Preliminary Project Proposal

Project Title: Non-Invasive Accessible Neural Prosthesis

Project Advisor: Dr. Ali A Minai & Dr. Tamara Lorenz

Team Members & Technical Skills:

Team CE3:

- Korey Kendall (EE) - Electronics, Agile Software Development, Organization & Communication
- Alexa Baker (CompE) - C++, Electronics, Group Organization & Communication
- Brandon Taylor (CompE) - C++, Python, Neural Networks, Communication, Firmware Controls
- Andrew Schmidlin (CompE) - C++, Python, Electronics, Group Communication

Problem Statement:

"In the United States, there are approximately 1.7 million people living with limb loss. It is estimated that one out of every 200 people in the U.S. has had an amputation."[1] The field of neuroprosthetics is an ongoing area of research that is expensive, requires invasive surgeries, and has not reached a point of large-scale feasibility. The current method involves surgically implanting sensors onto available nerve endings to provide a common interface to the neural prosthesis. Finding a way to make neural prosthetics affordable, practical and non-invasive would improve the quality of life for victims of limb loss, at least in the short-term.

Proposed Solution:

We propose a neuroprosthetic that is less functional than current advanced prosthetics requiring invasive surgeries, but more affordable and practical. Instead of performing surgery to create an interface on the neuron level, we hope to achieve this through non-invasive biosensors that measure nerve signals. We then expect to use machine learning to map signal patterns with desired prosthetic movements and ultimately control the prosthetic. We hope to develop a prosthetic hand, as that limb has the most dexterity, but our options are up for discussion based on feasibility and resources available. This is a proof-of-concept that would serve as an accessible, temporary solution until medical professionals and engineers develop a long term, affordable and invasive neural prosthetic.

Proposed Preliminary Features:

- Be able to reliably receive and interpret neural signals from the limb using biosensors
- Develop an algorithm using machine learning to map the neural signals from the biosensors to the desired movement of the prosthesis
- Build an electro-mechanical prosthesis that performs the desired movements

References:

1. Patricia F. Adams, et al, "Current Estimates from the National Health Interview Survey, 1996," Vital and Health Statistics 10:200 (1999).3
http://www.centeropcare.com/Portals/COPC/Amputation%20Statistics.pdf