

Innovated Quad Lock Desk Mount Kit

The following design is based on Quad Lock's Desk Mount Kit in their Home & Office section of their website. It allows the user to not only charge their phone while they are at work, but it props up the phone so that the user does not need to tilt their head all the way down to properly see their phone. It uses four magnets to keep the phone on the stand rather than the usual Quad Lock design to allow for greater ease taking the phone on and off the stand while still keeping the general design of the company by using the four interaction points to secure the phone.

This design is desirable due to a few reasons. The first reason is that my innovated design holds the phone at a better angle so as to make the entire screen more easily viewable without needing to tilt your neck down rather than just the top section like the current design. The second reason is that this design makes attachment and removal of the phone from the stand much easier due to not needing to mess with the current locking system that can be difficult to use. Lastly this design can fold up, with the main part of the body fitting into a compact 3" x 4" x 0.30" space and the flange sticking out a total of 1.5". This makes the product much more easily transportable due to its ability to fold, which is something that the current Quad Lock Desk Mount Kit does not do.

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Evidence of end-user engagement

As I worked to engage the end-users of Quad Lock to be able to determine issues that I could design for, I first went to the Quad Lock website. Quad Lock has already done a phenomenal job designing their current Desk Mount Kit, so the vast majority of the comments were positive. Due to this, I looked at comments that were primarily between 1-3 stars with a few 4-star comments. After reading forty-eight comments that had been posted that fell into the categories listed below, I came up with the following table:

Table 1: Data that shows the type of comments that came up, how many times it was brought up, and the percent of comments that brought up that comment.

Comment Category	Number of times it was brought up	% Of comments that mentioned this type
Need more color options	1	2.1%
Sound from wireless charger issue	5	10.4%
Need for easier removal	7	14.6%
Cannot use with other wireless chargers	1	2.1%
Customer Service issues	1	2.1%
Phone does not charge	2	4.2%
They like the stand	11	22.9%
Case does not fit phone	3	6.3%
Charging cord issues	3	6.3%
Wireless charger issues	9	18.8%
Did not get the product	1	2.1%
Tips over too easily	4	8.3%

This table was then primarily used to determine where major problem areas were and then direct the creation of my “How Might We” statements that are listed in the following section.

The next way that I attempted to engage the market was to go on to Amazon.com to see what kind of phone stands were already out there. Here are a few of the designs that I saw that influenced me at some point in my design process:



Figure 1: I liked this stand as it was easy to take the phone on and off.



Figure 2: I liked this stand for the way that you could set the phone at any height and how securely the phone was held.



Figure 1: I really liked this phone stand as it was both small and it was able to fold up for easier transport.

Each of the pictures that you see above, were rated with 4.5 stars or more, and the stands on the left and right both had five stars, each with a minimum of 26,000 ratings. With not only the quality but also quantity of ratings for each of these phone stands, I feel safe saying that they are pretty representative of what the market thinks about the stands and wants out of a phone stand.

As you will be able to tell as you see my design later in this report, I tried to employ the design principles that I mentioned that I liked in the captions of the pictures of the three phone stands shown above in my own design.

Theme and “How Might We” Statements

After reading up on the reviews listed above, I worked to find ways to innovate Quad Lock’s Desk Mount Kit. While reading those, there were many people who simply had not received the product for which they had paid. Since we are innovating products rather than user experiences, I had to move on from those. After compiling the information listed above, I came up with a theme of transportability and simplicity that guided my design.

While creating my persona, I realized that one of the main reasons why the Quad Lock Desk Mount Kit was so desirable, was that it lifted the phone so that it was not flush against the desk. To make this a better product, I focused on the “How Might We” statement of:

How might we allow the user to see their entire phone screen without moving their neck.

This “How Might We” statement came from the general knowledge of why people have phone stands, but also observations of my friends and others that are often around me. Many of my friends will work on a computer with their phone laying on their desk and when they get a notification, will look down to read, process, and respond to the notification if necessary. This, after being done repeatedly over a long time, gives them a kink in their neck that they proceed to try to massage out, to varying degrees of success, and when unsuccessful leads them to stop working all together. As I designed based off this “How Might We” statement, it was a drive of mine to design something that would help the person in my Persona and my friends to be able to continue to work longer as they would not have that inconvenience working against them.

Another common grievance was that the wireless charging adapter created a high-pitched electrical noise that was very frustrating to always have to listen to and therefore very distracting. Due to this I created a HWM statement around this that took the form of:

How might we help the end user be able to charge his phone while at work and not have to be subject to unnecessary noise?

To accomplish this end, my theme of simplicity helped with my design. Many people need to charge their phone while they are at work, so that capability must be designed for. When thinking of how to design for the noise, I realized that I do not know how to get rid of noise caused by electrical components. Since this design is a 22.5-hour design, rather than a +100-hour design, I decided that to keep the wireless charger would take too long and therefore, it would just be easier to get rid of that feature all together. There are charging cords on the market that are six feet long which would be more than enough to reach from an outlet to the users’ phone on the stand on their desk.

The next highest grievance was based on removal of the phone from the stand. Many complained that the device was too hard to take off, or that at least the effort that is required to take it off is greater

than the benefit that it provides and therefore makes the stand not desirable. To ensure that I designed according to this issue. I created the following “How Might We” statement:

How might we ensure that the end user is able to attach and detach their phone easily from the stand.

As I looked into this, I realized that the common issue was that the locking system was bulky for some, and simply difficult to use for others. To fix this, I focused on the theme of simplicity and went with magnets as the attachment style since so many people have either used or played with magnets. There are magnets in the stand as well as in the back of the phone case that are drawn to each other and are evenly spaced so that the phone can sit both vertically and horizontally.

The final “How Might We” statement that I designed around came from comments that talked about how they appreciated how small the Quad Lock Desk Mount Kit is and how it did not take up much space on their desk. So, to make sure that I designed accordingly, I came up with the statement:

How might we accomplish the previous three “How Might We” statements without taking up much space on the end user’s desk?

While designing, I tried to keep in mind dimensions of my part so that I it would never get too big. The end dimensions of my new Quad Lock Desk Mount Kit are 3” x 4” x 0.30” when it is folded to be transported somewhere else, and when it is being used the dimensions are 3” x 4” x 4.30”. This allows for the innovated Quad Lock Desk Mount Kit to be able to fit into almost any backpack pocket for easy transport.

Exploratory hand sketches

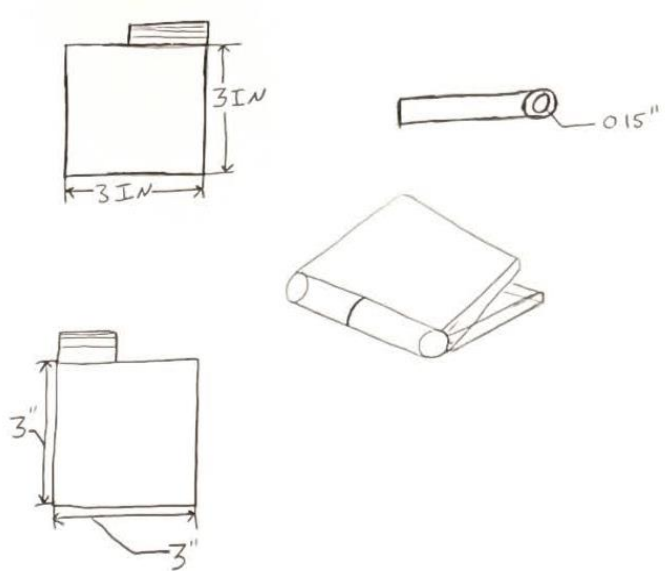


Figure 4: Initial page of exploratory hand sketches showcasing initial design for the stand

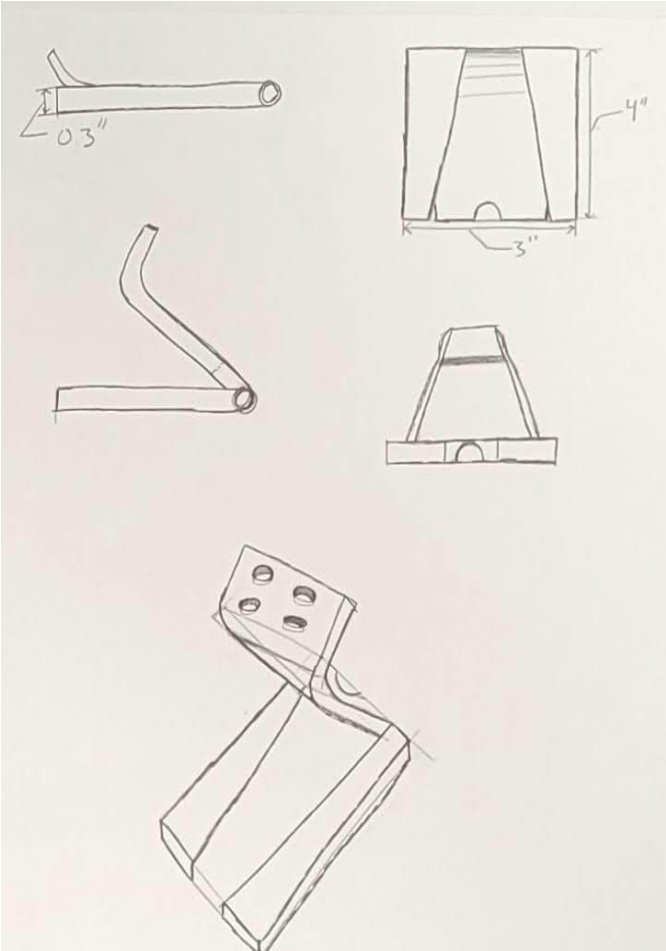


Figure 5: Second page of exploratory hand sketches showcasing current design of the stand.

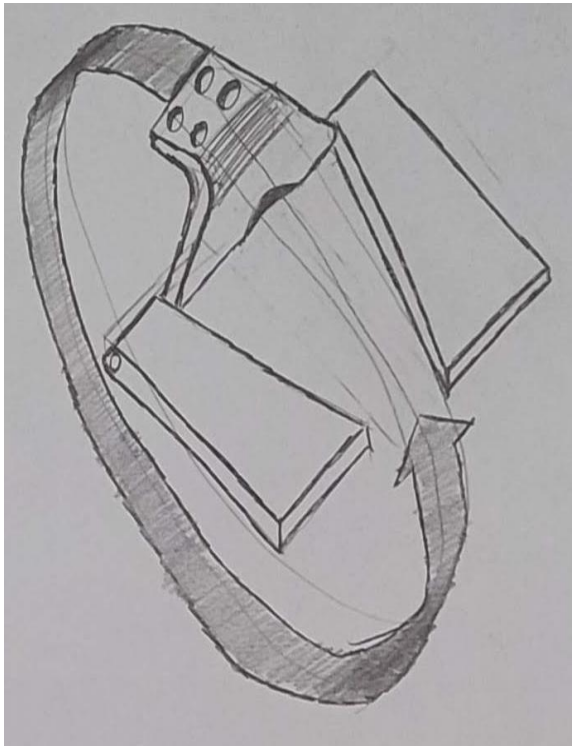


Figure 6: Sketch of the path the stand will take to reach its folded position.

Photo Montage of Prototypes

1st Iteration

As I went through my first iteration, I learned quite a few things. As seen in Figure 7 and Figure 9, my stand is not thick enough (it is .20" in this picture) to be able to hold the four magnets that would be used to hold the phone in place. Also, if you look closely, the locking pin, 1 is pointing towards where the locking pin should be located, is not in its lock. This taught me that more care was needed to make sure that the pin would be in place.

In Figure 9, we can see that the extrusion that acted as the lock for the locking pin that was mentioned in the paragraph above, is 120° clockwise away from where it should be. This pin was originally designed to be able to twist while in place, until it was put into the hole for the extrusion. This pin is firmly in place and has no ability to twist, which means that I need to increase the diameter of the hole that the pin goes in to. The next lesson is being pointed out by 2 in Figure 8. The pin I designed to use to lock everything into place, was too large for the hole that I was trying to get it to go through. I thought that I had given it enough clearance in my model. Obviously I had not, otherwise there wouldn't be as much of a crack along along the axis of the hole. While it isn't shown in this picture due to it being hidden by the stand, but the other part of the base has a similar crack running along the axis of its hole.

In Figure 9, shown below, there were a few things that we learned as well as a few other things that can be seen better on this view than others. The first thing that we see is that my recreation of the Quad Lock logo can be printed and it is recognizable. This one did have a few extra strings attached to it, but that is something that could be cleaned up with an exacto knife if necessary. 3 is pointing to some reliefs that I put in the stand so that the stand could travel its entire path without impinging on the base on either side. 4 is pointing towards the back of the holes that



Figure 7: Side view of the first iteration of my design in the folded-up

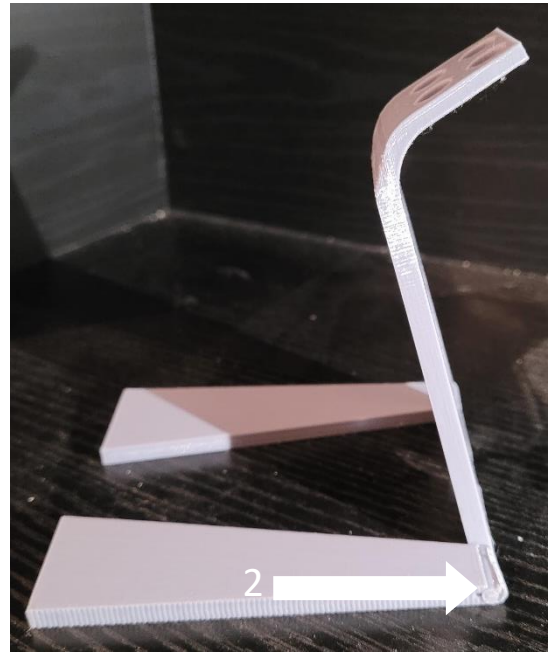


Figure 8: Side view of the first iteration of my design in the expanded position.

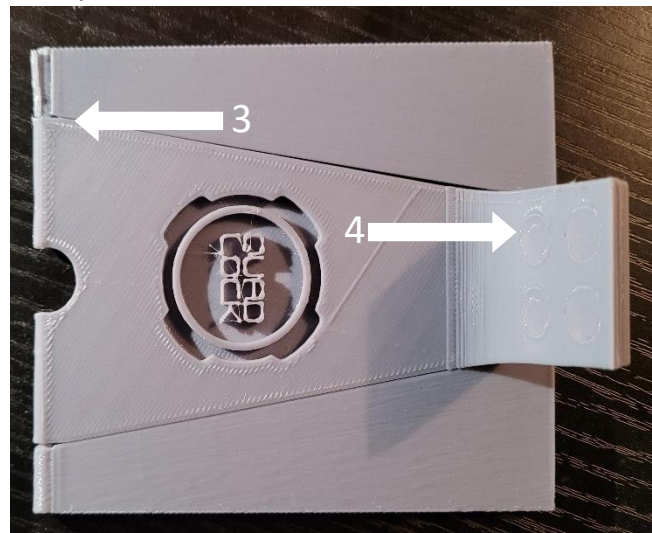


Figure 9: Top view of the first iteration of my design in the folded position

were created to house the magnets. As it can be clearly seen here, the flange needs to be thicker here so that magnets don't blow out the back of the flange.

2nd Iteration

In Figure 10, we see 5 pointing to a crack that has formed along the axis of where the pin is inserted through the hole of one of the feet, similar to what we see in Figure 8 as indicated by 2. This iteration is better than the previous one however as the crack does not run the entire length of the part. This is due to both thickening up the base from .20" to .30" along with shrinking the pin diameter. Along with that, we see that the outline of where the holes were, as seen in Figure 9 indicated by 4 and now seen in Figure 10 indicated by 6, have now disappeared as well after thickening up the entire stand to be the same thickness.

In Figure 11, we see that the locking pin indicated by 7 is clear. That is because I had it printed using clear resin on an SLA printer. I did this so that the cone that prevents the locking pin

from retracting out the way that it entered would be a little bit more flexible and therefore it would be possible for it to elastically deform until it reached the section inside the stand that had a wider diameter and would go back to its original shape. When trying to put these locking pins in, I had to sand the tips down and then hammer them into the holes. Due to that necessity, I learned two things, one, my hole diameter is still too small, and two my pin diameter is still too wide. To fix this, I got rid of the cone feature and only used a cylinder with the extrusions as my locking pin. Due to the friction of the press fit, it isn't able to be pushed out, which was the initial reason for using the cone feature.

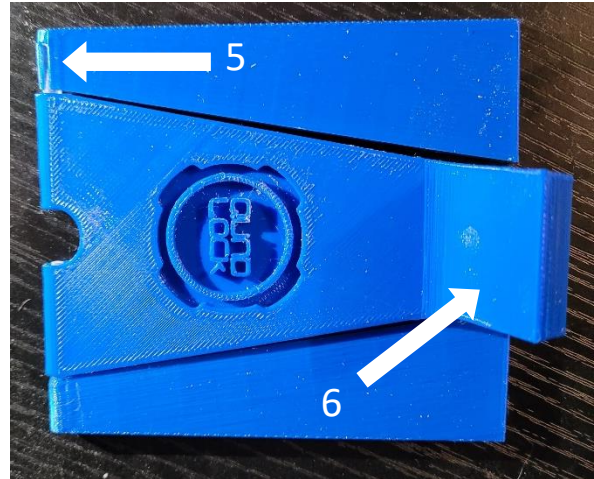


Figure 10: Top view of the second iteration of my design in the folded orientation

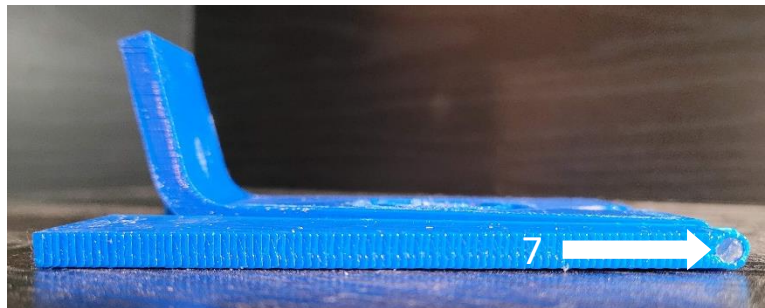


Figure 11: Side view of the second iteration of my design in the folded

Non-Annotated Unexploded rendering

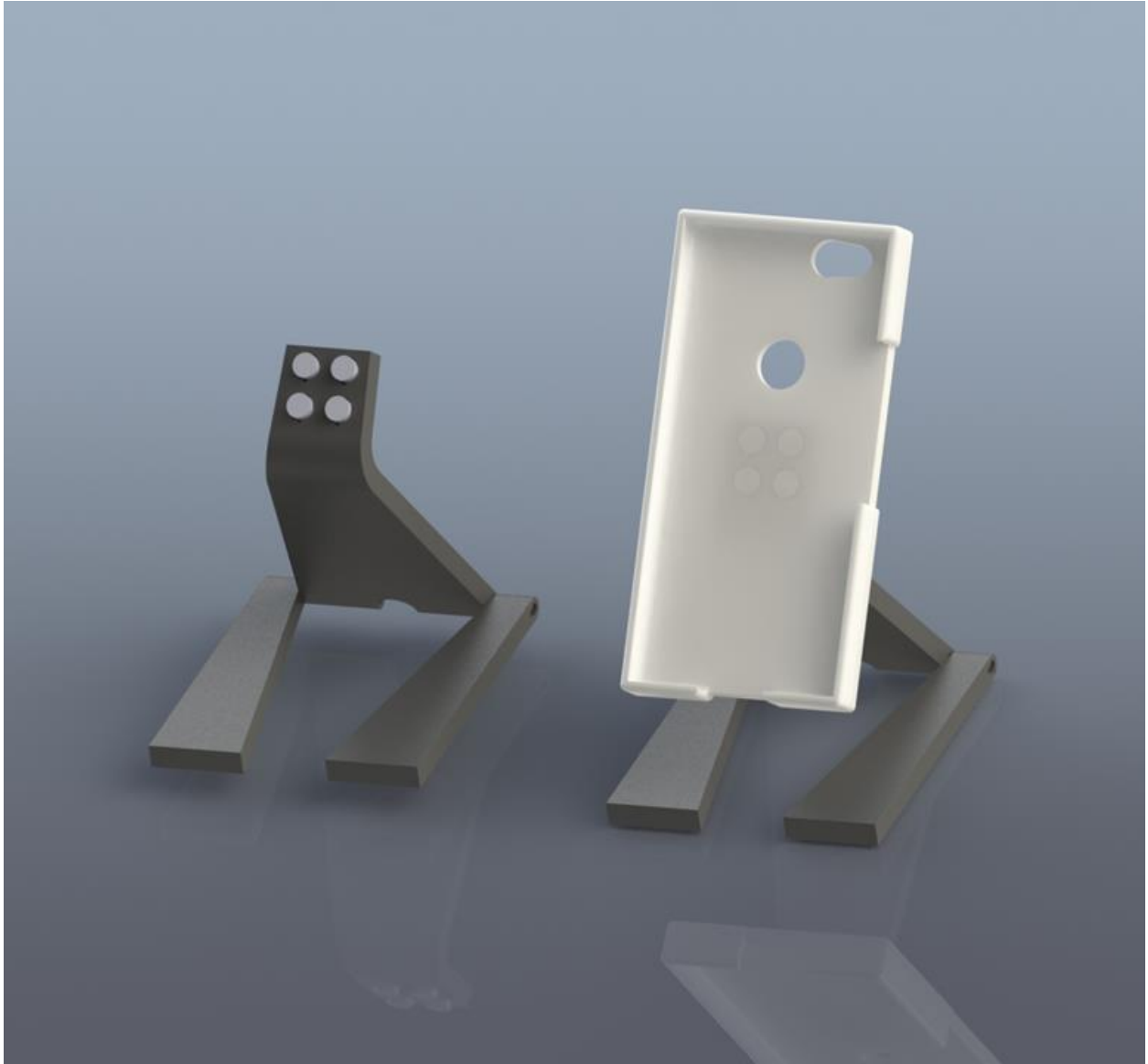


Figure 12: Render of my stand with (R) and without (L) the phone case.

Annotated Unexploded Rendering

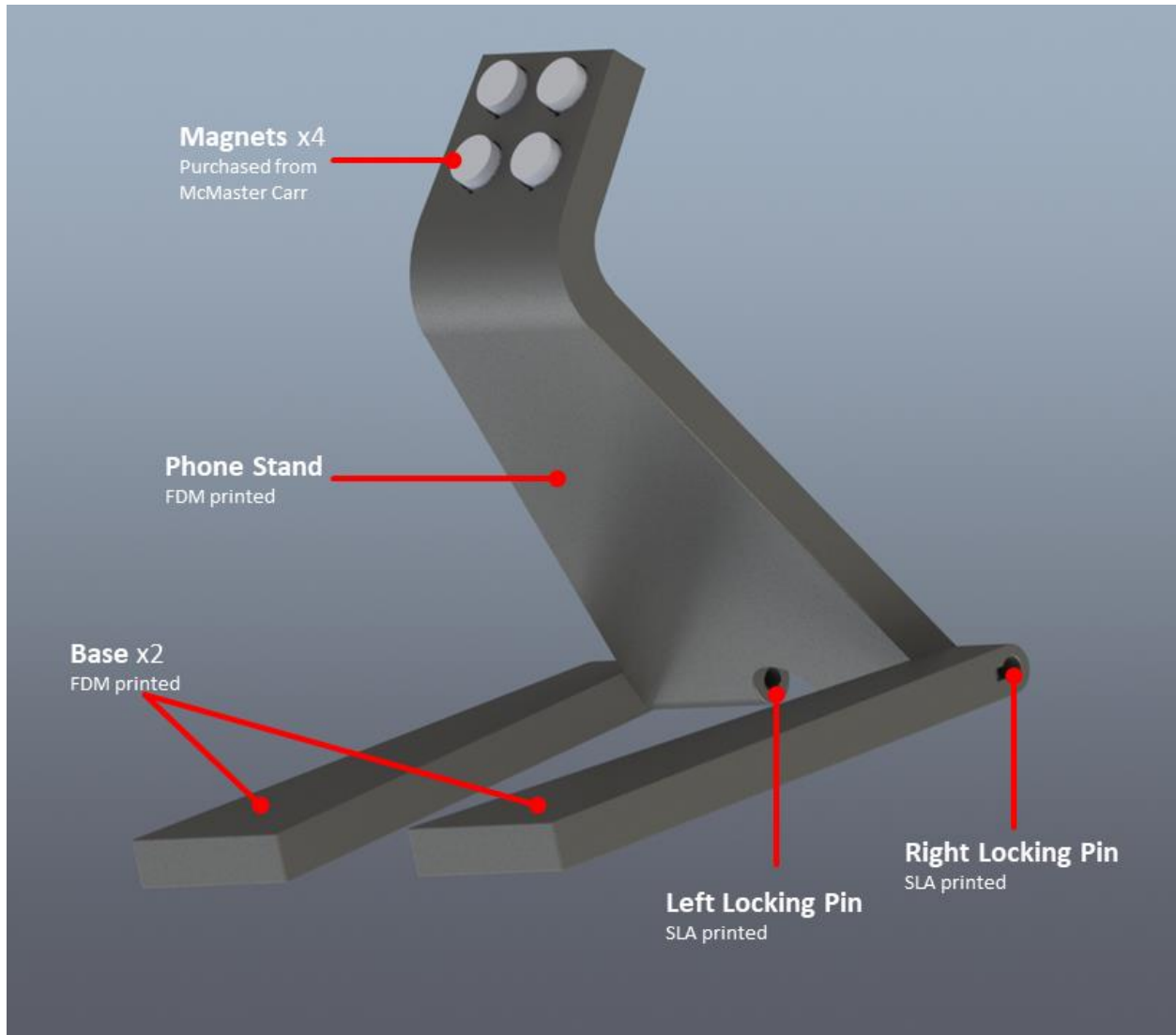


Figure 13: Render with descriptions of main parts.

Annotated Exploded Rendering

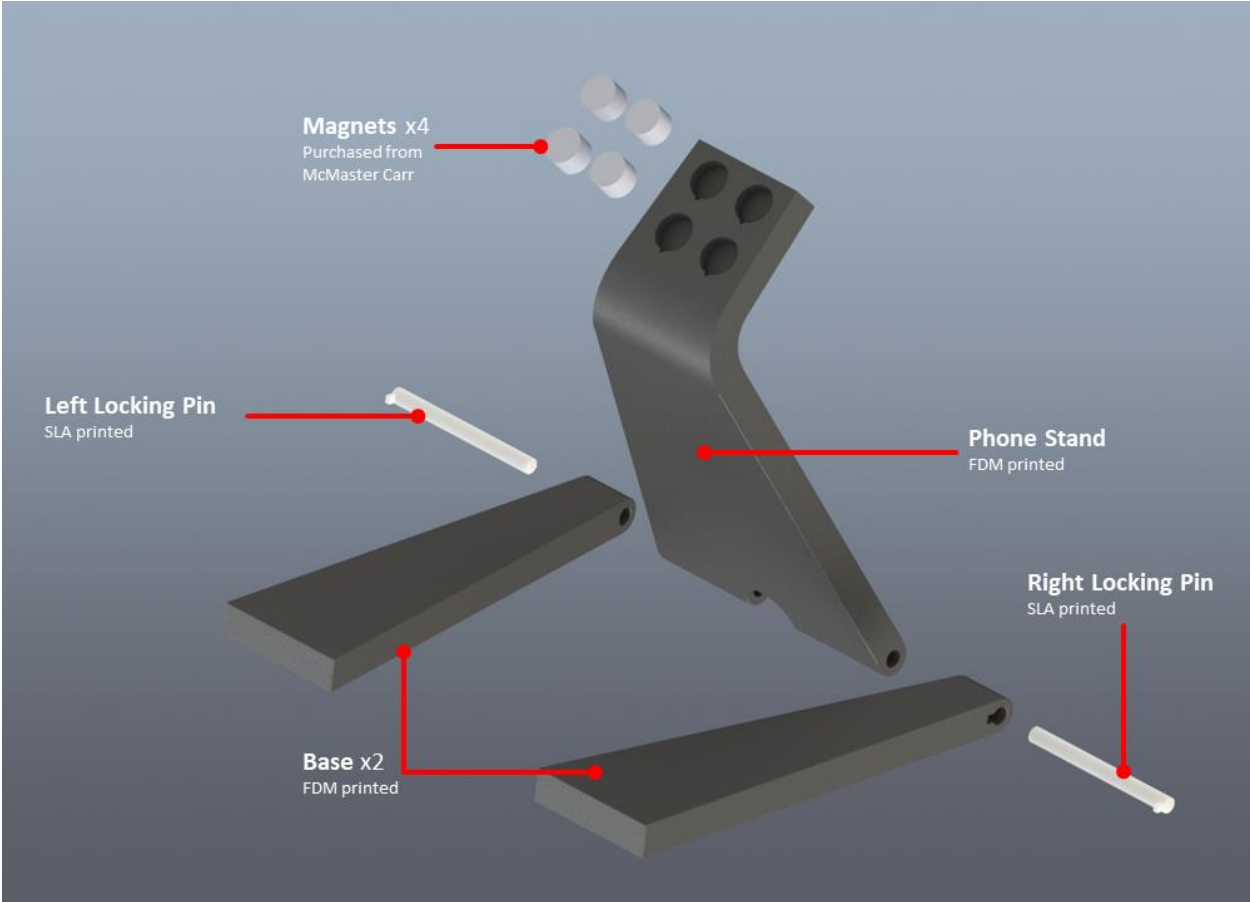


Figure14: Render of exploded view to see more of the part geometry with description of main parts

Annotated Cross-Section Rendering

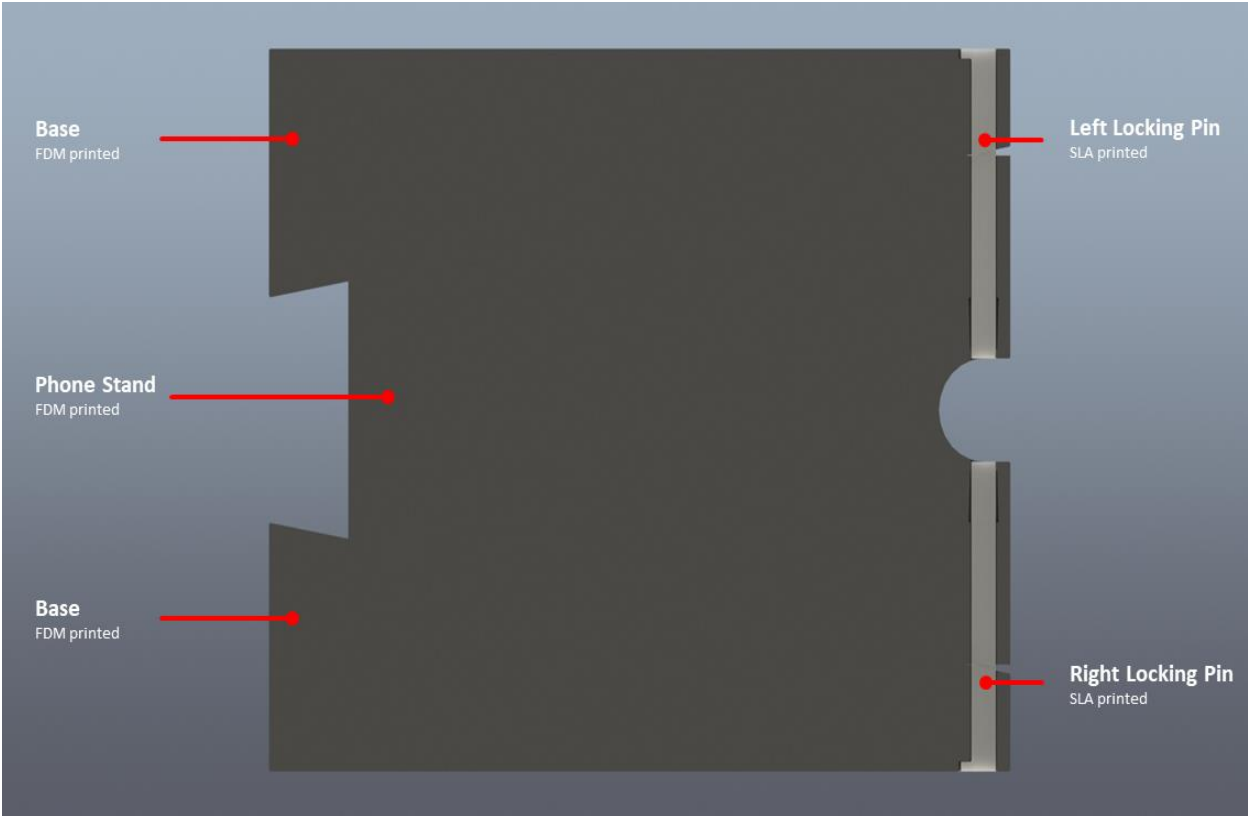


Figure 15: Annotated version of the cross section of the assembly

Evidence of Verification and Validation

Once the prototype was created and assembled, a Google Pixel 2 was put into the case. The case and phone were then attached to the pseudo magnets which were in the holes of the stand. Once attached the phone did not produce enough of a moment arm to bring the stand down. It should be mentioned though, that if excessive force was used to tap on the phone screen, especially towards the bottom of the screen, the stand would fall down.

For validation, I brought my final design over to my wife and had her give her honest opinions about the design and how it matched up with the “How Might We” statements. For the “How Might We” statement regarding not having to move your neck to look at the screen, she said that it very much depends on the person and what their body type is. If they are a smaller person, this will be simply fine. However, if they are taller, unless they sit super low in comparison to their desk height, or they have a separate stand for a monitor to be raised up and place the phone stand on that, the phone still is a little low. I then proceeded to ask her if the stand made it better than if she had to look down at her phone when her phone was laying flat on the desk, and she said that it would be better. This shows that, by at least one person, it has been validated that the phone stand would help decrease the pain the neck caused by having to look down at a phone screen that was on a desk.

The other “How Might We” statement that required validation was in regard to the size of the phone stand. When asked about the size, my wife stated that she thought that the design was small. This is interpreted to be a good thing, as we did not want to take up much space on the user’s desk. The one worry that would have to be checked with more people would be if it is perceived as being too small and therefore, they do not think that this phone stand could fix their problem.

Another “How Might We” statement that my wife commented on was in relation to attaching and detaching the phone. Since this prototype did not have the magnets and relied on the pseudo magnets, which were just FDM 3-D Printed cylinders, it was harder to put on. She stated that she felt that it took both hands to attach the phone since you had to line up the pseudo magnets with the holes on the phone case. She then also stated that it was her belief however, that if the magnets had been implemented that the attachment time would be much more simplified and easier.

The remaining “How Might We” statement referred to being able to charge without any electrical noise. Due to the semi-circle opening that is in the bottom of the Phone Stand, a charging cord can easily be placed there without any worry. This was validated as both of our charging cords could fit through that opening.

When talking about overall function, my wife had similar comments to those at the end of the first paragraph in this section, that when touching the top of the screen, the phone stand stays in place without any issues, but once she started to touch the bottom of the phone screen, that is when the phone stand rotated downwards.

Write up

This has been a phenomenal experience that I have thoroughly enjoyed. I have also learned a lot through doing this project. To start off I have never done market research before, nor have I really looked to see ways to innovate things that are in the world around me. This project has provided me with an opportunity to do both in a controlled and safe environment. I have also had the opportunity to see what the difference is between a 100-hour design and a 22-and-a-half-hour design. While talking with others in this class I was worried because I was at the same point in the design process that they were despite them spending almost three times the amount of time to get there. This caused them a lot of stress especially as we neared the project deadline, as they still had to write their report and figure out how to do the 3D model-based definitions and did not have much time to do so. I on the other hand still had enough time to be able to finish writing my report and learn how to do the 3D model-based definitions.

I know that for myself I did not evenly space out the time that I needed to work on this project over the course of the project. Due to this I have put a lot more time into this project during the second half of its duration. While that is not necessarily a bad thing, I believe that spacing out the time spent on this project will be beneficial as I work on the second individual project. This would allow me to be able to come up with designs quicker and therefore I would not feel as rushed and pressured towards the deadline. Another thing that I have learned is that if parts are needed to be bought, those should be bought the second that you believe they are necessary. If you wait too long there is a chance that you will not get the parts that you need in time for the deadline. This was the case as I initially wanted to prototype the magnet attachment style but was unable to as the magnets came too late.

To further this project, I would need to put time and design work into creating a locking mechanism that had a better chance at keeping the stand in place. The press fit that is currently employed does an adequate job for an initial prototype, but in further iterations, a true locking mechanism would be desired. Also, prototyping with actual magnets would be necessary, instead of pins to simulate the use of magnets. Two other things that would be beneficial would be one, a way to fold the flange down so that the entire stand would fit into a 3" x 4" x .30" cube, and two, a way to make it so that the two feet of the base are attached so that they cannot move independently of one another.

