



2022 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.



2022

an inside look at the

ENABLING ENGINEERING TEAM

Management Team



Ilaina Schneider



Evan Dakov



Irfhan Shaw



David Ewen



Arianna Ranalli



Priyanka Tyagi

Program Manager



Priyanka Jalan

OUR IMPACT

- “I joined Enabling Engineering at the start of my first year at Northeastern. Designing and creating products that have a real impact on the public has been extremely rewarding. Working on projects and in the Management team has helped me to strengthen many critical skills for class and the outside world. I appreciate how welcoming Enabling Engineering is to people from all majors, expertise, and experience and how everyone's ideas and thoughts are always heard and considered throughout the process of each project.” [Ilaina Schneider, Civil Engineering Major](#)
- “I joined Enabling Engineering the fall semester of my second year here at Northeastern and each semester since then has been more rewarding than the last. Enabling provided me with my first real project experience through which I have been able to build my technical skills and gain an understanding of the ins and outs of project management. It's a great opportunity for students to learn and grow into engineers while working in a creative and collaborative environment.” [Arianna Ranalli, Mechanical Engineering Major](#)
- “As someone who's been involved with Enabling Engineering since my freshman year, I can say confidently that I've become a better engineer both technically and professionally. The exposure to real-world problem solving is amazing and getting to work together with the client and eventually lead a group of engineers with different ways of thinking to design and construct a solution opens your mind to so many ways of thinking and reveals areas of interest you never knew you had. However, during my time at XMAX, my biggest motivation has been helping our client, Max, and working to complete this project so he can play Xbox. This simple dynamic is something unique to Enabling Engineering that anyone interested in this field of client-based work should be a part of.” - [Sebastian Ardila, Mechanical Engineering](#)
- “I joined Enabling Engineering during my second year at Northeastern as a project team member, and later joined the management team as well. Not only did working on my project team enhance the basic technical skills I'd learned in Cornerstone, but it also taught me so many important interpersonal and communication skills. I was really pleasantly surprised as to how much independence our project team members get when it comes to communicating with our clients and designing solutions for them. The work I've done at Enabling was one of my favorite experiences to talk about during my co-op interview and above all it helped me feel prepared and ready to take on my first professional experience as an engineer.” - [Evan Dakov, Mechanical Engineering](#)

CLINICIAN LIGHT

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

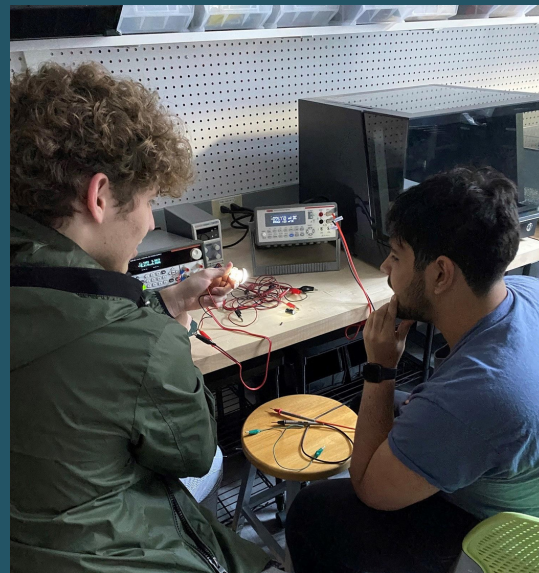
Status: In Progress

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.

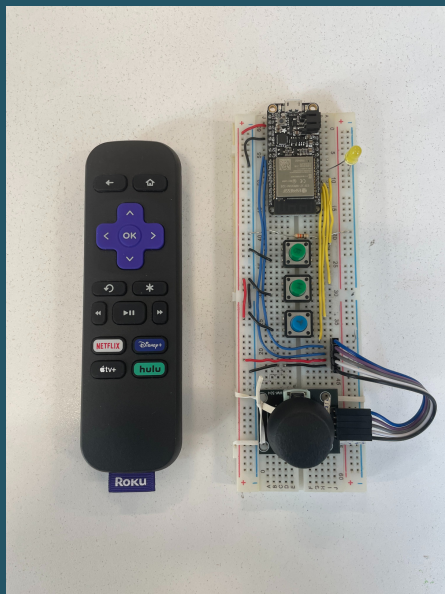
The Solution

The light will be on a small clip that can be attached to the clothing of clinicians. It will 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 being modified by adding a joystick-operated interactive system as well as several larger buttons on the remote. These modifications will help make the remote more accessible and help the client use the services connected with Roku TV independently.

SENSORY WALL

Overview: To design a portable sensory wall for individuals with sensory impairments such as tactile and visual to strengthen motor and visual skills.

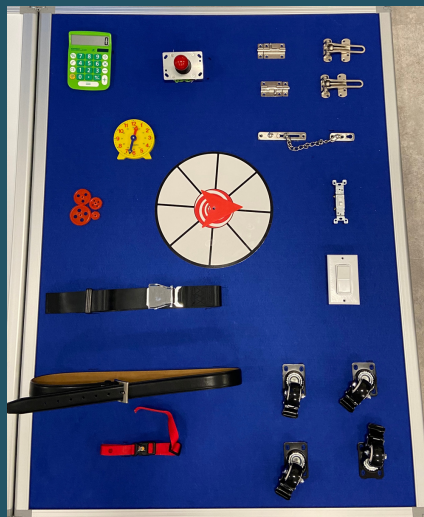
Status: In Progress

Members:

Arianna Ranalli, Alison Rogers,
Jillian Lombardi, Teertihveen
Parsicha

Client:

LifeStream



The Need

Adults with sensory impairments require therapies to strengthen their motor and visual skills and sensory wall can be used to cater to this need. The sensory wall should serve as a mode to strengthen motor and visual skills that is conveniently portable. The items fixed to the wall will incorporate aspects of touch, sound, and sight with the intent of creating a stimulating device that will promote interaction with the environment for the users.

The Solution

The wall is composed of 3 panels and has dimensions of 50.4 inches in height, and a total width of 106.5 inches, with each panel having a width of 35.43 inches. The design is portable to be used in all patient care rooms, which was done by attaching wheels to the base of the board structure. Lifestream has requested that it demonstrate daily task skills such as light switches, doorknobs, locks, belts, and buckles. Additionally, sensory stimulation devices displaying and verbalizing commands to complete certain tasks will further exercise visual, auditory, and tactile sensory responses. These components will be completed using Arduino software and coding techniques by building off of existing Arduino projects currently available.

TEACHING TOOLS FOR VISUALLY IMPAIRED

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

Status: Complete

Members:

Talin Calikyan, Evan Dakov,
Ilaina Schneider

Client:

Diane Poirier



The Need

Students with visual impairments require special teaching tools to facilitate learning in the classroom. While learning United States geography, students need to understand the shape and size of states. Physical models of each of the states allow students to hold and feel the outline of the state. Having the pieces come together like a puzzle would help students to learn where states are concerning one another. In addition to geography, students also learn how to read and write in the classroom. Physical models of letters would be a useful tool for students to learn what each of the letters looks like and to trace them with their fingers.

The Solution

Working on designing and building a large puzzle of the United States (approx. 4' in length), with each state its own piece and true to shape. The pieces will be solid black. Additionally, each puzzle piece will have a magnet to allow the pieces to stay in place while in the puzzle backboard. Five sets of alphabet letters have also been made (upper and lower case). Upper case letters are 4" tall and lower-case letters are 3" tall. All letters are solid red. Letters also have tactile grooves to trace the shape of them.

X-MAX GAME CONTROLLER

Overview: Develop an alternative Xbox experience for a client with cerebral palsy

Status: In Progress

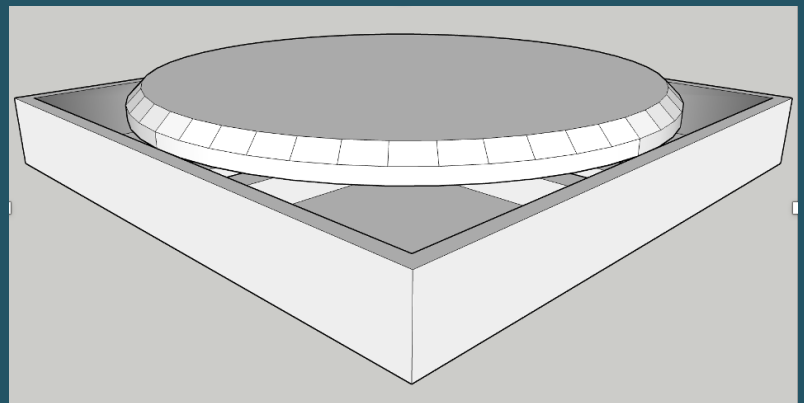


Members:

Sebastian Ardila, Matthew Luongo, Thomas Davie

Client:

Max Planksy



The Need

Our client who really enjoys playing video games has cerebral palsy. This inhibits his motor skills to the point where it is impossible for him to play video games. More specifically Xbox, using traditional control systems. Our controller aims to enable him to play XBox with minimal external assistance.

The Solution

Our current solution is an array of mechanical switches suspended around Max's head which allow him to control 4 of the 10 buttons on a traditional Xbox controller. The switches are covered with large foam pads to enable comfortable head operation. The recent update includes an inline companion controller so that an occupational therapist or friend can play the game with Max and aid him as he learns to use the device.

BLIND NAVIGATION MAP

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

Status: In progress

Members:

Evan Alexander

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 layout of the Museum of Fine Art to enable individuals with visual impairments to independently orient themselves around 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. We have completed the prototype of the first floor map and working towards designing the remaining floors of the museum.

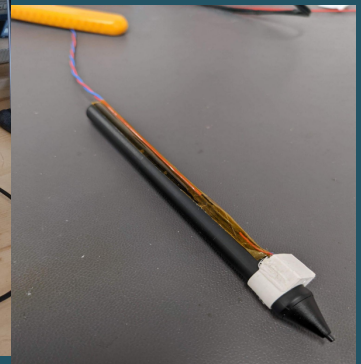
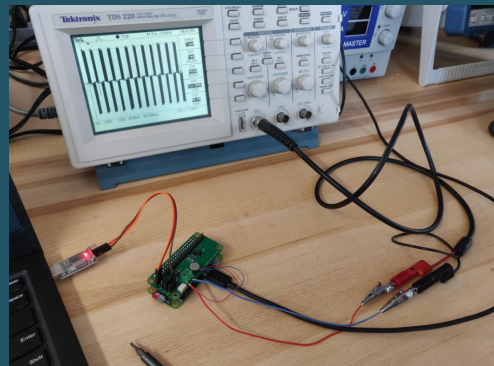
OSCILLOSCOPE FOR THE BLIND

Overview: An accessible oscilloscope for the visually impaired. This product provides hands-on learning that is 1.5x effective when teaching difficult concepts.

Status: Completed

Members:

Nicholas Fantasia, Nicholas Mullikin, Connor Northway, Alex Marley



The Need

There are 68,000 blind students in the USA where hands-on learning is 1.5x effective when teaching difficult concepts. Electrical Engineering is already difficult and there are almost no standard tools that are accessible for the blind.

The Solution

The primary solution was to design an oscilloscope with haptic feedback. The device consisted of a tablet and a stylus with the stylus vibrating on contact with the tablet. The device paired a haasoscope, a cheap and fully open-sourced oscilloscope, with a Wacom Tablet and Pen. The pen was modified with an affixed haptic motor driven by a floating cable. A custom PCB board was designed to add a haptic driver circuit to a Raspberry Pi. Eccentric Rotating Mass (ERM), which provided stronger vibrations, and Linear Resonant Actuator (LRA) motors, which provided sharper effects, were incorporated with custom driver software written to pair the motors with the haasoscope. Overall, the device allows for data visualization using haptic feedback allowing users with visual impairments to analyze electrical data easily.

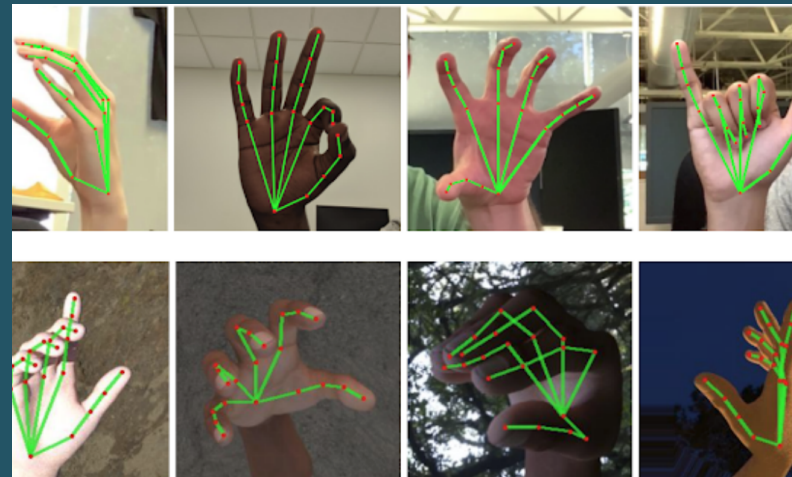
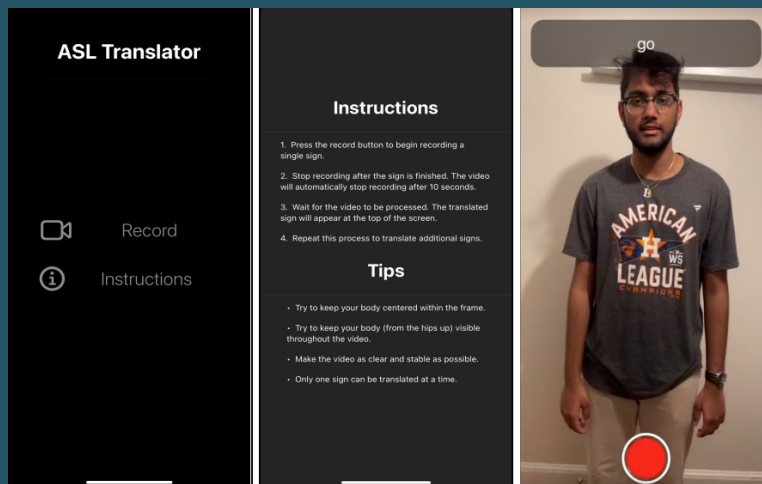
ASL TRANSLATOR APP

Overview: An ASL translator app that makes communication easier for the deaf.

Status: Complete

Members:

Ryan Corkery, William Funcheon, Sydney Lam, Yujia Li, Selena Nguyen, Gautham Velrajan



The Need

T2-3% of Americans (~9 million people) born with a detectable level of hearing loss. They have difficulties communicating with non-signing people. They have to always depend on written communication or interpreters and translation services not always immediately accessible

The Solution

The app will translate a small subset of important signs into English. Texts will be shown on the screen. The app will have a high (85%+) accuracy of translation and the service would be free. The app would run on modern smartphone hardware.

It would also have an iOS Software Application that would accurately and efficiently translate 12 American Sign Language (ASL) words or phrases to English on a popular platform. The app requires a smartphone camera to capture movement in a video and then it would translate output to the screen

ADDAPTIVE BOCCE

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

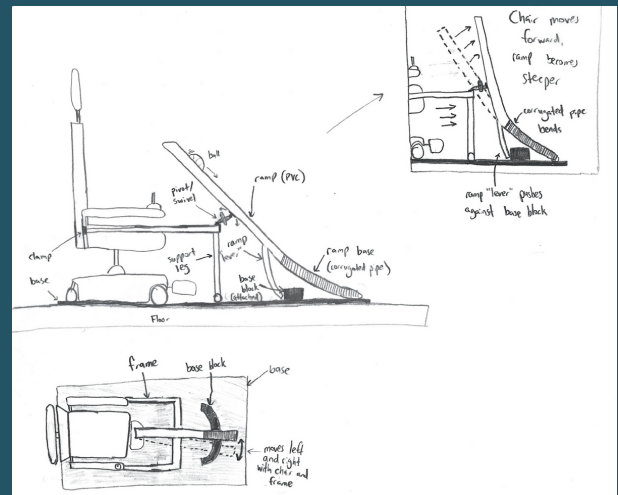
Status: In Progress

Members:

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

Client:

Dylan Hogan



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 is 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 will help to make the sport accessible to those with a wide range of physical disabilities.

The Solution

2 ramps will 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 will 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.

CRANKLESS BIKE

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

Status: In Progress

Members:

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

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 is in need of a folding bike capable of supporting up to 300 pounds, altered with comfortable sizing, large and balanced wheels, and storage components that will allow him to get around campus.

The Solution

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

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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Richard J. Scranton Fund
Timothy Moore