

Presentation to the Public

EE 454: Robotics and Professional Practice

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For my senior capstone project in EE 454 Robotics and Professional practice, my partner Christopher Gasper and I are working on developing an intelligent prosthetic arm. The purpose of our project is to create an insurance policy for our client. The policy would work by having the client come into the lab and do a calibration process using the Kinect in conjunction with the PowerLab. This would create a data set of EEG and EMG signals attached to motion intentions. If the client were to ever lose a limb later in life, they could immediately have their prosthesis programmed using this data. They would then be able to use the prosthesis without a learning curve.

In order to implement this plan, my partner and I are using a Raspberry Pi with a High Precision A/D board and an Adafruit 16-Channel PWM/Servo Hat with Raspbian OS. The final product will use this Raspberry Pi with the prosthesis, which is currently a prototype made of 3D printed parts along with a series of servos and DC motors with drivers. The purpose of the DC motors is to generate the higher torque required to lift the arm at the elbow and shoulder.

Thus far in the project, my partner and I have the prototype prosthesis built. We also have the Kinect working with the Fit PC. The program on the Fit PC is generating 3D points in space for the parts of the body. We also developed a brief program using the Arduino to start developing smooth motion algorithms for later use with the Pi. The last step we completed was getting some servo motion using the Raspberry Pi. This has only been achieved for individual servos due to unforeseen circumstances with the Adafruit 16-Channel PWM/Servo Hat.

Looking forward, my partner and I plan to fully implement the smooth motion with the Raspberry Pi. This has been rated red on the tall pole analysis for a few reasons. The first being the unforeseen circumstance mentioned above. The datasheet for the Adafruit 16-Channel PWM/Servo Hat links to GitHub, however, GitHub has since reorganized their website. For this

reason, we are currently unable to find the pinout for the Adafruit 16-Channel PWM/Servo Hat. We do believe that with some further research, however, we will be able to either find or figure out the pinout and overcome this obstacle. The second reason is that we are not acquainted with smooth motion algorithms, which will be made more difficult due to the inclusion of the higher torque DC motors. To overcome this obstacle, we were given the book *Introduction to Robotics*. This book has an excellent section on smooth motion of servos, DC motors and stepper motors. With the resource, we are confident we will be able to overcome this obstacle.

We also plan to develop communication between the Raspberry Pi and the Fit PC. On the tall pole analysis, we labeled this as a yellow. The reason for this classification is because although I have knowledge communicating between python and other languages, I do not have experience with C# specifically. I do believe I can apply my prior knowledge and am confident I will be able to overcome this obstacle.

Our final step we have planned is to collect data simultaneously with the PowerLab and the Fit PC. In doing this, we will be able to create a calibration file with EEG and EMG data attached to motion intent. This was labeled red on the tall pole analysis because neither my partner nor I have experience with either the PowerLab program or the C# language. We believe, however, that with significant research and our joint knowledge, we will be able to overcome this obstacle and work towards completing our project. If you have any further questions on this project or our progress so far, please feel free to contact me at Karissa.barbarevech@scranton.edu or my partner Christopher Gasper at Christopher.gasper@scranton.edu.