EP1000 Final Project

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Overview

- 2021 marks LEGO NINJAGO's 10th anniversary with celebratory "gold" edition minifigures.
- I originally was going to make a display of all 6, until I realized it would take almost $1000 to get all the sets that have a unique figure.
- So I have decided to make a singular display with lighting and interactivity a la Science Centre visual display.
- Materials: Plywood 3MM, Acrylic 2MM, PLA 1.75mm filament, electronics, Felt and LEGO pieces.

Build #1 : Measurements

- LEGO Minifigures come in standard size of 25mm wide and 40mm tall not including any extra appendages.
- Box was modelled and exported from Fusion 360 for laser cutting.
  - Errors made in design size, file export and material size.
  - Later corrected with our saviour the Ender 3 Pro.
- I did not remember to get the Arduino Uno's measurements. Being sick for 3 weeks meant I didn't manage to get a Nano, so we make do.
- My hamburger speaker and other parts are too big. Ender 3 Pro saved me here too by printing a new backing with extra space.
- Engraving the 10th anniversary logo was a pain, I recreated the logo as an SVG vector in Adobe Illustrator as per the method that I was taught to use in my course.

Build #2: Electronics

- Planning how to fit electronics into the display and also as part of interactivity
- A 3D model “stage” for the minifigure was made, with hollowed insides to fit in LEDs that poke through holes. My printer was quite poorly calibrated so I had to add some additional tolerance for the LED to fit.
- I consulted a senior formerly from electrical engineering on sourcing materials like LEDs, perfboards, power connectors etc.
- The schematic was also developed with his supervision because I have a tendency to destroy electronics.
- I got my own 30W soldering iron and soldered the electronics with very amateur skills.
  - I learnt to NOT solder at 6AM, because being sleepy means you WILL burn yourself.
- I learnt how to solder on the Internet. My CCA Makers Club was also great for advice because they have people who know things and people who are somehow contactable 24/7.
- At least I didn’t short two microbits in a day.

3D Modelling & Printing

- I have been doing CAD on Fusion 360 since early 2020. I currently sell custom 3D models for costuming purposes.
- The models are always built to size and proportion, but in a pinch scaling can work in Cura when slicing.
- I learnt how to add pegs and slice down too large models, but not that I didn’t need those anymore since I’m doing one figure and not 6, this is irrelevant.
- I received an Ender 3 Pro from another senior. I am studying how to calibrate printing now because the prints are very slightly skewed in measurements. It will be good to rebuild some of this sometime.

Assembly

- Assembling the laser cut pieces required a small mallet because of the tight fit.
- Wrongly cut pieces were saved by means of a hand chisel and patience. I learnt how to chisel joints in Makers Club. Thank you Ethan.
- The electronics had to be assembled in two parts, the front LED section and the back everything else. The LED section had to be installed into the stand mount, with a small hole drilled into the corner to pull the wiring to the back when gluing in the stand. The cordless drill was loaned. Thank you Ethan.
- The LEGO figure is not secure. I will remove the printed plate and put in a properly sized one that is secure.
- The electronics are soldered without perfboards in the end. I kind of just jam it all into the final cavity backing of the box once I was sure it was properly protected from shorting.

Arduino IDE

- Arduino ino file was created with references to a senior's linked instructable for installing an audio system. This involved TMRpcm and SD reader libraries. C++ syntax is quite familiar for me because Game Programming 1 but I see no reason to pretend to know anything.
- I can now add additional sound files formatted for the audio system without thinking too much.
- Isolating sounds can still be difficult, so I should attempt to use a high/low pass filter when preparing sound files.

Conclusion

- My seniors are gods at sourcing materials for cheap and great advisors for my insanity
- I should give more allowance for electronics holding spaces because better too much than too little since you can pad space closed but cannot pad extra space without it looking strange
- Calibrating tools properly is important to get correct fit.
- Gluing Acrylic with super glue is finicky, I should avoid shifting pieces once the acrylic has glue on it.
- Apparently it is very easy to clean laser cutting surface burn residue with acetone. Maybe acetone is overkill. I found out by chance while attempting to clean super glue.
- I would build this again. Just not in the next 4 months.