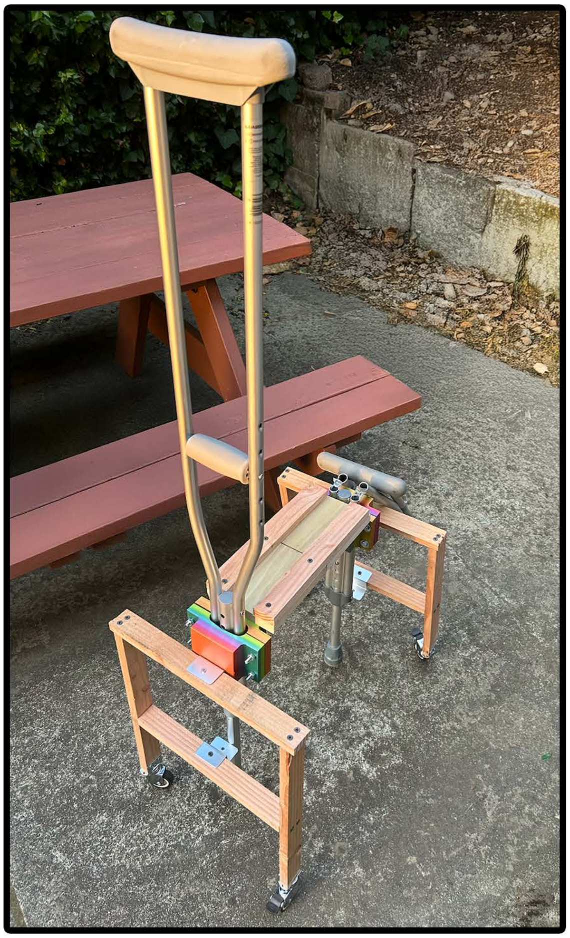
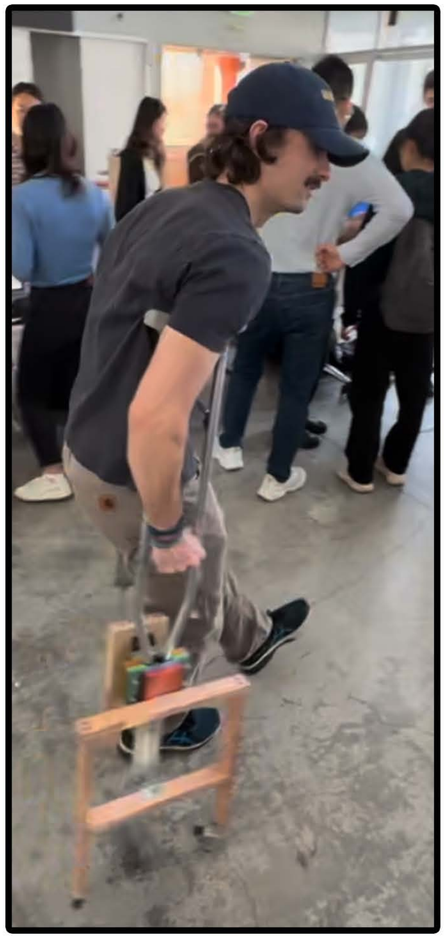
Samuel Robinson

Design Portfolio
2025

916-471-8226 • samrobnsn.w@gmail.com

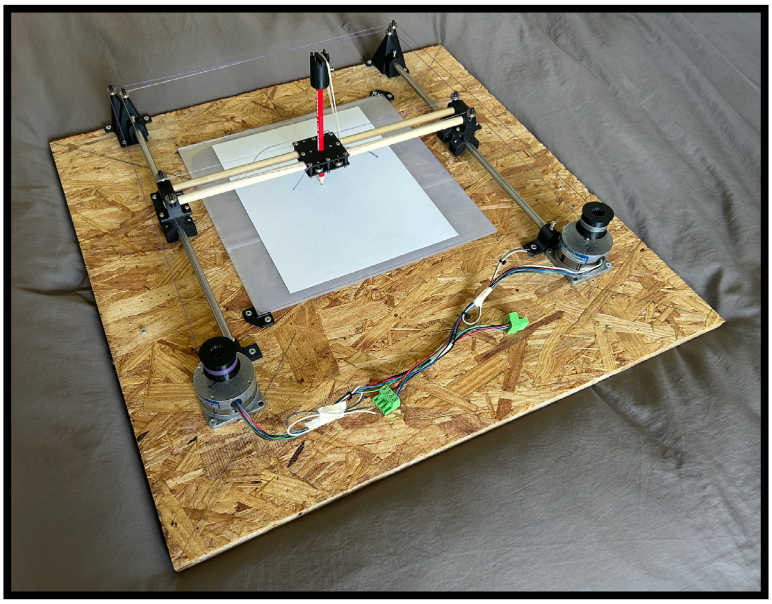
Knee-Bike Crutch Hybrid Assistive Device


- Above shows the device's **functionality**, where it can both serve as a pair of crutches and a knee bike depending on the user's needs and terrain. The intent was to make a **versatile device** that could serve many situations.

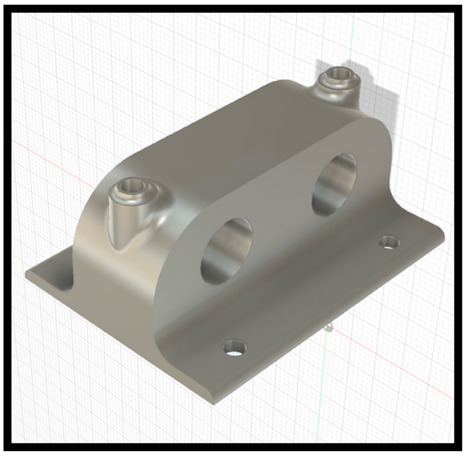
- Below shows how the device folds. Under the knee rest, there are **folding mechanisms** for transitioning it to the crutch mode, the crutches also adjust down through a specialized part on the right which was **3D printed**.


Core XY Drawing Robot



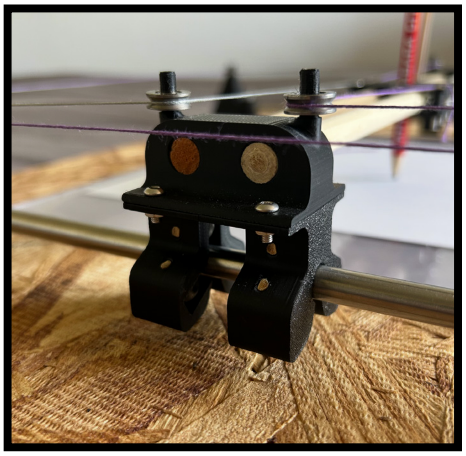
- Above shows the full prototype (without the electronics). This prototype consists of 2 stepper motors controlling a Core XY pulley system that slides along custom linear bearings. A pencil is inserted in the tool head under tension of a rubber band, which then draws on paper placed over a polycarbonate surface.

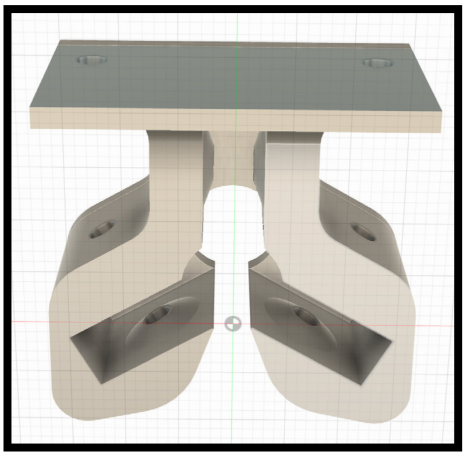
- This prototype was programmed in Arduino (C++) with assistance from LLMs. The system operates either through manual push-button controls (left, right, up, down) or through pre-programmed drawing algorithms, such as generating circular paths. Manual recentering functionality was also incorporated to mitigate back EMF and protect the stepper motors.



- Left images show the CAD models; right images show the assembled linear bearings.

- Incorporated a tri-contact bearing arrangement to improve balance and reduce friction.

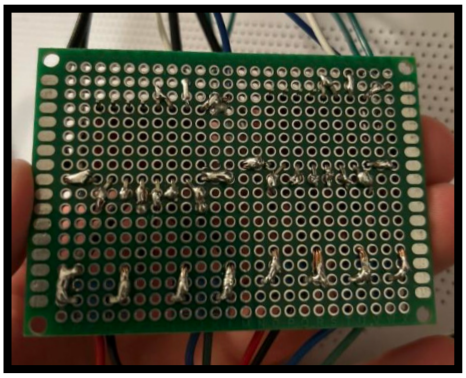




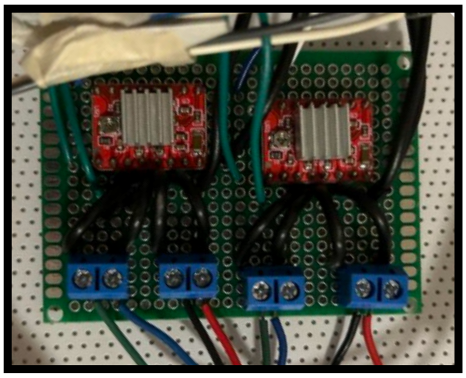
- Initially used wooden dowels, later upgraded to steel rods to reduce friction and prevent deformation.

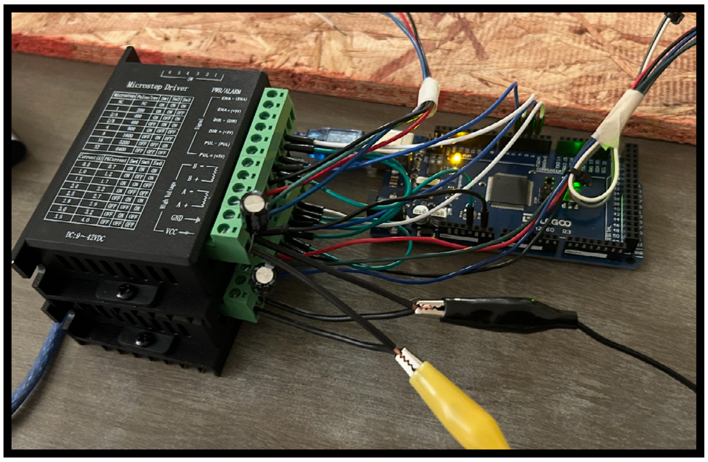
- Fabricated using PLA and assembled with M3 screws and nuts.

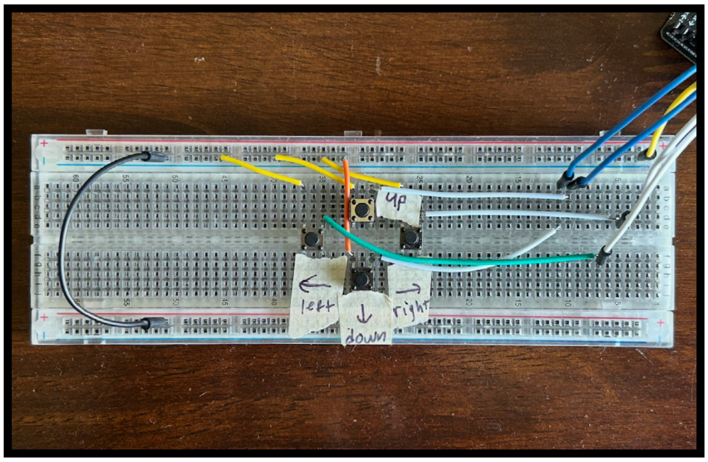
Core XY Drawing Robot (continued)



- Left and Right images show the first successful circuit board we soldered. This board used the A4988 drivers and worked well before braking after a few uses. After probing with a DMM, we decided the drivers broke. So we upgraded to more reliable drivers.





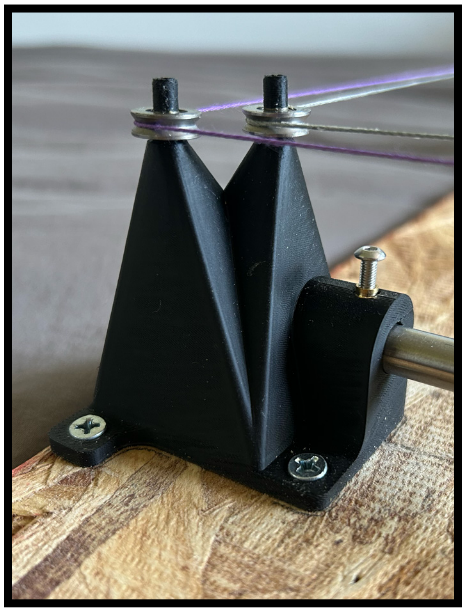


- Above is the latest microcontroller and driver system using the TB6600 driver. These drivers preformed much more reliably.

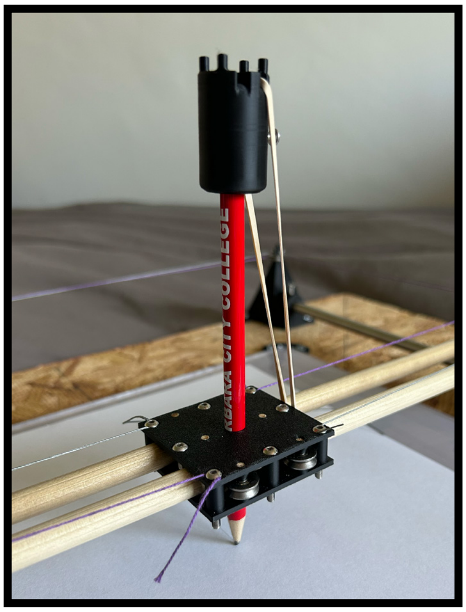
- Above shows the rough manual control set up on a breadboard. Initially I arranged the buttons in a row but later changed to the above which was more intuitive.

Additional 3D Printed Components

Motor and String Drum Assembly



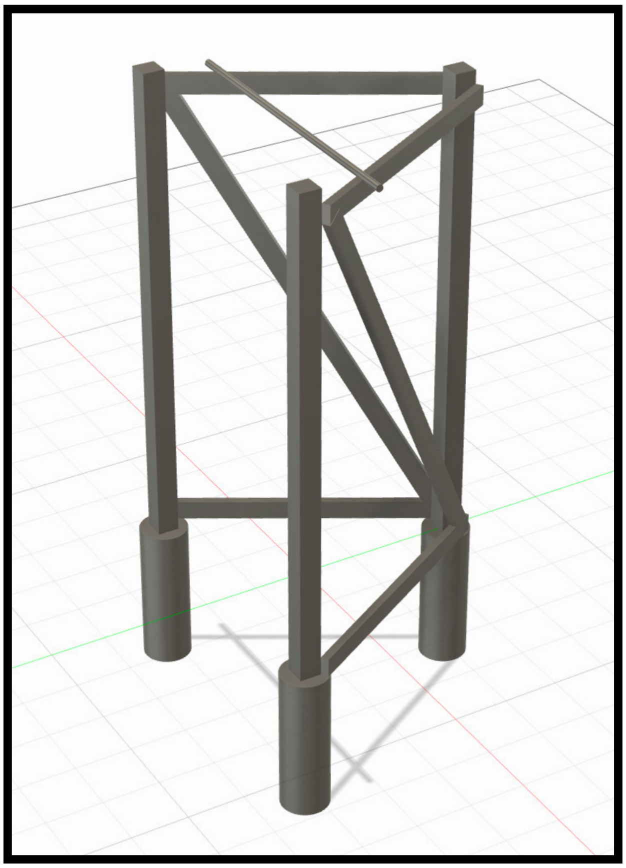
Idler Pulley and Fixed Anchor



Pencil Tensioner and Tool Head

Pull Up Structure

■ Engineered to withstand vertical and lateral dynamic forces with significantly less wobble than alternative pull up bars, resulting in high stability at a competitive price.



■ The images above show my initial CAD design and the final product. The only major difference is that the final design flips the orientation of the diagonal braces to avoid interference with legs when swinging.

■ The bar is positioned at the centroid of the triangular face to balance the structure's vertical load on all 3 pillars.

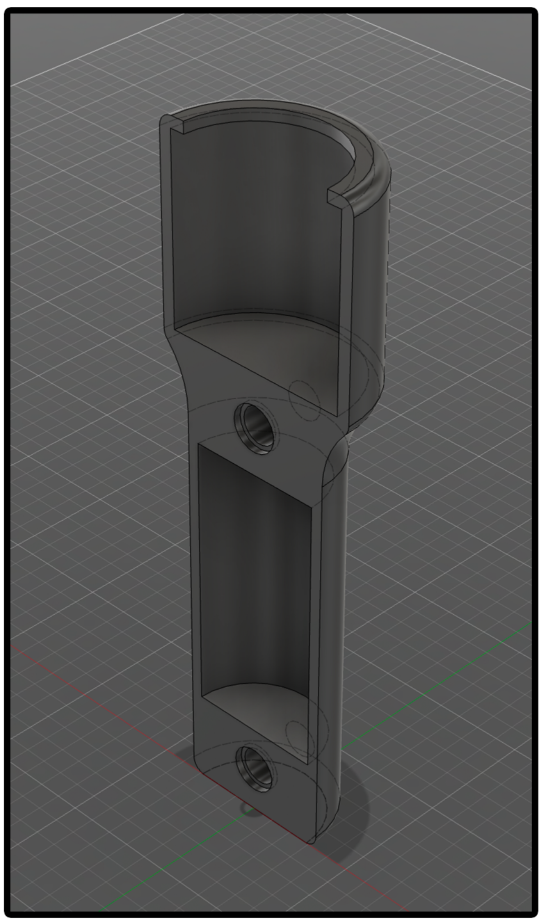
■ The left image shows a close up on how the bar is attatched to the frame. The bar and clamp are made from galvanized steel and the wood is pressure treated making the structure weather resistant.

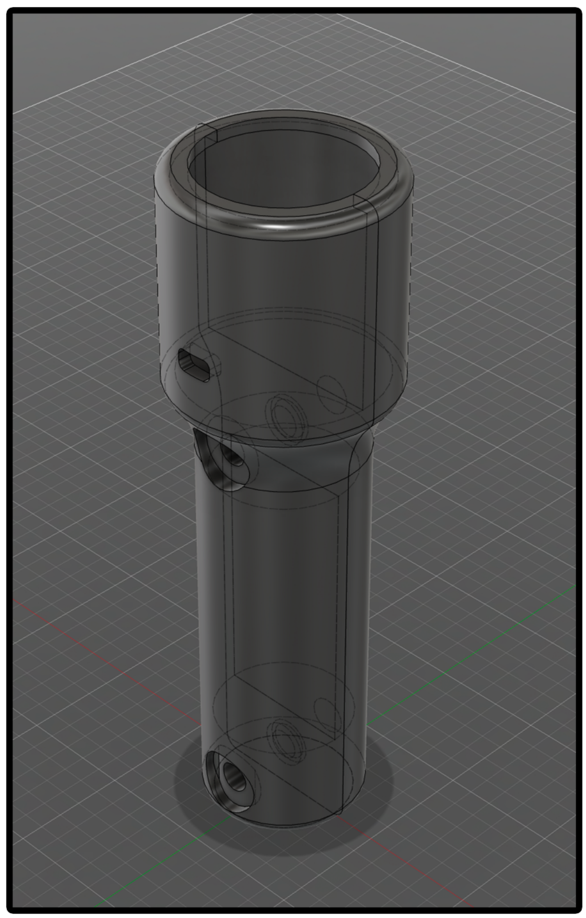
Umbrella Handle CAD Upgrade

Original

Problem: Hard to hold

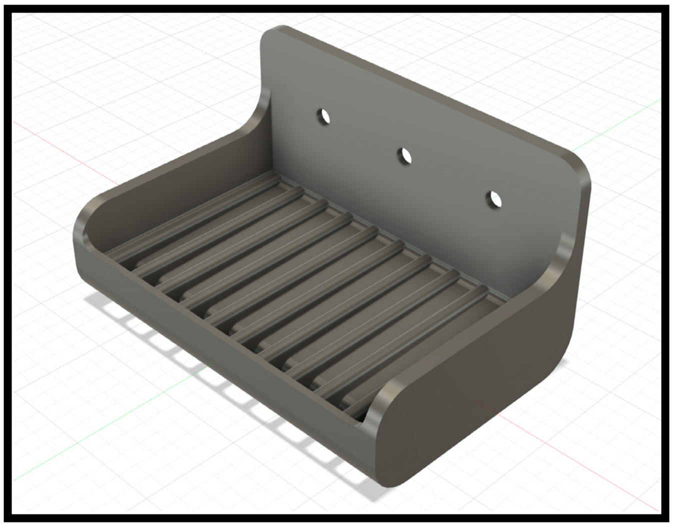
Upgraded





- Above shows the **CAD design** I modeled using **Fusion 360** to 3D print. I intended to design it so it could print 2 separate parts to **avoid print failure**. It was designed to fit around the existing handle and be assembled using 2 screws and 2 inserts.

3D Modeled Soap Holder



- Above is the 3D design, modeled in Fusion 360, next to its printed counterpart. I printed this part in generic PETG since it is less hydroscopic than PLA and the part would be constantly exposed to a wet environment.

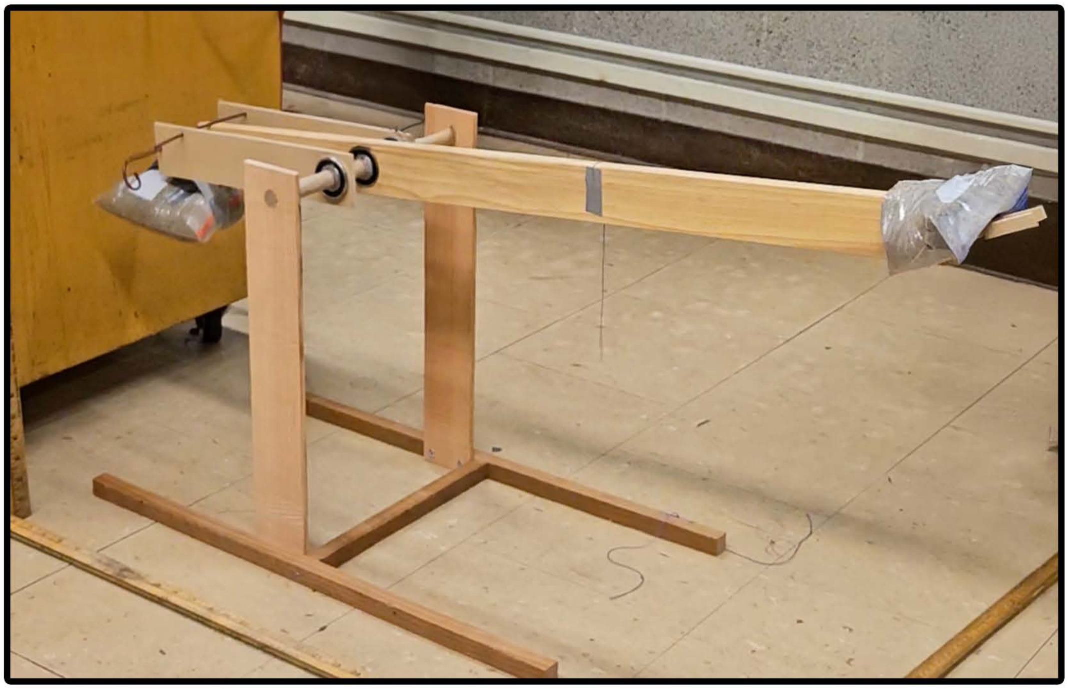
- I designed it within parameters that minimized use of support material to reduce waste.

- The part includes raised drying ribs and recessed, sloped drainage channels to prevent soap from sitting in water. These features promote drying by allowing water to drain away, helping the soap last longer.

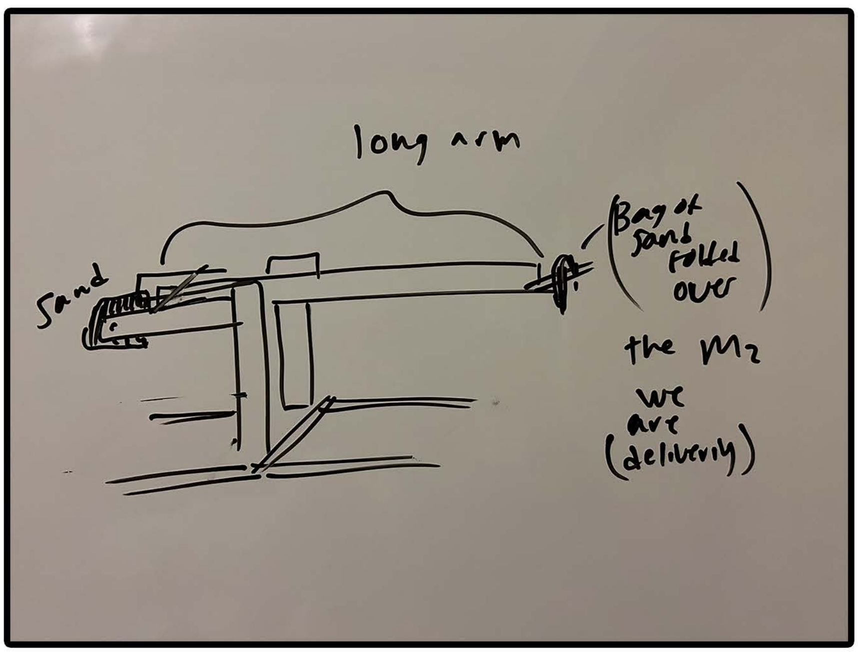
- I carefully matched the radius of curvature to the curved wall surface it would mount to. I used a hands-on, iterative method by measuring, marking, and cutting reference shapes from paper to design the fillet the curve.

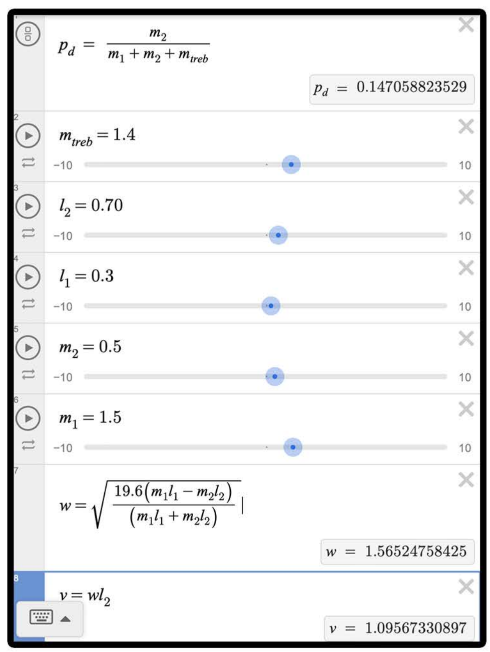
- There are 3 suction cup holes to allow flexibility in positioning or adjusting the number of suction cups used.

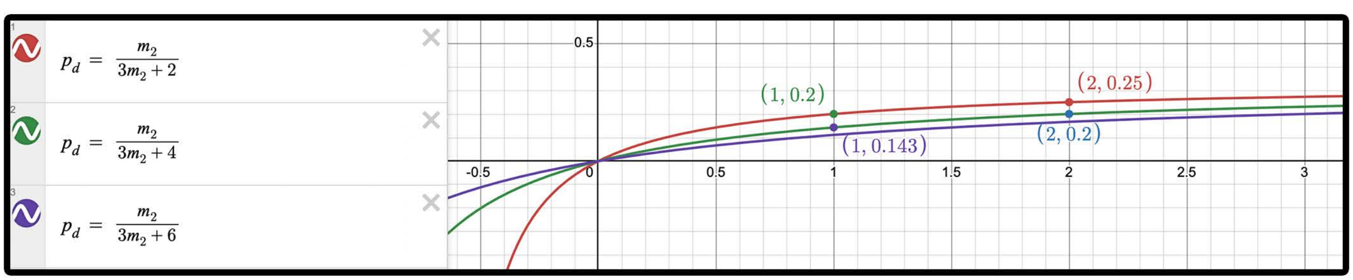
Optimized Mass Transfer Machine



- Below shows an initial sketch that shows my ability to **translate a drawing into a reality**. It was drawn in the final stages of design before building. The Desmos images show my ability to use **mathematical modeling** to optimize a design.



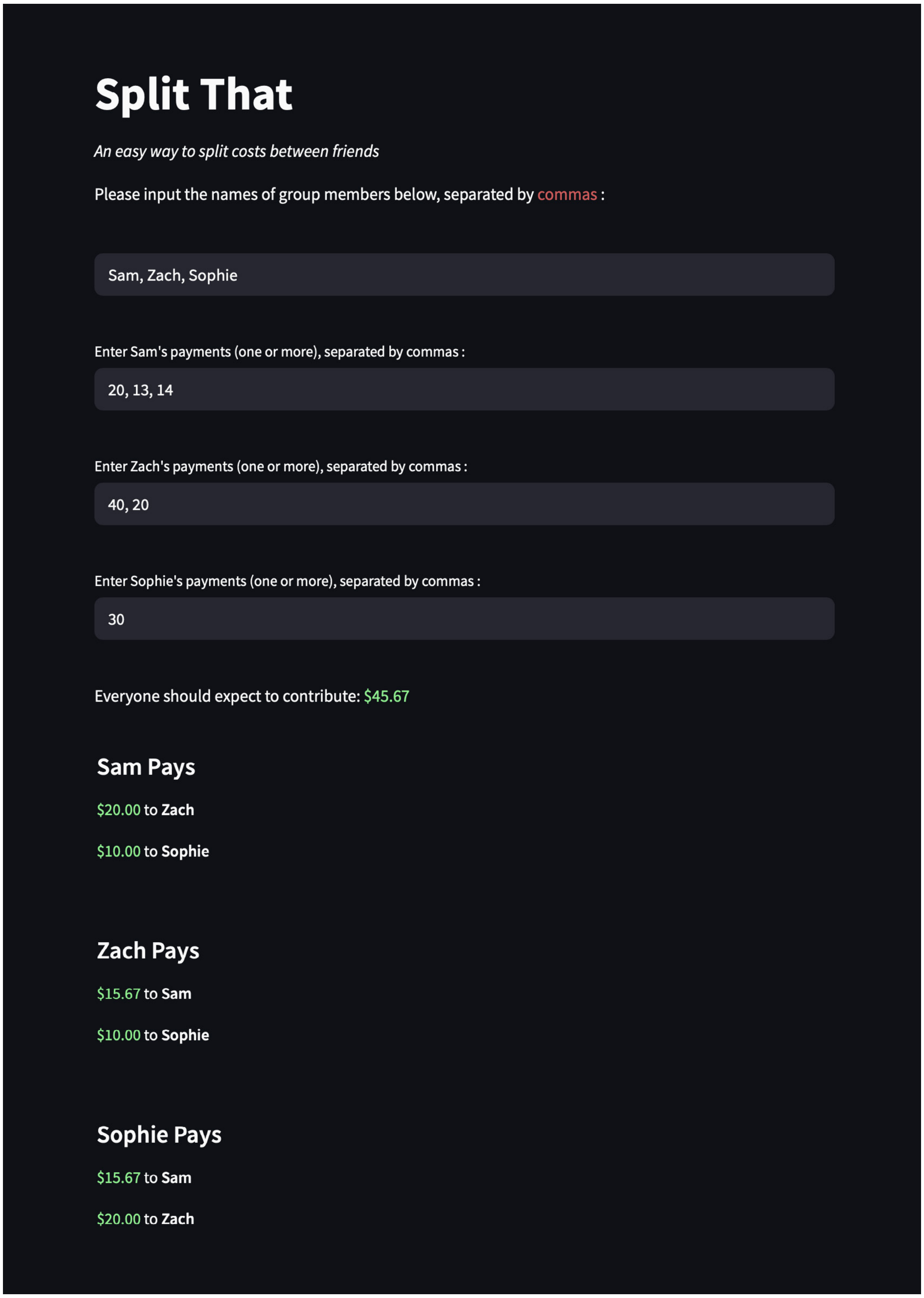




SplitThat Python Project

To access the SplitThat online tool click this [link]

Note: Click "Yes, get this app back up!" if the app is dormant.

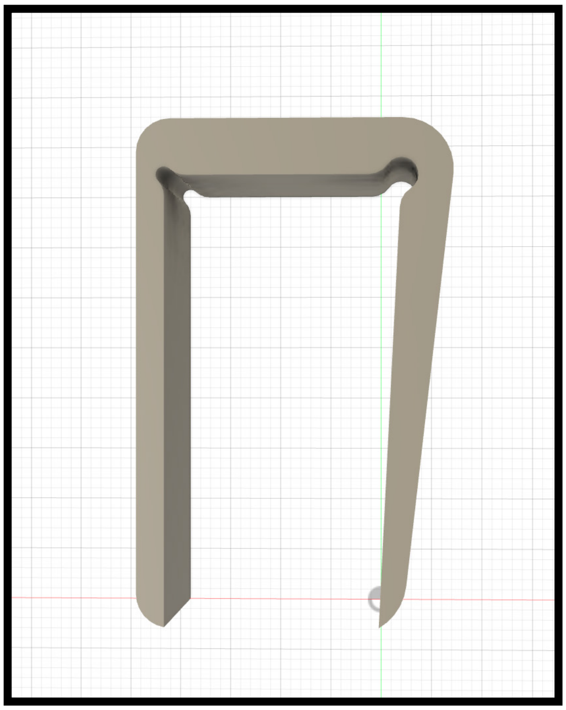


■ This project was built using Python and Streamlit to simplify group expense splitting. It accepts user input for names and payments, calculates average contributions, and displays who owes whom. An example input and output is shown above.

To access the full source code on Githib click this [link]

Clips Mini 3D Printing Projects

■ The picture on the above shows the clips in use. They were designed to clip a tapestry against the back edge of a movable kitchen island.

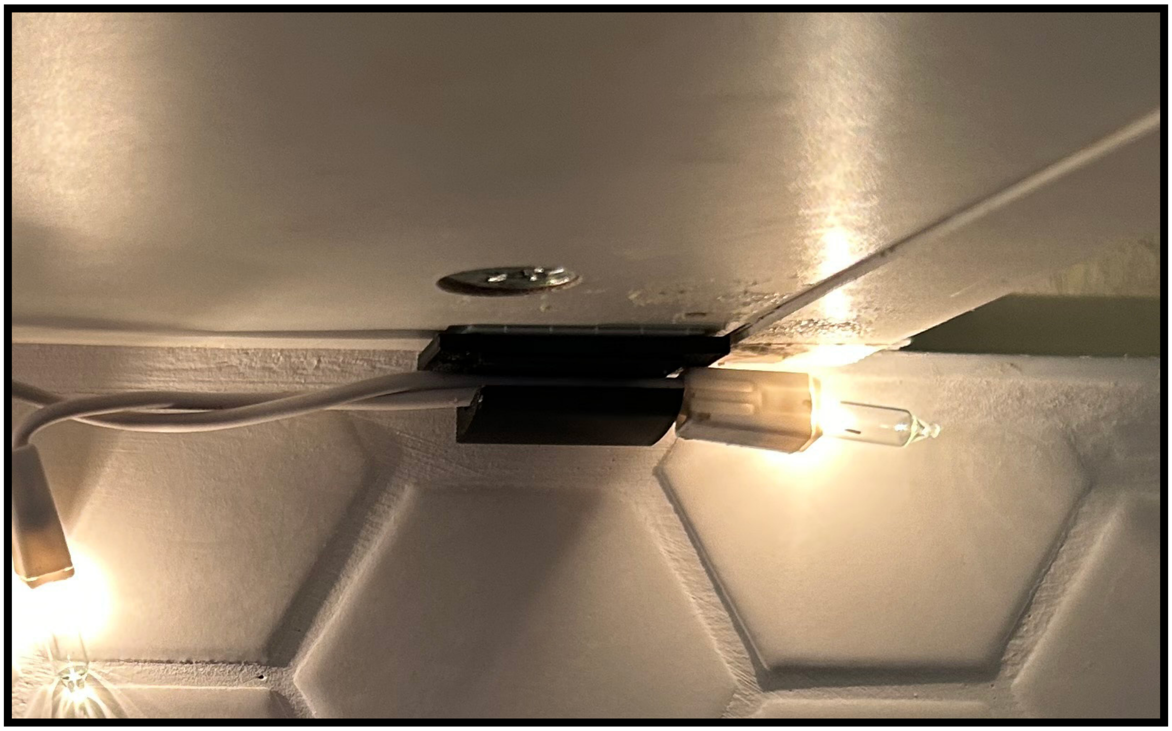


■ My primary focus was to design a clip out of PLA that could flex without breaking while also providing a secure grip on the fabric. Additionally, the design was constrained to print without supports and to function as a non-invasive attachment.

■ This simplistic design took advantage of geometry and curves while avoiding stress concentrations at corners.

■ Although the design initially worked with PLA, I learned that PETG was ultimately more suitable, as PLA showed deformation over time likely from moisture absorption and surface stress.

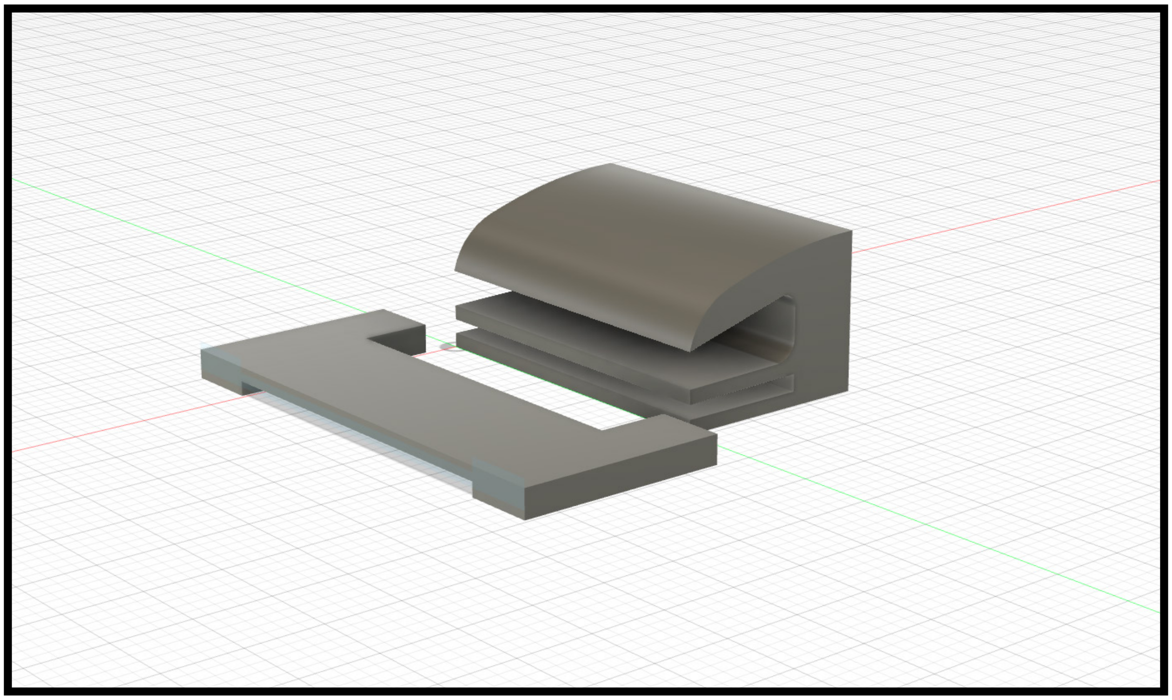
String Light Hanger Mini 3D Print Project



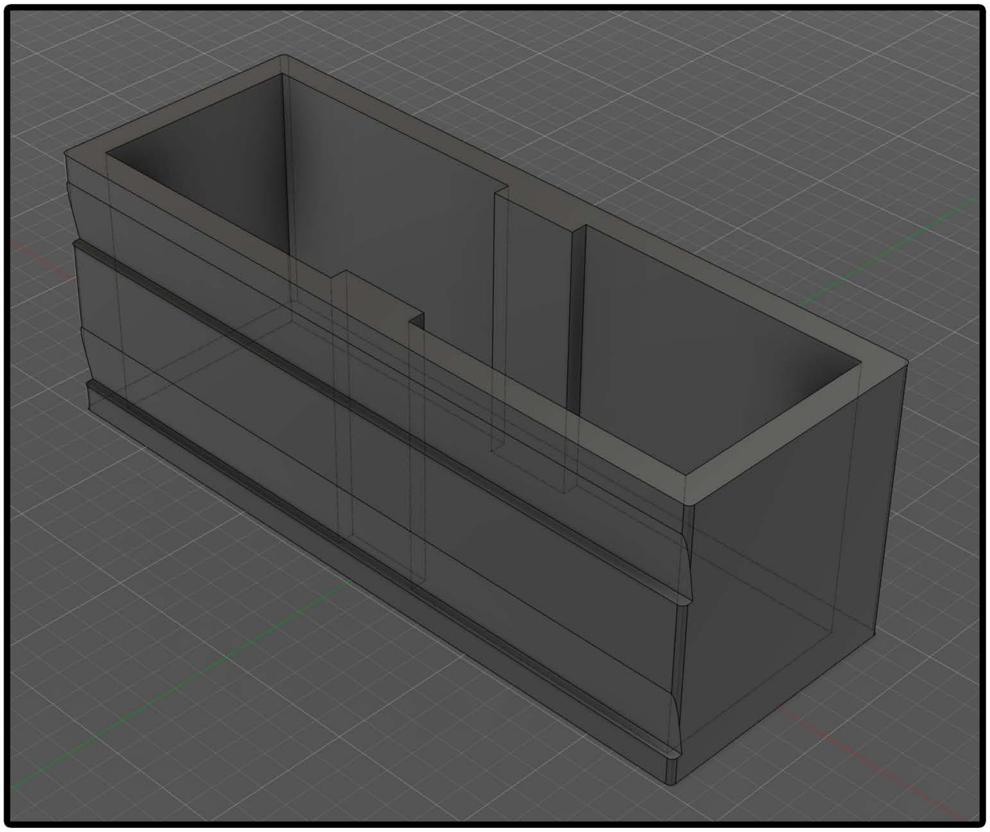
- This project aimed to solve the recurring issue of my string lights falling down after being taped to the wall. Rather than purchasing a pre-made solution, I took the opportunity to improve my 3D CAD skills by designing a custom part.

- To avoid printing with supports, I split the design into two interlocking pieces, as shown below. The clips are shaped to grip the string lights snugly and prevent catenary-style drooping.

- The entire system is mounted using Command Strips, allowing for easy installation.



Outlet Accessibility Mini Design Project



- This design **addresses a common household issue**: an inconveniently placed outlet. The extension cord, serving as a hub for multiple plugs, had limited reach. By integrating the table into the solution, it securely holds the cord against the wall, **keeping it stable and easily accessible** for use.

- This project highlights my **problem-solving skills** and ability to come up with **creative solutions** using CAD and 3D printing.