SYSC 3203
Project Title: EMG-Controlled Mouse
Lab Milestone #5: Assembly and Optimization of the EMG-Controlled Mouse

In the previous labs, we have assembled all the parts necessary for the project. In this lab, we finally put all the parts together, optimize the whole design and play Flappy Bird with an EMG-controlled mouse. There will finally be a friendly competition over several categories.

1. Drawing a complete circuit schematic

To properly plan the assembly, start by drawing out a complete circuit schematic showing the how each of the subcircuits that you designed and implemented in Milestones 1 through 4 are combined in your final design. Your schematic should include:

- unique **component designators** such as "R9" (resistor), "C23" (capacitor)
- manufacturers' **part numbers** (such as "OP97F") or **component values** ("22nF") as appropriate
- a **description block** including a descriptive name for the circuit, name(s) of the designer(s), version and date

Resources:

Wikipedia page on Circuit Diagrams

Rules and guidelines for drawing good schematics [from electronics.stackexchange.com]

NOTE: although you are free to use schematic capture software for this task, neat pencil-and-paper schematics are just as acceptable.

- ➤ Show your completed schematic to the instructor and have him/her sign the instructor verification sheet.
- ➤ Be prepared to answer questions on the functionality and component choices you have made.

2. Assembly of the EMG-Controlled Mouse.

Start assembling the EMG-Controlled Mouse starting from the source of the signal: the forearm muscle EMG signal. Using an oscilloscope, validate at each step of the design that the signal you see whenever you contract your muscle correspond to the expected signal. The signal should be validated at the following points:

1. Output of the instrumentation amplifier.
2. Output of the high-pass filter and gain stage (if applicable).
3. Output of the rectifier.
4. Output of the integrator.
5. Output of the comparator with threshold.
6. Output of the monostable circuit.
7. Output of the optoisolator.

The senior electronics engineer suggests you place a **test point** made from a wire terminated with a coil on which an oscilloscope probe can easily be connected at each stage output. The test point should also be identified with tape from #1 through #7.

➢ Show the signal at each of these 7 test points to the instructor and have him/her sign the instructor verification sheet.
➢ Be prepared to explain the function of each subcircuit, and how the observed signals demonstrate that it is operating correctly.

3. Optimization of the EMG-Controlled Mouse.

While testing your EMG-Controlled mouse, you may have noticed that under some circumstances, the mouse does not click when you want it to click (false negative) or that the mouse clicked when you did not want it to click (false positive). Try to minimize the number of false positives and false negatives by optimizing any or all of the following parameters:

1. The gain of the instrumentation amplifier and gain block (if appropriate);
2. The cut-off frequency of the common mode driver;
3. The cut-off frequency of the high-pass filter;
4. The resistor values for the rectifier circuit;
5. The cut-off frequency and gain of the integrator;
6. The threshold of the comparator with hysteresis;
7. The hysteresis width of the comparator;
8. The parameters of the trigger circuit;
9. The pulse width of the monostable circuit;
10. The current intensity driving the LED inside the optoisolator.

➢ Show and explain your improvements to the instructor and have him/her sign the instructor verification sheet.

4. Friendly competition.

➢ Show your Flappy Bird high-score to the instructor and have him/her sign the instructor verification sheet.

Lab 5
SYSC 3203
Fall 2016
Instructor Verification Sheet

Submit this page to the lab instructor.

Name: _____   Student ID:_____

Name: _____   Student ID:_____

1.1: Show your completed circuit schematic to the instructor.

Verified: _____   Date/Time:_____

1.2: Describe the functionality and component choices you have made.

Verified: _____   Date/Time:_____

2.1: Show the signal at each of these 7 test points.

Verified: _____   Date/Time:_____

2.2: Describe and explain what you see.

Verified: _____   Date/Time:_____

3.1: Show and explain your improvements.

Verified: _____   Date/Time:_____

4.1: Highest score at Flappy Bird:_____

Verified: _____   Date/Time:_____