Cost-Effective Robotic Arm Prosthesis Integrating Haptic Feedback, EMG Bands, FDM 3D Printing, and Novel Grasp-Type Auto Assistance Using Machine Vision

Choi, Jilly (School: duPont Manual High School)

The engineering goal of this project was to design a cost-effective and functional artificial limb with the integration of 3D printing, haptic feedback, and force-sensitive resistors (FSRs). Current prosthetic arms are still extremely impractical to use, being either simple and limited in their abilities/degrees of freedom (DoF), offer no feedback to the user, or are lucratively expensive, which are also often slow. For this project, the fingers, palm, and forearm were CAD modeled and 3D printed in PLA, control circuitry PCBs and electronics were custom designed and soldered, then all was assembled. In order to determine if the engineering goal has been met, the project was tested in 4 different aspects. Hardware performance, novel technology performance, real-world application performance, and cost each represent a dependent variable and aspect of testing. The current proposed arm, the previous year's prosthetic arm, and the industry-standard prosthesis each represent an independent variable. The "industry standard" for prosthetics was found by averaging collected statistics on various commercial and prosthetic research arms.