Week 3:

Date: 09/08/2021

Total hours: 14

Description of Design Efforts:

I messed around a lot with KiCAD. I was experienced with EasyEDA and still prefer it at the moment. However, I spent majority of my time learning about KiCAD this week and further debugging the piezo sensors.

After the mandatory lab section, we were faced with the decision to remove one of our microcontrollers from our design. Dr. Walter was adamant in asking "Why" we needed it. After careful consideration, we will most likely discontinue with the microcontroller that was to handle game logic and communication with the under-the-table microcontroller and the RPi. Game logic can be handled by the under-the-table microcontroller (if it is not able to then the RPi will). Another thing to note is that we have moved on from the RPi and are using a laptop instead. We faced too many dilemmas with the RPi and were worried about the computation power that the RPi could offer. So as of right now, we have contact mics and a keypad connected to a microcontroller. The microcontroller is then going to communicate with the laptop using UART transposed by the FT232RL.

- KiCAD

This is where majority of my time was spent. I created the schematic for the microcontroller that we ended up scrapping :(However, on the positive side, I managed to get a template schematic that we could use for the under-the-table microcontroller. There is a 5V to 3V converter circuit, pull down capacitors next to a ferrite bead circuit, NRST button circuit and a programming header with a timing crystal circuit. The parts of the circuit I will have to scratch is the ethernet connector in the top right of Fig. 1 below, we were going to send UART through ethernet to the under-the-table PCB. So, the schematic will be on hold until we are done with hardware prototyping. The hardware that we are still waiting on is the piezo circuit to finalize which will depend on the reliability of the signal it produces to the microcontroller for interpretation.

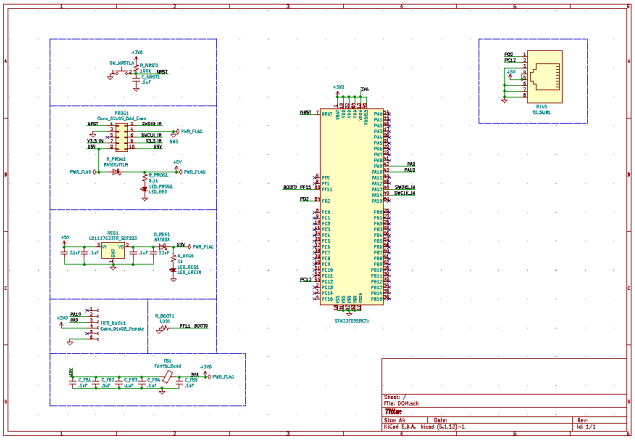

Fig. 1: First KiCAD schematic

The worst part of KiCAD was picking out the footprints for each part. Checking 3rd party vendors for the right part with the right price with the right supply was daunting. This step alone took me 2 days to figure out on KiCAD and sorting through the millions of options on Digikey. The PCB maker on KiCAD is worlds different than EasyEDAs and way less straight forward. I miss the autoroute option it had and its user friendly UI.

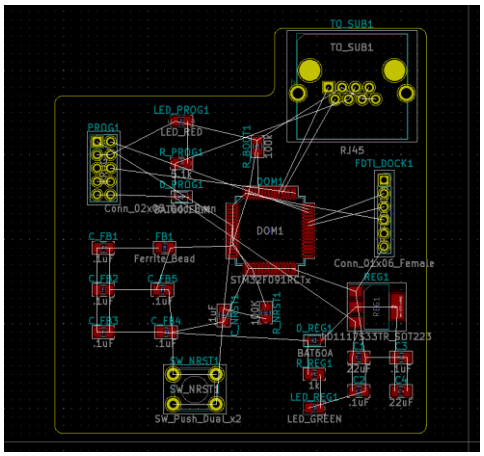

Fig. 2: PCB Design and Layout for a PCB

- Piezo Sensors

The piezo circuit from last week did not work. The Preamp circuit offered the same impulse signals of the ball bouncing when compared to not even amplifying the signal. Which gives a couple of problems, 1) we blew out the amp 2) if it works without 12V we'll need to change our buck converter PSSC 3) we need to buy more piezo if 1 V is the highest, we can detect. So, starting with problem 1, it is possible that the reverse feedback from the piezo could have potentially blown out the LM324 when we tested at 12 V. The spike could have affected the LM324 so we will have to replace it and test at a lower voltage. If we do not need 12V anymore, we will have to change our PSSCs yet again so that it will reflect not needing a buck converter. Lastly, if it works best without an amplifier then we will need to prototype with a better piezo. We do not know if we can get that signal from anywhere on the table and get it reliably.

Fig. 3: Oscilloscope reading of a ball being dropped on plywood

- Software Overview

I must submit a software overview on 9/10 which will be reflected in the team's website along with this report around the same time.

- Next Week

I am currently recovering from an illness as I am writing this. I could not meet in the lab with the group today and I will take the weekend off in lab meetings to not infect anyone else hopefully. I will be try to do some coding and adding the keypad to the schematic. Other than that, I will be rushing to finish getting a signal from the piezo sensor. If a signal can be detected, I can work on a buck converter if it requires more than 5 volts and adding it into a schematic. I should also start taking more pictures of lab progress just in case I get sick again on Friday and can't make it to lab to do so before the progress report is due.