

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 Flappy Bird competition.

1. Drawing a complete circuit schematic

1.1: To properly plan the assembly, draw a complete circuit schematic showing how each of the sub-circuits 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.

Be prepared to answer questions on the functionality and component choices you have made.

2. Assembly and Testing of the EMG-Controlled Mouse

Start assembling the EMG-Controlled Mouse starting from the source of the signal: the forearm muscle EMG signal. Make a **test point** (TP) using a wire terminated which an oscilloscope probe can easily be connected to at each stage output. Using an oscilloscope, validate at each step of the design that the signal you see whenever you contract your muscle corresponds to the expected signal.

2.1: Complete Table 1 in the Lab 5 Report.

Show your TA your results for each TP in Table 1. Be prepared to explain the function of each subcircuit, and how the observed signals demonstrate that it is operating correctly.

Table 1: EMG Controlled Mouse test points

Test point	Location
TP1	Output of the instrumentation amplifier.
TP 2	Output of the high-pass filter and gain stage (if applicable).
TP 3	Output of the rectifier.
TP 4	Output of the integrator.
TP 5	Output of the comparator with threshold.
TP 6	Output of the monostable circuit.
TP 7	Output of the optoisolator.

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
7. The parameters of the trigger circuit
8. The pulse width of the monostable circuit
9. The current intensity driving the LED inside the optoisolator

3.1: Explain any improvements that you made to your circuit.

4. Friendly competition.

4.1: Record your Flappy Bird high-score!