Information Needed!!

Hi there Alejandro,
This document has been split into several tabs, much like the resource handbook for students on Canvas.
As such, each tab will be dedicated to a different part of the report to prevent it from becoming excessively too long scroll-wise.

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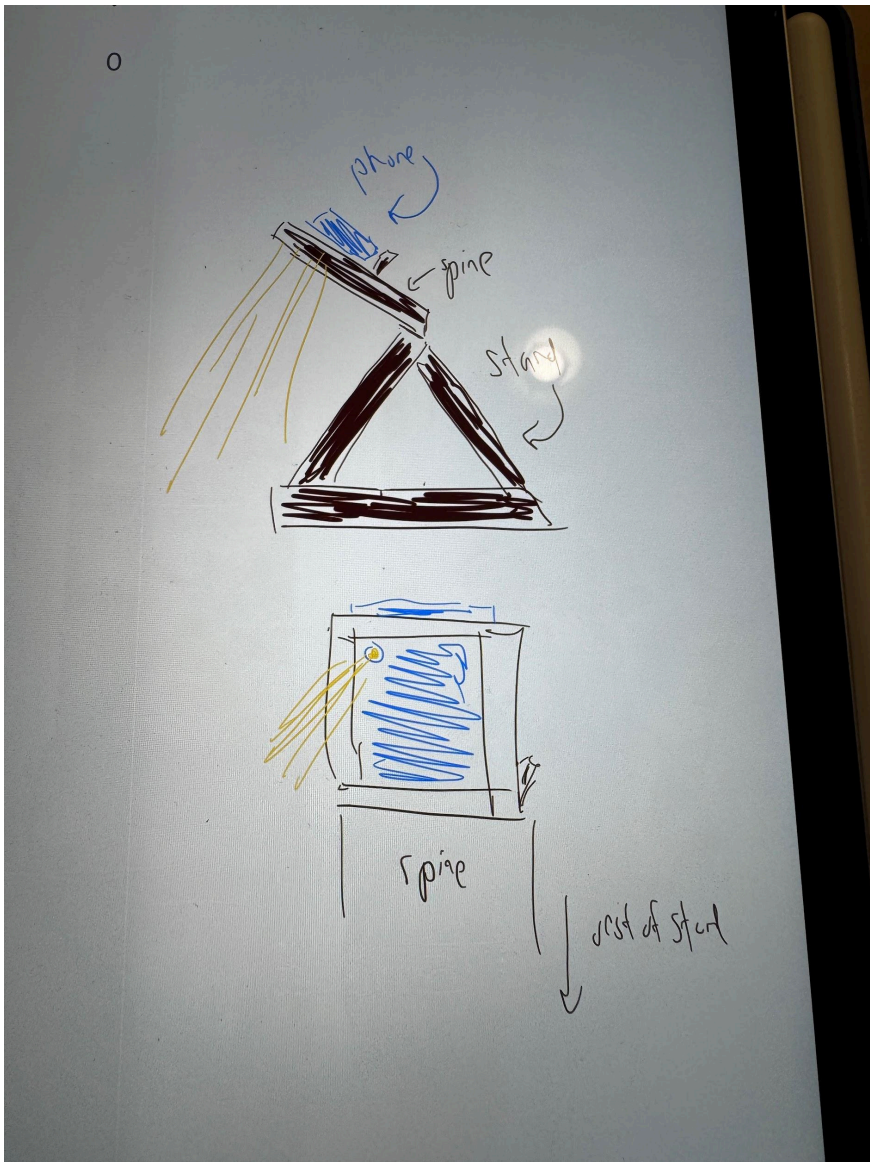
Project Overview

Project Overview

The original idea was to create a phone stand that could hold my phone securely at a high angle so its flashlight could be used to light up my desk. It'll be called the "iPhone-flashlight adjustable stand" (I know, not very creative naming.)

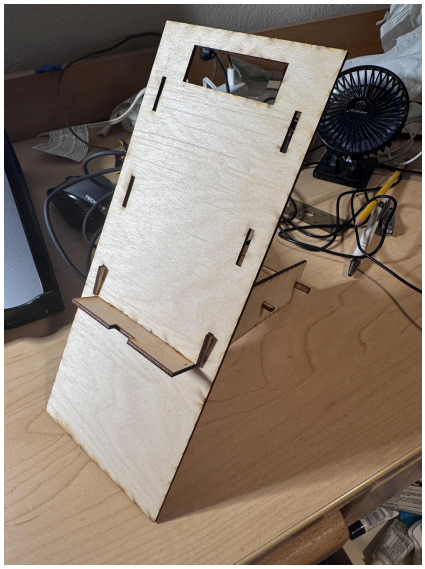
The image below is the very original prototype sketch of what it could've been.



In the end, I did end up making a phone stand that could do all this, as I could write up my final project report in the dark using it to light up my desk to see and my keyboard to type with.

The image below is what it looks like now, holding my phone. (It was photographed in another place for better lighting).

The image below is what it, the final product, looks like without my phone.

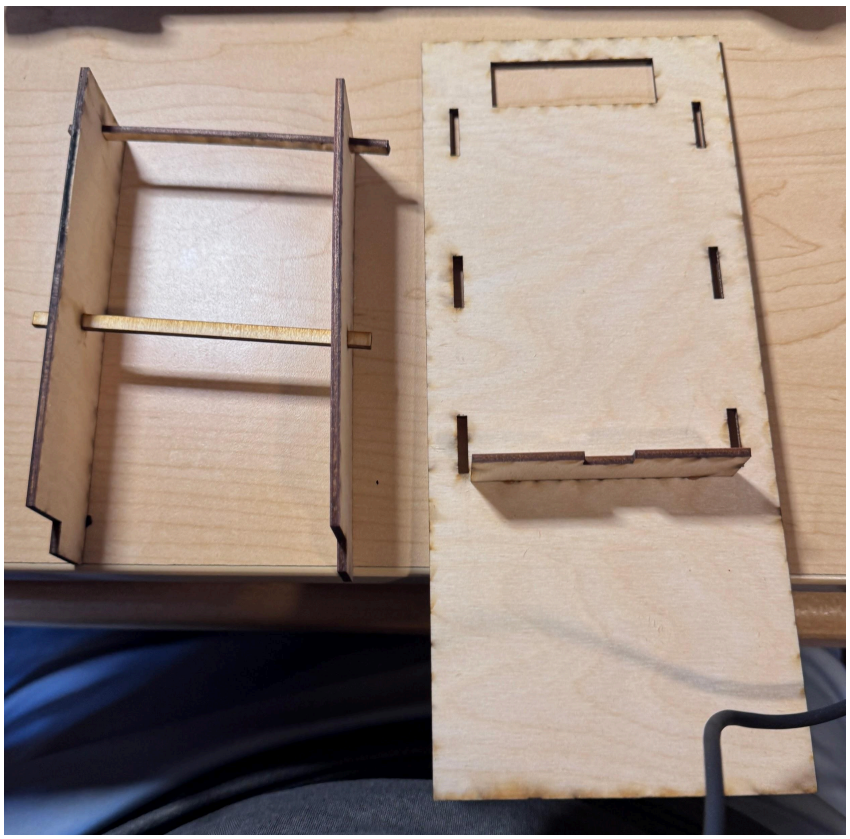


It has 1 very large spine, 1 phone clutch (to hold the phone), 2 supports (to support the spine) and 2 connectors (to bind the supports securely so they can adequately support the spine). The spine and clutch are securely attached to each other, and the supports and connectors are attached to each other as well. (The spine-clutch and supports-connectors are not however).

The spine distinctly has 3 pairs of holes on the sides for the supports (for variable height/angles of the flashlight), 1 hole for the phone clutch (bottom half of the spine), and 1 very large hole near the top (for the flashlight itself to shine through).

The clutch has a carved out area at the top for a wire to pass through, so the phone can remain continuously charged and therefore continuously lighting up my desk and laptop.

The image below is what the final pieces looked like before assembly.



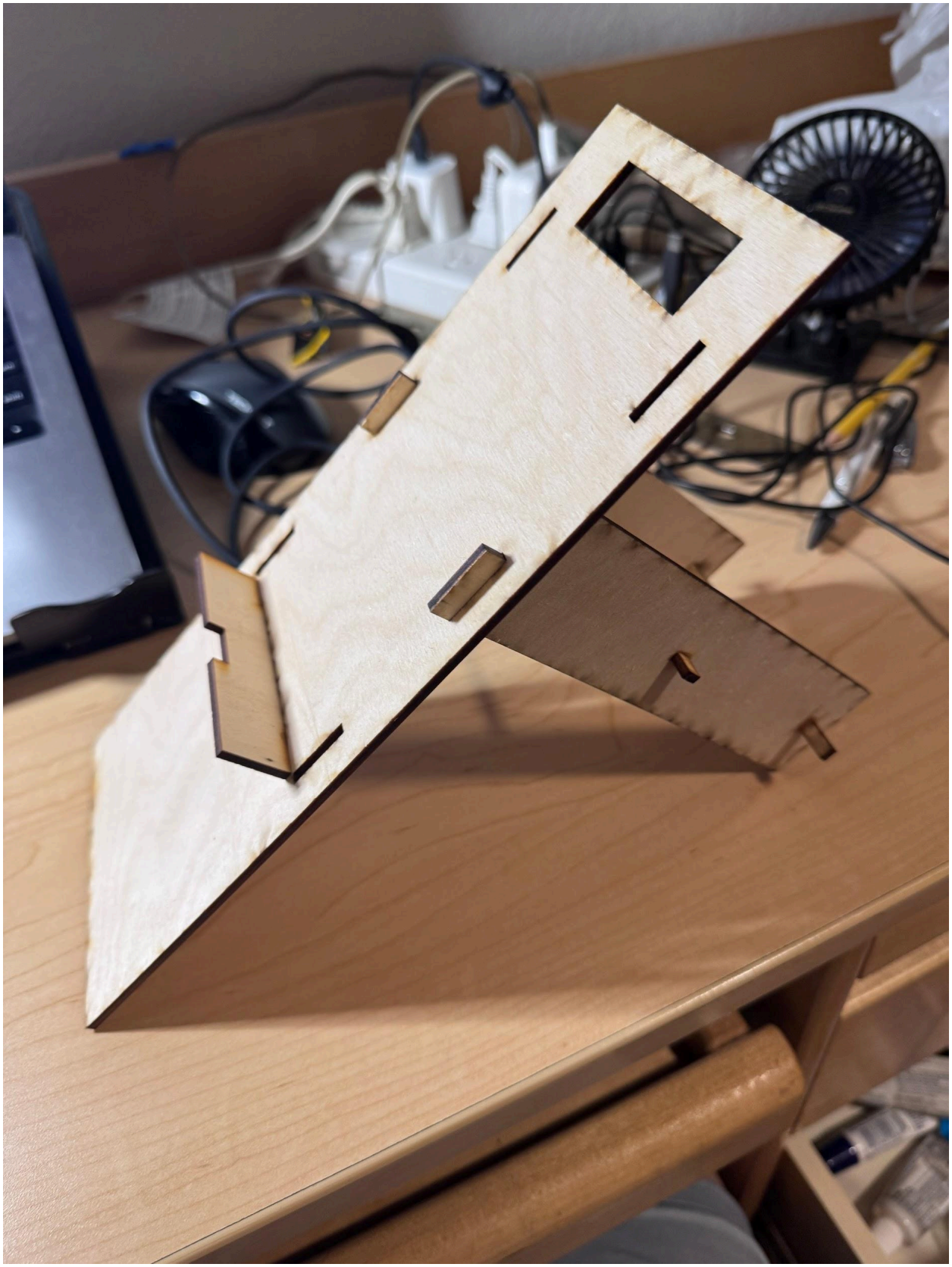
In the end, the final product had several differences. It:

- used 1 piece for the spine instead of 2 in the sketch
- did not have a base to connect both the spine and supports securely (the connectors replaced it in function)
- Had 3 pairs of holes to connect the spine to the supports (the original sketch didn't have any and relied solely on wood glue for attachment)
- Had a much smaller hole in the spine to let light through, since it offered better structural integrity and support to the phone (the original sketch had a massive hole in the center of the upper spine piece).

However, it still:

- Has a spine, support(s), and clutch
- The spine is far larger than the support(s)
- Has a hole for flashlight of phone to shine light through
- Met the intention of holding my phone securely at a high angle so its flashlight could be used to light up my desk

The image below is another image of what it looks like when fully assembled:



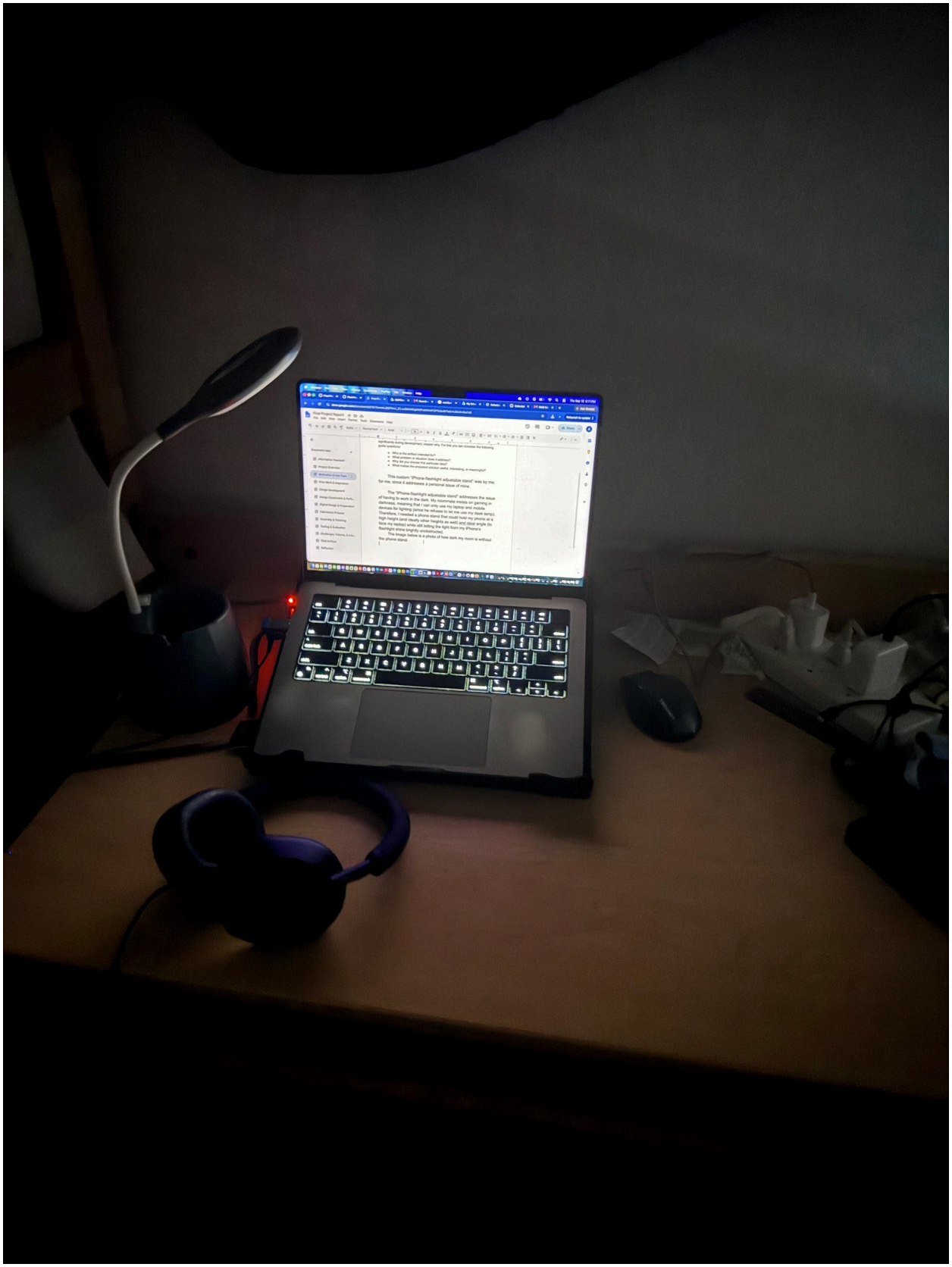
Motivation & Use Case

Motivation & Use Case

This custom “iPhone-flashlight adjustable stand” was by me, for me, since it addresses a personal issue of mine.

The “iPhone-flashlight adjustable stand” addresses the issue of having to continuously work in the dark. My roommate insists on gaming in darkness, meaning that I can only use my laptop and mobile devices for lighting (since he refuses to let me use my desk lamp). Therefore, I needed a phone stand that could hold my phone at a high height (and ideally other heights as well) and ideal angle (to face my laptop) while still letting the light from my iPhone’s flashlight shine brightly unobstructed.

The image below is a photo of how dark my room is without the phone stand. As you can see it is quite dark (and no, the desk lamp is off, not on. I have it but don’t use it).



I chose this particular idea because it lets me circumvent my roommate's rules on lighting, since he permits me to use my phone to have light. Therefore, I chose to make a phone stand to supply the light for me, which functions similar to a desk lamp without actually *being* a desk lamp, meaning I can keep it on at night. Therefore, this idea is also interesting, since it lets me have lighting without actually breaking any room rules through sheer technicality (which he had begrudgingly acknowledged just as I started writing this report).

My project did not significantly change during development, since at its foundation it would have functioned extremely similarly, enabling me to use my phone's flashlight function to light up my desk. Therefore, I did not need to change much during the development process; I only changed some of the smaller details to make the final product usable across various heights/angles and to change how it was stabilized for designing simplicity's sake. Fundamentally, it still kept the basic design of spine-holds-everything-together, clutch-holds-phone, spine-hole-lets-flashlight-light-through, and supports-stabilize-spine, although some details of *how* these design bits were achieved changed a little.

Prior Work & Inspiration

Prior Work & Inspiration

My initial and final designs were inspired by 3 separate images of various phone stands. They were the following:

1) Reclaimed wood handmade phone holder minimalist style
    a) https://www.pinterest.com/pin/reclaimed-wood-handmade-phone-holder-minimalist-style-en-2024--457403711572898 2/
    b) The image: 
    c) For relevant info that helped inspire my designs, this image had 2 supports for the spine instead of 1. (inspired the final design)
    d) I learned from this image that the supports could consist of more than just 1 support (the other 2 images and the original sketch have just one support for the large spine). (final design)
    e) My (final and initial) design differs from this work in that the support(s) are rectangular prisms, not circular rods, and that the support(s) in turn have their own connectors to ensure that they remain in place, not caps that double as phone clutch.
2) Phone stand, phone holder, mobile phone stand wood stand wooden iphone dock station wooden mobile
    a) https://www.pinterest.com/pin/phone-stand-phone-holder-mobile-phone-stand-wood-stand--863706034792651446/

b) The image: 

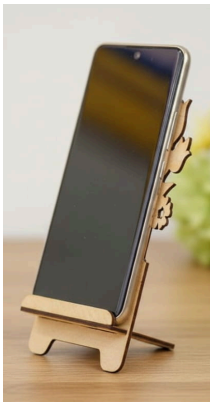
c) The relevant information that helped inspire my designs was that this image had a hole at the top of the phone clutch to let a charging wire through. A minor thing, but a thing nonetheless (inspired the final design). It also had 1 support (which helped inspire the initial design, not the final design).

d) I learned from this image that I could carve out a dedicated hole in the clutch for a wire, so my phone would never run out of battery while providing light, meaning I could work extended hours in the dark continuously. (final design)

e) My (final) design differs from this work in that the wire hole in the clutch is a rectangle, not a triangle. It also has 2 supports instead of 1 (see the first reference for how I got inspired to do this).

3) Laser Cut 8 March Phone Stand for Womens Day

a) https://vecty.co/lasercut/5545-laser-cut-8-march-phone-stand-for-womens-day

b) The image: 

c) The relevant information that helped inspire my designs were that 1) it had a singular support in the back (for initial design) and that it had an independently attaching piece that isn't the support as part of the clutch to support the phone.

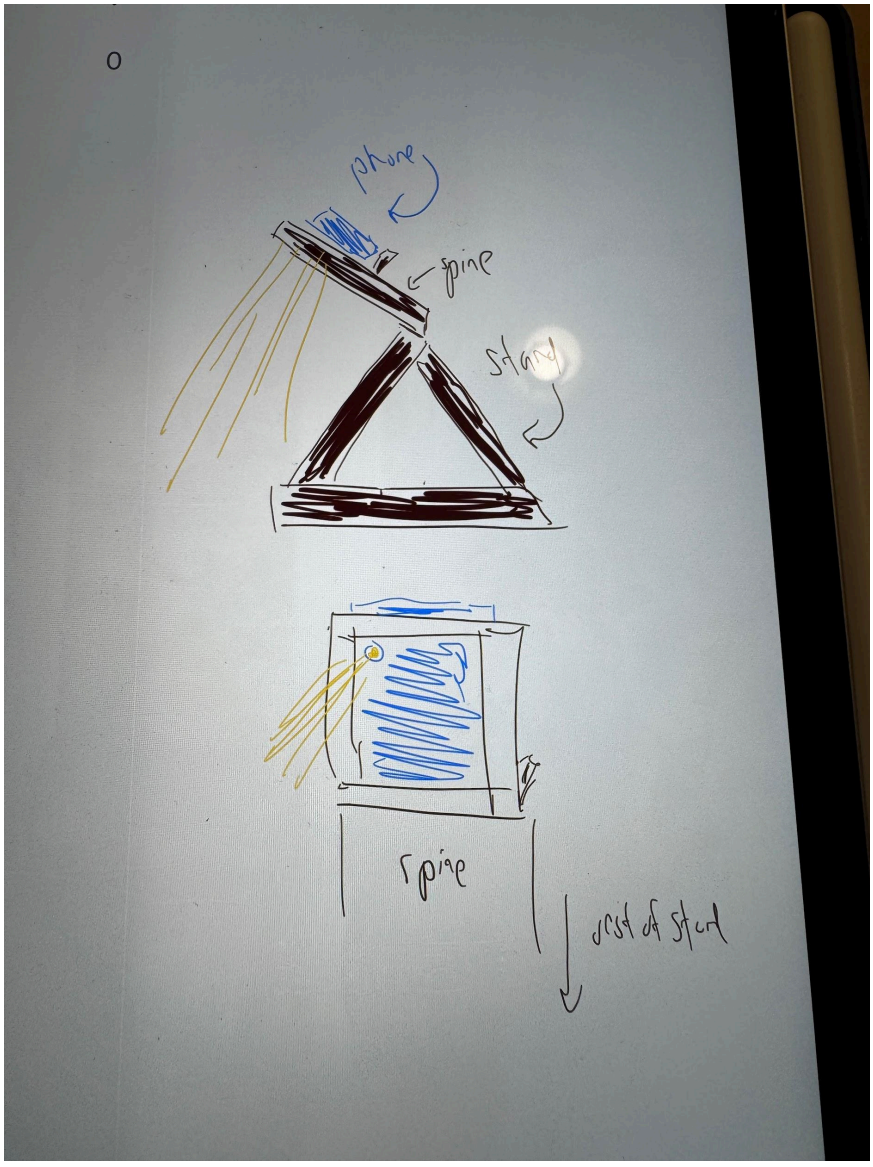
d) I learned from this image that 1) (for initial design) I could have a spine be supported by a singular support and 2) that I could have a different piece other than the support as the clutch.

e) My (final) design differs from the image in that 1) it has 2 supports (see the first reference above for why I was inspired to do this) and that my phone clutch is a separate piece compared to the supports (it has its own separate hole and is designed and cut out separately).

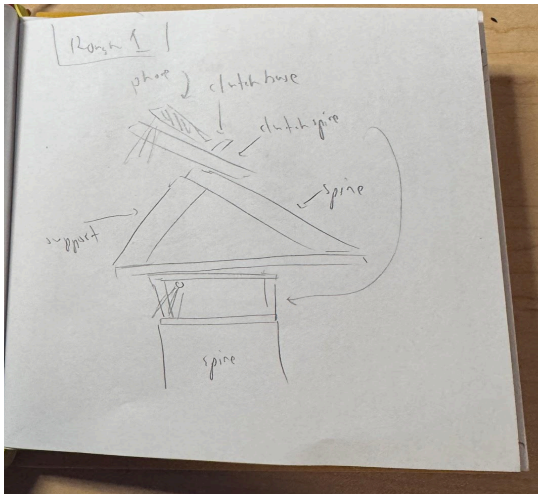
Design Development

Design Development

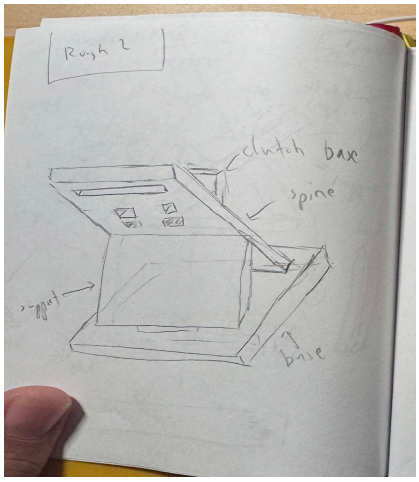
This was the initial sketch done on an iPad: (abandoned)

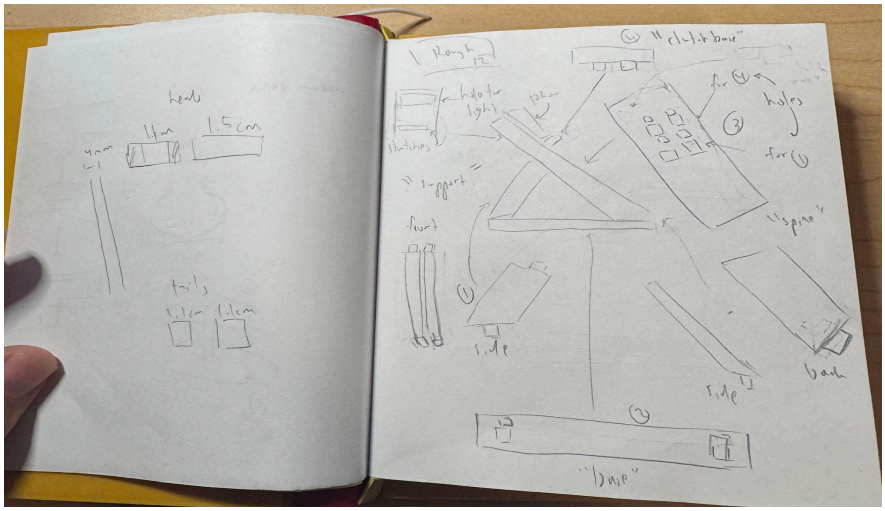


This was the first concept drawing done in the notebook: (partially abandoned)

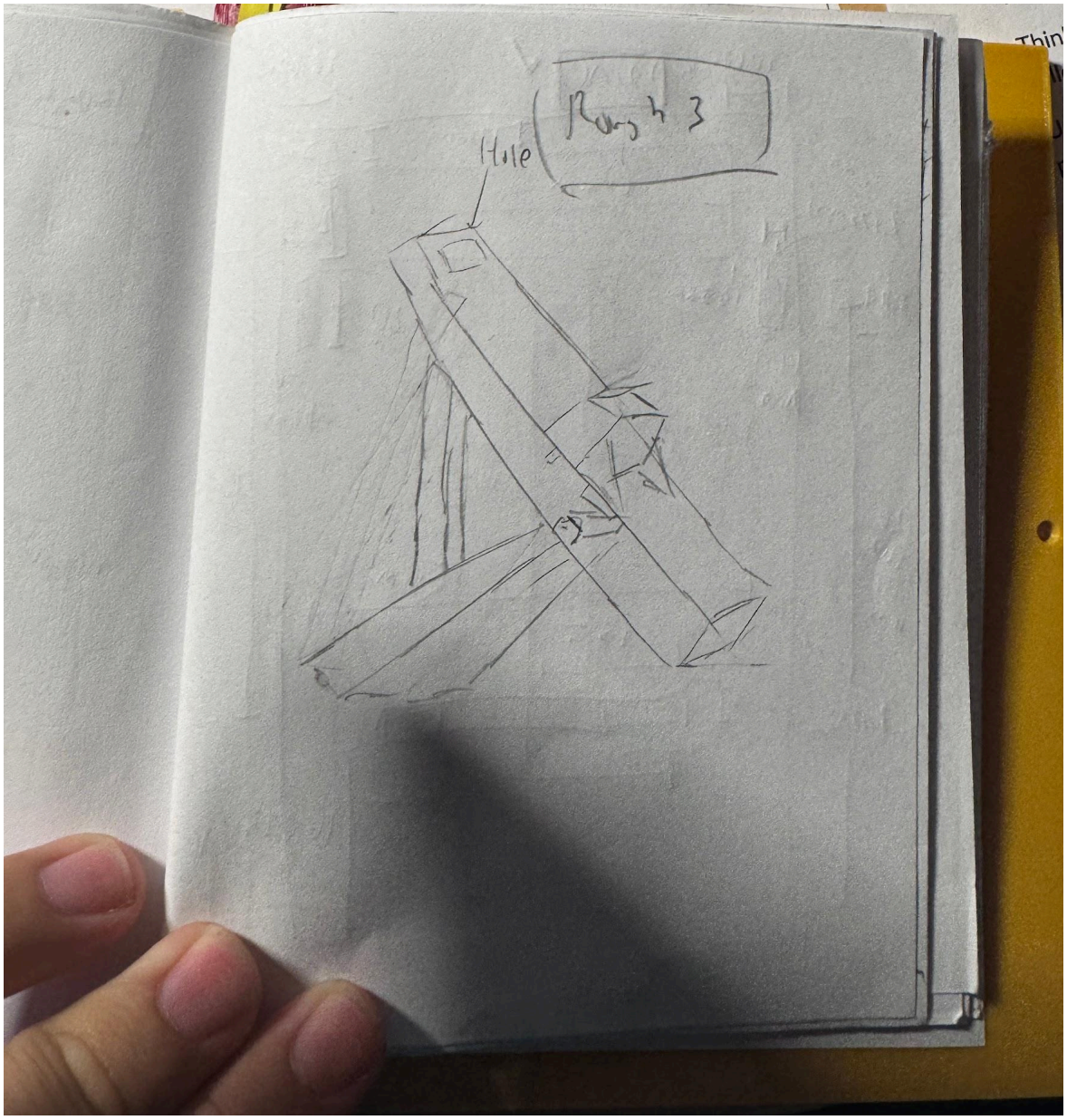


This was the second concept drawing done in the notebook: (partially abandoned)

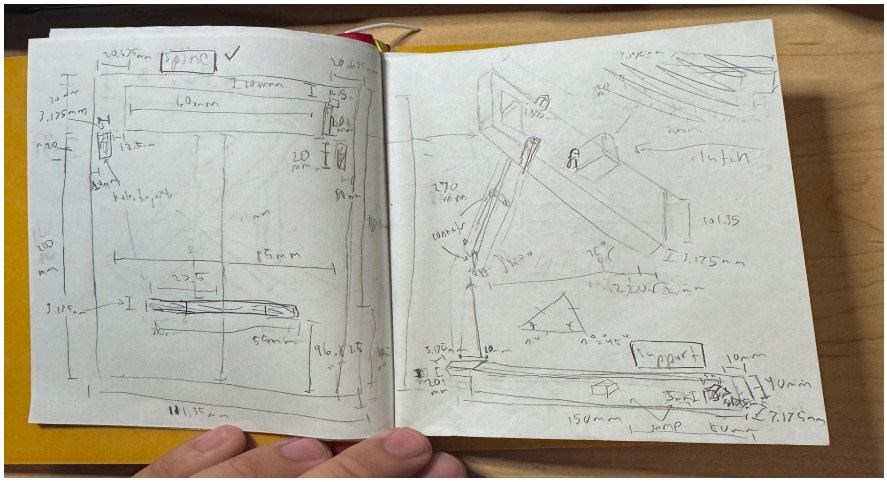


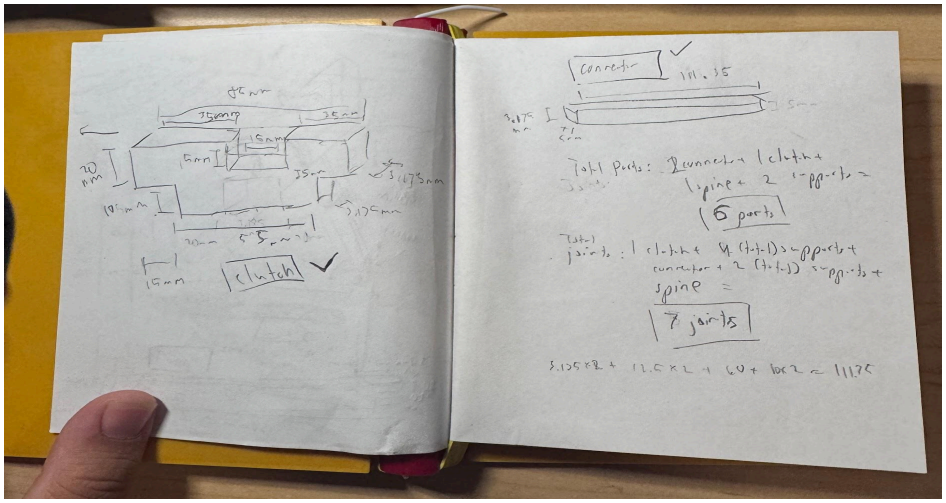


This was the third concept drawing done in the notebook: (partially abandoned)



And these were the “*final version*” drawings:





Here, I outlined the major dimensions in the design:

- Spine is 270mm tall by 111.35mm length by 3.175mm width
    - Support holes are 20mm tall by 3.175mm length by 3.175mm width
    - Clutch hole is 3.175mm tall by 55mm length by 3.175mm width
- Upper clutch is 20mm tall by 85mm length by 3.175mm width
    - Lower clutch is 10mm tall by 55mm length by 3.175mm width (the part that goes into the clutch hole)
- Lower supports are 150mm tall by 40mm length by 3.175mm width
    - Upper supports are 10mm tall by 20mm length by 3.175mm width (the part that goes into the support

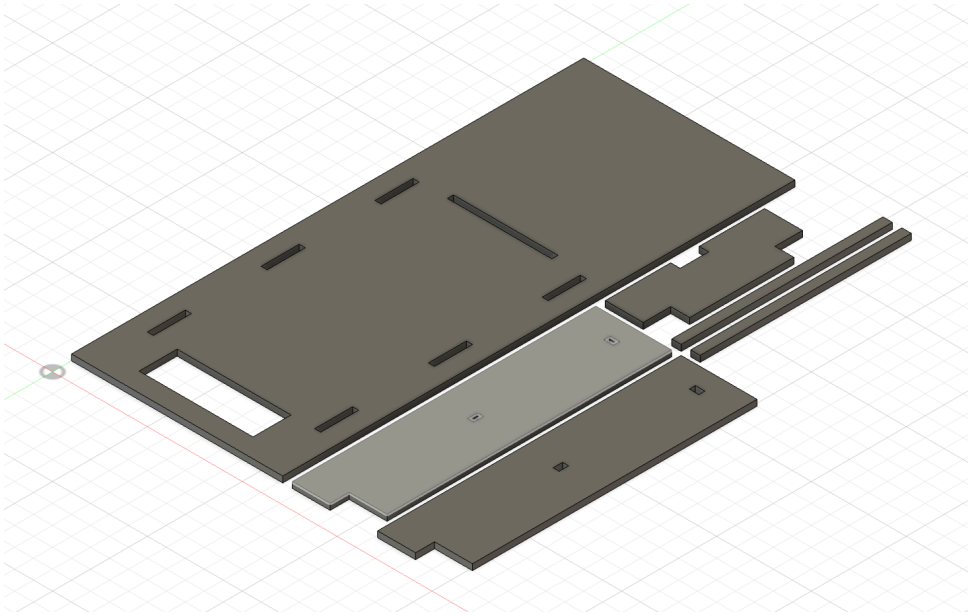
holes)
    - Connector holes are 5mm tall by 5mm length by 3.175mm width
- Connectors are 111.35mm by 3.175mm by 5mm

Here, I had *several significant design changes here,* being the ideas of having 2 supports and an independently embedded phone clutch with an empty region designed specifically for a charging wire. I changed the design since I was already going all-out on designing, may as well add in the bits I wanted but weren't strictly speaking necessary. It made the finland ensign have these features, as they were (mostly) untouched even until the end.

This lead to the first prototype, laser-cut from 1/8th inch plywood: (note, CAD model not available since I don't want to destroy my timeline on accident)

Here, I realized that the holes for the connectors in the supports were far too large. And thus, it would change (among other things).

And later on, in the digital Autodesk Fusion app workspace for the final design once more:



Here, I outlined the final dimension:

- Spine is 270mm tall by 111.35mm length by 3.175mm width
    - Support holes are 20mm tall by 3.175mm length by 3.175mm width
    - Clutch hole is 3.175mm tall by 55mm length by 3.175mm width
- Upper clutch is 20mm tall by 84mm length by 3.175mm width
    - Lower clutch is 10mm tall by 55mm length by 3.175mm width (the part that goes into the clutch hole)
- Lower supports are 150mm tall by 40mm length by 3.175mm width
    - Upper supports are 10mm tall by 20mm length by 3.175mm width (the part that goes into the support holes)
    - Connector holes are 5mm by 3.175mm by 3.175mm
- Connectors are 111.35mm by 3.175mm by 5mm

I had another *significant design change* here, which was that I added in 2 more pairs of holes to the spine for the supports to enter in. This was changed so I could accommodate the idea of having variable heights/angles of my phone's flashlight, to fit the situation (writing on paper in notebook, looking at tablet for

sketching, or looking at keyboard to type.) This made the final design have 3 total pairs of holes for the supports to enter through, firmly securing the concept of allowing the use of various heights/angles for the flashlight. It also meant creating and extruding in negative directions more rectangles in fusion.

Design Constraints & Performance Goals

Design Constraints & Performance Goals

There were several design constraints and requirements that influenced my design of the initial and final products.

- It had to be made out of 1/8th inch plywood (since I didn't know how to laser cut any other material at the UCSB Library Makerspace) that was smaller than 12" by 24" (since that's how large the plywood provided was).
- It had to be cut using the laser cutter machine at the UCSB Makerspace (since 3D printing would take far too long)
- It had to be cuttable within half an hour (since UCSB Makerspace lets you book in half-hour intervals; yes I am aware that you could technically do 15 minute intervals but it defaults to 30 minute intervals unless you shorten it to 15).
- It had to be small enough that wood glue applied could dry within 24 hours (so I could remove it from the locker and use it for assignments such as this one and the video, which was initially due on Wednesday, hence the emphasis on drying within 24 hours part so it could be cut on Tuesday and assembled on Wednesday).
- It had to designable in Autodesk Fusion (since I don't know how to create my own 3D structure to 3D print with).

There was also one specific goal in my initial proposal, and several in my later proposals (that you read in the Project Overview and Motivation & Use Case, will reiterate them here).

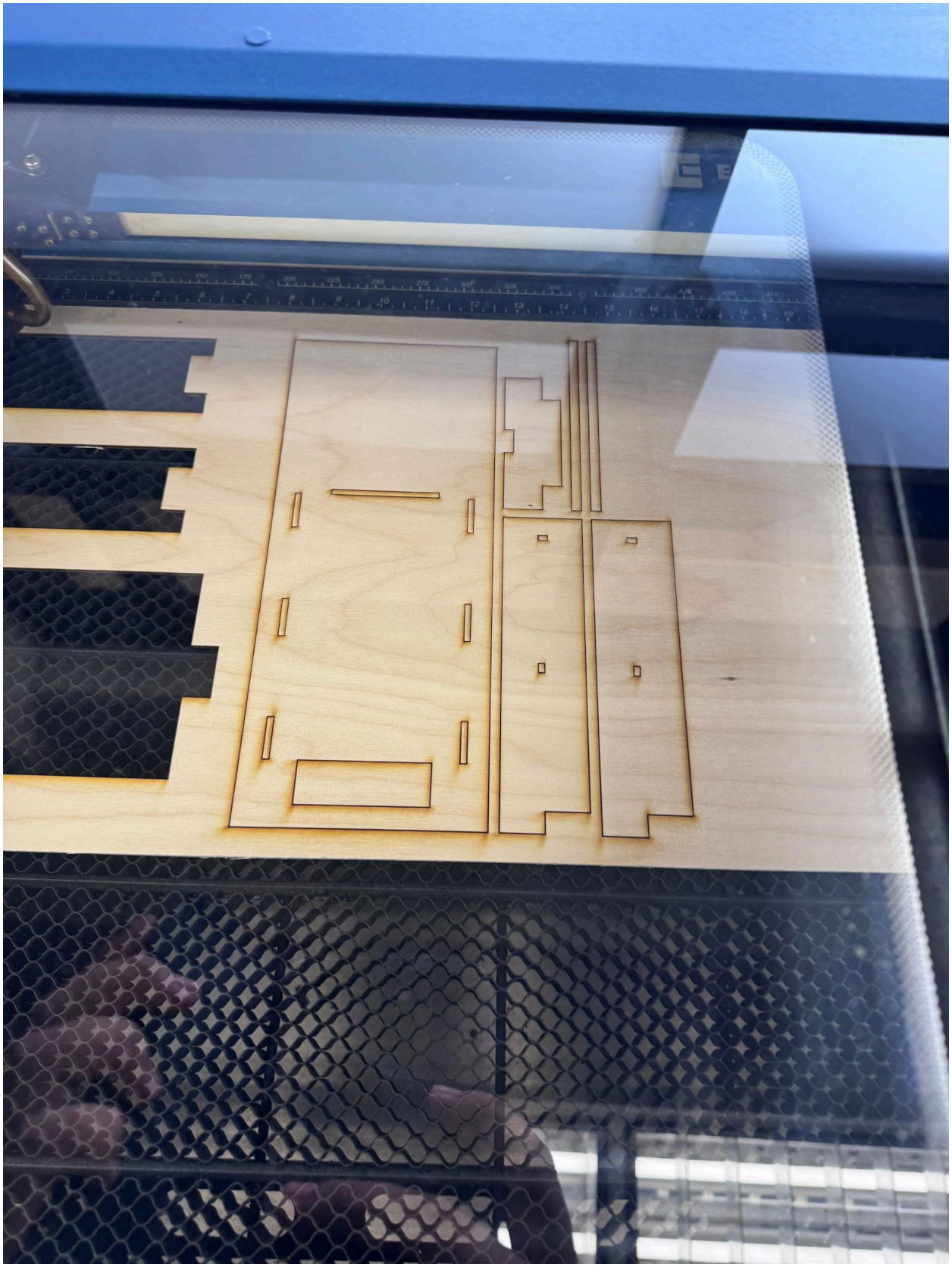
- (initial) It had to securely hold a phone in place relatively high up so its flashlight could shine down upon a specified area (like laptop keyboard).

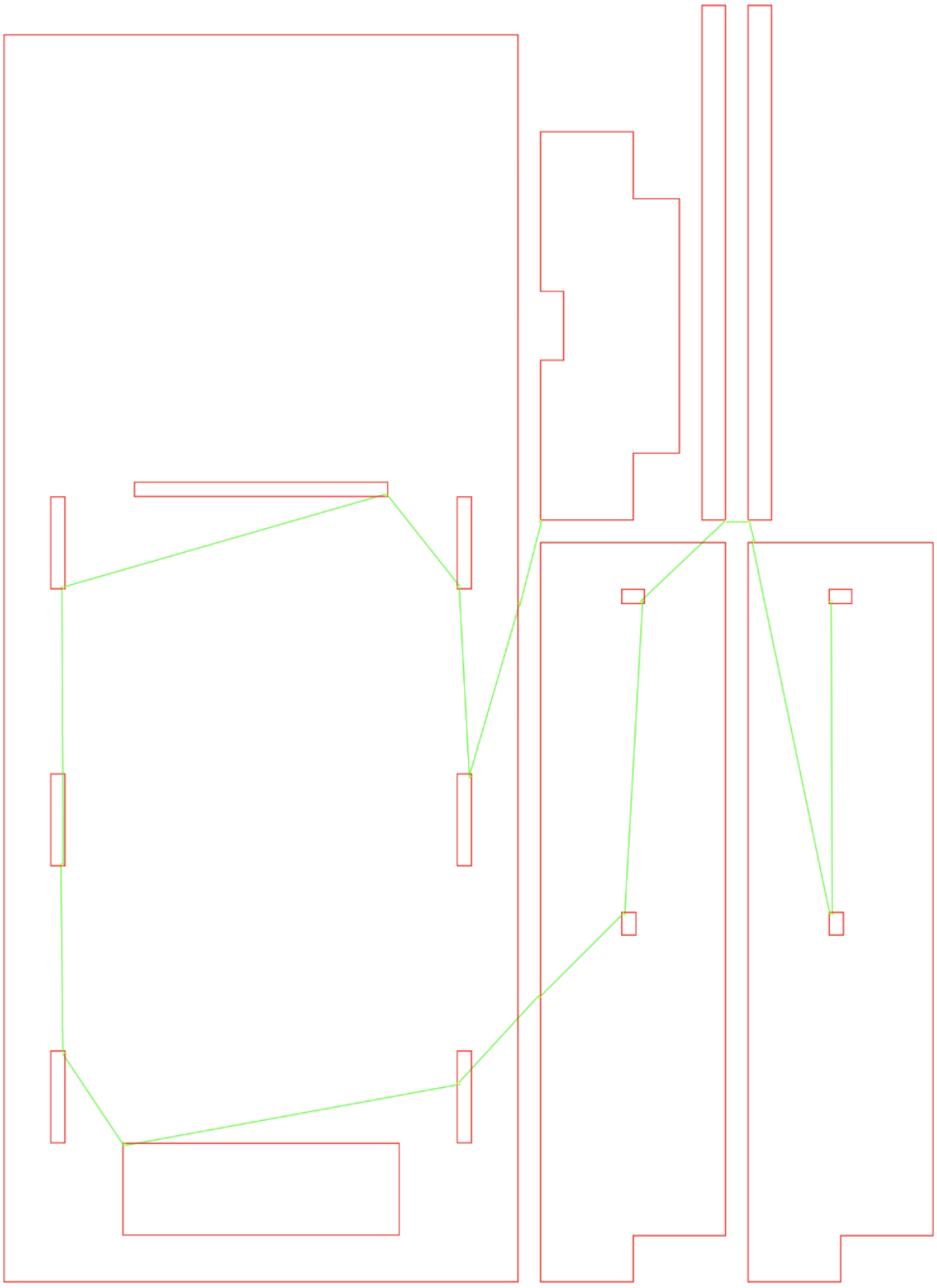
- (initial) It had to be capable of withstanding the weight of an iPhone 15 Pro Max for extended periods of time (implied).
- (initial) It had to let an iPhone 15 pro max's flashlight light through even while holding the phone
- (final) it had to be capable of being transported other places easily (implied)
- (final) it had to be capable of accommodating a variety of angles/heights for different uses.
- (final) it had to have a place in the clutch for a charging wire to go through so the phone could remain charged while being used as a flashlight

Looking at all of these, I believe that my design was successful across both fields, in both design constraints and performance goals.

For design constraints, the final product did end up being laser cut at Makerspace from 1/8th inch thick plywood smaller than 12 inches by 24 inches within half an hour (it took 6 minutes), was small enough that wood glue could be used successfully, and was designed in Autodesk Fusion. Therefore, this was a success and met the required design constraints and requirements.

The images below are proof that it met the design constraints and requirements. The first one is of the product being laser cut at Makerspace into a 1/8th inch plywood area less than 12 inches by 24 inches large and the second one is of the digital design dxf file.





For performance goals, it also checked every box that needed to be checked off. It could hold and withstand the weight of my iPhone 15 Pro Max for hours stably and securely while allowing a wire to continue charging it whilst its flashlight shone through to my laptop at various different heights. Therefore, this was a success and met the performance goals.

The images below shows it holding the phone securely at different angles, withstanding its weight and allowing the flashlight to shine through. (I was unable to get a photo of the wire going through the clutch though since I can’t take a photo of it at my desk due to my phone being used as a light source though; I don’t have two phones).


YouTube

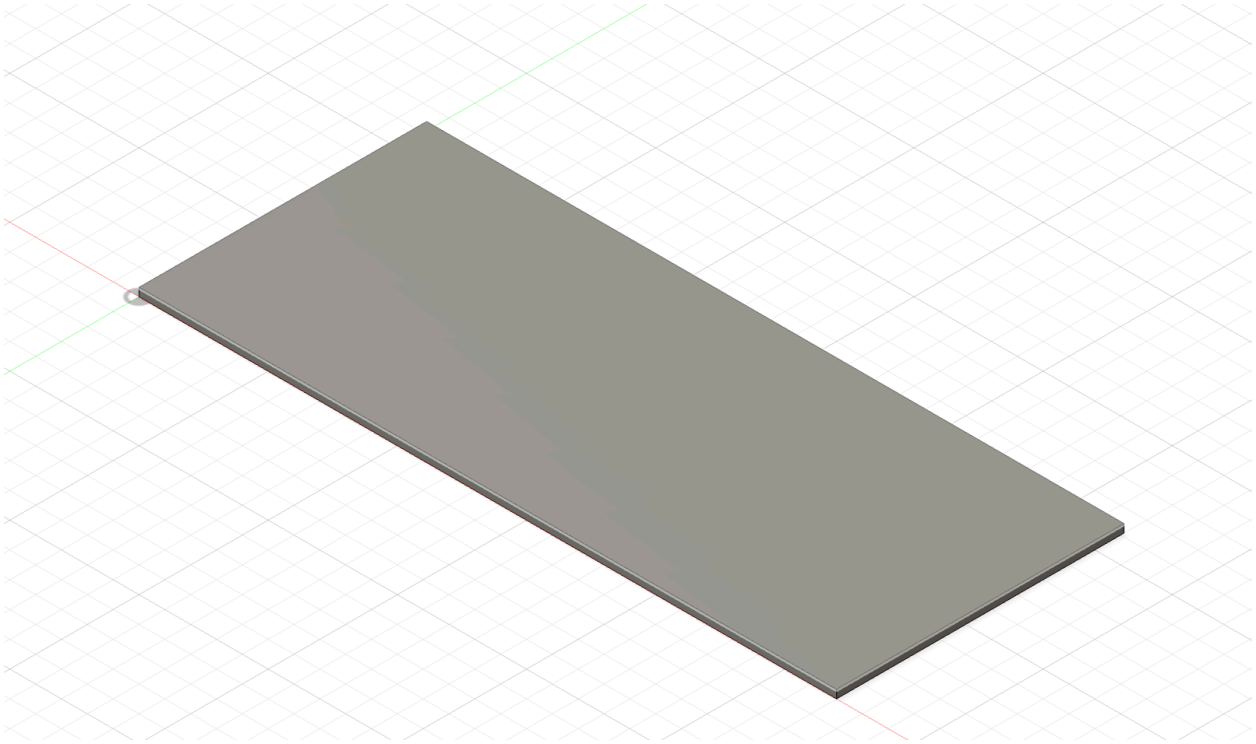
Digital Design & Preparation

Digital Design & Preparation

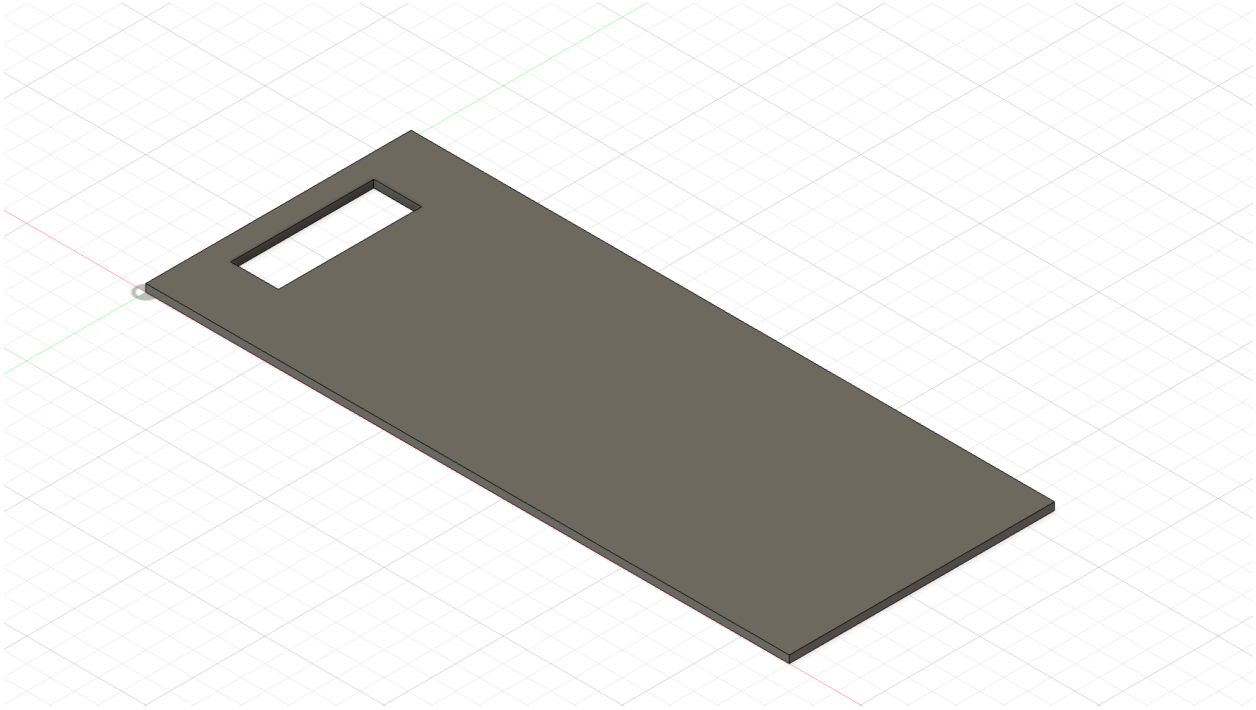
This product's initial digital design was developed in Autodesk Fusion's laptop app in the Design function, was turned into components and arranged flat in Manufacture, then was calculated via 2D Profile and NC Program in Manufacture, and finally exported as a dxf file from Manufacture as a downloaded file that could then be accessed via justbeamit.com at the adobe illustrator in the Makerspace.

As for the final digital design, I went back to the initial Design and modified it there, and its changes cascaded into another usable collection of components in Manufacture that could undergo the same 2D Profile, NC Program, and exportation as a dxf file in Manufacture to be accessed via justbeamit.com at the adobe illustrator in the Makerspace.

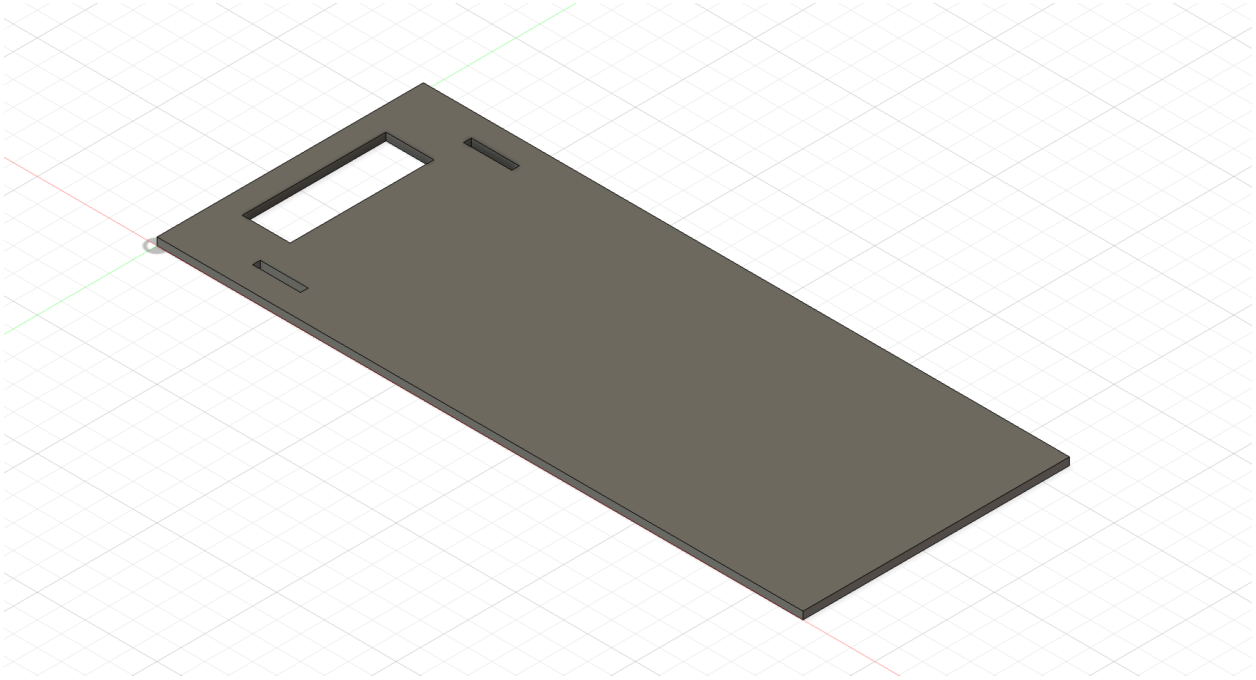
For the initial digital design in Design, I started off with creating the spine as a flat rectangular prism.



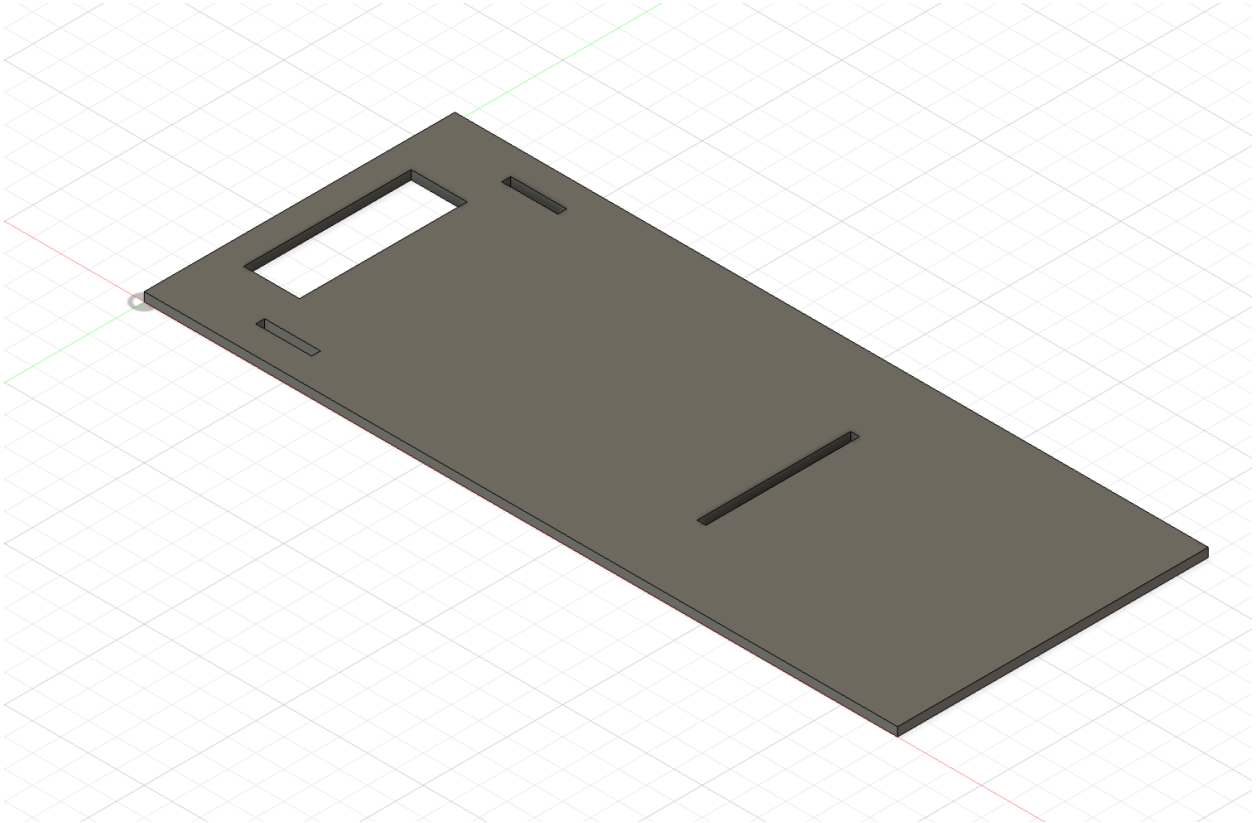
I then added in the hole for the phone flashlight



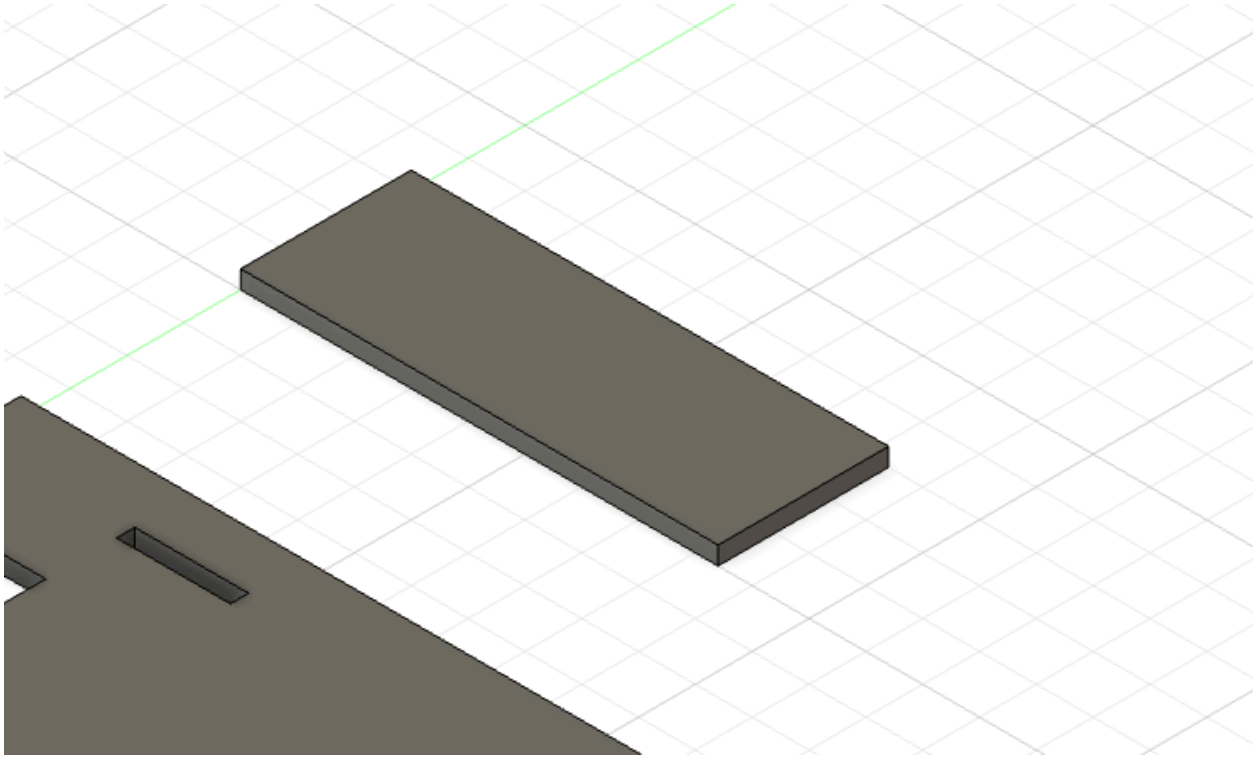
I then added in the two side holes for the supports.



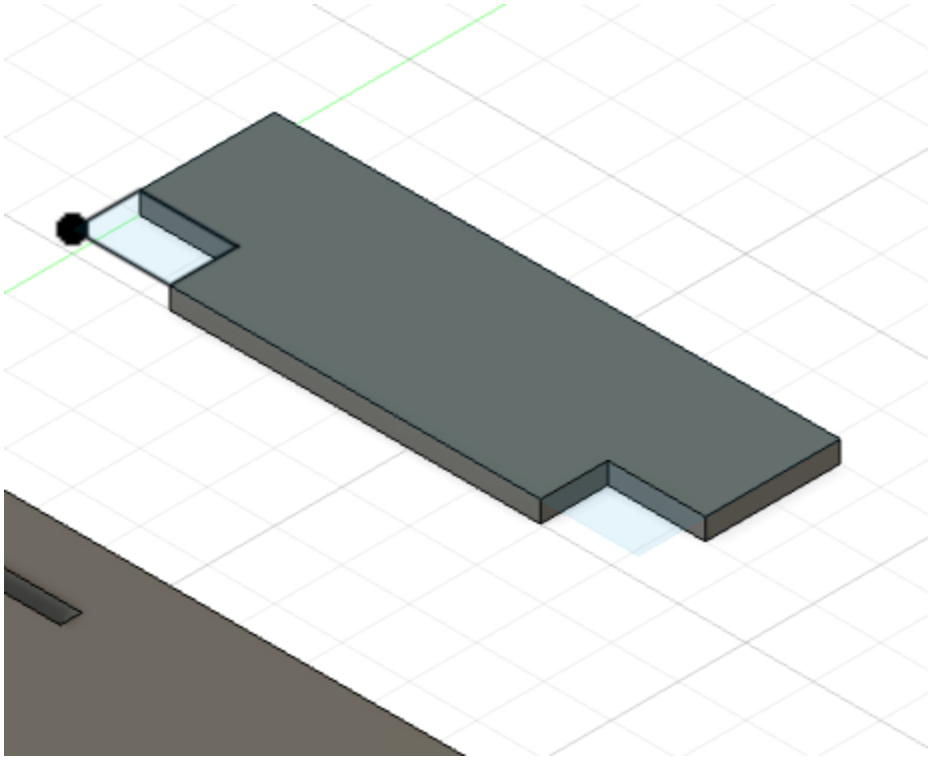
I then added in the hole for the clutch.



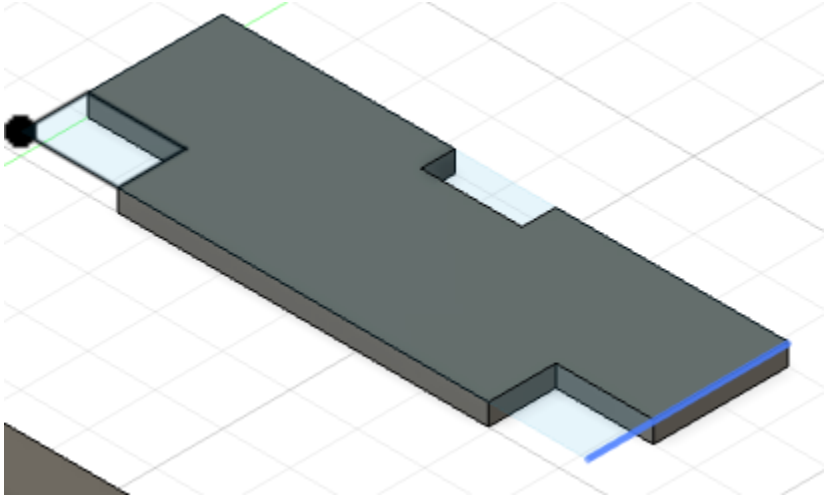
I then began making the clutch as a rectangular prism. (do note that it is 1mm too long, this is the final image and I won't be changing its sketch to preserve timeline integrity.)



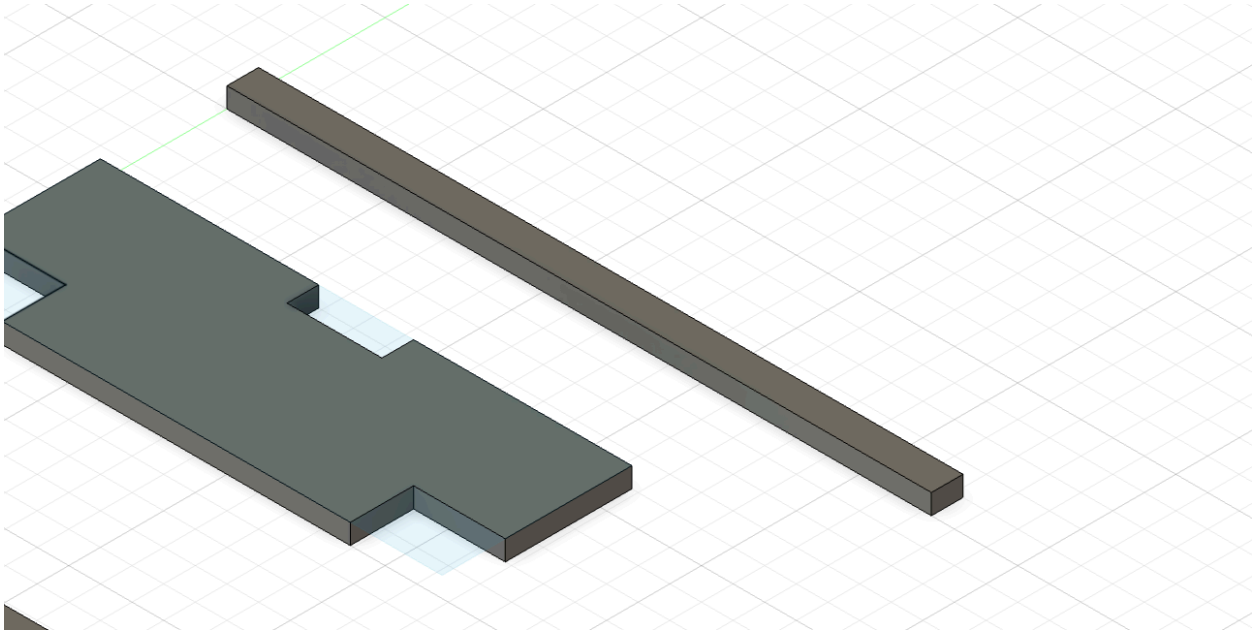
Then I cut out two corners to make the joint that would insert into the spine.



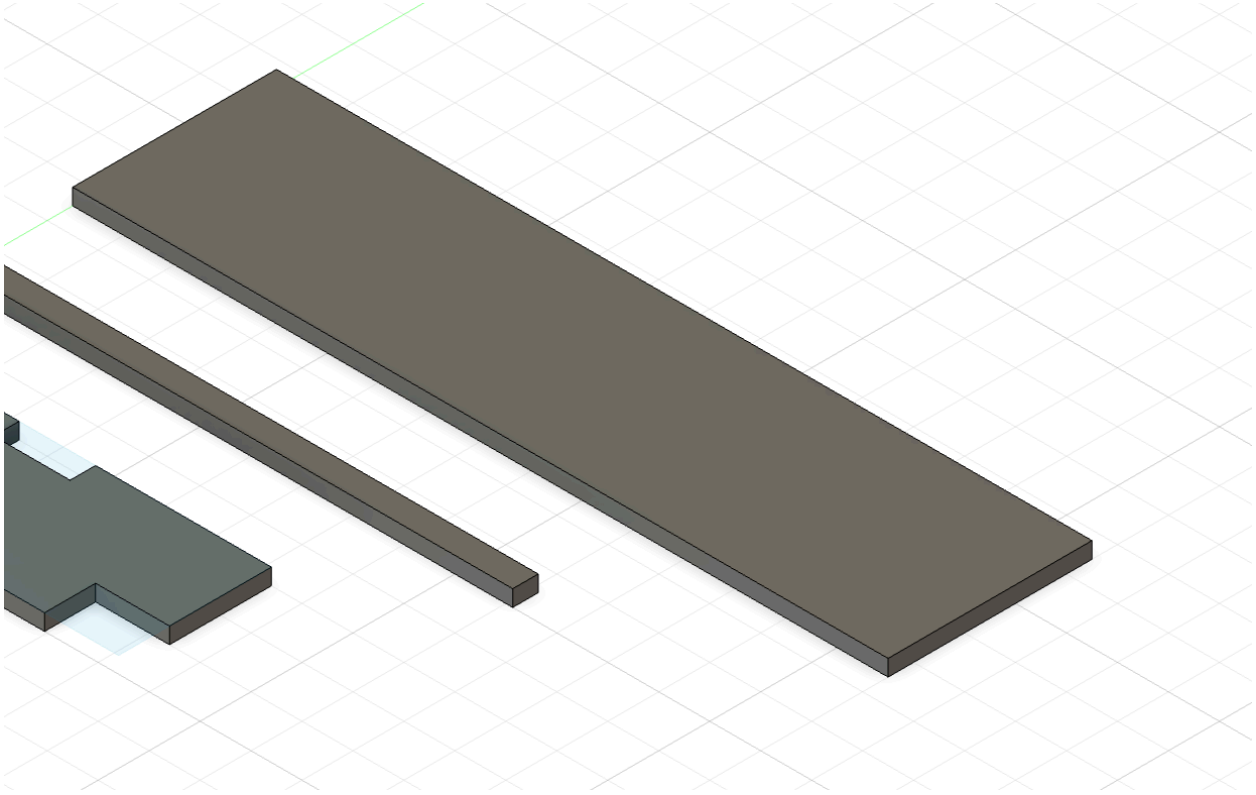
I then cut out the hole part that would allow the wire to enter and pass through at the top.



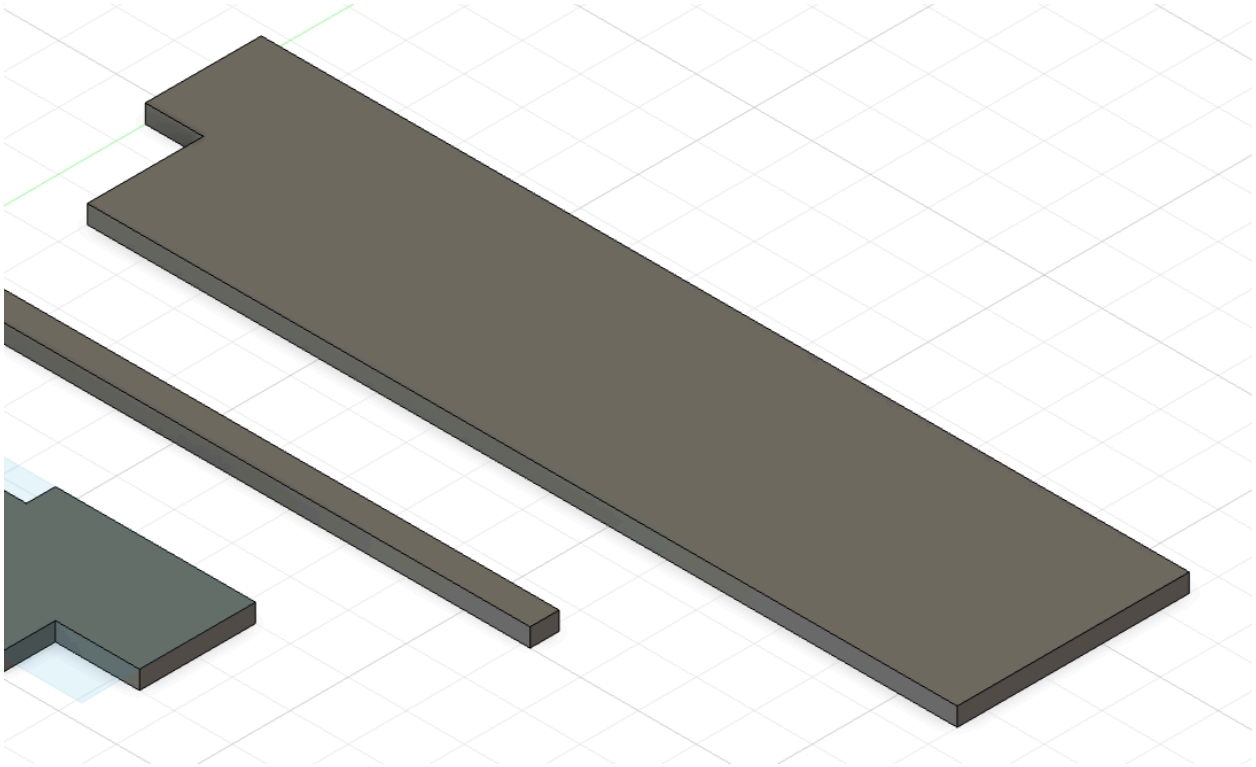
I then created the first connector as a singular rectangular prism. (note that the dimensions are from the final design, as initial design dimensions couldn’t be obtained due to technical limitations and not wanting to destroy the timeline. Just imagine it being twice as tall).



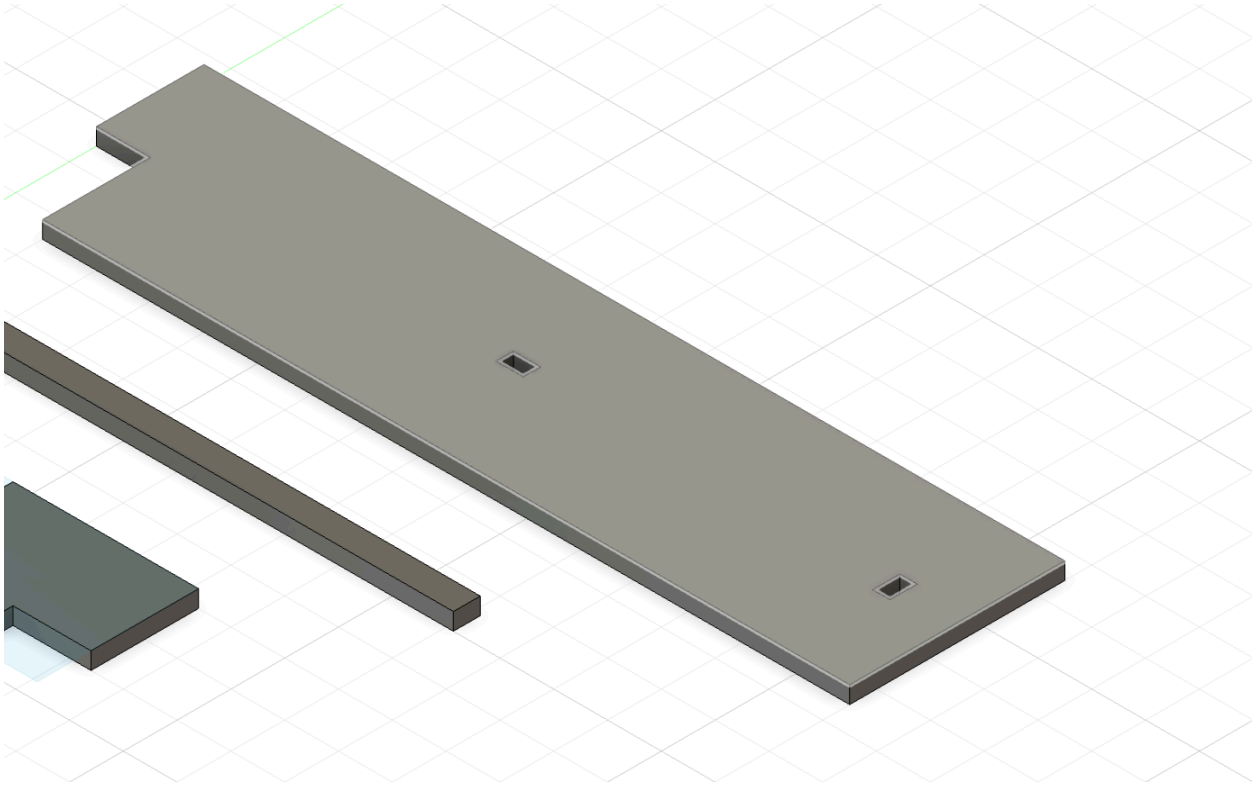
I then began the designing of the first support by creating a rectangular prism.



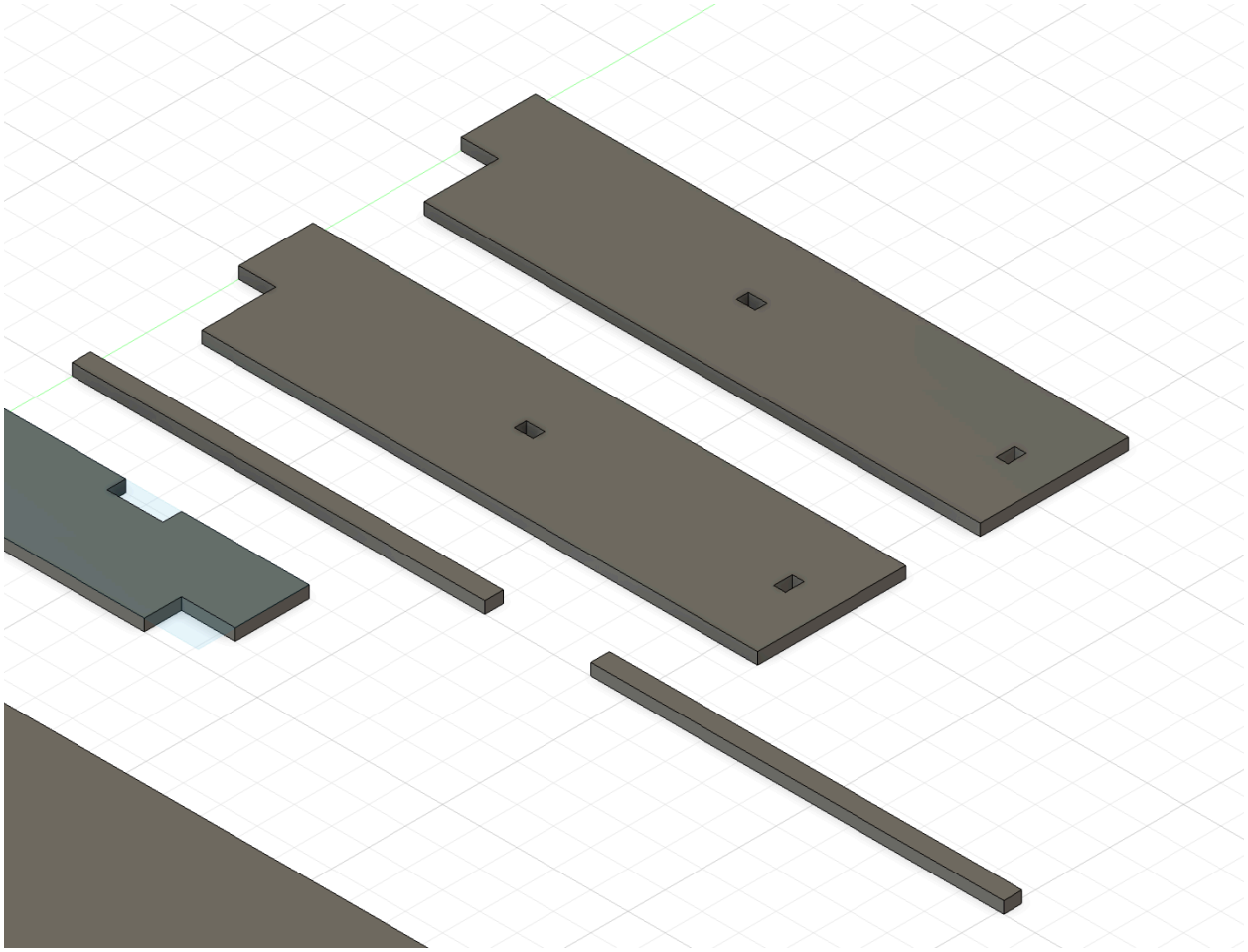
I then cut out a corner to make the extrusion that would enter the holes in the spine for the supports.



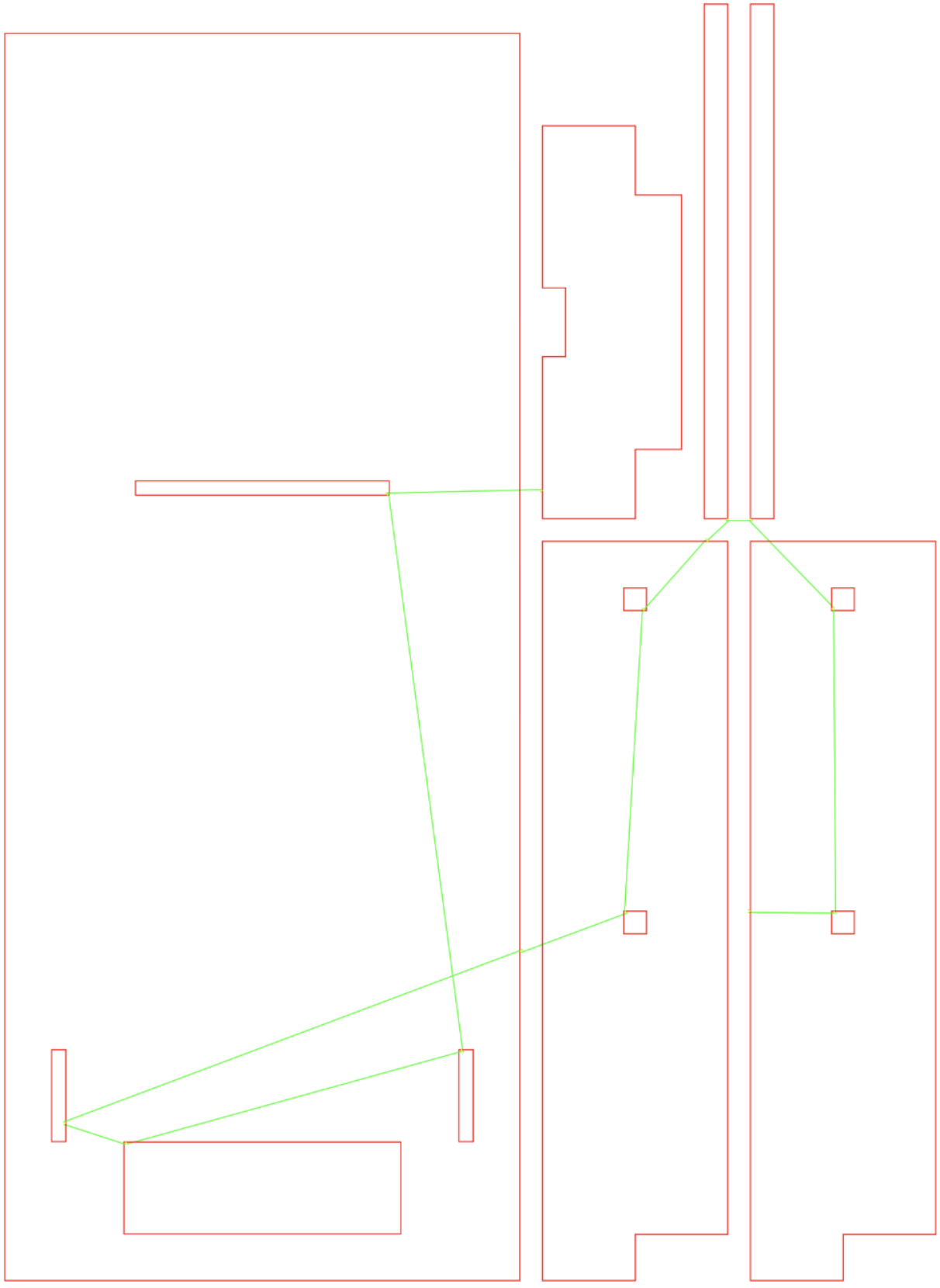
I then created the holes for the connector sticks to enter the supports. (note that due to technical limitations the holes here are the holes from the final design, but just imagine them being square shaped instead of rectangle shaped).



I then duplicated the support and the connector stick to make a pair of each.

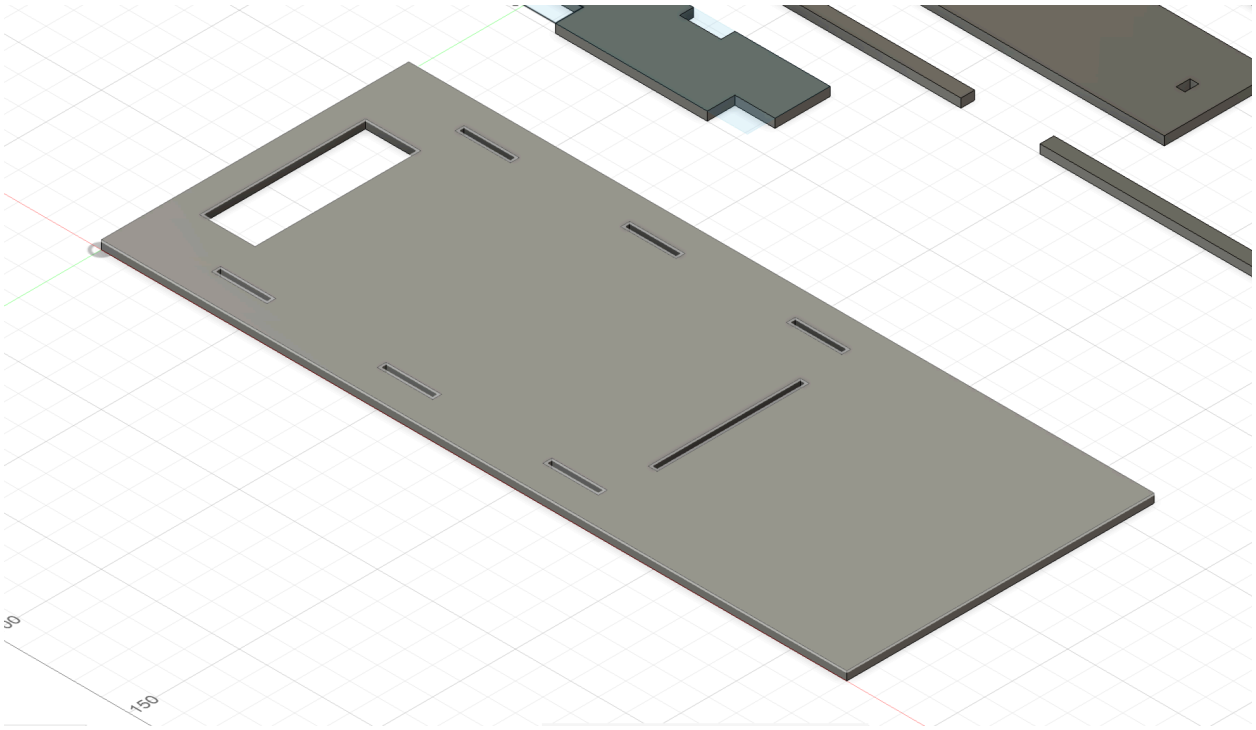


After this, the parts underwent the 2D profiling and NC Program process with arrange, and created a dxf file. (no image of 2D profiling and NC program processes will be supplied since I don't want to destroy the stuff already set up that will be displayed later. However the image below is of the initial dxf file)

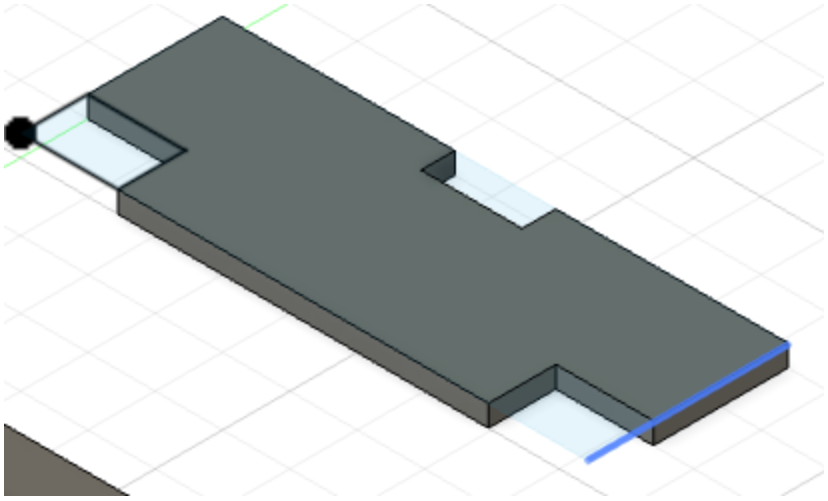


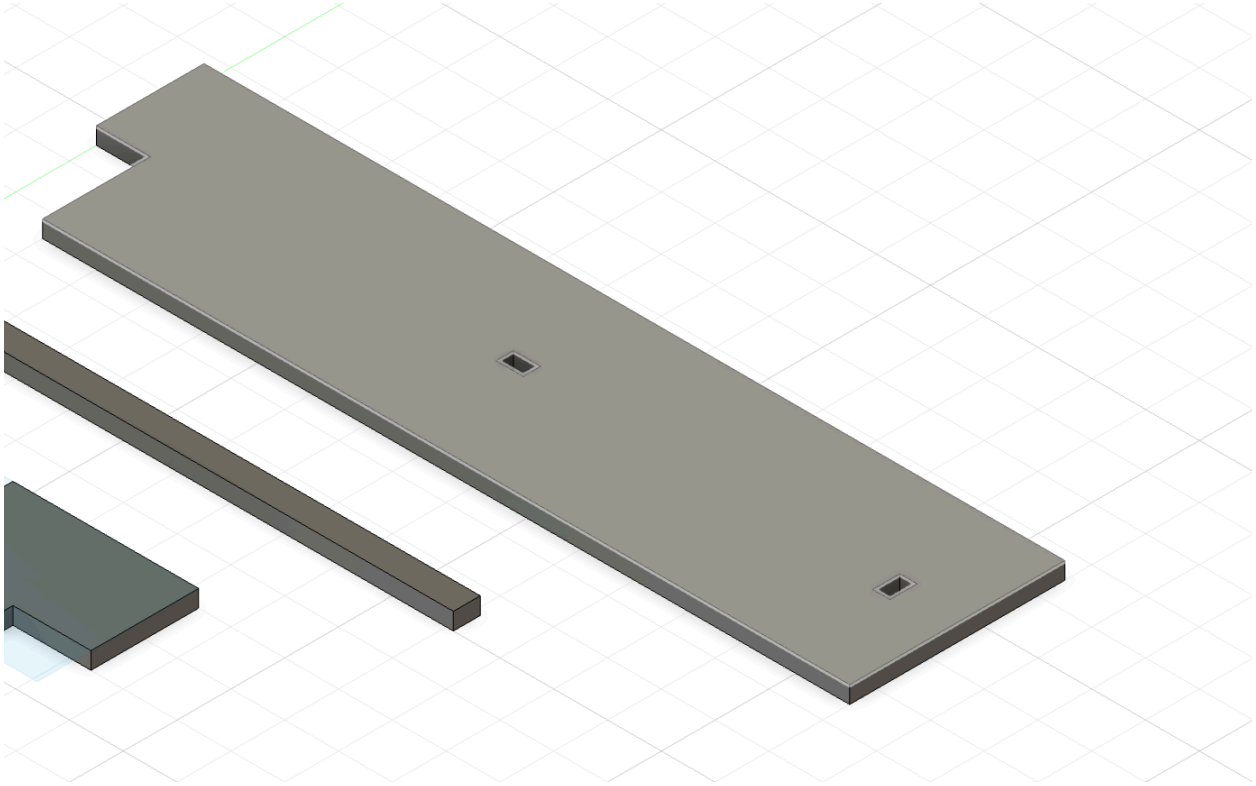
(as you can tell, the holes in the supports are square shaped).
I did not take any images of the file in adobe at the Makerspace, but it happened.

On to the final design, after initial fabrication and testing, I first returned to Design and added 4 more holes, 2 pairs, for supports on the sides of the spine.

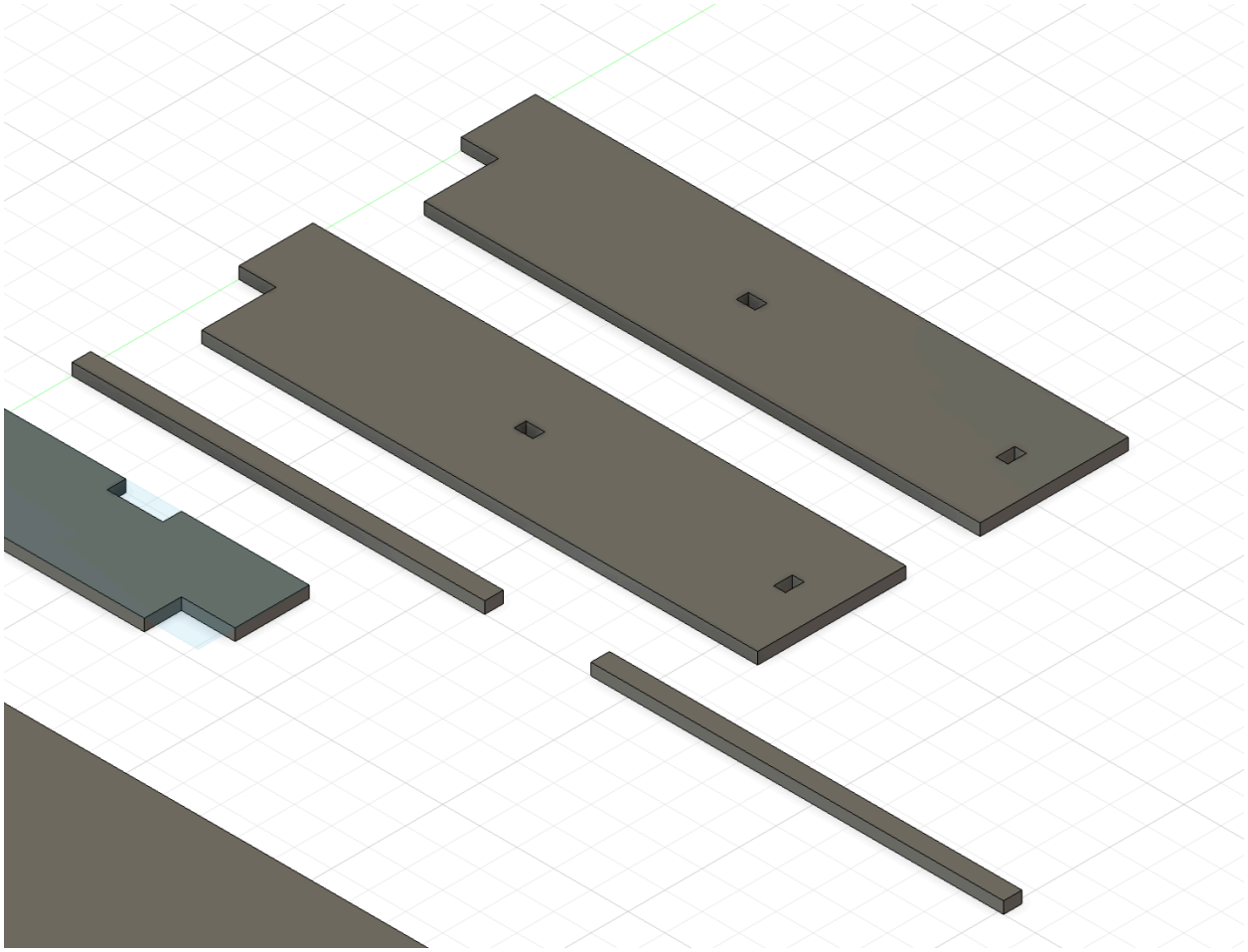


I then modified the sketches of the clutch and connectors to make the clutch 1mm smaller and the holes of the connectors into properly dimension sized rectangles.

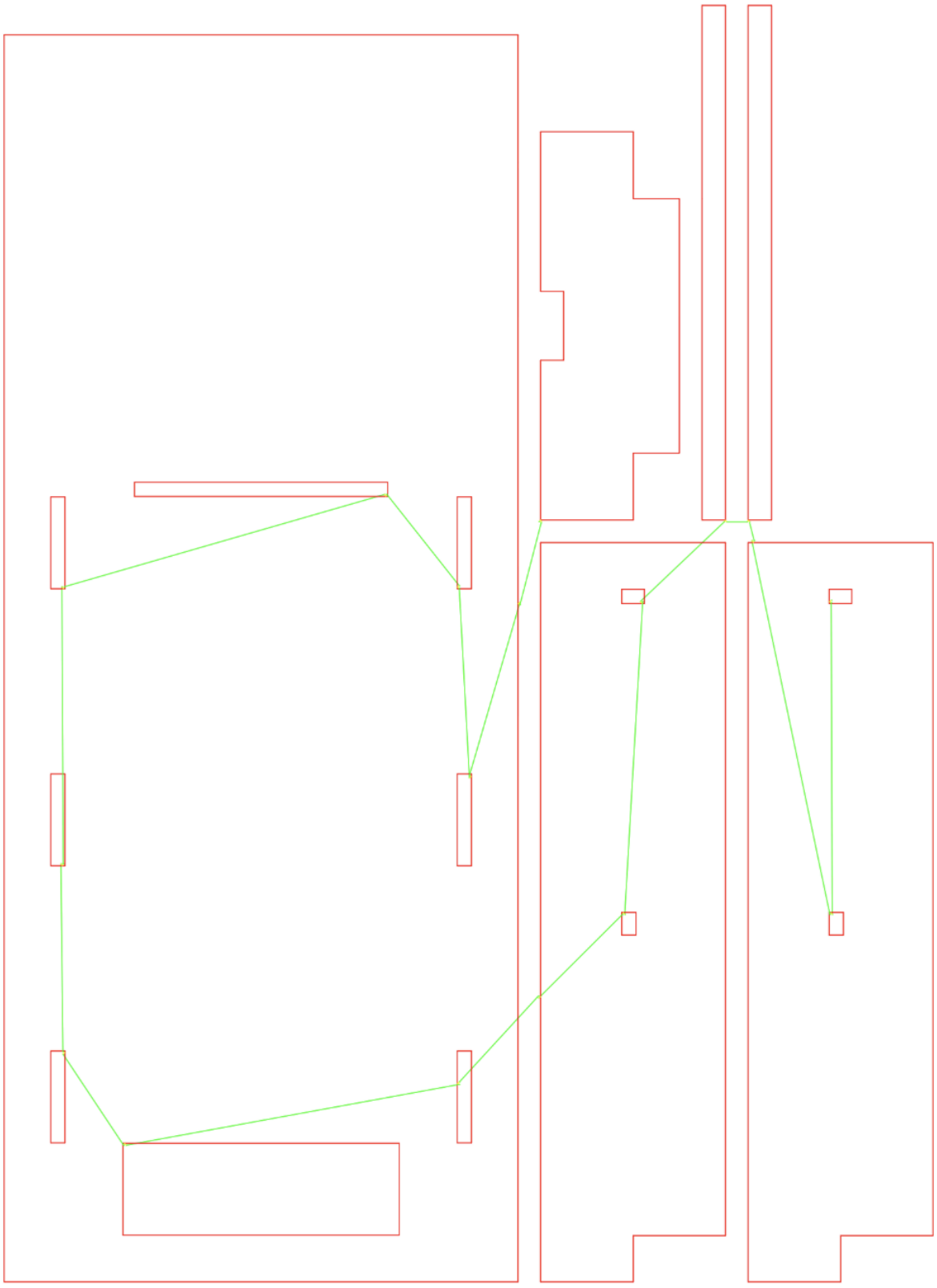




And because I had directly copied the connector to make another, the second connector was also fixed.



Again, no image of the 2D Profiling and NC Program will be supplied. However, here is the image of the final dxf file.



Here is the link to a google drive file of the dxf file for the initial design. You can download the file directly from the linked file.

https://drive.google.com/file/d/1a0OXnNFbd2i-zGnDyqHa5OtlGLhwswtD/view?usp=sharing

Here is the link to a google drive file of the dxf file for the final design. You can download the file directly from the linked file.

https://drive.google.com/file/d/1PAQ6H47S1LzScjoiKwZKMJpY4BvVchSy/view?usp=sharing

Here are the dimensions of the initial design, number for number.

- Spine is 270mm tall by 111.35mm length by 3.175mm width
    - Support holes are 20mm tall by 3.175mm length by 3.175mm width
    - Clutch hole is 3.175mm tall by 55mm length by 3.175mm width
- Upper clutch is 20mm tall by 85mm length by 3.175mm width
    - Lower clutch is 10mm tall by 55mm length by 3.175mm width (the part that goes into the clutch hole)
- Lower supports are 150mm tall by 40mm length by 3.175mm width
    - Upper supports are 10mm tall by 20mm length by 3.175mm width (the part that goes into the support holes)
    - Connector holes are 5mm tall by 5mm length by 3.175mm width
- Connectors are 111.35mm by 3.175mm by 5mm (they're also found in Design Development)

Here are the dimensions of the final design, number for number.

- Spine is 270mm tall by 111.35mm length by 3.175mm width
    - Support holes are 20mm tall by 3.175mm length by

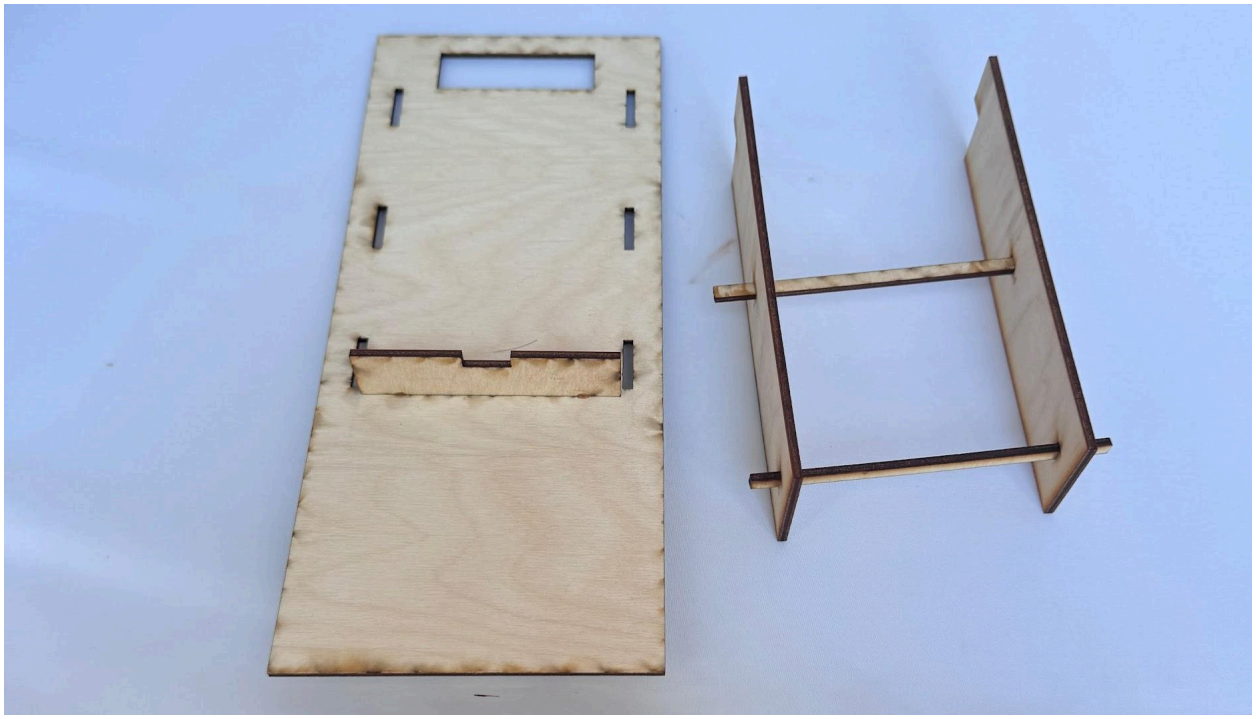
    3.175mm width
    - Clutch hole is 3.175mm tall by 55mm length by 3.175mm width
- Upper clutch is 20mm tall by 84mm length by 3.175mm width
    - Lower clutch is 10mm tall by 55mm length by 3.175mm width (the part that goes into the clutch hole)
- Lower supports are 150mm tall by 40mm length by 3.175mm width
    - Upper supports are 10mm tall by 20mm length by 3.175mm width (the part that goes into the support holes)
    - Connector holes are 5mm by 3.175mm by 3.175mm
- Connectors are 111.35mm by 3.175mm by 5mm (They're also found in Design Development).

Do note that only rectangles and rectangular prisms were used - this was intentional in the design process, since rectangles are (for my personal experience and expertise) much easier to work with than circles and curves (which I had difficulty working with in Assignment 3). Even for the wire clutch, its hole for the wire was made of a rectangular carving for this reason.

For both designs, regarding how all the parts relate to one another, the spine is the main, central piece, of which most of the others are attached to (eventually). The clutch is attached to the spine at the hole at the bottom half, and the two supports are connected by the connectors going perpendicular between the two through their own holes.

The image below shows this via physical products (since I had designed it electronically the entire time as flat pieces, there aren't digital images of it assembled or in the process of

assembly.); it applies to both the initial and final designs, albeit the image only shows the final design.



Eventually, the supports are plugged into the holes on the sides of the spine opposite of the clutch, such as seen in the following images. The first one is of the prototype, the second one is one possible height/angle for the supports to be plugged into.

This is how all the parts relate to one another.

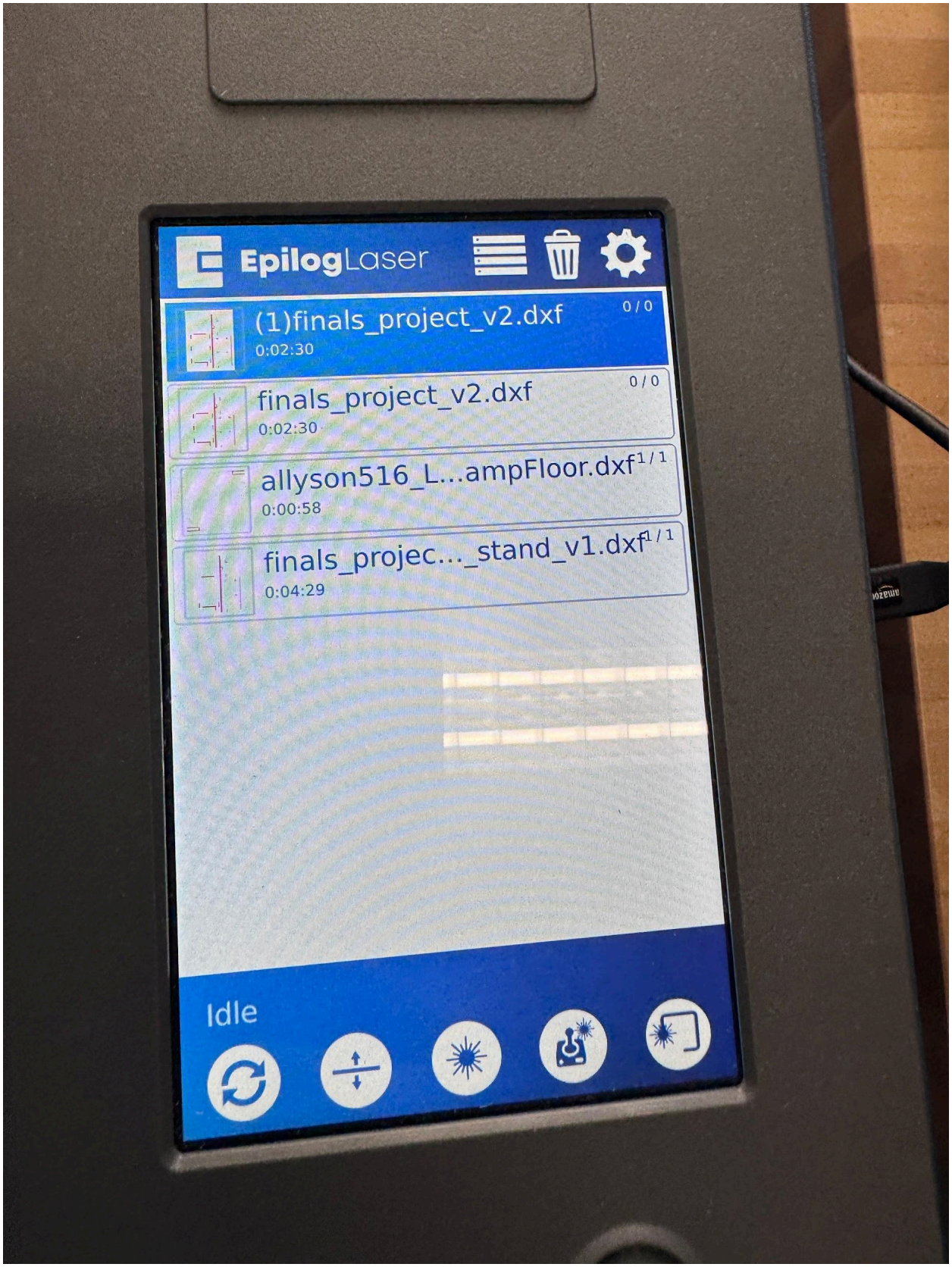
Fabrication Process

Fabrication Process

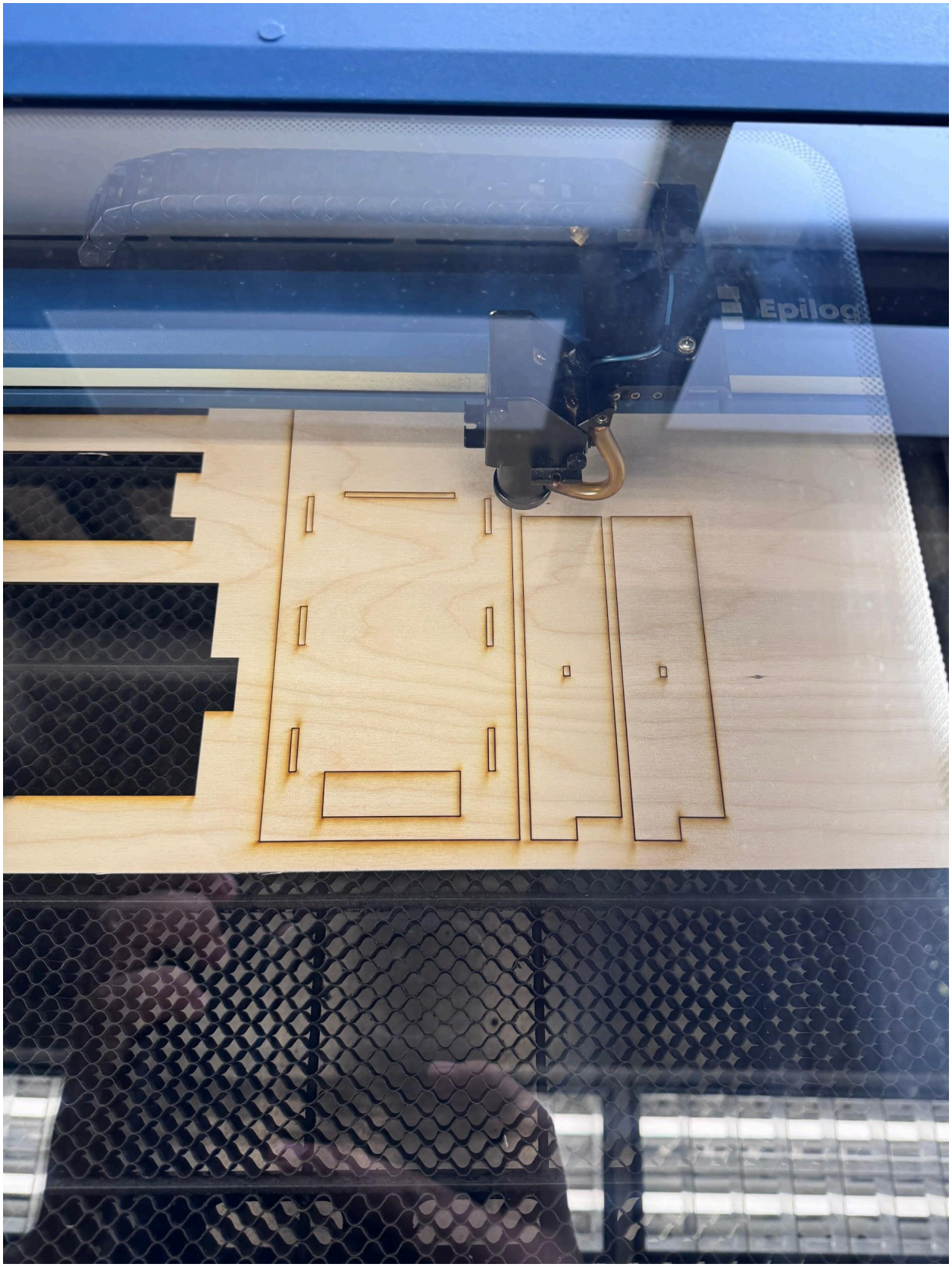
This was made in 2 parts, for both the initial and final designs. Similar processes were applied to both. However, I will be using images from the fabrication of the final design since the initial design did not complete the fabrication process *unless otherwise specified to be of the initial design*. Steps that both initial and final designs underwent will be colored purple. Images will be supplied where I remembered to take them.

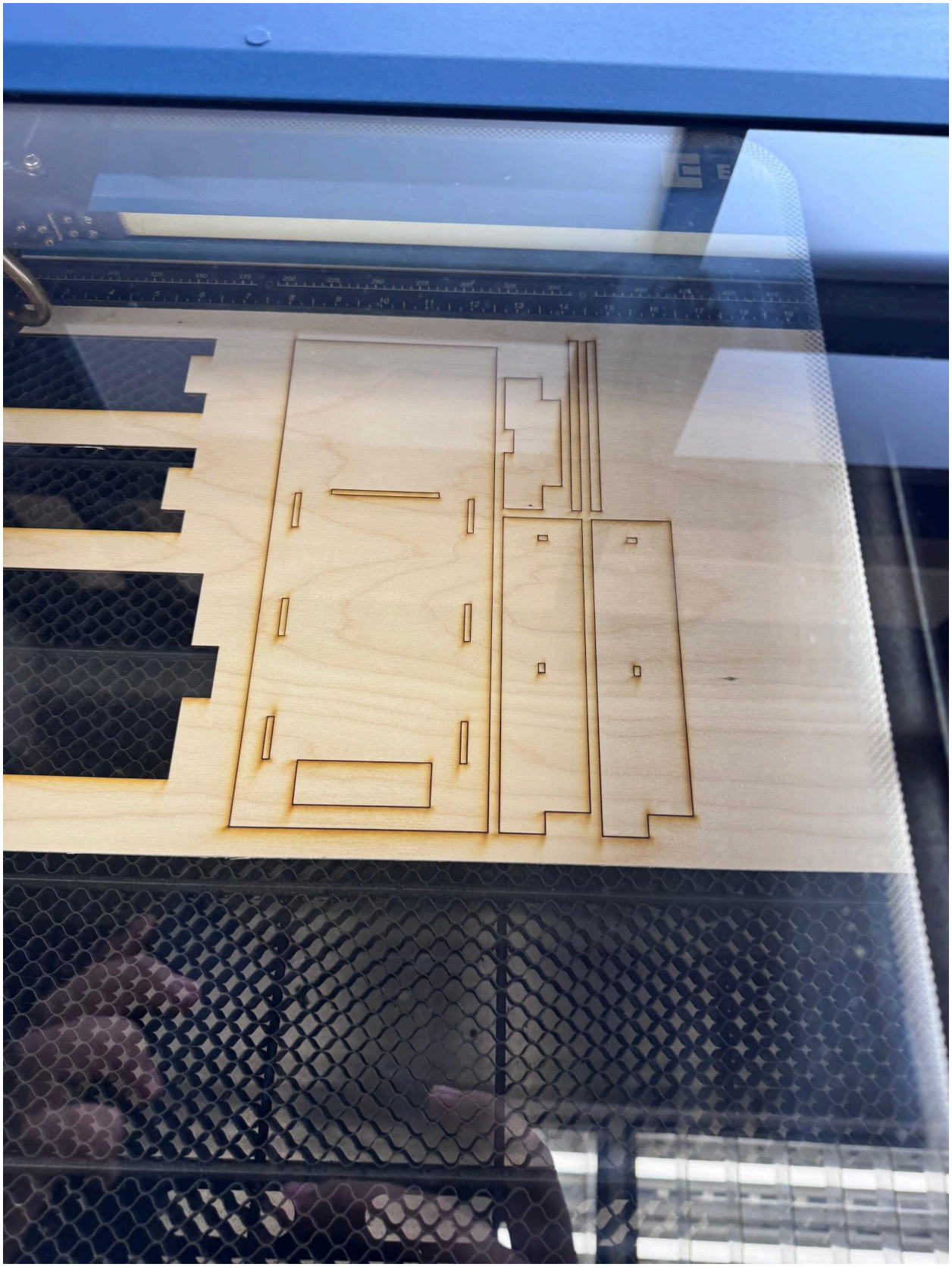
1) The downloaded file was sent to Adobe Illustrator on the Makerspace computer via justbeamit.com, which was downloaded and fixed so adobe would interpret it in mm instead of inches (which it defaults to).
2) The downloaded file had its pathways for laser cutting between pieces removed (the green lines seen in the dxf files).
3) A 1/8th inch (3.175mm) thick plywood piece was put into the laser cutter machine, and the exhaust vent was turned on.

4) The extra yellow thing that even Cloud didn’t know or could identify was removed, and the power was set to cut through 1/8th inch thick plywood, and the file was sent to print over to the laser cutter machine.


EpilogLaser
(1)finals_project_v2.dxf
0:02:30
0 / 0
finals_project_v2.dxf
0:02:30
0 / 0
allyson516_L...ampFloor.dxf
0:00:58
1 / 1
finals_projec..._stand_v1.dxf
0:04:29
1 / 1
Idle

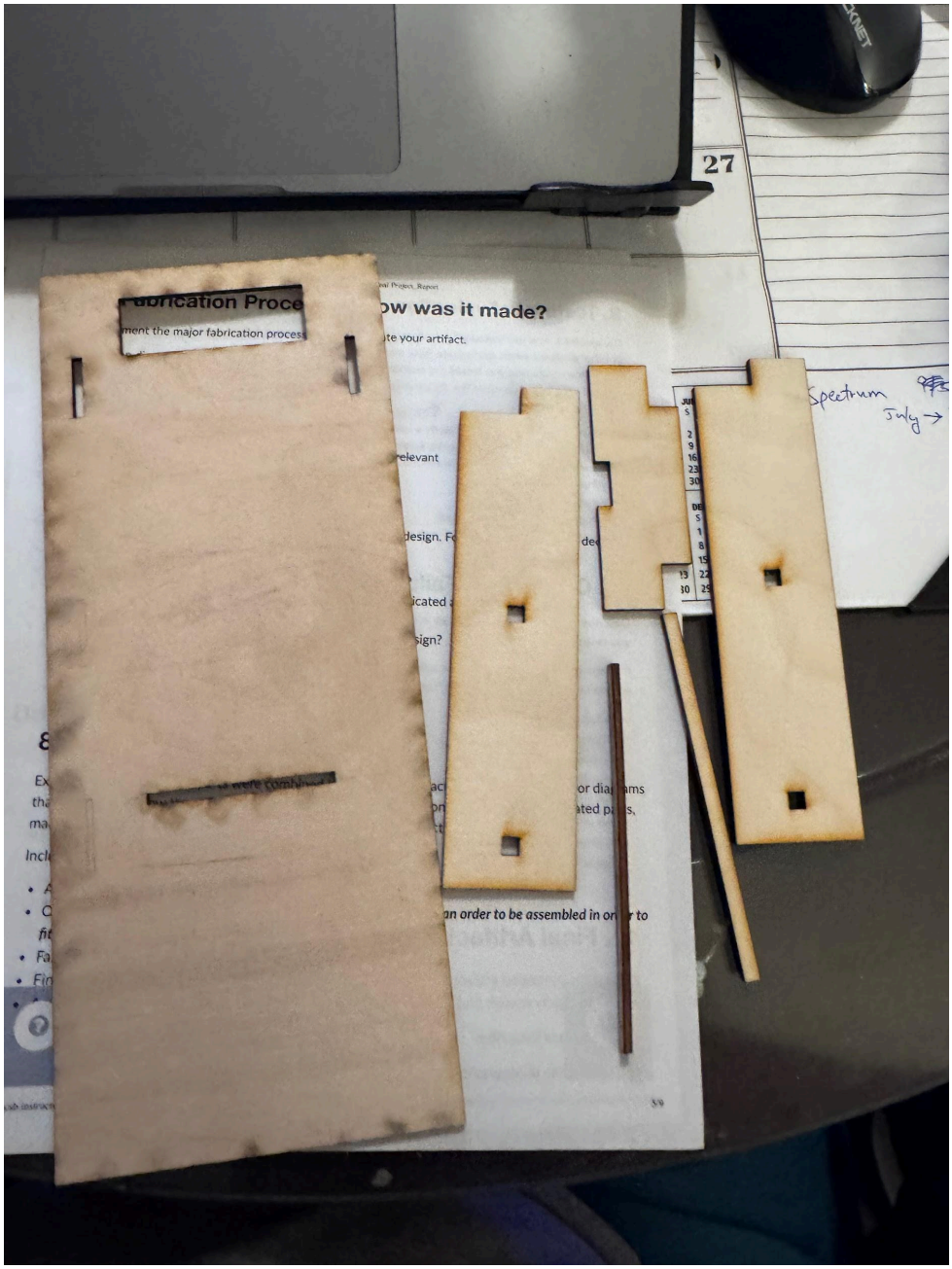
5) The cutting pattern of the product was laid over the plywood, ensuring that it stayed within the bounds of the plywood.
6) The cutting pattern was traced and the machine was autofocused onto the plywood.
7) The machine began laser cutting out the products' pieces.

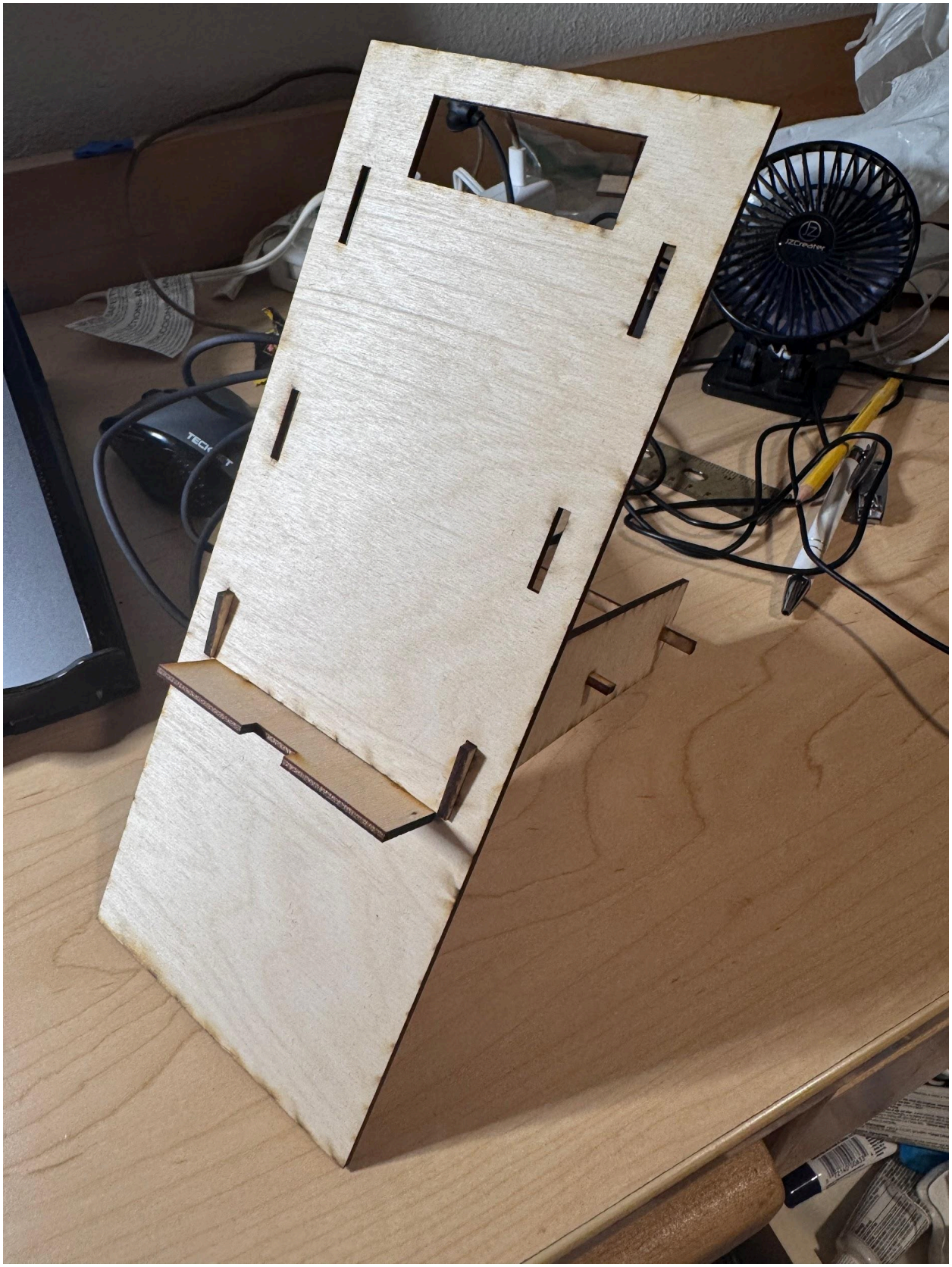

Epilog



8) The exhaust fan was turned off after a few seconds and the pieces were removed from the machine.

(This image is from the *initial design,* not the final design)





Regarding the fabrication decisions that mattered to the final result:

- Did the available material dimensions change my design?
    - No and yes, the available material dimensions did not change my design from what it originally was *for the most part*. It was well within the 12 inch by 12 inch dimensions that I could have used, hence no. However, it did mean I had to make the holes of the supports smaller to accommodate the size of the connector sticks, hence yes.
- Did I have to modify a part because it could not be fabricated as originally designed?
    - Yes and no. Most of it stayed as it was, but the holes in the supports had to be shrunken to accommodate the fact that the connectors could only be 3.175mm (1/8th inch) thick. It was originally 5mm by 5mm by 3.175mm, it had to be changed to 5mm by 3.175mm by 3.175mm. However, the rest of the design was unaffected by the available material dimensions.
- Did tolerances affect my dimensions?
    - No, tolerances did not affect my dimensions, because since the start I had had to make the dimensions quite large for a phone stand to hold the phone higher up anyways. The tolerances were naturally quite high, and thus were not part of the decision making for my dimensions.
- Did fabrication time cause me to simplify or modify the design?
    - Fabrication time did not cause me to simplify or modify the design.

- Did a fabrication mistake lead to a new design decision?
    - Yes. The holes in the supports were too large in the initial design's fabrication, and thus had to be shrunken to a new design in the final design.

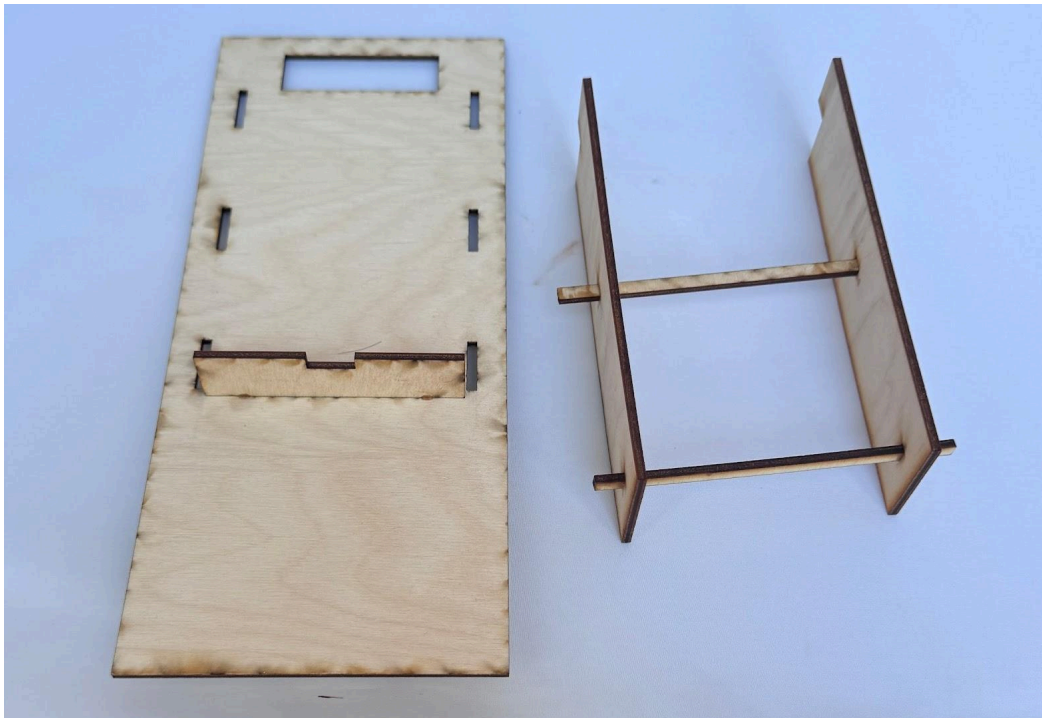
Overall, the physical fabrication process mostly affected the design by forcing me to use 3.175mm as a height and/or width in various places, since the plywood used was only 1/8th inch thick. Therefore, even if I designed for pieces thicker than 1/8th inch (3.175mm), it would not have been possible to make it in the laser cutter given the source material I had access to. Perhaps if I had been supplied plywood with thickness > 3.175mm (perhaps 1/4th inch) it could've been different.

Assembly & Finishing

Assembly & Finishing

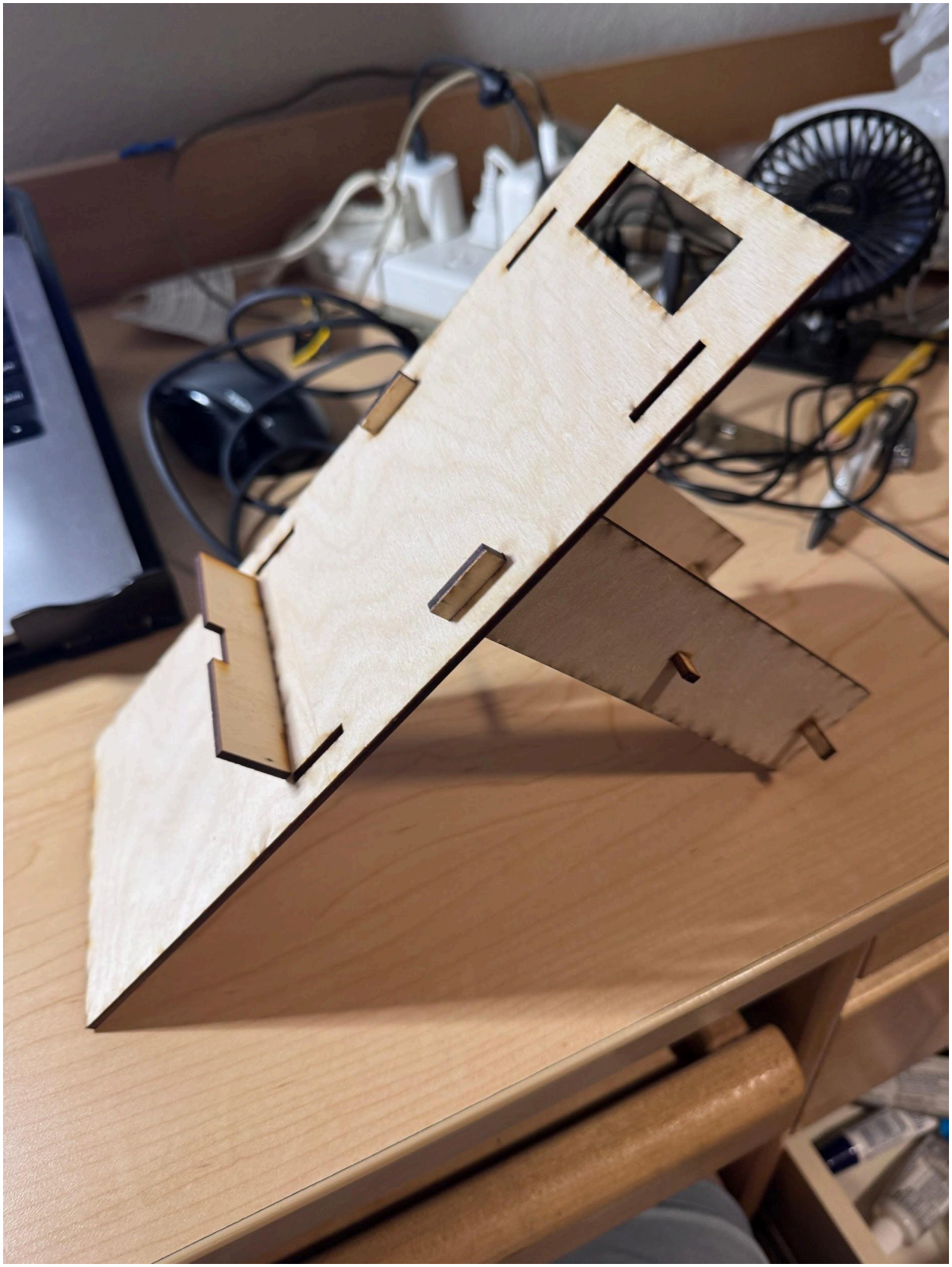
For the final artifact, there was a short but multi-step process that created 2 significant pieces, the spine+clutch and supports+connectors. These 2 significant pieces are not glued to each other though, as explained later, to give the possibility of having multiple options of heights/angles.

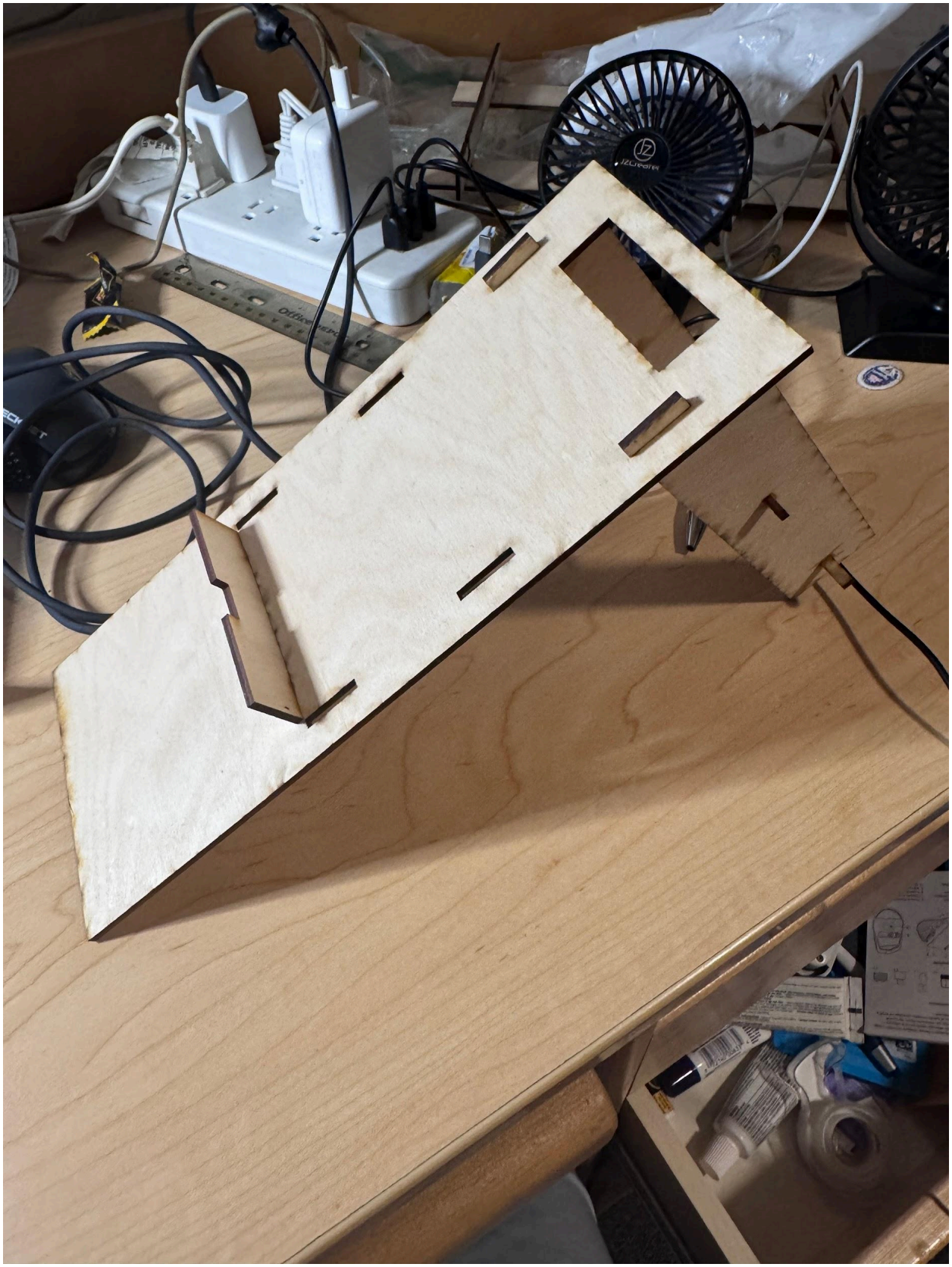
1) The pieces are popped out of the plywood
2) The clutch has wood glue (an external adhesive) applied via toothpick to its extrusion at the sides and corners.
3) The clutch is slid into the designated hole in the spine.
4) Additional wood glue is applied via toothpick to the visible gaps between the clutch and the spine to ensure further connection.
5) The supports have the insides of their holes covered in wood glue via toothpick.
6) Quickly, the connectors are inserted into the holes, connecting both supports in a perpendicular fashion.
7) More wood glue is applied via toothpick to the visible gaps between the supports and the connectors to ensure further connection.
8) Both pieces (spine+clutch and supports+connectors) are left to dry for several hours overnight and into the next day.

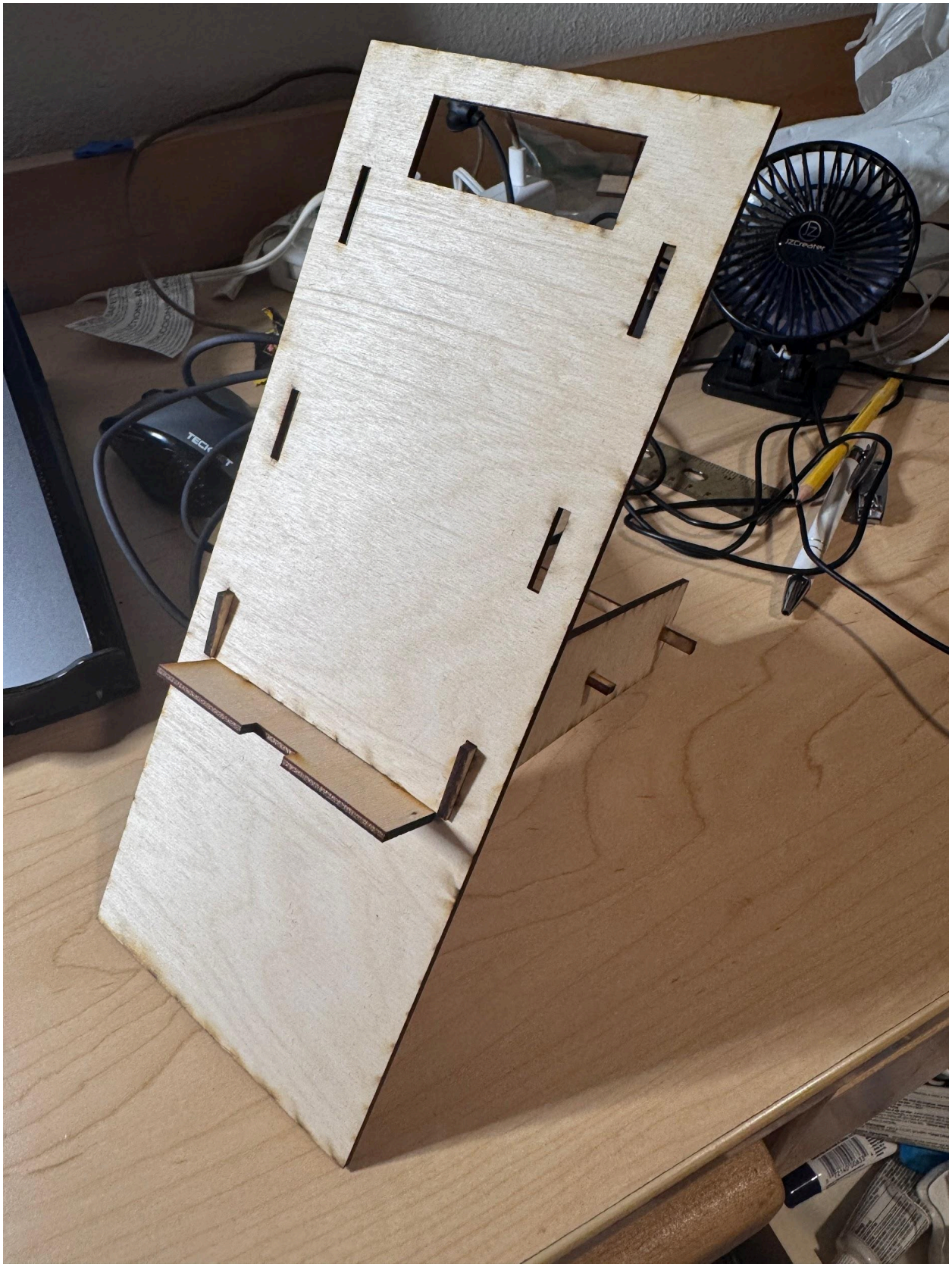


(left is the clutch attached to the spine or spine+clutch, right is the supports connected to each other via the connectors, or supports+connectors)

9) Once dried, the topmost extrusions of the supports are inserted into the holes near the sides of the spine as a pair. NOTE: THESE ARE NOT GLUED TO ENSURE THAT THE SUPPORTS CAN BE REMOVED TO BE EITHER PLACED AT ANOTHER PAIR OF HOLES OR TO BE MORE EASILY TRANSPORTED







Note that strictly speaking you can make+glue the spine+clutch after you make the supports+connectors, but this was the order in which I made it, finding it easiest to get used to handling plywood with the larger spine than the smaller supports. However, it is impossible to make either without popping their respective parts out of the plywood first, nor is it recommended to insert the topmost extrusions of the supports into the spine holes to avoid inadvertently giving one side more weight than the other, therefore tilting the product while drying.

No finishing was applied to the final product, the “iPhone-flashlight adjustable stand.”

No other materials were involved in the assembly of the final product, the “iPhone-flashlight adjustable stand.”

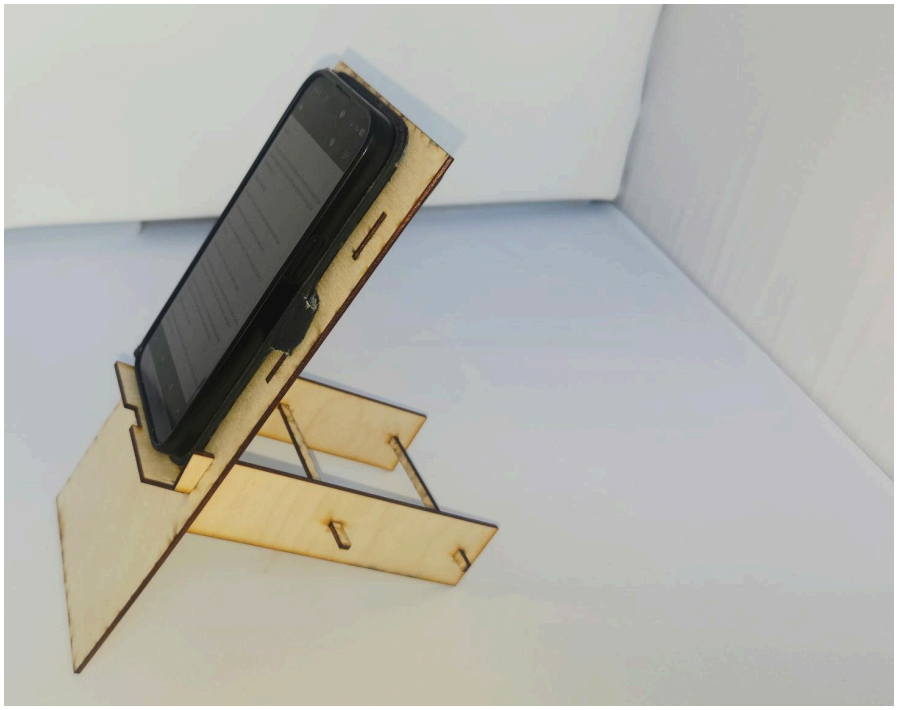
Testing & Evaluation

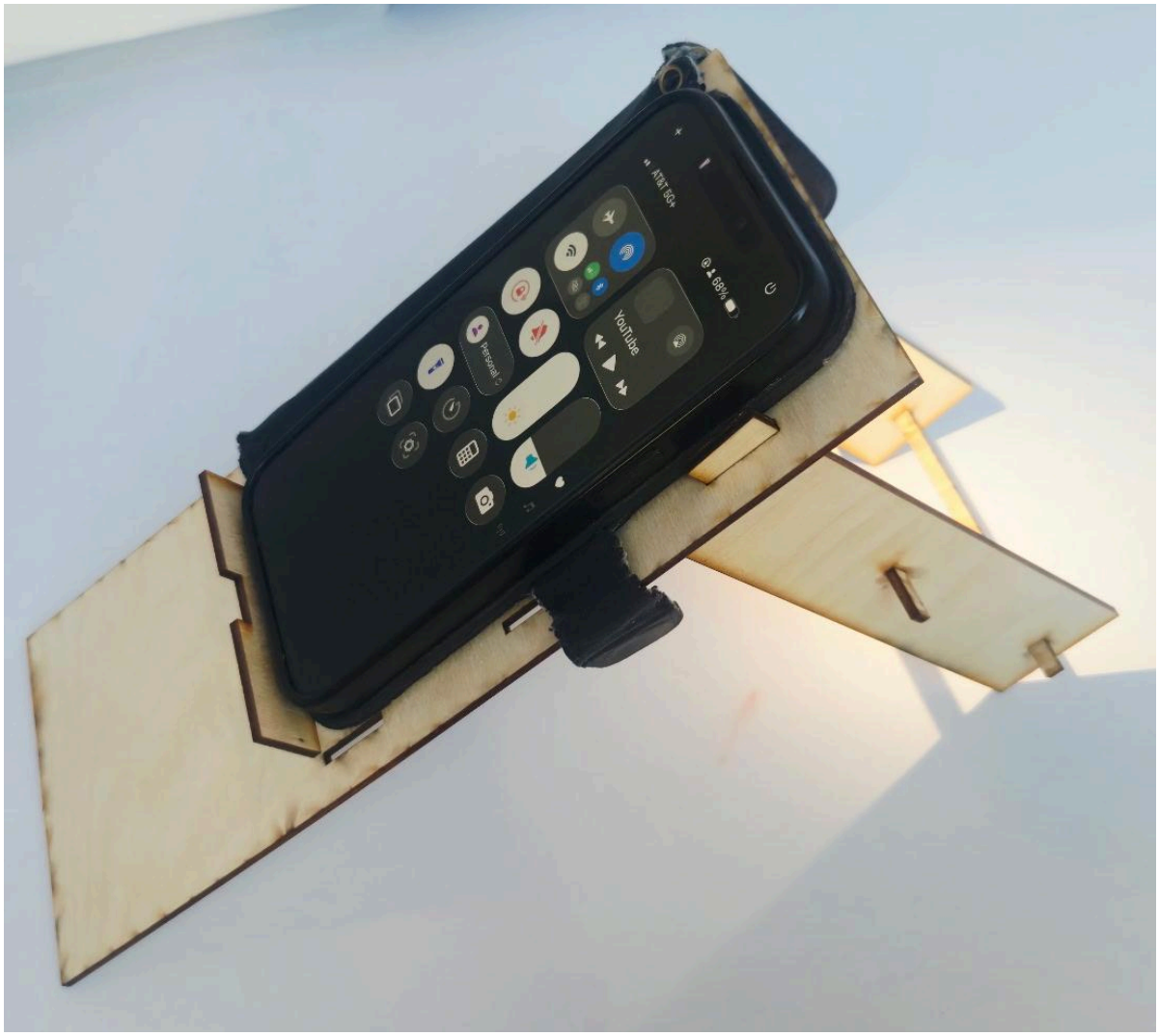
Testing & Evaluation

I tested the final product, the “iPhone-flashlight adjustable stand” by putting it in a box and putting my iPhone on it, then asking a friend to take photos of what it looked like inside the box.

I was looking for a distinct shine in light from the flashlight compared to the other light sources in the room (I was unable to take photos of it being used in a dark room because nobody there would take photos for me nor did I have alternative devices to take the photo, however, if I could see a distinct flashlight light in a semi-lit room it would surely also show in a dark room).

The images below are what we took of the final product in the box with my phone with the flashlight on.




AT&T 5G+
68%
YouTube

As you can see, and as I saw, there was a distinct difference in lighting for the final two images (that was the flashlight). However, there was not a distinct difference in lighting for the first image, suggesting that the flashlight made little difference at that height. This suggests that the options where the phone+flashlight was closest and second closest to the horizontal surface were successful and worked well, but the option where the phone+flashlight was farthest from the horizontal surface was not successful and did not work as expected (although this could've just been a lighting thing).

Therefore, the final artifact did meet my original goals and requirements, since it securely held by phone at a reasonable

height (all 3 heights regardless of option are still higher than most phone stands you'd find out on the internet) for more than one height/angle and allowed the light to shine through from the phone's flashlight; all while for an extended period of time.

Challenges, Failures, & Unexpected Discoveries

Challenges, Failures, & Unexpected Discoveries

An unexpected result that I had during test of the final product was that at the highest possible angle/height, the flashlight was not producing visible results.

This could have happened for two reasons:

1) The room lighting was too bright (possible, since it was taken during the day)
2) The height was just too far away and thus the light reflected enough in the air that it did not produce any significant change in lighting on the floor of the box nearby. (since light gets dimmer the further away you get from it, that's what I meant by reflected since it's because of air particles reflecting light that it looses brightness over distance).

I responded by documenting it and moving on, since I still had two other settings to test for the final product. However, if I had time I would've redesigned so the tallest height/angle was not quite as tall as it was.

A design+assembly problem that I had (and have described before) was that during assembly of the initial prototype (initial product), the holes in the supports were too large compared to the connector sticks, meaning that the sticks would not stay well and remain secured in the holes. This would affect their stability in the supports and therefore affect the stability of the supports as well, which has the cascading effect of affecting the stability of the product as a whole (since the spine relies on the supports for stability).

This was because the holes were initially designed to be 5mm by 5mm (square) by 3.175mm (thick), but the supports were 111.35mm by 3.175mm by 5mm. Meaning the holes had to be changed to 5mm by 3.175mm by 3.175mm to accommodate the 3.175mm width of the connector sticks.

This happened because I was bad at math when making the initial design and forgot to accommodate the dimensions of the connector sticks, instead assuming that they would make a perfect square when laser cut (which they would not). Lack of foresight happened, pretty much. A downside of making all your pieces flat on the ground for the sake of convenience instead of attached to each other in the Design of Autodesk Fusion like other people.

And thus, I responded by making the change to the initial design, shrinking the holes in the supports to 5mm by 3.175mm by 3.175mm, as part of the final design.

Final Artifact

Final Artifact

Congratulations, you've made it this far into the report. What's here are final images and descriptions of the final product, the "iPhone-flashlight adjustable stand."

Images of Final Product, the "iPhone-flashlight adjustable stand" (not in use and in use)

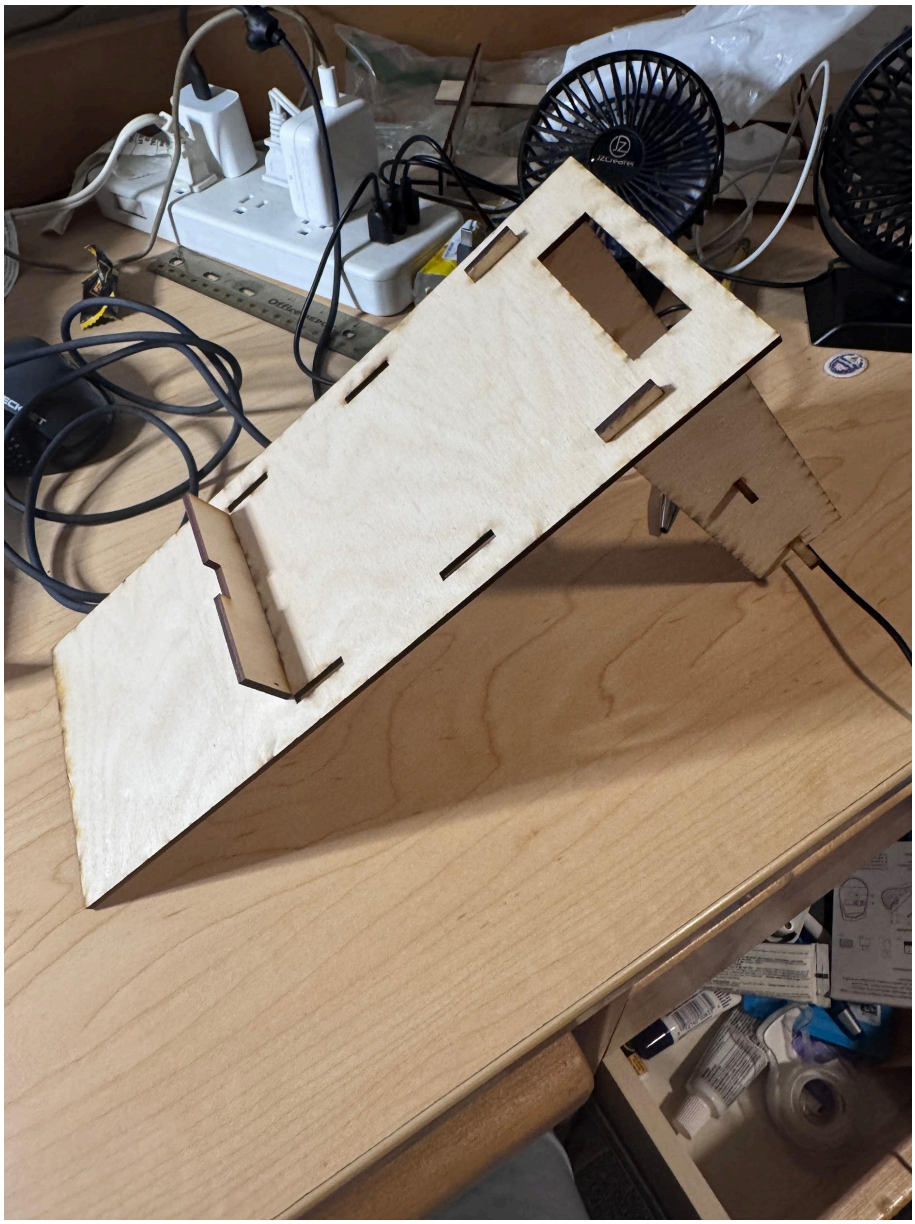


Fig 1a. The final product at its lowest possible height/angle alone

Description: the final product at its lowest possible height/angle option (the supports are closest to the hole for the flashlight to enter through) when not in use.

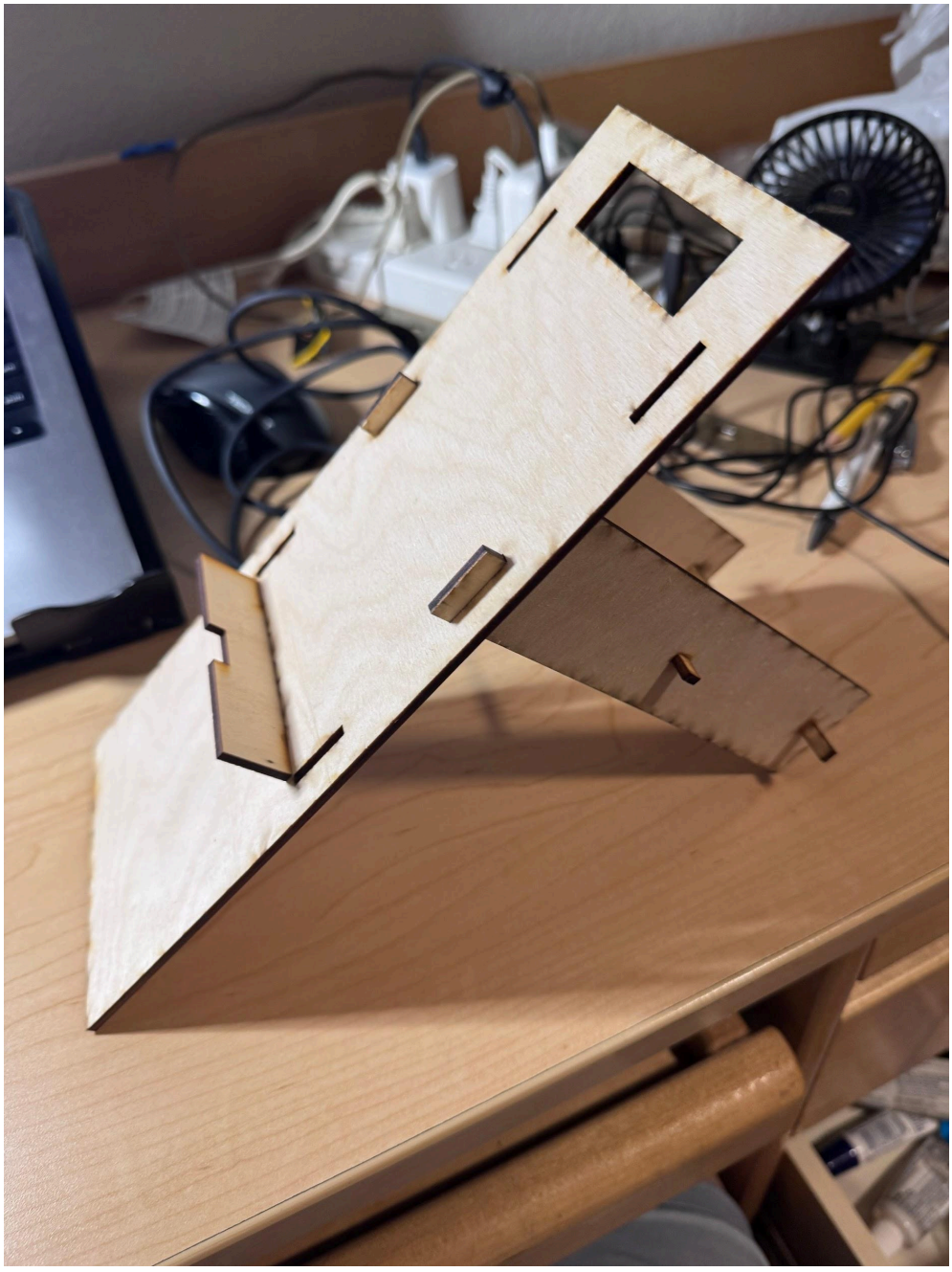


Fig 1b. The final product at its medium possible height/angle alone

Description: the final product at its medium possible height/angle option (the supports are second closest to the hole for the flashlight to enter through) when not in use.

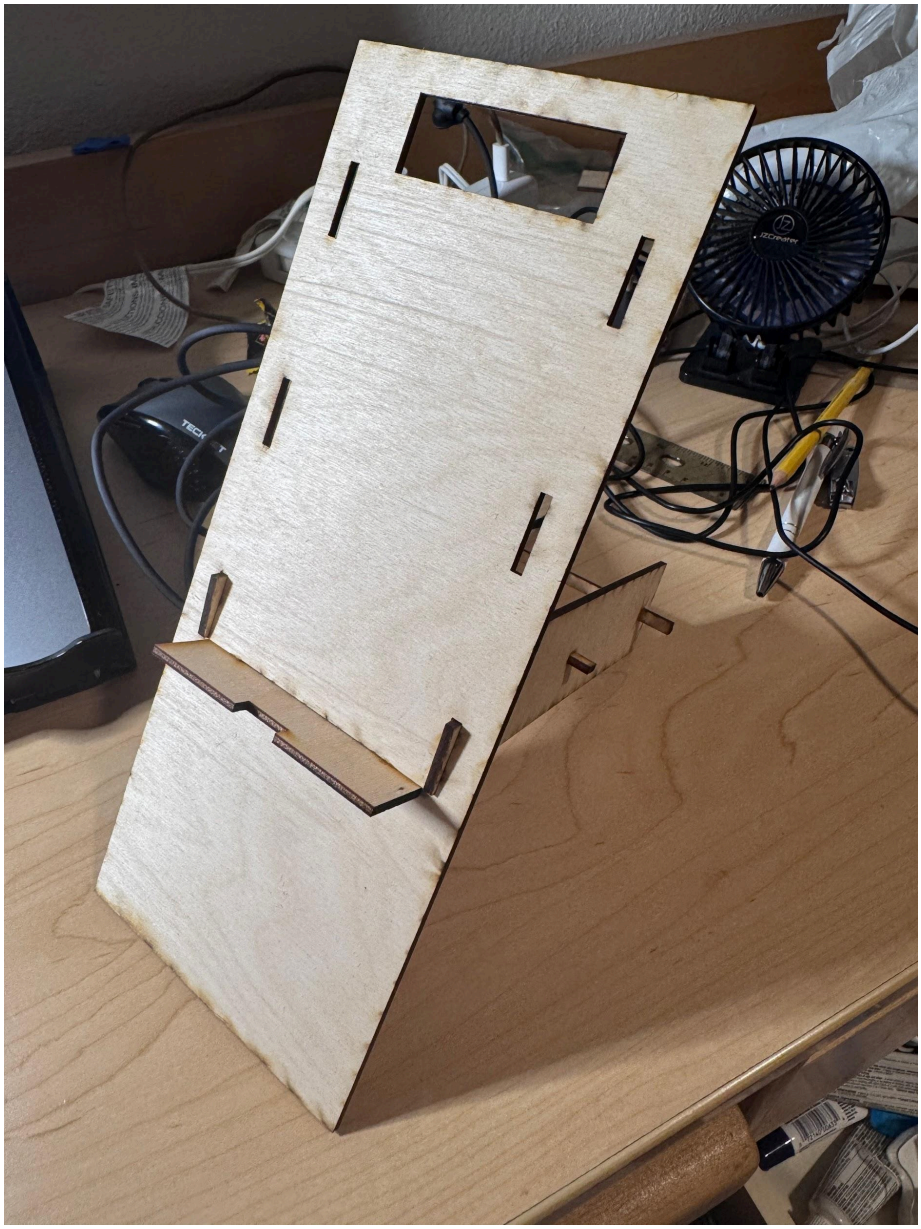


Fig 1c. The final product at its highest possible height/angle alone
Description: the final product at its highest possible height/angle option (the supports are farthest from the hole for the flashlight to enter through) when not in use.

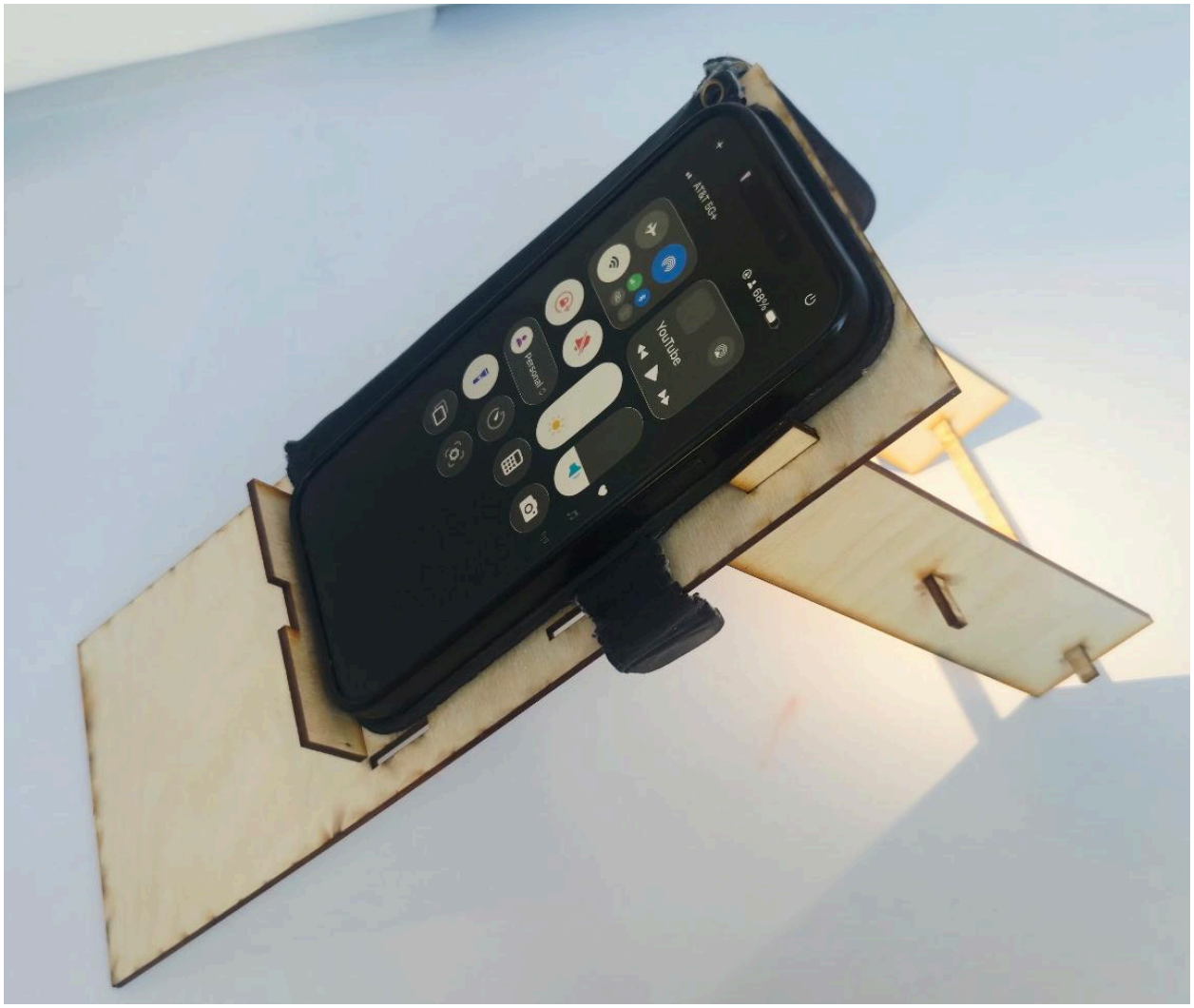


Fig 2a. The final product at its lowest possible height/angle with phone

Description: the final product at its lowest possible height/angle option (the supports are closest to the hole for the flashlight to enter through) when in use, holding an iPhone 15 Pro Max with its flashlight on. The flashlight's light is clearly visible below the stand.

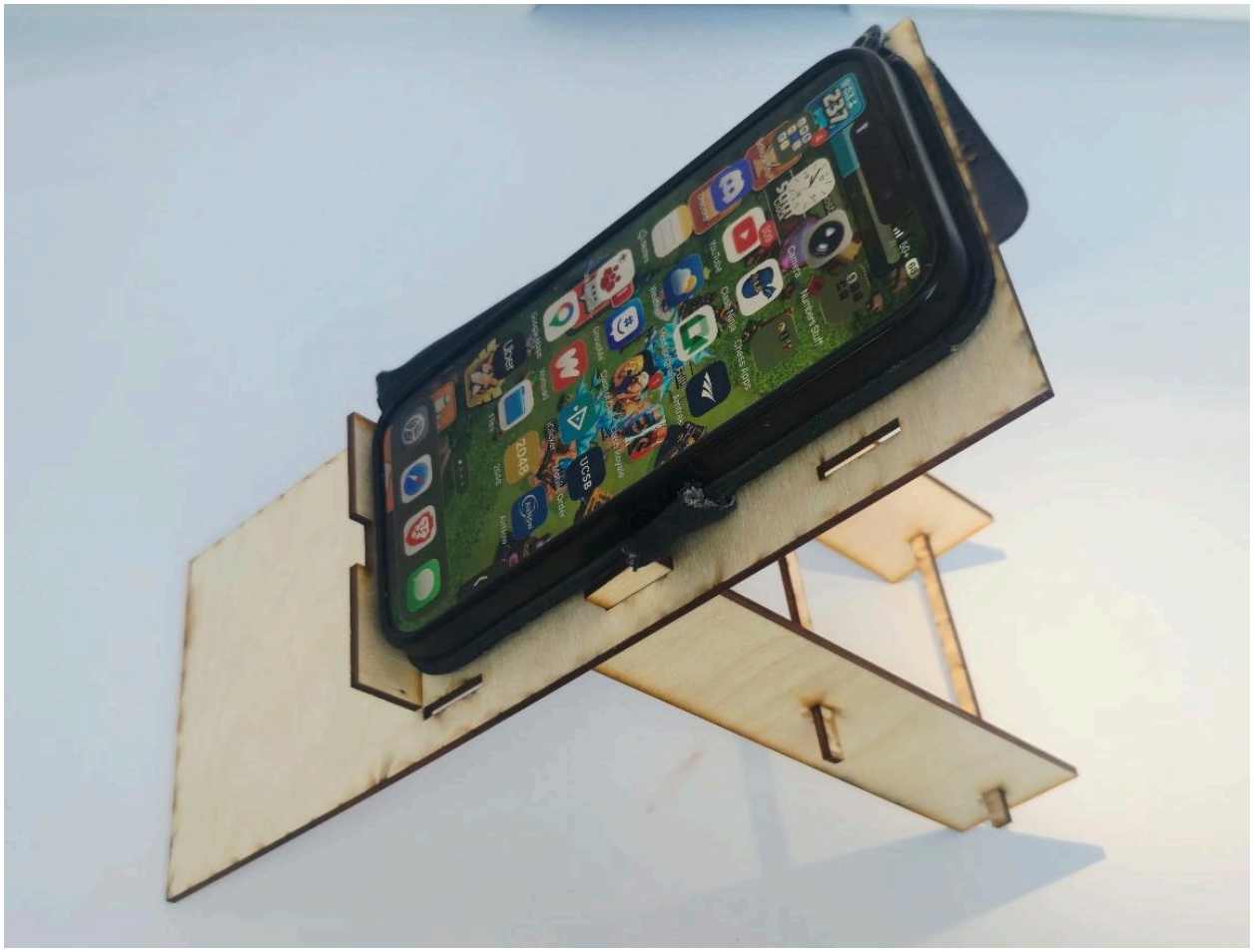


Fig 2b. The final product at its second lowest possible height/angle with phone

Description: the final product at its second lowest possible height/angle option (the supports are second closest to the hole for the flashlight to enter through) when in use, holding an iPhone 15 Pro Max with its flashlight on. The flashlight's light is clearly visible below the stand, albeit farther away from the supports than in Fig 2a.

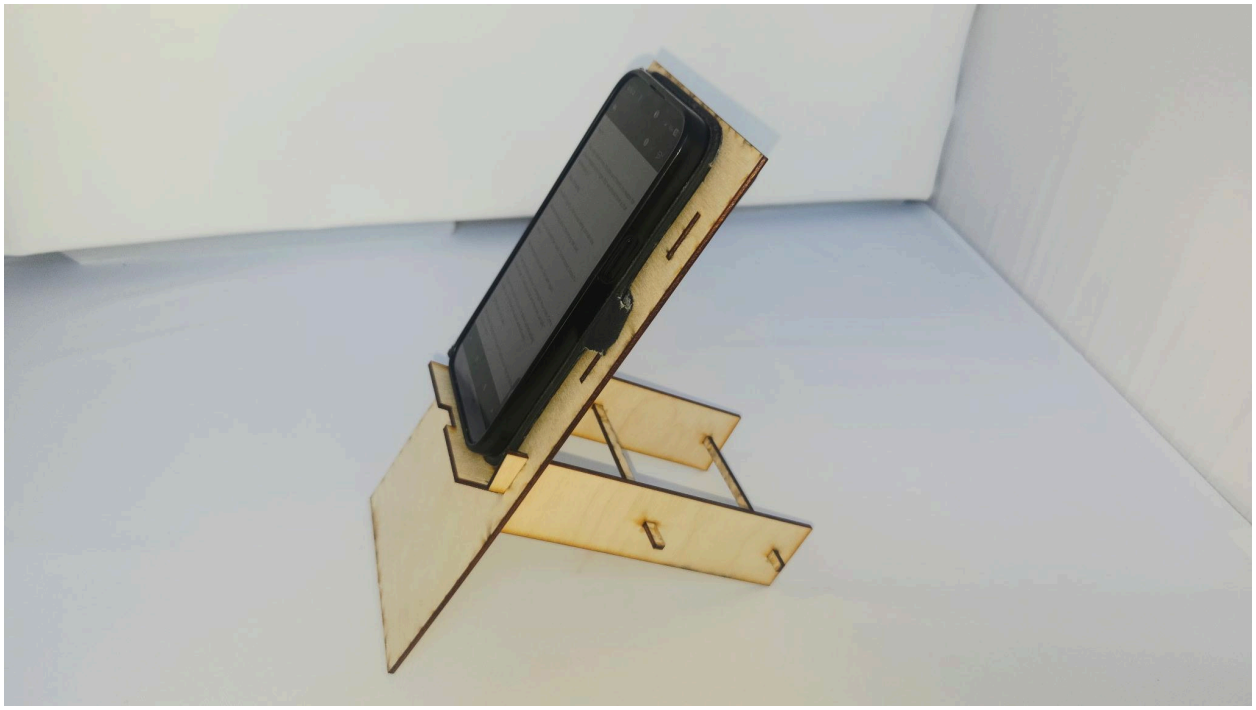


Fig 2c. The final product at its highest possible height/angle with phone

Description: the final product at its highest possible height/angle option (the supports are farthest from the hole for the flashlight to enter through) when in use, holding an iPhone 15 Pro Max with its flashlight on. The flashlight's light is not clearly visible below the stand.

Dimensions of the final product, the "iPhone-flashlight adjustable stand"

- Spine is 270mm tall by 111.35mm length by 3.175mm width
    - Support holes are 20mm tall by 3.175mm length by 3.175mm width
    - Clutch hole is 3.175mm tall by 55mm length by 3.175mm width
- Upper clutch is 20mm tall by 84mm length by 3.175mm width
    - Lower clutch is 10mm tall by 55mm length by 3.175mm width (the part that goes into the clutch hole)
- Lower supports are 150mm tall by 40mm length by 3.175mm

width
    - Upper supports are 10mm tall by 20mm length by 3.175mm width (the part that goes into the support holes)
    - Connector holes are 5mm by 3.175mm by 3.175mm
- Connectors are 111.35mm by 3.175mm by 5mm

Usage Dimensions of the Final Product, the "iPhone-flashlight adjustable stand"
Width: 111.35mm
Length: Variable
Height: Variable

NOTE: no exact dimensions are supplied for the length and width since there are multiple options for usage, and depending on your surface and laser cutting they could vary. However, the width is fixed at 111.35mm regardless of option used.

Overall, the final result is that the final product, made of plywood and wood glue, holds up an iPhone 15 Pro Max at different heights/angles sufficient to light up a small nearby area using the iPhone's flashlight, securely and stably. It does its job.

Reflection

Reflection

What did I learn? I'll present what I learned in a Q-&-A format, with Q (colored purple) , then A (colored red),

Q: What was something that went particularly well?
A: Something that went particularly well was the designing process. As long as I kept the shapes simple (rectangles and sharp edges, not circles and curves) and made the parts flat on a plane (instead of building on and intersecting with each other), designing digitally in Autodesk Fusion was quite easy, simple, and quick to do, meaning I could quickly adapt new designs with changes quickly and thus iterate easily and quickly.

Q: What was something unexpected that I learned?
A: Something unexpected that I learned was that if you change something in Design in Autodesk Fusion, the 2D Profiling and NC Program will not automatically adapt like everything else, even if it was a change in the timeline - you have to regenerate the 2D Profile and the NC Program has to be scrapped and remade completely. I thought with how smart and adaptive Autodesk Fusion was that it could handle adapting those as well, but I unexpectedly learned that it couldn't (and thus had to relearn how to manually recreate the NC Program and google how to regenerate the 2D Profile).

Q: What was a challenge or failure that taught me something?
A: A failure that taught me something was the holes in the supports being too large for the connector sticks for the initial prototype/design. This taught me that I needed to pay more

attention to details in design based on the materials that I could use, since having 1/8th inch (3.175mm) thick plywood meant that I had to accommodate all of my holes in the product precisely to that number - I had forgotten to do that here. In essence, this was just a reminder to pay more attention to how I designed - the problem solving was pretty simple though (just make the holes smaller from 5mm to 3.175mm in one more dimension).

Q: How did fabrication influence my design?
A: Fabrication influenced my design by making me design pieces where only one direction could be cut. The laser cutter at Makerspace only cuts in 2 axes (x and z), so I could only create normal prisms with sharp edges (since refined, curved edges would require a combination of all 3 axes). Thus, all of my pieces are designed as just rectangular prisms (not spheres or pyramids or anything else), albeit most are carved out along 2 axes, meaning the laser cutter during fabrication could actually cut them properly and quickly with no rearrangement necessary.

Q: What was something I would change if I made the project again?
A: Something I would change if I made the project again would be the position of the holes for the supports in the spine; I would move them a few mm closer to the edges of the spine so they would give more space for the phone to rest on the spine (since I forgot to accommodate for thick phone cases, as they can be too large to fit in the given area sometimes depending on the case). In essence, it'd be a re-design of the spine. (It'd also mean I'd have to re-do the wood gluing of the supports to the connectors, making them slightly farther apart).

Q: What was one important takeaway about designing for digital fabrication?

A: One important takeaway about designing for digital fabrication is that you need to keep the overall design as simple as possible with as few unnecessary details as possible, in order to keep the designing and fabrication processes as easy as possible. The more complex the design, the more difficult it will be to create the design in an online environment such as Autodesk Fusion (which struggles to handle curves and circles in my personal experience, hence why I didn't use them in this final product). And the more complex the design, the more axes it could need to cut from in a laser cutter, which could make your laser cutting far more difficult or outright impossible depending on how the axes are handled (if you need to involve all 3 axes in a movement for example it becomes impossible to cut it at the laser cutter at the UCSB Makerspace, since it can only move and cut in 2 axes at a time).

Final Design Files

Final Design Files

Here are the design files as google drive links (the files themselves are in the shared folder Alejandro has access to since he has editor access to all the folders for all students).

I wasn't sure if you wanted the .dxf or the .f3d

The link for the .dxf file (called finals_project_v2.dxf)

https://drive.google.com/file/d/1PAQ6H47S1LzScjoiKwZKMJpY4BvVchSy/view?usp=sharing

The link for the .f3d file (called 3d_model_of_finals_project_phone_flashlight_stand_v1.f3d)

https://drive.google.com/file/d/1TYC9QnZ_JxZtUYjy88gioyWnqawXlMjE/view?usp=sharing