uOttawa

PD-D: Detailed Design, Prototype 1, BOM, Peer Feedback & Team Dynamics

GNG2101, Section #A01
Team #2

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PM: Ayesha Khan
TA: Ravisha Sharma

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1. Introduction

This deliverable will go over the client feedback that was received in meeting number two and the improvements made to the team's final product design. First of all, the client's feedback was discussed as a team and it was decided what the more crucial design features were to be. The feedback was then implemented into a more refined final tablet holder design. This improved final design was then further refined and made into the team's first analytical prototype, which will be covered further in the deliverable. This document will also cover the possible price of the product and some of the minimal testing that could be done on the analytical model.

2. Main Subject Body of the Report

2.1 Summary of Client Feedback

After presenting the final design choices to the clients, the team received the following feedback:

- The tablet holder should be able to move back and forth.
- The tablet should be able to move upward in order to cater to those who do not have much neck mobility.

Overall, the clients were very pleased with what the team had come up with and they were very impressed with the team's design and ability to solve the problem of the stow away tablet. In order to implement the feedback into the design, the team redesigned the tablet holder and created the first prototype in CAD, which will be shown in the deliverable.

2.2 Design Details

Building on the client feedback, a way to adjust the tablet height was added to the design. Apart from that, the design was significantly refined from a basic concept into a model which is restrained to move in a given way. As a ribbon is pulled by a motor, the tablet holder is rotated and pulled along the rails until it reaches the deployed position. The specifics of how the electronics work have not yet been defined, however the basic concept is that pressing the buttons on the front of the table will trigger the arduino to execute a routine which moves the motor.

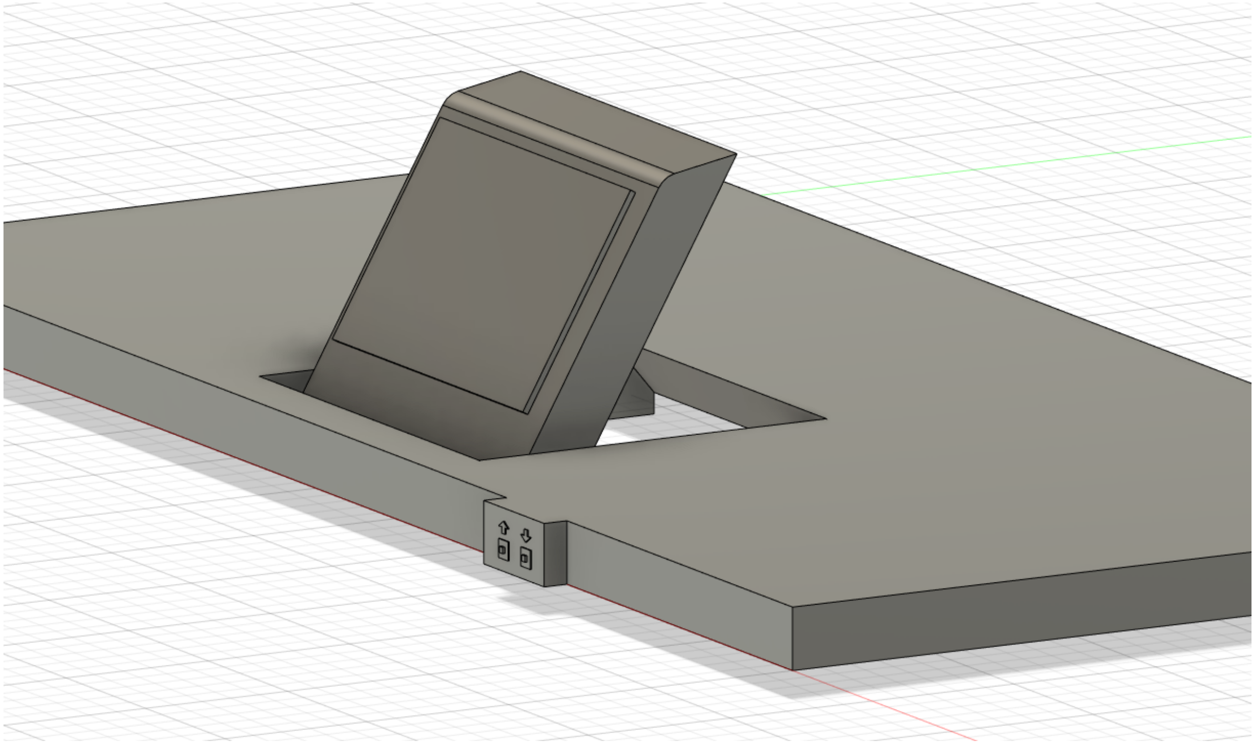


Figure 1: *Product Overview*

Figure one shows the tablet holder in the deployed position. On the front of the table are two buttons allowing the user to move the tablet between stowed and deployed.

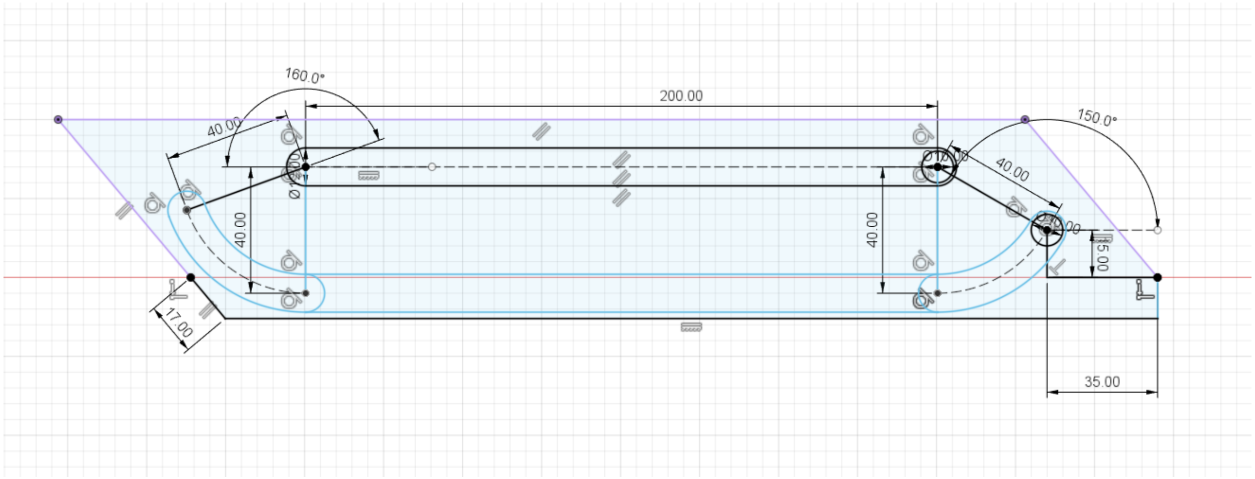


Figure 2: *Sketch of Rails*

Figure 2 shows the shape of the rails. There is a consistent distance between the two rails, meaning that when the tablet is stowed away (Figure 4), the tablet holder is only capable of rotating. Once rotated so the pins are arranged vertically (Figure 5), the tablet holder is now able to move horizontally. While moving horizontally, it is unable to rotate. Once the top pin is at the end of its slot (Figure 6), the bottom pin becomes able to follow the curved path and the tablet holder can rotate into the deployed position (Figure 7).

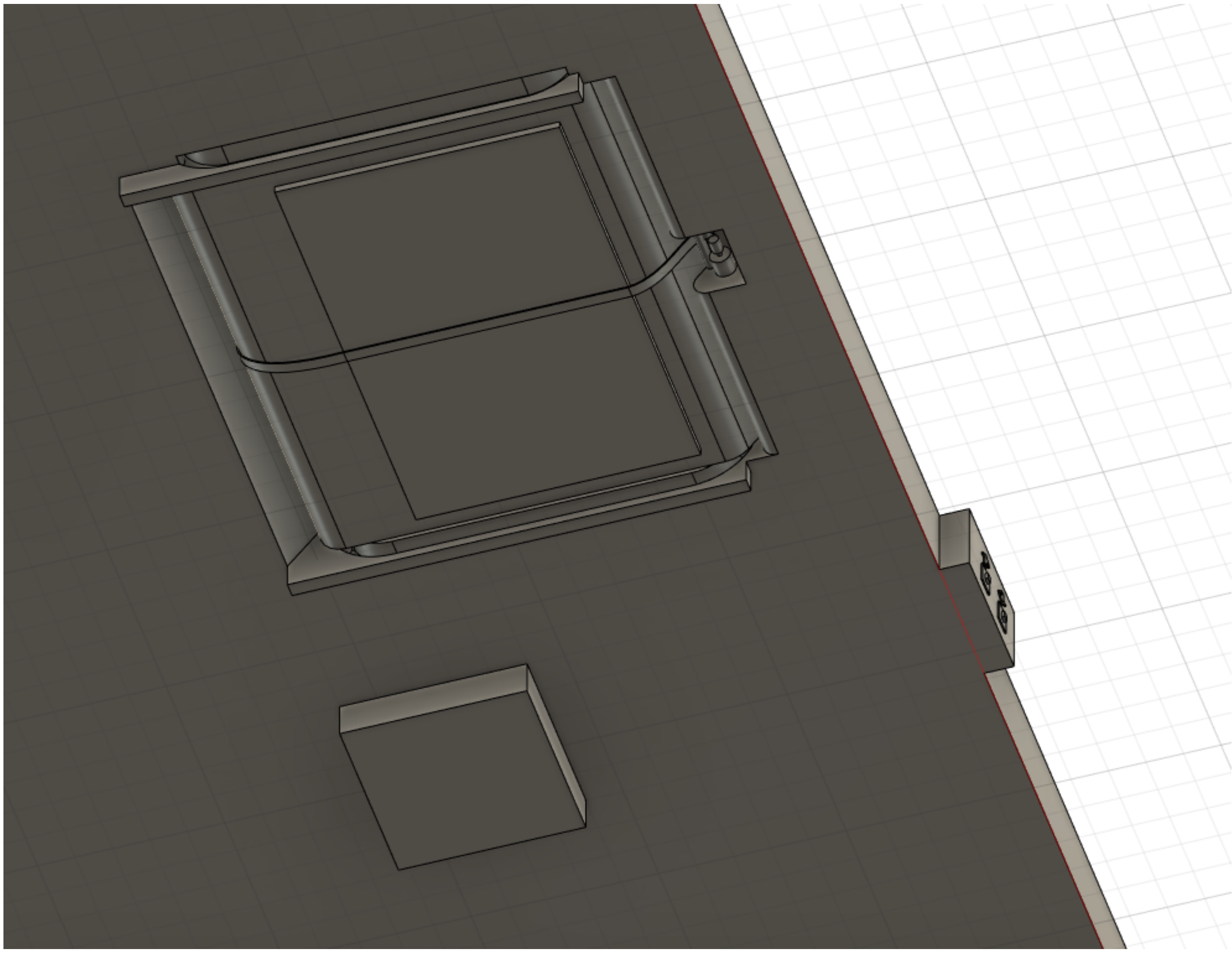


Figure 3: *Bottom View*

Figure 3 shows the bottom of the desk. At the top can be seen the tablet holding tray as well as the ribbon and motor that will pull the tray along the rails into the open position. To the right are the buttons, and at the bottom is the box that will hold the controller.

2.3 Critical Product Assumptions

To aid in the project planning and execution, the following assumptions were made in regard to the adjustable table and tablet holder.

1. The tablet screen will be at a recommended distance from the user to reduce eye strain and related eyesight effects.

2. The tablet's vertical height can be adjusted to an appropriate standard, so that the user maintains a correct posture while using the product.

3. The project costs will remain constant as indicated in the bill of materials. Price changes and extra functional requirements are not expected.

4. The table screen shall be at a reachable distance from the wheelchair and the user. The user can operate the tablet with ease; hands resting on the table surface.

5. The dimension of the wheelchair is in accordance with ADA standards.

6. The materials shall be acquired at the right time as indicated in the project plan. Delays are considered negligible.

7. The table surface shall be able to fit on the legs provided by the user.

8. The schedule task duration will not change, and therefore, the project will be complete as scheduled.

9. The group shall stick together till the end of the project.

2.4 Product Prototype

The CAD prototype makes use of Joints and Contact Sets to restrict the movement of the product along the rails as they would move in real life. Joints allow ranges of motion to be set between two components. A Pin-Slot Joint was used on the top rail for the main motion, and a Slider Joint was used on the tablet holder tray for the height adjustment. Contact Sets prevent components from passing through each other. A Contact Set was used on the bottom rail which prevented the pins from moving in a non-realistic manner.

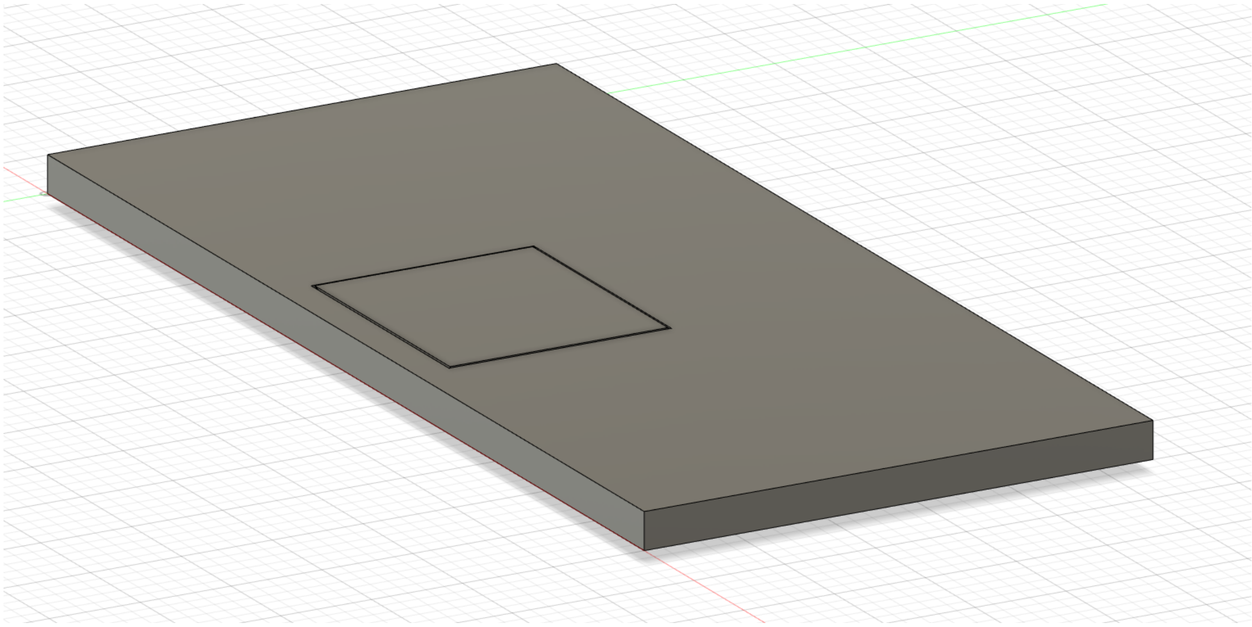


Figure 4: *Stowed position*

Figure 4 shows the stowed position which allows full use of the table surface.

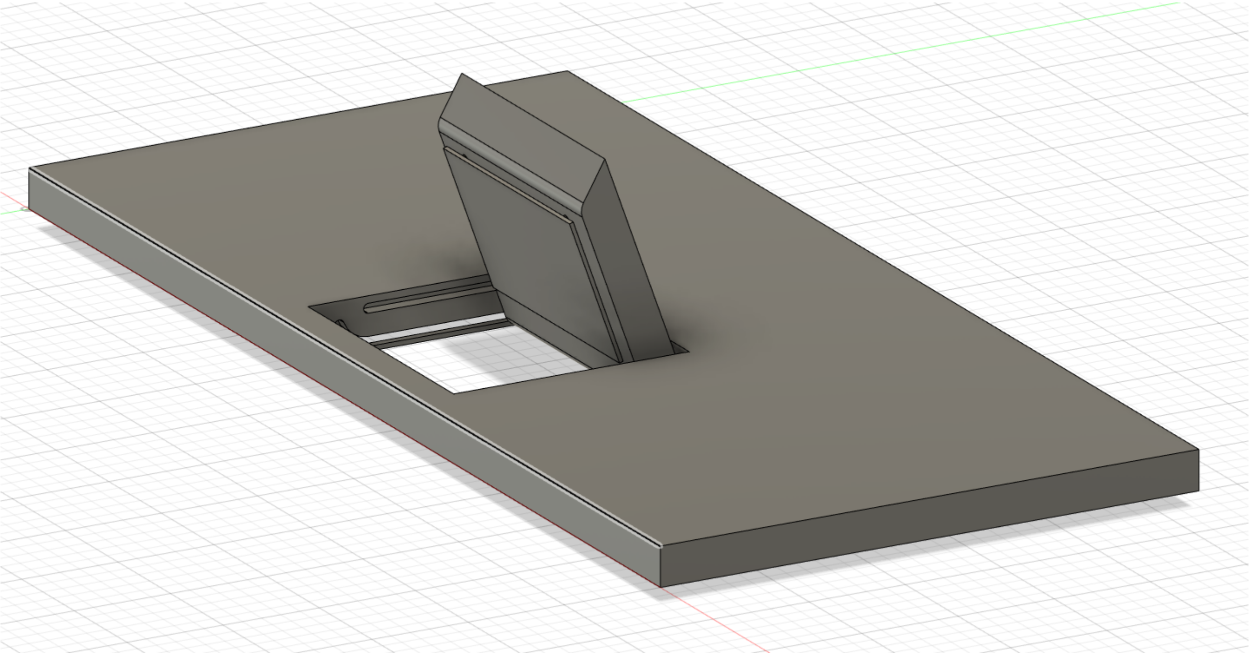


Figure 5: *First Position*

Figure 5 shows the first position which occurs when the pins are vertical. This is the first transition between rotating and sliding.

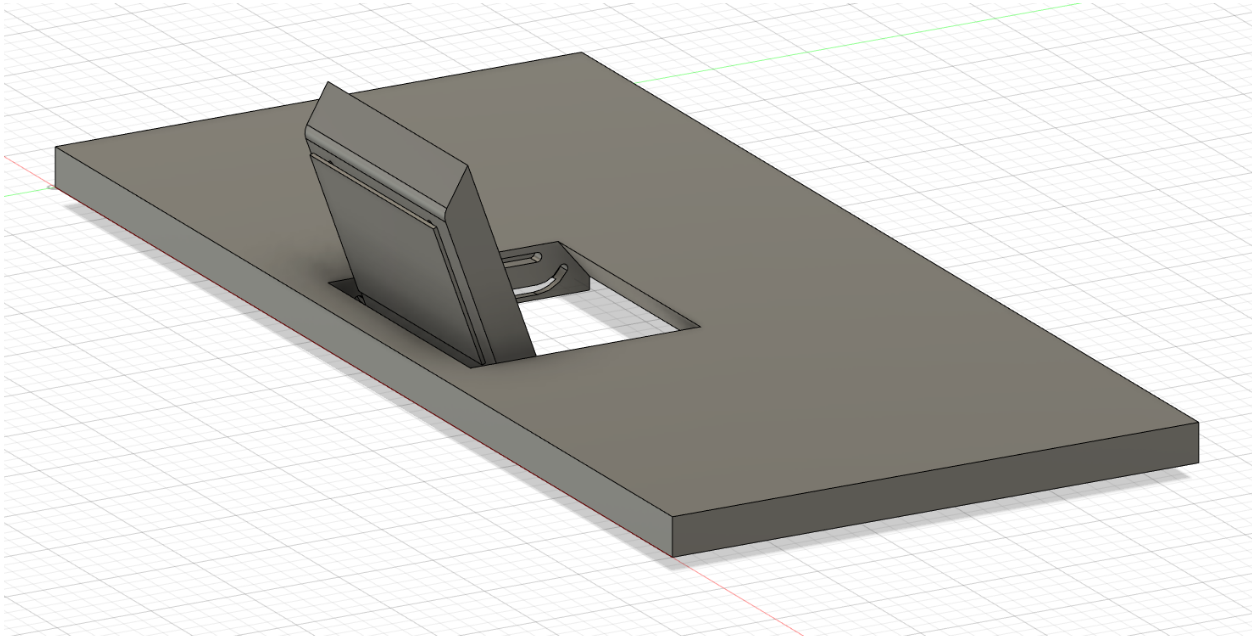


Figure 6: *Second Position*

Figure 6 is the second transition position which occurs when the top pin has reached the end of its slot and the bottom pin begins moving along the curved path.

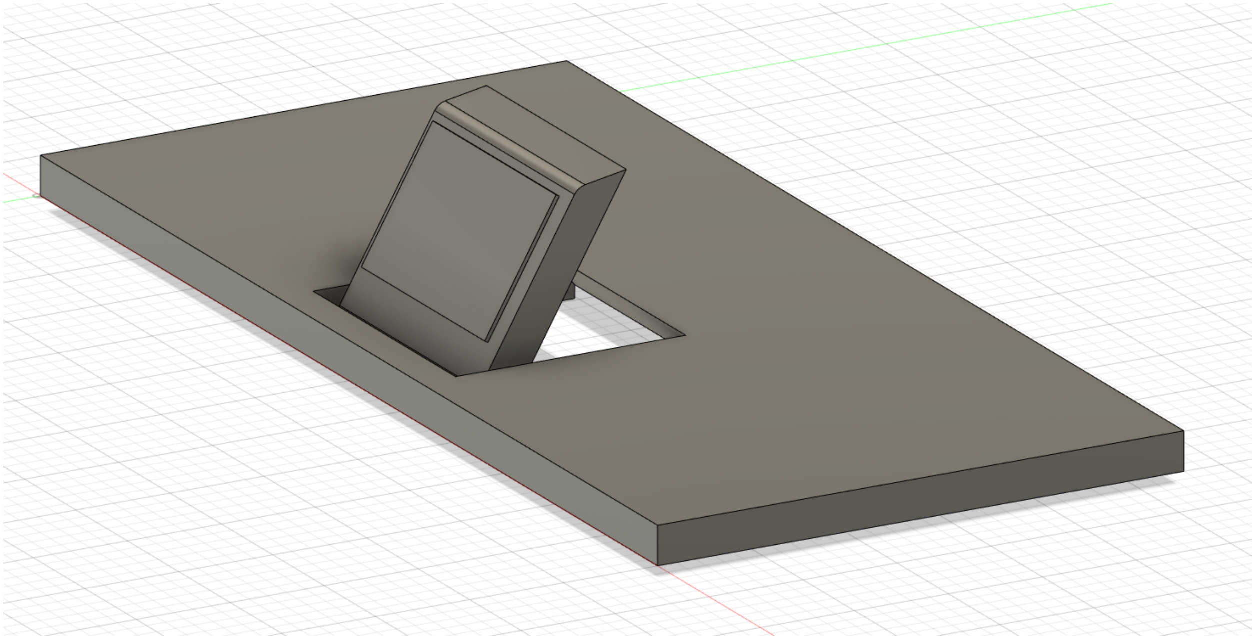


Figure 7: *Deployed Position*

Figure 7 depicts the deployed position which is the end position of the main movement.

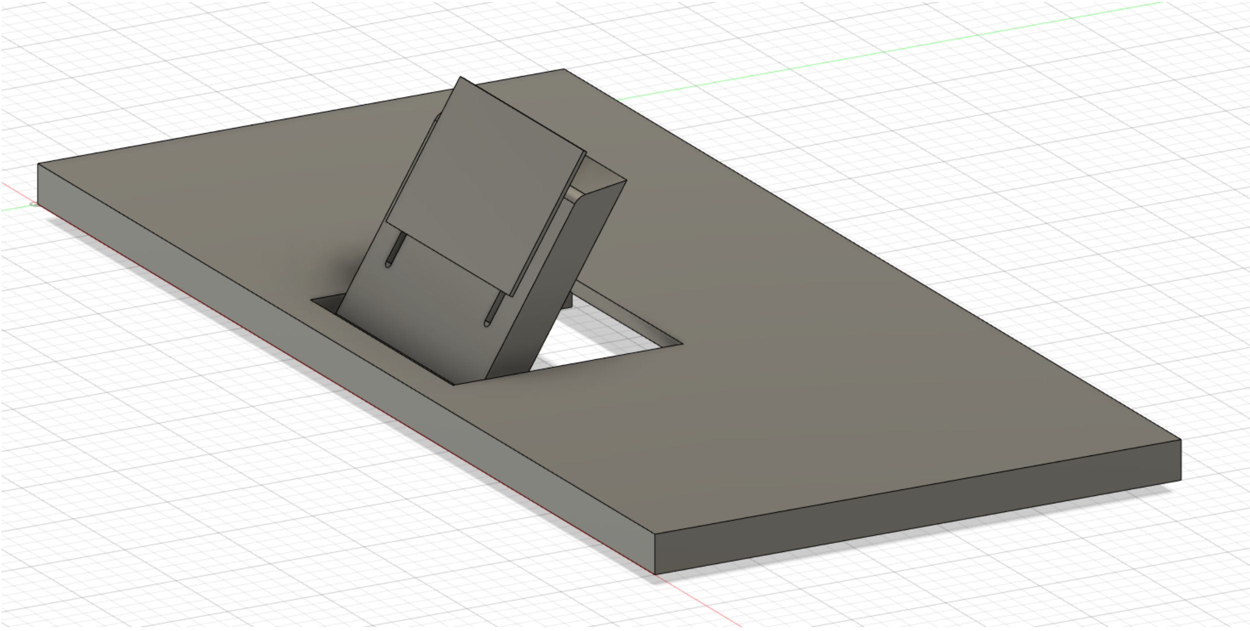


Figure 8: *Height Adjustment*

In Figure 8, the tablet holder can be seen in its fully extended position. This will be accomplished by a geared stepper motor behind the tablet holder.

2.5 Bill of Materials (BOM)

Table 1: *BOM*

Material	Count	Price per unit ($)	Cost ($)	Source
Tabletop	1	9.99	9.99	IKEA (https://www.ikea.com/ca/en/p/linnmon-tabletop-white-00251135/)
Rails/Tablet Holder (Cut from MDF)	4	4	16	Maker Store
Arduino	1	17	17	
Power Supply	1	14.50	14.50	
Wires (5ft)	2	1.60	3.20	
Button (x5)	1	5	5	
Motors	2	14.39	28.78	Amazon (https://www.amazon.ca/Reversible-Reduction-Electric-15-200RPM-Diameter/dp/B07D28H965/ref=sr_1_53?dchild=1&keywords=electric+motor+kit+arduino&qid=1633652551&sr=8-53)
Sum			94.47	

2.6 Prototype Testing & Evaluation

Table 2: *Prototype Testing and Evaluation*

Component	Design Criteria		Description	Test	Expected Result	Actual Result
Tray / Functional characteristic	This refer to the characteristic Of the tray and how those characteristic affect aspect of the design	Wight of the assembly	Amount of force extracted by the user to deploy the tray. Amount of force to push the lever, lift the tray,etc	FEA	Stress well	Stress well
		Amount of user motion	This should take in the account the amount of user motion and rotation is necessary to deploy	FEA	Smooth and little function	Smooth and little function
		Adjustability of tray	Can the tray have multiple configuration and be adjust by the user	Not tested	Vertical and horizontal adjustment	Not tested

3. Conclusions and Recommendations for Future Work

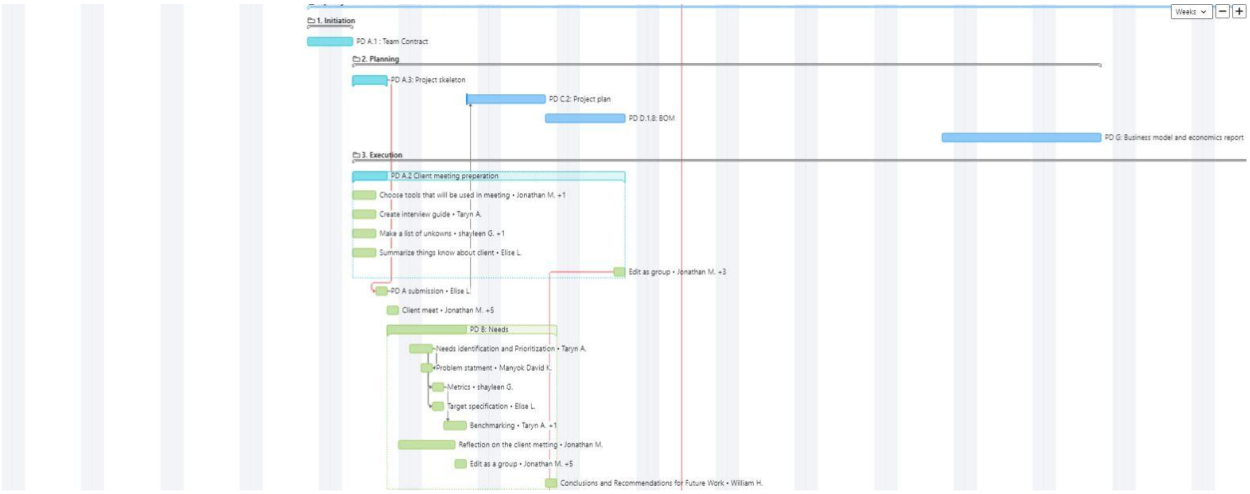
In Conclusion, this deliverable comprises prototype 1 illustrating the final design concept, the analytical test results of the major functionalities and bill of materials. The short CAD animation illustrates the functionality of major parts. The following will be presented to the client during the third client meeting.

1. A CAD low fidelity prototype
2. Incorporated ideas from the previous client meet
3. Updated estimated cost of the project
4. Project setbacks and challenges
5. Conceptual electronic part
6. Changes that have been made since then.

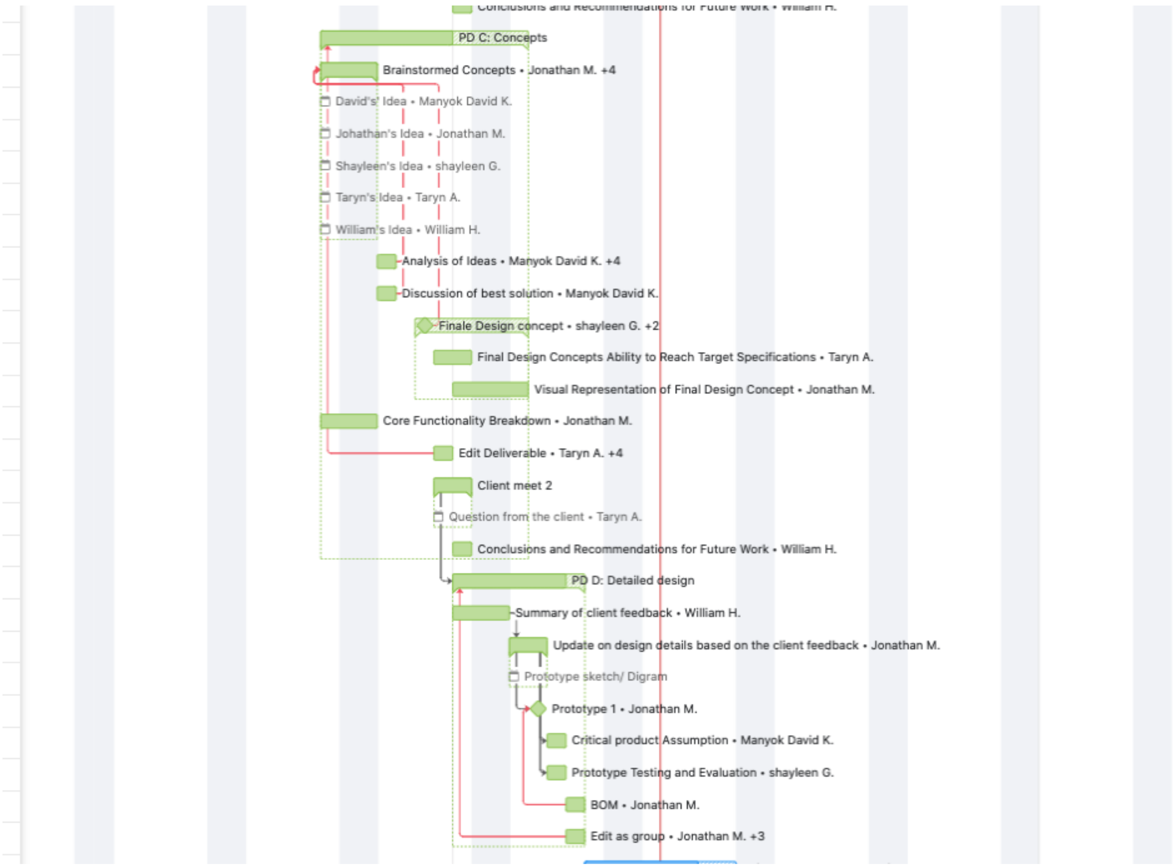
In doing so, we expect to get feedback on our process, positive criticisms on the final design concept and prototype, and suggestions for a second prototype.

In the future, we would like to incorporate more advanced electronic subsystems as a part of the team's automation plan.

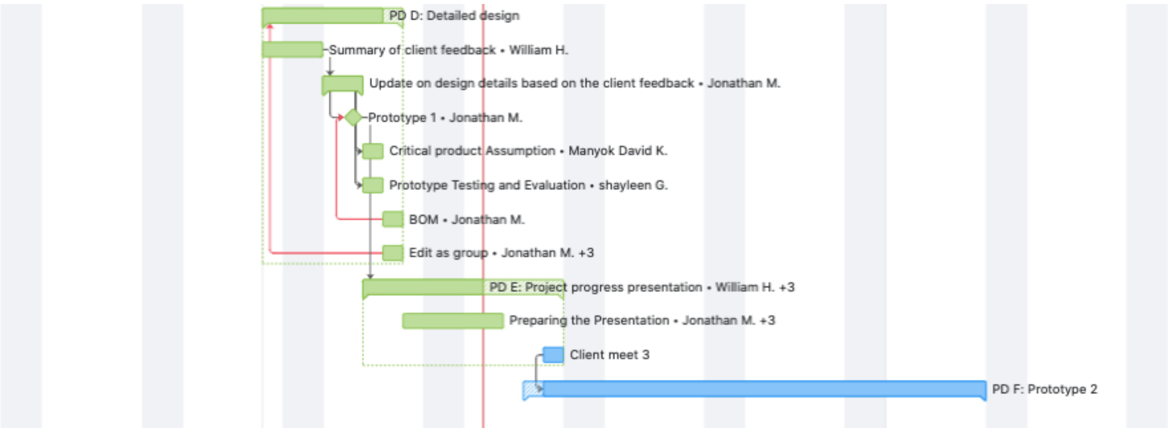
4. Project Plan (Update)



1. Initiation
PD A.1 : Team Contract
2. Planning
PD A.3: Project skeleton
PD C.2: Project plan
PD D.1.8: BOM
PD G: Business model and economics report
3. Execution
PD A.2 Client meeting preperation
Choose tools that will be used in meeting • Jonathan M. +1
Create interview guide • Taryn A.
Make a list of unkowns • shayleen G. +1
Summarize things know about client • Elise L.
Edit as group • Jonathan M. +3
PD A submission • Elise L.
Client meet • Jonathan M. +5
PD B: Needs
Needs identification and Prioritization • Taryn A.
Problem statment • Manyok David K.
Metrics • shayleen G.
Target specification • Elise L.
Benchmarking • Taryn A. +1
Reflection on the client metting • Jonathan M.
Edit as a group • Jonathan M. +5
Conclusions and Recommendations for Future Work • William H.



Conclusions and Recommendations for Future Work • William H.
PD C: Concepts
Brainstormed Concepts • Jonathan M. +4
David's' Idea • Manyok David K.
Johathan's Idea • Jonathan M.
Shayleen's Idea • shayleen G.
Taryn's Idea • Taryn A.
William's Idea • William H.
Analysis of Ideas • Manyok David K. +4
Discussion of best solution • Manyok David K.
Finale Design concept • shayleen G. +2
Final Design Concepts Ability to Reach Target Specifications • Taryn A.
Visual Representation of Final Design Concept • Jonathan M.
Core Functionality Breakdown • Jonathan M.
Edit Deliverable • Taryn A. +4
Client meet 2
Question from the client • Taryn A.
Conclusions and Recommendations for Future Work • William H.
PD D: Detailed design
Summary of client feedback • William H.
Update on design details based on the client feedback • Jonathan M.
Prototype sketch/ Digram
Prototype 1 • Jonathan M.
Critical product Assumption • Manyok David K.
Prototype Testing and Evaluation • shayleen G.
BOM • Jonathan M.
Edit as group • Jonathan M. +3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Critical product Assumption • Manyok David K.
Prototype Testing and Evaluation • shayleen G.
BOM • Jonathan M.
Edit as group • Jonathan M. +3
PD E: Project progress presentation • William H. +3
Preparing the Presentation • Jonathan M. +3
Client meet 3
PD F: Prototype 2