Presentation

System overview:

The jist of this project is to get a robotic hand to close when it receives a signal from the BCI headset. This was accomplished by dividing the work into 3 main sections: Acquisition, Real-Time Processing and Application.

An EEG-Helmet was used to acquire the data from the subject. The electrodes needed to be screwed down to tightly fit on the subject’s head. The subject would then alternate between relaxing their hand and closing their hand at 6 second intervals for 2 minutes. The data could then be streamed using a dongle or a wifi connection to the openBCI program. The openBCI would then send data packages to matlab using an IP (LSL) for processing.

Matlab was used to write a program for processing. A band pass filter was used to get rid of all the unnecessary noise. The filter would only let in data in between the frequencies of 8-15Hz. The chosen feature extraction method is common spatial patterns (CSP). Once the processing was complete, the data would then be sent to the next component.

For the application, roboRIO was used to connect to LabVIEW. This component made use of UDP to transfer data from component 2. A python script was used to send commands to the UDP relay so that this section could be tested without component 2. Each command is received in a string on 1s and 0s and this string was then converted into bits.

The hardware consisted of a 3d printed hand and a forearm. The forearm held 5 servo motors, 1 for each finger. The tips of each finger were connected to its respective motor using fishing line and springs. When the signal was received from component 2, all 5 servos would be actuated, pulling the fingers down and the hand would close. If the signal came that the hand should open, the servos would reverse their movement and the hand would open.