Week 4:

Date: 09/16/2021

Total hours: 12

Description of Design Efforts:

This week may or may not be our final hardware week. We have been finalizing our hardware components slowly but surely. I have been updating the schematic with every component we add to keep it from being too much work. The piezo circuits have probably had the most revamp this week as we have been getting reliable signals of the ball bouncing on the table.

- KiCAD Schematic

I have completely converted the schematic from being a part of a two microcontroller PCB to one by itself. This fix was from last week's man-lab that Dr. Walter suggested using just 1 microcontroller and handling game logic on the laptop itself. So, the schematic in Fig. 1 is showing the microcontroller with all its peripherals. The first thing I got rid of is the UART to the other microcontroller adapter and replaced it with a FT232 UART to serial chip that will be handling RX and TX to/from the laptop. The chip also has 3V coming from it so we will be utilizing it to power the microcontroller (added diodes so it doesn't clash with the programming header's supply). Next, I added a connector for the button matrix, however, today (9/16) we discussed on using a different button matrix to hardware fix masking and ghosting problems. The button matrix connector is connected to the STMs PB0-PB7. Lastly, I added 8 piezo circuits. Four piezo circuits were too little so adding another amplifier, added 4 more.

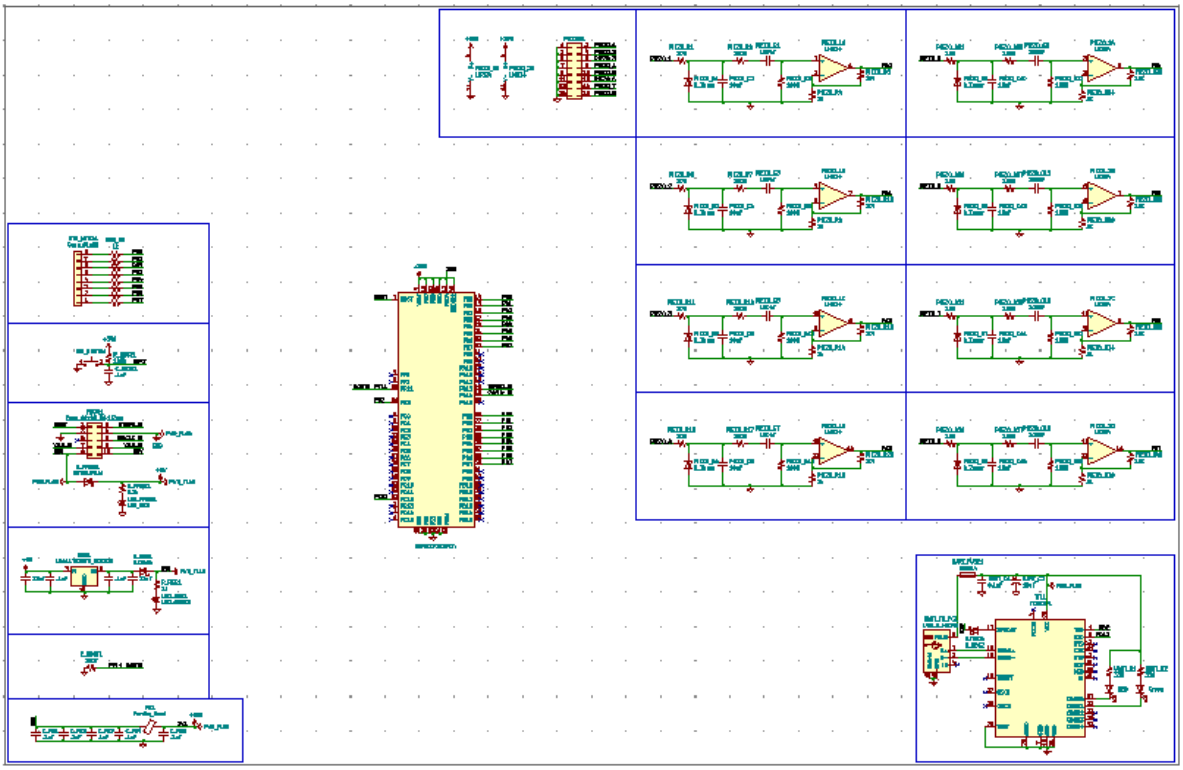

Fig. 1: Our entire schematic in its current form

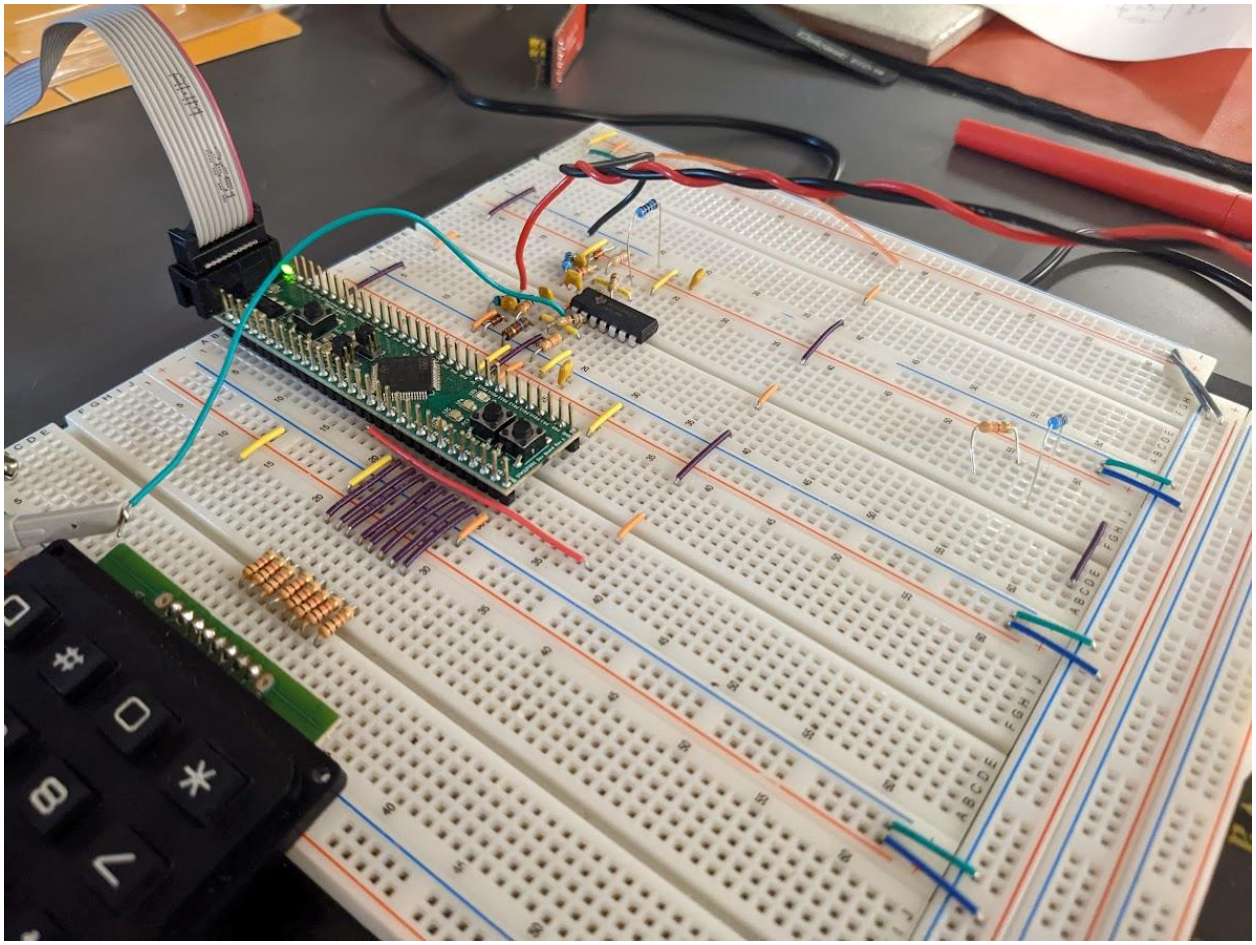

Fig. 2: Physical form of the schematic

- Piezo Circuit

The Piezo circuit underwent many renovations. First, we believed that we had to amplify the signal to see it at all. However, the signal was perfectly clear without the amp. The bad thing is, the piezo became too sensitive. It started sensing vibrations from the wire, connecting it to the circuit, move. So, we added a high pass filter and it worked to filter out the wire movement and some other triggers. Since we had a high pass filter, we added a low pass filter. The low pass filter removed loud talking and other environmental noises. After the filters, the signal did need to be amplified for the ADCs to pick it up.

The ADCs that will be used are PA0-PA7. The software for having so many piezo microphones may be complicated. There might have to be circular checks for interrupts for each channel to see if any detected a noise. And if they did, reset them and send a signal to the laptop. If multiple go off, then reset all of them. This could potentially replace the PSSC of making a buck converter, because so far, it looks like we might not need one.

Fig 3: Last weeks piezo signal compared to this week's (new on right)

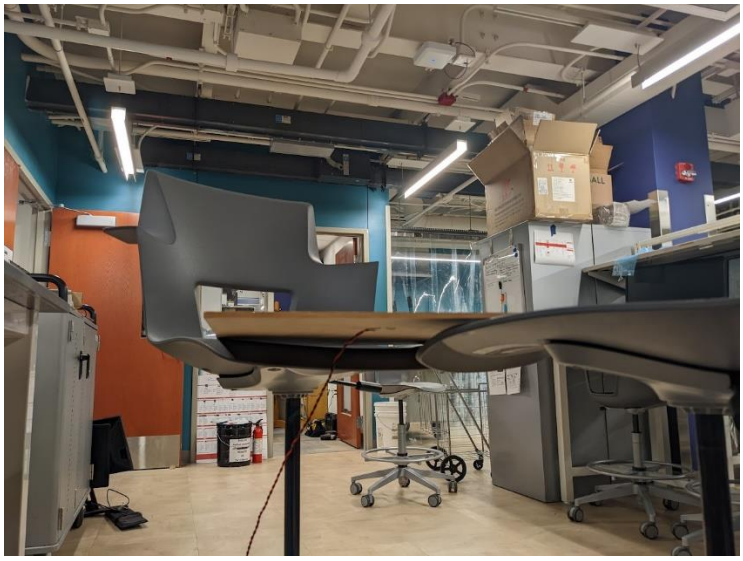

Fig. 4: Piezo sensor glued to the bottom of plywood to test the analog signal

- This upcoming week

This last week was busy from all of IR going on and applications for jobs and being sick. However, this week was the week of actual progress being made. The piezo has visible signal, UART is sending, camera feed was attained, it was a promising low effort week.

Now it is time for finishing the hardware. Resistor/Capacitor values can be finalized after the PCB is ordered if needed. But once the button matrix circuit can be made, we can show the schematic for approval and send it off for ordering. We think that is all the hardware we need so it would be nice to prototype with the pcb in order to see if the pcb itself gives us more problems.