DELIVERABLE D

Detailed Design | Prototype 1| BOM

Peer Feedback and Team Dynamics

SUBMITTED BY

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Abstract

This document intends to illustrate our first prototype, Prototype 1, which will be a low-fidelity prototype focusing on our one-handed walker's connections and wiring system. Our proposed Bill of Materials (BOM) will also be featured in our document. It will include all the necessary components required for the successful completion of our project and the total cost of all items.

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Introduction

This document illustrates the feedback from our client after the second client meeting. It showcases the client's likes and dislikes of the group concept that was presented to her. This document also features the image of our first prototype which will be a CAD diagram of our walker handle etc. The diagram will highlight a specific subsystem in our walker handle which is the connection mechanism. This prototype is a low-fidelity analytical and focused prototype. Subsequent prototypes will illustrate other subsystems which will be tested and compared with our target specifications. This document also includes our Bill of Materials (BOM) which showcases all the components needed for the successful completion of our project. It also states our proposed expenditure in consideration of the budget provided to us. Our future plans will also be stated in this document and it will include the plan for our in-class presentation as well as the plan for testing our prototype.

Client Meet Summary

Feedback Summary

1) The client is not supposed to lift over 5 pounds. Weight of walker attachment – 5lbs arm max.

2) The client's height – 5'7, a comfortable height range for the handle to reach – is just below her chest, at the elbow bending level.

3) The client plans to use a walker regularly. Dislocates shoulder 8-12 times a day.

4) On a bad day, the client is volatile and needs good support from the walker.

The client's current walker has bigger wheels. Her regular one uses smaller wheels.

5) Client expects the timeframe of the walker to be 4-5 years (although she realizes that it might not be feasible).

6) Expected folding time of walker – highest up to 5-7 minutes.

7) Client needs light at a wide angle to see left and right a couple of steps ahead.

The client loved the adjustability concept for the connections of the handle to the walker.

Concept Feedback

The client asked about the light bar and where it will be positioned. She stated a preference for the light to be anchored at the side of the walker. She indicated that the light bar should be versatile. The client loved the handlebar idea and noted that it would make things easier for her if it was positioned at the front.

Client concerns

She expressed concern about the positioning of the handle brakes. She feels that if she pulls it hard enough, it could break because it is not sturdy enough. She feels the handle brake should be adjusted to the front where the probability of breakage will be low. She requested a strap on the handle that could be fastened to her wrist/hand because she loses strength in her arms and hands when she dislocates her shoulder.

Client Priorities

According to Project Deliverable C and the feedback from the previous client meeting:

- The client expressed that **positioning a handlebar at the front** would be huge for her.
- The client indicated that she is not allowed to lift a weight over 5 pounds so the handle must be **lightweight.**

Prototype 1

Product Assumptions

After turning client statements into needs and needs to metrics, we were able to generate quantifiable qualities for our product, and after benchmarking similar products we put together some target specifications that we are trying to meet. After our second client meeting, we validated some of our target specifications, while adjusting some others. Taking these polished specifications, we can generate some critical product assumptions for our prototype of the connections subsystem:

- Our product can fit walkers that are 24”-32” wide (8” range)
- Our product is made of materials that corrode at less than 0.28μm/year
- Our product adds less than 6” of height to the walker
- This subsystem costs less than $30
- Our product can attach to walker handles ranging from 1.25”-2” in diameter

Documentation of Prototype 1

Connections Sub-System:

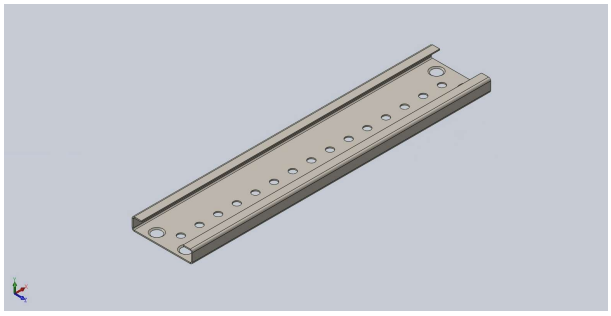

Figure 1.1 Rail

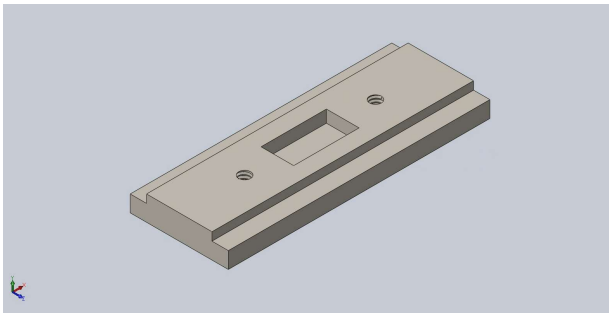

Figure 1.2 Slider

Figures 1.1 and 1.2 show the components of this subsystem that allow it to attach to walkers of varying widths. The slider is allowed to slide along the length of the rail, and can be fixed in any position where the tapped holes on the slider line up with the holes on the rail. The tapped holes are size #14 diameter with a 20 tpi thread. The tapped holes are 1” from either end of the slider and 2” apart from one another. The holes in the rail are also a #14 diameter and ½” apart and ½” from the end. The countersunk holes in the four corners fit a #8 100 countersunk screw for fastening the rail to the rest of our attachment. The rail is made of a stainless steel sheet and the slider is also stainless steel, for low corrosion rate with high strength and low cost.

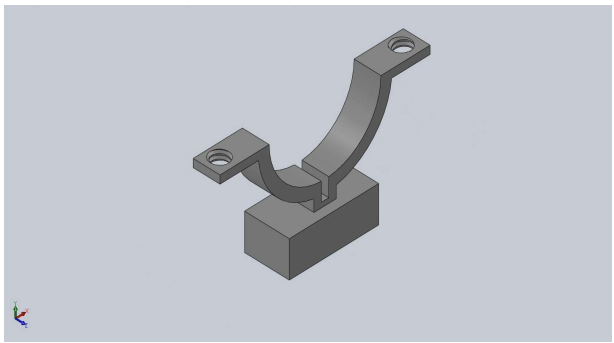

Figure 1.3 Clamp Bottom

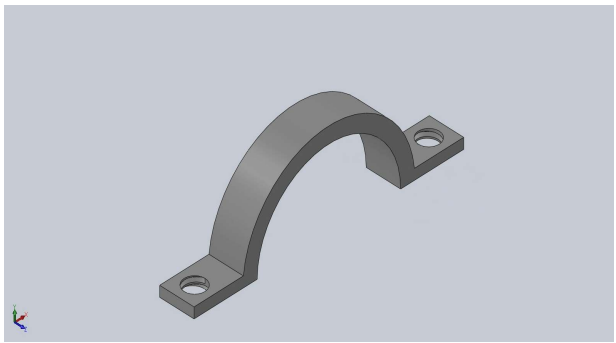

Figure 1.4 Clamp Top

Figures 1.3 and 1.4 show the top and bottom of the clamp which wraps around the walker's handles. They use the same thumb screws as the slider and rail and the inner diameter of the clamp is 1 ½". The material is PP copolymer plastic, which is strong, weather resistant, and semi-rigid, which will allow it to form to fit diameters larger than 1 ½" without breaking.

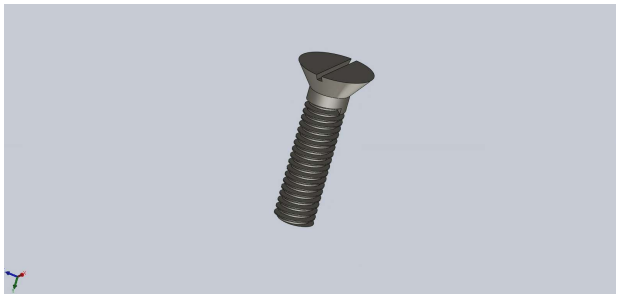

Figure 1.5 Machine Screw

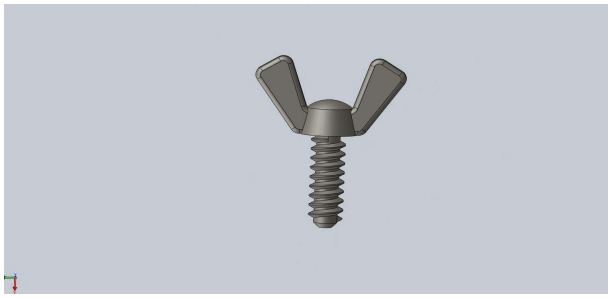

Figure 1.6 Thumb Screw

Figures 1.5 and 1.6 show both the machine screws and thumb screws used in our prototype. The machine screw is size #8-32 and are 1" long, while the thumb screw is size #14-20 and ¾" long.

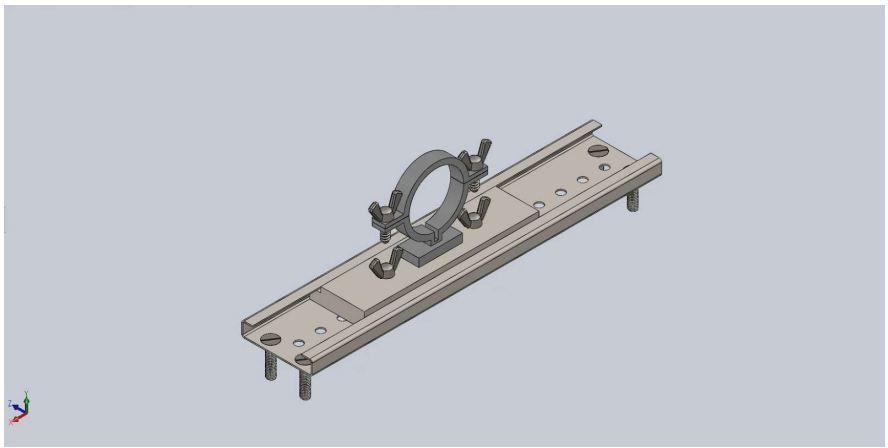

Figure 1.7 Connections Assembly

Figure 1.7 shows the connection subsystem as a whole. The entire subsystem is 3" tall, 8" long, and 2 ⅛" wide.

Lighting Sub-System:

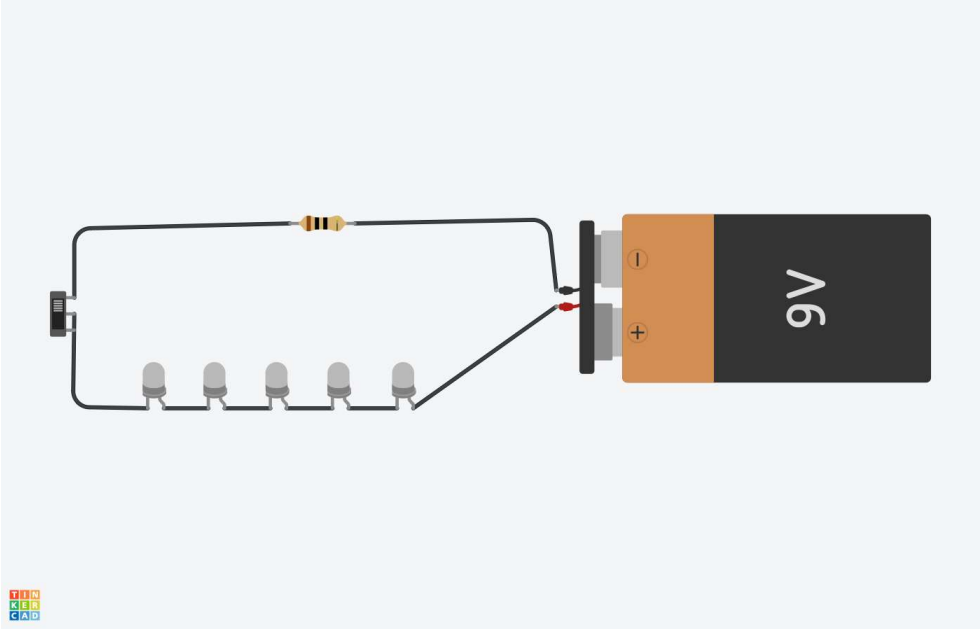

Figure 2.1: Electrical setup for lighting system

Figure 2.1 shows an electrical circuit designed in Tinkercad, which consists of a 9V battery, a resistor, a slide switch, and several LED lights. This will be the foundation of the lighting subsystem which will be further developed to be weatherproof and durable. The simulation in Tinkercad proves the circuit to be functional with all of the LEDs lit depending on the position of the switch.

Testing

Connections Sub-System:

- Our product can fit walkers that are 24”-32” wide (8” range): Each slider has a range of 5” in ½” increments, so with a slider on each end our product has a 10” range, which is greater than our target of 8”

- Our product is made of materials that corrode at less than 0.28μm/year: Any metal in the prototype is stainless steel, which typically has a corrosion rate of between 0.05 and 0.25μm/year, and the PP copolymer plastic doesn't corrode, which are both below our target value of 0.28μm/year
- Our product adds less than 6" of height to the walker: The entire subsystem is 3" tall, which is below our target value of 6"
- This subsystem costs less than $30: 8x thumb screws: $12.00, 8x machine screws: $6.30, 2x plastic clamps: $18.35, 2x stainless steel blocks: $7.60, 6"x8" stainless steel sheet: $25.06. Total cost: $69.31, which is over twice the cost of our target value. This could be potentially reduced by researching alternatives for materials or cheaper parts.
- Our product can attach to walker handles ranging from 1.25"-2" in diameter: We weren't able to test this because our prototype is an analytical model.

Bill of Materials

The bill of materials is submitted alongside the main content, i.e. this document, as an excel sheet, please see the attachment "**Bill of Materials GNG 2101 A02 A2.1**". This document includes the equipment list, the descriptions and the quantities of the items to be purchased, along with their unit costs and extended costs. Each item is paired with a link where the item can be viewed. The total cost, including taxes and shipping is also provided in this bill of materials.

Future

Our future plans include;

- Testing the connections of our braking system which will feature an attachment that connects to the braking system on the walker itself by means of wires or a wiring system.
- Testing the connections of our lighting system which features a 12V LED strip, wires and an electrical switch.
- The project progress presentation layout
- The implementation and testing of our 2nd and 3rd prototypes
- Design Day presentation

We plan to start all activities regarding the practical and analytical testing of our upcoming prototypes from next week, after our midterm examination period is over. We also intend to present our preliminary prototypes presented in this deliverable to the client, along with our upcoming CAD models of the handle working in unison with the twist lock system. Once we do present our prototypes, we expect the client to have queries about the schematics of our design, which we will hopefully satisfy in that meeting. We also intend to ask the client about their opinion regarding the wiring system's placement on the handlebar.

Wrike

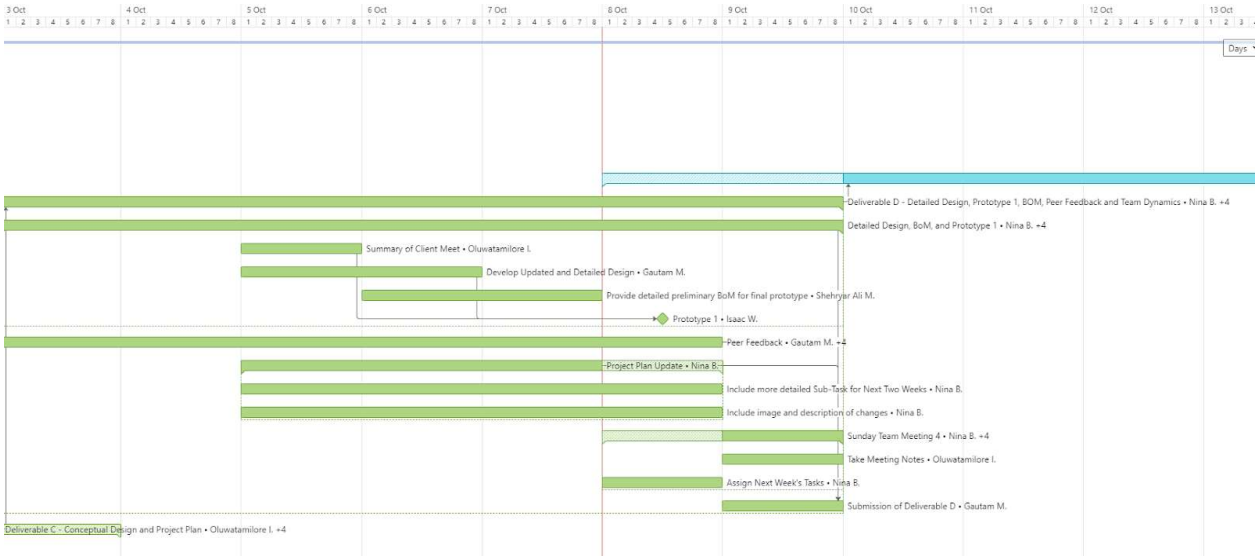

Figure 3.1: Wrike Screenshot for Deliverable D; completed

The figure above shows the plan that the group followed for the previous week. In comparison to when a screenshot was taken before, (figure #), which was the original plan, a lot has changed in terms of the timing and dates of specific tasks being changed. For example, assigning the next week's tasks was changed from the usual team meeting days on Sundays to the Saturday before, due to the person being assigned having prior commitments on that day. One thing that did stay the same is the completion of prototype 1 is an important milestone for us to all meet.

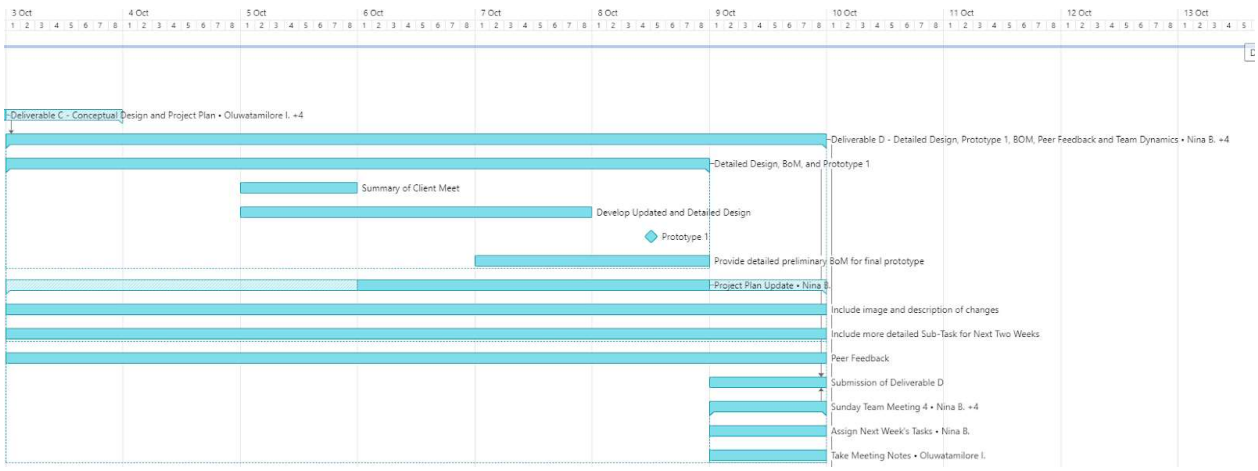

Figure 3.2: Wrike Screenshot for Deliverable D; rough draft

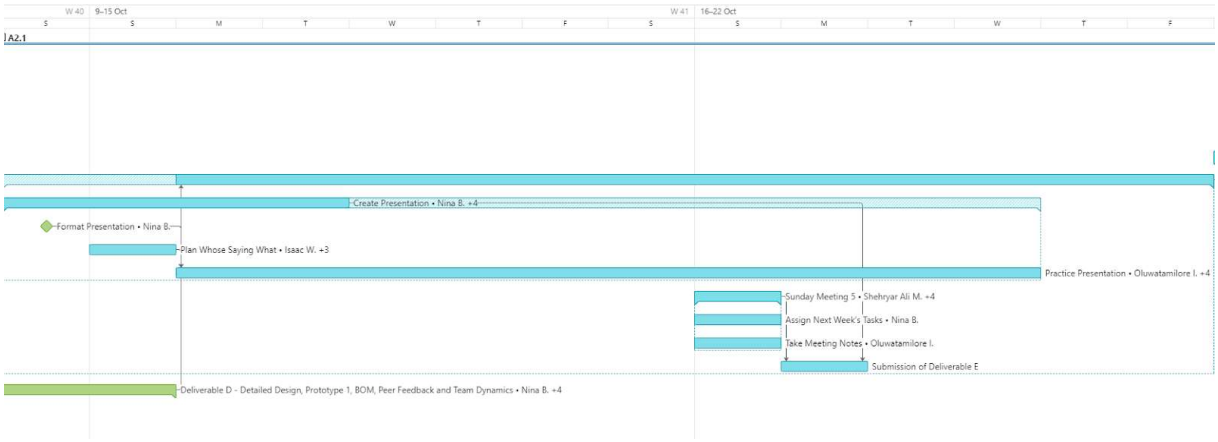

Figure 3.3: Wrike Screenshot for Deliverable E

The above figure outlines the plan for the group for the next two weeks. While we have two weeks to create and practice the presentation, the group thought it would be better to get the PowerPoint presentation completed before every member gets busy with practicing and studying for the midterm examinations in their other courses. Doing this should lessen the stress of every member and allow everyone to put their full focus on studying, and not worrying about an upcoming presentation that may not be completed in time.