Design Challenge 2 – Opportunistic Design Challenge

Old Functionality Retained

When compared the the original design, the new design retains all of the old functionality while adding some more as well. The original design encompassed 3 main design functions: 1) Self-supported on the wall socket/plug, 2) Hold's up a mobile device, and 3) wire-management for charging cable. As seen in Figure 2, the new design takes all of these three design aspects into consideration.

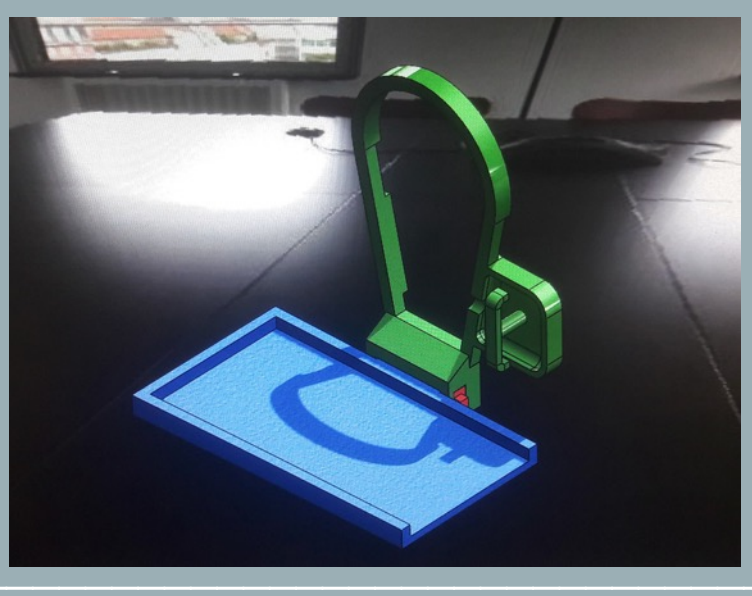


Figure 1: Original design for electronic support device

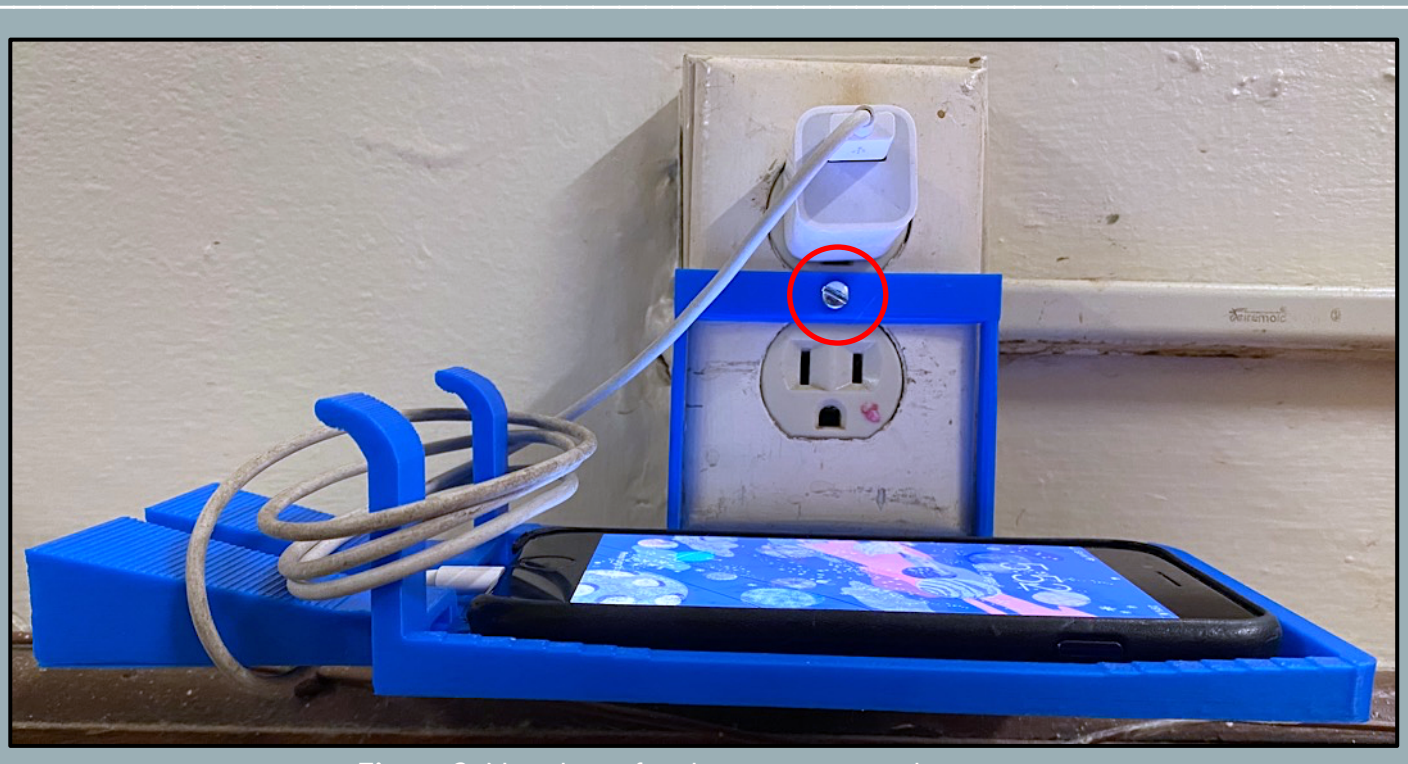


Figure 2: New design for electronic support device

New Functionality Added

One thing to be noted from the initial design seen in Figure 1 is that the "wire-loop" for cable management is not wide enough to cover a regular 3ft cable. The cable management system in the new design, as seen in figure 3, easily tackle's this problem. However, the new functionality added is not of the cable management system, but of the speaker located in the left end (figure 2) or bottom (figure 3). The purpose of the speaker to a amplify notifications sounds that may be missed if the outlet where the phone is being charged is at a significant distance from the user. Now, you will be there for an important call, a work text, or a loved ones message while charging your phone.

Figure 3: Cable. Management system in new design using a 3ft apple charger

Free Complexity

As seen in figure 4, the new design takes advantage of the capabilities of AM. One example of this can be seen circled in figure 4 (bottom) through the use of a honey comb-structure for material reduction. This was implemented by inserting equally spaced hexagons throughout the plane where the device rests. Moreover, a huge chuck of material is eliminated from the center of the plate directly where the device directly lies, pointed in red in figure 4 (bottom). Instead the phone sits on the ledges pointed in green in figure 4 (bottom). This saves a considerable amount of material that was being wasted in the original design.

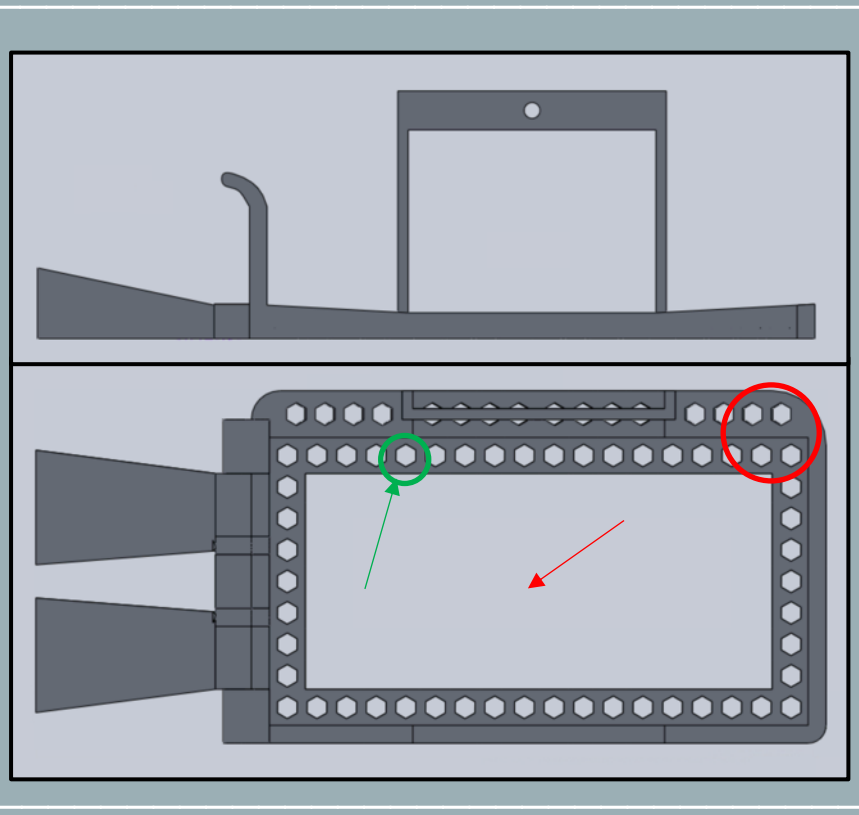
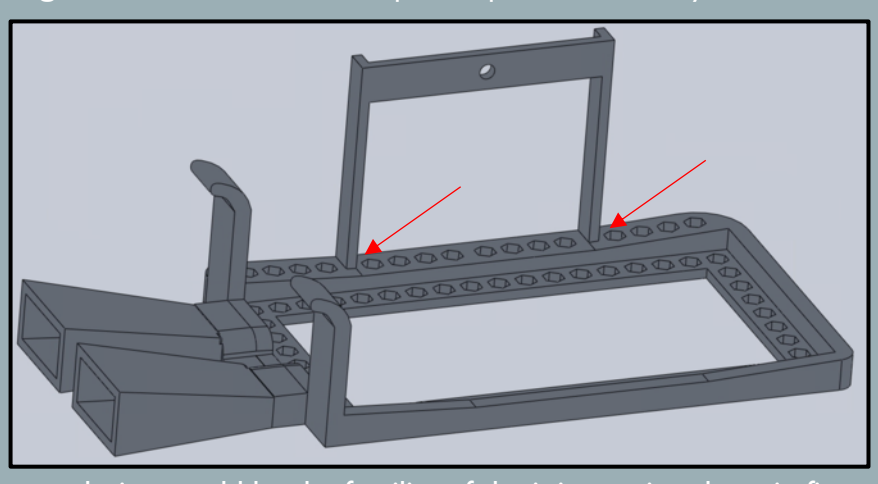


Figure 4: (Top) Front view of new design **(Bottom)** Top view of new design

Figure 5: Locations where the printed part is structurally unstable/weak



Design Reflection

One noticeable design change in the new design is the way it fastens to the electrical outlet. The new design uses the screw included in every electrical outlet as circled in figure 2 above. This new method provides additional stability to the design and ensures that the part doesn't slip of the outlet as it might with the original design. However, this fastening technique rigidly attaches the part to the electrical outlet which means applying too much strain to it can subject it to fracture while the original design might just slide off the outlet. Lastly, the biggest drawback of the new design would be the fragility of the joints pointed out in figure 5 in red. While the structure was able to hold itself as well as the device to perform its function, the dimensions 3mm x 8mm (WxL) at the base are simply not sturdy enough for cyclic loading. This means that eventually, with time, the part will fail and has to be redesigned to regain its structural integrity.

Build Analysis

Since both parts are printed using PLA material extrusion, I choose to do the build analysis based on the prints material usage, time, and cost. Unlike the new design, one single print, the original design is printed in 3 parts. Although this takes about 30 less minutes to do so when compared to the new one, those 30 minutes could essentially contribute to removing each printed part from the build tray to start printing the next one. Hence, both the new and the old designs take approximately the same time to print. However, the new design require slightly less filament and is a bit cheaper to print as well. While the original design was structurally stable, the new design was slightly fragile as pointed out in the design reflection. Personally, one of the biggest challenges faced while designing this part was approximating the sufficient dimensions of the joints pointed out in figure 5. After physically inspecting the printed part it was clear that these joints need more material surrounding them to improve the structural integrity of the design.

	Original Design			New Design		
Print	**Filament**	**Time**	**Cost**	**Filament**	**Time**	**Cost**
Pin	1.15	00:05:19	0.12	N/A	N/A	N/A
Tray	39.93	02:02:46	3.99	N/A	N/A	N/A
Base	25.87	01:31:16	2.59	N/A	N/A	N/A
Final	66.95 g	03:39:21	$6.7	61.22 g	04:16:18	$6.12

Table 1: Build analysis on the original design vs the new one