uOttawa

PD-C: Conceptual Design, Project Plan, and Feasibility Study

GNG2101, Section #A01
Team #2

Team member	Student Number
David Manyok	300152283
Jonathan Michaud	300080995
Shayleen Ghanaat	300198724
Taryn Atlas-Jones	300117226
William Hayes	300077212

PM: Ayesha Khan
TA: Ravisha Sharma

September 30, 2021

Table of Contents

List of Figures

List of Tables

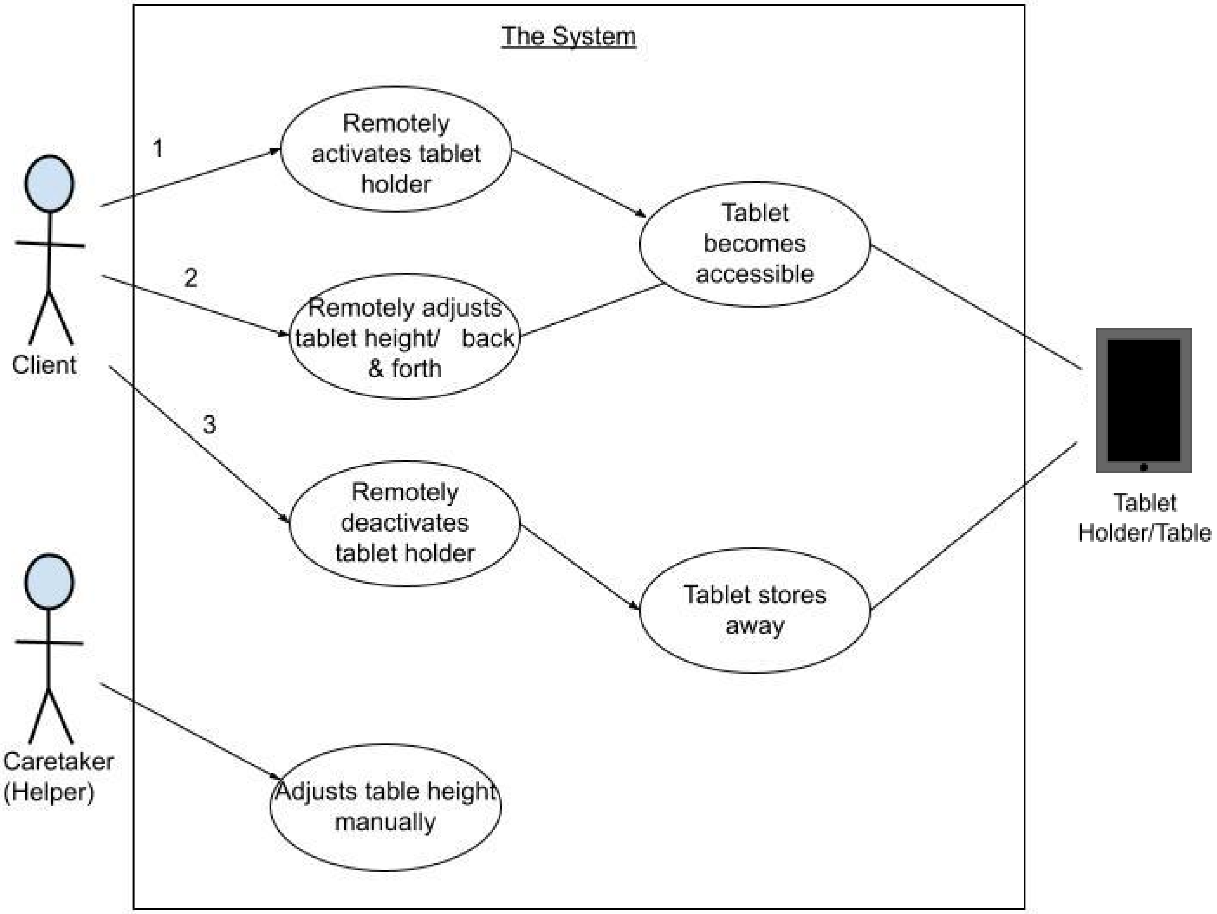
1. Introduction

This deliverable will discuss various options of how the team can meet the needs of the client. This process will be started by identifying the core functions and subfunctions of our product. After this is completed each team member brainstormed three ideas separately. This will be followed by putting the ideas through a ranking system which will allow the concepts that best fit the clients needs to be identified. These concepts will be discussed as a team and the benefits and drawbacks of each concept will be weighed. From these portions of the top ideas will be combined to create a final design concept.

This process will allow the team to brainstorm effectively to find multiple solutions which then can be discussed. The discussion periods allow for time to come up with new ideas that may merge aspects from other team members' designs. This will ultimately lead to the team finding the design concept that best fits the function, needs, and limitations of the project at hand.

2. Main Subject Body of the Report

2.1 Core Functionality Breakdown


The System
1
2
3
Client
Caretaker (Helper)
Remotely activates tablet holder
Remotely adjusts tablet height/ back & forth
Remotely deactivates tablet holder
Adjusts table height manually
Tablet becomes accessible
Tablet stores away
Tablet Holder/Table

2.2 Brainstormed Concepts:

<u>2.2.1 David's Ideas</u>

<u>Idea #1:</u>

The sketch illustrated a table with a two surface table with sandwiched tablet space. The upper surface of the tablet works like a cd slot. It slides off to open space for the tablet to roll out or roll in, then slide back to cover the to maintain uniform table surface. The tablet is fastened to a hinge that enables 360 degrees rotation on all axes. This will be adjustable as shown below.

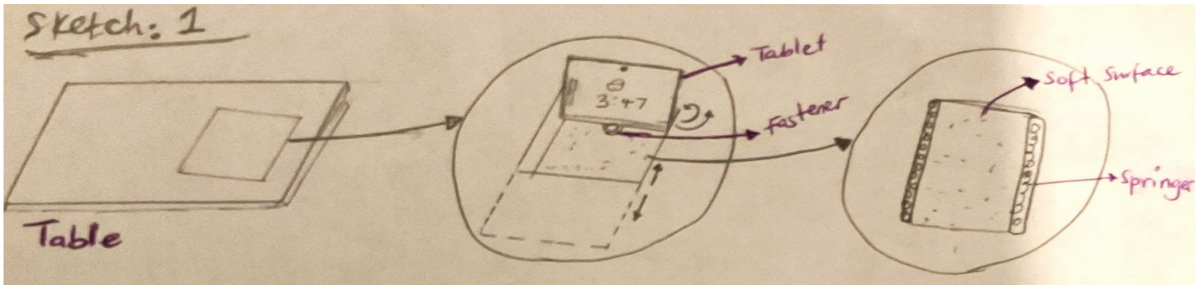


Figure 1: *Diagram of Idea #1*

<u>Idea #2:</u>

Sketch #2 illustrate a bunker the size of a tablet that acts as a storage space for the tablet. The end of the tablet rests on a weight that is thrust up when the user needs the tablet, and moves down whenever the user wants to store the tablet. Therefore, the motion of the tablet is due to the motion of the weight it rests upon. This will also be adjustable as shown below.

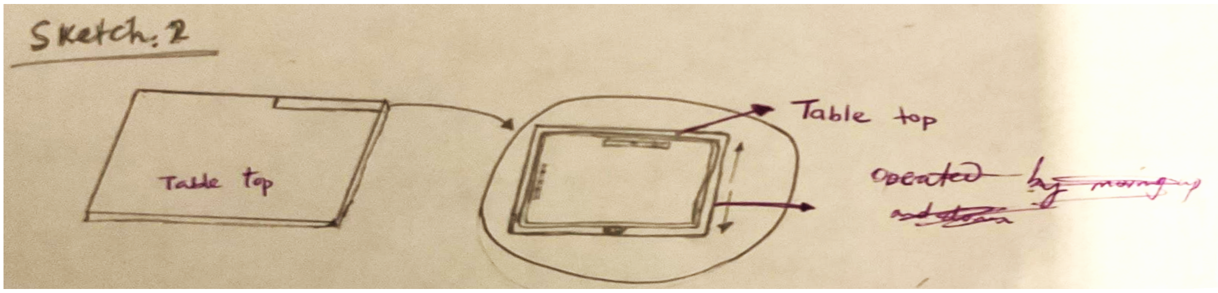


Figure 2: *Diagram of Idea #2*

Idea #3:

Sketch #3 illustrate a tablet that is facing down, and the back of the tablet, which is a protective cover made of rubber acts as a uniform table surface. The tablet flips 90 degrees vertically when the user needs to use the tablet, and flips back when the user needs to store the tablet. This will be adjustable as shown below.

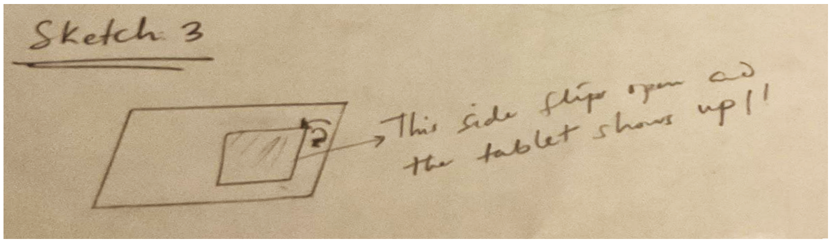


Figure 3: *Diagram of Idea #3*

2.2.2 Jonathan's Ideas

Idea #4:

This idea is based around a more traditional monitor mount with added adjustability to allow the tablet to be moved forward and vertically, as well as adjusting the angle of the tablet. While this idea does not hide the tablet away, it does keep the entire table top usable and allows the user to play videos on the tablet while using the table. The device would clamp or bolt to an existing table. Ideally, every axis of movement would be motorized.

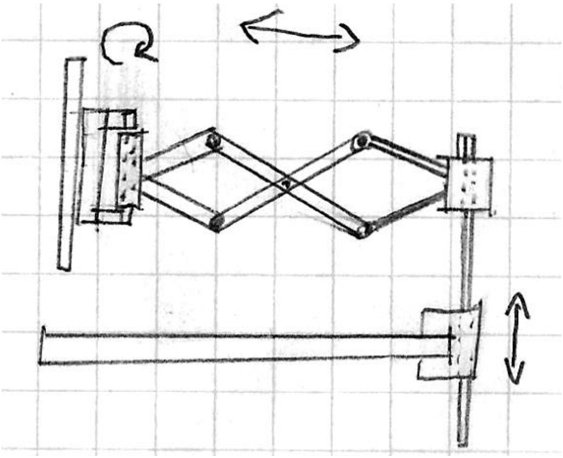


Figure 4: *Diagram of Idea #4*

Idea #5:

Concentrating on the ability to hide the tablet away, this design turns a part of the table itself into a revolving panel that would slide along a rail in such a way that the bottom of the table where the tablet is mounted would end up facing the user at a comfortable angle for use.

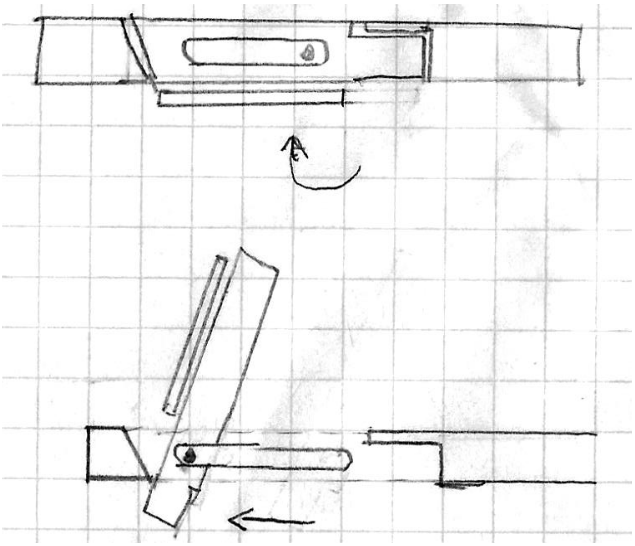


Figure 5: *Diagram of Idea #5*

Idea #6:

Similar to idea #4, this idea works by having the tablet float above the table and moving forward and backwards. However this idea uses the design of a balanced-arm lamp which is a much simpler construction than idea #4, but would be much more difficult to motorize, and would likely be less stable.

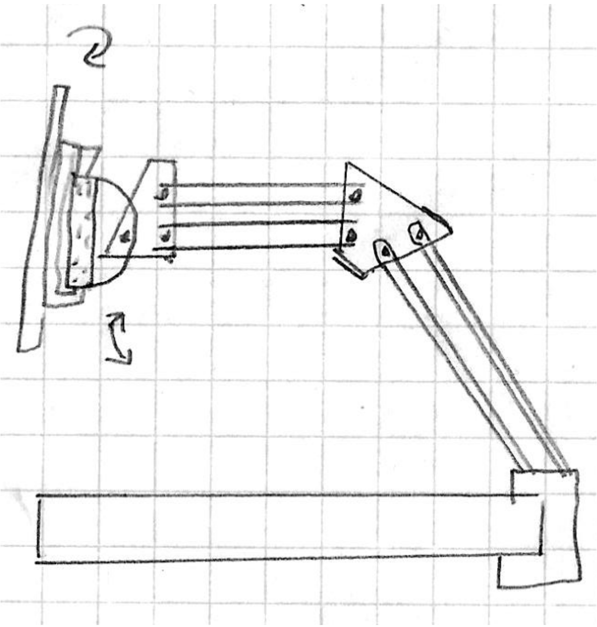


Figure 6: *Diagram of Idea #6*

2.2.3 Shayleen’s Ideas

Idea #7:

This idea is focused only on the tablet. At the back of the tablet are holes that can be linked to the tray. It is secured by 3 strays and 2 backstops. The straps will prevent the laptop from dropping.

This tablet is going to be attached to a stand. The stand has two plates that are joined by a pin lock that controls rotation. The top plate has holes that are compatible with all devices. The top plate is going to be attached to the tablet with The stand has 3 settings; it can be flat, vertical and 45 degrees.

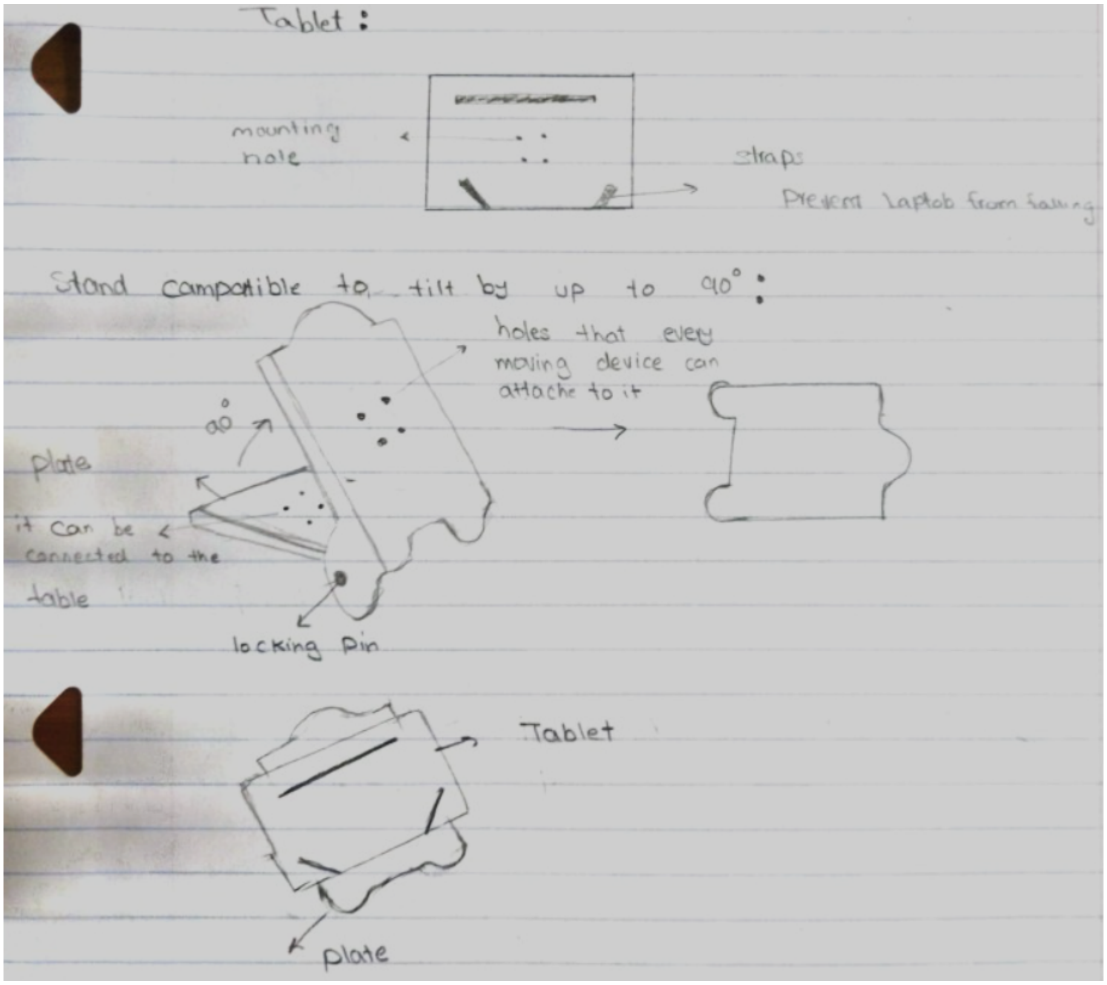

Tablet :
mounting hole
straps
Prevent laptob from falling
Stand campatible to tilt by up to 90° :
holes that every moving device can attache to it
90°
plate
it can be connected to the table
locking pin
Tablet
plate

Figure 7: Diagram of Idea #7

Idea #8:

This idea uses the same function as the idea 7 for the tablet. The main difference is the rotation component. This tablet has a lighter stand and fewer components. The design is in round shape made from stainless steel. The rotator has holes that can be attached to the tray and it can lay horizontally. It can rotate the device to accommodate a person's head tilt.

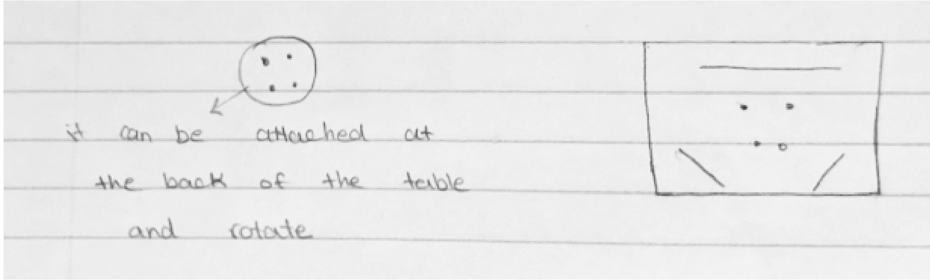


Figure 8: *Diagram of Idea #8*

Idea #9:

This idea contains a tablet that is connected to a stand. This design has two arms that are connected and they can rotate. The arms can be adjusted from low to high resistance. It has a movable joint that can easily glide to desired position. It clamps to any wheelchair or desk vertically.

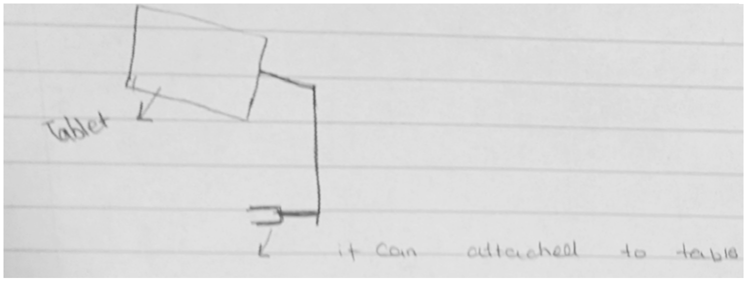


Figure 9: *Diagram of Idea #9*

2.2.4 Taryn's Ideas

Idea #10:

This concept is an idea of where the tablet can be housed in the table. The sliding lid will allow the table to still be fully functional when the tablet is not in use. The sliding lid could be automated by installing rollers that will propel it forward and backward inside a cavity in the table. The tablet would then sit inside the inlet on a hinged board that could move upward towards the user.

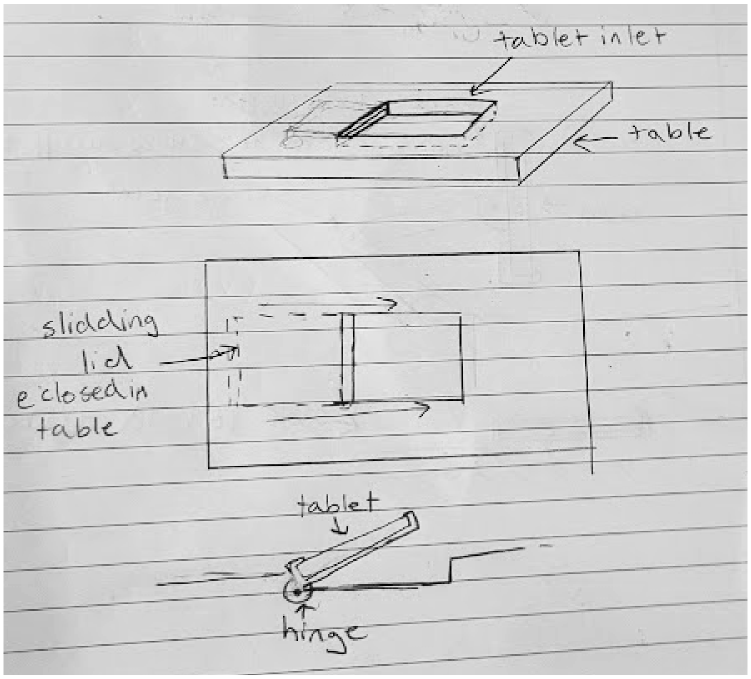


Figure 10: *Diagram of Idea #10*

Idea #11:

This concept could allow the table to be adjusted to various heights of the users choosing. Unlike many mechanized concepts this would allow the project to be cost effective. Aswell most users would not require their table height to change height on a regular basis. The table legs could be put at various heights then locked into place using the spring loaded pin. These legs would be made of metal so they would be durable.

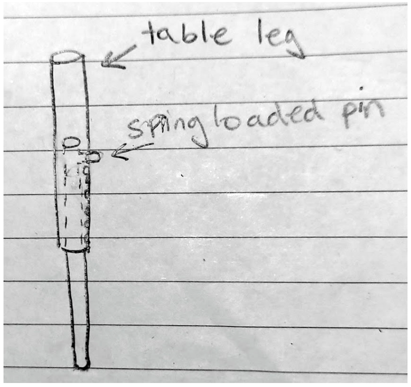


Figure 11: *Diagram of Idea #11*

Idea #12:

This is a tablet holding system. It holds that tablet using spring loaded grasps, allowing it to fit multiple table types. The arm system allows multiple angles and heights to be achieved and is able to fold flat as pictured in the second part of the diagram. This option has the ability to be mounted on both the table or the wall behind the table.

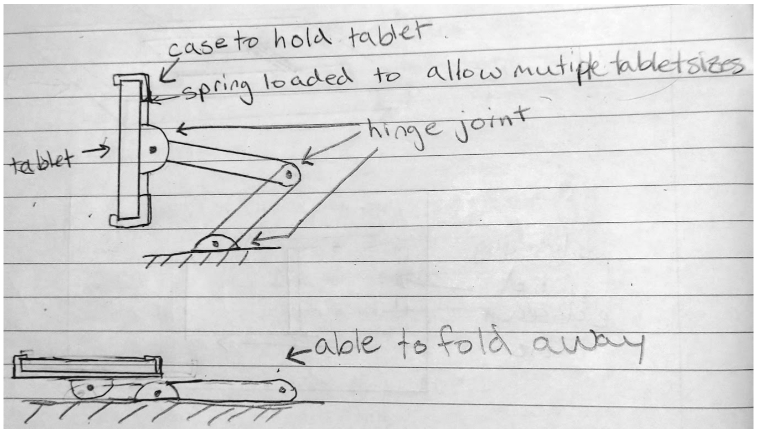


Figure 12: *Diagram of Idea #12*

2.2.5 William's Ideas

Idea #13:

This sketch illustrates a tablet mounted under the table on rails. The tablet would slide out horizontally, and then fold back to a usable angle and height. The main disadvantage of this is that the user would need to back away from the table to give it room to move.

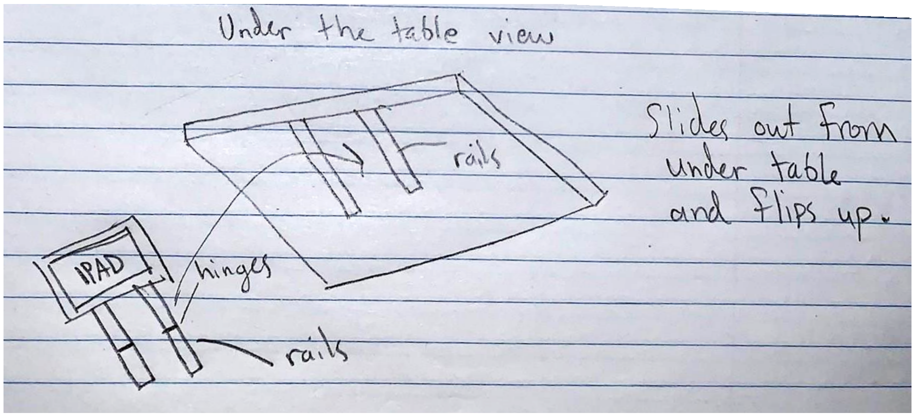


Figure 13: *Diagram of Idea #13*

Idea #14:

Similar to other ideas discussed above, this one has a tablet stored inside the table that would be able to flip up and adjust to a usable position. The table's height would also be adjustable. The movements would all be motorized and controlled from a remote.

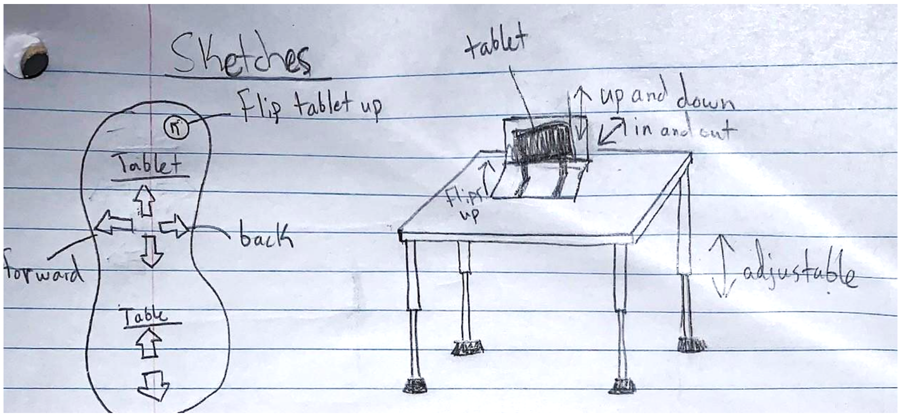


Figure 14: *Diagram of Idea #14*

Idea #15:

This idea uses a sliding cover design with the tablet then flipping up and adjusting after the cover slides away. This sketch also focuses on the table design itself, including adjustable height.

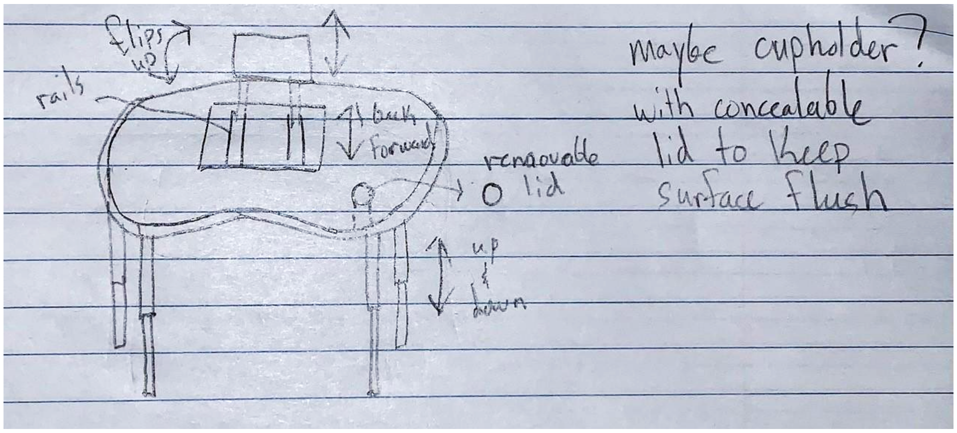


Figure 15: *Diagram of Idea #15*

2.3 Analysis of Ideas

In this section each of the brainstormed concepts above will be ranked on their ability and or potential to fulfil each of the following metrics established in the last deliverable on a scale of 1 to 5. Where 5 is the idea being capable of meeting ideal specifications and 1 is the idea not being able to meet those specifications. From these rankings a total score will be calculated by using both the ranking and the priority of each metric (Sample calculation can be found in Appendix I).

Table 1: *Table of the Ranked Values and Overall Scores of Concepts 1-5*

Priority	Metric	Idea #1	Idea #2	Idea #3	Idea #4	Idea #5
5	Force table can hold	5	5	5	3	5
	# of sharp corners	1	1	1	1	4
4	Expected lifetime	4	4	4	3	4
5	Tablet angle range	5	4	3	5	2
	Tablet height range from table	1	1	1	5	1
	Tablet range (back and forth)	2	2	2	5	1
2	Tablet visibility when not in use.	3	1	1	1	5
4	Electric / remote control	4	3	2	5	5
3	Tablet is securable	5	3	1	5	5
2	% of table available when tablet not in use	3	3	2	5	5
	Table size	5	5	5	N/A	N/A
3	Table height range	5	5	5	N/A	N/A
1	Material	5	5	5	N/A	N/A
5	Development time	3	4	5	N/A	N/A
4	Cost	3	4	5	1	5
-	**Total Points**	**186**	**176**	**158**	**158**	**156**

Table 2: *Table of the Ranked Values and Overall Scores of Concepts 6-10*

Priority	Metric	Idea #6	Idea #7	Idea #8	Idea #9	Idea #10
5	Force table can hold	1	5	5	4	4
	# of sharp corners	1	5	5	5	5
4	Expected lifetime	2	5	4	4	4
5	Tablet angle range	4	5	5	5	4
	Tablet height range from table	5	5	4	5	1
	Tablet range (back and forth)	5	5	4	3	1
2	Tablet visibility when not in use.	1	3	3	3	5
4	Electric/remote control	4	1	1	1	1
3	Tablet is securable	3	5	5	3	5
2	% of table available when tablet not in use	5	5	5	4	5
	Table size	N/A	5	4	5	5
3	Table height range	N/A	4	4	5	1
1	Material	N/A	5	4	4	5
5	Development time	N/A	5	4	3	4
4	Cost	1	4	4	3	4
-	**Total Points**	**129**	**248**	**226**	**209**	**179**

Table 3: *Table of the Ranked Values and Overall Scores of Concepts 11-15*

Priority	Metric	Idea #11	Idea #12	Idea #13	Idea #14	Idea #15
5	Force table can hold	5	3	3	3	3
	# of sharp corners	5	3	1	1	5
4	Expected lifetime	4	3	3	3	3
5	Tablet angle range	1	5	3	3	3
	Tablet height range from table	1	4	4	4	4
	Tablet range (back and forth)	1	4	4	3	3
2	Tablet visibility when not in use.	1	3	5	5	5
4	Electric/remote control	1	3	4	4	4
3	Tablet is securable	1	5	4	4	4
2	% of table available when tablet not in use	1	2	5	5	5
	Table size	5	5	4	4	3
3	Table height range	5	1	3	3	3
1	Material	5	4	3	3	3
5	Development time	5	3	3	2	2
4	Cost	4	4	3	1	1
	Total	**163**	**192**	**182**	**164**	**182**

2.4 Discussion of Best Solutions

2.4.1 Discussion of Idea #5

After successful screening and evaluating the fifteen ideas, concept #5 emerged as the winning idea. Under this concept, the tablet is embedded into the table as a jointed section of the table surface. The tablet is fastened in such a way that the tablet can flip through an angle greater than 180 degrees under the table. The slide fastener on both sides of the tablet controls rotation of the tablet. This way, the user is able to adjust the tablet to desired angle.The table is set to proper height and adjusted carefully to protect the tablet screen from getting damaged under the table.

This design idea is feasible. It is also less costly and it is time efficient because it has fewer subsystems. Even though this idea is less complex it is still able to fulfil all the project specifications as shown in Table 1 above.

2.4.2 Discussion of Idea #7

Idea #7 illustrates the concept of a paper-punch mechanism. This mechanism has the lower side fixed on the table, and the upper side, which is the movable part, has holes for fixing a tablet holder. The tablet is held in place by a pair of braces on corners to stop it from sliding off the holder. The two parts of the mechanism are joined by a pin lock that controls rotation of less than 90 degrees along the vertical plane.

This concept is feasible but might cost a little more in terms of money and time. The braces at the corners of the tablet holder could be incorporated to the first idea, as they provide extra security for the tablet which was an aspect that the client highlighted the importance of.

2.4.3 Discussion of Ideas #1 & #10:

These two ideas are similar and could easily be merged. These concepts have a tablet that can be housed in the table. The upper surface (The sliding lid) works in the way a CD tray comes in and out of a computer. It slides off of the open space that the tablet is housed in to allow the tablet to be accessed, then slides back to cover the open tablet house, thereby maintaining a uniform table surface. The sliding lid could be automated by installing rollers or can be fastened to a hinge that allows 360 degrees rotation on all axes.

This concept is feasible but will cost considerably more time and money than the previous ideas. For these reasons, this idea is not as ideal as the previous two options. The tablet house, and the sliding top increases the number of subsystems and the complexity. In future, the team could work on this as another tablet holder model.

All these concepts are independent of the adjustable table. For all these ideas the team is going to use an adjustable table that is made of the materials of customer's preference. In each case, the table can be a single surface or have a cavity for the tablet. The team's focus is mainly on the tablet subsystem since adjustable tables are already in the market.

2.5 Final Design Concept

The final concept was created by combining the best ideas. This was done in order to generate a concept that represents our collaborative effort. In case the result of the combination does not meet customer needs, the team would consider better ideas, as they could still be helpful. For the tablet holding system, it was decided to move forward with idea number 5 and refine the concept as the project progresses. Our most promising plan is to design a tablet holder that can be flipped under the table.

In order to prevent the tablet from sliding off the holder, the tablet is held in place by a pair of braces on the cornes. The team has decided that a variation of the marial for the table holder will be moving on to a more detailed design phase.

Due to the low number of parts in the tablet holder, it should be relatively easy to construct and design. The tablet is fastened in such a way that the tablet can adjust to any angle between 180 degrees and 90 degrees. Adding straps to the tablet will prevent the tablet from dropping.

The slide fastener on both sides of the tablet controls rotation of the tablet. It can quickly switch out between reading, communicating, or working on the computer. Also it can be tucked away when not in use. The tablet is embedded into the table as a jointed section of the table surface, guaranteeing no interference with the client’s other devices.

This concept had the lowest point in terms of adjustability. This tablet tray is going to be based on the dimensions and height of the client's wheelchair.

2.5.1 Visual Representation of Final Design Concept

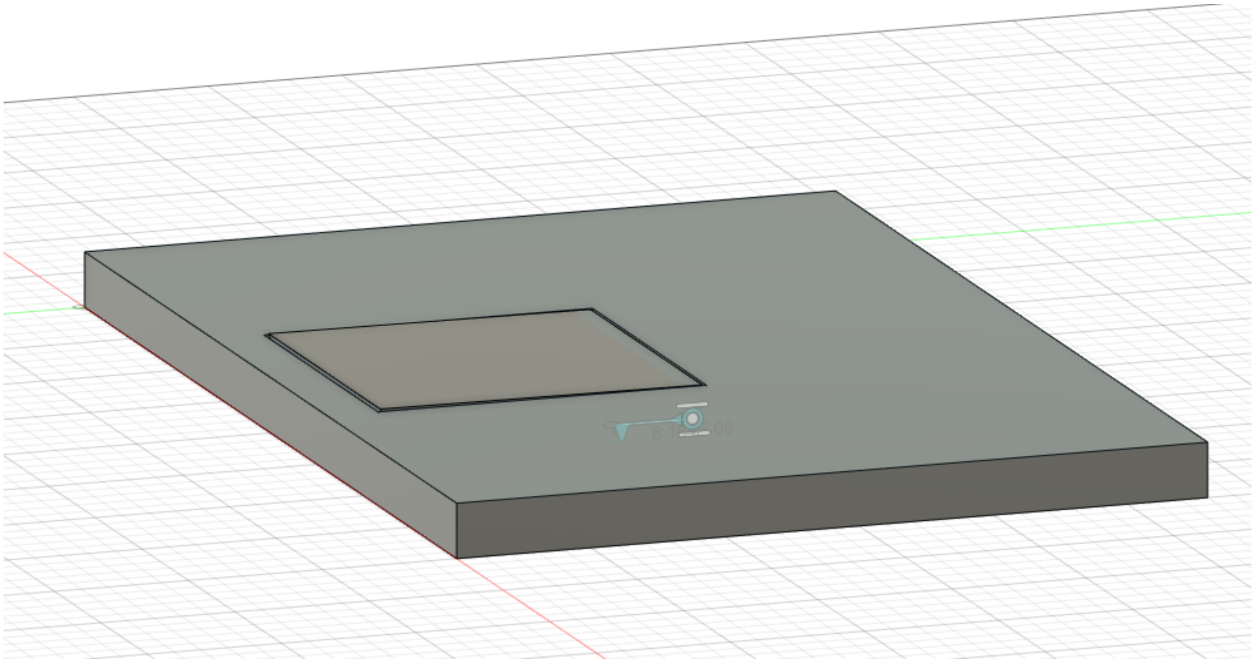


Figure 16: *Final Design Concept Closed Position*

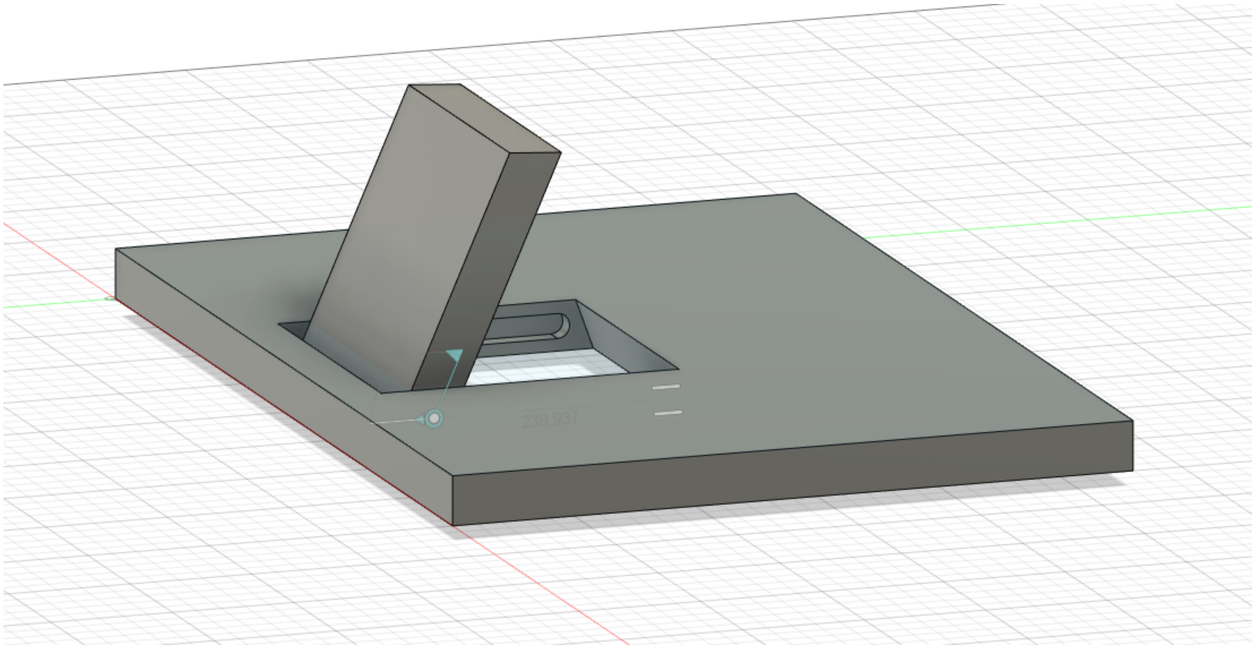


Figure 17: *Final Design Open Position*

2.5.2 Final Design Concepts Ability to Reach Target Specifications

The final concept was able to fit many of the design specifications. The concept is also able to fit some of the more important metrics that were set out. It particularly excels at meeting the need of being able to hide the tablet when it is not in use. It is able to make the table multiuse. The concept does not reach any of the table height needs because it neglects to include direct information about table legs. However this is a trade off made so the other needs can be met much more effectively. Some of the table height needs also needed to be neglected in order for the final product to continue to be feasible. Overall this final concept is able to meet the majority of the target specifications.

3. Conclusions and Recommendations for Future Work

To conclude, the team conducted a brainstorming session where fifteen design ideas were generated. Each idea is a reflection of the core design functionality, that is, tablet adjustable and table adjustable. After brainstorming, the team underwent a screening and evaluation session to select a feasible and better design concept. The results are as shown in Table 1, 2, and 3 above. This lead to the selection of three outstanding ideas (#5, #7, #1&10 merged) among the fifteen. The final three ideas helped in the formulation of the main project idea which is visually represented in Figure R and Figure S. The final design idea's ability to reach the desired specifications is accessed using the list of metrics and constraints to the project execution and planning.

All the design ideas were brilliant. In the future, the team would try creating different models of tablet holders by implementing the rest of the ideas. Also, one could incorporate more advanced technology into the device electronic subsystem to complete the automation of the product.

Appendix I:

Sample Equation for calculating idea points:

For Idea #1:

$total\, points\ =\ \Sigma(priority\ \times\ rank)$

$=\ (5\ \times\ 5)\ +\ (5\ \times\ 1)\ +\ (4\ \times\ 4)\ +\ (5\ \times\ 5)\ +\ (5\ \times\ 1)\ +\ (5\ \times\ 2)\ + \ldots +\ (4\ \times\ 3)$

$=\ 186$ points