Brenden Koo

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2025

Brenden Koo

Engineer | Portfolio

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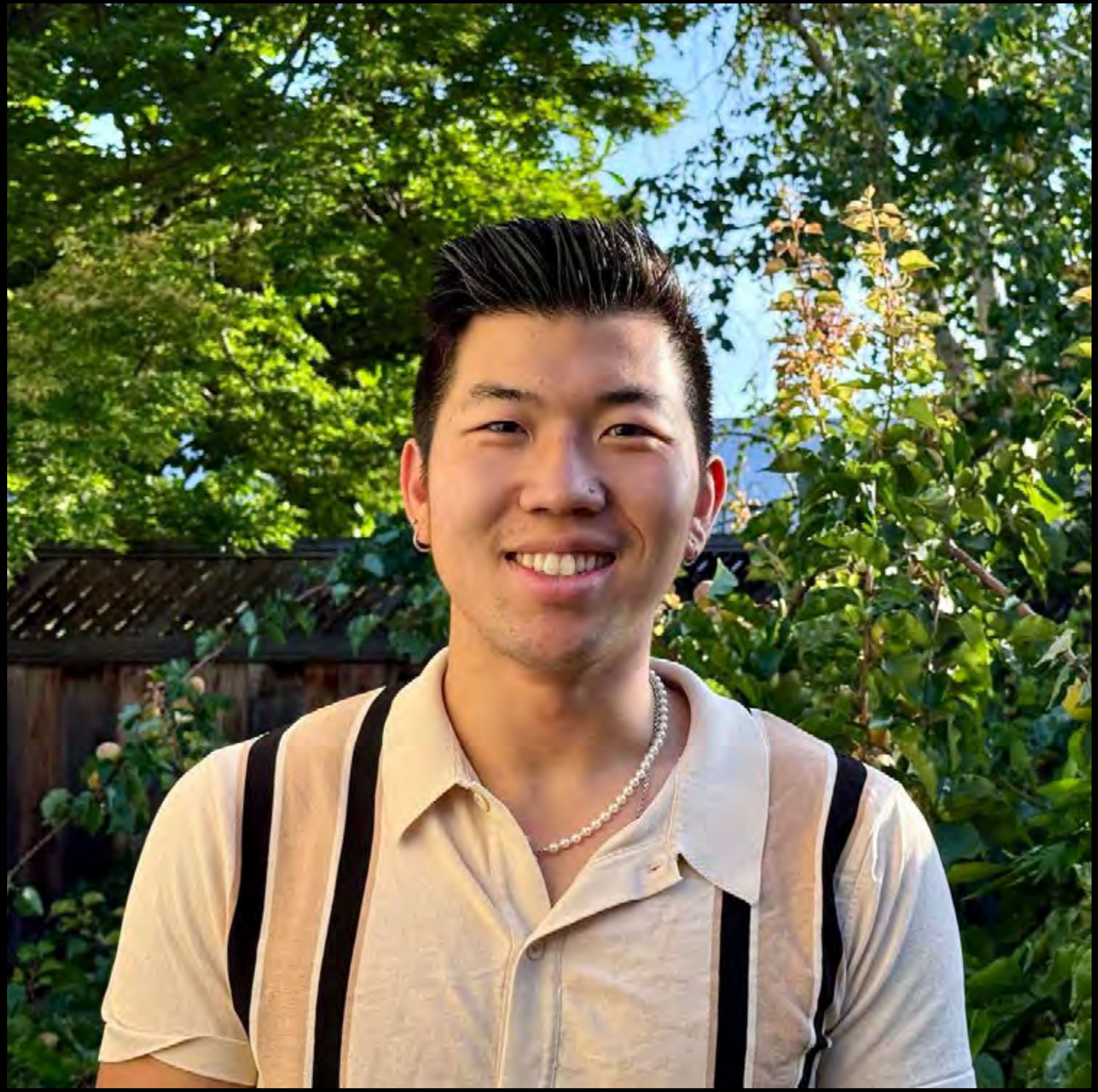


Signature Projects

Swope Designed Spinner

When working with Swope Design Solutions, I spearheaded the Design for Manufacturing (DfM) work for a CNC-turned promotional spinner, and designed CAD and CAM for mass-production and reduced per-unit cycle time by 25%. I designed the spinner by following the four pillars of the Swope Design Solutions process: Design, Build, Test, Repeat. The end product is a fun, compact giveaway item that can be distributed at business development events and conventions.

Contribution

As the sole lead of this project, I researched spinning top designs, created CAD and CAM models in SolidWorks, and validated the CAM through extensive testing. I machined multiple iterations on an ST-20Y CNC lathe and designed a custom fixture for a Bridgeport mill to efficiently remove the “pip” left by the parting operation.

Swope Designed Spinner

Research

I first needed to understand the physics behind spinning tops and how the design elements can be tuned for manufacturability.

After much research and many rapid prototypes,
I settled on this design:

The final design is a traditional wide-base, thin-stem form with the stem diameter set at 0.16" for stability during machining. I rounded the tip to prevent wear over time and incorporated a clearance region between the base and tip to allow for a more forgiving spin.

DFM Considerations

In order to continue refining the process:

- The top is machined from a cylindrical stock of 303 stainless steel, which is relatively easy to machine
- The 1:1 diameter-to-height ratio not only provides stability but also favorable in a cost analysis.
- The top is quickly machined first in a 15-minute operation on the CNC lathe, followed by a quick pass on the bridgeport mill to clean up the “pip” (pictured bottom right).
- **I tuned the feeds and speeds of the machining process to reduce per-unit cycle time by 25%.**

Machining





TSA Boat

Designed for ME218C | Smart Product Design Practice, TSA is a combined set of a remotely navigated watercraft and a remote controller. Using a standardized communication protocol and XBee radios, any controller can pair with any boat. Once paired, the controller controls the boat's navigation through an obstacle course, manages limited battery life via barcode "recharging," and activates servos for anchoring and dispensing rubber balls into the designated area. Built-in pairing and timeout mechanisms ensure reliability across teams and prevent communication lockups.

Contribution

Working on a team of 3, I took a **lead on this project.** I wrote the software that drove both the controller and the watercraft, and was my team's designated representative to write the communication protocol. I also designed and took charge of the electrical wiring configuration. Furthermore, I provided the aesthetic touches to the controller and the watercraft.

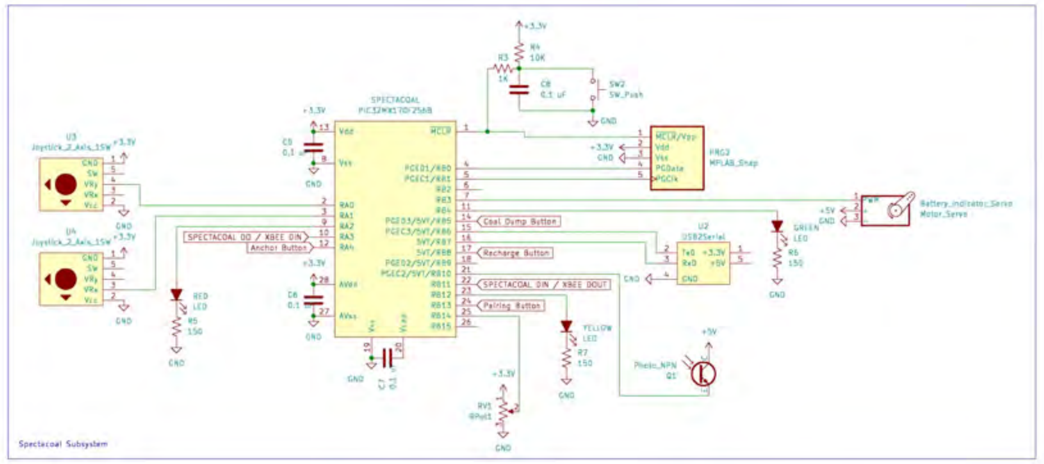
TSA Boat

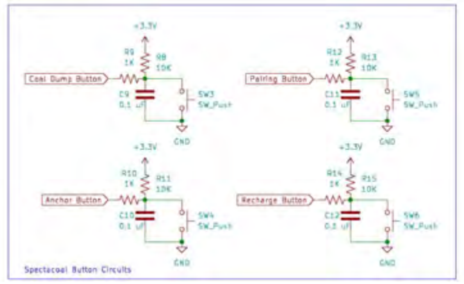
The Controller

The Watercraft

Electrical Wiring Diagram

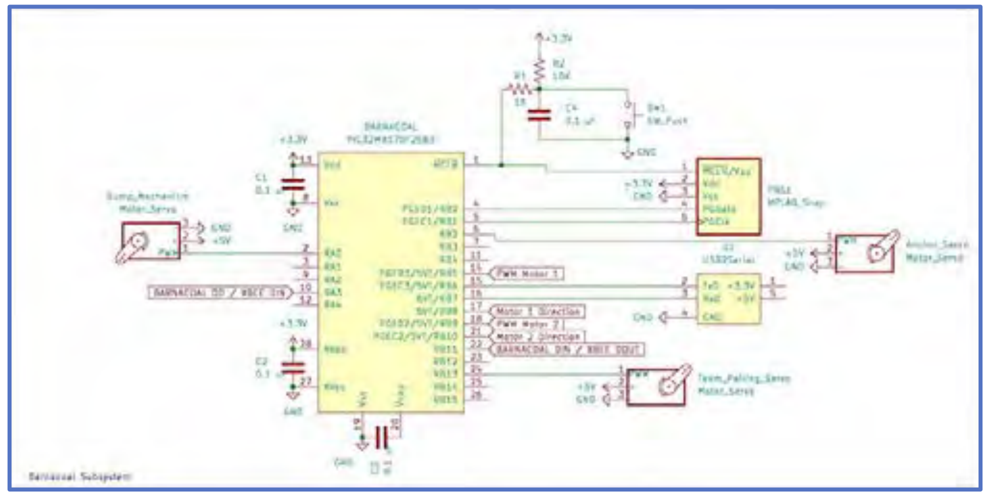
The KiCAD Schematic of the entire electrical system is as follows. Note that the electrical design of this project is divided into two subsystems–the watercraft and the controller. The former is connected to most of the servos and motors, whereas the latter is mainly connected to indicators and buttons to control an action and provide feedback on the completion of the action.





The Controller Subsystem

The Watercraft Subsystem



PortaBottle

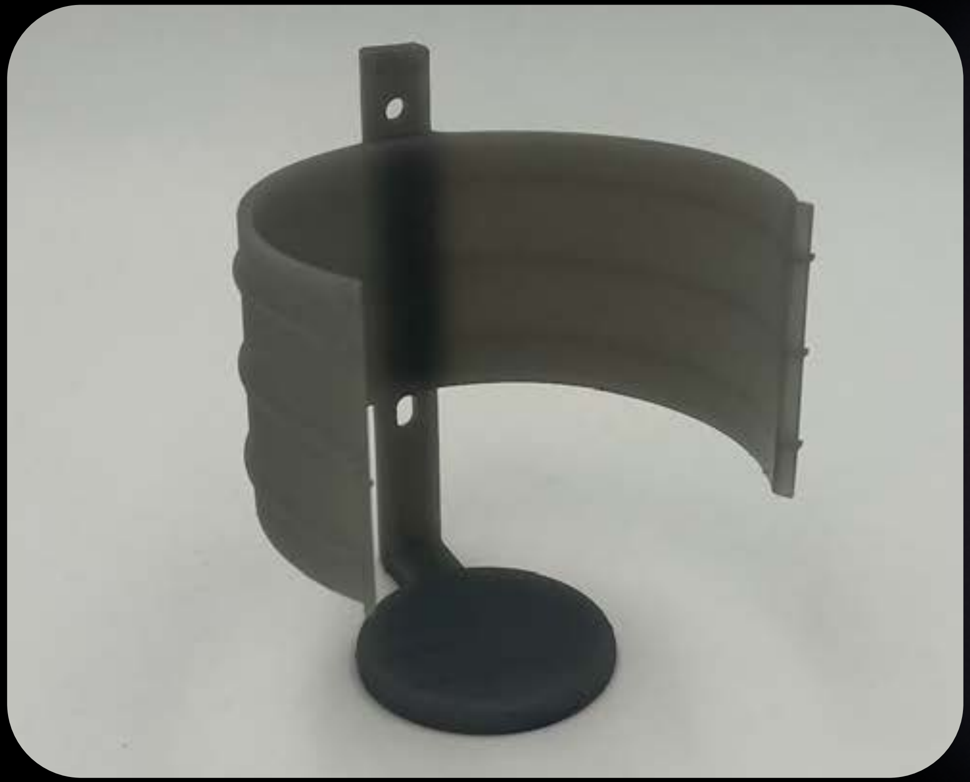
As someone who drinks a lot of water on the go, I wanted to design a new bike-mounted water bottle holder that has a satisfying snap feature as it secures the water bottle in place.

By leveraging Additive Manufacturing capabilities, I was able to achieve my goal of designing a water bottle holder that is adjustable and accommodates a wide range of sizes.

Takeaways: Finite Element Analysis, Simulating load cases, Rapid prototype prints to validate simulations

Processes: FormLabs SLA Printing

Materials: Tough 1500, Nylon

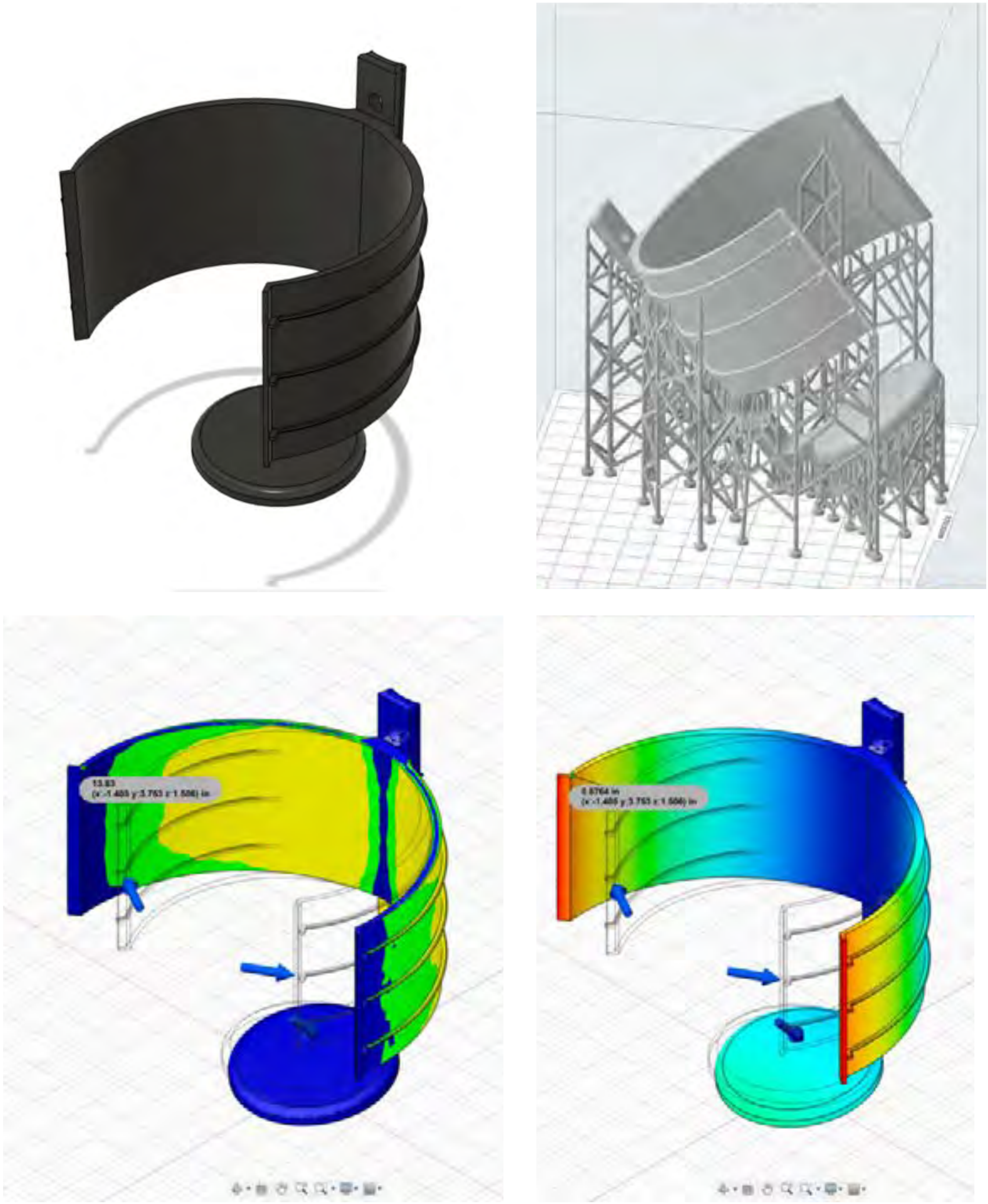


PortaBottle

CAD Modeling and Simulation

I used Fusion 360 to design and simulate my water bottle holder. To ensure that the holder will flex back into place, I added **ribs** into the design to ensure that there was an element of rigidity at play in snapping the design back into place.

To test the load capabilities of the design, I simulated the FEA not only with necessary load cases of the water bottle being inserted into the holder, but also some error cases–if the bottle was hastily inserted or the path that the bike travels causes the bottle to rattle in place.



Material Properties

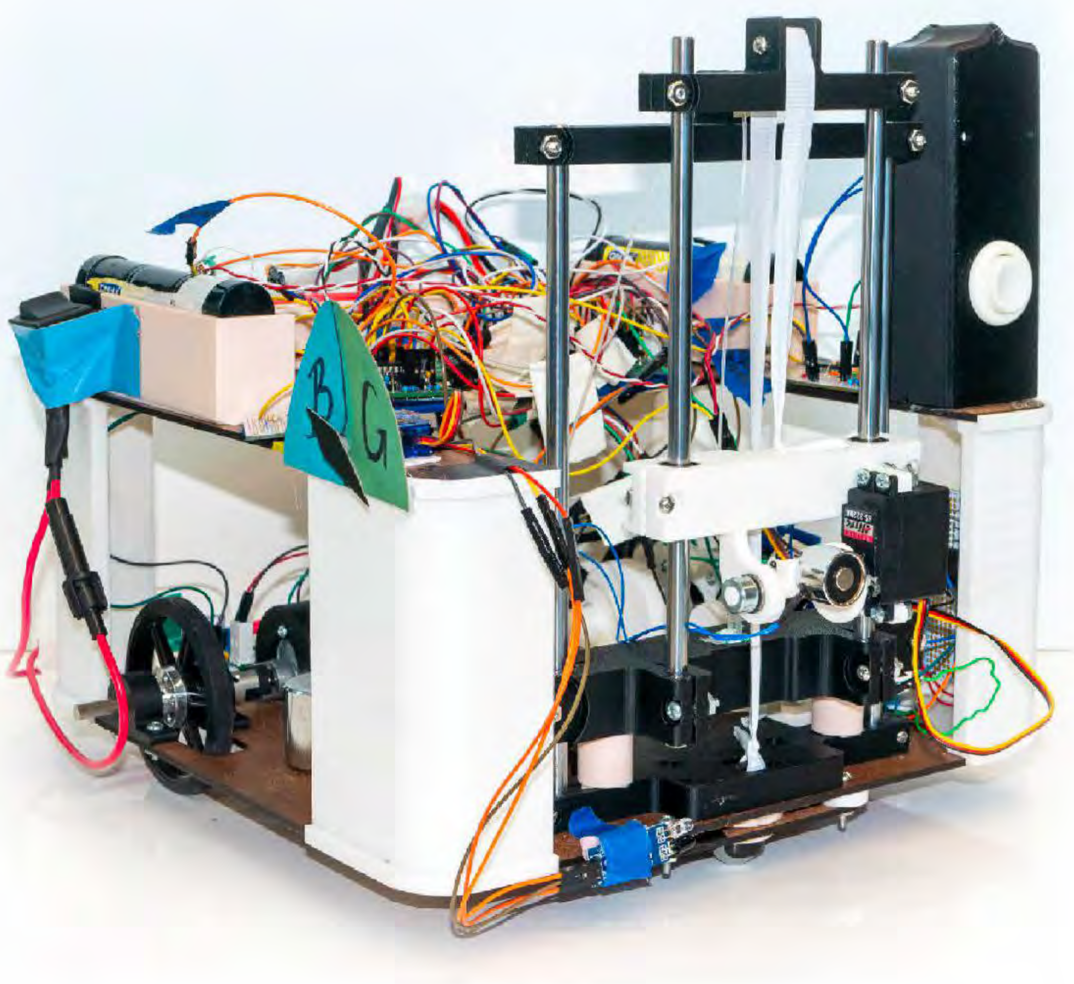
I took advantage of the material properties of **Tough 1500**, as the natural state of the design is slightly smaller than the diameter of the water bottle. When the water bottle is inserted into the holder, the holder flexes and extends to secure the bottle into place.

BabyGotBaxter

Designed for ME218B | Smart Product Design Applications, BabyGotBaxter is an autonomously-driven electromechanical robot that uses a combination of IR sensors to navigate an arena adorned with a pathway of black tape. Powered by a series of portable batteries and controlled by a PIC32 microcontroller, the robot is tasked with picking up electromagnetic blocks and dispensing them into the corresponding shelves of the towers positioned along the center axis of the arena. In order to dispense the blocks, the robot utilizes a cascade lift driven by a stepper motor to raise the blocks vertically.

Contribution

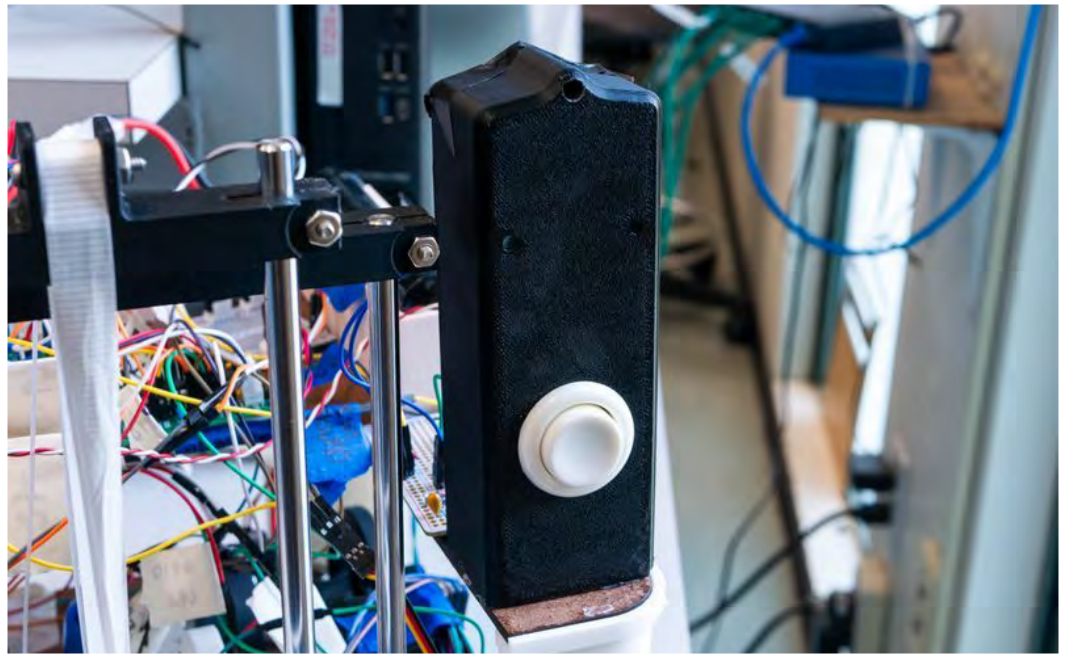
Working on a team of 4, we divided labor pretty evenly. I took ownership of **CAD design**, **mechanical design and assembly**, and **electrical assembly/soldering**. I also wrote software commands and services to control the robot.



BabyGotBaxter

Initiation

In order to start our game, the robot uses an IR sensor to identify and indicate which side it is starting from.



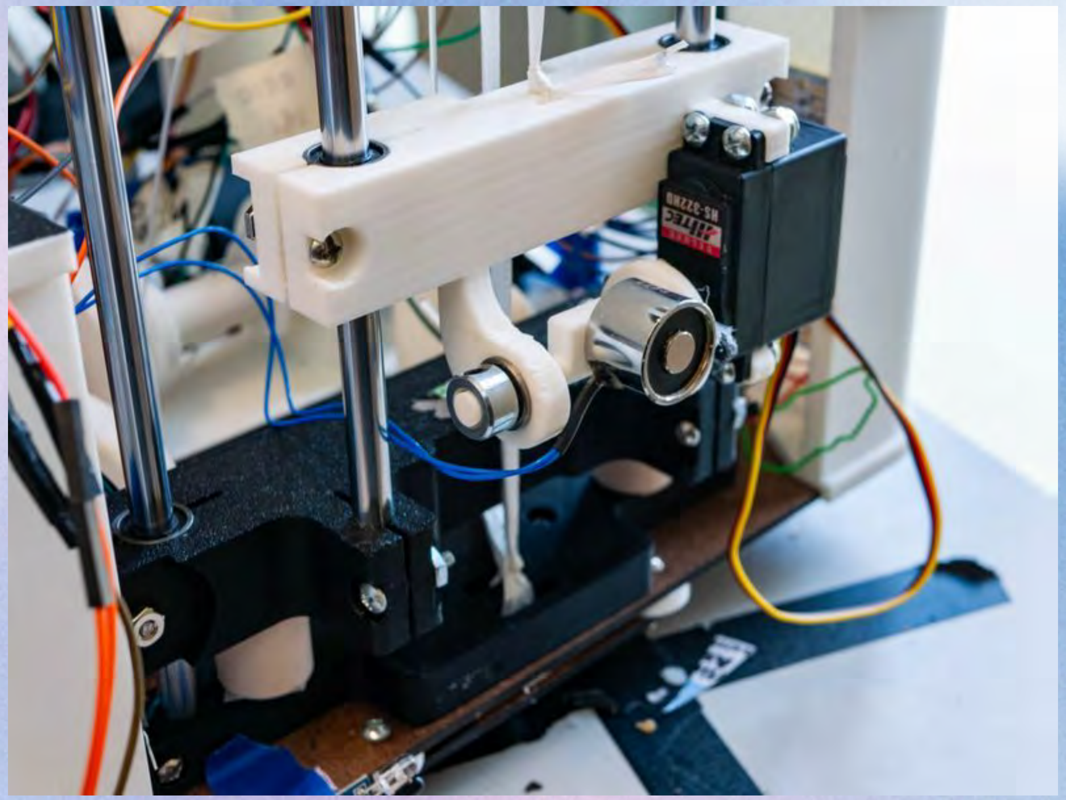
The robot rotates in place, and upon sensing the corresponding IR frequency, adjusts the servo motor to indicate which side of the arena the robot is sitting on.

Drive / Maneuver

The robot is powered by two DC motors to drive itself about the arena. The BGB uses a 5 Channel Infrared Reflective PIR Sensor Module to follow the black tape placed on the arena floor. By shining a light and detecting the reflection back into the sensor, the robot self-adjusts its direction as it maneuvers about the arena.

Lift

To access the higher levels of the tower, the robot utilizes a cascade lift to raise the magnetic block. In order to ensure accurate placement, the robot uses a servo motor to extend the magnetized block 90 degrees out into the tower.



Buoyant Aero

I joined Buoyant Aero, a startup company focused on re-envisioning transportation and bringing novel ideas to market, as the Mechanical Engineering contractor.

For this project, I focused on the overall design of the scooter and the folding mechanism to maximize portability for the scooter user on-the-go.

Contribution

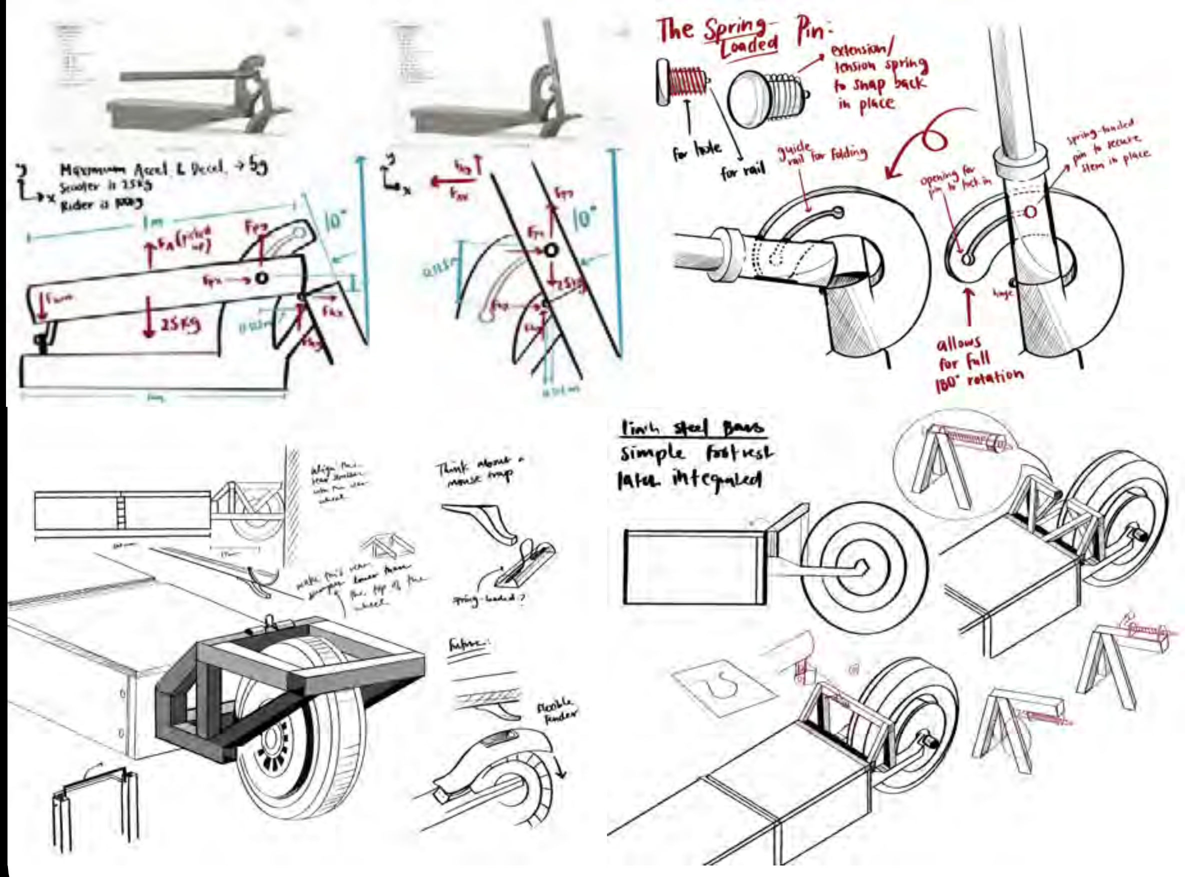
During this three-month position, I took ownership of the designs, calculations, CAD sketches, CAD simulations, and physical manufacturing.

Due to my NDA, I cannot share specific details, but I can provide high-level takeaways.

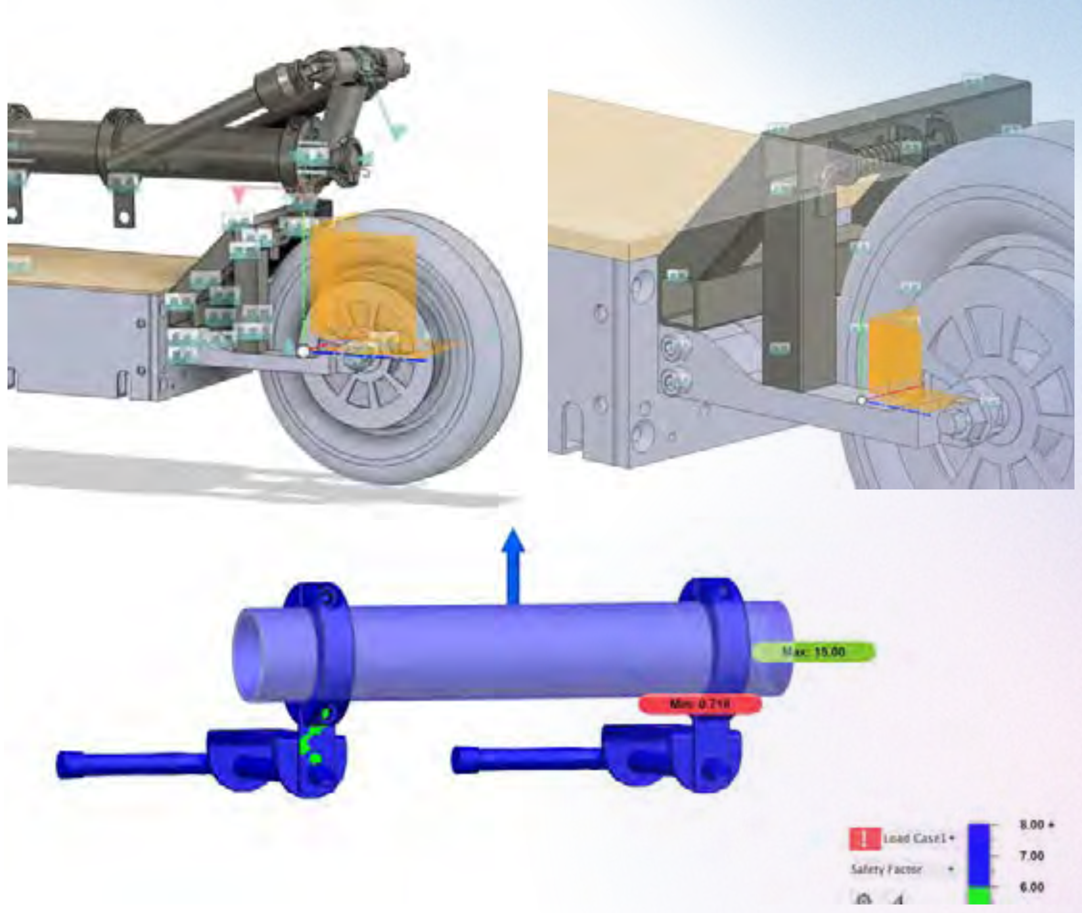
Buoyant Aero

Sketches

I created many sketches, from concept designs to FBDs–fashioning aesthetics with mechanical principles to understand how the scooter design could function and improve.



CAD



Using Fusion 360, I modeled and simulated key elements of the scooter to evaluate kinematic performance and stress conditions (models in the images have been greatly generalized).

Machining

I built and tested rapid prototypes using a combination of 3D printing and off-the-shelf component modifications to validate concepts. I machined parts using a manual mill and lathe.

Processes:

- Milling, Turning, Boring
- 3D Printing

Combo

I collaborated with a team of Product Designers and Mechanical Engineers for a 10-week project applying the Design Thinking process to reimagine the composting experience for young adults.
Together, we determined that **time** and **discomfort** are the two major deterrents of composting. As a result, we developed Combo, a compost bin that uses natural Bokashi Composting to reduce food waste and help people compost with confidence.

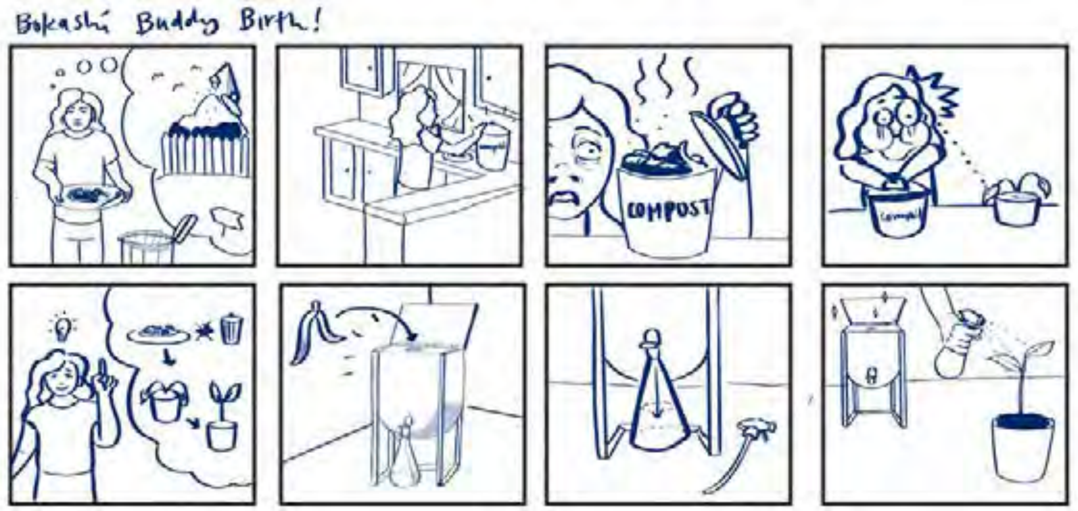
Contribution

Throughout this project, our team divided the work evenly. We all had some contribution to the product development and manufacturing processes.

Combo

Design Thinking

Together, we conducted numerous interviews with people within our target demographic, and determined that Bokashi composting could alleviate most of the qualms users have with composting. Following concept sketches and journey maps, we had a direction to move toward bringing composting to young adults everywhere.



Manufacturing

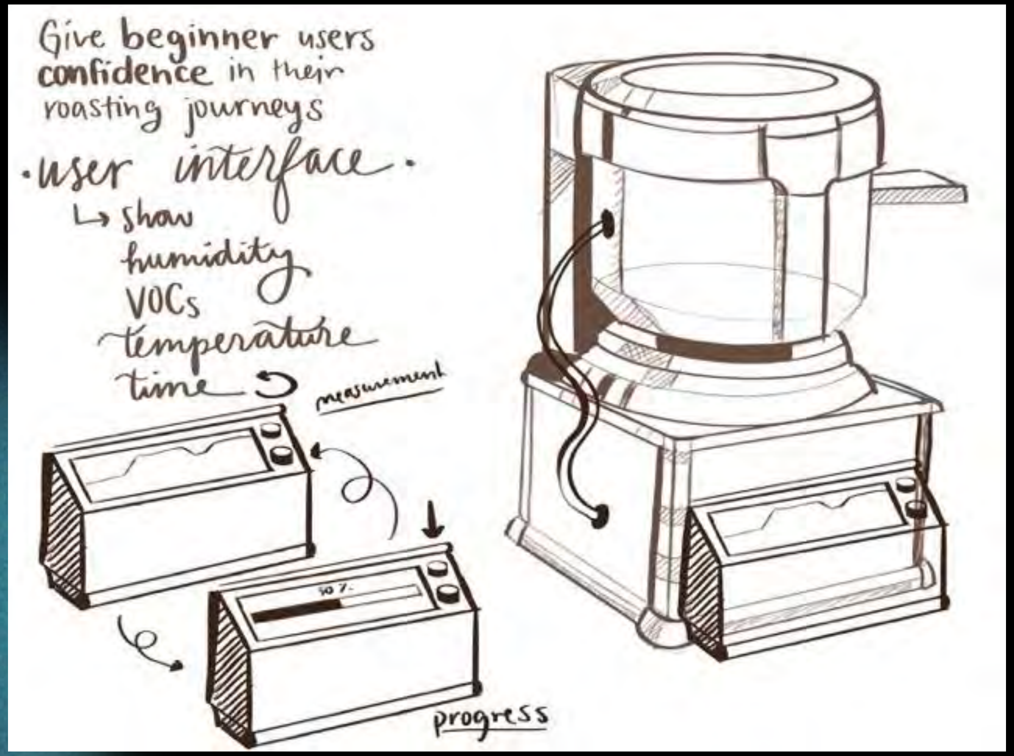
Features

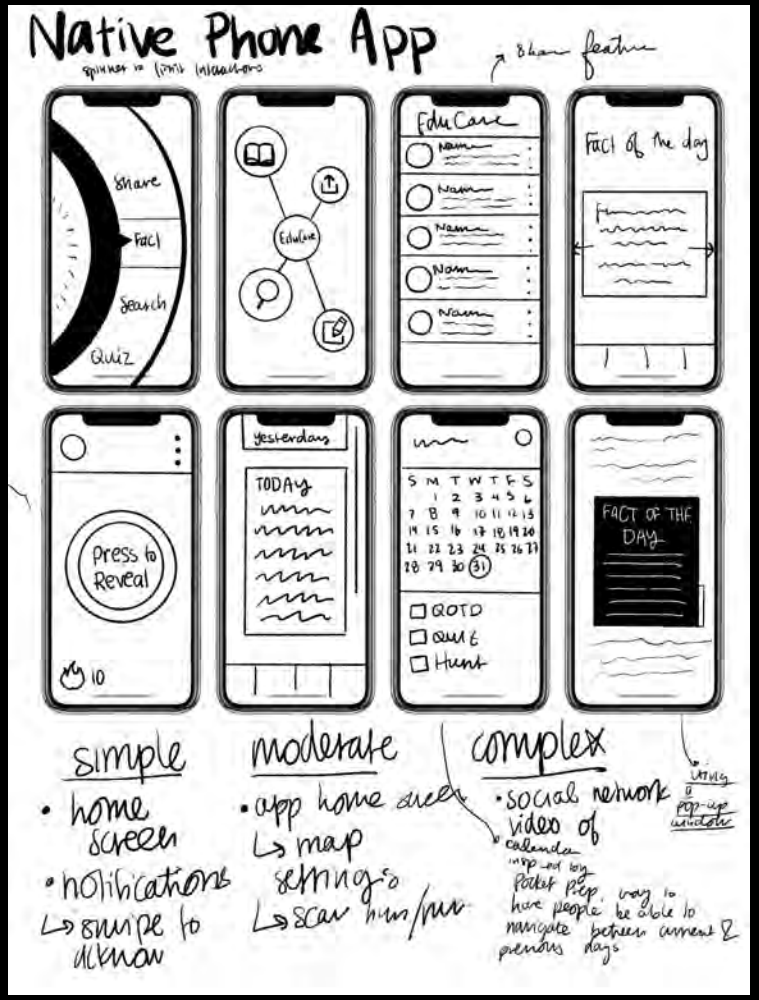
- Dual-Bin design for around-the clock composting
- Aesthetically attractive
- Spigot automatically drains tea into spray bottle
- Plunger for no-contact compression
- Removable stand for versatile placement in small spaces

Materials

- 5052 Aluminum
- Pine Wood
- Acrylic Plastic
- Found Plastic Bins
- 3D Printed PLA
- Modulin

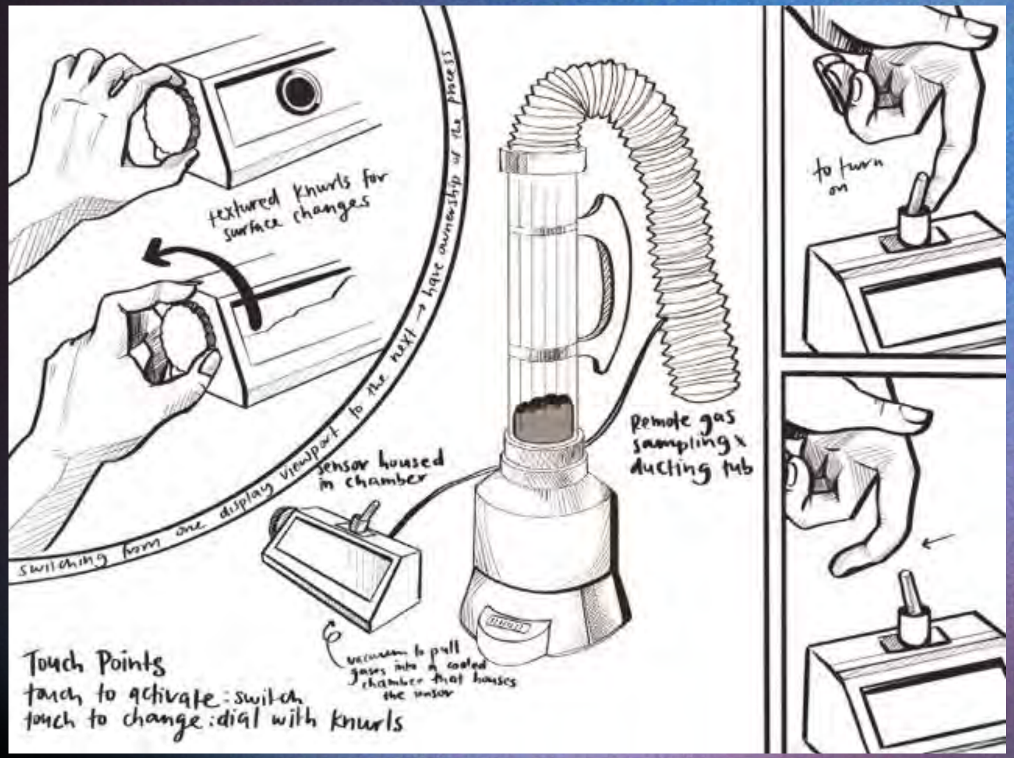
Design ↗

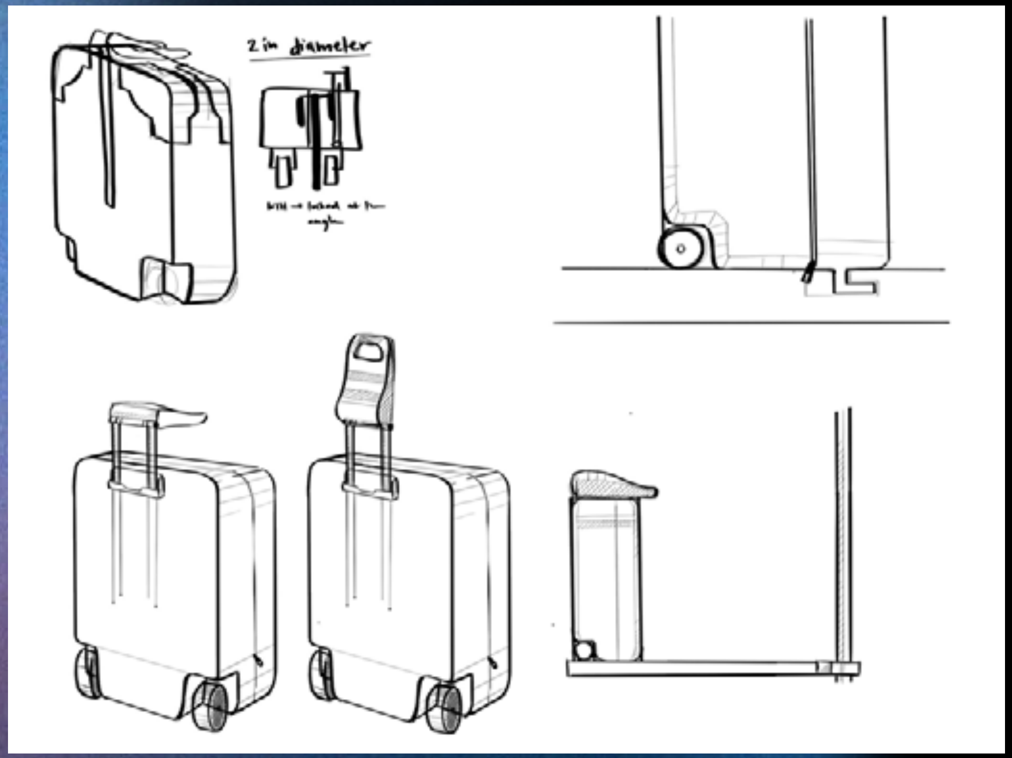


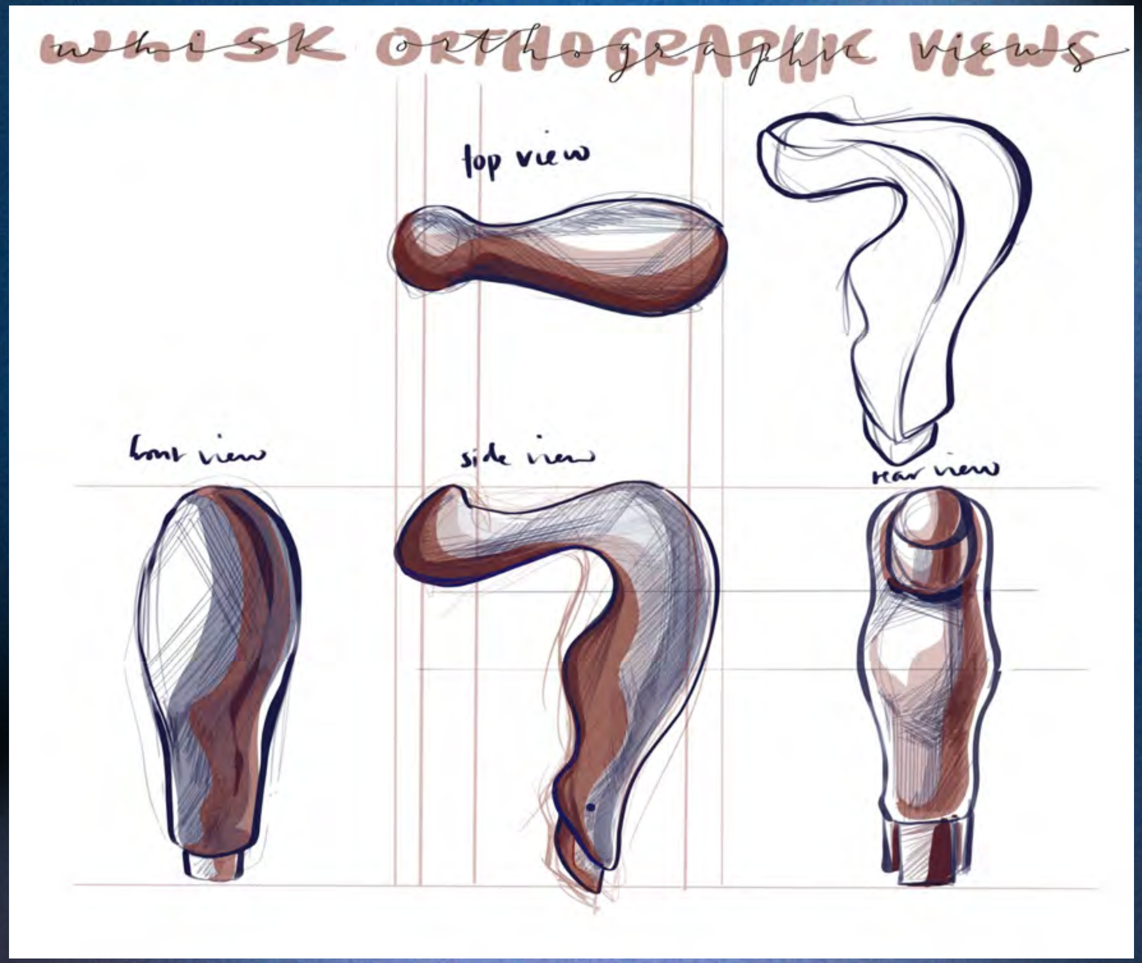


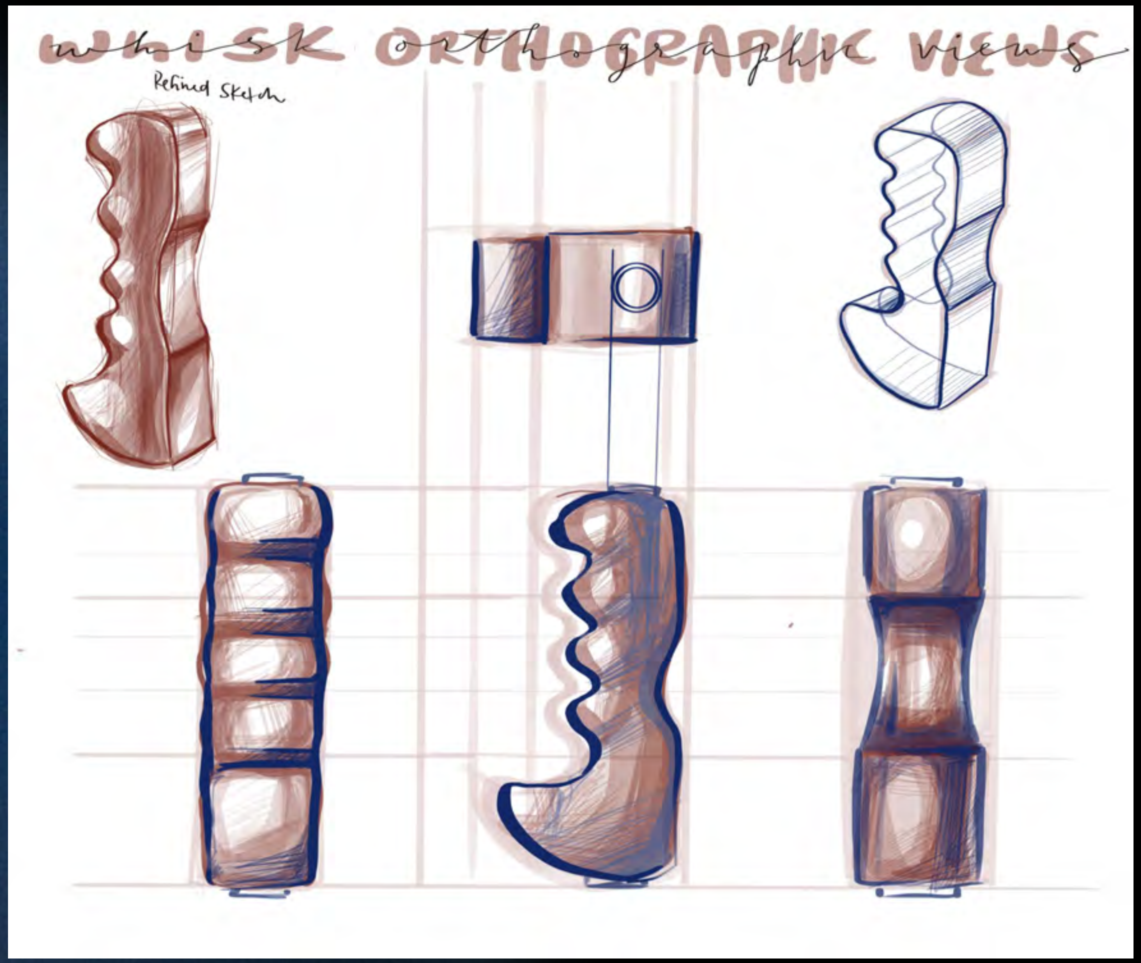
Design Sketches

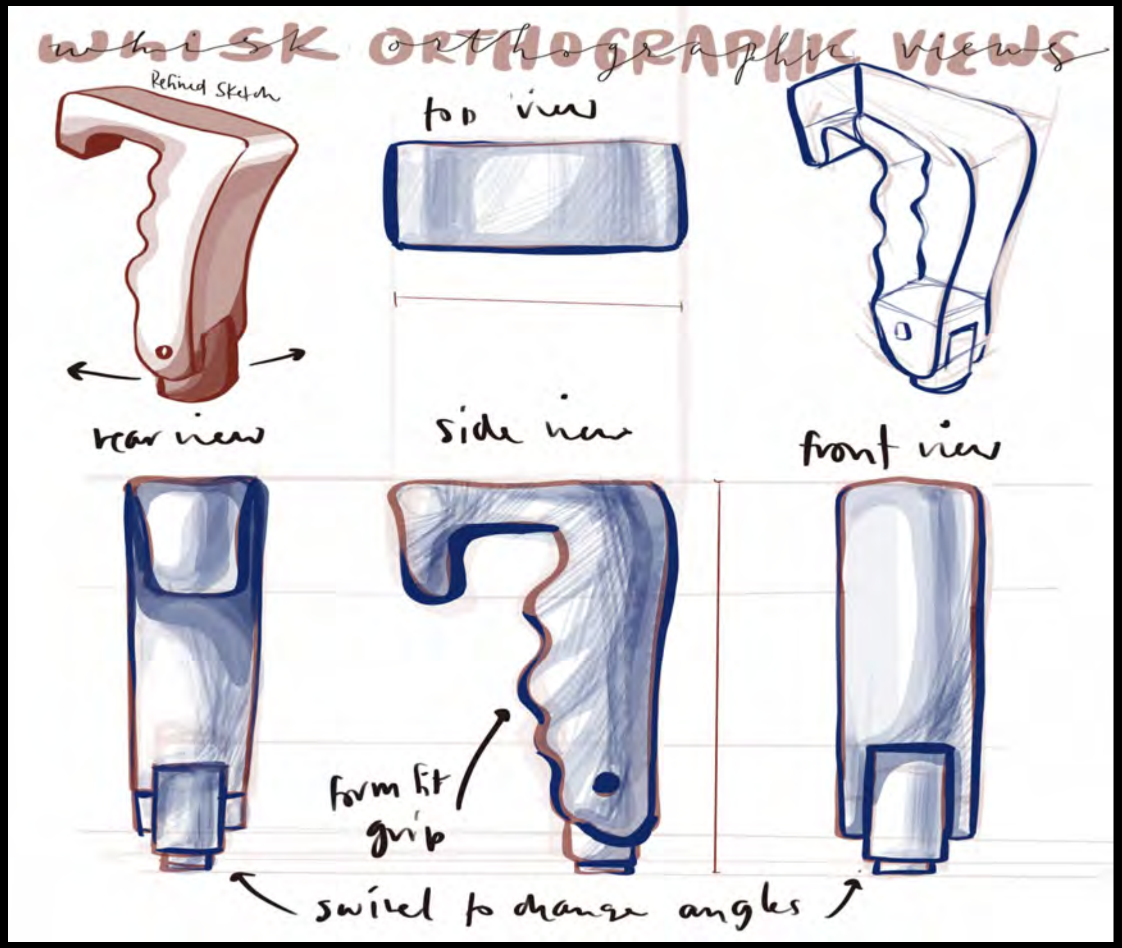
Ideas in their most authentic form





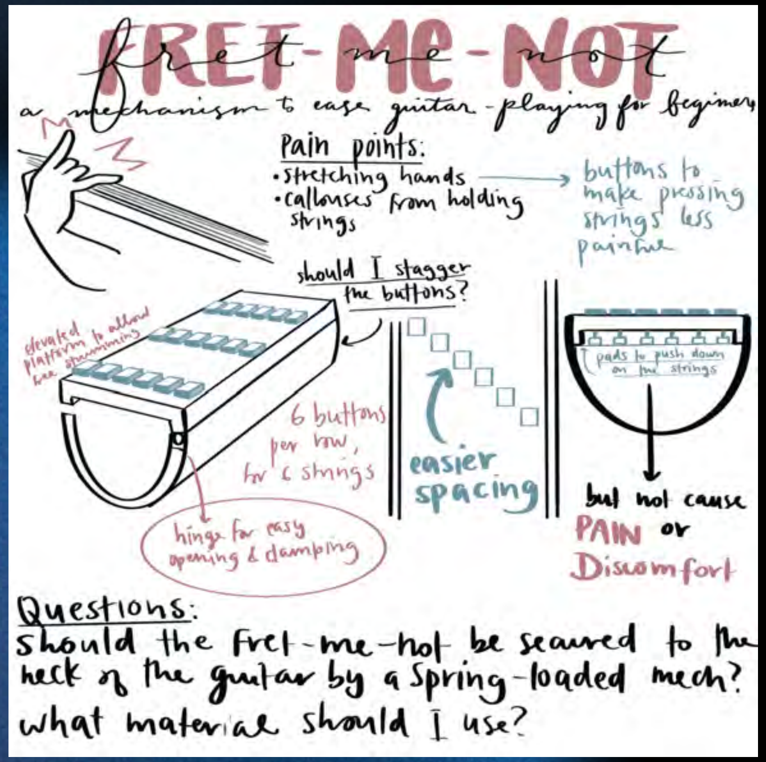

top view
side view
rear view


Refined Sketch


Refined Sketch
top view
rear view
side view
front view
form fit grip
swivel to change angles


a dress form for all body types
Inspiration
crank umbrella
expanding mech. toys
expanding mechanism
Aerial
Questions: what material?


The closet organizer to access all of your clothes, not just the clothes at the top
It is difficult to access clothes at the bottom of the dresser w/out messing up the clothes at the top
tiers of shelves that can be pulled upwards to reveal deeper levels


fret-me-not
a mechanism to ease guitar-playing for beginners
Pain points:
•stretching hands
•callouses from holding strings
buttons to make pressing strings less painful
should I stagger the buttons?
6 buttons per row, for 6 strings
easier spacing
hinge for easy opening & damping
but not cause PAIN or Discomfort
Questions:
should the fret-me-not be secured to the neck of the guitar by a spring-loaded mech?
what material should I use?


Efficiency with you, on the go!
A water bottle + thermos IN ONE!!
HOT...
...and cold
Katy Perry presents:
hot + cold: a versatile drinking experience

About Me

Brenden Koo

Master's Degree:

Mechanical Engineering

- Mechatronics
- Manufacturing
- Robotics

Bachelor's Degree:

Product Design

Computer Science (minor)

Skills Matrix

CAD/CAM	SolidWorks, Fusion360, FEA, GD&T, HSMWorks
Manufacturing	CNC (Mill, Lathe), Milling, Turning, SLA/FDM 3D Printing,
Mechatronics	Embedded C, KiCAD, MPLAB
Software Engineering	Python, C++, C, C#, PyCharm, Unity, Visual Studio
Prototyping and Design	Figma, Rapid Prototyping, Design Sketching, Blender

BRENDEN KOO

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SUMMARY

Mechanical Engineering M.S. candidate at Stanford with hands-on experience in prototyping, mechanical/CAD design, materials selection, and design for manufacturability and assembly (DFMA). I blend engineering precision with a human-centered, empathy-led design approach to create products that are intuitive, accessible, and thoughtfully engineered.

EDUCATION

Master of Science in Mechanical Engineering (Mechatronics) Apr 2023 - Dec 2026 (Expected)
Stanford University | Stanford, CA

- GPA: 3.822/4.000
- Course Assistant | CS 148: Introduction to Computer Graphics and Imaging

Bachelor of Science in Product Design Engineering Sept 2019 - June 2023
Stanford University | Stanford, CA

- GPA: 3.875/4.000
- Completed a minor in Computer Science

PROFESSIONAL EXPERIENCE

Apple, Packaging Product Design Intern March 2026 - Sept 2026

- Design and prototype fiber-based packaging solutions for a range of consumer products and accessories.
- Partner with cross-functional teams to develop packaging that meets environmental, performance, manufacturing, and brand identity requirements.
- Develop and evaluate packaging concepts through iterative prototyping, testing, and validation.

Swope Design Solutions, Mechanical Engineering Intern June 2025 - Sept 2025

- Spearheaded the Design for Manufacturing work for a CNC-turned promotional spinner, designed CAD and CAM for mass-production and reduced per-unit cycle time by 25%.
- Designed prototypes for multiple high-profile client projects — produced parts via CNC and SLA, and documented build and assembly procedures, prepping for 1,000 unit production.
- Created SolidWorks engineering drawing packages, adhering to GD&T ASME Y14.5 standards.

Buoyant Aero, Mechanical Engineering Intern Nov 2023 - Jan 2024

- Designed and iterated mechanical components using Fusion360; produced multiple iterations via FDM in a quick timeline to streamline product development process.
- Developed two working units and manufactured custom parts on manual mill and lathe.

Virtius, Product Design Intern July 2023 - Dec 2023

- Designed and implemented a landing page via Figma and Webflow, informing gymnastics fans of the Virtius company, services provided, and a teaser of the Virtius product in development.
- Developed an interactive Unity demo (C#) to highlight the Virtius user flow in context.

SKILLS

Manufacturing

FDM/SLA 3D printing, Milling, Turning, Computer Numerical Control (CNC) milling and turning

Programming and Tools

Siemens NX, SolidWorks, HSMWorks, KiCAD, Fusion360, GD&T (ASME Y14.5), Python, C++, C, C#, PyCharm, MPLAB, Unity, Visual Studio

Design Thinking

Figma, Rapid Prototyping, Design Sketching, Blender, Web Development (WordPress, Webflow), Adobe Creative Suite

THANK YOU

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Appendix ↗

AstroSnatchers

Designed for ME218A | Smart Product Design Fundamentals, AstroSnatchers is an interactive game that combines mechanical and electrical components to have players control a UFO-stylized “wheel” to shift their character left and right, catching stranded “astronauts” and avoiding “meteors” as they pass by on the infinite scrolling canvas. As the scrolling canvas moves at varying speeds, the user needs to slide the UFO to the left and right with precision to maximize their point total before time runs out.

Contribution

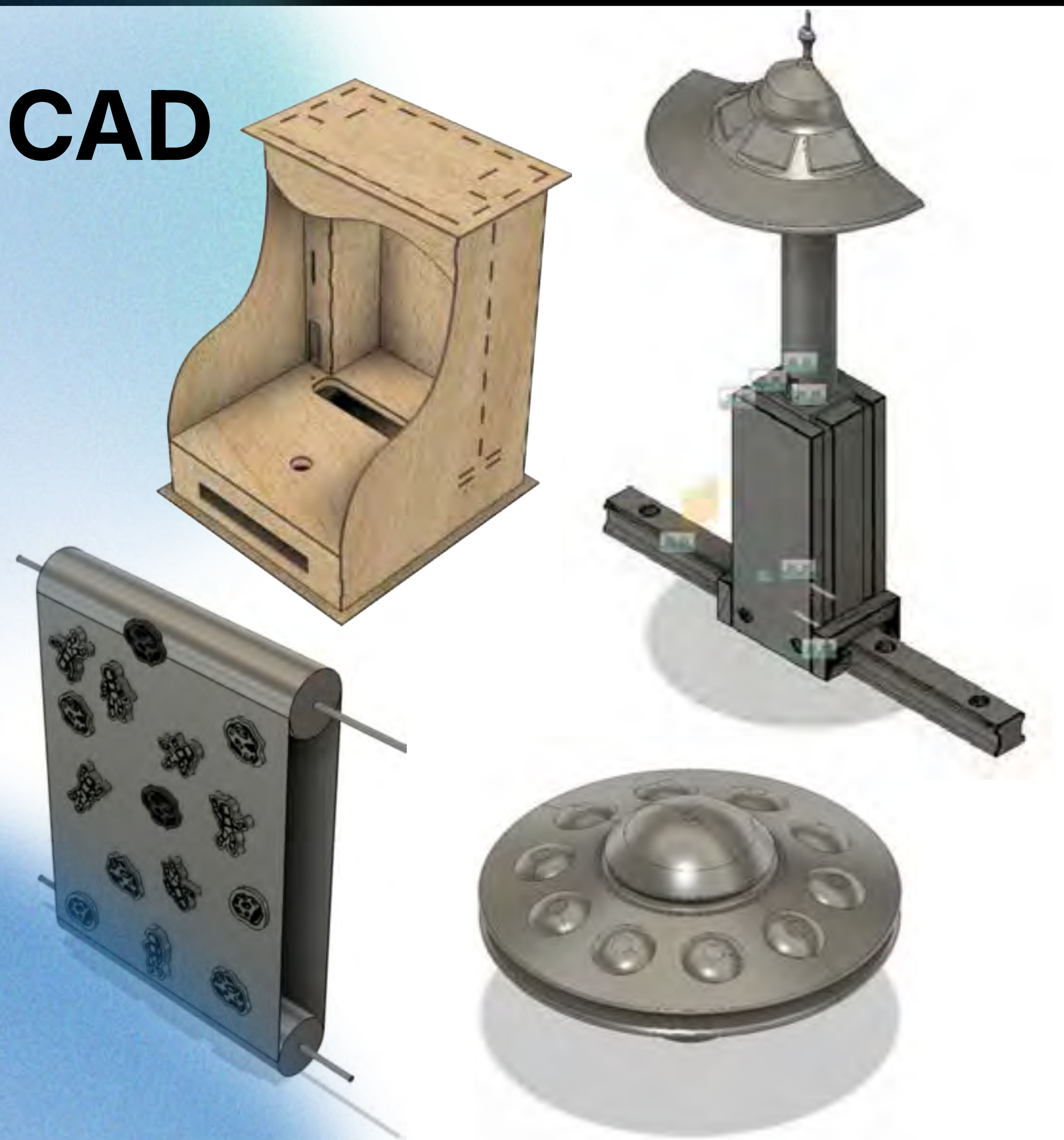
Working on a team of 4, I took ownership of the **design sketches, CAD design, laser cutting, 3D printing,** and overall **mechanical assembly.** I also contributed to the coin slot insertion programming and overall aesthetic design.

AstroSnatchers

Steps and Functions

1. The game starts when two coins are inserted within three seconds of one another.
2. Players will turn the steering wheel left or right. This movement will translate directly into the horizontal motion of the sliding UFO.
3. As the sliding UFO moves horizontally, the limit switch behind the UFO interacts with the astronauts and asteroids, increasing and decreasing the player's score, respectively.
4. While steering the UFO, moving the joystick can change the speed of the map.

CAD



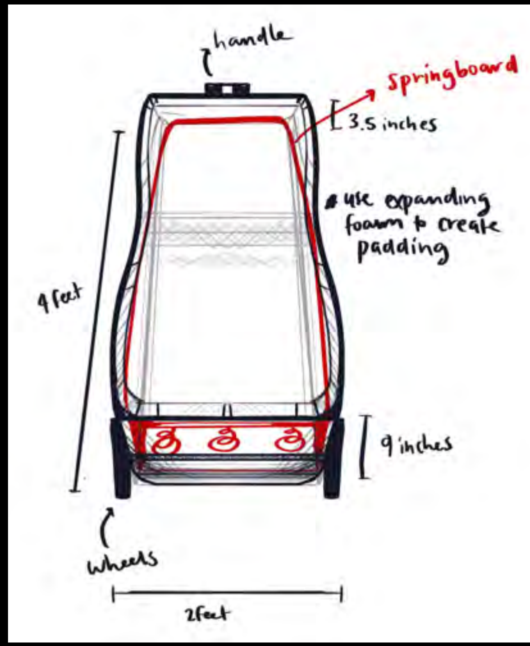
Using Fusion 360, I took ownership of designing the mechanical parts, allowing the team to visualize the assembly of the individual components.

Springboard Case

As a natural product designer, I am constantly seeking areas of need and determining product solutions. As the Stanford Women's Gymnastics Volunteer Assistant Coach, I wanted to design a case to transport the 50lb springboard to and from competitions.

I created a case out of fiberglass cloth and resin, using a power sander and angle grinder to refine the design.

I attached wheels, clasps, and handles to the fiberglass, reinforcing the hardware with steel plating to ensure durability. I am constantly improving and developing this design to ensure longevity and portability of the design



Fret-Me-Not

As a designer, one of my greatest values is accessibility. When tasked with designing and manufacturing a project for my ME 103 course, I wanted to take the first step towards my goal for accessible and inclusive art and music.

I designed the Fret-Me-Not in SolidWorks and brought the design to life with turned aluminum buttons, inset springs with bushings, and manipulated aluminum sheet metal.

Purpose

The idea behind the product is that the user can press the smooth buttons of the product to activate the strings, avoiding the calluses caused by the harsh textures of the guitar strings.

Takeaways: GD&T, Repetition with machining

Processes: Turning, Metal-Bending, 3D Printing, Bead Blasting, Sanding, Polishing

Materials: Aluminum, Bronze, and Zinc-Plated Steel.