Amanda Sari Perez
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Final Project – Applied Fabrication Techniques

Device: A gripper

For whom: People who don't have dexterity or gripping strength, or perhaps who are missing their hand altogether. This device would help them hold onto objects like a pen or a phone or eating utensil without having to exert effort.

The idea: A user could put the gripper onto their hand or stump, and in its default mode, the apparatus would be "loose." An object can be placed in the gripper, and after pressing a button, the gripper would be set to "tight."

Mechanisms that need to be figured out:

1) How to put on the gripper with minimal effort, preferably without the aid of someone else
2) How the button will be pressed (using the other hand, or a muscle contraction)
3) How the gripper should lock into place (mechanical, magnetic)
4) Optional: how the gripper can sense how tightly to grip

Sydney Howard

4/18/18

Project 5

The Helpful Hydrator

Two common problems elderly people face are remembering to consistently take their daily medication at the same time and drink enough water. The Helpful Hydrator is a water bottle that contains a bottom compartment for medication and solves those two problems. The bottle will be able to connect to an application on one's phone. It will be initially programmed to take into account the user's weight, height, gender and activity so that the application will know how much water the user needs to drink per day. Every few hours the bottle will make a sound that notifies the person to drink water until an indicated line. Along the outside of the bottle, there will be lines that have the time in which that amount of water should be drunk up to. There is a sensor on the cap that detects when the lid is opened and closed; therefore, the program will know if the water is intaked.

The medication compartment is in the bottom half of the bottle. There will be seven different drawers that will open at the specified time of day for when to take the pills. If the user has a nurse that checks on him, he can have the nurse refill the pills once a week. Another sensor will be placed by the opening of each compartment so that the application knows if the pills were consumed.

The bottle will be 3D printed with a plastic that is safe to hold items that can be consumed. In total, there will be eight sensors- one is on the lid and seven will be at the opening of the pill compartments.

Ariana Nathani
AAFT Proposal- Project 5

Background: My grandmother is diabetic and last year stubbed her toe. A small injury that most people wouldn't even bother to treat became worse and worse until she developed Gangrene, dead tissue caused by an infection or lack of blood flow, in that toe. It became so bad that her toe was amputated but the infection continued to spread to the rest of her toes and eventually her foot and leg. Ultimately her leg was amputated. She has the best prosthetic leg possible now but she is weak and it is hard for her to learn to use it. The situation has continued to get worse as the Gangrene has spread to her other leg and her toe was amputated and now a second leg amputation is in question. Her mother died over 50 years ago as well from Gangrene, and my idea stems from the hope that we can make something affordable to make my grandmother's (and anyone else) who suffers from this diseases life more comfortable.

Idea: Create a prosthetic for toes that can be customizable and easily and cheaply produced as in order to maintain comfort and facilitate a transition to a larger leg prosthetic if needed in the future. Loss of even a single toe impacts gait and may be associated with foot, knee and even hip pain. A well-designed toe prosthesis can help maintain the normal position of remaining toes and improve gait and comfort by restoring normal toe length. Toe prosthetics already exist out of silicone and take about a month to be made.

Execution: This prosthetic would be 3D printed with a flexible filament and work as a cap to the toe nub that is left. We can model the toe cap in Fusion360 and then print it. This single toe prosthesis can attach securely by overlapping the residual toe and relying on the resulting suction for retention. The toe cap would have to be weightier on the bottom in order to be substantial in balance. Another possible approach is 3D printing a resin mold and making a toe cap out of silicone.

Joshua Kery: Final Project Proposal for Applied Fabrication Technologies for HCI

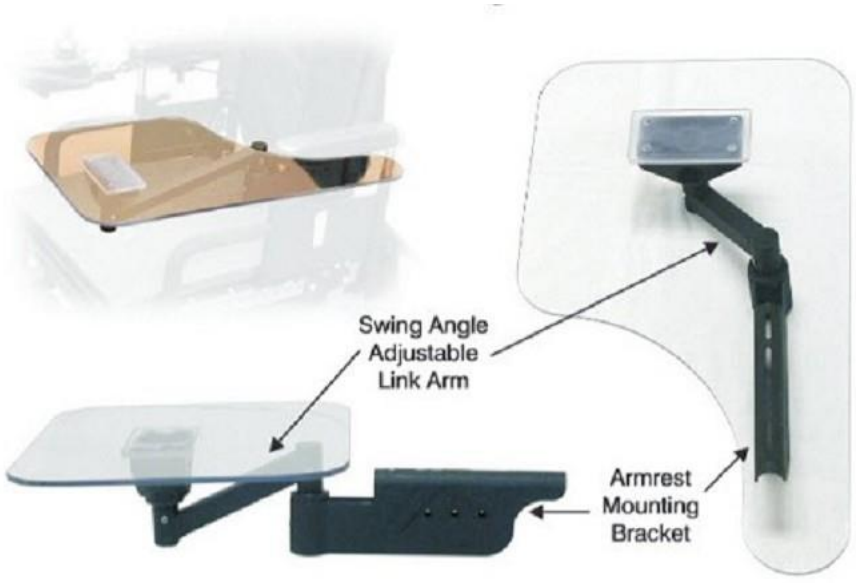
My grandmother had a stroke fourteen years ago and since then, her reach of the world has been limited to an arm's length from her wheelchair. In addition to losing the ability to walk, my grandmother lost the use of her left hand, and over the last couple of years, her mobility even within the chair has deteriorated. One of the results of these developments is that my grandmother has trouble reaching food and nearby objects when they are placed on the table in front of her. While she was writer and a schoolteacher when she was younger, she now cannot reach to pick up a pen and paper on her own.

A simple and implementable solution to this problem is providing her with a tray attachment for her wheelchair, which would allow her to hold her meals closer to her, and keep things like pens and notepads within reach, as well as giving her a surface on which to use them. A tray like this would ideally be one that my grandmother can push away and pull in to use on her own, granting her some more autonomy from her caretakers.

My family, however, has not provided my grandmother with any of the existing models for tray attachments. They object to many of these models because they appear difficult to install, and many of them furthermore require the caregiver to put them into place so that the person in the wheelchair can use them. Existing tray attachments are bulky, are incompatible with the cushioned arm rest already attached to my grandmother's wheelchair, and above all else, appear and are expensive.

For our final projects, I propose to develop a tray attachment for a wheelchair that meets some of these complicated challenges to what seems to be a straightforward solution. I want to design and prototype a tray that is easy for the person in the wheelchair to position, to install, and to remove and to reattach. For this functionality specifically, I anticipate that the most creative part of the design process will happen in developing the grip to the wheelchair's arms. This design should also account for the limited mobility of someone like my grandmother, and should work for someone with the use of only one arm. It should be strong enough to support the weight of a hand writing on its surface, and it should be compatible with other wheelchair attachments that make use of the metal arms. And, particularly important to its actual use, this design should appear and be easy and inexpensive* while also encouraging a commitment to the object, via a surprising ease of use and durability, that Scott mentioned was one of the important criteria for a successful assistive product.

A tray attachment like this solves a direct and presumably common problem for people of limited mobility in wheelchairs, the aspects of which presented here are nevertheless yet to be solved, at least in my personal case. This tray attachment is within the scope of our final project, and an object I believe a team could both accomplish and refine given our timeframe. Its components, additionally, have the potential to contribute to the creation of screen holders and other wheelchair attachments. Thus, such a design would do better than just assist my grandmother; it is potential groundwork for a set of solutions to problems for a range of people in wheelchairs.



*While I like the design pictured above and you can see it at the following link, I want to highlight that replacement parts for it cost $168, and the full product is $315. To cut the price for our hypothetical manufactured product down by even a third from that would be significant to my proposed project and to my family's needs.
https://www.rehabmart.com/product/scotty-laptop-tray-system-replacement-parts-41967.html

Jonathan Loeb

Assistive Device Idea: Portable Sensory Room

A single central object, paired with many smaller toys, built with a 3D printer, laser cutter and Arduino.

It would serve as a central display that can turn any room into a sensory room with lights, objects, images, and sounds. Sensory Rooms are used with children who, due to their condition, have limited communication skills. They can be used for a wide variety of therapeutic educational purposes.

The central object could be shaped like an animal, or building and feature buttons and maybe even a display for its control. It would have lights, and speakers built in, as well as prerecorded array of sounds. It will be able to interact with various toys, either through switches, or through infrared sensors. It, or its ancillary toys could also be equipped with haptic feedback.

Exo-Brace (aka Cast-Away aka Armed aka Helping Hand)

Jordan Tick

My idea is to 3D print a wrist/hand brace that also functions as a multi-tool. At the very least, it would be a cast that has a grip for opening doors and hangers/hooks for holding things. Essentially, it would redistribute the force from the injured area to your forearm so that you can still be functional even while wearing a cast.

I also liked the idea of lattice hinges (pictured below) from our lasercutting days. Potentially, we could design a portion of the cast as a lattice hinge that would resist movement but not completely hinder it.

Self opening and closing umbrella

-Umbrella that could open and close with the click of a button

-Even though many umbrellas open with the click of a button, they are spring loaded and require the exertion of some kind of force to close (pulling or even pushing against a surface) and a good deal of range of motion.

-current idea is to use a counterweight on the handle so the umbrella would open/close itself depending on orientation. Switch simply locks umbrella in whatever position its in.

-potential problems:

1. unknown counterweight mass (might be too heavy for friction in system)

2. Dont know if this is actually a problem to begin with.

-open to other fully mechanical/electric assisted ideas

Assistive Technology to help guitarists with tiny fingers

Project Proposal by Sharon Zachariah

Problem Statement

People with small hands find it hard to play advanced levels of music on specific instruments because their fingers can't reach as far as they want them to. The standard ring finger-to-index finger reach expected out of guitar lesson books is physically impossible for them. This leads to frustration, and they give up. Custom-making a guitar to suit small hands can only go so far without changing the sound.

The goal of the project

Use fabrication as a way to help people with small hands to adapt to a regular sized guitar.

Braces that Support Rather than Restrict

Sarah E Schultz

In many cases of joint injury, doctors will recommend that a patient wear some type of brace to help reduce further damage. However, many of these braces do this by restricting certain movements- for example a functional knee brace (Figure 1) allows the knee to bend, but not rotate in any other direction. These braces are often used for ACL injuries- by keeping the knee from rotating further injury to the ACL is prevented. However, what if instead of restricting movements we could create a brace that could act like the compromised tendon or ligament and allow the user more range of motion?

Figure 1- Functional Knee Braces

Another type of knee brace, patellofemoral braces, are more flexible, but are usually better for general knee pain than for people with specific injuries (Paluska and McKeag). These braces can be bought over the counter and are therefore fairly generic. By using 3D printing techniques, we should be able to customize braces to people's specific injuries in a way that allows flexibility and support.

(Note: This is something I personally would like to have- while I don't wear a brace daily, I do have a torn ACL and there are certain activities, such as skiing, that I'm not supposed to do because of the way the muscle would be rotated, but having something that supports it might make these activities possible. I'd also like it to be something that can be worn swimming.)

References:

Paluska, S and McKeag, D. "Knee Braces: Current Evidence and Clinical Recommendations for Their Use." *Am Fam Physician.* 2000 Jan 15;61(2):411-418.

Project Proposal

Talking Blocks: Communication devices as toys for children with developmental disorders.

Goal: Build toys in the shape of blocks or puzzle pieces that produce different sounds and multi-sensory feedback to support toddlers with ASD with their communication.

The problem space

People with developmental disabilities often struggle with a phenomenon called "over-selectivity" in other words, they miss the forest by focusing on the trees. This can have an impact on the way they perceive visual information and the way they communicate.
Little to no treatments are available to the broader population of preliterate, minimally verbal individuals [1].

Therefore, I propose fabricating Talking Blocks! (concept name but project name can change). A fun tangible technology to support children's development of visual perception and visual recognition. Cubes/blocks or puzzle pieces augmented with conductive paths that can be rearranged together to light-up, produce sounds and create words or shapes that can train children with developmental disorders to look at the pictures as a whole.

I am imagining that some blocks will have the batteries while others will have different colors LEDs embedded in them and we will laser cut or 3D print different cube or block faces that will be revealed once the LED light is turned on inside the cube thanks to the right connection made by the child.

References

1. LouAnne E. Boyd, Kathryn E. Ringland, Heather Faucett, Alexis Hiniker, Kimberley Klein, Kanika Patel, and Gillian R. Hayes. 2017. Evaluating an iPad Game to Address Overselectivity in Preliterate AAC Users with Minimal Verbal Behavior. In Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '17). ACM, New York, NY, USA, 240-249. DOI: https://doi.org/10.1145/3132525.3132551
2. Caio Brito, Gutenberg Barros, Walter Correia, Veronica Teichrieb, and João Marcelo Teixeira. 2016. Multimodal augmentation of surfaces using conductive 3D printing. In ACM SIGGRAPH 2016 Posters (SIGGRAPH '16). ACM, New York, NY, USA, , Article 15 , 2 pages. DOI: https://doi.org/10.1145/2945078.2945093

Ticha Sethapakdi

Project 5 Proposal

One of the biggest fears many artists have is the loss of their motor skills. An artist's most valuable asset is their hand, which can be susceptible to strain or trauma after years of repeated use. As motor skills deteriorate, it may not be too difficult to make larger gestures but can be nearly impossible to control more subtle ones. I propose to design an assistive glove that enables artists with manual motor disabilities to make fine-grained gestures. This can be achieved through programming the glove to perform a set of small actuated motions and allowing the user to select which motion is appropriate for the task they wish to accomplish.

Projects 5 Proposal

The device proposed its catered to the visually impaired. Throughout their daily lives most must depend on someone to take care of finances. There have been cases where caretakers will take advantage of this. For something so simple it has become a problem among the visual impaired community. I am proposing creating a wallet type device that can identify dollar bills and credit cards once taken out and put back in place. The feedback indication can be audio or varies vibrations. I believe this will give the confidence for someone with this disability can pay for things on their own without having to worry. The device can consist of a camera that reads the bills or some other creative way of identifying currency. Another idea would be to not scan but to store certain dollar amounts allocated within the device. Call a certain bill or debit/credit card using brail buttons on the side or top.

Just like a bill counter banks use but for a more personalize and assistive nature. The device will have to have a battery that will not only be efficient but easy to charge. Another feature that would bring value to the device would be a locator that the individual can hear or feel in case they lost their smart wallet around the house. As for accessibility it would better if the device can fold or is as small as a personal wallet/purse.

Full-Depth Push-to-Open Drawer

Matthew Savage
mdsavage

For those with muscular impairments or a disability that requires the use of a wheelchair, opening drawers and cabinets can pose something of a problem. While closing cabinets and drawers is generally a straightforward task due to the relative ease of the pushing motion and the large area over which that motion may be applied, opening them requires grasping a relatively small handle or edge and pulling towards the user, which is a much less natural and much more precise motion. As daily life often requires opening many drawers and cabinets -- for example, to obtain the necessary implements and utensils for cooking a meal -- those inflicted with these impairments are required to turn to others to help them, limiting their independence.

The most natural solution to this problem is to apply the same motion used to close the cabinet or drawer to perform the opening motion as well. While some existing mechanical push-to-open drawer schemes use this method, they often target convenience rather than accessibility, only opening a few inches before stopping. While this is sufficient for some uses, it provides limited assistance in this case: for a person using a wheelchair, this would still require them to use an awkward angle to grasp the drawer in order to open it the rest of the way. If we instead attempt to push the door as far open as possible, then this could aid the user significantly.

The most natural design would be to extend existing push-to-open drawer designs with more (or longer) springs, which would allow the storage of more potential energy from the much-easier pushing motion that would then be used to push the drawer all the way open. However, this may prove difficult due to the intricacy and necessary strength of these parts; if so, an approach that uses the area along the length of the drawer on one side could be used (allowing a very long space for the spring and locking mechanisms), with the downside of requiring modifications to the drawer itself rather than just its mounting hardware. A drawer designed with this exact purpose in mind could keep the springs on the exterior of the drawer by adding extra gaps on the back corners to allow for the extra space of the springs and locking mechanisms. Another alternative would be to take a motorized approach at the cost of adding electronics to the system. All of these approaches would likely require 3D printing at the very least, and either the laser cutter or the ShopBot could likely be used for creating the structural pieces of the drawer itself.

Proposal:

Constraint Induced Language Therapy is a therapeutic method found to facilitate language rehabilitation for individuals who have lost their language skills[1]. Specifically, the method capitalizes on the use of game mechanics to introduce constraints on communication and coordination during conversation. Game design is structured around the (1) the materials used in the game, (2) the rules of the game, and (3) reinforcement contingencies. While CILT is largely accepted in the speech-language pathology community, the materials of its implementation remain inaccessible. The project Meeple Like Us routinely conducts tear downs of common board games to provide guides on whether or not many off the shelf games meet accessibility standards[2]. This project proposes using the design guides of Meeple Like Us for best practices in creating table top games to design a therapy game using the prototyping capabilities of the various fabrication techniques that we've been learning and developing in this class.

[1] Pulvermüller, F., Neininger, B. and Elbert, T. 2001. Constraint-induced therapy of chronic aphasia after stroke. Stroke. 32, (2001), 1621–1626.
[2] https://meeplelikeus.co.uk/

Warren Glasner

4/21/18

Assistive Technology: Grip Assist

A pair of mechanized gloves for lifting objects. The goal is to provide support along the fingers, as well as giving mechanical support to the wrist (and possibly the elbow). It would employ mechanical and myoelectric sensors to detect muscle movements and move accordingly.