



2023 ANNUAL REPORT

Enabling Engineering

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Disability is one of the most important issues in the contemporary society, with the likelihood increasing as individuals age. Supportive resources for individuals with disabilities are oftentimes costly, inaccessible, and reduce an individual's ability to perform specific tasks independently. Additionally, insurance often fails to cover expensive devices or services needed to carry out everyday tasks.

We seek to support this population via low cost, customized solutions that empower individuals by giving them greater independence, reducing medical burdens, and increasing social connectedness.

This annual report serves as an overview of our projects but is by no means exhaustive. Much of our work is dependent on our collaborators, clients, and supporters and we want to express deep gratitude for all of those who have helped us make 2022 such a successful year.

ENABLING ENGINEERING

Who we are: Enabling Engineering is a Northeastern University student group that designs and builds devices to empower individuals with physical and cognitive disabilities.

What we do: Our students collaborate with clients on projects that provide greater independence, reduce medical burdens, and increase social connectedness. We help family members, clinicians, and teachers care for people with disabilities.

By giving students the opportunity to participate in Enabling Engineering projects, we are training the next generation of engineers to be knowledgeable about, and aware of, the needs of individuals with disabilities.



2023

an inside look at the

ENABLING ENGINEERING TEAM

Management Team



Ilaina Schneider



Evan Dakov



Zoia Okulova



Prithika Jean



Nitin Sadhia



Priyanka Tyagi



Jona Fezjaj

Program Manager



Priyanka Jalan

Founder & Faculty Advisor



Waleed Maleis

OUR IMPACT

Student Testimonial

- "The reason I chose to study engineering was to solve important problems and try to make people's lives around me better. This project with enabling engineering allows me to do just that. I am proud to have worked on this project to help Julie-Marie and other disabled filmmakers pursue their passion" - [Alexandros Paliouras](#)
- "I think it's remarkable to be able to apply my technical skill set from classes to an area outside of the field and have a positive impact on the filmmaking community by opening it up to all people."- [Olivia Peters van Aalst](#)
- My project with Enabling has been exceptionally rewarding. On top of being able to put what I've learned in classes into practice, I've learned quite a few new skills. The experience that I've gained has helped me in coops and will certainly help in future jobs. Most importantly however, it has provided the very unique opportunity to work on a project with the sole purpose of improving someone's quality of life. Working closely with the our client and ensuring that our design is meeting all of their needs has been the best part of my project and a highlight of my college career. - [David May](#)
- I have very much enjoyed my experience working with Enabling Engineering. It was one of the most fulfilling parts of my week whenever we would meet or progress on our project. Using my engineering skills to help others is one of the biggest things I want to do with my degree, and working with Enabling Engineering has helped me do that. I look forward to working more with Enabling Engineering in the future. Enabling Engineering has helped me focus my mind more on accessibility with designs given the constraints of the respective clients. I am also always learning more about working as a team. - [Sal Campo](#)

Client Testimonial

- "Thank you all so very much for your incredible work on this project. It was an amazing experience. I know that it was a lot of work for you and I really appreciate all that you did. I hope that you had a little fun with the process as well. My students and staff are loving it! Thanks again. I am overjoyed and thankful!" - [Mollie Carvello \(South Shore Education Collaborative\)](#)
- By involving the end-users in the design process and tailoring solutions to their specific needs, Enabling Engineering embraces the principles of human-centered design. These students are transforming the traditional perception of engineering and harnessing its power to create positive change. In my case, they designed a low-cost, durable wheelchair camera mount for the organization I founded, the Disability Justice Project (DJP), which trains persons with disabilities in the Global South in documentary storytelling. In a robust media ecosystem, we need a diversity of practitioners at the table - to recognize who is there by choice and who is absent by design. Thanks to Enabling Engineering for helping the DJP take a huge step forward in making filmmaking more accessible for everyone. - [Jody Santos, founding executive director, Disability Justice Project. Associate Teaching Professor, Northeastern School of Journalism](#)

MUSICAL SENSORY WALL

Overview: To design a Musical Sensory Wall for children with all kinds of disability

Status: Complete

Members:

Valentina Ribeiro, Katherine Poissant, Owen Van Sickle

Client:

South Shore Education Collaborative



The Need

The client currently uses music to provide therapy. The schoolteacher, Molly currently holds therapeutic sessions for the children in the school. The clients wanted to incorporate a musical board with different instruments, and the use of the wall would serve as a reward or therapeutic break for the students inside the music room. Further, this wall would be used as a form of physical therapy, a sensory tool, and to assess the children's interactions with the instruments, such as whether they are able to grab, squeeze, or hit a target. This wall needs to be accessible to a wide range of users, including students who are deaf and blind. Further, students who would use the wall on their stomachs, in wheelchairs, and in chairs that assist them in standing up to 6 feet will also be using this wall. These children have a wide range of abilities, so it is important that we thought of all types of users.

The Solution

The need was addressed by creating a music sensory wall that adapts to the needs of our client. One of the challenges of creating this product was to find a way to display it and adapt it to the user. We proposed the idea of two 4'x6' boards that are mounted to slide them up and down. This allowed children to reach the board standing or on their stomachs, which was requested by the client. These boards have different instruments attached. The boards are split based on whether the instruments are calming or more stimulating. This allows a user to decide which board they need. Beyond instruments, we included lights and other electronics such as haptic vibration to further stimulate the user. Finally, we included sections of the board that fold down for children in wheelchairs or in other similar situations to better use the wall.

MODIFIED PROX TALKER

Overview: Modifying an existing prox talker according to the clients needs

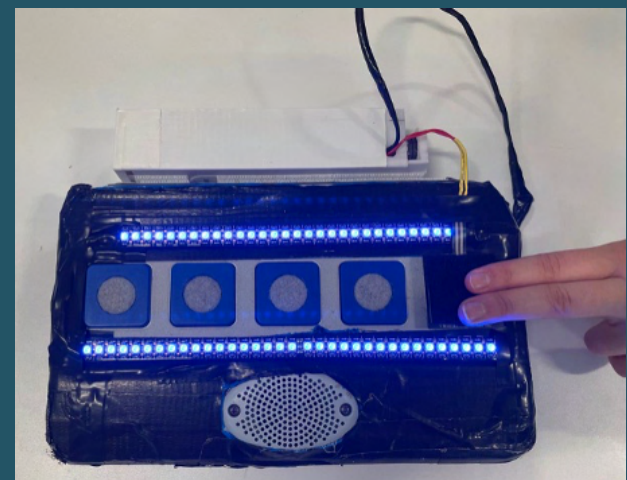
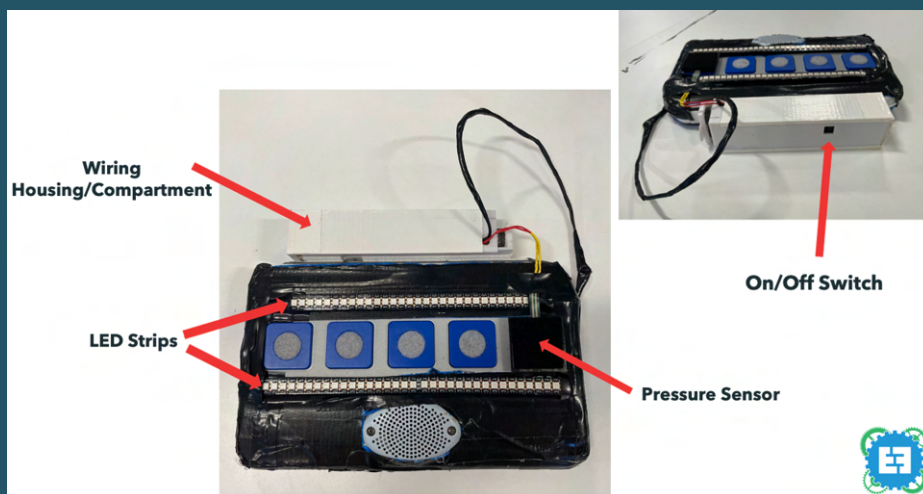
Status: Complete

Members:

Rebecca Ramos, Dorthea Geroulakos, Fahia Bashar, Xinyi Looi , Prithika Jean

Client:

Perkin School Of the Blind



The Need

Communication amongst hearing and non-hearing individuals is vital for student education and human wellbeing. The Perkins School for the Blind works with individuals aged 3-22 years old who are blind, visually impaired, or deaf blind. A speech and language pathologist approached Enabling Engineering with a request to adapt a ProxTalker device for an 18-year-old student who is diagnosed with cerebral visual impairment (CVI). Currently, the ProxTalker device enables users to communicate with others using RFID tags linked to common words and phrases. The RFID tags can be put together by the user to build common sentences. The ProxTalker device then audibly reads the message out loud to the intended audience.

The Solution

As the student user is deaf, the client had requested the addition of visual feedback such as light responses to ensure that the user's message is heard. Our goal was to adapt the current ProxTalker device to best fit the needs of the client and student. To address the need of the student at the Perkins School for the Blind, we modified the ProxTalker device to include visual cues such as lights and LEDs. In designing the modified ProxTalker, there were numerous qualities that must be considered like safety, cost, sturdiness, performance and many more.

UNIVERSAL WHEELCHAIR CAMERA MOUNT

Overview: Building a universal wheelchair camera mount for filmmakers who sit on wheelchairs

Status: Complete

Members:

Olivia Peters Van Aalst,
Alexandros Paliouras

Client:

Jody Santos (Disability Justice)
and Julie Marie (Activist)



The Need

The client who is a filmmaker, she sits on a wheelchair and always requires some sort of assistance when filming. They asked to build them a universal camera mount that would attach to her wheelchair easily and allow the client to fully develop her own film without asking for help from external sources

The Solution

Designed a high adjustable camera mount with a clamping mechanism to be attached and removed from the wheelchair footrest as needed. The mount telescope pole is approximately 2.5' - 3.5' to allow the camera to sit eye-level. The pole clamps onto the footrest of the wheelchair and is easy to remove. Using a pivot joint at the top of the pole, a camera tripod can be attached so the camera can be adjusted in front of the wheelchair user.

BLIND NAVIGATION MAP (EXTERIORS)

Overview: Creating an 3D map of the Museum for visually impaired.

Status: Complete



Members:

Conner Ellis, Elise Cooke,
Gabe Peralta, Nicole Tanelli,
Sophie Chabot

Client:

Ronit Minchom
Museum of Fine Arts

The Need

Individuals with visual impairments have been traditionally limited in their interactions with visual art museums. This project is focused on creating a 3D printed map of the exterior layout of the Museum of Fine Art to enable individuals with visual impairments to independently orient themselves about the MFA.

The Solution

The primary objective is to enhance the MFA way-finding experience for individuals with visual impairments via a portable, tactile map by extruding the digital copy of the map to develop a physical 3D print. The map is easily transportable, tactile, and comprehensible. For transportability, we developed a 3D printed map booklet of the four levels combined by binder rings. While the booklet will be tactile regardless, we want to ensure that the tactile experience is comfortable and discernible. Lastly, to ensure the map is comprehensible, we plan on experimenting with various sizes, extrusion heights and symbol markers.

WHEELCHAIR BACK PEDAL LOCK

Overview: Built a wheelchair back pedal lock for manual wheelchair users

Status: Complete

Members:

Alejandro Hervella, Guidelson Celamy, Katherine McElderry



The Need

The need to be addressed here was for a middle ground in which the wheelchair can move forward and turn on forward motion but would not roll backwards. This allowed the wheelchair user to propel themselves up hills and long ramps without the fear of rolling backward if they lose grip or get tired. This would be beneficial for both self-propelled wheelchair users as well as those who aid wheelchair users by pushing their wheelchair from behind. Wheelchair users and aids are subjected to long steep inclines of wheelchair ramps and it is difficult to propel up the entire incline. Unexpected rolls can sometimes be the cause of falls from speed or loss of control or place the user in dangerous situations such as rolling back towards a busy street or rolling into other pedestrians. As a result, using the device will improve the overall safety for wheelchair users.

The Solution

We planned to address this need by designing and building a rollback brake that allows for forward motion without rollback. This would likely either be a friction lock or a ratchet system that can easily be set on or off so that it doesn't affect movement when it is off. The team explored the larger design concepts and considered their merits before narrowing it down to the idea with the most potential. We found a universal solution with attaching the brakes, such as along the axle of the wheels, or along the backrest bars. In any case, we implemented the brake such that it can be activated and deactivated via a simple switch, this control will be small and flexible enough to be placed anywhere the wheelchair user desires. The location of the brake controls will be around the armrests or the wheels of the wheelchair. This way the user and whoever is propelling them would be able to turn on and off the brake as needed. The goal of this device was to be simple enough that prior knowledge is not required to add it on to an existing wheelchair.

CRANKLESS BIKE

Overview: A custom-made bike that allows for easy commute without putting strain on the client's back or leg.

Status: Complete



Members:

Faith Lukang, Emilina Tran,
Preston Luh, Benny Wu, Prithvi
Raj Macha, Magan Lee, Nitin
Sadhia

Client:

Professor Richard Swasey



The Need

The vast majority of commercially available bicycles are not designed to accommodate a wide variety of body types. Available models are generally uncomfortable, incapable of supporting large frames, and are difficult to balance on uneven terrains. Our client was in need of a easy ride bike capable of supporting up to 300 pounds, altered with comfortable sizing, large and balanced wheels, and storage components that would allow him to get around campus.

The Solution

Our product was highly modified bike catered to the client's needs. The pedals and chains were removed, the bike seat was replaced by one with a larger base, and larger adult training wheels were added. These modifications made the bike more comfortable and balanced for the client, allowing him to traverse uneven terrains around Northeastern's campus. The bike was also fitted with additional features such as a basket and cane holder for convenience, and was based off a foldable model if possible to make it portable and lightweight.

WEBSITE FOR UPPER LIMB PROSTHETICS

Overview: A website that would be a complete guide for those with upper-limb prosthetics

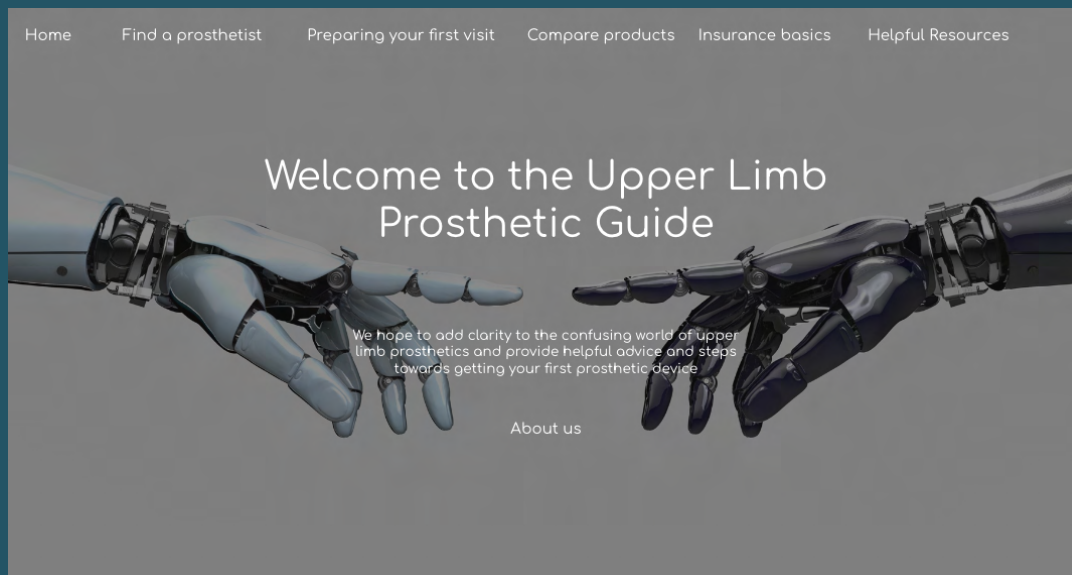
Status: Complete

Members:

Parth Patel, Quang Ngo, Tasmiha Amir, Eva Chamard

Client:

Nicole Kelly



The Need

This project was targeted towards individuals with upper limb loss looking to get their first prosthetic device. The field of upper limb prosthetics is currently much smaller than lower limb prosthetics and there are few resources for those with limb loss to learn more about their prosthetic options and the steps towards getting their first prosthesis.

Many prosthetic users find information through social media, asking their questions on Reddit or discovering new prosthetics on Instagram. This poses a problem because many of these devices seen on social media are either not accessible products or custom devices not available to the typical user.

The Solution

The idea was to create the foundation of a website to inform users about upper limb prosthetics. This website would ideally be interactive and intuitive. Some ideas include a survey-based platform to help guide users towards the information they're looking for and ways to connect users. A survey-based platform is one concept to make the website interactive and intuitive. The idea was to use targeted questions (think of a flow-chart) to guide the user towards the information they are looking for. We were looking to make an application or a website that would help prosthetic users gain a better understanding of the options they have available to them prior to meeting with a clinician. This website provides users with preliminary information.

ADAPTIVE DOG TRAINING DEVICE

Overview: Large US puzzle and tactile alphabet letters to facilitate learning in the classroom for visually impaired

Status: In Progress

Members:

Nitin Sadhia, Magan Lee, Sal Campo, Mars Keeseey

Client:

Jason Lake



The Need

The client for this project is Jason Lake, a professional dog trainer and handler who was born with a congenital condition which leads to reduced mobility of his joints. Jason uses an electric wheelchair and due to his condition, he does not have the ability to easily throw balls and toys to the dogs he trains. He has stated that he would like to use a ball launcher that can shoot rubber balls approximately 2-10 feet within a couple of seconds in order to reward the dogs he is training and reinforce certain behaviors. The device should be designed such that he can drop the ball into it with little to no additional force provided, and simply press a button or trigger to shoot the ball.

The Solution

The plan to address our client's needs is to create a dog-training device that attaches to his electric wheelchair. To make the launcher more convenient and less encumber some for the client, it would be mounted by magnets or another form of removable attachment system. This device would be able to shoot Gappay medium-sized rubber balls a distance of 2-10 feet as a reward system for dogs being trained by our client, Jason. Due to his range of motion, he will use his mouth to grab the rope that is attached to the ball and drop the ball into the device in order to load it. He will control the launcher by using a remote and instantaneously launch balls at the press of a button. The ball would likely be launched via a battery-powered piston mechanism which will retract back into place after firing.

CLINICIAN LIGHT

Overview: Light weight, low-cost clinical light for nurses to work with on patients

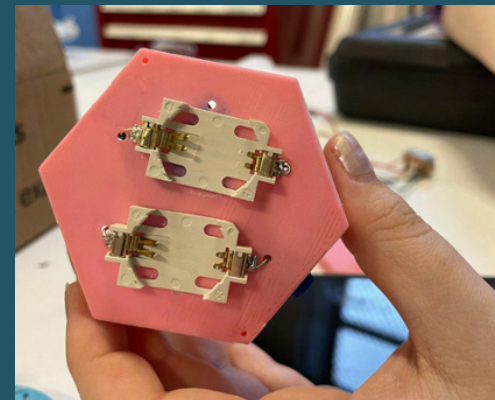
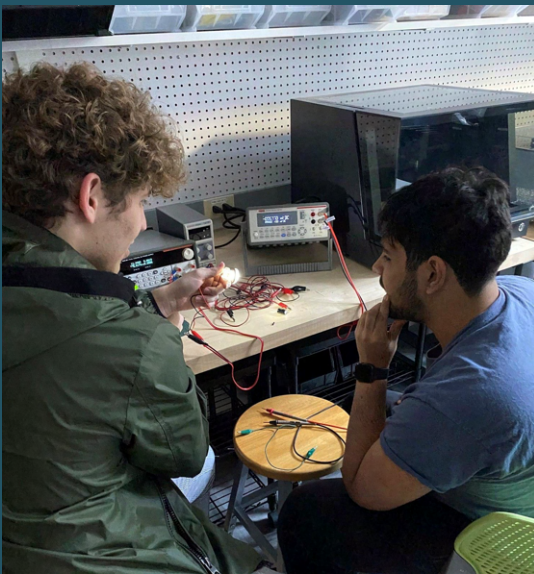
Status: In Progress

Members:

Diego Acosta, Antonia Simas, Jonah Levis

Client:

Stephanie Pretty



The Need

When clinicians need to enter the rooms of patients, it can be very disruptive to the patient, as they may need to turn on lights in the room to see, take notes, or examine the patient. This makes the patients uncomfortable as they may be sleeping or the lights may be hurtful to their eyes and the clinician would not want to harm them. With a small adjustable light, the clinician can do their work in the patients' rooms with little or no disruption to the patients.

The Solution

The light would be on a small clip that can be attached to the clothing of clinicians. It would have multiple different color settings as well as a dimmable brightness. These multiple lighting settings allow the light to be used in many different room environments without disturbing patients that may be in the room at the same time.

ACCESSIBLE ROKU TV REMOTE

Overview: Accessible custom remote for the client

Status: In Progress

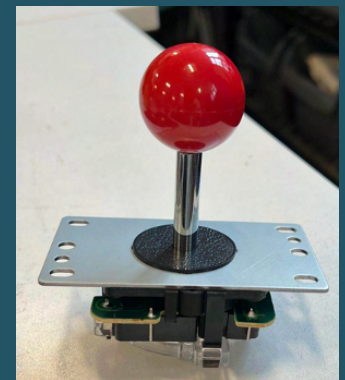


Members:

David May, Tasmiha Amir,
Thomas Bell, Jianning Chen

Client:

Max Planksy



The Need

Our client with Cerebral Palsy has difficulty using a television remote. Because of this, he needs others to assist him when using the remote; however, assistance is not always available, so an accessible Roku television would allow for more independence and suit the need.

The Solution

The Roku television remote is modified by adding a joystick-operated interactive system as well as several larger buttons on the remote. These modifications would help make the remote more accessible and help the client use the services connected with Roku TV independently.

ADAPTIVE BOCCIA

Overview: Building a ramp out of PVC pipe to throw the ball for those who have restrictive mobility with their upper body.

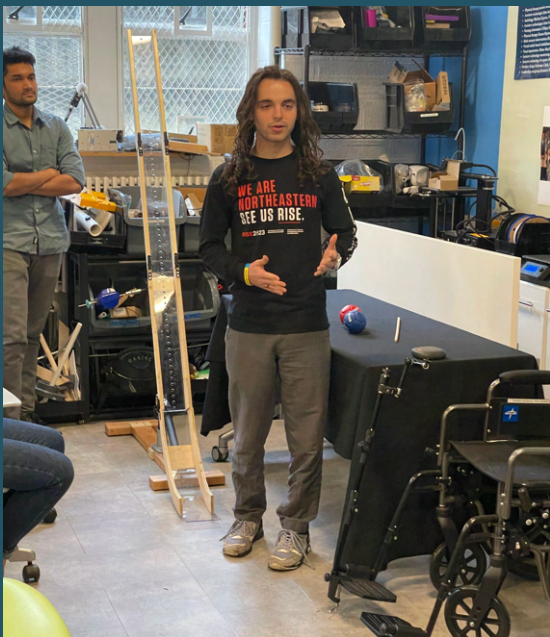
Status: In Progress

Members:

Dylan Hogan, Jennifer Yeo,
Ryan Potechin, Deekshita
Gorrepati, Lavanya Senthil

Client:

Boston Self Help Center



The Need

Many people living with disabilities do not have the ability to participate in sports and recreation activities that able-bodied individuals have access to. The aim of the Boston Self Help Center was to provide those with disabilities access to sports and recreation opportunities to improve their physical and mental health and wellbeing. The Boston Self Help Center is looking to begin an adaptive Boccia program with the goal of gaining participants from the Boston community who live with physical disabilities. Boccia ramps would help to make the sport accessible to those with a wide range of physical disabilities.

The Solution

2 ramps would be made for use by the BSHC in creating an adaptive boccia program for disabled persons in the Boston area. These ramps may be used for weekly meetings of program members. 1 ramp will be brought to a service site in Ecuador. This ramp would be used by children with physical disabilities in Ecuador and provided to the site during the next trip upon completion of the project. The last two ramps are for by the Boston Home. If residents are interested in frequent use of these boccia ramps for recreation, we will consider making an additional two ramps for the site depending on funding. These ramps could potentially be used in conjunction with Northeastern service learning students to assist the residents in playing the sport, and develop a new service learning site for the school.

ADAPTIVE DRUMSET

Overview: A custom made set for the client to play drums as an hobby

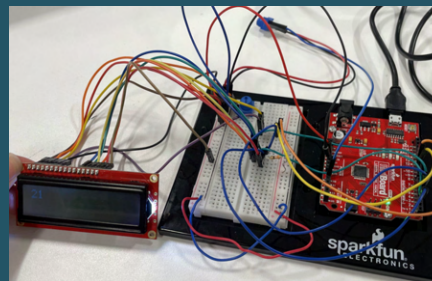
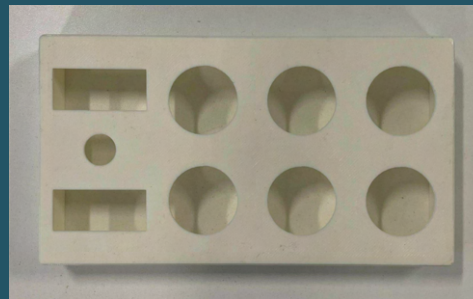
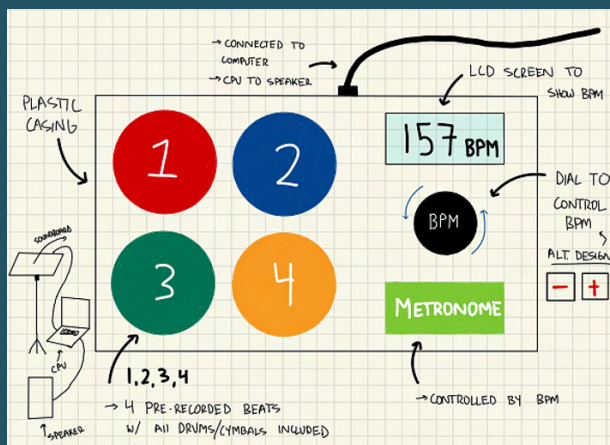
Status: In Progress

Members:

Faith Lukang, Emilina Tran,
Preston Luh, Benny Wu, Prithvi
Raj Macha

Client:

Brian Manning



The Need

The client has limited use of the left side of his body but wishes to play the. We have been tasked with creating an apparatus that allows the one-handed usage of an drum set. The client requires us to make a set that will allow him to play notes and create beats without having to use in left hand much. Currently he can only play some parts of the drum set

The Solution

Our solution was to make him a electronic Console that would include 6 buttons, 1 LCD display, 1 buzzer and 1 potentiometer. It would be displayed adjacent to the drumset. It would allow him to press buttons and dials before beginning to play. Each buttons play a different beat. The beats simulates playing along with other instruments and adds additional drum set features such as hi hat and cymbals

THANK YOU

Enabling Engineering wants to thank all of those that have made it possible for us to continue to scale our impact. We want to express gratitude to our collaborators for offering professional and technical expertise, our clients for providing essential feedback, and our donors for ensuring we have the resources needed to operate.



Enabling Engineering particularly thanks our major donors, without whom our work would not be possible:

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