Project: EnAble v3.0 – An Affordable Prosthetic System and Design

SUU SUCCESS Academy

Research Plan

Jeron Osguthorpe

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Introduction

For my 2023 Science and Engineering Project, now named Project: EnAble (v3.0) (aka. Project: Enable All), I am continuing to redesign, develop and produce a more affordable, functional and efficient Prosthetic Hand by using microcomputers, sensors, programing and more. The overall goal for the project this year is to redesign a more economic, self-sustaining, self-efficient and functional prosthetic hand compared to previous year(s).

For this year, the goals are to create a prosthetic hand that is more user friendly, can complete a multitude of functions, including functions that just randomly get thrown at it. Meaning, instead of having a set number of functions that it can complete, it can alter itself at any given time to adjust to any circumstance.

Continuing from last year, the emphasis on being affordable is still high priority, however, by allowing for a small percentage of more money compared to last year, the goal is to create a prosthetic hand that makes up for that small percentage with a better product in the end. The overall goal is to stay in the same function to price ratio as last year.

By using CAD Engineering, as well as by referencing the design from the previous year (ISEF 2022) we can create a new design that better fits the parts that we are using this year, so that we can stuff more functions into the prosthetic hand as well as keeping a strong and efficient structural design.

In the end, the overall goal of the project this year is to create a prosthetic hand that will maintain affordability, while being much more functional, efficient and economically better compared to the previous year(s) project.

Materials and Methods

Methods

For this year's continuation of the project, we are first going to redesign the hand piece by piece. By using a design from Creighton University, which was used in the previous years project, we are going to create a new design with reference to the University's design, however, our design will be more built towards the parts we are doing, allowing for part integration into the hand so that less space is taken up for more space to use for other parts/features.

By first redesigning the hand, this will allow for more leeway of adding more features and different redesigns of the hand later in the project (if needed). For the next part of the project, we will use a base computer board, either a Raspberry Pi or an Arduino (model: unspecified). This will act as the main controller for the project. By using Python programming (for the Raspberry Pi) or C++ (for the Arduino), or even a combination of both, we will program a series of motors to complete functions to move fingers based on data collected by sensors.

The sensors that are being used for this project contain pressure sensors, gyroscope sensors, touch sensors, temperature, compass, GPS, buttons and more. These sensors will relay data back to the computer, which will from there decide how it's going to move the motors (a series of stepper motors, servo motors, or both).

In the end, by using the 3D printed new design of the hand, sensors, microcomputers and motors, the goal is to create an affordable, yet much more functional prosthetic hand compared to the previous year(s). By creating this affordable, functional prosthetic hand, we can produce a way to make the world more accessible to those with disabilities.

Materials

- Raspberry Pi 3B+
- Arduino (many types)
- Micro:Bit or PiSense
- Pressure Sensors
- Stepper Motors x5
- Servo Motors x5
- Wires (m-m, m-f, f-f)
- 3D Printer & Filament
- Resistors
- Breadboard
- Many Sensors (pressure, geometry, temp, est)
- Touch Screen for Raspberry Pi (if using Rasp)
- Other basic materials and tools
- Buttons
- Solar Panels (small) for providing power to the project if needed
- Battery compacts for the Rasp/Arduino for backup power
- Computer & Accessories (mouse, keyboard, monitor, laptop, flash drive, MicroSD, est)

Conclusions

In the end, the goal o the project is to create an affordable prosthetic hand, like last year, but this year improving the “Price to Functionality” ratio. The goal is to create a prosthetic hand that can adjust to whatever situation it is in, instead of having set things that it can do.

In order to achieve these goals, the price of the prosthetic hand is aiming to be under $300. Compared to prosthetics of similar functionality, that cost around $25,000+ this project is at least 83 times as cheap. We are achieving this by using a 3D design that will be open source based off the Beast Design from Creighton University. The project will in fact all be open source for this year on GitHub as respiratory “Project: EnAble”. This will help keep the cost down, as consumers will not be charged for the base code of the project.

With the many new functions that are being introduced this year, as well as the new “environment adjust” settings being introduced, the project will have many more forms of functionality for consumers, creating a very useful tool/prosthetic for those who need it.

As well as creating new functionality, this year the project aims to also be able to potentially be used not just in prosthetic hands, but in prosthetics of all types. With the same theory and design, the project can be converted to work with prosthetic arms, legs, feet and more.

Overall, Project: EnAble aims to create a prosthetic design and system to allow for the world to be more accessible to everyone, hence the name “Project: EnAble”. By creating an affordable way to help make the world just a little bit more accessible, the world can be a better place for many more people, and that is the goal.

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