



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title A Cost-Effective Prosthetic Hand for Transradial Amputees	
<p style="text-align: center;">Abstract</p> <p>Objectives The goal for the project was to create an inexpensive prosthetic hand for transradial amputees capable of performing daily tasks. The team wanted the prosthetic hand to be user-friendly and proportional in size to a human hand.</p> <p>Methods All the prototypes used 3D printed pieces designed in Fusion 360. The first two prototypes used a glove to control the prosthetic hand. The glove would be worn on the user's functional hand while the prosthetic hand would be worn on the user's residual limb. Using flex sensors, an Arduino Nano detected which fingers bent. Using this information, the glove would send data to the prosthetic hand via bluetooth. When the prosthetic hand received this information, another Arduino Nano bent the appropriate fingers. In the first two prototypes, the fingers bent when continuous N20 motors pulled fishing line. The position of the fingers in these two prototypes were detected by potentiometers. In the third prototype, the continuous motors were replaced by MG90S servos, so there was no need for potentiometers. Rather than a glove controlling the prosthetic hand, the third prototype used a voice recognition module paired with an Arduino Nano. By recognizing specific vocal patterns, the prosthetic hand performed specific gestures. For the experiment, the independent variable was whether the functional hand or prosthetic hand were being used. The dependent variable was the time it took for hand to complete each task. The testing procedures involved the hands performing diverse daily tasks. The control was the time it took for the functional hand to perform the tasks. Katherine used her hand and the prosthetic hand for the testing while Michael timed and recorded the results and Basim videotaped the procedures. All programming was done using the Arduino IDE. Some code was written as inspiration from other sources. The code for the bluetooth modules used knowledge from code posted by Riffliiger, the code for the voice recognition used knowledge from JiapengLi, and the team learned how to program the Arduino to work with servos by looking at code from Scott Fitzgerald. However, the entirety of the code wasn't modified, instead, the team merely used simple statements</p> <p>Results The first prototype was a failure because it was unable to close or open its fingers. For this reason, it was not put through the testing procedures as the team knew it didn't work. The second prototype was put through the testing procedures, and it succeeded at three out of four procedures. Out of the three procedures it completed, the time difference for each task between the prosthetic hand and the functional hand was on average 27.55 seconds. For the third prototype, testing is ongoing. However, the third prototypes has</p>	
Summary Statement The team successfully created a prosthetic hand for transradial amputees that performed everyday tasks. The cost of the hand was a mere \$200, this cost is a fraction of the cost of the current functional hands on the market.	
Help Received The programming, 3D modeling, research, and construction of the prosthetic hand were done entirely by the team.	