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EMID Project Final Report **December 20, 2019**

Introduction:

In the preliminary stages of this project, the main goal was to build a handheld harp that was driven by the Light Diode Resistor (LDR) sensors to trigger musical notes when a laser was broken. This idea seemed very flexible and feasible when two laser harp DIY kits showed us how the instrument would work. There were also LEDs that would serve as a feedback for the user to signal when each individual note was being played. When the instrument was completed, the next step was to add two buttons or FSRs to change the scale by a half or whole step up or down. An accelerometer was used instead of the FSRs due to spacing on the frame used to hold the laser harp. The versatility and potential with this instrument are very beneficial for possible future models because the original design was not polyphonic, and it also required more materials than we ended up using in this final prototype.

Discussion:

The first step in implementing the concepts used in the device were taking the DIY laser harp that we first had and re-configuring the LEDs to the LDRs so that we could have 8 notes as opposed to7 notes, therefore giving us a whole scale. This involved using the Arduino as a power source instead of having power come from a secondary power source. The way we read data off of the circuit was by plugging the LDRs to power, ground, and analog input on the Arduino, then plugging the short leg (negative) of the LEDs into ground and pulling digital data (1 or 0) from the positive leg of the LEDs going into a 1k ohm resistor. Whenever the LDR was covered enough, where the current going across the sensor is low enough, this would trigger an LED to light up. This served as an indicator for a note being played.

The next major step when assembling the individual modules of the device was making sure the Arduino to Max patch script worked with the reading of analog coming from the LDRs and digital coming from the LEDs. The reason why we decided to keep the LDRs as analog inputs was to help the sound of the notes be more malleable in terms of being modified in the reason patch. This helped with making the actual playing of the notes more similar to playing the piano as opposed to plucking a string. When triggering the notes, they can have a more realistic attack and decay based on the amount of data being fed into the Arduino to max script.

When assembling the final portions of the instrument, a few issues arose in terms of the compactness of the device, as well as the amount of ambient light being fed into each of the LDRs at any given time. The threshold value was written into the triggering of the LED's so that they weren't always lit/playing notes. The problem was that the slight covering of any of the LDRs triggered the LEDs as well as any blockage up to 5 feet away from the LDR sensors. This problem was partially solved by having a small desk lamp aimed at the desk used to present the instrument. While this solution was temporary and was not ideal for the presentation of the prototype, the triggering of each note created many fascinating sounds when the sensors were triggered in the way they were meant to. The functionality of the instrument relied on amount of ambient light in the room being high enough that each LDR wasn't triggered by something blocking the sensors, say the desktop for example. The angle of the surface that the circuit board sat on the frame was 40 degrees downwards. This modification resulted in the LDRs being triggered if the user's hand is flat.

Results:

The final product ended up being an Arduino plugged into the desktop holding the code being used plugged into the frame holding the laser harp and accelerometer. The final product can be viewed in the appendix section at the end of this report. The final instrument did not have the original lasers used in the first model because the light in the room made it, so the lasers were unnecessary. It would have also been difficult to re-implement the branch of lasers seeing as the amount of notes were increased to 8 and the laser branch only had 7 inputs.

The max patch added the LFO amount interfaced with the x-rotation axis in the accelerometer. There were two buttons to go up in scale pitch when pressed twice, on the side of the frame that can be accessed with the user's thumb. These parameters both functioned as intended when the instrument was presented.

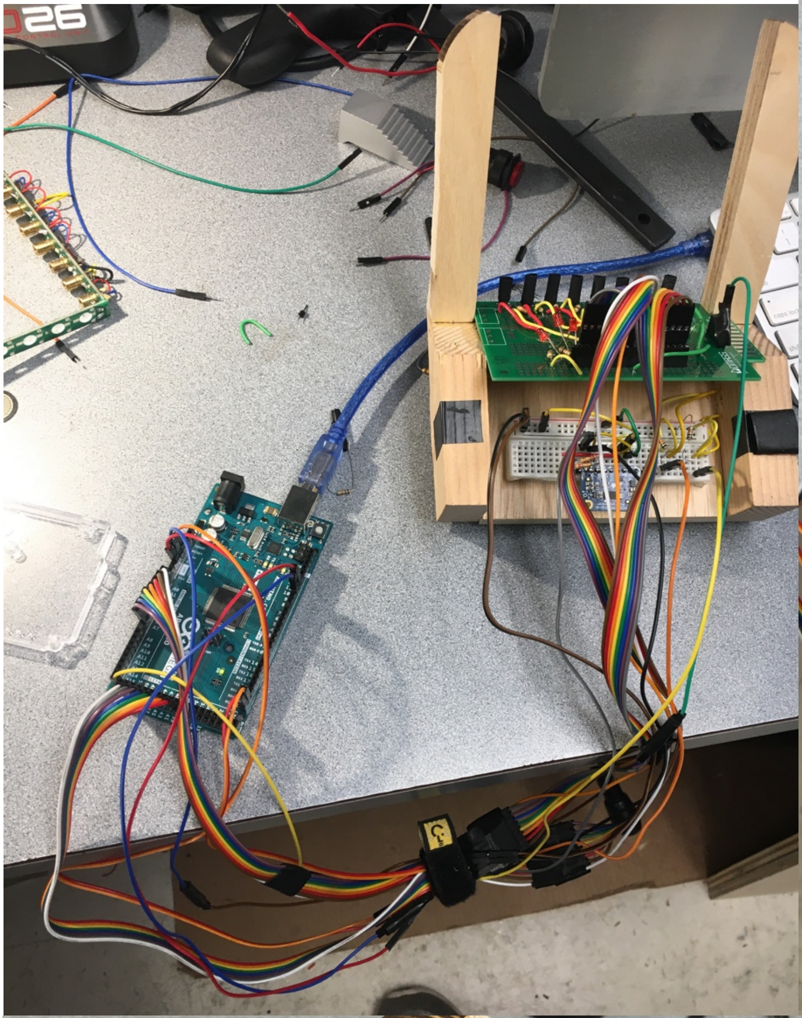
Conclusion:

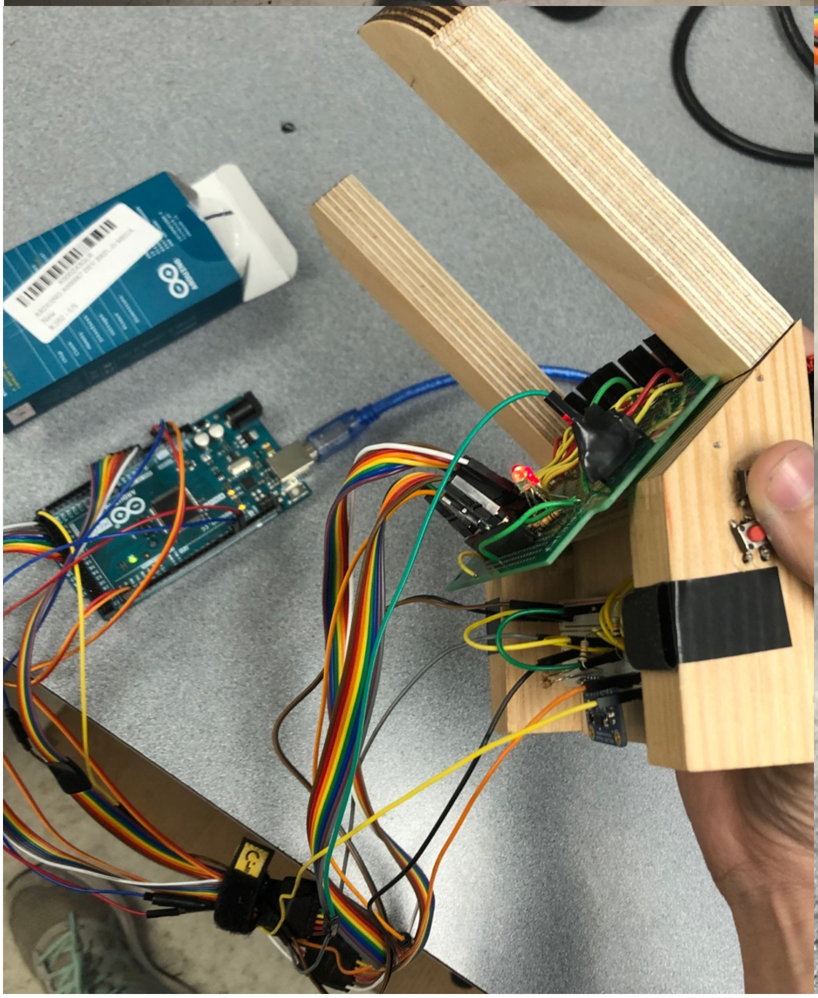
To conclude, the design process of this product was the most difficult portion of this project because the original idea of having lasers ended up not being used in the final product. This lead to three complete prototypes being made which took up majority of the time that could have been used refining a single model. If we had stuck to a single idea instead of trying to come up with new ones along the way, there would have undoubtedly been fewer issues that arose towards the end of the project window.

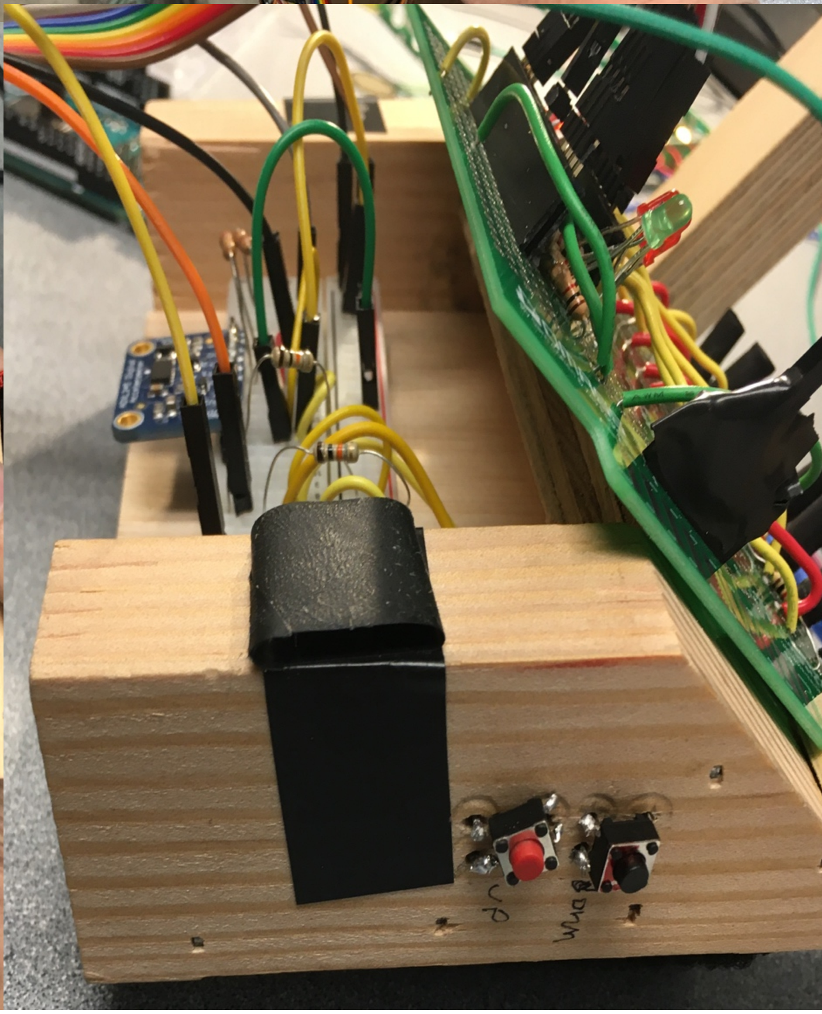
Given more time, future improvements would include: fewer really long wires to the Arduino, attaching the Arduino to the frame, a newer frame model that is a lot sturdier and a working red LED. The first improvement could be implemented by accomplishing the second listed modification. The USB cable connecting the Arduino to the desktop could have been longer to help the player use the instrument further from a desk. 100% of the wires coming from the Arduino were either receiving/transmitting data or supplying power to the accelerometer, push buttons, and circuit board with LEDs and LDRs. This made it difficult to use the full capabilities of the device when interfacing with the accelerometer parameter because whenever the wires because twisted, the loser connections that were not soldered into the breadboard would come loose.

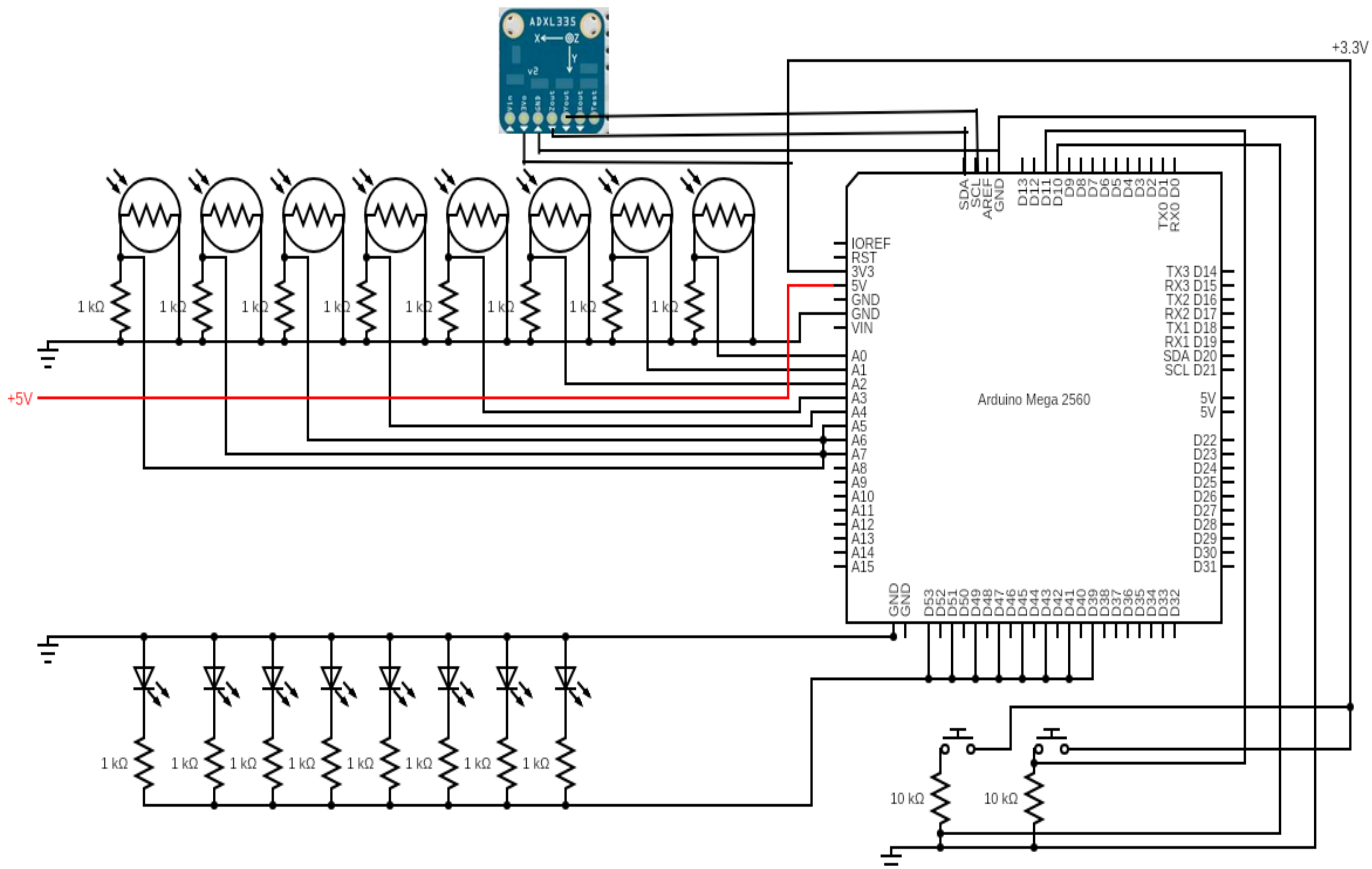
Overall, this project was very beneficial to work on because I learned more about the interfacing of Reason, Max and Arduino in a way that I would not have with the smaller assignments we had been working on throughout the semester before the projects really got under way.

Appendix:





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RX0 D0
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RX1 D19
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