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Project Portfolio

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Electric Skateboard Project

Modified electric skateboard into monster electric skateboard featuring larger treaded wheels, and 2 batteries.

Many roads have small rocks and gravel around which can cause trouble when skateboarding. To help with this, custom designed and 3D printed rubber wheels were implemented as a cover onto the existing wheels. These were glued in place as a permanent solution. To ensure a strong wheel, they were 3D printed with TPU at a high temperature (240 °C) and high infill (75%).



When the larger wheels were added, the motor drew more current due to the higher torque. For this reason, another battery to the existing one was added with a battery management system (BMS board). This battery was put together and is a 7s battery which uses 7 18650 cells in series (total of 25.9 volts). This is the same

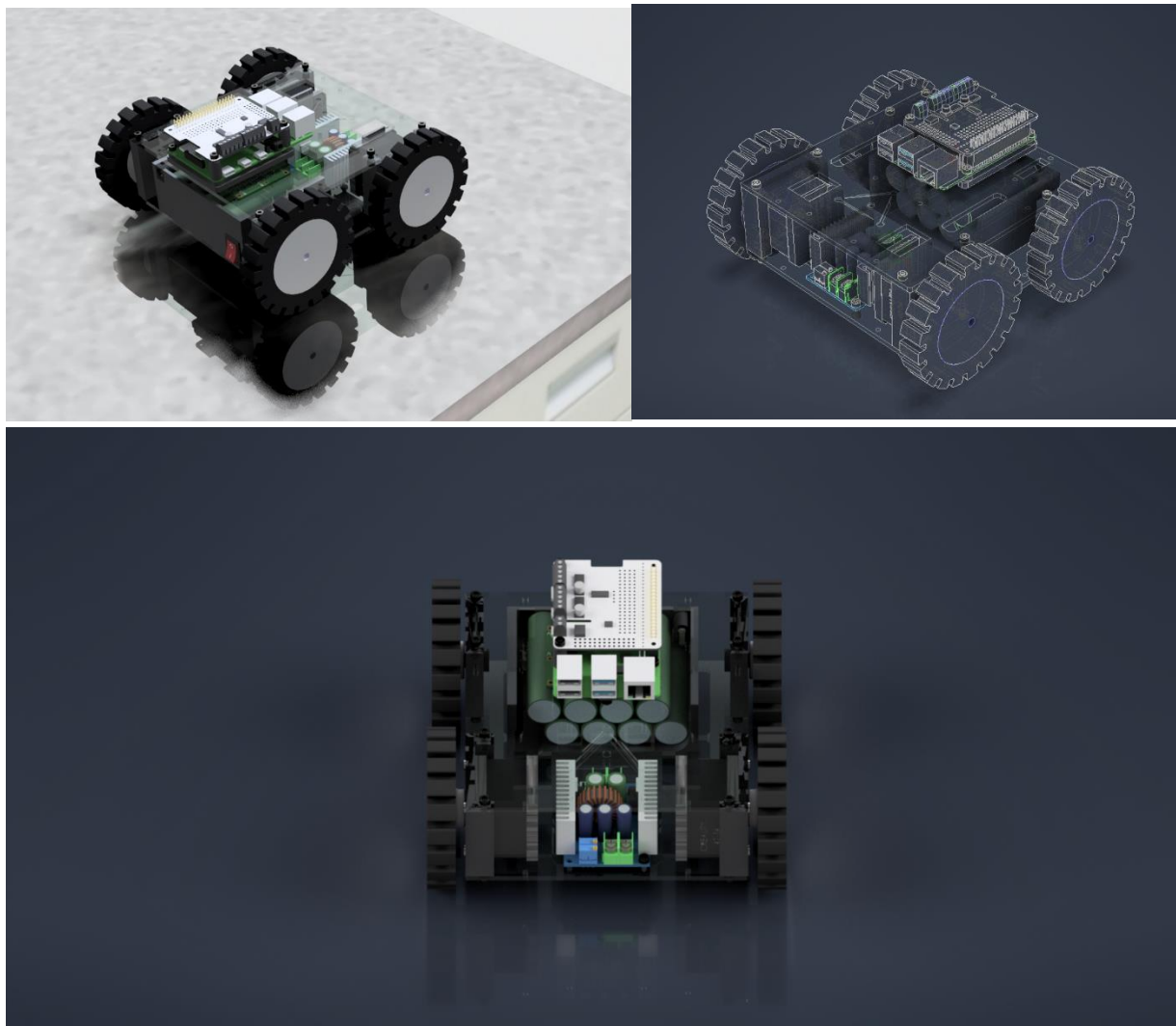
as the existing battery. This now increased the run time to about 40 minutes at full speed.

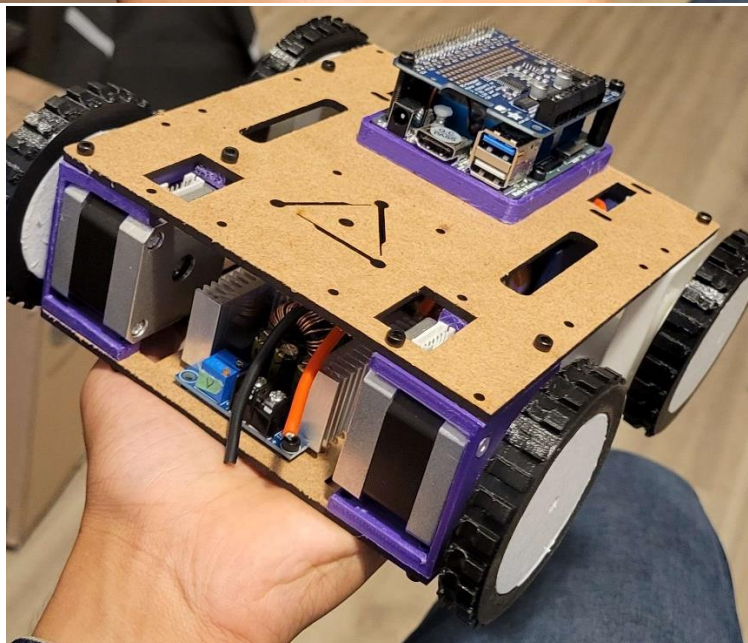
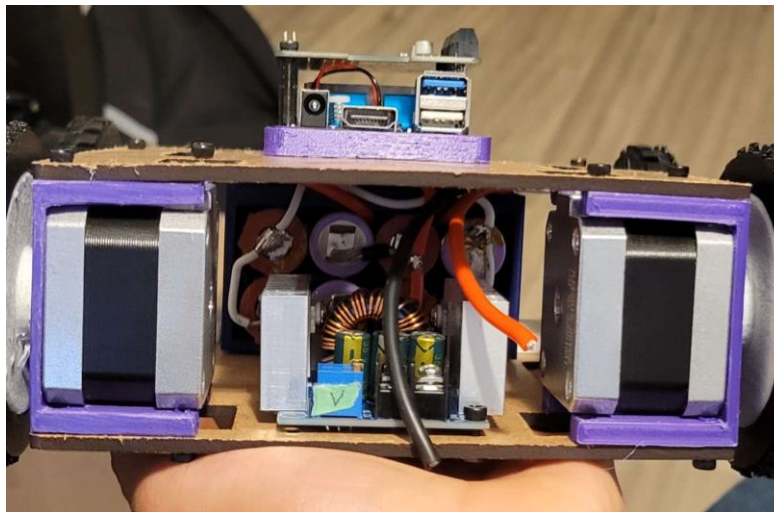
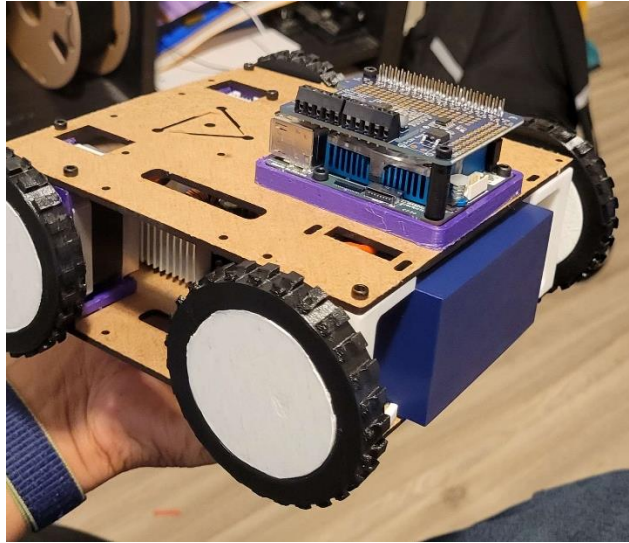
The system uses a single motor ESC to drive the board.

Trinity Robotics Storm Robot

During May 2023, myself along with some other fellow mechatronics engineering students started a company for an educational robot with AI implementation. Being one of the founding members, I became the Chief Strategy Officer and the Lead Mechanical Designer for the robot.

The device uses a front wheel drive with stepper motors with rear wheeled bearings. The battery is a 4s2p battery to run the system. Most of the robot is 3D printed with brass heat-inserts to add a thread. The top and bottom plates are laser-cut. Renders and images of the prototype can be seen below.





Dog Design Projects:

Hiking Water Bottle Design

Looking online for a water bottle for hikes with my dog resulted in expensive designs that couldn't hold too much water. For this reason, an adaptable water bottle was designed and manufactured. Due to the water bottle cap, it can hold any type of large water bottle. Due to the pressure TPU plug it does not leak and it was 3D printed with high infill for strength. See below for the design.



Auto-refilling Dog Water Bowl

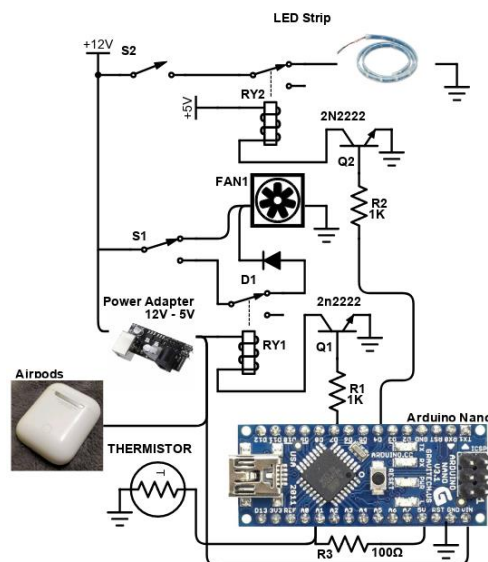
Often dog water bowls do not hold enough water for a long warm day. For this reason, a reservoir was added to an existing water bowl. This uses the gravity and air pressure to slowly refill the water bowl to a desired amount. The water in the bowl then seals itself thus only re-filling when required. To allow for adjustability, it was made with aluminium extrusion and a clear adjustable acrylic pipe. The reservoir holds an extra 1L of water, along with the 750 mL bowl.



Laptop Cooling Stand

Custom-designed laptop cooling stand with temperature detection, Air Pods charging, external hard drive mount, USB hub mount and pencil holder.

The device was made with a premade aluminium laptop stand that was modified with fan and other electronics. The project involved a full design cycle with mechanical, electrical and software components.



The mechanical design involved the various mounts, and machining design. The electrical design was control circuit as I wanted temperature and manual control of the fan. A schematic drawn in Digi key Scheme it can be found Above.

The uses relays so they Arduino Nano can control when the fan is on and off. A 2-step switch was used so the fan could be turned on manually.

The software component came in when coding the stand for temperature detection. A thermistor was used as an input sensor for the Arduino and software was programmed. When the computer reaches a specific temperature without the user knowing, the external fan would turn on to provide extra air to dissipate the heat.



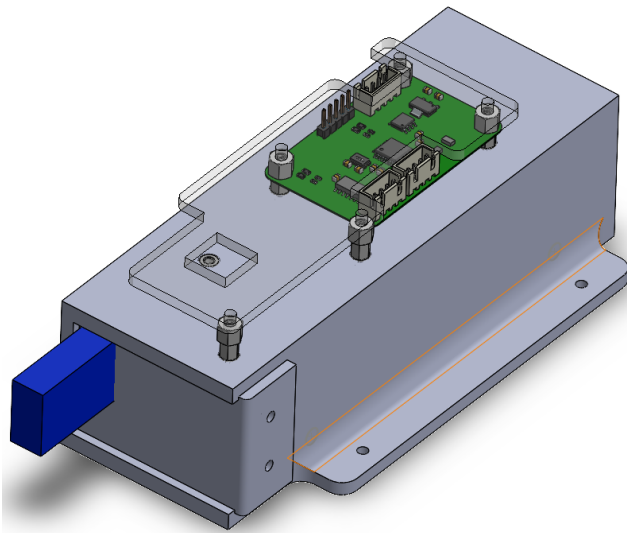
Waterloop Design Team Projects

Enclosure Designs

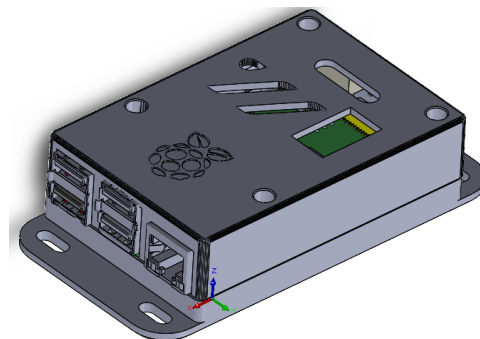
Designed and fabricated enclosures for control and management boards.

These were then 3D printed and assembled with heat inserts to hold fasteners.

The first enclosure shown is the one for our Low-voltage system. It has a compartment for a LiPo battery.



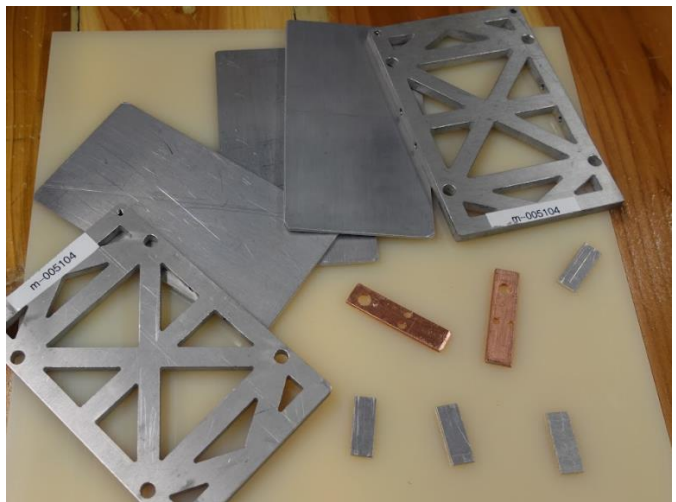
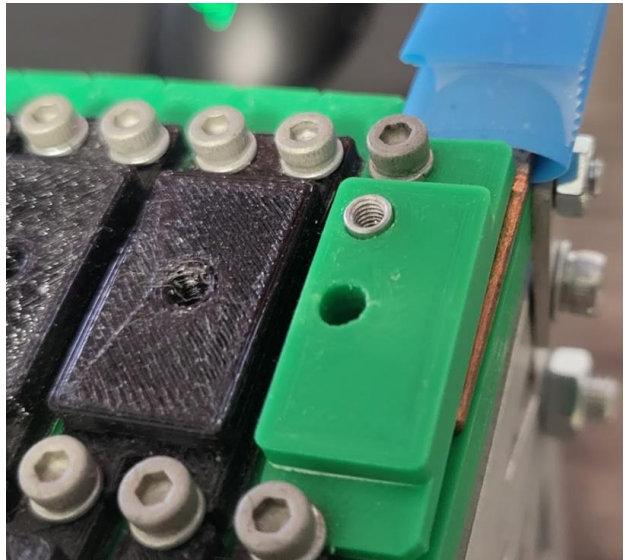
The next enclosure is a custom Raspberry Pi case to allow shield integration.



G5 Battery Manufacturing and Redesign

Created part drawings and used different manufacturing processes to create parts for the G5 Battery. These processes include 3D printing, waterjet cutting, and using manual machines such as the mill.

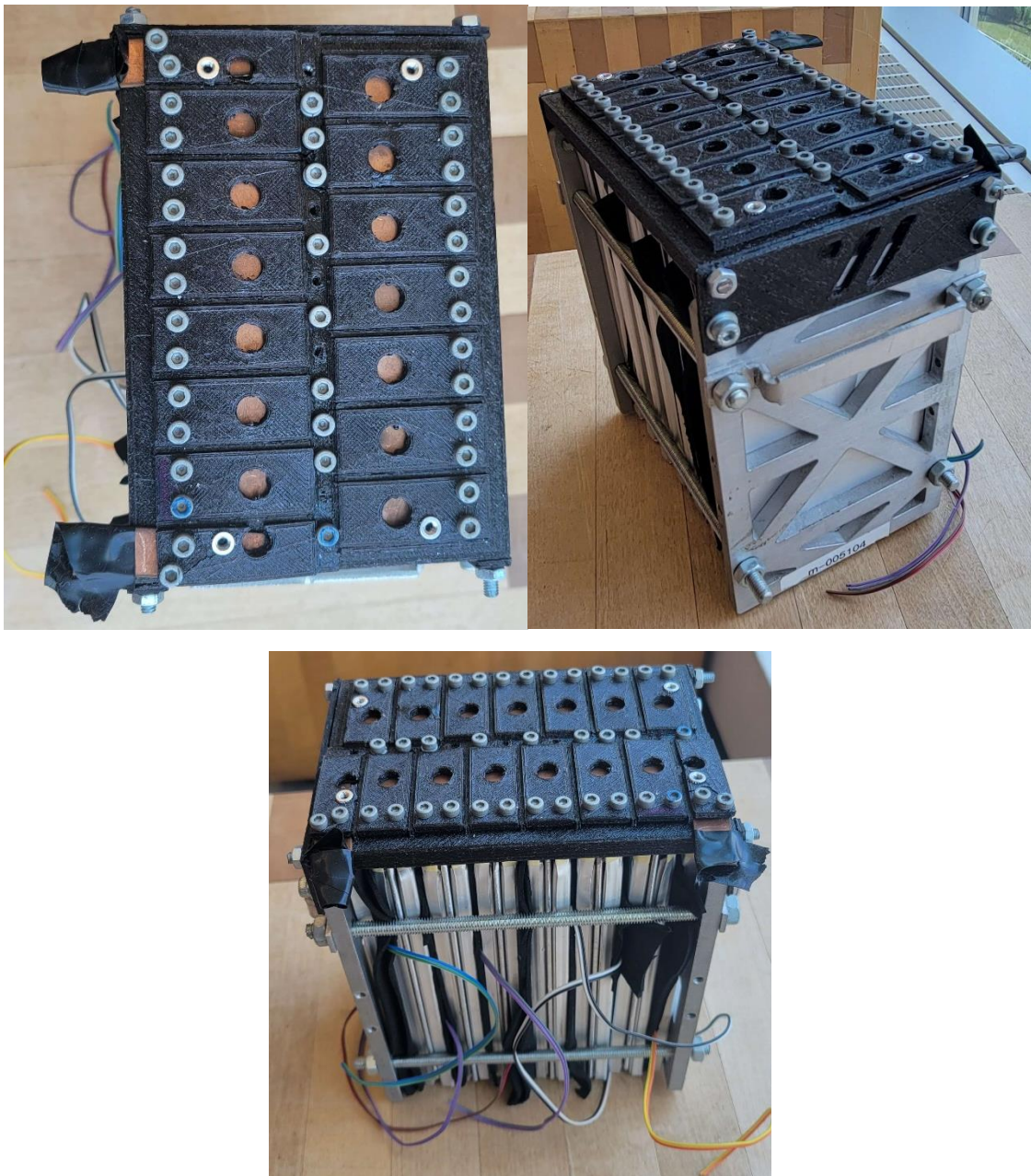
After the parts were manufactured, they were assembled as shown to create the battery for the team's G5 pod.



Redesigned Parts

To increase the safety and manufacturability of the design for the G5 battery, some aspects were redesigned.

This included clear access to the copper panels and walls between them to ensure no shorts during assembly. Additionally, thermal pads were added to monitor the temperature of the cells. See images below for the completed Goose 5 battery.



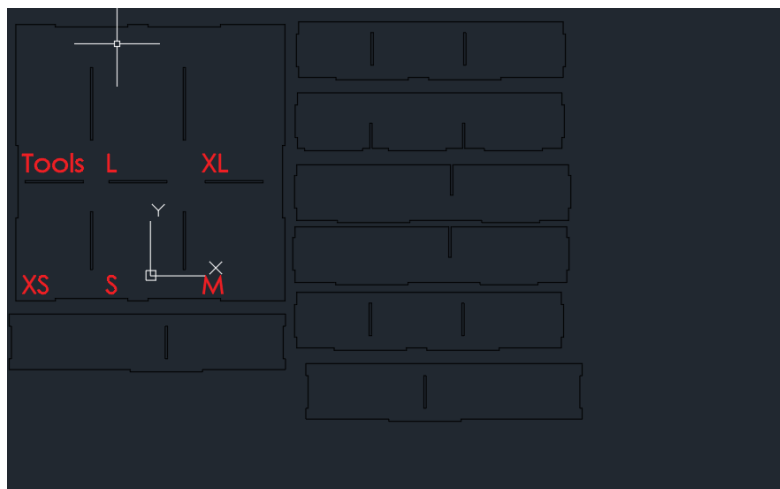
Trexo Robotics Internship Design Projects

Clinic Device Cubby Drawer Organizer Re-Design

Designed laser cut drawer inserts to organise parts for cubby.

Used SolidWorks to create parts and exported files for laser cutting by a vendor.

Parts will be assembled and provided to Clinic customers.



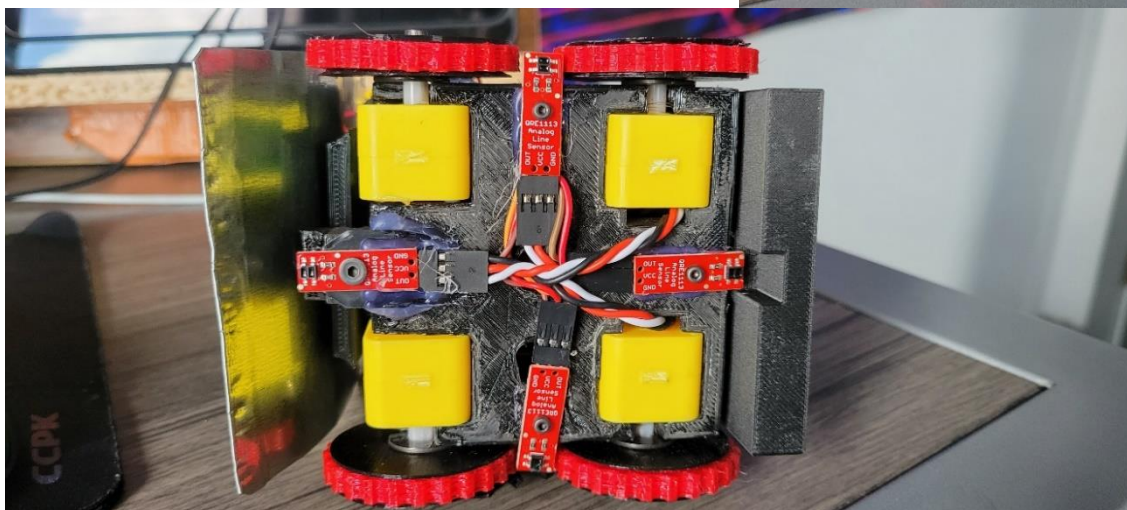
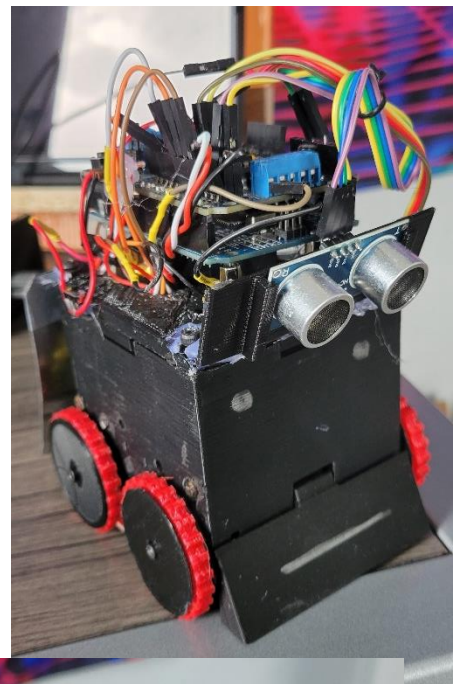
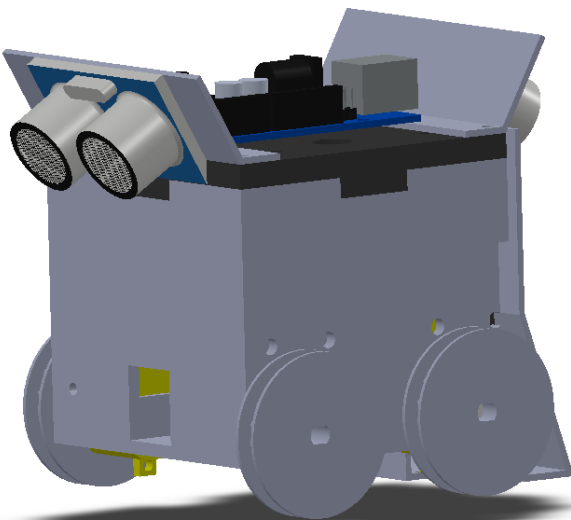
Internal Sumo Robot Competition

Designed and manufactured a sumo robot for an internal competition between employees.

3D modeled in SolidWorks and 3D printed parts for prototyping and final product in PETG and Nylon Filament.

Incorporated heat inserts and electrical wiring in my design.

The final design used an Arduino, with a DC motor shield. We used Ultrasonic sensors to detect other robots, and line sensors to detect the arena. DC motors were used to drive the system.

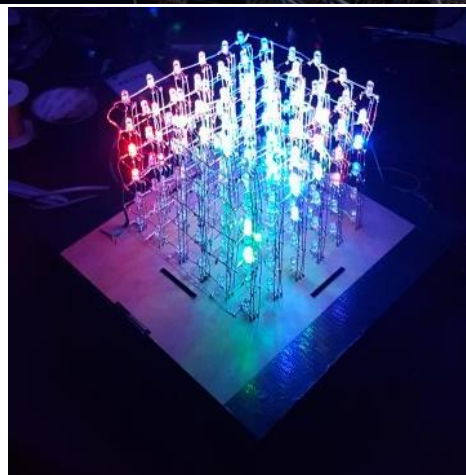
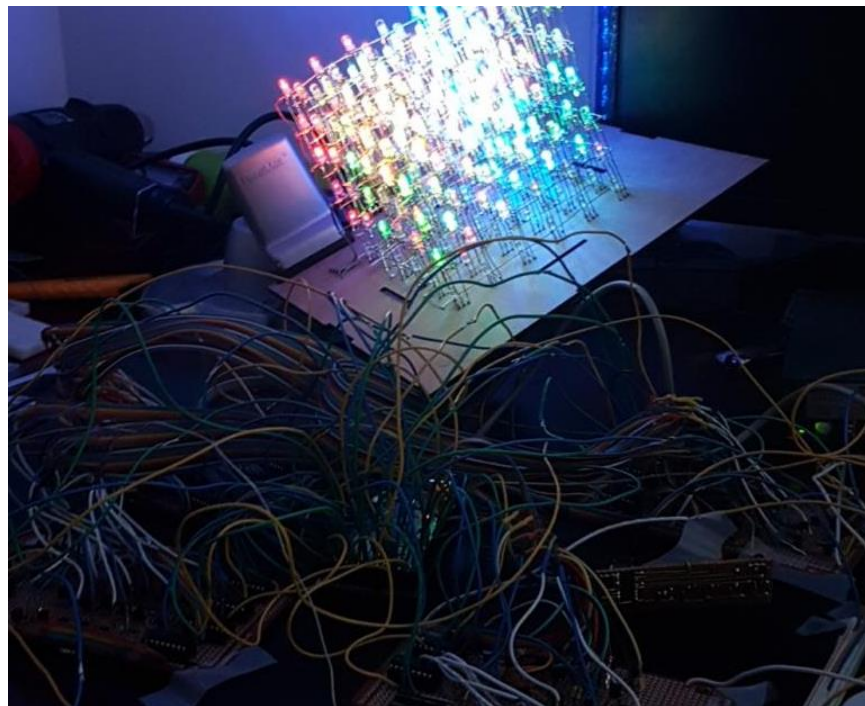


Electrical RGB LED Cube

Project Overview

For our Grade 11 design summative, we were tasked to create a display device that was able to create a lightshow for Chinguacousy Secondary School's future open houses. Our team created an RGB LED Cube.

The RGB cube uses RGB (multicolor) LEDs to create a delightful lightshow for those who turn it on. It displays preprogrammed shows used a 3D 6x6x6 LED display.



LED Cube Hardware

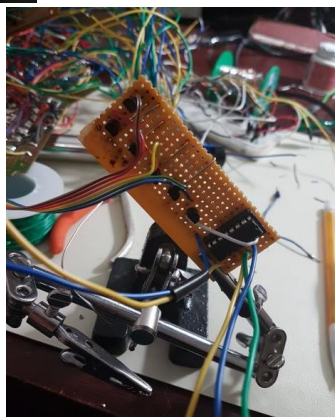
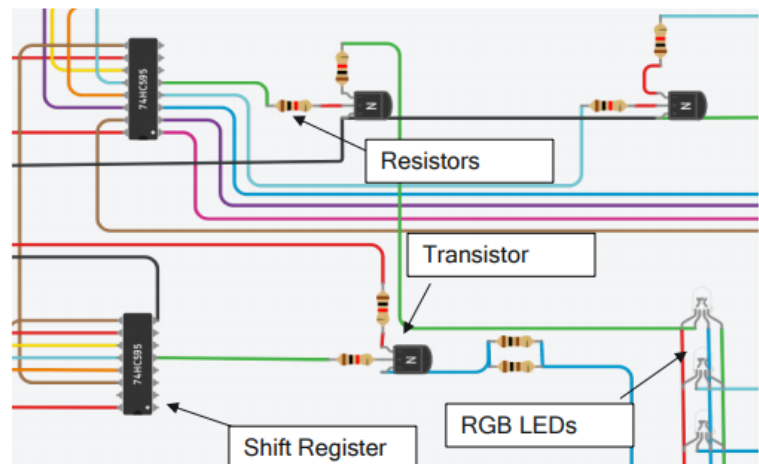
The Arduino programming and hardware platform was used.

Circuit Design:

Before the circuit was soldered, it was designed and drawn as a schematic. Six 6x6 matrices of LEDs were stacked on top of each other to form a cube. Transistors control the state of the LEDs and shift registers are used to control the state of the transistors.

The Arduino Mega was connected to the system to control the values inputted into the shift registers. It was one of few microcontrollers which had the correct number of pins to hold all the shift registers.

The system required adequate power, thus a 16-amp at 5-volt power supply was used to ensure the system would run successfully. To prevent overheating, a fan was placed in the casing.

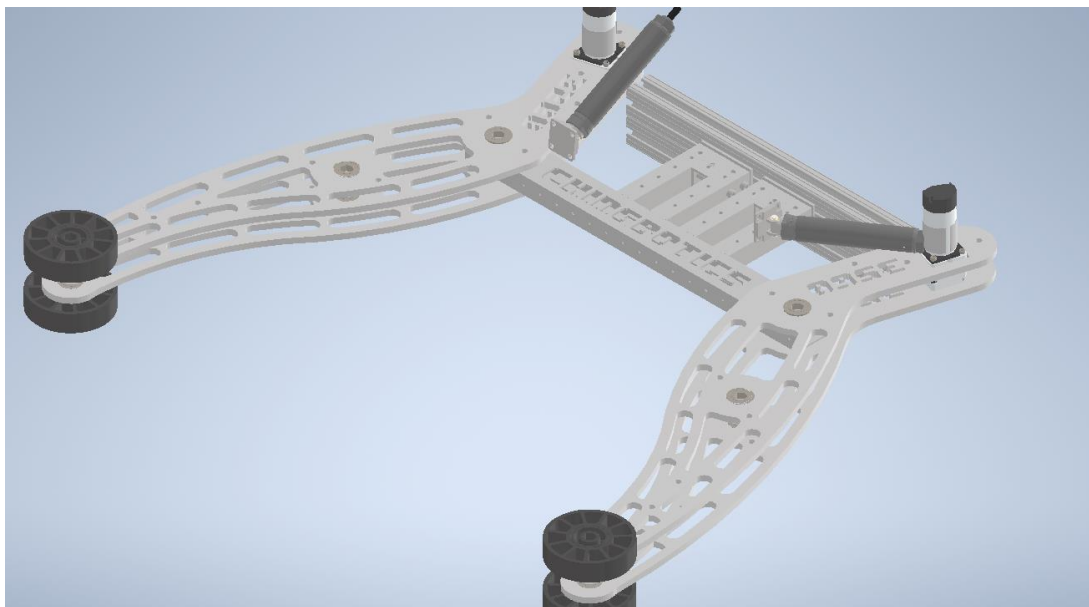


FIRST Robotics Mechanical Designs

2018 POWER UP Robot Cube Intake

Overview

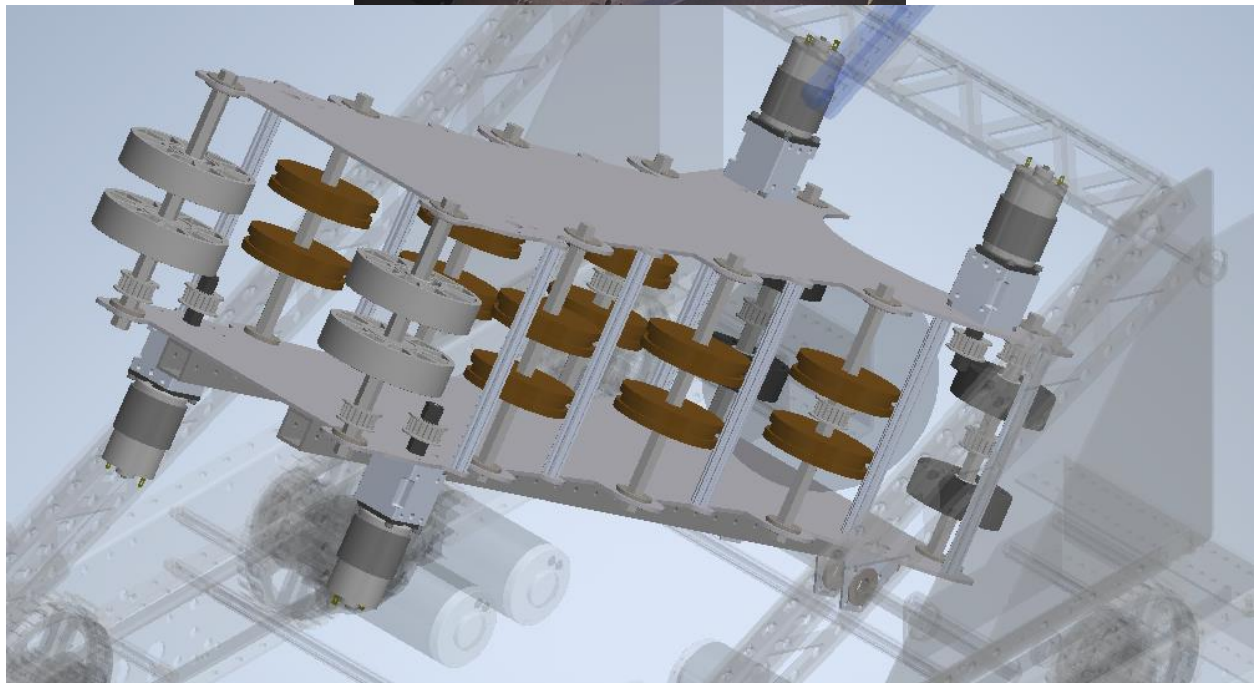
As the design leader for the 2018 FIRST Robotics team, a small team and I were tasked with designing an intake to hold the “power up cubes” from the challenge. Using Autodesk Inventor, the system was designed and implemented onto the robot. Various stress analyses and tests were done to ensure a successful design. The system was driven by BAG motors with a gear box and timing belts.



2020 Infinite Recharge Robot Ball Launcher

Overview

As the team leader for the 2020 FIRST Robotics team, a small team and I were tasked with designing a shooter to shoot the “power cells” for the 2020 challenge. Using Autodesk Inventor, the system was designed and implemented onto the robot. Various stress analyses and tests were done to ensure a successful design. 775 Pro motors with a combination of chains and belts were used to drive the wheels. The 775 Pro motors had a gearbox that was calculated using a design calculator.



CAD Hudson Bay Train

Overview

Due to Covid-19, we were tasked to 3D model a train and modify it to a design of our choosing. We were provided with orthographic views of the parts and assemblies and had to 3D Model it using Autodesk Inventor.

Our group chose a Hogwarts Express train style.



Machine Project: Hammer and CN Tower

Overview

For various machine shop classes, we had to design and manufacture a hammer and a landmark of our choosing. A CN Tower and a simple yet effective hammer design was chosen. Using various machining techniques and design, the following were created.

Process

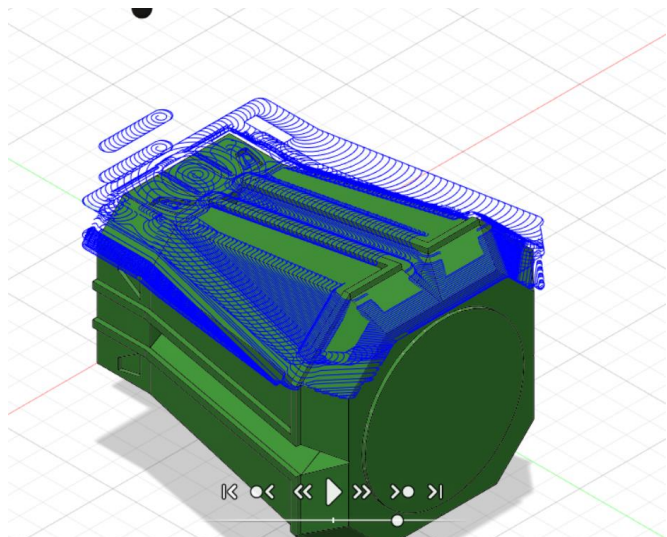
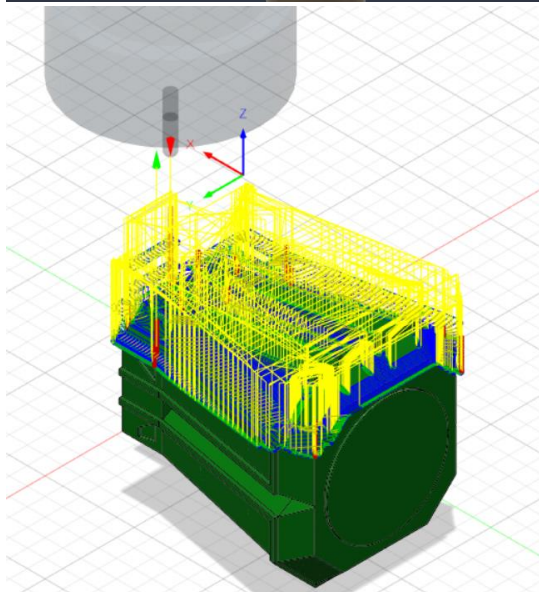
All cylindrical components were made using a lathe with various tooling operations. The rectangular and cubic components were manufactured using the manual milling machine. All engravings were programmed in G-code and engraved using the CNC milling machine.



Personal CAD Project: Thor's Hammer

3D modelled a scaled version of Thor's Hammer from Avenger's Infinity War. Created plans and G-Code to have it CNC machined at school's machine shop. G-Code was made in Autodesk Fusion 360.

Unable to produce due to Covid-19 pandemic.



Laser Cutter Projects

Using personal Omtech K40 Laser Cutter, created custom nightlights, coasters and keychains. Used Adobe Illustrator, Photoshop and K40 Whisperer to generate files and g-code.

