CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35892

Project Title

Using Electromyographic Technology and Voice Control to Create a Cost-Effective Prosthetic Arm

Abstract

Objectives/Goals

My project#s goal was to create a prosthetic hand that rivals mid-priced prosthetics in both price and functionality. The original objective was to embed muscle control but I eventually added voice control because it added a tremendous amount of value for the price. The target price range is $250-300.

Methods/Materials

My most important materials were the Arduino board, servo motors, the 3d printer, sEMG electrodes, bluetooth module, two prong microphone and the rest were mainly used to assemble the hand. With the software side of the project, I split up the different components for EMG(for muscle control) and voice control. In order to maximize my efficiency, I split up the project into several smaller projects and combined each segment one by one. I first worked with the EMG side and determined that a conditional statement between three variables gave the most accurate results. The next module I needed to develop was the voice control. I went through several iterations for both hardware and software, but I concluded that that a VR shield provided the best results for the price.

Results

In its current state, I have to say that as a prosthetic, it would be relatively large and unwieldy for an amputee. This is mainly because the forearm houses the five servos and there is little space for anything else. As a result, some of the batteries and the Arduino must lie outside the original arm#s specifications. So currently, I would recommend it as a viable prosthetic, but not in its current state. More work would have to go into the design side of the project in order for it to be a worthy replacement.

Conclusions/Discussion

Overall, I do think my project is successful in terms of functionality but the usability aspect needs work. In order for it to be more usable, the user would have to use smaller microprocessor. In my current setup, there are too many parts outside the forearm that it is cumbersome to use. Moving forward, I would like to create an entirely new arm where I would use smaller motors embedded within the hand. This would free up the forearm to add the internal components with a lot of space left over. This space can be used to accommodate a wider variety of amputees because my current hand requires that the entire forearm of the user is missing. Regardless, my work has created a new foundation for cost-effective prosthetic hands that will hopefully change the lives of current and future amputees.

Summary Statement

For my project, I created a prosthetic hand (that used muscle control and voice control) with the purpose of minimizing the cost.

Help Received

Gavin Periera, an orthopedic professor at UC Davis helped me with information on amputation procedures, current prosthetic, etc; the staff at the Long Beach public library allowed me to use their 3D printers.