Cindy Huang
Engineering Project Portfolio

Introduction

Hello, my name is **Cindy Huang**, I'm a sophomore pursuing dual degree in **Mechanical Engineering** and **Business Administration** at **UC Berkeley M.E.T** Program (Management Entrepreneurship Technology). This portfolio is designed to supplement my resume by demonstrating some of my Engineering project experience.

I have interests in manufacturing, aeronautical engineering, automotive engineering, and robotics/automation. In my free time I enjoy solving twisty puzzles(Rubik's cubes) and tennis.

All CAD in this portfolio are done using SOLIDWORKS.

Thank you for taking the time to look at what I have created!

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Contact Information

Email: c.h@berkeley.edu

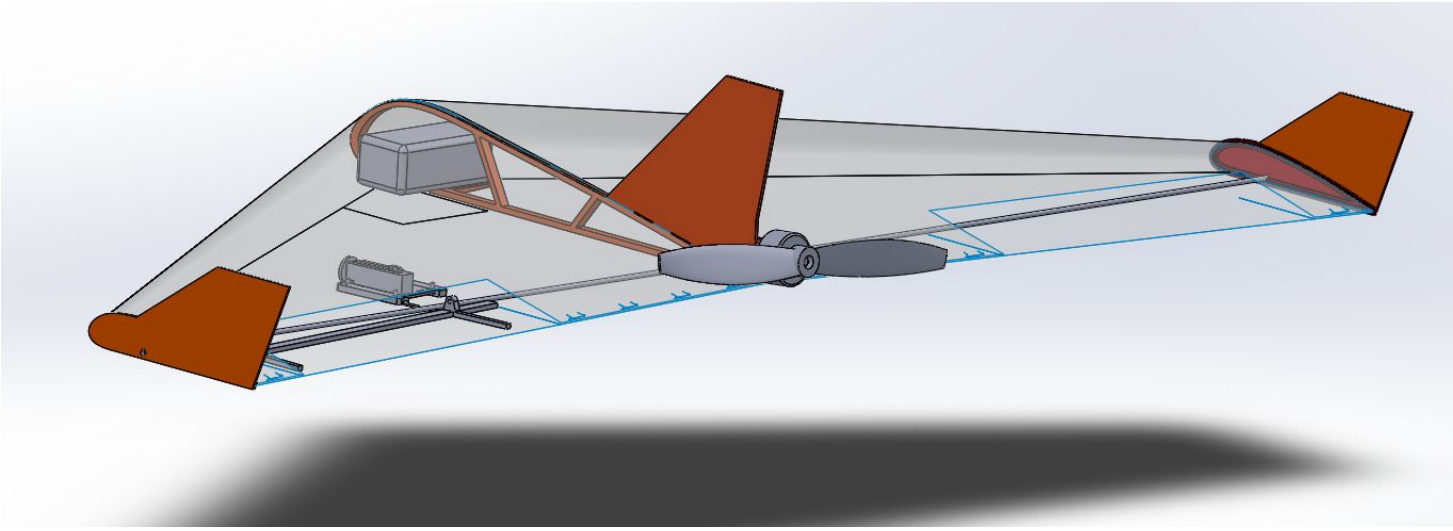
Phone: 949-378-3258

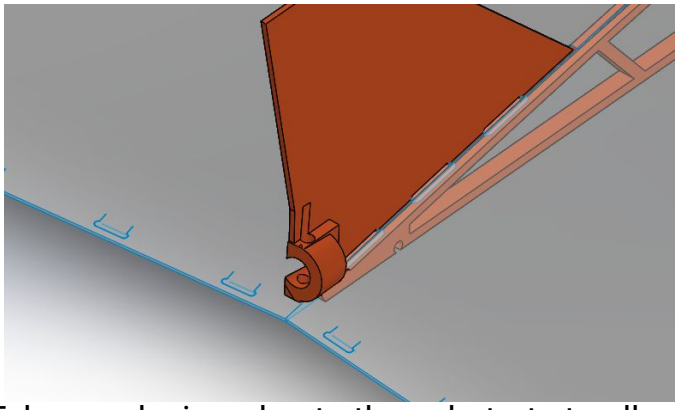
Linkedin: https://www.linkedin.com/in/cindyhuangx/

Resume:https://xcindyhuang.github.io/resume/

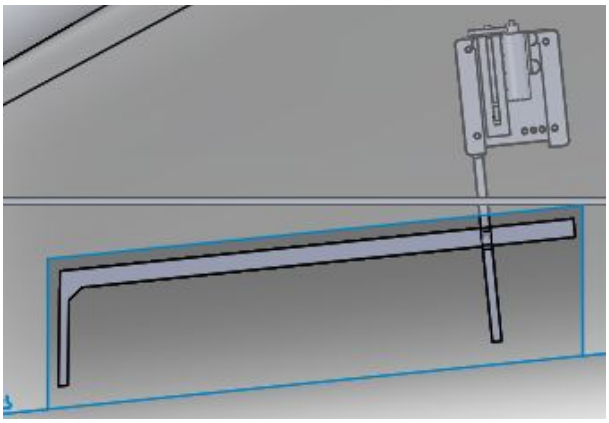
1. Flexible Hybrid Electronics RC Flying Wing

Objectives: Create an RC flying wing airframe that can be folded by 1 sheet of flexible substrate that has electronics printed directly on it, including printed ESC, power distribution, servo connections, sensors.

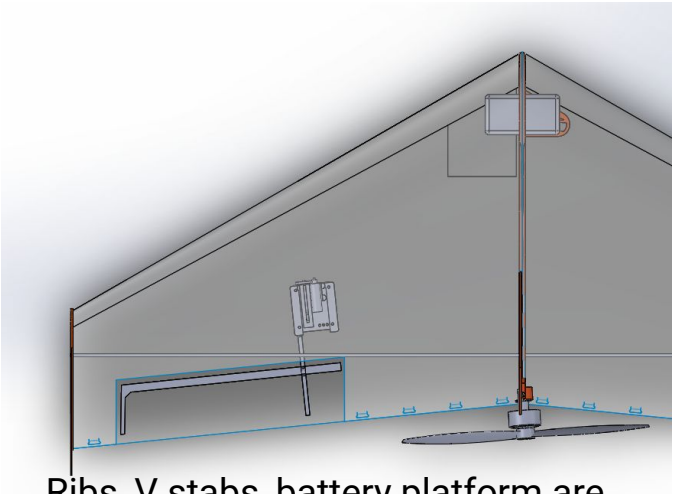




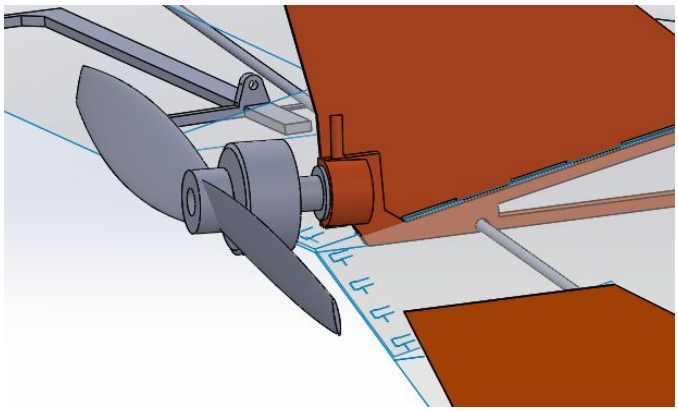
Tabs are designed onto the substrate to allow ease in assembly. Tabs to connect trailing edge, and to secure tabs onto the center ribs are shown in the picture.



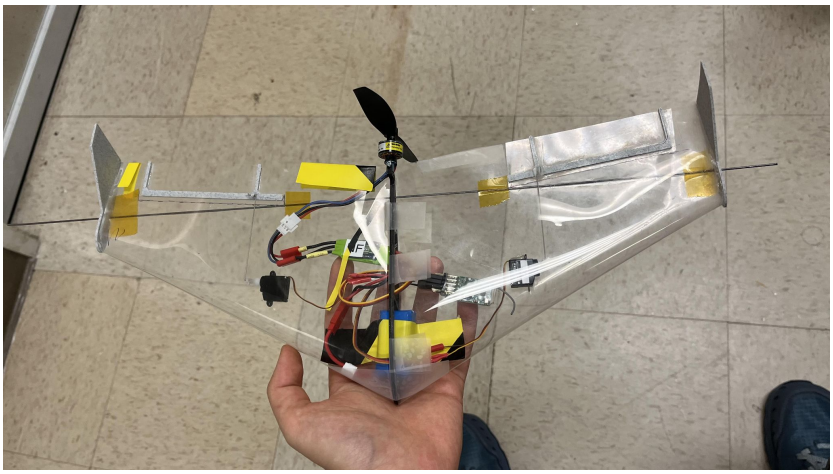
Compliant mechanism between servo mount and elevon-support decreases the parts count, thus decreasing the complexity in assembly process



Ribs, V stabs, battery platform are designed to be 3D printed with PLA without any supports

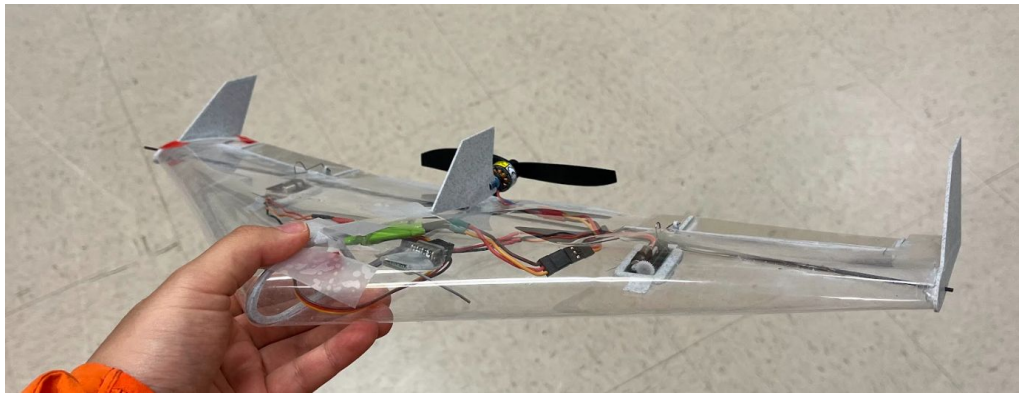


Angled motor mount (4 degrees in Z and X direction) to offset inertia caused by motor turning.

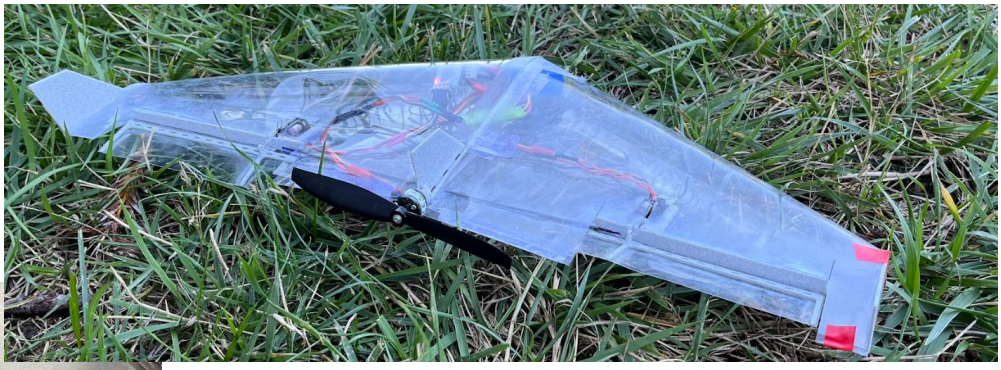


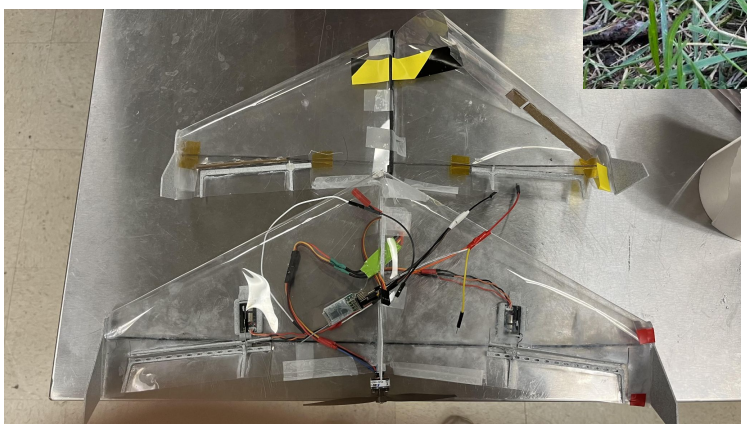
First Prototype: Flight test was <u>unsuccessful</u> due to small wing area, and faulty servo on elevons. V stab area too small to provide proper stabilization in yaw direction. Angled mount isn't angled to offset rotational inertia motor produces.

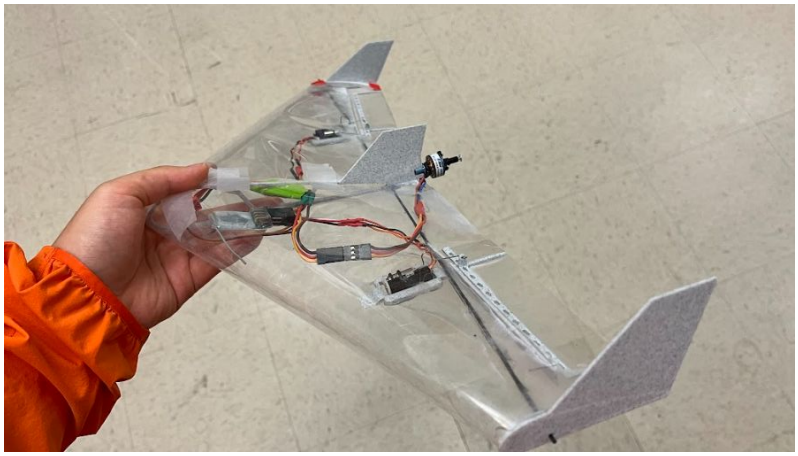
Second Prototype
Changes:
- Maximum wing area and wing span that fits on substrate
- Angled motor mount
- Proper weight distribution



- Central V stab to provide proper stabilization.
- Linear throw servo to minimize distance between elevon and servo.



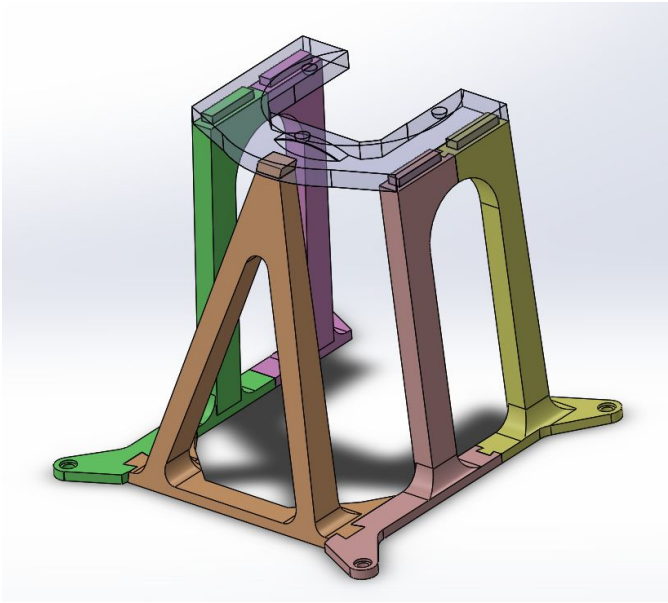




Flight test was <u>successful</u>.

Stabilization was still an issue due the nature of small scale RC aircraft.
Future improvements:
- Taller V stab

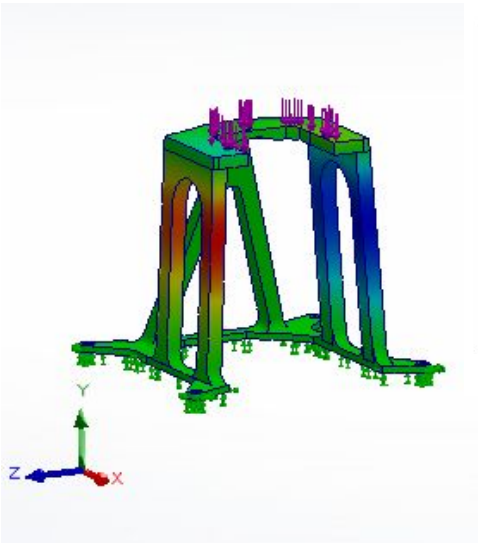
2. 5-Axis Gantry Tool Changer Fixture

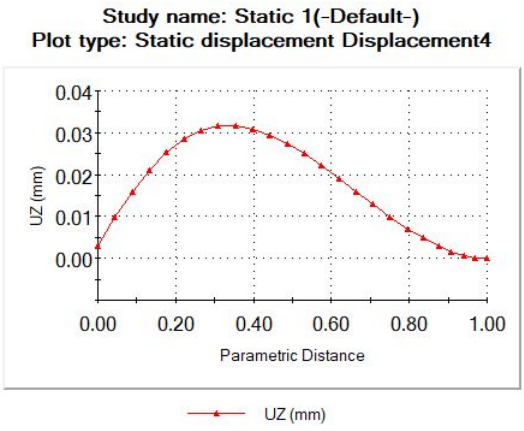


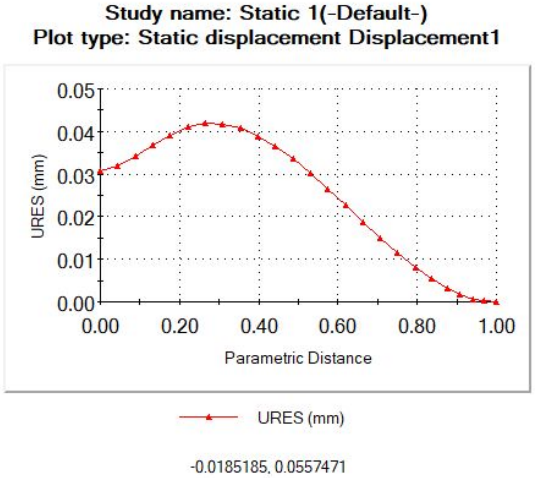
Objective: Design a universal fixture that is placed onto the print bed, that catches head attachments(3 designs) when released.

Design Considerations:

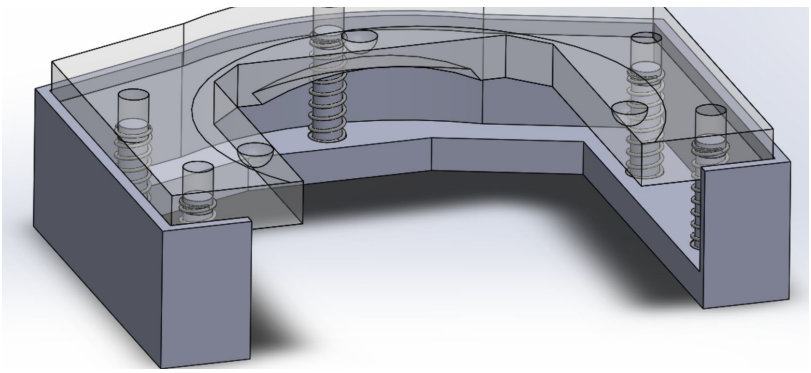
1. Must be manufactured by FDM 3D printing
2. Withstand heavy load
3. Easily Attachable and detachable.



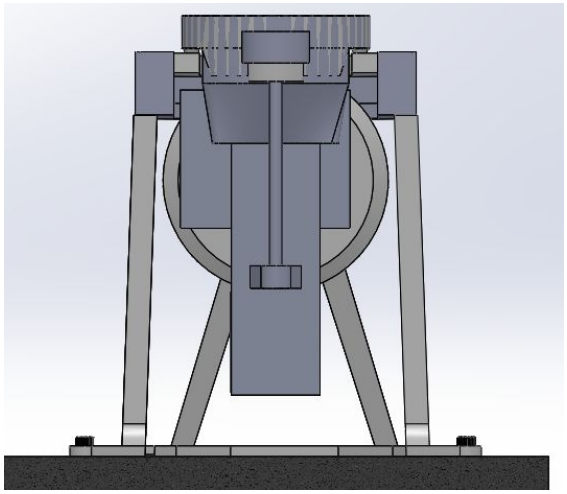




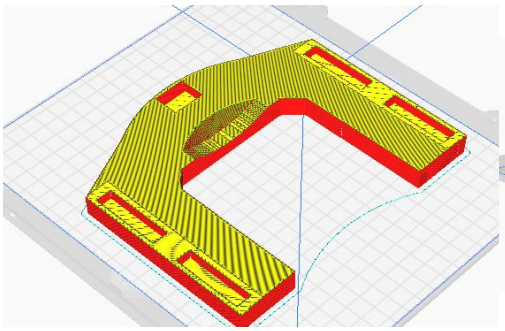
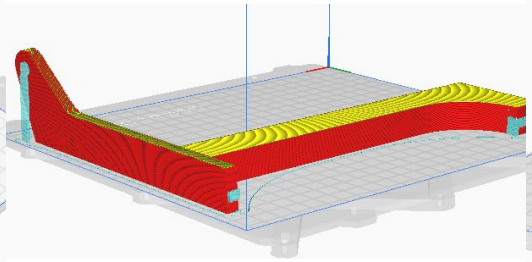
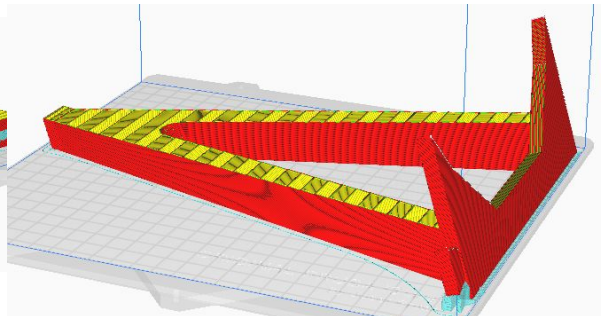
FEA Analysis for beam displacement in Z and X directions under factor of safety = 3. Maximum stress is within PLA's yield strength.



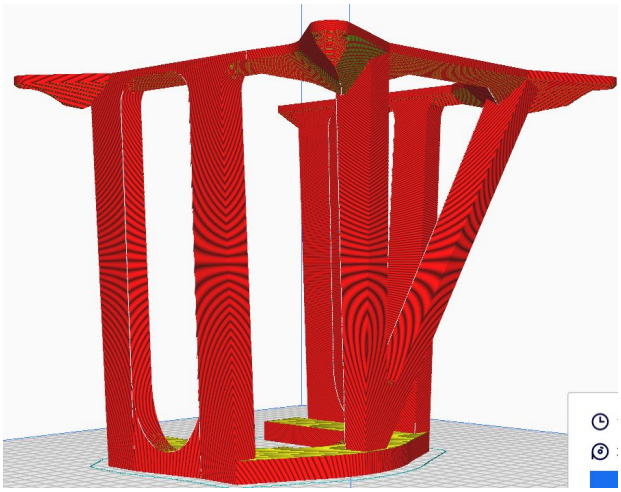
A removable spring loaded top piece to serve as cushion for tool attachments to rest on.



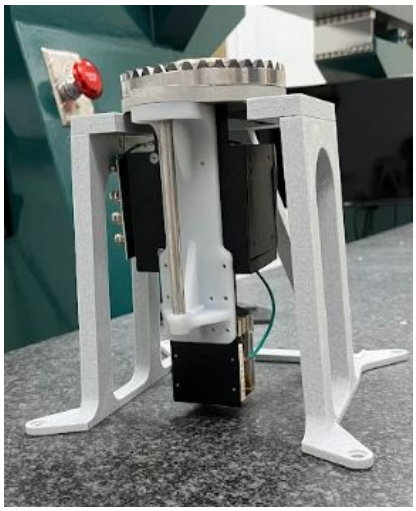
Gantry head attachments sits perfected onto this fixture.

Structure was designed to fit into Prusa print bed and print with minimal supports, since Prusa MK3 was the printed I have access to. PLA filament was used to minimize warping.



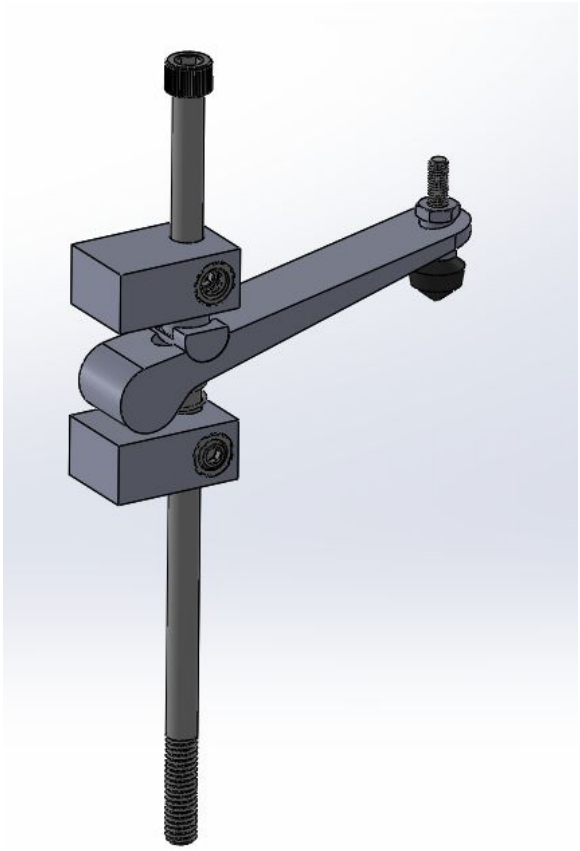
If a printer with larger printed bed was available, this design is able to print in the shown direction with no supports at all.

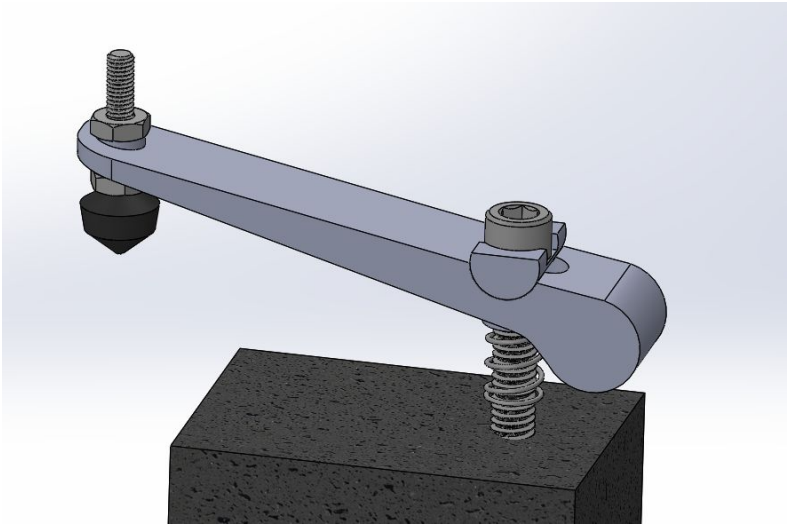


Results:
Fixture captures all gantry attachments securely.


3. Hold Down Clamps

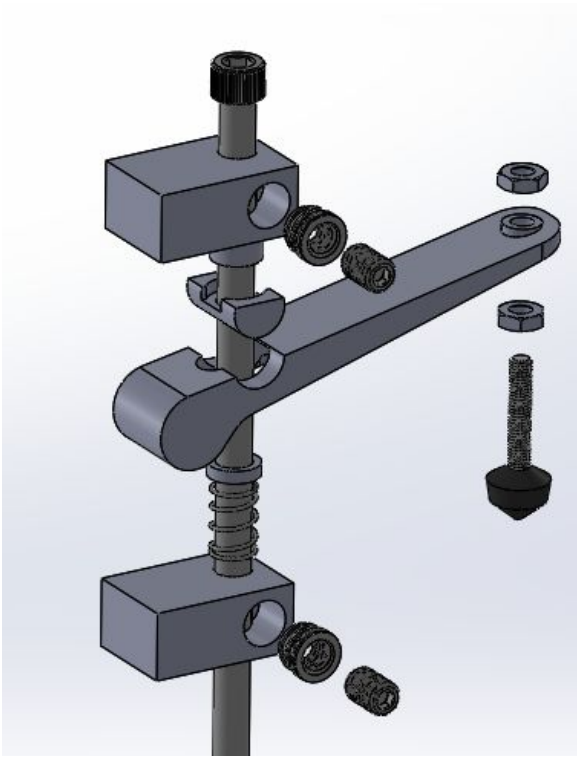
Objectives: Fixture that holds down irregular objects onto a gantry system.
Challenge: Needs to hold down objects from 0 to 8 inches tall.
Idea: Create two clamps. Tall clamp holds object from 0 to 8 inch tall, while the low clamps can ensure that when low objects are clamped, the interference to tool path is minimal.

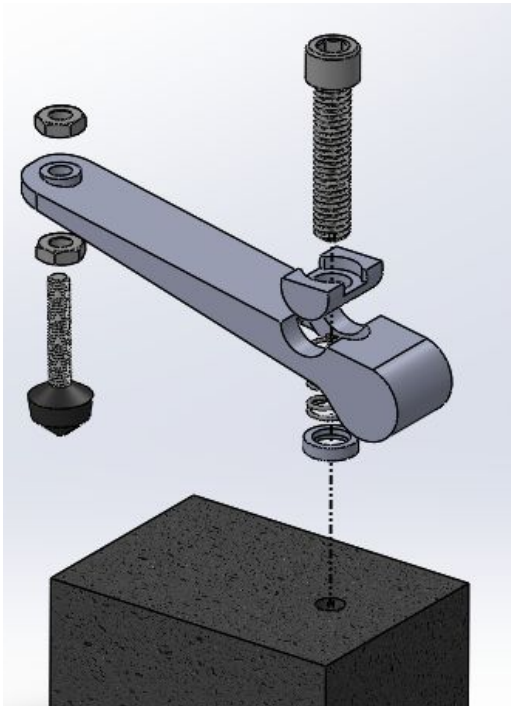




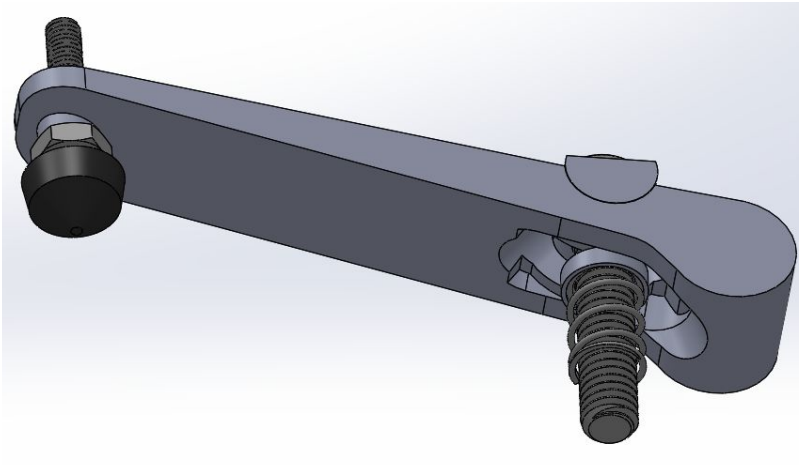
Design choices:

- Cylindrical platform to ensure uniform contact between screw and clamp
- Spring to allow adjustable tension
- Rubberized tip to increase friction

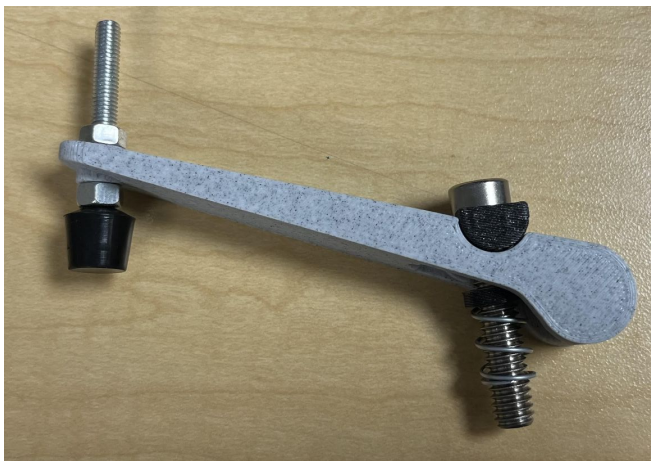




- Parts are off the shelf, or 3D printed with PLA filament.
- Adjustable platforms allows clamp to reach 8 inches tall.



The circular disk prevents spring from rubbing the clamp body, allowing smoother usage experience when changing clamp angle.

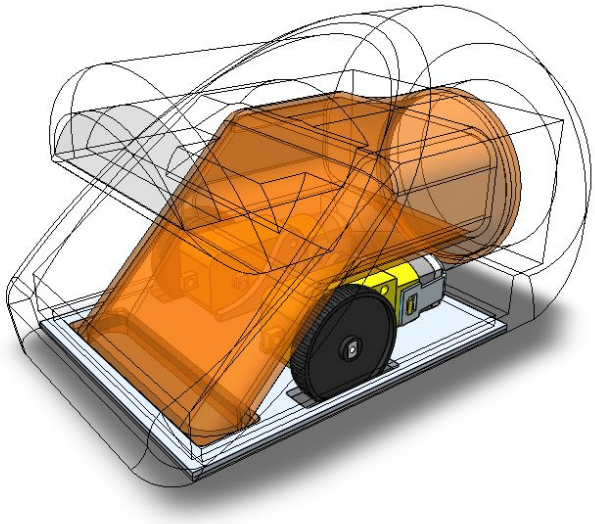


Bolt for rubber tip was trimmed down to prevent intervention with gantry tool path.

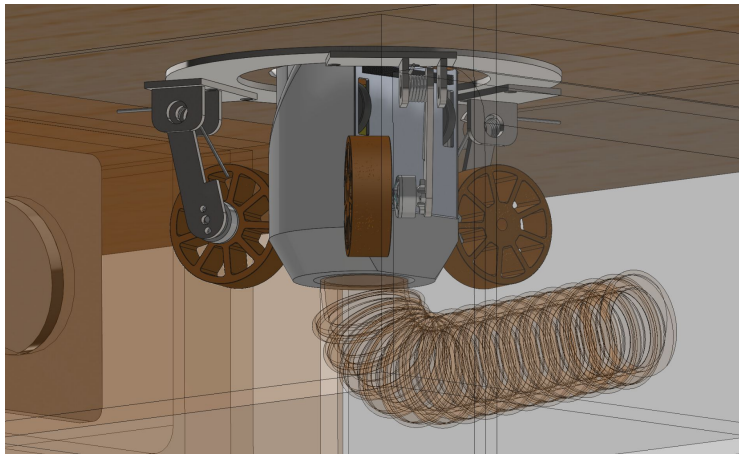
4. Cleaning Robot: Sneaky Showcase

Objectives: Design an autonomous robot that needs to clean the table in a space hotel environment. The table needs to be cleared of all foreign elements (solid and liquid).

Idea: a snake inspired soft robot that attaches to the underside of table, and “craws” on the table surface to achieve cleaning.

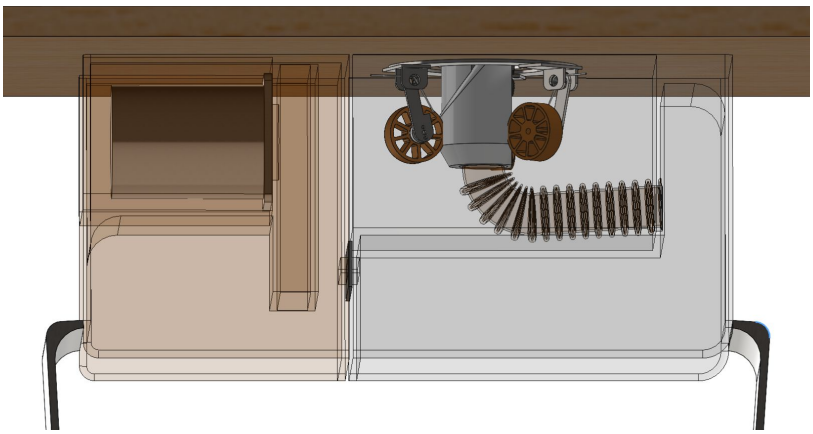


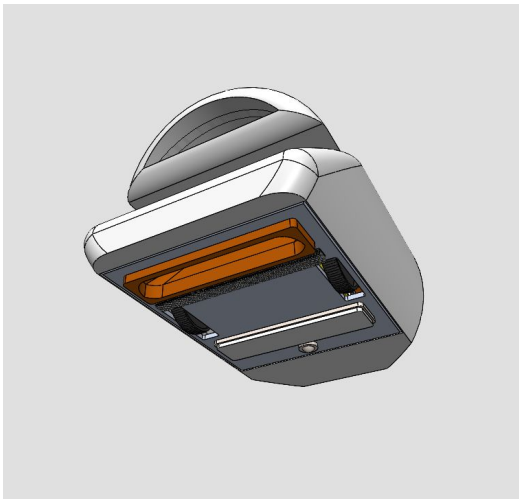
Robot design assembly utilized off the self motors and wheels.



Compliant wheel and spring loaded system to hold robot in place during the fully retracted configuration.

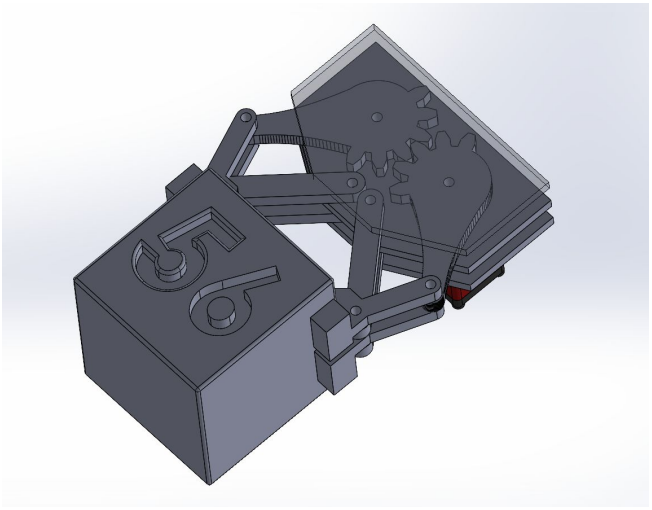
Additional Pictures:

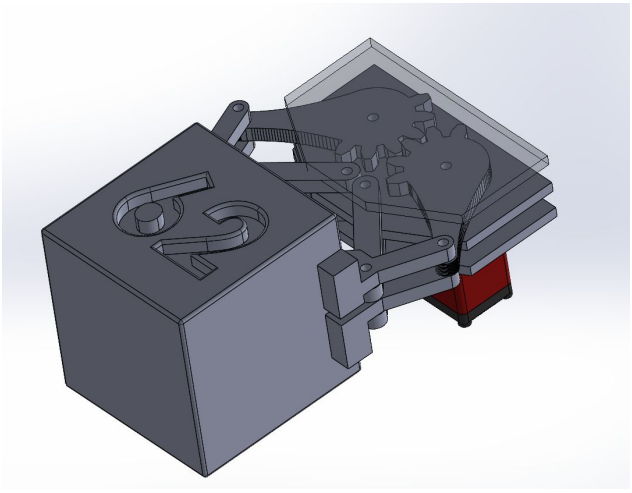




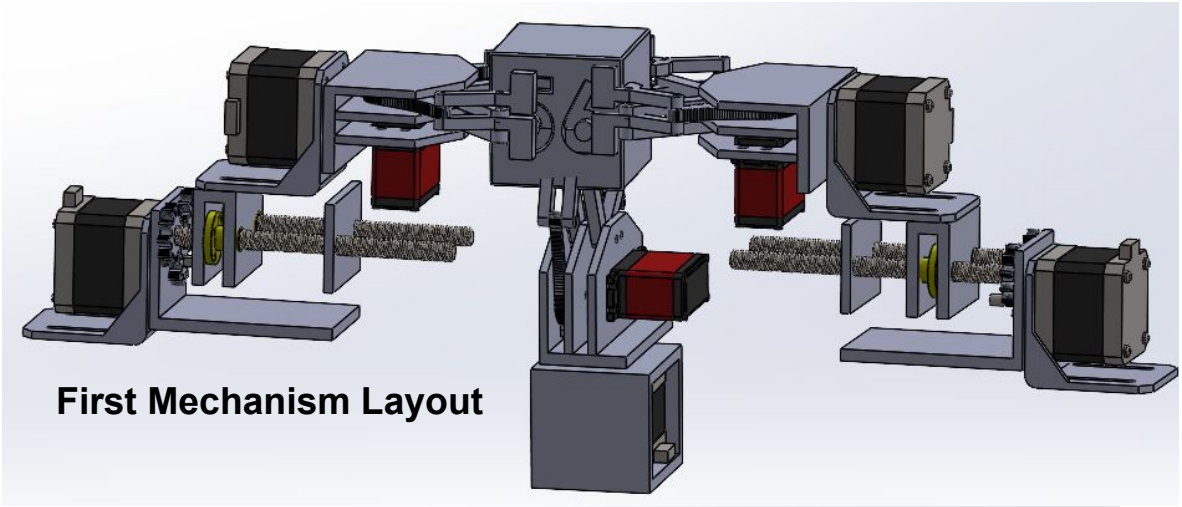
5. Rubik's cube solver/Scrambler (In Progress)

Objective: Design a universal cube solver/ scrambler for 3x3, 4x4 and 5x5 cubes.



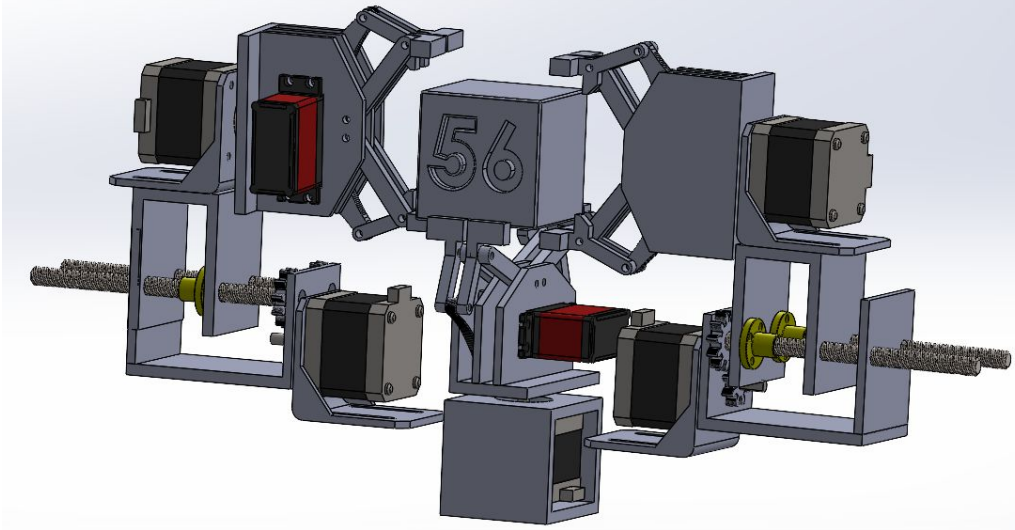


Claw gripper that can grip cubes demonstrating gripping 56 mm cubes and 62 mm cubes

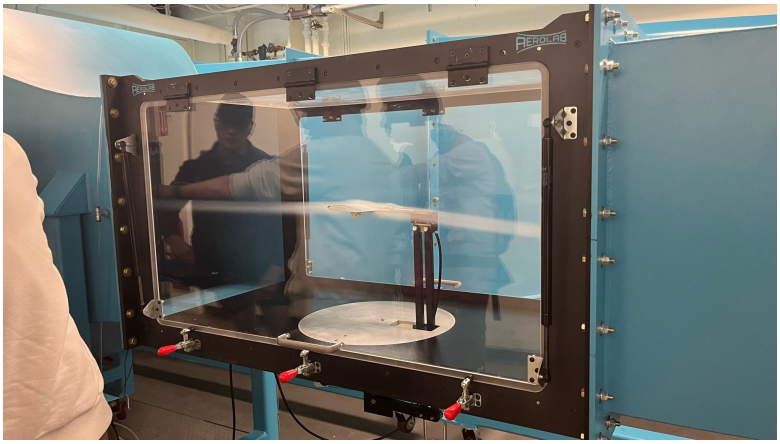


First Mechanism Layout

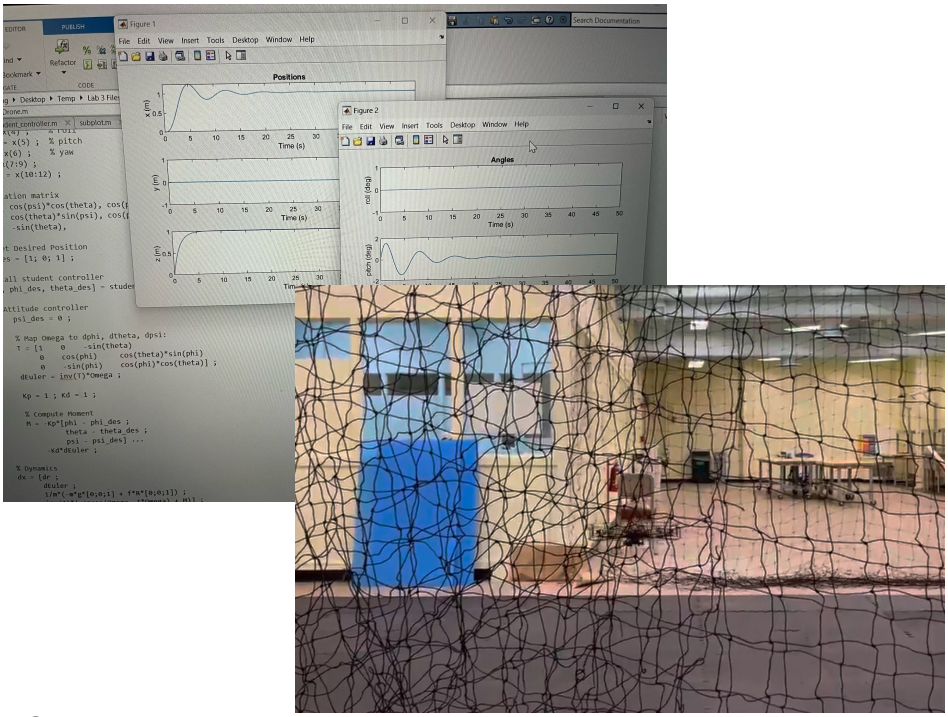
More compact Mechanism Layout



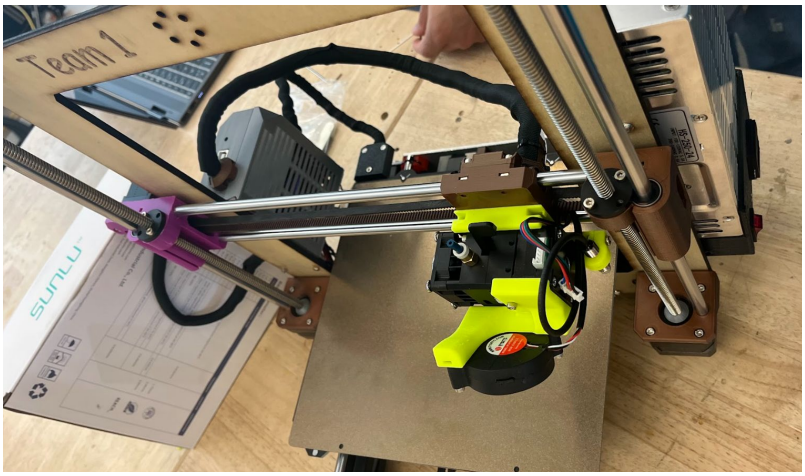
6. Some other fun stuff I did



Learning to operate wind tunnel

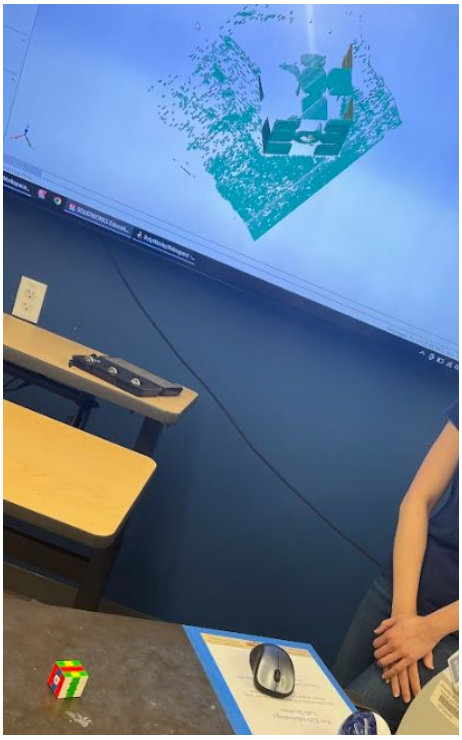


Quadrotor PID controller sims and testing



Building a modded Prusa MK3

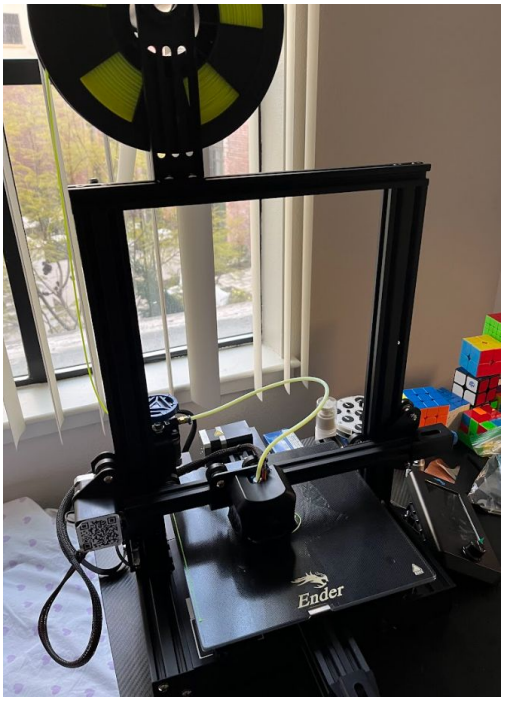
My 3D printed PCB soldering helping hand and campus



Scanning a Rubik's cube with hexagon metrology romer arm

Laser cut and assembling a shelf

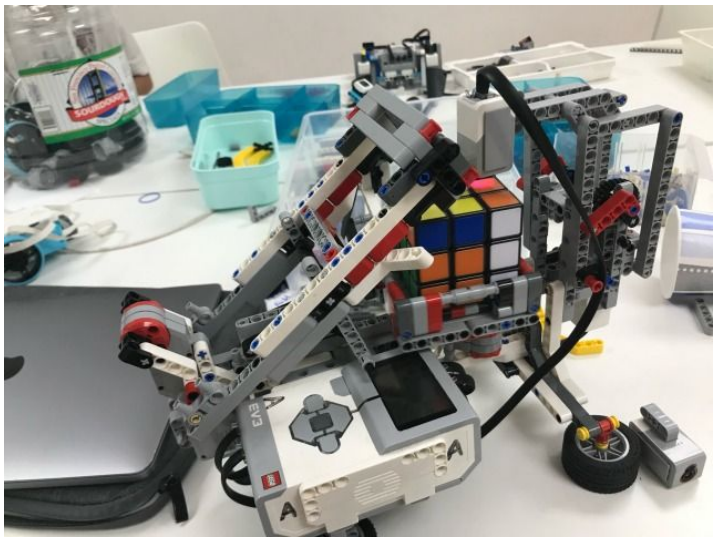
3D model of foldable wing



My first 3D printer

Touring Joby with Berkeley institute of transportation

First time using SLA printer



Building Rubik's cube solving robots while coaching First Lego League

First time welding