# Project Proposal

## Problem Statement

Many people struggle with fine motor skills, such as moving fingers and toes. This can be caused by a wide variety of disorders such as Parkinson's disease [1]. Simple yet enjoyable tasks, such as playing video games, can become a chore for people with this disability as their dexterity with controlling the computer's mouse or reacting with the keyboard's arrow keys deteriorates.

## Objective

The aim of this project is to create a system that allows users to control their avatar in a video game using only limb muscle contraction. The user will be playing a maze-based video game where they need to control their avatar in order to escape the maze. Their avatar will be controlled by the user's muscle contractions. We will place EMG sensors on the user's limbs and depending on the muscle contracted, the avatar will move either upward, downward, left, or right on the screen.

## Design and Approach

The design of our project will be a standard EMG setup with electrodes on each of the limbs of the user. These electrodes will lead to a circuit with four different amplifiers and filters, one set of each for each limb. We are planning on using a gain of about 500x and using a band pass filter with a passband of 50-150Hz to filter out any unnecessary frequencies [2]. We will also use a notch filter at 60Hz to filter out 60Hz noise. As the user is playing the game, they will contract their muscles to move their character and these muscle movements will be recorded by a LabVIEW VI. The VI will have a signal processing algorithm that detects muscle contraction and will move the user's avatar appropriately. The direction of the avatar's movement will depend on which muscle was contracted.

## Outcome Measures and Testing Plan

The outcome measures of our project will be divided into three parts, namely hardware, software, and overall testing. For the hardware part, we plan to use the function generator to generate sine waves of different frequencies as the input of our signal conditioning circuits, and then use the oscilloscope to measure the output of our circuits. We will use the data obtained through the oscilloscope to make corresponding Bode Plots of circuits, so that we can test whether the circuits serve our purpose. For the software part, we plan to use the waveform indicator in LabVIEW to obtain the waveforms of our signals after processing, and test whether the waveforms meet with our expectation. For the overall testing, we will let one of our teammates put on the electrons on each limb, and then test whether the user can control the avatar in the maze-based video game using only muscle contraction.

## Parts List

We are only using reusable materials that are already in the lab, so we do not need to purchase anything.

Total Price - $0

## References


1. https://www.frontiersin.org/articles/10.3389/fneur.2013.00050/full
2. https://www.mdpi.com/1424-8220/21/18/6064/htm