Second Presentation: Project Update to Team

EE 454: Robotics Design & Professional Practice

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Karissa Barbarevech and myself, decided to design and create an intelligent prosthetic arm for our EE 454 senior capstone project. To overview the project for the team, this arm is used as an insurance policy for the user. As part of the user's insurance plan, he or she must attend a calibration session to have data logged for their brain signals based on their arm movement. Therefore, if the user should lose a limb in the future this prosthetic will allow for no learning curve. The user will be able to simply attach and go. The calibration requires a Microsoft Kinect to capture data relating to arm and hand movement in space and correlate it to the users' EMG and EEG signals. This will somewhat mimic a database of the user's arm and hand movement. This will allow for the prosthetic to be controlled solely by the users' brain signals in the long run. A RaspberryPi (using Python language) will record the users' brain signals using a High Precision A/D converter shield to process the signal and then will output movement to servos on the prosthetic.

A summary of how to accomplish this project is the created milestones. My partner and I have two individual milestones. Her first milestone is to get the right arm device moving smoothly and coordinates determined for myself. Her second milestone is to get communication between the Pi and the fit-PC. My first milestone is to get the right arm movement detection software running on the Kinect. My second milestone is to obtain EMG and EEG signals with PowerLab – detect and save signals using the fit-PC simultaneously from the Kinect and PowerLab. These milestones will put us on track to complete the project.

The team thus far has accomplished several goals. The prosthetic arm has been fully constructed. The shoulder motors had to be replaced to support the arm. Two DC motors are used so there is enough torque to support the arm when it is lifted. They are connected to their motor drives which make them function as servo motors. Next, the RaspberryPi and various

shields, High Precision A/D shield and the Adafruit 16 – channel PWM/Servo Hat, were mounted. The A/D shield is used to convert the EMG and EEG signals to digital to be processed by the Pi and react as wanted. The Servo Hat is used to drive the 9 servo motors and 2 DC motors on the prosthetic. These shields are up and running on the Pi. We were able to obtain servo movement using the Pi and Servo Hat.

On my end, I completed my first milestone by getting the movement detection software running on the fit-PC using the Kinect. I did research on the proper placement of the electrodes to get strong EMG and EEG signals. This is on the backside of the neck, half way between the middle and side of the neck. Place the positive lead about halfway between your hairline and where your neck connects to your shoulders. Then place the negative lead about an inch under the positive lead. You want to place a set on the right and a set on the left side of the neck. I have also been researching C# tutorials online to learn more of the various functions within the language. Lastly, I have been researching the PowerLab software using their various tutorial videos on their webpage.

There has been set backs due to equipment not being up to spec in the lab. Microsoft Visual Studio is not properly working due to being installed for windows 10; the PCs in the lab are currently running windows 7. Therefore, I wasn't able to personally run tutorials. The fit-PC is not detecting the PowerLab 8/35 hardware to run the software. Therefore the software needs to be updated on the fit-PC using the included disc. The fit-PC lacks a disc drive so an external disc drive is needed. The next steps to get my end of the project back on track is to work with Dr. Spalletta to get the software up to date. Once this is accomplished I will be able to experiment with the PowerLab to capture the signals and learn how to export the raw data. I will also be able to practice using Visual Studio to program using C#. Then, I will be able to tie everything

together to record and save the Kinect data for arm position and EMG/EEG signal data simultaneously.