Portfolio

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GyroCoach 2.0

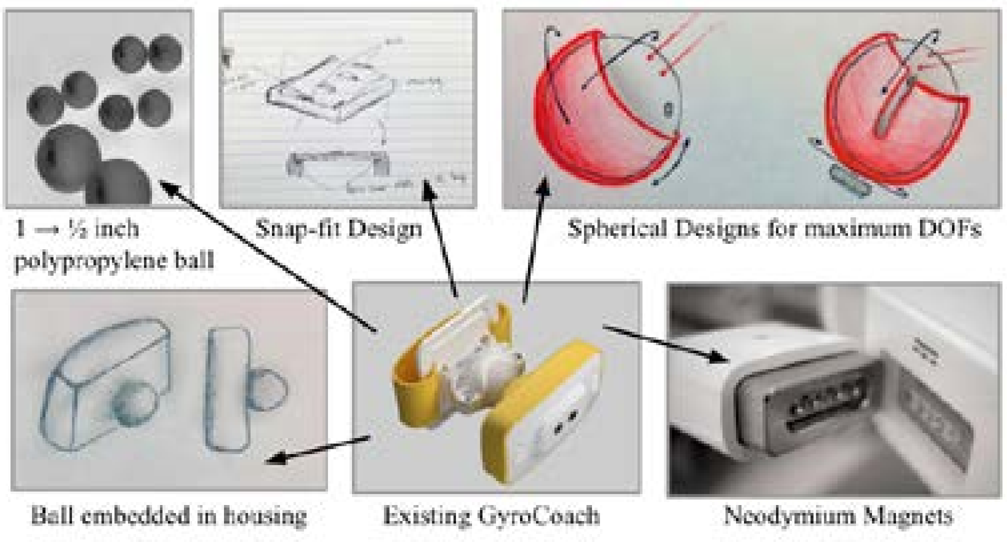
Fall 2018

Overview

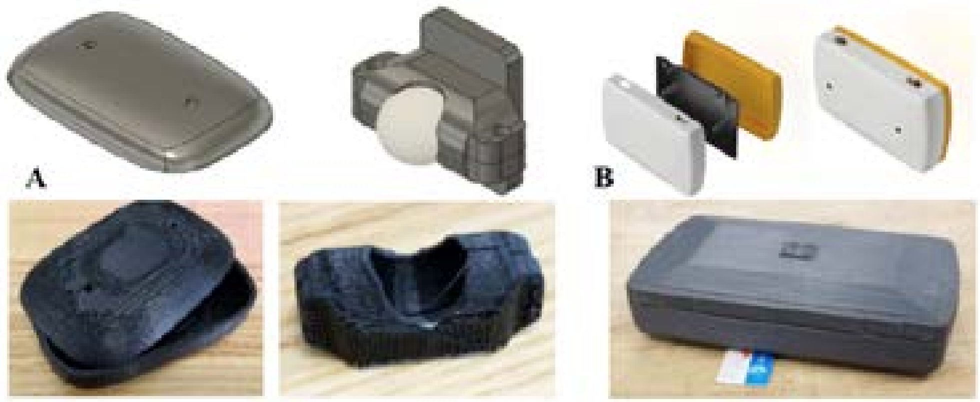
The GyroCoach provides laser guides that act as a visual cue that therapists and patients can use to define motion and postures. However, the current version of GyroCoach has issues such as attachment diffculty faced by stroke recovering patients with limited hand mobility and its weight which caused discomfort to the wearers. Our project group was approached by Ms. Stimson to provide design recommendations and create a functional prototype that could be manufactured via injection molding. **Within the group, I was in charge of redesigning the electronics enclosure and its attachment to the user and building a prototype enclosure.**

Brainstorm

For the case, we decided to **eliminate the need for screws with a snap-fit case** which would reduce the weight while maintaining manufacturability. To address ease of attachment, we debated between traditional belts, zip ties, and velcroes. However, traditional belts cannot be fastened with one hand, zip-ties cannot be undone, and velcro has a tendency to stick to everything which is highly inconvenient. The magnet design, inspired by the MacBook charger was selected since it could be placed and removed with one hand.



Initial brainstorms



Prototypes created during the process

Prototype

In our initial pass of prototyping, we realized that we should reduce excess space as much as possible such that the electronics could be secured without the use of screws. As we incorporated the snap fit in to the second pass of prototyping, we added slots for the switches, and guides for electronics to be held in place by the two pieces.

To attach the device to the user, we intially tested with neodymium strips on the harnesses to the magnets on the prototype. However, the strips did not provide enough force to support the weight of the hardware. Therefore we decided to implement non-stick velcro elastic straps with embedded neodymium magnets.

The electronics attached to the harness created by the group.

Result

With the finalized prototype, we were able to reduce slightly reduce the weight from the original product while improving the ease of attachment/ detachment. The client was extremely satisfied with the resulting prototype and its demonstration. One major weakness identified was that since the device was attached to the straps at a single point, it was possible for the device to come off if the user were to swing or move too quickly. Some solutions could be to increase the surface area of magnet, or increase the number of points at which the device is attached to the harness.

Finalized Functional Prototype

Visuals produced by the final prototype

Adaptable Hand

Fall 2018

Overview

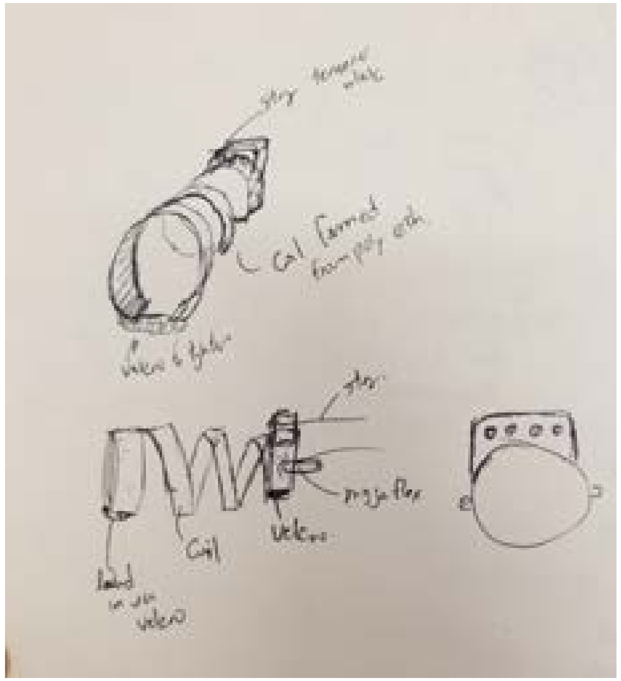
Adaptable Hand was a class project for ME C178 - Designing for Human Body, in which groups modified existing designs of a prosthetic hand from an online source to improve one specific feature. Our project group focused on being able to fit a large variety of arm sizes. I was tasked with **designing and building the forearm mount of the hand.**

Brainstorm

A major limitation of the current designs and materials of 3D Printed Prosthetics is that it can only fit a single size and requires scaling and reprinting to fit different sizes, especially for children who are growing. With children as user in mind, our main criteria during the brainstorm session was size adaptability and robustness.

Original model from thingiverse

Palm model from thingiverse



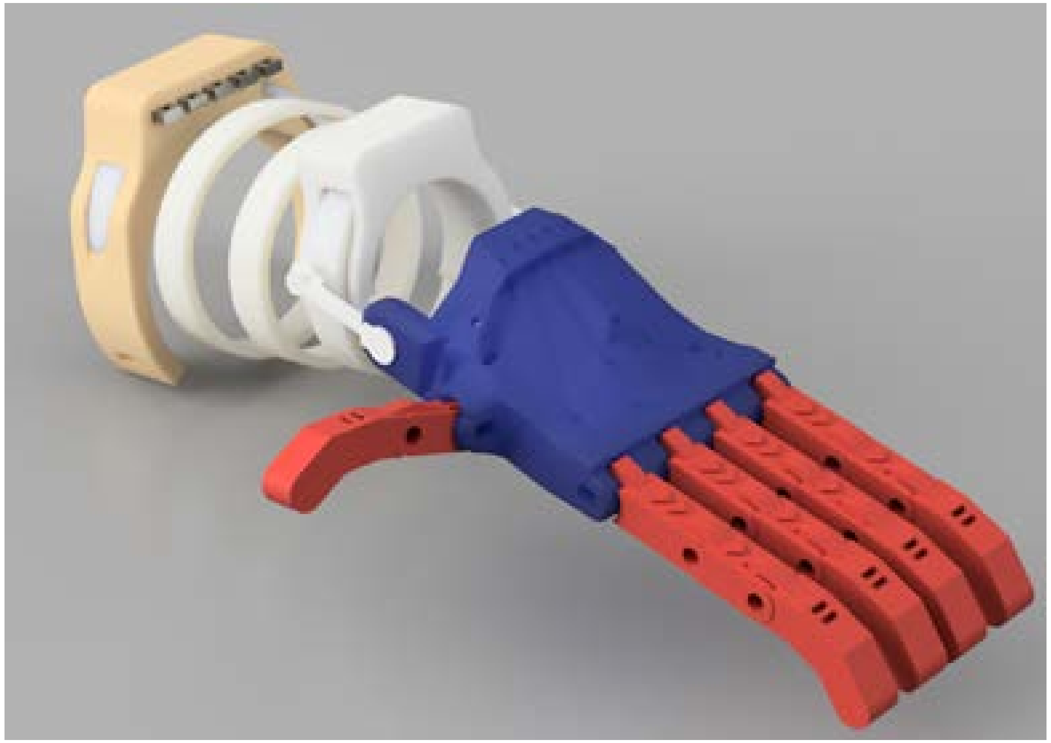
Initial sketch from brainstorming

Re-Design

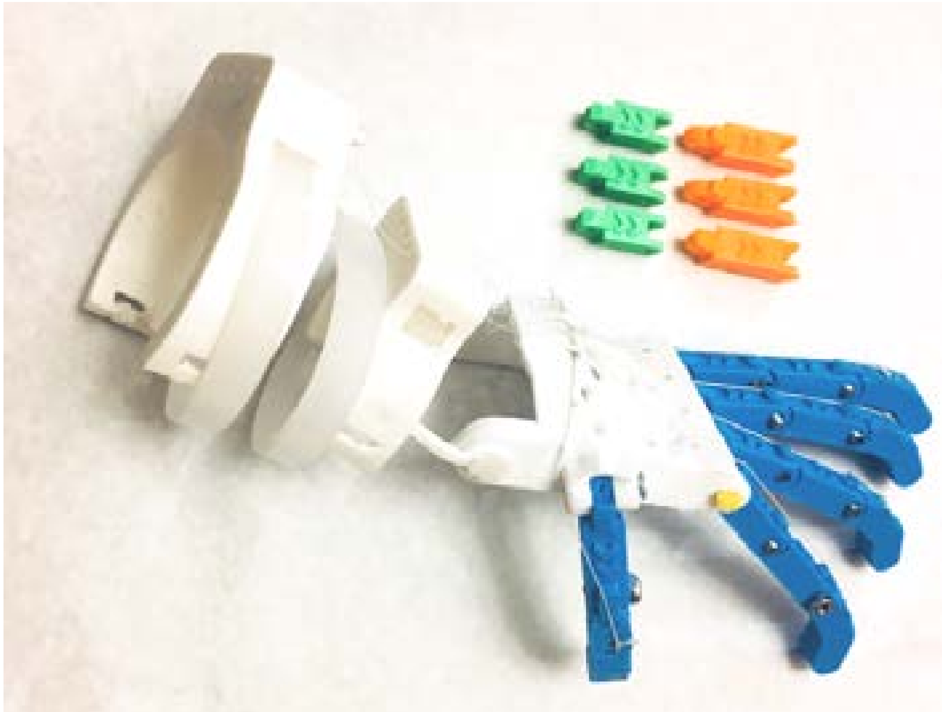
For the arm, I decided to create a coil using heat molded PET plastic to wrap around the user's arm. The PET coil provided the flexibility to expand or shrink in diameter on need while wrapping around the arm without being bulky or hard to breathe. The wrist and arm attachments at the ends of the coild were printed with ninjaflex for flexibility. The palm design was modified to be comptabile with ninjaflex connection between the wrist and the palm.

Reflection

The final prototype of the coiled wrist proved to be very successful where it was able to fit well many different sizes of wrists. However, there were occasional misalignment issues between the arm attachment and the wrist attachment, which affected the tension of the wires that curl the fingers. Furthermore, due to underestimating the tension required, the wires selected lacked the strength to maintain the tension.In the future iteration of the prosthetic, cords with higher strength should be used as well as addressing the misalignment issue by possibly adding a rigid support between the attachments.



Render of the finalized design



Assembled prototype

Room Anemometer

May 2018 - Present

Overview

The Anemometer project is to build a low-cost, compact, air-flow sensor in HVAC systems. I was tasked with **modifying the existing design to accomodate additional components**, as well as changing the outline of the main body per recommendation from Professor Arens **to minimize air resistance for accurate reading.** Further changes have been made based on feedback.

Process

One of the main concerns of the intial design was the sharp edge between the center lid and the main body of the sensor, which affected the wind velocity readings from wind resistance. To mitigate the effect of wind resistance, the main body's outer outersurface, as well as the arms have been modified to form a continuous, bullet-like surface with the lid.

Result

The anemometer readings from the modified prototypes became more consistent with expected values and the anemomter is planned to be shipped to industry partners in the coming months.

Initial model

Render of the modified model

A printed model for fit testing

Personal Comfort System

May 2018 - Present

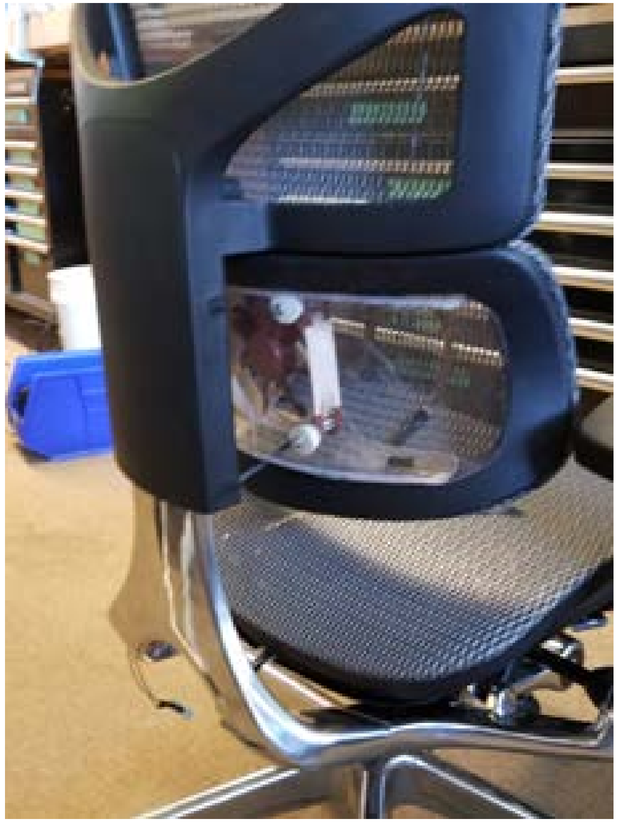
Overview

Personal Comfort System is a personalized thermal comfort system that can accomodate users' different temperature needs. I was tasked with **transferring the heating and cooling element and the electrical system to a new chair** to create a proof of concept to be presented before potential investors.

Process

An approximate shape for the bottom and back housing unit was made from cardboard to be used as reference for making cutouts with ABS and polycarbonate. I added a heat molded polycarbonate as a backcover to protect the fan, the heating coil, and the insulation from any outside hazards. For the bottom cover, ABS with cutouts were used to mount batteries, fans and electronics since the sheet required flexbility from the possibility of the user's weight pushing all the way into the seat against the plate. The old charger which was directly attached to the battery was replaced with an old macbook magsafe charger unit to prevent damages caused by wire trips, which was common with the old system.

Original model used in research



Polycarbonate backcover

Result

The protoype as been shipped to a manufacturer in China for a potential licensing.

A housing for the battery status light was 3D printed.

Final product, that was sent. The Back was covered with a black cardboard to simulate the intended aesthetic.

Windmill Tower

Fall 2016

Windmill Tower was a class project to design a windmill tower and baldes. Stiffness was tested by attaching an increasing amount of weight on the tower until fracture. The wind blade was tested by attaching it to a motor and blowing wind across it and measuring the power generated.
I was responsible for designing the motor hub and the tower which had the highest stiffness to weight ratio out of the class.