AKSHAT DOCTOR

Mechanical Design Portfolio

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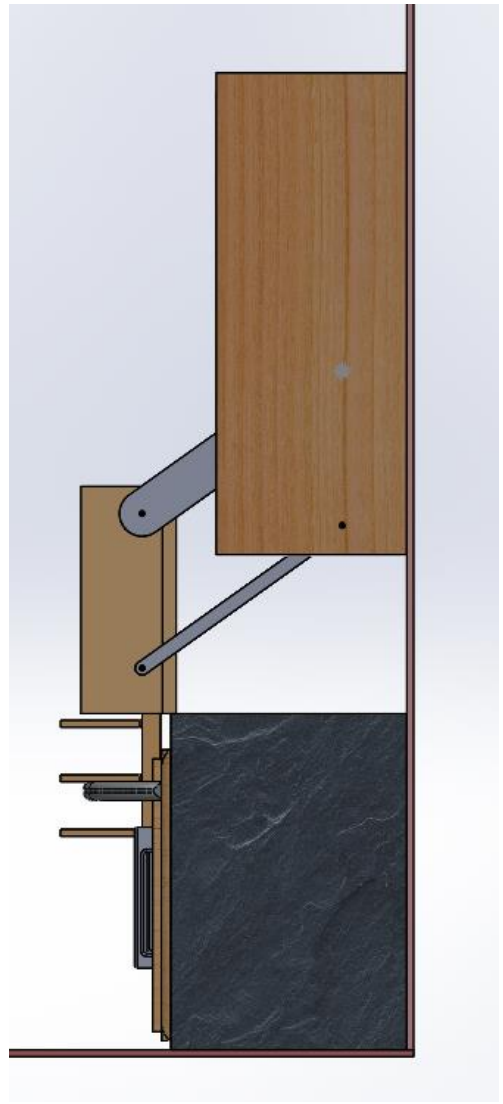
MECHANICAL SECTION

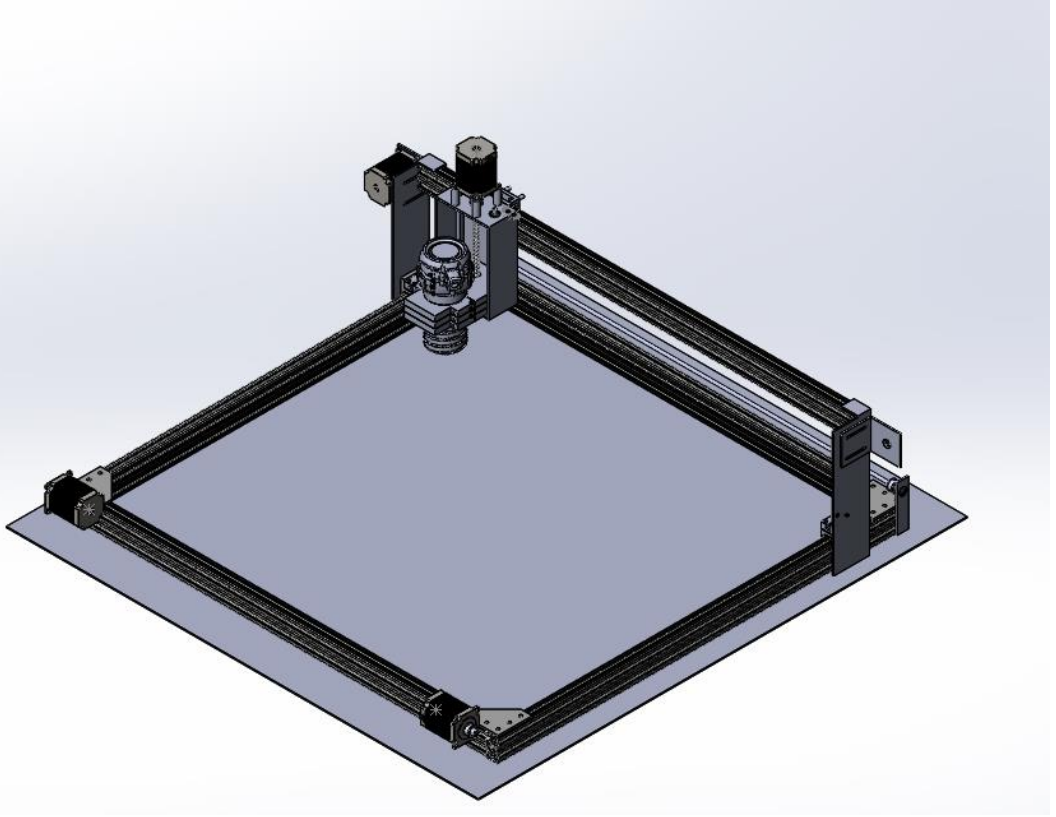
Accessible Shelving Unit

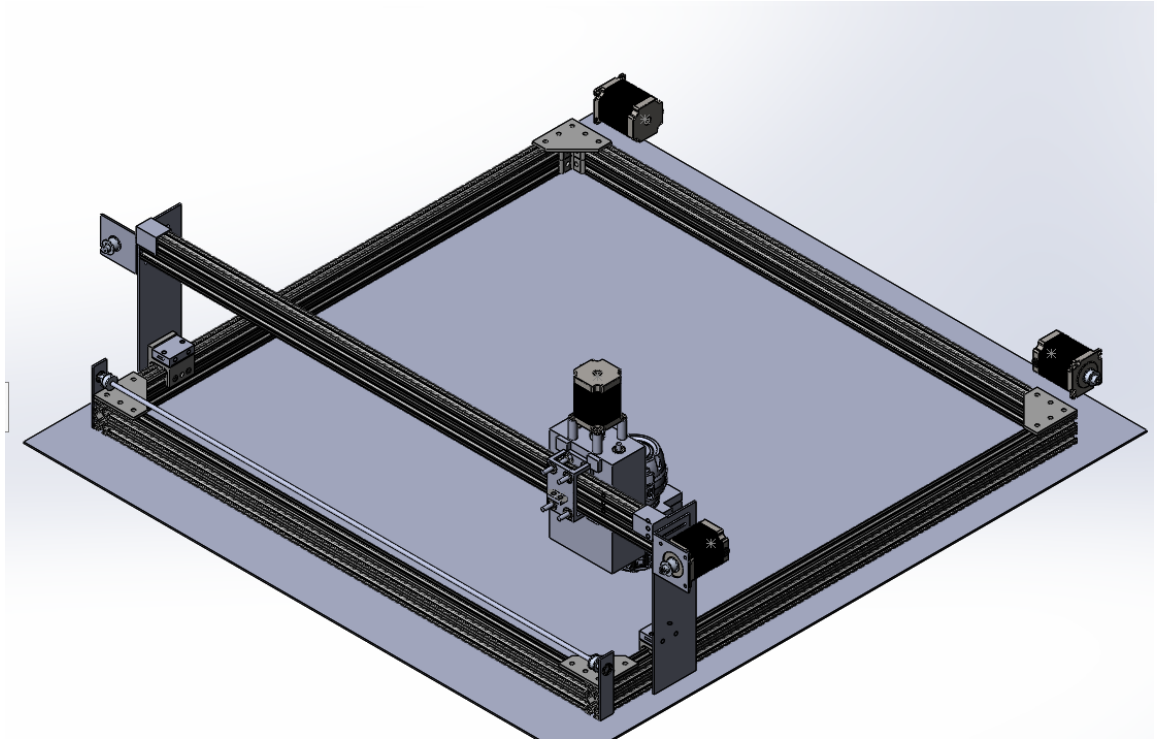


- Researched different products that help persons with disabilities act more autonomous in life
- Amalgamated the different shelving unit for users unable to reach high standing shelves on **SOLIDWORKS**
- Designed features a **4-bar** rotating arms to help with he compactness of the system
- Designed belt driven **linear** descent system for the shelves in order to increase range of shelves

DIY CNC Project

- Modelled a 4ft by 4ft CNC Router/Laser Engraving machine using custom plywood parts along with Commercially Off the Shelf(COTS) products on **Solidworks**





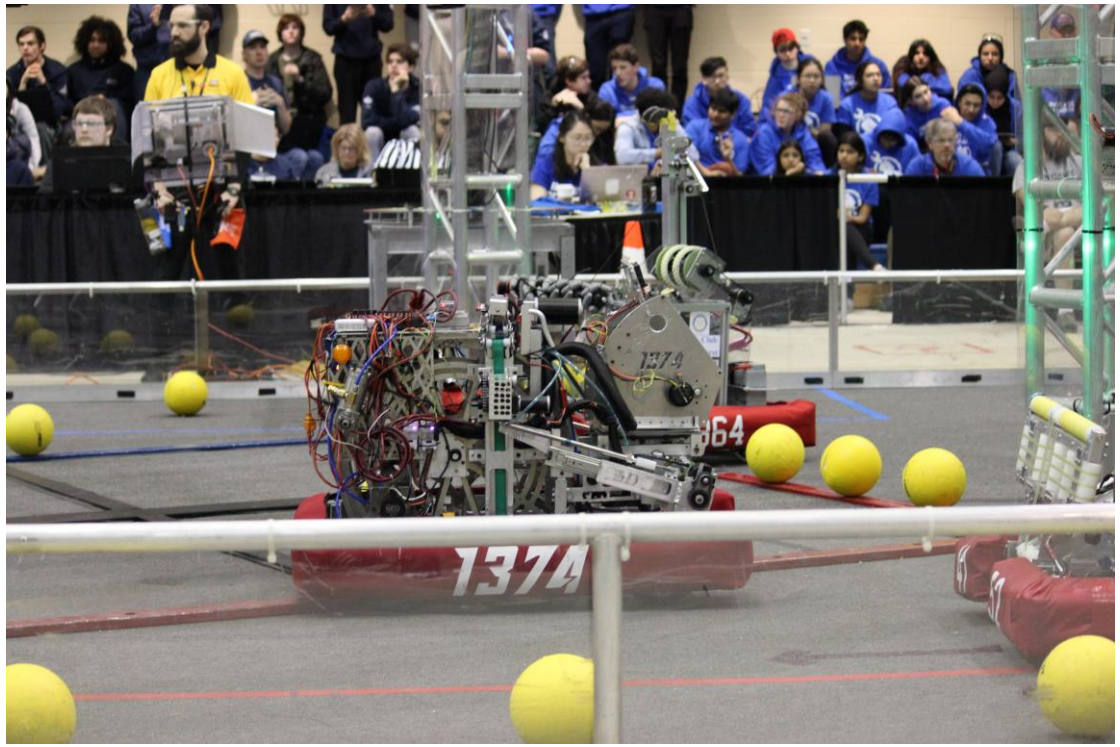
- The **X-Axis** and **Y-Axis** are belt driven by a **NEMA 23** stepper motor as it is a cheaper alternative to a ball screw set-up while still producing a machine resolution of 0.3mm per step
- The **Z-Axis** is lead screw driven by a **NEMA 23** in order to gain more resolution and avoid potential slippage problems with a spinning tool

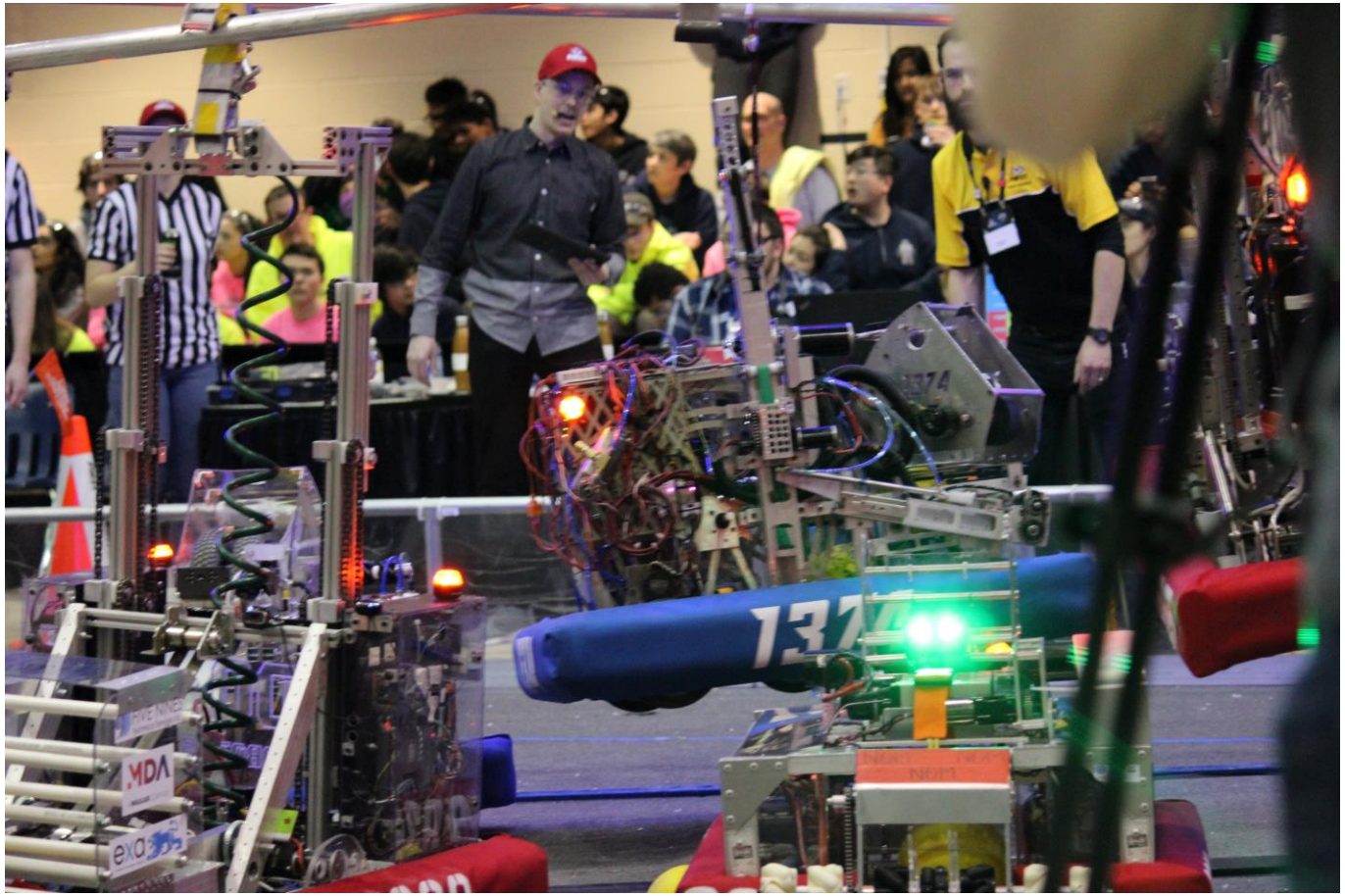
Next Steps

- Add electronics and wire routing system for different axis
- Review design with engineers/technicians
- Create a Bill of Materials for the whole machine
- Build the design

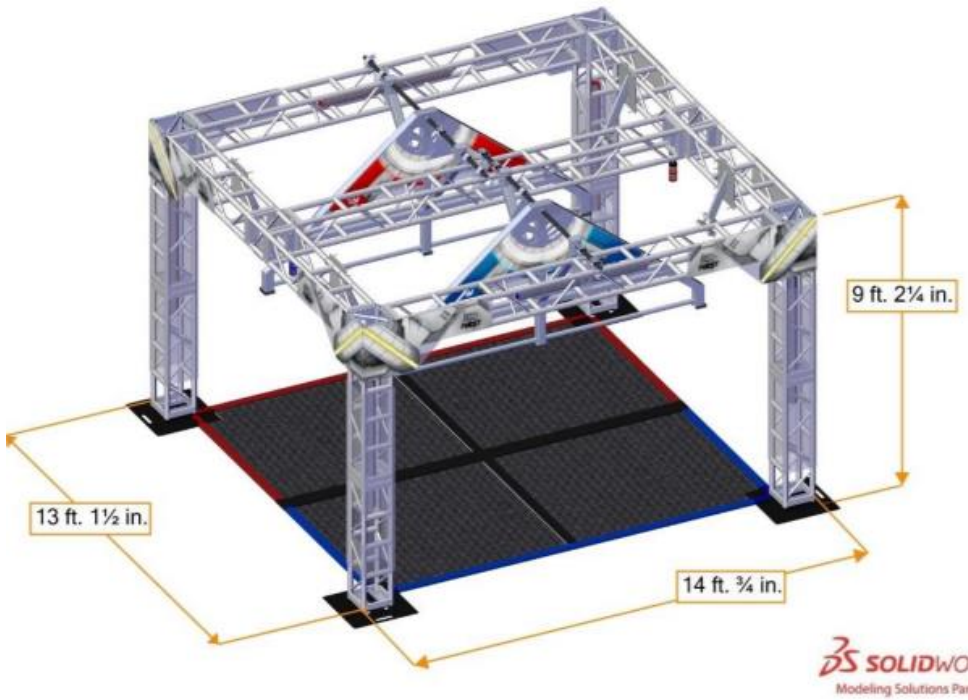
FRC Team 1374 Robot: Climber System

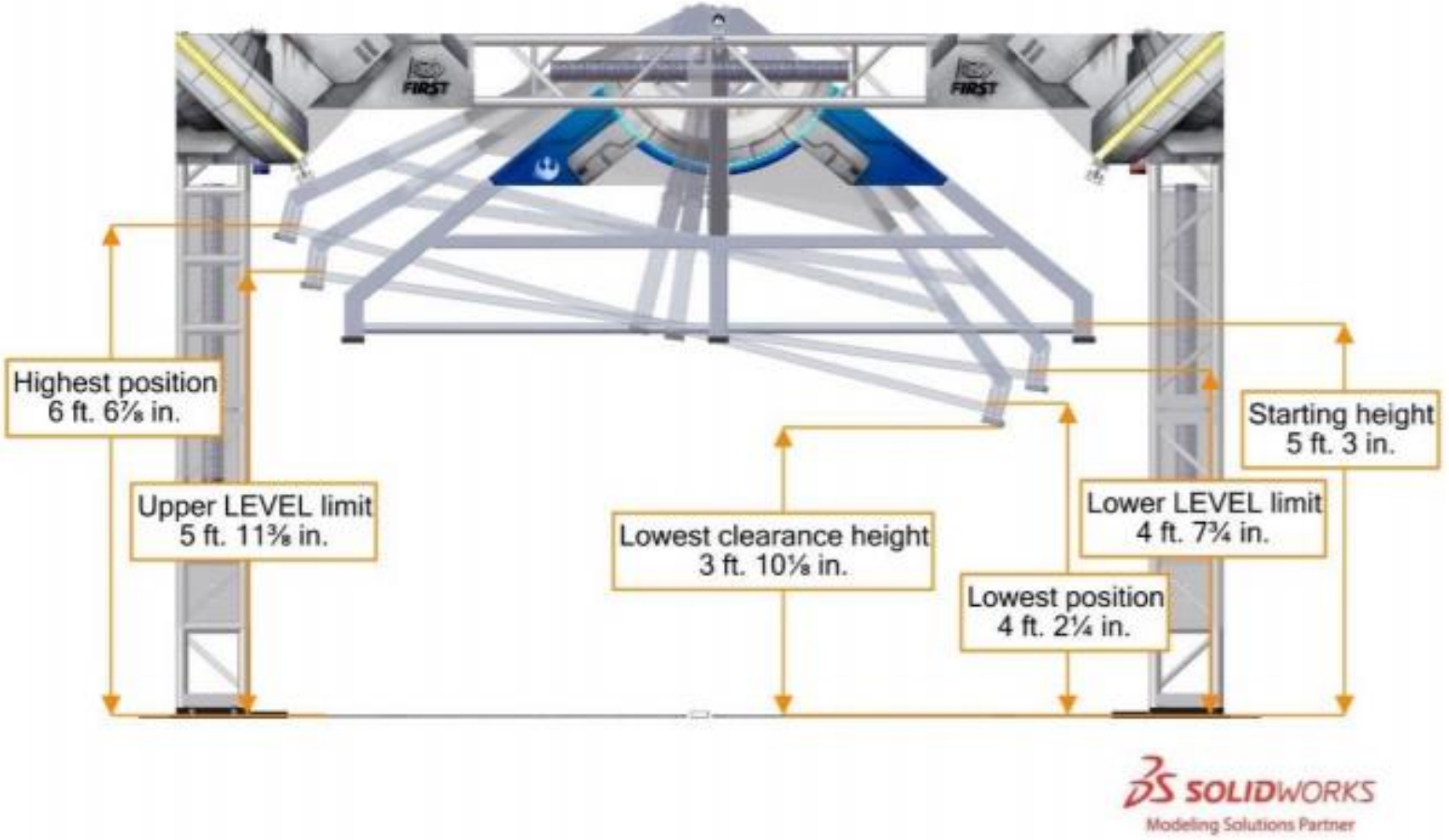
- Designed a climbing system for FIRST robotics competition on **SOLIDWORKS**
- Manufactured & Maintained the climber throughout the 8 week competition period





The Goal

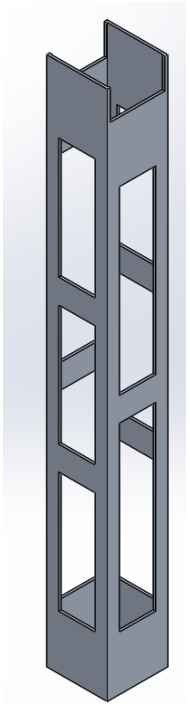




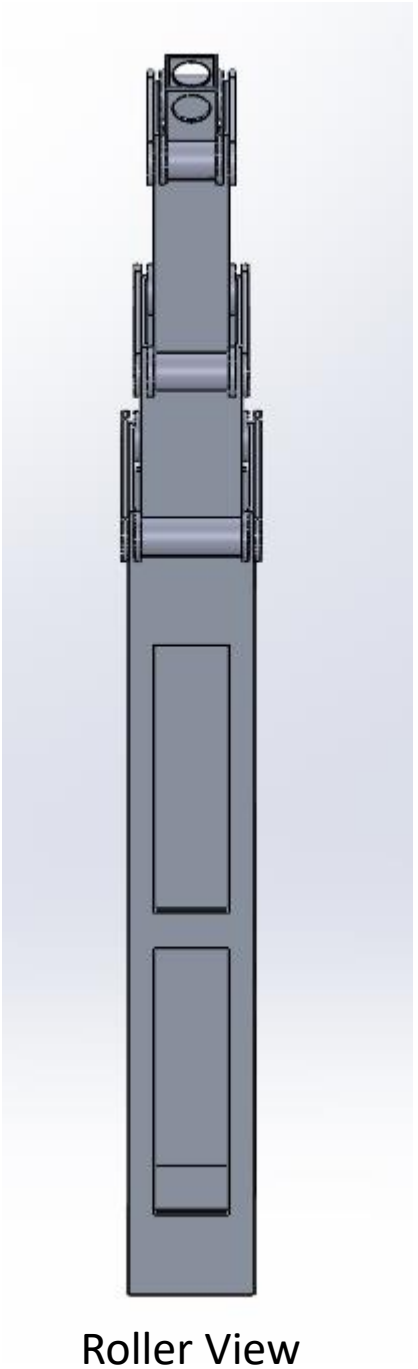
- Climb the “Generator Switch” (above) during the last 30 seconds of gameplay
- The switch changes heights based on where other robots have climbed
- The more robots on the team that climb, the more points the team receives

Design of Climber: Tubing

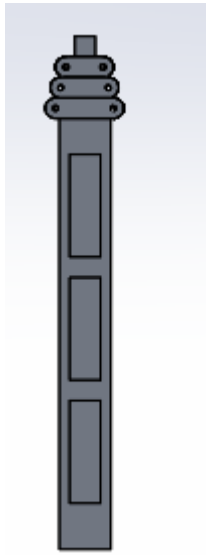
- Focused on creating a compact system to allow for a small and nimble robot
- Used four sets of Square 6061 Aluminum Tubing (2.5x2.5in, 2x2in, 1.5x1.5in and 1x1in) to create a telescopic arm
- Delrin rollers used on the outside to carry belt rigging and align tubes as structure rose



- Used **HSMWorks** to generate toolpaths and G-Code for slots on tubes
- Used **Plasma Cutter** to create slot profile

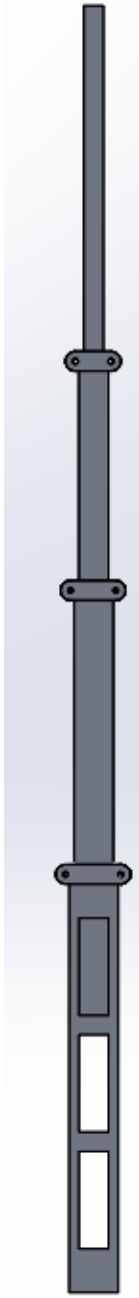


Roller View



Compressed

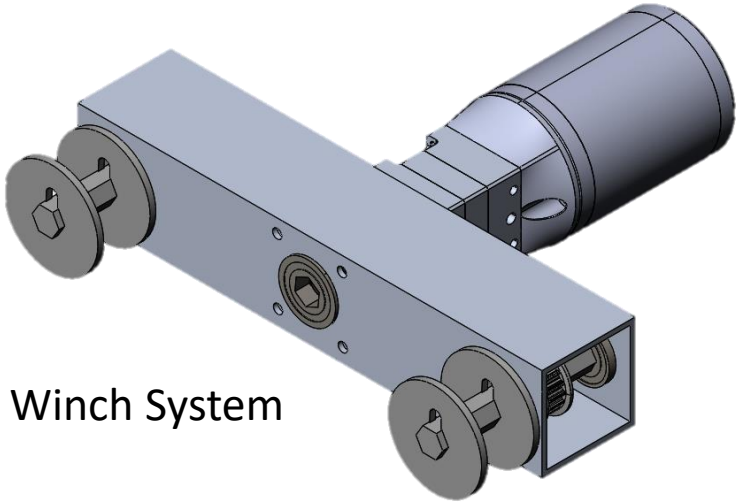
Extended



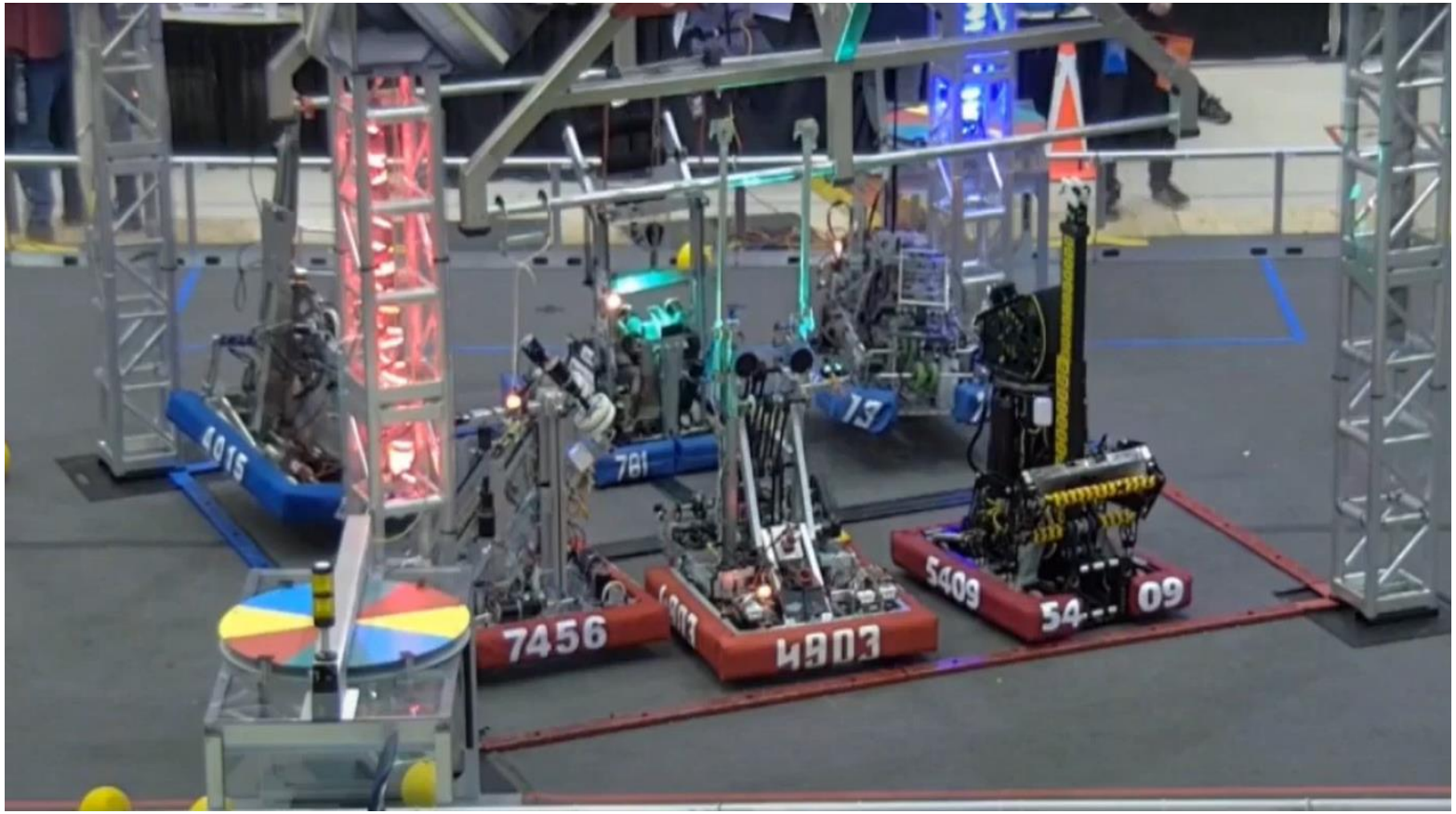
Design of Climber: Winch System

Winch Caps

- The winch system utilizes a 100:1 brushed DC motor
- The gearbox is attached to an axle that contains the winch caps
- A pin is placed between caps to hold the belt in place between itself and the axle
- Using a ½” Socket, the winch is can be tightened easily



Winch System

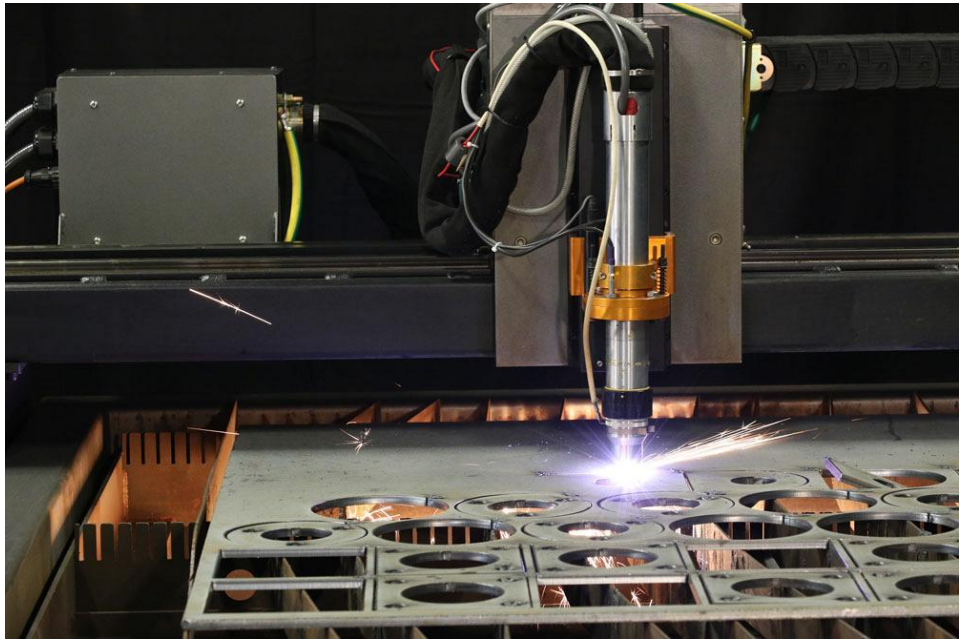


The image on the left is the winch system that was used to pull up the robot. Attached is about 140lbs (the weight of the robot)

The image on the top is a gameplay match where we(1374) climbed with our alliance partners(the other teams in blue). The video is found: here (start at 2:07)

Construction

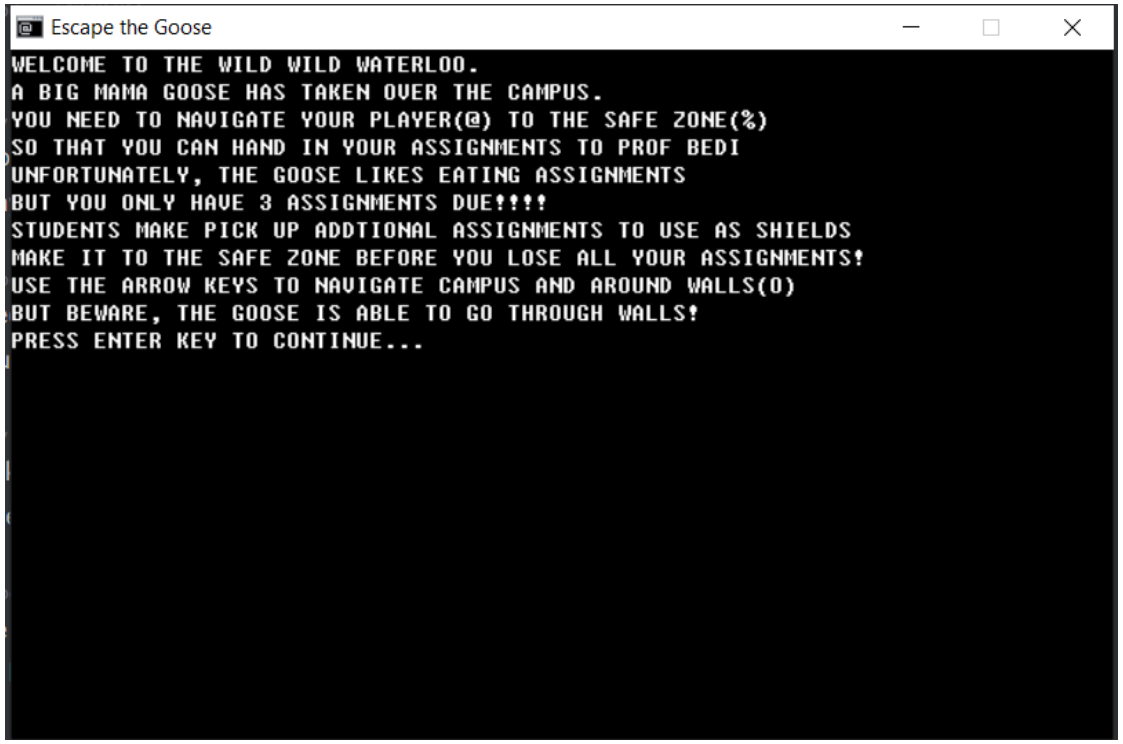
- This climber system was built using a **CNC Machine**, **Vertical Mill, Lathe**, **Bandsaw**, **Drill Press**, **Plasma Cutter**, **Horizontal Cut-off saw** along with hand tools



SOFTWARE SECTION

The Goose

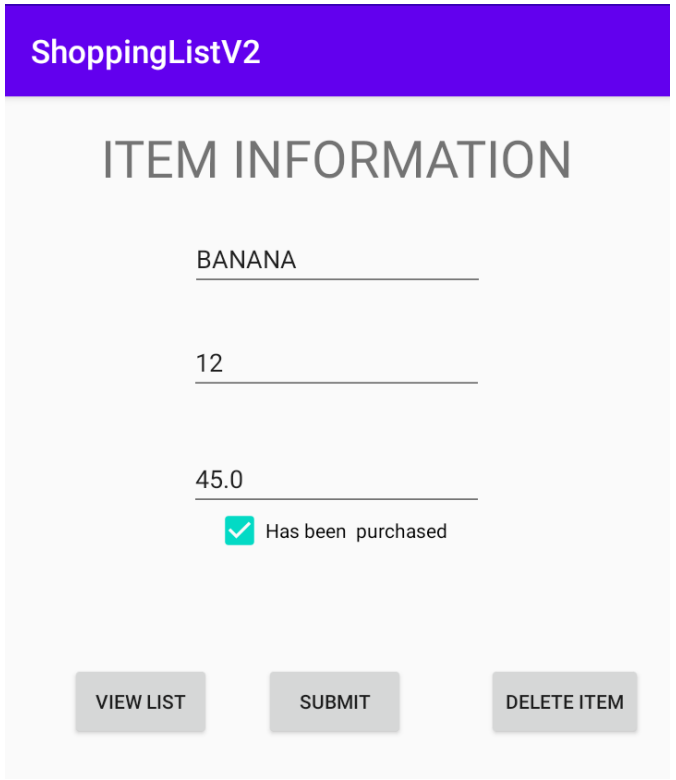
- Used **C++** and **BearLibTerminal** to create a maze-style game where a player is chased by a Goose

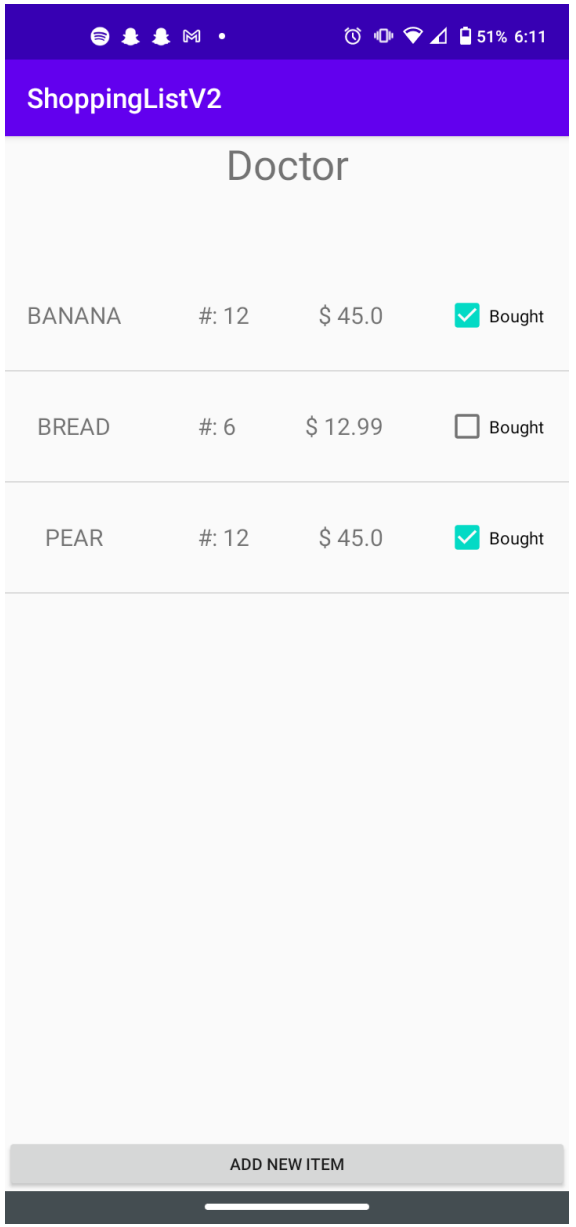


- Leveraged OOP to create player objects
- Used 2D Array to keep track of movements of the different characters
- Read different level layouts from .txt files

Shopping List

- Used **Android Studio(Java + XML)** to create an android phone app that tracks different household grocery lists
- Allows different home users to change item status and quantity

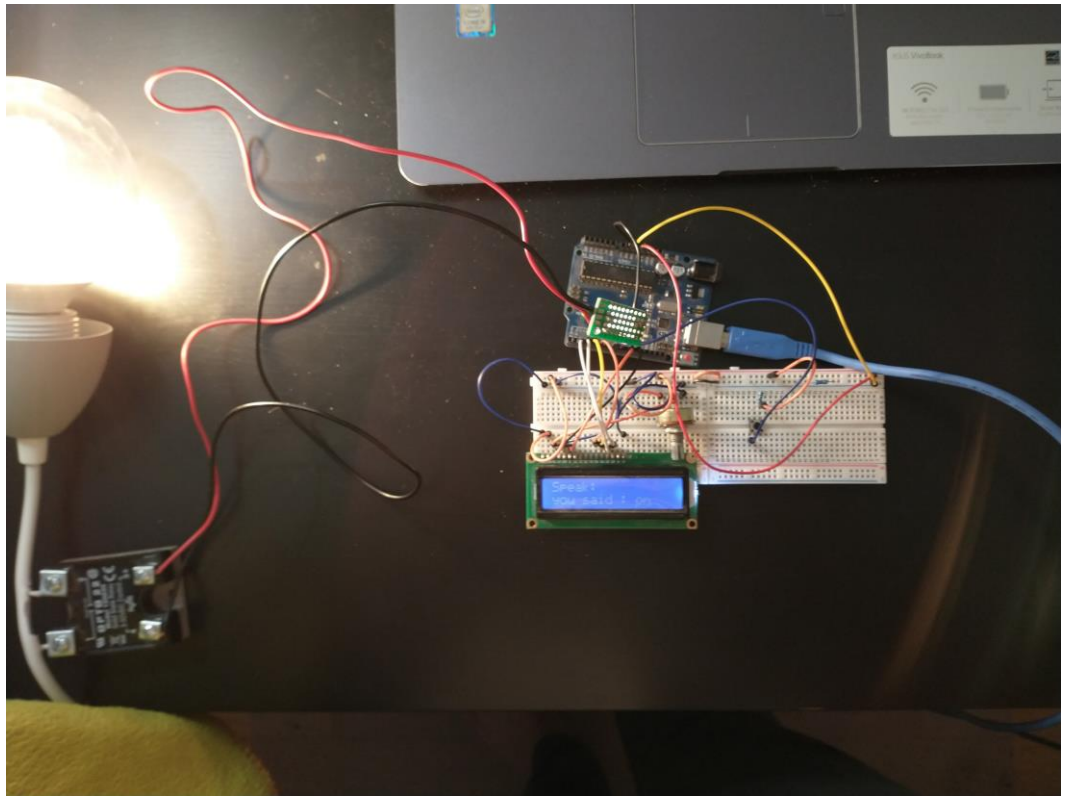


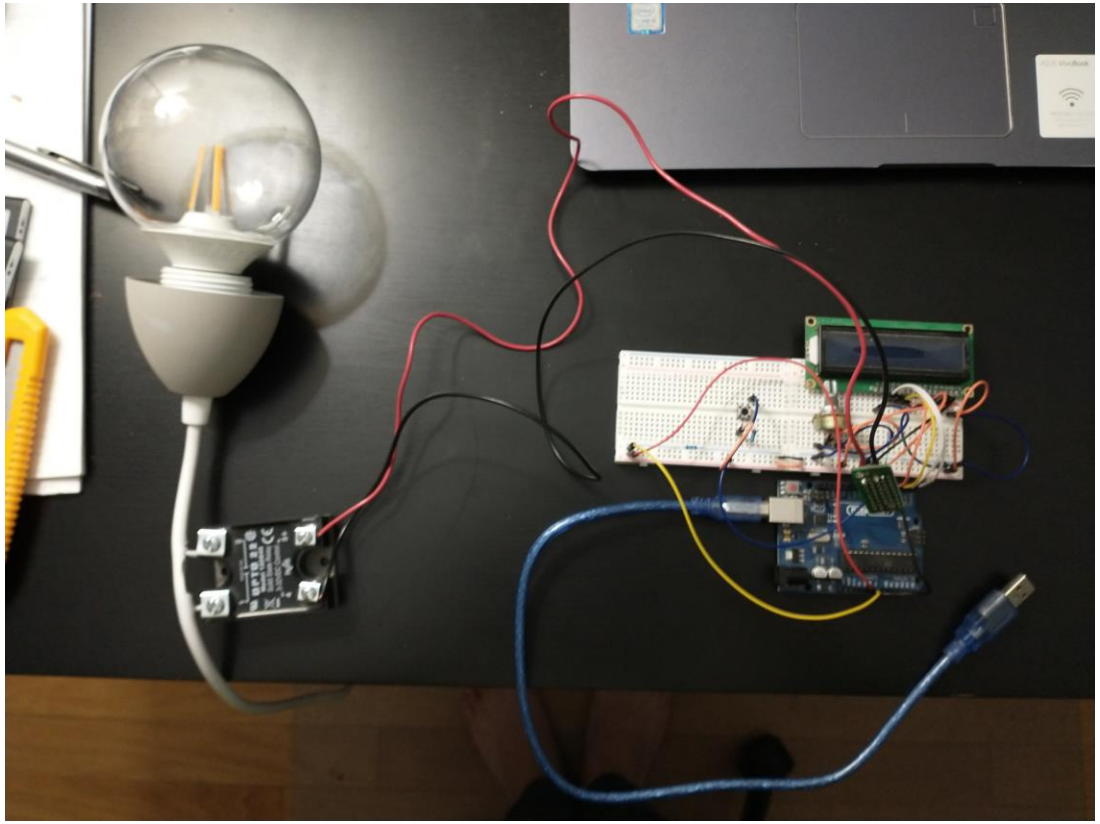


- Used **Firestore** to store user specific lists
- Used **Firebase Authentication** to create email based logins
- Used Java OOP to create item templates in order to use **ListView** and a custom adapter

Remote Light System

- Developed voice activated IoT lighting control with **Python** and **Arduino** integration





- Used the **PyFirmata, Speech Recognizer and Flask** libraries to read user voice and develop a web app for the light controls
- Used an LCD to display what was spoken and Solid State Relay to control the light