using her hands. Because of her condition, she says that using her credit card at the gas pump is the one of the most painful and stressful tasks she must perform. The device was created with Sandi's difficulties in mind, and through many adaptations and changes to the design, the final product became something that was fully functional as well easy to use. When using the device at various different card slots, it was clear that it did its job perfectly and required very little force to maneuver.

Materials, Components, and Assembly

The materials required to construct the device are wooden dowels, wood glue, and two clothes pins for the basic structure. Duct tape, silicone and a wrist band can be added for more convenience and ease of use. All of these materials are very easy to find, they can all be purchased at any hardware or home improvement store. The materials are also not very costly, as everything needed for the construction came up to around fifteen dollars. The tools that are required to make the device are; a saw to cut the wooden dowels and sand paper to sand down rough edges at the end. Making the device is very simple, all there is to do it to cut the wooden dowels to a preferred length, attach it to the clothes pins with wood glue, and then glue the two clothes pins together side by side. Letting the wood glue dry with take a few hours, and once the glue has dried, any modifications that need to be made regarding the width and length of the handles can be done by gluing extra wooden dowels onto it. Once the basic structure of the device has been made, slight modifications are optional for a better user experience. The sharp or rough edges from the cut dowels can be sanded down or covered up with any soft/smooth material. The mouth of the device can be coated with fast drying silicone. The handles can be wrapped in a cushioning material to reduce the strain on Sandi's hands while using it, and a band can be attached to the handles for easy carrying while the device is either in or out of use. For extra durability, the device can be sprayed or coated with a layer of wood varnish. This will make the device resistant to water and wear and tear, which means that Sandi can use it for a long period of time before it wears out. If the device was to ever break, repairing or replacing the device would be very easily done.

Use

Using this device is very simple and can be summed up in a few steps:

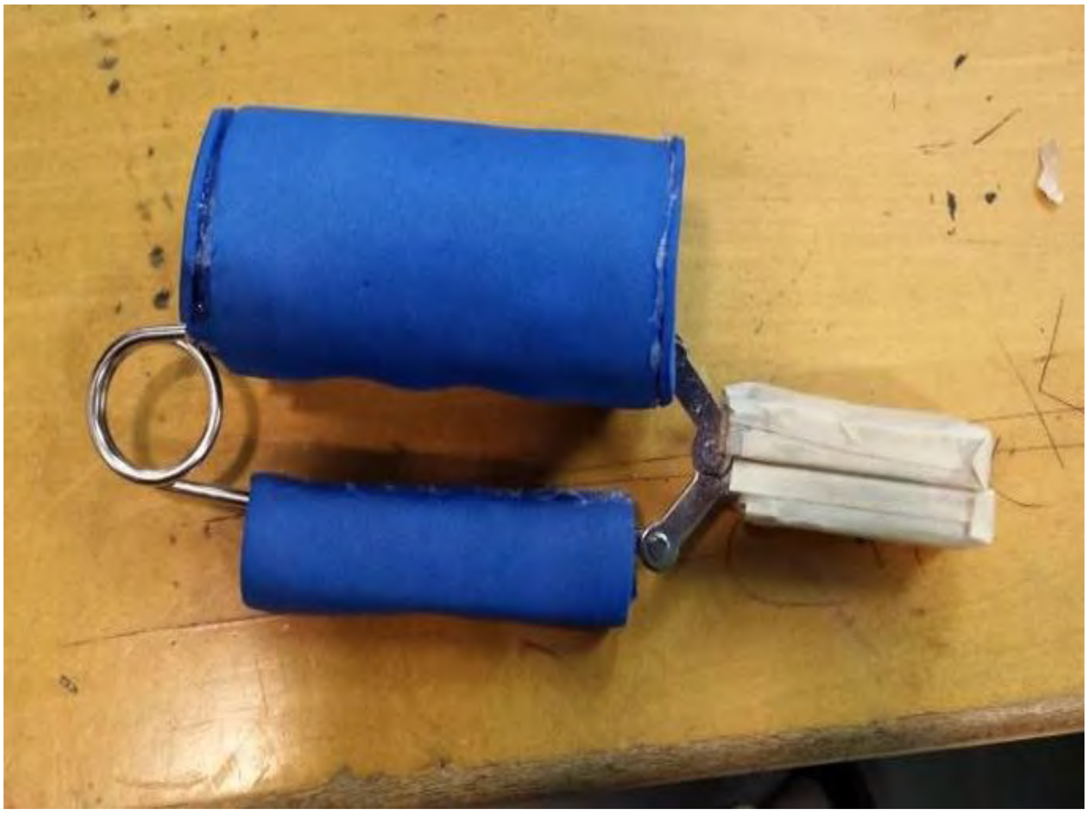
1. Squeeze the device to open the mouth and insert the card.
2. Release pressure on the handles so the card is secured in place.
3. Insert the card into the machine and proceed with transaction.
4. Pull the card out and squeeze to release the card and put it away.
5. Hang the device from wrist while other tasks are being performed.
6. Store the device in a preferred spot when the refuelling process is done.

Benefits

One big benefit that this device has is how lightweight and easily made it is. There are virtually no lighter designs from other groups which are also easily recreated from such standard and easy to find materials. This product is essentially entirely made of wood and held together by wood glue, both are very easy to find and very cheap. They're also much easier to work with than other materials such as thermoplastic, regular plastic, or metal. A lot of the other designs in the course would be very difficult for Sandi to remake if it was to break, and the commercial products offered would be more expensive and have limited availability. Another benefit is its small size, which means it is very easy to store and carry. It can fit in a purse or anywhere in a car, and when the device is not being used, instead of placing back into her purse or car, she can simply attach it to herself using the wristband or clip it onto a piece of clothing. The small size and weight of the device will ensure no hindrance to other tasks.

Clampy

Team Name
F 2 3 - 1 2 6 – 1



Problem Description

Design a device that enables Sandi Mugford to insert and extract a card from a credit card reader with ease at a gas station. This would allow her to maintain her independence by making the process of fueling her car easier and less painful. The project will be completed under the guidance of Dr. Fleisig, Abbey, and Katie.

Design

The design for this project will be a clamp with large comfortable handles and a small but powerful gripping mechanism. The device will be less than 150 grams making it incredibly light. In addition, the device will be only 10 cm long and 5 cm wide making it small enough to fit in a purse and most other small areas.

Functionality

The device is able to hold onto the credit card both while it is being inserted and while it is being extracted from the machine. This saves the user from having to use their hands to directly insert or retrieve the credit card which decreases the load on the finger joints. This device fulfills all of the requirements with regards to the problem and the needs of the client.

Materials, Components, and Assembly

This device requires a tea infuser, thin foam, Popsicle sticks, and rubber gloves. The tea infuser can be bought for about 5 dollars and the same goes for the gloves. The foam and Popsicle sticks can both be purchased for under a dollar. Altogether the materials would cost about 10 dollars. The tea infuser can be obtained at certain specialty tea shops and Ikea. Both the foam and Popsicle sticks can be obtained at any dollar store and the gloves can be found at any hardware store. The only tools required for construction are a hot glue gun, scissors, tape and a lighter. The device could be assembled in about an hour if time is used efficiently. The only instructions required for assembling this device would be with regards to removing the top of the tea infuser and gluing the Popsicle sticks on in the correct way. The tops of the tea infuser must be heated using the lighter and then twisted of the handle of the device. Once this is done, two stacks of Popsicle sticks must be glued to each side of both leftover clamp arms to create the new clamps. Other than that the assembly of this device is very straightforward and does not require any special knowledge.

Use

1. Take the device out of the purse
2. Apply force to the foam handles to separate the clamps enough to insert the credit card
3. Place the credit card between the clamps then release the handles to secure the credit card
4. Insert the credit card into the machine and proceed with the transaction then remove the credit card with the device
5. Apply force to foam handles again then remove the credit card
6. Place device around neck using lanyard and finish fueling the car
7. Once process is complete store device in purse or any other desired space

Benefits

The Clampy stands out compared to the other devices already on the market and those designed by other engineering students because it fulfills all the required functions in a simple yet effective way. The device is extremely light weight, allowing Sandi to carry it without any stress to her joints or muscles and in addition it is also very small allowing Sandi to store the device anywhere that she pleases. Though the device is light and mobile, its robustness and functionality is not sacrificed. The device is made out of durable metal that could resist being dropped and most other forms of abuse. With regards to functionality the device can both insert and remove the credit card from the machine with ease. In addition, the device’s neutral position is closed. This means that the user must only apply force at the beginning and end of the car fueling process as the device will hold on to the credit by itself while no force is being applied. In terms of manufacturing, the device is very easy to make as all the components can be found in almost any town and the assembly is quick and not very complicated. In terms of price this device can be made for only about fifteen dollars which is inexpensive considering how much the device could help people reduce their pain in everyday life. With the device’s combination of mobility, functionality, robustness, ease of manufacturing and low cost, it clearly surpasses all other designs both already on the market and being created by the other engineering students.

HandsFree

Team Name
F23 - 126 -1

Problem Description

Design a device that enables Sandi Mugford to fuel her vehicle without exceptional strain to her hand joints. This would allow her to maintain her independence by making the process of fuelling her car easier and less painful. The project will be completed under the guidance of Dr. Fleisig, Abbey, and Katie.

Design

The design for this project will be comprised of a Velcro strap which wraps around the user's arm and a long belt with an attached hook. The device will weight approximately 200g and can reasonably fit in Sandi's purse or glove department.

Functionality

Functionally speaking, the device can allow the user to direct the required force of compressing the gas nozzle handle from the user's hand to the user's arm. The device does everything the client asked for in regards to the problems addressed.

Materials, Components, and Assembly

The device does not require an exceptional amount of materials and all can be purchased from a local Home Hardware or similar hardware store. A black tool belt with attached hook can be purchased for $11.00, the Velcro tape for $16.37, the tie down belts for $17.84, and the double sided tape for $2.26. The total cost of the materials will be $47.46. The tools required will be a stapler, sharp scissors, and the clamp from the McMaster metal shop. In order to build the prototype, a wide strap was cut out from the tool belt that was wide enough to cover over half of Carmen's upper arm and long enough to wrap around her arm twice. The ends were folded in so that strands of the material wouldn't get caught on to other objects and slowly rip. In addition, the hook that was already part of the tool belt was cut around. This hook was used to pass the red tie down belt through it and then attached in a way that was steady and secure. Using the McMaster metal shop, the hook was then moulded to a desirable shape so that the rope would be more secured in. Lastly, three thick pieces of Velcro were attached on one side of the arm component and one opposite piece on the other side so that Sandi can adjust it to her desired tightness. In total, the device will take approximately 20 minutes to construct. Instructions required for assembly are included later in the final report. Special instructions include the fact that great care must be taken when clamping the metal hook and may require some trial and error to be successful.

Use

The correct usage of the device is as follows:

1. Remove the device from car.
2. Use the Velcro straps to make adjustments if needed, and then slide the device up forearm and onto shoulder.
3. Wrap the strap with the hook attached under and over the gas nozzle's handle and back upon itself, making a loop around the handle. Make sure to pass the strap through the hook to create a closed loop
4. Place opposite hand on pump to prevent pump from pulling out of car
5. Retract other arm by either turning away from the pump or stepping sideways, tightening the loop, causing gas to flow.
6. Once finished, contract arm by coming closer to the gas pump, causing gas to stop flowing.
7. Unhook the device and stow it in car as desired

Benefits

The device is superior to other solutions for a variety of reasons. In Sandi's present situation, she must exert the entirety of the force through her hands, and doing so causes her great strain and discomfort due to her disease, rheumatoid arthritis. With HandsFree, however, the force needed to compress the handle comes from Sandi's arm, rather than her sensitive hands. This eliminates the use of any joints in the process. The device is also exceptionally lightweight and sturdy; it will not break from falling and should survive through years of wear and tear. The device can be stored in Sandi's purse, glove compartment, or trunk. The thick straps and durable Velcro should not fray from repeated use. Some solutions made by peers required Sandi to exert the force through her leg. This situation is not ideal as Sandi has expressed her difficulty using the joints in her legs for tasks such as this. It also greatly increases the risk of Sandi tripping on the device, a scenario which could prove to be greatly detrimental to her health. Other devices that attempted a lever still required some forces from her joints, while the HandsFree reduces all these factors to great extent. The final price of HandsFree is admittedly high, though the price could be lowered if different materials were used, especially if purchased in high quantities. HandsFree amply fulfills the intended objectives and is durable and lightweight, making it an ideal solution for improving Sandi Mugford's gas station experience.

Scizor©

Team Name
F 2 3 - 1 2 6 - 2

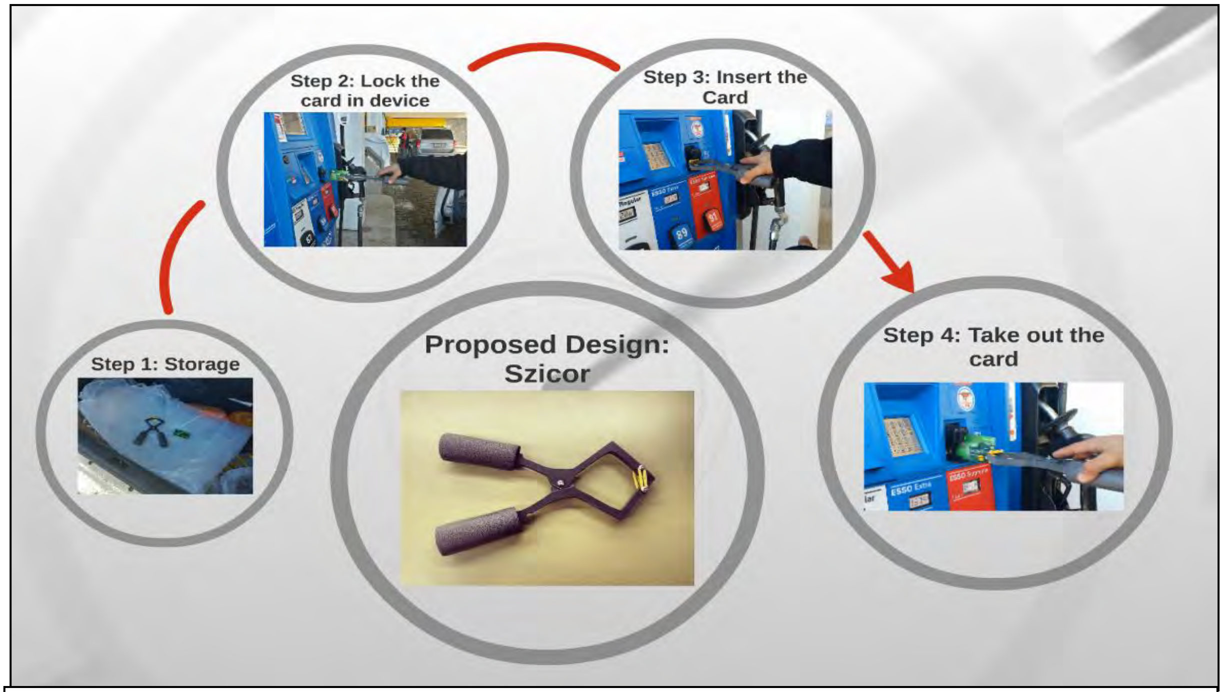


Figure 1: The sequence above shows 3 major factors regarding the design: Step-by-step procedure, the prototype from above, the size of the design compare to a debit card and a hand.

Problem Description

Rheumatoid arthritis can cause chronic inflammation of the joints and in other organs in the body, making everyday gas station fill-up operations extremely painful. A device has been proposed for our clients (Dr. Flesig, Abbey Desjarlais, Katie) and client/user (Sandi Mugford) to reduce her pain and make her feel independent while inserting a debit/credit card in order to pre-pay at any gas station.

Design

The team's proposed design is clearly depicted in the center picture, and its physical look can be characterized as of a pair of scissors, but in fact it works in a reverse manner; when the user closes the handles, the ends open. It weights a little over 0.4 kg, and while the prototype has been made larger in size for functionality purposes, the actual product will be almost 80% of the prototype's size. The size of the prototype can be assessed by comparing it to the hand and the normal debit card in the visuals.

Functionality

The device is simple, and achieves the objective it was designed for. It was particularly planned and tailored to address the problem of 'swiping a debit/credit card at the gas station'. Functionally speaking, the user gets an advantage of not applying a constant force to hold the card due the forces present in the elastic. Additionally, the grip on the tips guarantees no slipping of the card. Furthermore, there is a fixed pivot to allow the desired rotation of the handles, and the physical characteristics (soft cushion handles, portability, light-weight, durability, and water-proof) makes it certainly suitable for the intended user.

Materials, Components, and Assembly

The final prototype sculpted is a result of various improvements made during each stage of design development. First, the prototype was built from PVC sheet ($20 – long sheet) and acquired form the McMaster's Machine shop located in JHE-115, the rubber bands ($2 – 100/package) were obtained from the local convenience store, and the two screws ($2 – 20 screws), pivot ($2 – 10 pivots), and plumbing insulation foam ($8 – long tube) were attained from The Home Depot (Hardware section). Since everything was bought in bulk, the realistic estimated cost of the goods is $5. Secondly, the tools used in the construction of the prototype were specific machines (miller, grinder, saw) present in the machine shop. It took an estimated 6 hours in total to produce the proposed prototype and the construction instructions are as follow: Carve out the exact desired handles shape from the PVC sheet, make holes for pivot, insert pivot and screws, and glue the cushion and the rubber in the specific location to complete the prototype. The assembly requires training in the machine shop (2 hours), and since the product is very small, it requires precise cuts therefore the safety is the uttermost concern in the construction. It must be checked that the pivot is firm and rotatable, and the glue on the rubber and cushion must have suitable conditions to achieve optimum adhesive strength.

Use

It has been the team's top priority to keep the functionality aspect of the device as simple and compatible as possible. It is proposed that the user stores the device in the trunk where they keep their debit/credit card. Additionally, they can simply carry the device in one hand and keep it on top of the car while performing other tasks. The following are the in-detail step-by-step instructions of how the device is intended to be used once at the gas station:

1. Open the trunk, and place the card on the palm of one hand.
2. Pick up the device from the trunk and hold it in the other (preferred) hand.
3. Apply just a minor force on the device handles to open up a small gap to slide the card in while it is on the other hand's palm.
4. Simply hold the device straight and insert it in the card holder.
5. Place the device at a reasonable distance while performing other tasks (preferably on top of the car).
6. Once other tasks are completed, use the device again to take the card back from the card holder and put it on the other hand's palm.
7. Place the device back in the trunk, and the card from its initial location.

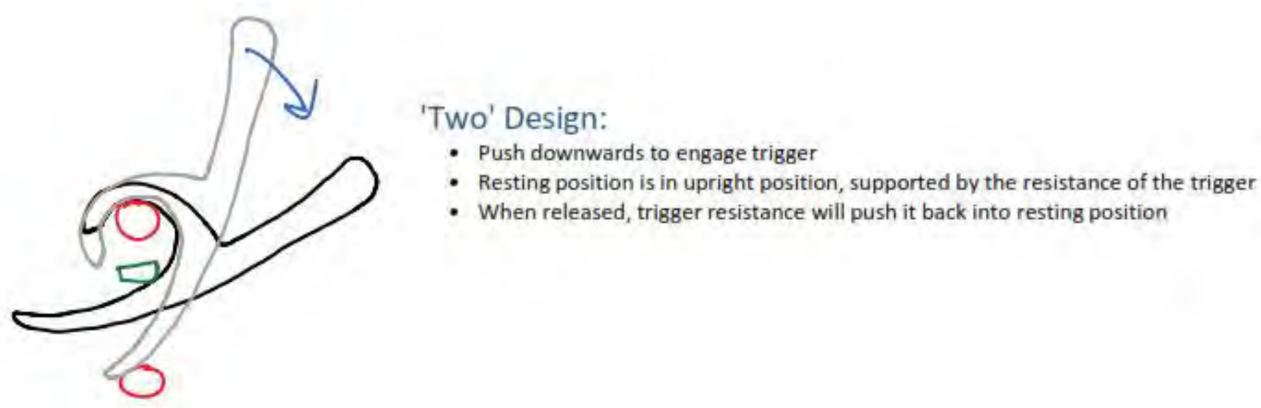
Benefits

The proposed design provides the user with various benefits from its physical characteristics to functionality. The prototype is extremely lightweight (0.4 kg), portable, water resistant (PVC material) and cost effective ($5/unit). The best feature about the design is its ability to keep the card intact at the end rubber holders with the device's elastic forces itself, and thus requires minimum force from the user in the process. Apart from this, the elastic provides a barrier to the card from moving back when swiping in, and provides enough force to swipe out the card. At this moment, there is a small variety of such products in the market and it is strongly concluded that this design is better than products in the market and the prototypes presented due to both its physical characteristics and its simple yet flawless functionality.

Project Voithós

Project Voithós
F 23 - 126 - 3

(Final product of Project Voithós)



(Final design of Project Voithós demonstrating use)

Problem Description

Design a mechanism that helps Sandi to do such tasks such as holding the gas nozzle in order to promote her independence and reduce pain at the gas pump, while satisfying the expectations and the requirements of the stakeholders including Dr. Fleisig and Abbey.

Design

The design of the device resembles that of a claw. As shown in the visual the device is around the length of the steering wheel of a car. The device is very light weighing at 1-2 pounds.

Functionality

The function of the device is to engage the trigger of the gas nozzle in order to allow the gas to flow. This device achieves that with a lever motion that uses a downward force along the handle in order to raise and engage the trigger. With regards to the problems this device addresses all of them. It requires very little force meaning it helps reduce the pain for the user.

Materials, Components, and Assembly

The product requires simply a piece of wood, a foam handle, and varnish. Depending on the type of wood and the size, the cost of wood can vary from $10-$20 and can be found from any hardware store. The foam handle costs $2 and can be found at most retail stores. The varnish costs $15 and can be found at any hardware store, however note that very little of the varnish is used compared to the amount purchased. To assemble the device the design is draw onto the wood then cut. A precision saw is necessary and using a professional machine shop is recommended. After the design is cut, the device is varnished and the foam handle is attached. This process is very short and no special instructions are necessary.

Use

1. Sandi exits car
2. Sandi opens her trunk to retrieve credit card, at the same time retrieves the device
3. Device is hung around wrist/arm
4. Sandi uses card reader and keypad to pay for gas and select fuel type
5. Sandi grabs fuel nozzle and inserts it into car
6. Sandi uses the device, hooking the top part of the claw over the top of the gas nozzle and the bottom part of the nozzle under the trigger
7. Sandi uses a downward force in order to engage trigger and allow fuel to flow
8. Sandi stops fueling and places device on arm
9. Sandi returns gas nozzle into the holder
10. Sandi returns device to trunk
11. Sandi gets back into car

Benefits

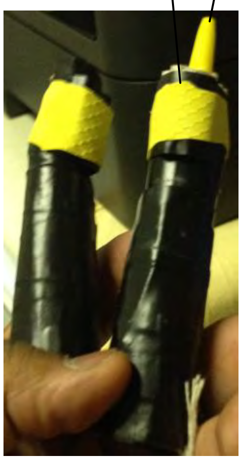
Most existing solutions cannot be used in Canada due to the law requiring constant force to be applied to the nozzle trigger during fueling. Project Voithós address this by disengaging the trigger once the force is stopped. The Project Voithós reduces pain and time spent at the gas station. With this device, the breaks that the client normally needs during the fueling process are completely removed. It also makes the fueling process much less painful as the motion required to operate the device is a pushing motion, one easily performed by the client. This device is also very light, small, and easy to use all while having an appealing design.

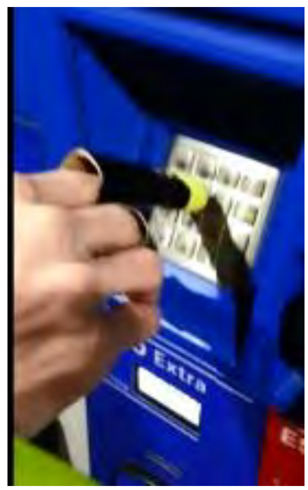
Finger Vice

Hephaestus Inc.
F 23 - 126 - 4

Rubber grip around the end of vice to grip the credit card

End of pen cap for precise keypad pressing






Problem Description

The client, Sandi Mugford experiences pain and difficulty when refueling and paying for fuel at the gas station. The client and numerous stakeholders, Dr. Fleisig, Abbey and Katie are searching for a way to reduce the time and pain that Sandi endures while at the fuel pump. Maintaining Sandi's independence and quality of life is the main goal. The key areas that will be addressed are the credit card insertion and removal and keypad pressing.

Design

Our device is very lightweight, less than a pound, and compact. It does not take up very much space and is a very creative tool. The finger vice will be about the same length as the client's finger but it will be wider than her finger. The device will be put on the fingers on the client similarly as a glove goes over a person's hand. The device is cylindrical in shape so that the client's finger can be inserted in it. There is a pen cap at the end so that Sandi Mugford will be able to precisely press buttons on the keypad. There are nodules on the side on the device wrapped around with rubber grip so that she may grip her credit card and be able to insert it and remove it from the card slot.

Functionality

Our product is able to fulfill all the required needs that the client has requested to be incorporated. The device is able to effectively assist the client with pressing the specific keypad buttons when paying for fuel due to the pen cap attached at the end of the finger vice. Sandi Mugford will also be able to grip her credit card when paying at the gas station. She will be able to use both finger vices to grip the card in between her fingers. The finger vice is small enough for storage but large enough for the client to use with ease. All these objectives are accomplished with minimal effort, decreasing the amount of pain and time for the client.

Materials, Components, and Assembly

The finger vice is made of very basic materials that can be found in one's home. The finger vice is constructed out of electrical tape, super glue, cardboard, rubber tube, pen cap, metal rod, cloth, rubber gloves, Velcro straps, elastic wristband and string. Since most of the materials can be found at home they would not cost anything. The other materials that would have to be purchased would all be under three dollars. They can be purchased at a hardware store such as Home Hardware or even Canadian Tire. There are very little tools needed to build this device. To assemble it, one must need a pair of scissors, a knife and a ruler. The timeframe to build the finger vice is also very short. It may be done within 3 to 4 hours. This product does not need any special instructions to be assembled because the steps to build it are very straight forward. Although there are a few instructions needed to assemble it. Step 1, a cylindrical shape was made using the cardboard where it is smaller in circumference at one end. Step 2, a small rectangular piece of cardboard was rolled up and put inside a rubber tube with a metal rod. Step 3, the rubber tube was then inserted into the cylinder at the smaller end and the two elements were taped together using electrical tape. Step 4, the end of a pen cap was then inserted into the roll of cardboard in the rubber tube and super glued together. Step 5, a small amount of rubber was cut up and taped around the end of the product to create a gripping surface and rubber was wrapped around the nodule. Step 6, the finger vice was coated with layers of electrical tape. Step 7, cloth was then placed inside the product to provide a soft cushioning for the finger. Step 8, holes were made in the finger vice and a string was run through to attach the product to bracelet.

Use

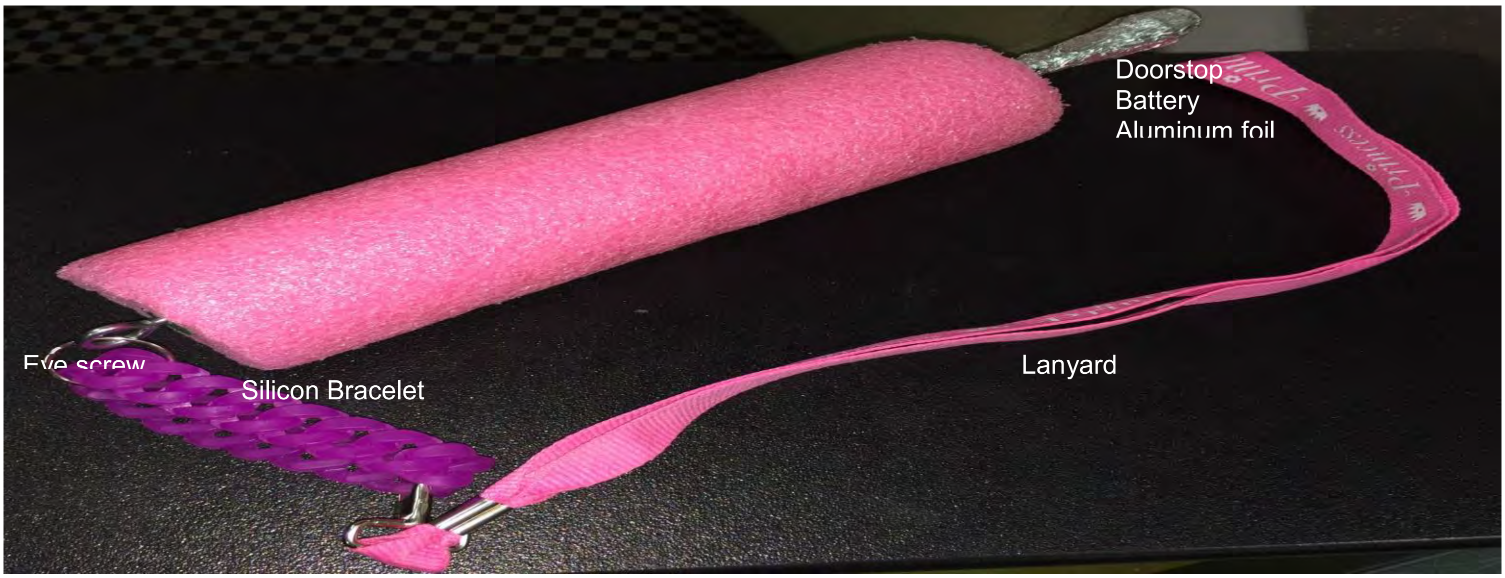
The finger vice is very easy and simple to use. Due to its simplicity, it does not take a great effort to operate. Since the device is small, it may be stored in the arm rest compartment of the client's car. When the client is doing other tasks, Sandi Mugford may either store it in arm rest compartment or she can keep it on her hand as there is a bracelet attached to the finger vice. There are only a few steps to instruct the client how to properly use the product. Step1) the client will take the finger vice out of the storage compartment and put the bracelet around her wrist. Step 2) once the bracelet is securely attached around the wrist, according to how the client feels on that particular day, she will put each finger vice on the finger of her choice. Step 3) Sandi Mugford will then take her credit card and hold it in the middle using the gripped nodules at the end of each finger vice. Step4) the client will then insert the credit card into the paying machine slot. Step 5) Sandi Mugford will then use the pen cap attached at the end of the finger vice to press the keypad buttons with precision. Step 6) the client will take the credit card out of the slot by grasping it from both sides using the gripped nodules on the product and pull the card out a little. Once the card is taken out a sufficient amount, the client will then grasp the card in the middle and pull it out completely so that she may have full control and the credit card will not fall out of from the finger vice. Step 7) once the client is done with the device, she may take the bracelet off and put the product back into the arm rest compartment in her vehicle or keep it around her wrist.

Benefit

Our design is better than current solutions and the solutions of our peers because our product is very lightweight, cheap to build and simple. Along with all these qualities, it is durable and can withstand various types of environments and weather conditions. The finger vice solves the key issues of pain, force and time consumption, all of which were problems for the client, Sandi Mugford before. It works effectively and continuously without any trouble using the device. Our product helps Sandi Mugford maintain her independence and facilitate her way of life in the present and in the future.

The Easy Grip

Rheumatronics
F 23 - 126 - 5



Problem Description

Our goal was to design a device for our clients, Sandi Mugford, Dr. Fleisig and the TAs, to make Sandi's car fueling experience easier and more comfortable. We also had the intention for the device to allow Ms. Mugford to maintain her independence. Ms. Mugford reported that she had difficulty accessing and using the numbers and buttons on the keypad. This is due to the size and angle of the keypad itself, and the lack of motor control in Ms. Mugford's hands.

Design

The design consists of a wooden dowel with a diameter of 0.5 inches. The dowel is encased by a cylindrical foam outer shell with a small point at one end, with a battery tip wrapped in aluminum foil as the tip. At the end opposite to the point, an eye screw is used to affix a lanyard to the device. The device is approximately 33.5 cm long, and 8 cm wide. The device is very light, weighing approximately 1.2 pounds.

Functionality

The device is a substitute for the client's own hands when pressing a key pad. Gripping the device at the end opposite to the fine point, where the grooves are to provide assistance, a downward force can be applied. The force applied concentrates the pressure in the tip, allowing the keypad buttons to be pressed.

The device fulfills the requests from the client because it is a working solution to allow the keypad to be pressed without outside assistance. Also by relieving the pressure on the clients joints within the hand, the device is successful in minimizing pain and increasing comfort.

Materials, Components, and Assembly

The complexity of the materials used to design the device is minimal. There is only DSJDS materials required to build the entire device, which are as follows. For the core of the device, a ½ inch wooden dowel was used, which costs $4.99 The outer foam encasing was a pool noodle, which was $4.99 as well. The tip of the device was a door stopper, which cost $2.49. The battery attached to the tip cost $2.99, and the aluminum foil used to wrap the tip was $0.99. The eye screw used to anchor the lanyard was $0.49, and the lanyard was $0.99. All of the previously listed materials can be obtained at a local hardware store such as Home Hardware. The only tools required for construction are a knife, to cut the pool noodle down to proper size, a handsaw to saw the dowel down to desired size, and a knife to pry the tip of the battery off. The device will take approximately 15 minutes to complete. Instructions that are needed to complete the device are minimal. The most complicated part of the device is attaching the battery tip to the doorstop, and wrapping it in aluminum foil.

Use

1. Mrs. Mugford will place the device around her neck using the lanyard.
2. While around her neck she will grip the pool noodle and clamp her palm around the device.
3. While grabbing the device she will position her body such that she is facing the keypad device.
4. Using her elbows and shoulders, Mrs. Mugford will thrust her arm forward and use the thinner, doorstopper end of the device to input the numbers into the keypad.
5. When finished entering the numbers into the keypad, she can loosen her grip on the device and let it fall, and dangle around her neck.

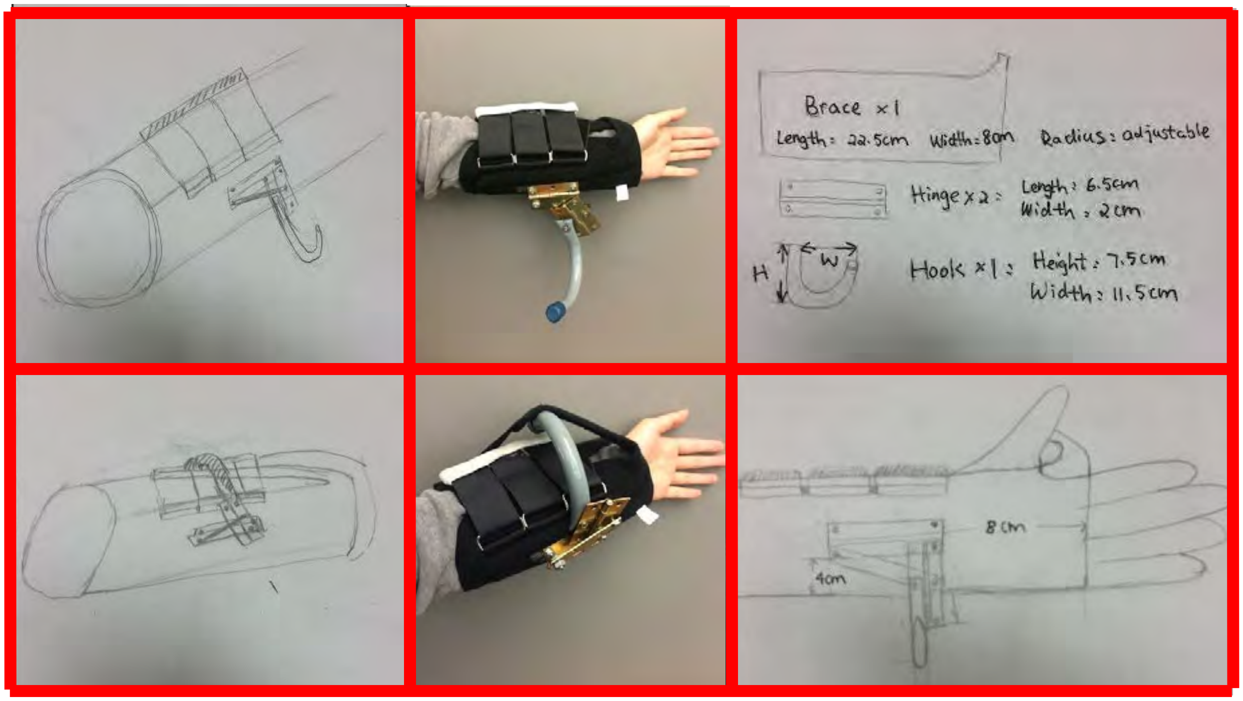
While not using the device Sandi will be able to store the device inside the glove compartment of her car or inside her handbag. She could also use the lanyard to hang the device on any wall peg. When she has finished using the device at the gas station, she can carry the device around her neck using the lanyard, allowing her hands to be free to carry out the other tasks.

Benefits

The device has many benefits for the client, especially in relation to decreasing pain and increasing ease of use. The device allows the user to press buttons without using hands directly, and it speeds up process of pressing buttons because of no need to manoeuvre hands in the small space of the key pad. The device is a simplistic design, with no complicated moving parts, and it is lightweight, sturdy, and inexpensive. For reducing pain, the device requires minimal fine motor movement. Finally, the device is flexible in its use, it is not entirely gas station key pad specific.

Dr. Hook

G.R.I.P
F 2 3 - 1 2 6 - 6



Problem Description

Design a device for use by Ms. Sandi Mugford that makes the process of operating the gas nozzle easier at any gas station, allowing her to be more comfortable than she is at present. It should also make the process more convenient. Said device is to be approved by Sandi, Dr. Fleisig, Abbey and Katie.

Design

Our design has three main components: the brace, the hinges, and the hook. It is approximately 3lbs and slightly shorter than the length of Sandi's forearm, such that it does not interfere with elbow extension or flexion. It is fully adjustable and can be worn on either arm.

Functionality

Its main function is to compress the lever on the handle of the gas nozzle and it does this efficiently, requiring little effort. The hook is also deployable in three different positions, allowing for a more comfortable use. It can easily be compacted together by folding the hook over the arm; this will make sure that the hook will not get in the way when Sandi is performing other tasks, and it will not poke her while she is trying to put it away. The device can effectively do everything Sandi requested regarding the gas nozzle task because not only does it compress the gas nozzle lever, but it does this with little to no effort and no pain.

Materials, Components, and Assembly

This device requires a carpel tunnel arm brace ($28), a metal 'handy hook' ($3), two 2.5" brass hinges ($4), a small strip of thermoplastic (free), a metal mending brace ($2), six screws ($2), three washers, and six nuts ($1). All of these materials can be purchased from a local hardware and drug store. The tools needed to build this device include a Philips and Robertson screwdriver, a kettle and pot, bolt cutters, superglue, and pliers. It should take between half an hour and an hour to construct the device. Basic construction skills are required to create this product, such as knowing how to use screwdrivers, pliers, and bolt cutters. To assemble the device one must attach the two hinges in a perpendicular arrangement using screws and nuts. The hinges will both bend outwards, one bending right, the other upwards. The hook is then attached to one of the hinges with screws, nuts, and washers. The metal bar is then attached to opposite ends of the hinges, creating a triangular brace. Using the remaining screws, nuts, and washers, the free hinge is attached to the stiff portion of the brace (inner arm). A 1.0cm wide strip of thermoplastic is then heated in a water bath. The thermoplastic is fitted across the ends of the Velcro straps and wrapped around the outer 2 straps. Using superglue, the middle strap was attached to the thermoplastic strap.

Use

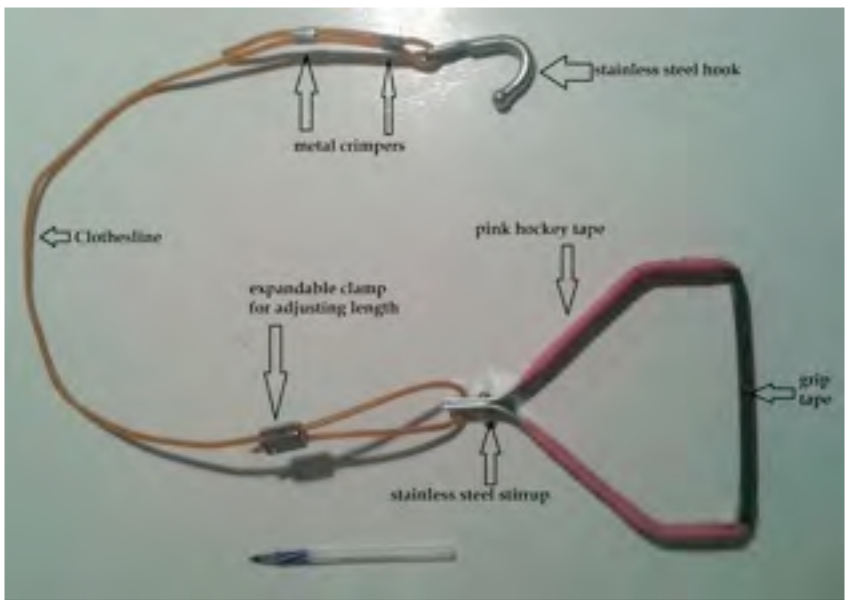
1) The device is removed from its storage space, most likely the pocket of the car door.
2) Slipping her arm through the brace and pulling the straps to tighten it, Sandi will strap the device onto her arm while still in the car.
3) The hook will be secured to the brace via the Velcro thumb strap, so it can be worn without the hook affecting any other tasks before operating the nozzle.
4) Sandi will carry on with other necessary tasks in her fueling procedure, up to and including inserting the nozzle.
5) She will unstrap the hook from the brace, arrange in the configuration of her preference, and place the hook beneath the nozzle lever.
6) From this position she will raise her forearm in a hammer- or bicep-curling motion, thereby raising the hook and lever, starting the flow of gas.
7) When finished, she will lower her arm to release the lever and stop fuelling.
8) Collapsing and re-securing the hook, Sandi will be able to return the gas nozzle and continue with the remaining tasks without obstructions.
9) Returning to her car, Sandi will loosen the straps of the device and slide her arm out.
10) Folding the brace and compressing it beneath the hook portion, she will return it to its storage area and drive away.

Benefits

The design of Dr. Hook is an improvement over many competitors' designs. It is a very effective yet simple design that is very easy to use. A standout factor of this design is its reliance on the use of larger muscles and joints, rather than those of the hands, wrists, fingers and forearms. This reduces fine motions Sandi would usually need to perform when fueling her car. It is also a very adjustable device in many ways; it can fit over Sandi's arm in the summer and over her coat in the winter, and can be expanded or contracted via a system of four possible adjustments. The device is entirely unaffected by weather conditions and is easily washable, simply by rinsing with water, and can therefore be worn at any gas station without worry or damaging the device or hindering the fuelling process. If this was not sufficient reason to support the claim that Dr. Hook is better than what competitors may offer is because it can be used in multiple positions, meaning that Sandi can use the device wherever and however she feels most comfortable. The arrangement of the hinges allows the device to be used facing and/or standing left, centre, or right, with respect to the nozzle. Finally, it is both lightweight and durable, which will allow Sandi to use the device easily, comfortably, and for a long time.

Fuelling Stirrup

Mobility Support
F23-126-07



Problem Description

The final project challenge is to design and build an effective prototype that will be evaluated by Dr. Fleisig, Sandi Mugford and the teaching staff. The design must assist Sandi at the gas station by helping her pull the trigger of the gas nozzle to pump fuel into her gas tank. The goal of the design is to help Sandi be more independent, reduce her pain and limit her energy consumption at the gas station.

Design

The device is made up of three components: the hook, the clothesline and the stirrup. The hook slips under the trigger of the gas nozzle. The cable is passed over the nozzle handle and the stirrup hangs from the cable close to the ground. The hook component is made of a stainless steel hook that is attached to the clothesline component with a stainless steel clamp. The clothesline component is braided wire with a rubber casing that attaches to the hook and stirrup component. The stirrup is a piece of stainless steel shaped into a triangle with pink hockey tape around the top two sides and grip tape attached to the bottom side. The stirrup attaches to the clothesline by a second adjustable stainless steel clamp. The total weight of the prototype is 0.411 kg and is approximately 1.3 meters long. However, the prototype is adjustable to many different heights from the gas tank to the ground.

Functionality

For the user, this prototype can almost completely eliminate the use of the hands while fuelling one's car. It only uses the hands to guide the hook underneath the trigger and to hold the hook on the trigger while one puts one's weight in the stirrup, and afterwards solely uses the foot to keep the trigger depressed until the fuel tank is full. It can do everything the client requested, as the client's main concern was the pain caused by the use of her hands while fuelling the car. The team has succeeded in minimizing the use of the client's hand, thereby minimizing the pain experienced while fuelling.

Materials, Components, and Assembly

The Fuelling Stirrup requires clothesline, stainless steel, one adjustable metal clamp, and two metal crimpers. The clothesline is approximately $10 for a length that is much larger than required, the stainless steel for the triangle is about $20, and the hook, crimpers, clamp, grip tape and hockey tape combine for about $15. Of course, the prototype only needs small amounts of the tape and clothesline, so the actual cost of the prototype is much less than $45. All of these materials can be found at most major hardware stores, like Canadian Tire, Home Hardware, and Home Depot. The only tools needed are pliers to squeeze the crimpers, and wire cutters to cut the clothesline to desired length. All in all, it takes about 25 minutes to assemble the prototype. The assembly does not need any special instructions; simply wrap the stirrup with the correct tape in the right places, pass the clothesline through the hole in the hook, put the clothesline side by side and squeeze the crimpers to fasten the two pieces of clothesline together.

Use

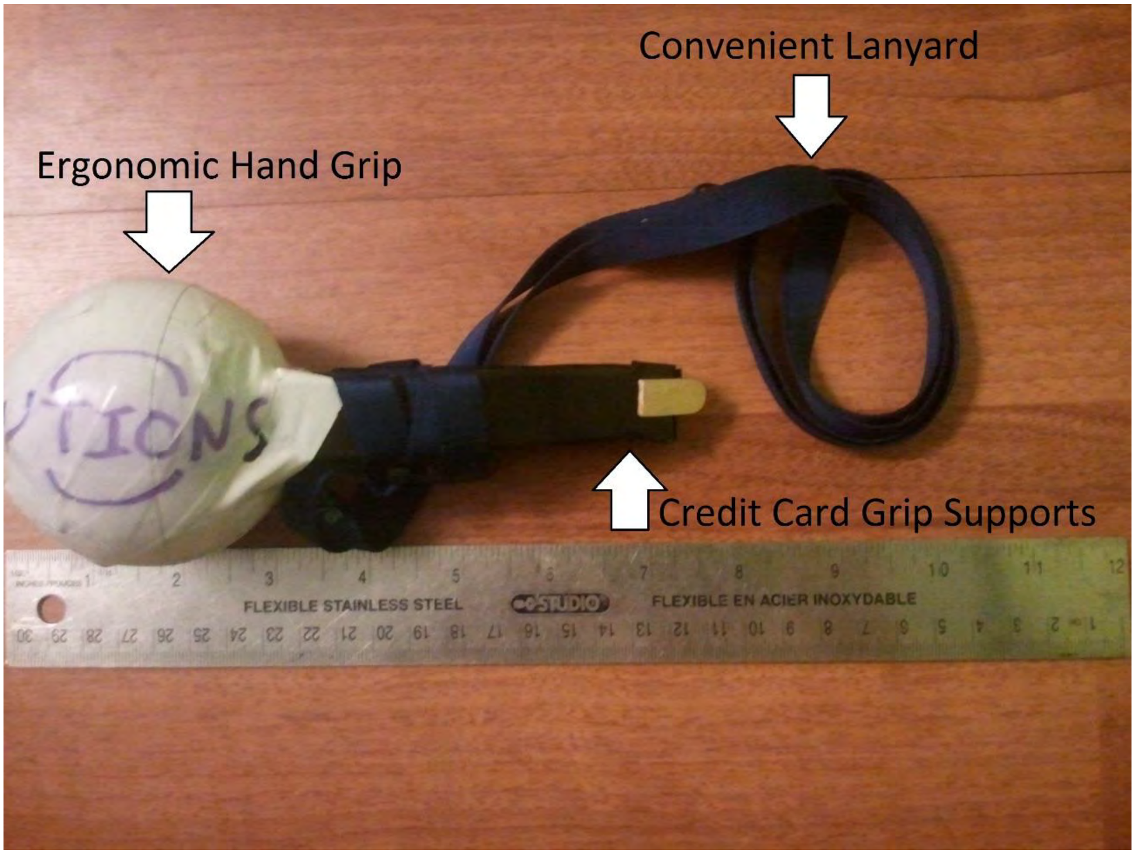
1. The device will be stored in the trunk of the car, along with Sandi's credit card.
2. Sandi will step out of her car, go to the trunk, and take out the Fuelling Stirrup
3. She will pass the stirrup over her head, and attach the hook to the stirrup while she pays for fuel
4. When she is finished paying, she will take the nozzle from its place and put it in the fuel filler neck
5. She will take the stirrup off of her neck, pass the hook overtop of the nozzle handle, and place the hook underneath the trigger
6. She will then put her foot in the stirrup, and while putting her weight on the stirrup she will lift up slightly on the handle to bring the trigger up
7. Once the trigger is fully depressed and her foot is on the ground, she can let go of the nozzle and just keep her weight on the stirrup until the tank is full

Benefits

Compared with what other teams are making, the Fuel Stirrup is superior because it uses the foot as a main means of operation. Most of the other teams still use the upper body to control the gas nozzle, whether it be the arms or torso. However, the fuel stirrup is used by the foot, which will minimize the use of Sandi's hands. Most of the other teams did minimize the squeezing motion of her hands, but they still ended up designing something that still required her to use her hands. The team went into this project with the goal of effectively eliminating the use of Sandi's hands, and the team designed the fuelling stirrup. By effectively minimizing the use of Sandi's hands while fuelling, the team thereby minimized the pain that Sandi will experience while fuelling her car.

Credit Card Extended Grip

Simple Solutions
F 2 3 - 1 2 6 – 0 8



Problem Description

Dr. Fleisig, Sandi Mugford, and the TA's request a device or multiple devices compatible with modern gas stations to assist Sandi in the refueling process. This includes insertion/retrieval of a payment card, operating the keypad and squeezing the nozzle on the fuel pump. As a person with rheumatoid arthritis, she experiences significantly more pain when performing this task. Our goal is to help her increase her independence and reduce her pain.

Design Convenient

Our prototypes design is simplistic, but effective. It has a large spherical grip. This is an ideal ergonomic shape, and it is very easily deformable. This in turn, aims to reduce pain that a user might incur. Also, the arms of the device, (seen in picture above), are extensions of the binder clip that holds the card. This makes it easier to open the binder clip, due to the decrease in torque required. Within the binder clip, there is a layer of material that has a high coefficient of friction. Furthermore, the lanyard on our device allows for the user to have both of their hands free, while having the device on their person. The lanyard further enables the portability of our device.

Functionality

The mark III is a credit card insertion and removal device designed to help the user relive the amount of stress on the intrinsic hand mussels when griping a payment card. Specifically when paying at a gas station at the pump.

Materials, Components, and Assembly

The materials that are required to build the Mark III prototype are, electrical tape, popsicle sticks, a foam ball, a binder clip, and a lanyard. The cost of these materials are all $1.13, and they can all be for at most dollar stores. The tools required for construction were simply an exacto-knife, and a small amount of super glue. The actual construction of the device did not take very long, and the Mark III can be reproduced in approximately 20 minutes. The instructions for assembly are fairly simple. Start by taping the popsicles sticks to the arms of the binder clip. After that, cut two matching slits on either side of the ball. After inserting the popsicle sticks attached to the binder clip into these two slits, wrap the entire device in electrical tape. Then, cut the first 2 cm off of a popsicle stick, and glue them onto the binder clip as shown in the picture on the pervious page. Lastly, line the interior of the binder clip with electrical tape. As a final touch, attach the lanyard to the device, so that it does not obstruct use of the device.

Use

1. When the user applies minimal pressure on the sphere at the designated areas, it causes compression of the two handles.
2. The two handles are an extension of the binder clip. The binder clip is forced open which allows the payment card to be inserted into the mouth of the prototype.
3. The user then is able to insert the payment card into the card reader with a greater amount of ease.
4. After the card is ejected from the card reader the prototype makes it easier to remove the payment card.

The device can easily be store in the client's purse, or in the glove box within their car. While in use, the device can hang from the client's neck through the use of its lanyard.

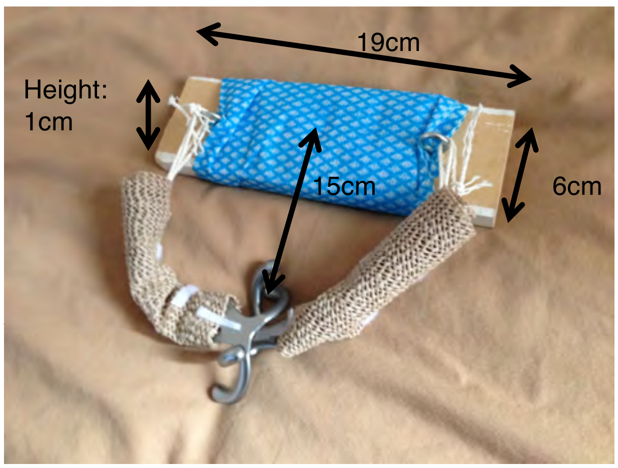
Benefits

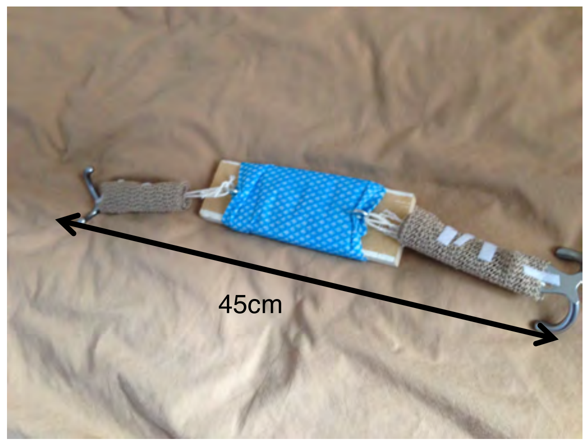
This device reduces the stress on her intrinsic hand muscles, which are primarily involved in grasping objects. It consists of a spherical shape attached two extensions of a clip. The clip attaches to the card. The large spherical surface is an ideal ergonomic shape. The extensions of the clip that attaches the card increase torque applied to the device, with a larger effective lever arm and same applied force. Other groups have not included this consideration of ideal shapes.
The parts of our device are easily replaced and maintained, and the surface attaching to the card has a high coefficient of friction to grip the card effectively.

Hook Line Squeezer

Moby Industries
F 24 - 224 - 1

The Hook Line Squeezer is hooks behind the gas nozzle and allows for a secure hold on the handle. The user gently pulls on the board wrapped with the soft kitchen towel to press the gas nozzle. The length of the board is less than a quarter of the metre (19cm) and provides an advantage of being easily stored in the side of the car.





Problem Description

To provide a solution and assistance to Sandi Mugford, the user who suffers from Rheumatoid Arthritis and has restricted hand movements at the gas station while pumping the gas nozzle. The user can be contacted through the client, Dr. Fleisig.

Design

The product is very lightweight as it can be easily worn on the forearm without any stress on the arm and bones. On a quantitative scale, it weighs 2 pounds. From the peak of the hook to the base, there is a height of about 15cm, enough for the prototype to fulfill its function and be small enough to carry around. The length of the board is only 19cm and with the arm stretched out, it is roughly 45cm, indicating that the arms are of decent length to fit through the nozzle and pull without much strength.

Functionality

The Hook Line Squeezer is able to fulfill the function of being able to easily squeeze the gas nozzle for a continuous flow of gasoline without stress or tension of the user’s affected hands. Therefore, the product can do everything the client asked for in the situation and problem at the gas nozzle aspect only.

Materials, Components, and Assembly

To build the product, a small piece of wooden block dimensioned roughly around 19cm by 6cm by 1cm was needed for the base. The piece of block found as a spare at home, whomever one can obtain a 1'x6'x8' plywood piece at Home Depot for $3.98. The product is wrapped around with a blue kitchen towel, which also is found easily at home, however it can be brought from any grocery or convenience store for $3.99 for a pack. The brown gripping material wrapped around the strings was also obtained at home, but one can purchase it from Canadian Tire for 12 inch by 10 feet roll for $7.99. The velco strip of 10 feet cost $5.99. The two silver and metallic hooks cost $ 6.77 and the two iron hooks attached in the wood cost $3.65. The ropes attached from the two hooks to the metallic hooks cost $4.15. Not all the materials are used, but only a small amount of it. Therefore, relative to the size of the device, the whole project costs about $10. To assemble the materials, the saw machine was used to cut the wood; hammer to nail the hooks and velco was a means of tape to optimize its use. The amount of time used to make the device was only 15 minutes to assemble all the parts together. The simplicity of Hook Line Squeezer is that is very simple to use and therefore special instructions are not required.

Use

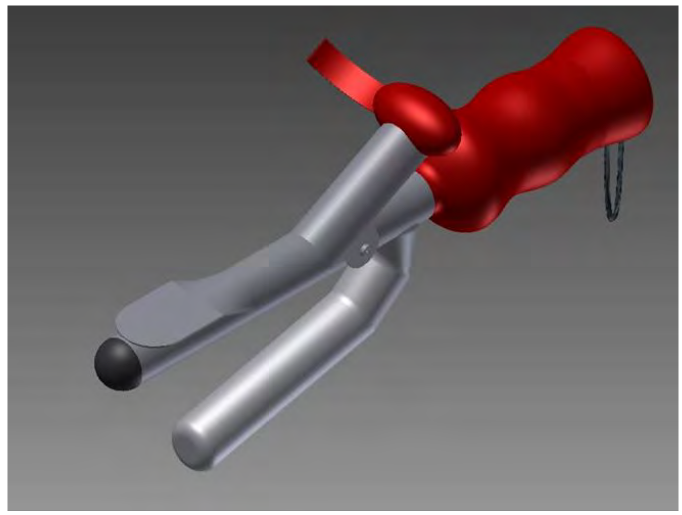
1) The product is stored at the side of the door, dashboard, purse or on the passenger's car seat depending on where the user feels is comfortable. The device is closed, preferably.
2) The user slides the device on her forearm to allow her to open and close the car's door.
3) The device is still hanging on the user's arm while the user inserts the nozzle into the car and chooses the option of the machine.
4) The user quickly and without any trouble unbuckles the hooks and slides one through the handle.
5) Without much difficulty, the user just attaches the two hooks together by means of touching them together. The small pieces of velco on the hooks allow them to attach easily without having the user to physically work with the velco.
6) The user slides her arm through the block again; does the same motion used to carry the product.
7) The user pulls the block towards oneself to pull the nozzle. The pulling motion was chosen to make the motion of pumping the gas more natural.
8) Once the function of filling the gas is done, the user stops pulling the block and lets go the product.
9) The hooks are undone easily by just puling apart with gentle force.
10) The hooks can easily be attached again to allow the user to hang the product on her forearm while doing the final steps at the gas machine or store it inside the purse, which ever the user feels more comfortable doing.
11) If the product is still on the user's arm, the user enters the car and stores it away in its respective place.

Benefits

The product is very portable, as the user does not have restrictions doing other movements while at the gas station. Therefore, it does not stop the user from multitasking and is not a barrier and burden while performing other tasks. The product itself weighs about 2 pounds and does not provide stress or tension on the arms or hands. Also, the product is padded with soft materials on the wooden block so it is very comfortable for the user to pull the block. The ropes are wrapped with the strong gripping material so that the ropes are not easily eroded by time and provide the user with the assurance that the product will last. Also, the product is very simple and does not require any instructions on how to use it. Another simplicity of the device is that is can be easily stored anywhere in the car, for example in the side of the door, dashboard or the passenger's seat. Therefore, the product can be easily adjusted to the user's preferences. The Hook Line Squeezer is better than any other product due to its simplicity and its ability to fulfill the needs and requirements of the user easily without any complicated means.

Gas Pump Patriot

engi·Near
F24 - 224 - 2



Problem Description
The problem presented by Dr. Fleisig is to allow Sandi to achieve independence at the gas station. This is seen specifically in her issues with the gas pump trigger, the credit card slot and pressing the buttons on the machine.

Design
As seen in the figures above, the team's final design is much like a rigid clamp with a lever arm on the top. There is a large handle on one end as well as wrist band for further convenience. The prototype turned out to be about 24 cm or 9 ½ inches in length and weighs approximately 150g or 1/3 of a pound.

Functionality
The Prototype can successfully hold up the gas pump trigger, insert the credit card and press buttons. Issues that were addressed while testing out the prototype were that if the gas station ATM does not automatically release the credit card, the device will not be able to retrieve the card. Otherwise, this prototype is fully functional.

Materials, Components, and Assembly
The team's final design did not require many materials or much complex assembly. A curling iron was used for the main support structure. The iron that the team used was second hand, however, Sandi would be able to purchase one for 5 – 10$ at various second hand stores. The team constructed the handle from wooden

shims, wood glue and covered this with hockey tape. Cotton balls could be added between the tape layers for extra comfort. The lower arm was made from wire and covered with thermoplastic and then tape. The hockey tape can be bought at Canadian Tire or other similar stores. The tape the team used was approximately 4$ a roll and 1 ½ rolls were used. Total cost for the team was less than 10$. Sandi can purchase all the items used for no more than 30$.Total time required to build was less than 2 hours. Tools needed for construction were a screw driver, hammer, wire cutters, pliers, hot glue, wood glue and

Use

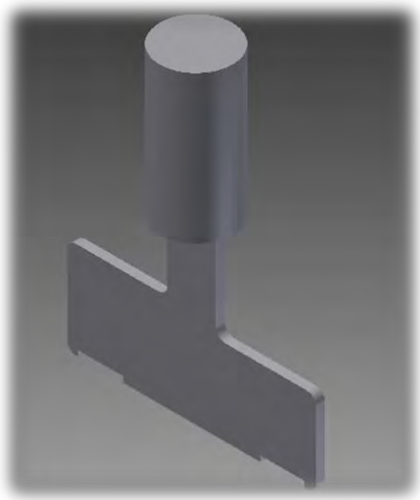
1. Device is taken out of car door.
2. Wrist strap is around the user's wrist (tighten to users liking).
3. User lets go of device (supported solely on the strap) to perform other tasks they desire.
4. User grabs hold of device once again.
5. Takes card out and slide it into the clamp of the device by holding down on the lever.
6. Uses device to insert card into machine and unclamps card.
7. The device's rubber tip is then used on the key pad to enter input values into the machine.
8. Uses device to retrieve card by once again pressing down on the lever to clamp on card.
9. Let's go of the device (supported solely on the strap) to perform other tasks they desire.
10. Places gas nozzle in the car.
11. Using both hands user pulls the trigger of the nozzle.
12. User holds the trigger in one hand while getting a hold of the device.
13. Then using the wedge-shape of the device to wedge the trigger up.
14. Now applying a horizontal force using bigger muscles to keep trigger pushed up.
15. Releases device (supported solely on the strap) to stop pumping gas.
16. Place gas nozzle in appropriate location.
17. Closes gasket.
18. Loosens strap
19. Places device back in car door for future use.

Benefits

There are many benefits for Sandi when it comes to this device. It is compact, eye-catching, inexpensive and relatively light. The design has been optimized to fit Sandi's personal limitations and the team has tried their best to make it comfortable to use. This device also addresses all three of Sandi's major problems at the gas station. It is also not large or heavy or embarrassing to pull out in public. One other benefit for Sandi is that if she were to use this device, she would only use the one device for all three problems rather than three equally large devices for only one problem each. This device is also legal in the way that it cannot function without constant pressure on the gas pump trigger.

Simplici-T

2Shar Designs
F 24 - 224 - 3



The figure on the left and the figure on the right are photographs of the device. The figure in the middle is a CAD model representation of the device. The dimensions of the device are as follows: the device has a height of 256 millimeters, a width of 196 millimeters, and a thickness of 7 millimeters.

Problem Description

The goal of this project was to create an assistive device that will help the user, Sandi Mugford, with her difficulties associated with fueling her car. These difficulties include the process of squeezing the gas nozzle trigger. This device is being designed at the request of the clients, Dr. Fleisig and Sandi Mugford, to help Sandi ease her pain and reduce the challenges she faces throughout the fueling process.

Design

The device is both light with respect to weight and small with respect to size. It weighs approximately 100 grams or 3.5 ounces. The device is 256 millimeters tall and the “t-portion” or blade is 196 millimeters wide. The material also has a thickness of 7 mm. The size of the device is comparable to the size of a large hammer and would be able to fit in a large purse or in a glove box. The handle as seen in the photos above, is a pool noodle wrapped with black hockey tape with a cylindrical shape. The white nylon rope as seen in the photos is useful for carrying purposes. The “T-shape” of the device provides universal usage at all gas stations.

Functionality

The device functions as a mechanism to assist Sandi with the gas nozzle aspect of the fueling process. It acts as a “simple machine” to hold the gas nozzle trigger in the “on position.” The device acts as both a lever and a wedge. When Sandi is ready to fuel her car, she will insert the notched blade between the trigger and the lower nozzle frame. She would then pull the handle of device towards herself, thus activating the fuel flow through the nozzle with minimal force exerted by the user. During the fueling process, very little effort would be required from Sandi. When the tank is full or the desired amount of gas has been pumped, Sandi would simply release her applied force and the trigger would return to the "fuel shut off position." This device helps reduce the pain inflicted on Sandi during the fueling process by reducing both required force and flexion of the hands. "Simplici-T" helps Sandi to overcome the challenges she faces during the fueling process and helps Sandi to maintain her independence.

Materials, Components, and Assembly

The device is made out of a poly cutting board, a pool noodle, hockey tape, and a thin nylon rope. The cutting board costs $9.99, the pool noodle costs $4.99, hockey tape costs $2.99, and the nylon rope costs $0.50 bringing the total cost of the device to $18.47. All of the materials required for the device can be obtained at Canadian Tire. A pencil, ruler, knife, sandpaper, power drill, and scroll saw are required for the construction of this device. If assembled correctly, the construction of this device can be completed in 30 minutes. The device needs the following instructions to be assembled: one – sketch out the design for the device on the cutting board with a pencil and ruler, two – cut out the device with a scroll saw, three – smooth the edges with sandpaper, four – drill a hole in the end of the handle and attach the nylon cord for carrying purposes, five – attach the pool noodle to the handle using a knife to cut a wider slit, and six – wrap the pool noodle with hockey tape for extra grip.

Use

1. Sandi will store the device in the glove box of her car.
2. When Sandi arrives at the gas station, she will open the glove box, retrieve the device, and hang it on her arm.
3. Sandi will leave the device hanging on her arm while inserting her credit card, entering her pin number on the keypad, and selecting her grade of fuel.
4. When Sandi is ready to begin fueling her car, she would insert the nozzle into her fuel tank, take the device off of her arm and insert it into the trigger frame.
5. Sandi will then use the device to actually pump the gas.
6. When Sandi is finished fueling her car, she would once again hang the device on her arm, put the fuel nozzle back into its holder and grab her receipt.
7. Finally, Sandi will put the device back into the glove box of her car and the fueling process will be complete.

Benefits

First and foremost, the device is better than existing solutions because it is both simple and effective. It reduces required grip strength and minimizes physical exertion by giving the user a mechanical advantage. In addition, the device is small, lightweight, and durable and so it can be easily manipulated. It can be easily stored in the glove box of Sandi's car and so it will not be a hindrance to her. Another important benefit is the fact that the device is universal. The "t-structure" ensures that the device will work with all sizes of gas nozzles. Sandi will be able go to any gas station that she wants and the device will work for her. Additionally, while the device is inserted into the nozzle, hand use is optional because Sandi can use her forearm to hold the handle in the vertical position. This is a vital benefit as it is the arthritis in Sandi's hands that cause her the most pain.

Nozzle Belt

4ward Engineering

F 24 - 224 - 4

Problem Description

Since Sandi's Rheumatoid Arthritis causes problems at the gas pump, the Nozzle Belt aims to help Sandi with the process of gripping the gas nozzle in a way that reduces her pain and energy consumption. In order to restore Sandi's independence at the gas stations, the Nozzle Belt must be durable and lightweight. It must also give Sandi a wide range of motion so as to increase her effectiveness at the gas stations.

Design

The Nozzle Belt is small, lightweight, and portable. The Nozzle Belt consists of three parts: the loop end, the hook end and the main belt. The hook end is made of a strong, metal hook and it is the part of the device that allows the tightening or loosening of the loop formed around the gas nozzle. The loop end is the end that Sandi will interact with. Sandi will place her arm inside the loop and pull her arm away from the nozzle. The belt connects the two ends and allows a loop to be formed around the gas nozzle. When Sandi places her arm inside the loop and pulls her arm away from the gas nozzle, the formed loop around the nozzle is tightened. Therefore, the gas nozzle lever is pulled upwards, and effectively, fuelling is done with less effort than if Sandi had pumped manually.

Functionality

The Nozzle Belt will help Sandi when pumping gas at the gas station. The device eliminates only the stress and pain on Sandi's hands obtained from gripping the nozzle while fuelling, by transferring the weight and stress to stronger parts of her body, her arms.

Materials, Components, and Assembly

In order to build the Nozzle Belt, common and minimal materials were needed, which includes a lightweight belt whose length is around 60cm, a metal hook with a small space in it, scissors, needles and threads. They can be purchased at Dollarama and Wal-Mart. The price of the prototype is cheap and affordable for just about anyone, especially Sandi. The belt only costs approximately three dollars while the needlework and scissors may cost four and three dollars, respectively. Tools required for the construction of the Nozzle Belt were a knife, needles and scissors. The process of building the Nozzle Belt lasts less than half an hour. Knowledge of physics and sufficient sewing skills were required to build the device.

Use

The device's small size and ease of portability enables Sandi to store the device anywhere in the car. Sandi can easily carry the device with one hand. While performing other tasks, Sandi can easily put the device in her purse or, because of the lightweight and comfortable nature of the device she can leave the Nozzle Belt around her wrist.
How to use:

1. Loop device around gas nozzle.
2. Insert the loop end through the metal hook.
3. Put arm through loop end.
4. Pull arm away from gas nozzle, thereby tightening the formed loop around the gas nozzle and pulling the gas nozzle lever upwards to allow gas flow into the car tank.

Benefits

The Nozzle Belt has many benefits that make it superior to Sandi's current methods and the methods thought of by our peers. The Nozzle Belt is a simple design and easy to use. The device has no complicated parts and is therefore durable as well. Also, the lightweight and portable nature of the design allows for Sandi to be able to carry it using one hand, easily. The small and flexible size and shape of the device means that Sandi can store the device in virtually any part of her car, or in her purse. The Material is made of soft, but durable fabric, and so is not irritating to use over extended periods of time. Along with its extremely effective functionality, the Nozzle Belt is also esthetically pleasing, and would not bring unwanted attention to Sandi while she is using the device.

Fill-Up Friend

The device is just over 30cm long, allowing a long enough handle to be able to easily grasp it with two hands.

Levamentum

Team Name
F 24 - 224 - 5

The device can easily be hooked over the gas flap to free both hands to perform other tasks.

As seen below, the device simply slides onto the gas nozzle without the need for straps, hooks, or any other attachments.

Problem Description

A device is to be designed for Dr. Fleisig and those with arthritis to assist the client, Ms. Sandi Mugford, when at the gas station. The device should reduce the amount of pain felt and force required to use the gas nozzle.

Design

The final product incorporates the effectiveness of being lightweight and of usable size. The entire device does not exceed one pound and can be held effortlessly in one hand. The lightweight design of the device makes it easy for it to be held by the user without resulting in a significant amount of strain on the user's arm. The device is only 33 cm long along its greatest length, which provides the user with added flexibility when using it. The design of the final product also allows the user to place it on the fuel tank door while performing other actions at the gas station. The ability to place the device on the fuel tank door allows the user's hands to be free to perform the other tasks required at the pump.

Functionality

The main function of the device is to alleviate the pain endured by the user by limiting the required amount of force needed to operate the gas nozzle. Pumping gas becomes much simpler when the user can exert a force simply by pushing on the device as opposed to having to squeeze and lift the gas nozzle handle. This allows the use of the stronger arm muscles, as opposed to the muscles in the hand. The pushing force exerted by the user enables the use of the palm, decreasing a significant amount of the pain felt. This device satisfies the requests of the client to reduce the amount of pain felt when pumping gas.

Materials, Components, and Assembly

This design is made from hardwood dowels connected by wood glue and screws, then finished with wood filler, sanding, and white lacquer. A mitre saw, belt sander, drill, and drill press are used in the construction of this device. The mitre saw is used to cut dowels to length, then the drill press is used to create holes to put the smaller dowels through the larger one. Angled faces are made using the belt sander. Finally, sand paper is used to smooth all edges and joints. All materials can be purchased at Home Depot for a total of $18.08 (with enough materials left over afterwards to make at least one more). Manufacturing of the device takes approximately 6 hours, including time between paint coats.

Use

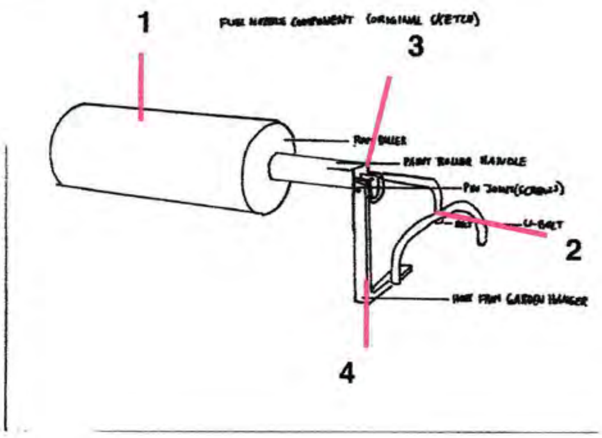
1. Open the gas flap
2. Take the Fill-Up Friend out of the car and hook it over the open gas flap
3. Pay for the gas
4. Take the nozzle from the gas pump and insert into the gas tank
5. Remove the Fill-Up Friend from the gas flap
6. Slide the Fill-Up Friend onto the gas nozzle, with the front prong over the trigger and the back prong under the trigger
7. Push the device forward using the handle or the ball on top of the device until the gas tank is full
8. Remove the Fill-Up Friend from the gas nozzle and hook over the gas flap
9. Return the gas nozzle to the gas pump
10. Take the Fill-Up Friend off of the gas flap and close the gas flap

Benefits

The Fill-Up Friend has many benefits that set it apart from other devices. The first benefit is that the Fill-Up Friend is extremely lightweight, making it easy to use and handle. There are no straps, buckles, attachments, or anything else needed to use this device. This allows the Fill-Up Friend to be used immediately and without hassle. Storage of the device at the pump is simple as it can be hooked over the gas flap while one is doing other things, such as paying and handling the gas nozzle. The Fill-Up Friend changes the squeezing motion normally required to use the gas nozzle, to a pushing motion. This transfers the force from the hands to the arms, allowing the use of the stronger arm muscles and reducing the pain felt in the hands. The longer handle permits different methods of holding the device. One can use the back of the hand, palm of the hand, two hands, or the arm to apply the required, minimal, force to the device. Lastly, the Fill-Up Friend is universal to all gas pumps, allowing the user the freedom to fill up their car with gas at any gas station.

Easy- Fuel

Ancona Six Assistive Devices
F 24- 224-6



Problem Description

To create an assistive device for Sandi Mugford, a 61-year-old woman who has rheumatoid arthritis, to reduce pain and effort while filling up her car at the gas pump without introducing new difficulties or risks to her or the public.

Design

The design is 29.5cm long by 14cm high by 10cm deep. It weighs in at under 1kg, which is well within the weight restriction. The device can be easily carried by the user.

Functionality

This design can reduce pain and effort required to pump the gas. It no longer requires small finger motion. Instead, the design allows for a lever to be used, thus minimal gripping action is required. This design satisfies all of the requirements based on the client's requests for this device.

Materials, Components, and Assembly

This design requires a paint roller, a U-bolt, several bolts, nuts and washers, one garden rack and a roll of shelf liner. The cost of the materials is approximately $25, and can be obtained from Home Depot or Home Hardware. A drill press, a grinder and a hacksaw are required to construct the device. The approximate time required to construct it is one hour, and requires only very basic machine skills. No instructions are required to assemble it, as it will be pre-assembled.

Use

Use the diagram from above for reference.

1. The device will be stored in the side door pocket of the driver's side when not in use. The user will remove the device when going to fill up her car, and place the Easy-Fuel on top of her car until it is needed.
2. Once the gas nozzle is in the car, the U-pivot point, 2, is placed on top of the gas handle, with the Easy-Fuel handle facing out from the car.
3. The base of the lever, 4, is placed under the trigger.
4. The end of the handle, 1, is lifted up, pivoting about the pin joint, 3.
5. It is held until the gas has finished filling, then removed. It is placed on the top of the car until she is ready to drive.

Benefits

Some benefits of this design include a decrease in the force required to pump gas. This device follows all applicable laws and is easy to use. It requires no assembly by the user, and is compact enough to fit in the door. This allows the user to open and close fewer doors, increasing the simplicity of filing the gas. Additionally, this device can be used by the hand, elbow or forearm of the client, not simply the client's hands, which is a major benefit of this design. The handle of the Easy-Fuel is comfortable and large, reducing the client's need to close their hand.

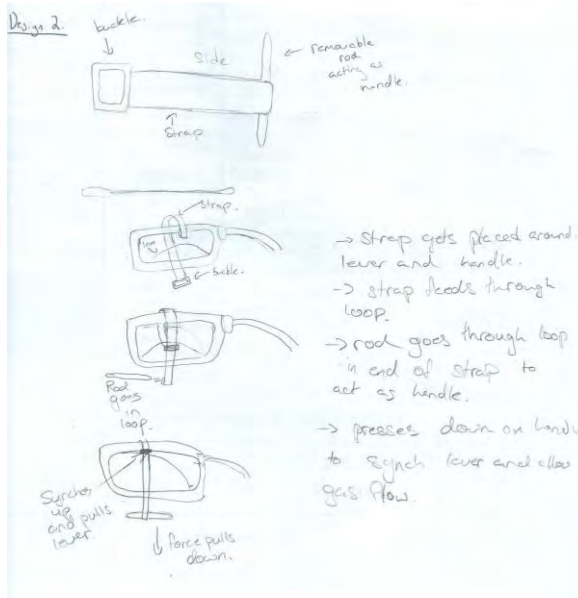
The Gas Strap

S.L.A.B.
F _ _ - _ _ _ - _

Size: 1' wide, about 2" thick.
Use: Once the seal is created by looping the strap around, the handle is pulled, tightening the strap and compressing the lever.

Picture of final design

Size: Roughly 2.5' long
Use: Buckle end is looped under the lever, then over top of the handle, and slid through the notch.



Conceptual sketch of device, briefly outlining function

Problem Description

To design an artefact for the client, Sandi Mugford, who suffers from an autoimmune disease called Rheumatoid arthritis. She has trouble performing certain tasks at the gas station because of the lack of motor skills and mobility. Therefore, she requires some sort of device or aid to help her complete these tasks. In order to do so, the device must reduce the pain involved in the process, simplify precise tasks, and in general make the process easier for the user. To be more specific, our aim is to design a device (or devices), that will allow for less painful use of the gas pump lever, less precise and cramped used of the keypad, and easier use of the credit card reader. Overall, the device will help the client joint dexterity impairments, and increase Sandi's independence at the gas station.

Design

The Gas Strap is incredibly lightweight and portable weighing less than 1 lb. Its strong and lightweight cord compliments its flexible design. The handle is made with a comfortable length while also being big enough for Sandi to grip easily and painlessly, at about 2" in width. The large grip is thanks to the foam coating surrounding the handle, as seen as the photo on the right. Finally, the buckle is equipped with a slit (again, refer to the photo to the upper right) that makes attaching the Gas Strap to itself significantly easier. Regarding size, when fully extended the strap is about 2.5' long, however when rolled up for compact storage, it becomes less than 3" wide. The handle is cut to a comfortable width of 1', big enough that your hands are not to close, but not too wide as to take up unnecessary room.

Functionality

The Gas Strap can compress the gas nozzle trigger with very little force required by its user. Its design allows it to be pulled from a wide variety of angles. This will make Sandi as well as other users comfortable, as they can choose their own preferred pulling position. The Gas Strap can easily hook onto itself which eliminates the need for additional accessories. Overall, the device efficiently and effectively does exactly what the client needs, pumps gas with much less strain and effort.

Materials, Components, and Assembly

The Gas Strap requires five, easily obtainable materials. This includes a D-ring, which is $1.50, a wooden dowel, which is $2.50 and duct tape which is $3.40 at Home Hardware. The foam handles are from a paint roller which was $2.00 at Dollarama. The most important material was the nylon strap, which is $1.30 per metre at MEC. The tools needed to build The Gas Strap include a lighter, a construction knife, and a hack saw.

Building The Gas Strap is easy and very time efficient. Firstly, the nylon strap must be cut to the appropriate length, and then the end that was cut must be burned with the lighter, removing the fraying caused by cutting. Next, one end of the nylon strap must be looped through the d-ring and duct taped to itself. The other end of the nylon strap must wrap around the dowel and then duct taped to itself, similarly to the previous step. Using a hacksaw, a roughly 1” notch must be cut into the d-ring on one side, in order to create the hook. Lastly, the foam handle must be attached by gluing the inside if it to the dowel. This whole process takes approximately 10-15 minutes to complete. The process is relatively easy and requires no special design knowledge to create.

Use

1. The Gas Strap can be stored in various places due to its flexible design. This includes the glove compartment, the trunk, or the door pocket.
2. When at the gas station, take The Gas Strap out of its stored location and hold it by its handle.
3. When the gas nozzle is secured in the gas tank, take The Gas Strap’s cord and put it through the gas nozzle trigger area.
4. Loop the cord over the gas nozzle and hook The Gas Strap Cord onto itself with its slit.
5. Pull The Gas Strap in any direction desired.
6. Upon completion, unhook The Gas Strap from itself.
7. The Gas Strap’s hook can now be used to hook onto the users belt or pant pocket to perform other tasks.

Benefits

The Gas Strap is better than other gas nozzle solutions because of its ease of use and portability, and that it tackles the problem in a very straightforward way. There’s no fancy parts or tasks, as it was designed to be simple and to the point. A lot of the devices created for Sandi have great functionality and get the job done, however, many of them seem uncomfortable and awkward to use. As stated, the beauty of The Gas Strap is its simplicity; it manages to do its functions seamlessly while being incredibly easy to use. Its ease of use is so great that it barely requires any prior instruction, a very brief explanation is enough, and the rest is straightforward. Along with this, The Gas Strap is incredibly portable. It manages to be this way due to its lightweight design and flexibility. The main part of this device is its cord, which is strong, light, and flexible. This makes storing it no problem and also makes it usable at any gas station by any user. This point introduces its best feature that makes it better than other devices. The fact that The Gas Strap can be pulled and its handle can be rotated in any direction truly makes it the superior device. No matter where the joint pain may be, The Gas Strap can be pulled in the direction that is most comfortable to the user while still performing its function at maximum efficiency. Along with that, the design allows the strain to be moved from only her wrists to her whole upper body, arguably the strongest part. This fact makes it better than devices that just move it to one other joint just as just one arm, and overall makes it a very effective device.

Card Insertion Device

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Creative Incorporated
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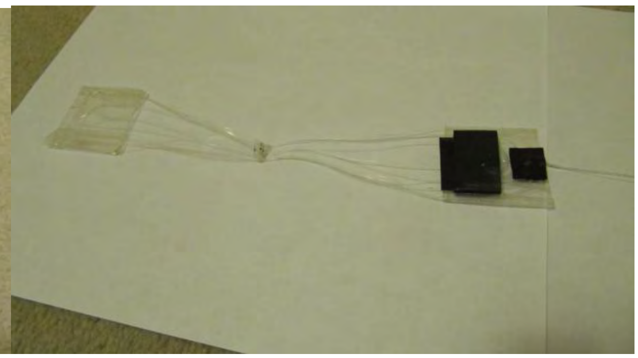

Problem Description

Our client, Sandi Mugford has rheumatoid arthritis and this limits her ability to be independent. She would like to become independent while fuelling her car, and it is our goal to design a device to aid her in inserting/removing a credit card and to press buttons on a keypad.

Design

Our device is designed to be a simplistic folding-ruler style implement that straps onto the user's hand. Our device is very light and weighs approximately 10 ounces, and has a length of a ruler (1 ft) when extended. In its compact storage mode, it is about as half as long. It has a width of a hand span, or about two inches, and height of an inch. The secondary device is a fold of material that wraps around the credit card to hold it in place. It is flexible and about the same size as a credit card. In its extended configuration, it is able to insert and remove the credit card. In the compact configuration, it is able to press buttons.

Functionality

Our device satisfies the problem description as it is able to insert and remove a credit card, and press buttons on a keypad. It performs these tasks without requiring the user, Sandi, to exert a great amount of energy or effort. It can perform everything that the client requested, as it helps her achieve independence while fuelling at the gas station.

Materials, Components, and Assembly

The device requires Velcro strips, a plastic ruler, tape, a pencil, a magnet, a belt, fishing wire, keychain loop, and optionally, wood. All of the materials are available for less than a dollar at a hardware store, such as Home Depot or a general goods store such as Walmart. The entire device can be assembled with a hot glue gun, scissors, and tape. Construction time takes approximately an hour. To construct the device, it is easy to observe its image and build from observation. To explain in detail, a belt was cut and wrapped around the end of the ruler, and glued into position. Then, Velcro patches were added in order to allow the device to be secured to the user's hand without requiring a pinching motion. Next, the ruler was cut in half and taped to allow it to have a foldable and extendable state. Underneath the ruler, a block of wood and pencil were added to ensure that the extended ruler would not fold downwards upon itself. Velcro strips and magnets were applied to the ruler to ensure that the ruler would stay in the extended or collapsed mode without switching between them. A hook, created from tape was applied to the end of the ruler to allow the card to be extracted from the machine. To create the flexible material device, two strips of Velcro were glued to fishing wire, creating a cradle for a credit card to sit in. Then, a keychain was attached to the Velcro to allow the hook on the ruler device to hook onto it.

Use

1. The ruler device is attached to the user's wrist by means of a strap. This strap requires no usage of finger pinching, and can be applied with only an extended palm.
2. The ruler device may be extended by unfolding it from its compact position.
3. The flexible material device is attached to the user's credit card by folding it into the flap. Velcro panels secure the card into the secondary device.
4. The flexible material device, plus credit card is attached to the end of the ruler device with another Velcro panel.
5. The extended ruler device is now able to guide the credit card into the payment machine. It detaches easily from the card after the card is inserted.
6. The ruler device can be folded into the compact mode to access the underside. This allows the device to function as a button pusher.
7. When transaction is complete, the user can pull the card out of the device without effort, as there is a hook attached to the end of the ruler device.

The device is compact enough to fit inside a car glove box, and is even unobtrusive enough to fit within a purse. To carry the device, Sandi may attach it to her wrist and fold it down into its compact mode. This keeps the device out of the way of her hands when she is performing other tasks, such as operating the fuel nozzle.

Benefits

We consider our design to be a good design as it fulfils Sandi's requirements and performs its function to an acceptable degree. We believe our design is superior to that of our peers, as it is able to have a compact form. This means that it is able to fit in a purse or glove box while still being able to perform its job of insertion and removal of a credit card into the payment machine.