Name(s)

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Project Number

S1017

Project Title

Designing an Affordable Advanced Mind-Controlled Robotic Arm

Abstract

Objectives

The objective of this project is to improve an amputee's mobility and the ability to manage daily activities, as well as provide the means to stay independent. Along with the arm is a glass-encapsulated chip which would be capable of relaying electrical signals from the spine to the arm through the use of NFC (otherwise known as Near Field Communication) enabling the amputee to have better control over the arm itself. Currently, a typical robotic prosthesis cost substantial amounts of money and have a limited quantity of functionality. With this design, an amputee would be capable of living life as they once used to but at an affordable price.

Methods

Carbon fiber composite PLA, NinjaFlex filament, 3D printer, Dupont wires, Arduino Mini Pro, heat shrink tube, SG90 servos, fishing line, braided nylon sleeves, 9V battery, NFC chip, glass wafer, glass capsule, graphene capacitors and taptic engine. Tested the functionality of a robotic arm through the use of rapid prototyping and conducted stress tests through the use of OnShape and SolidWorks. In order to test the functionality of the robotic arm, I utilized EMG sensors as a form of input. Simulated connectivity between the robotic arm and glass-encapsulated microchip relaying the electrical signals from the spine utilizing Unity. Developed the code required to run the arm in collaboration with Loma Linda University and redesigned the chipsets by designing my own silkscreen. Utilized a modified injector from Loma Linda as a way to deliver the glass-encapsulated chip to the spine.

Results

The glass-encapsulated chipset was successful in relaying the electrical signals from the spine in simulations. The arm was also capable of having similar functionality to a normal arm with 290 degrees of freedom.

Conclusions

We can conclude that the affordable prosthesis designed would have similar functionality to a regular arm and be capable of allowing the user to have full control of the arm itself through the use of a glass-encapsulated chip capable of relaying the electrical signals from the spine to the arm.

Summary Statement

I built a robotic arm which would have similar functionality to a normal arm through the use of rapid prototyping and utilized a glass-encapsulated chip capable of relaying the electrical signals from the spine to the arm via NFC.

Help Received

I designed the robotic arm by myself utilizing some of the resources at Harvey Mudd College and received help writing the code necessary to operate the robotic arm at Loma Linda University along with the modified injector used to inject the glass-encapsulated chip into the spine.