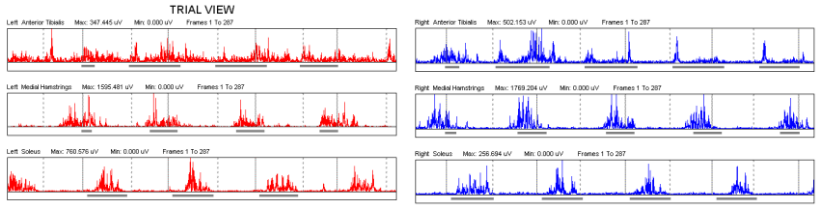
Conscious Brain Mind-Controlled Cybonthitic Cyborg Bionic Leg - V2

Ahmed Ayman, Moaz Allam, Mohammed Sabry || El-Sadat STEM School, El-Sadat, Menofia, Egypt

Engineering Problem & Objectives

Current surface biopotential sensor (surface Electromyography (sEMG)) having cons with collecting amputee's data such :

- Output voltage measures in interval [n , µ] Volt depend on sEMG .
- Disturbance in data after examining the source of real-person speed movement, as well as the absence of HPF and LPF



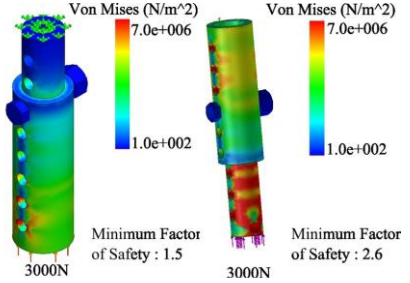
Motion lab system : Software : EMG Graphing,
Sample of body muscle's movement and its output range,
Credits via Motion lab system

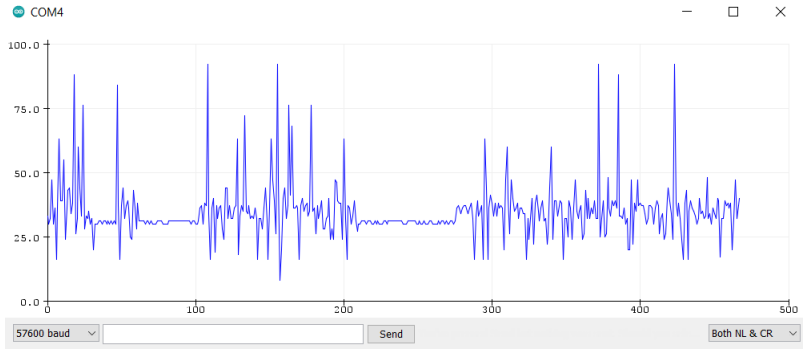
Research Goals:

- Increasing accessibility for developers and amputees by amplifying, Integrated filtering and Precision rectifying the sEMG signal to (mV).
- Design a novel prosthetic limb that has a **high bearing capacity**, flexibility, comfort, shock absorption, long-term use, and is accessible to amputees.

Data analysis & Results

- Von-Mises Stress analysis diagram, simulate the maximum load which the leg can effort
- Real-life output for sEMG including improvements; Amplifying **(**From nV to mV and **CMRR mode** (**common mode rejection ration**) rejecting impossible captured signals in interval [<mV, nV] U [>mV, V]**)**, Integrated filtering (HPF & LPF cut of noise from muscle sensitivity), precision rectifying (converting AC output to DC).

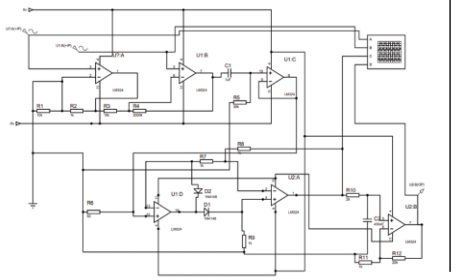




Project Design

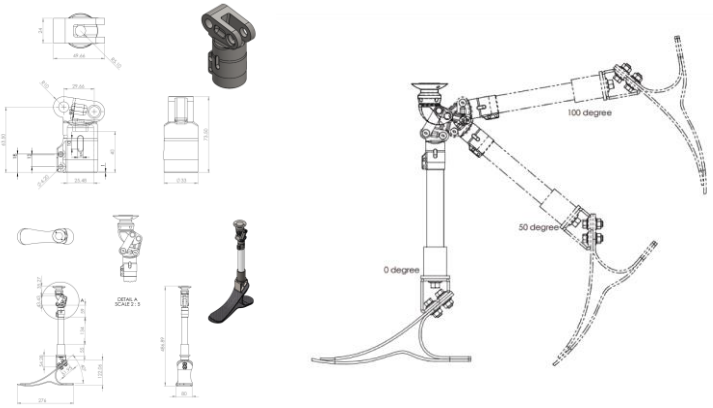
1. PCB Modeling (Schematic Diagram)

Schematic diagram of the developed PCB with amplifying, Precision rectifying, Integrated filtering



2. Leg and knee Modeling & Designing

Rea-life ration modeling for the prosthetic leg with 100 angel of movement (one axis of movement), suspension area to absorb sudden forces



Interpretation & conclusion

- The maximum load can prosthetic leg can bear approximately 3000 Newton.
- Our prosthetic leg rotate 100° as more freedom of motion required.
- K-mean and support vector machine increased accuracy of motion classification.
- sEMG depends on two majors: contraction and relaxation.
- Canny edge detection detected the edge of stairs to measure height and strength required by amputee to traverse stairs.
- Usage of machine learning in diagnosing dystonia and other diseases through the use of pattern recognition algorithm,P300 algorithm.

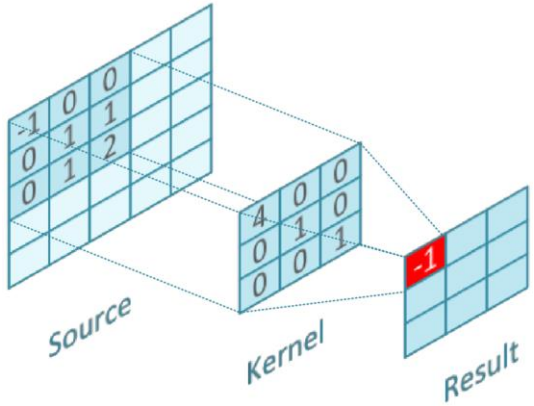


Image credit: High Performance Deep Learning Library (DLL)