DELIVERABLE C

Conceptual Design and Project Plan

SUBMITTED BY:

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Abstract

This document intends to showcase preliminary concepts to the primary user and readers formed according to the target specifications devised in the previous deliverable. It also lays out a plan for the remainder of the project dates.

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Introduction

This document demonstrates our understanding of the project assigned to us, in the form of sketches of our preliminary concepts. Building on the problem statement formulated in the last deliverable, each of us created conceptual designs of each system involved in our walker steering. In this deliverable, we also break down the problem into functions that the attachment should have. It also showcases our plan for the remainder of the project dates: upcoming deadlines and milestones.

Functional Decomposition

Case Diagram:

Move the walker:

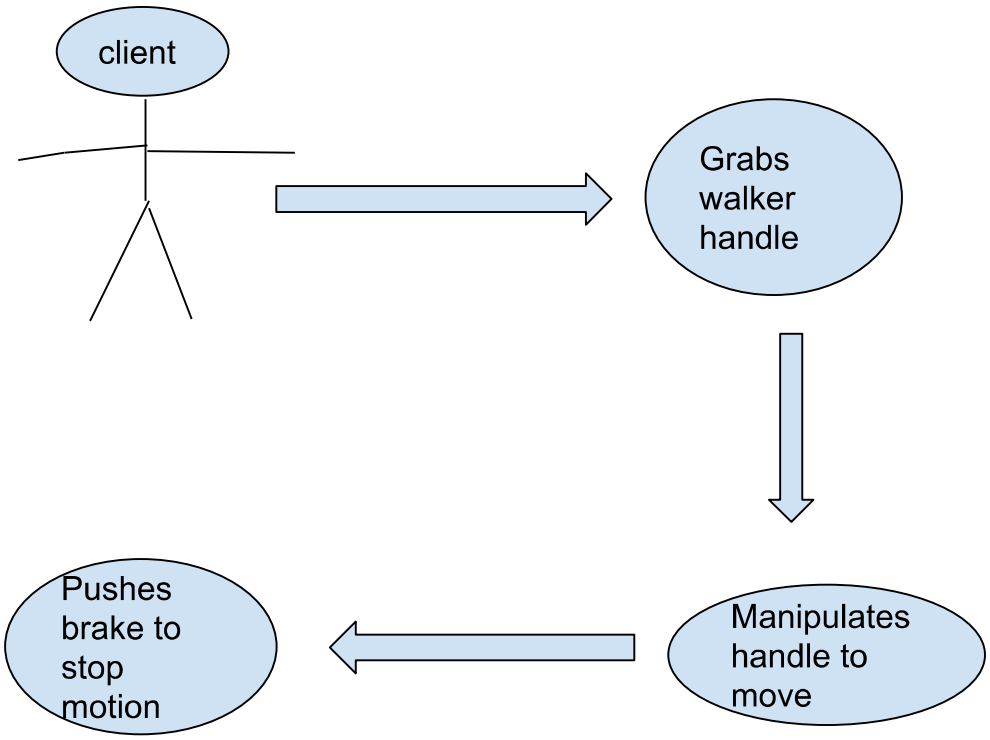

Figure 1:Use Case Diagram

Design Criteria for Walker handle include:

1. Additional force required to move the walker
2. Ease of use
3. Attachment time
4. Folding time
5. Weight of handle
6. Corrosion rate of material
7. Weight capacity (maximum weight handle can support)

Brief explanation of proposed subsystems:

a. **Handle:** A bar made of sturdy material that should support the client's weight, and be able to turn freely in multiple directions (at least left and right) with minimal effort. It should work perfectly in all climates.

b. **Brake:** A device for stopping the motion when using the walker. The device will be installed on the walker handle either mechanically or electrically using a wiring system. Installation onto the walker will make it easier for the client to stop motion.

c. Light source: A light source attached to the handle as well for the client to use at night or in poorly lit areas. The client requested that strobe lights should not be used due to her history of epilepsy. A preferable light source will be an LED.

Concept Generation

For Concept Generation, the group came up with 3 individual ideas, separate from everyone else to avoid outside influence on their own designs. The designs were made from the functional decomposition outlined above.

Generated Designs

Below is a catalogue of each member's designs/concepts:

Nina

Concept 1

A simple design, with a metal bar being clipped to one of the existing handles (securely), and then ‘clamping’ to the other side. This enables the client to easily ‘unclip’ it and swing it to the other side to allow them to fold it. In the middle, a break would be added to allow the client to still apply the breaks on the walker.

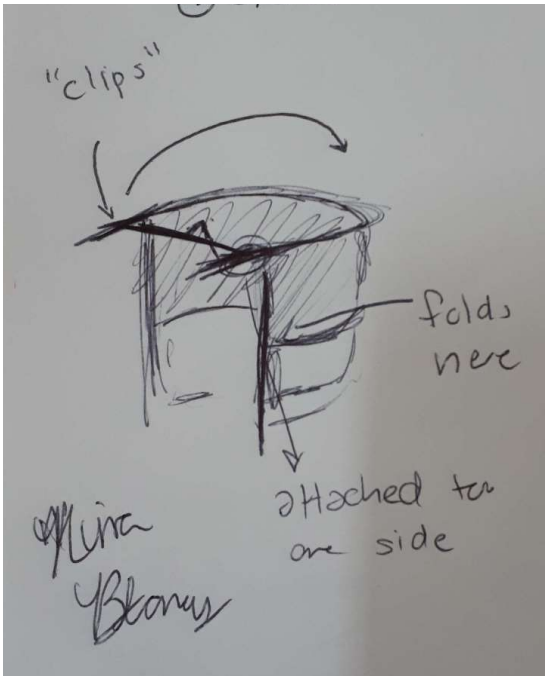

Figure 2: “Cross-Bar”

Concept 2

Figure 3: "Brake Concept"

For this design, a close-up is done on the first concept developed. However, there is a difference, in where an upright handle is attached in the middle, and where a handle would be attached. The idea behind this design is to allow the client to have a handle to firmly grip and use the braking system without putting strain on one hand due to limitations.

Concept 3

Figure 4: "Umbrella Extender"

With this design, a three-point attachment is used. The thought behind this design is that the attachment in the front would be fixed, while the other two attachments would be sliding up and down their respective sides, whereas when the product is brought straight up, the other two would be right next to the central and fold away from the walker. The central pole would extend, similar to that of an extendable umbrella, with a brake attached to the top.

Tami

Concept 1

Handle attached to a bar placed between the walker handles originally on the walker. A brake is also attached to the handle to make braking easy. Handles also possess padding (probably a soft material to make gripping comfortable).

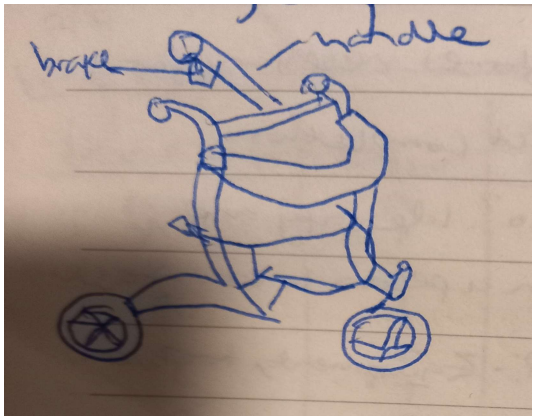

Figure 5: "One-handed walker steering pivoted at the centre"

Concept 2

A metal bar is placed horizontally between the two walker handles on the original walker. The client will grip the handle at this point. The handlebar has soft material as a protective covering. Brakes can also be attached under the handle.

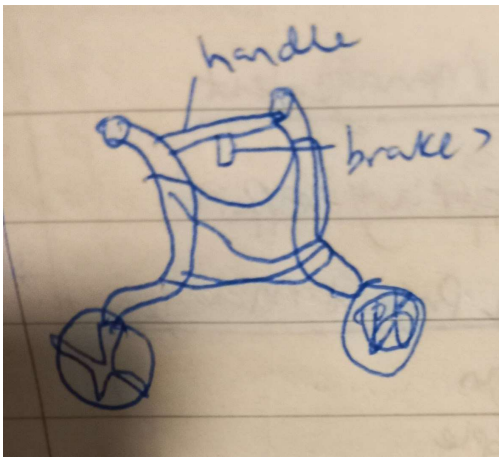

Figure 6: "One-handed walker attachment placed horizontally between both sides of the walker"

Concept 3

Mini- steering wheel attached to a walker through a wiring system for the client to use to navigate while seated or standing with the walker.

Figure 7: "A mini steering wheel"

Isaac

Concept 1

The hand brakes from the walker are attached to the brake on the product by a cable. When the product's brakes are engaged, the cable is pulled up, tightening it, which engages the walker's brakes.

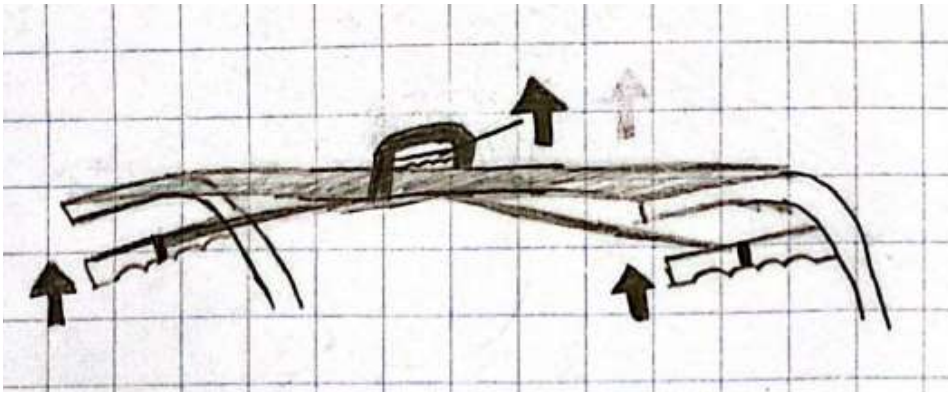

Figure 8: "Braking"

Concept 2

The attachment is made of 3 parts that are held together by hinges. The centrepiece has flaps on either side that fold down to lock the attachment in its extended position. The side pieces have grooves for the flaps to lock into.

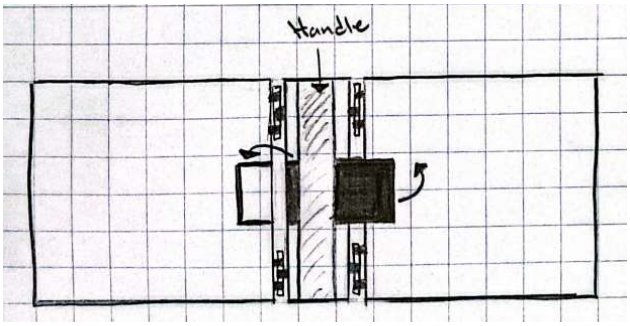

Figure 9: "Folding"

Concept 3

The clamp wraps around the walker's handle and squeezes it as the screw is tightened to secure it in place. The clamp is attached to a slider, which is inside a rail. When the screws on the slider are loosened, it is able to move along the rail so it can be used for walkers of varying widths. When the screws are tightened, the slider is pressed against the lips of the rail, securing it in place.

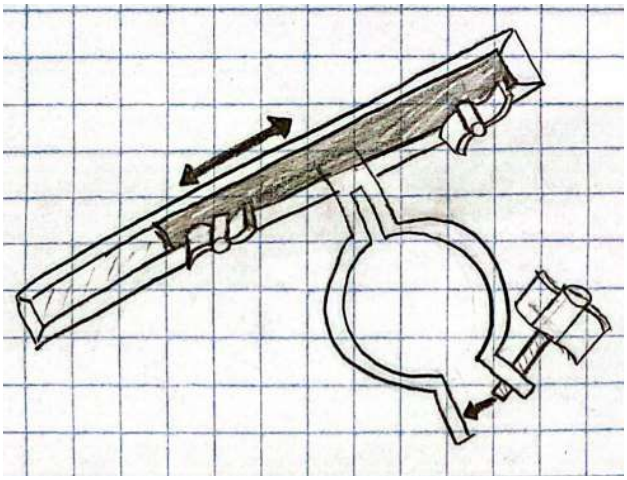

Figure 10: "Connections"

Gautam Mehta

Concept 1

This concept consists of a solid bar which will be attached on both ends onto rails. This will allow the bar to change angle and turn left to right. The bar will be able to be adjusted with one hand for easy operation. It will also be able to lock in certain positions for a fixed movement.

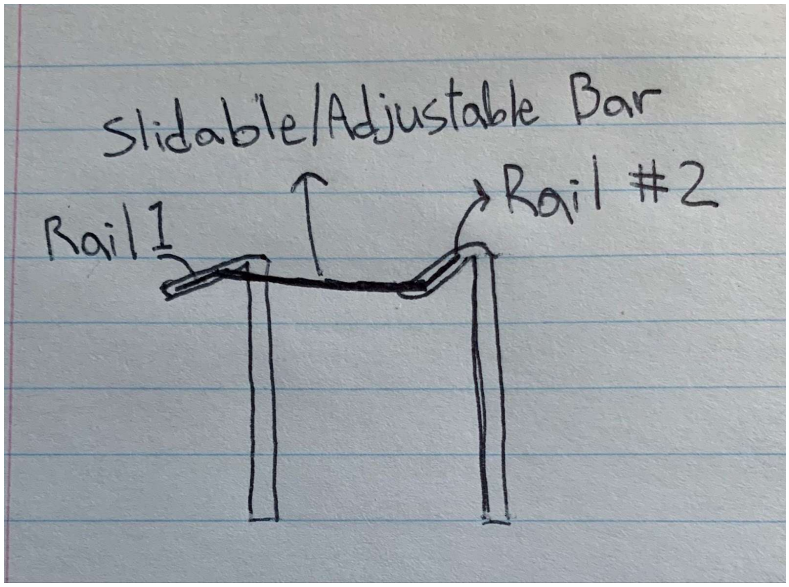

Figure 11: "Bar"

Concept 2

The braking system displayed in this concept has one set of brakes and one set of handles. This allows for a braking force to be applied on either side of the walker. The brakes will mechanically activate when the brake handle is compressed and the brake cable is pulled.

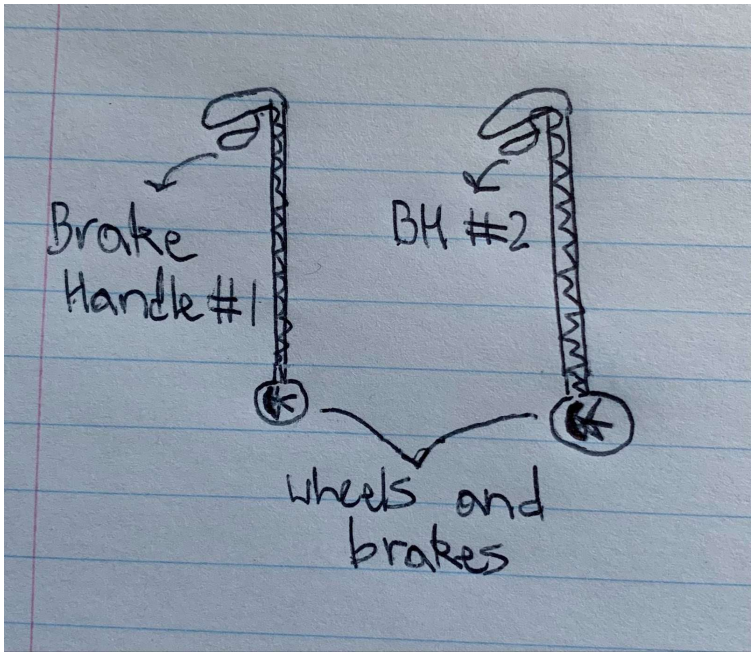

Figure 12: "Brakes"

Concept 3

For the pathway light, a wide-angle LED light bar will be used. This is because someone using a walker in the dark should have a wide field of view. An LED is also a great choice because they are bright and energy efficient.

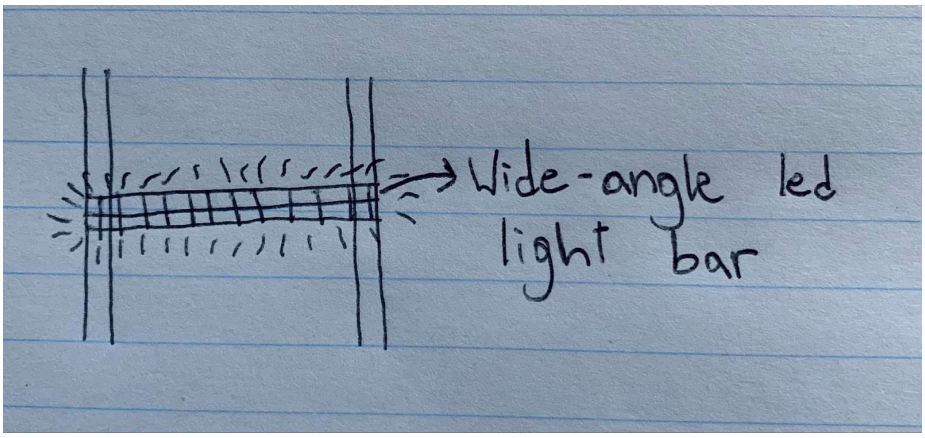

Figure 13: “Pathway Light”

Shehryar

Concept 1

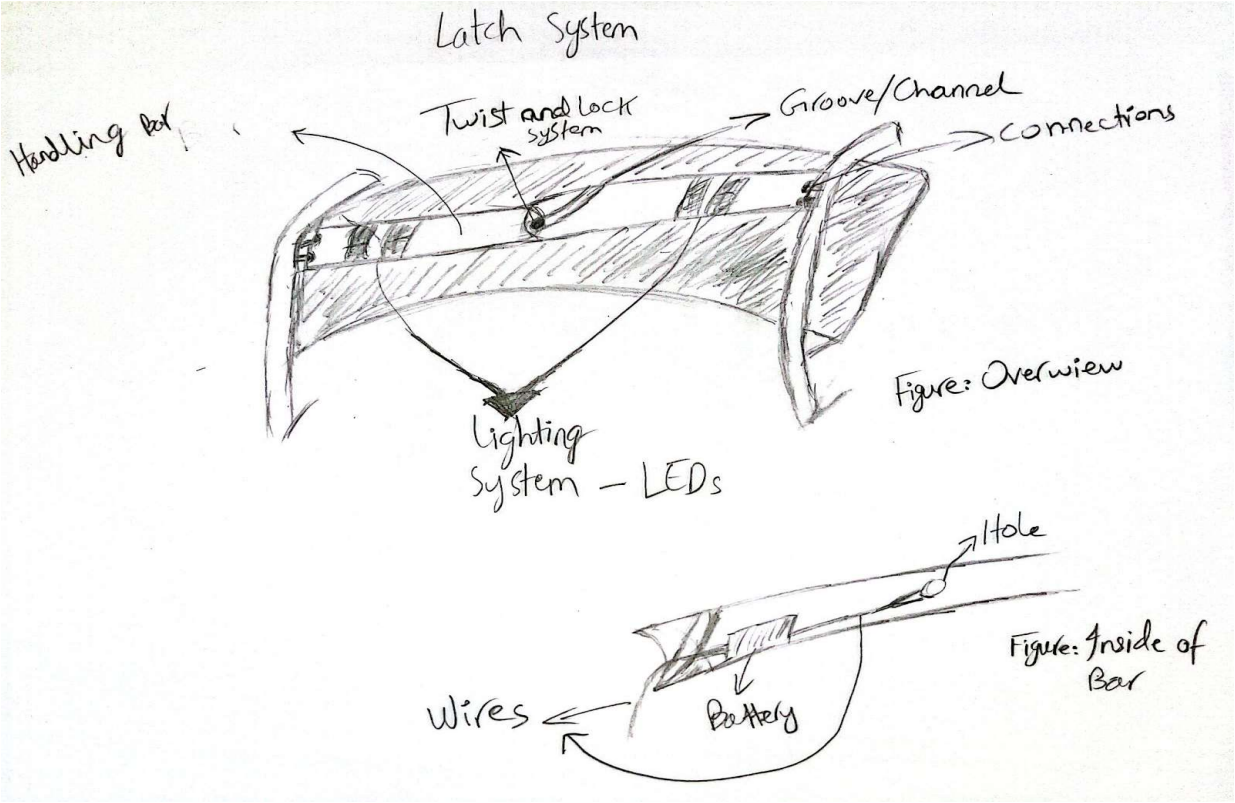

Figure 14: "Latching System"

The handling bar when pushed with any one side allows the user to utilise the walker's assistance function with only one hand. Along with that it serves to house the components required for the lighting system inside the bar, including wires, batteries and LEDs. It bolts on the handles of the walker by using tightening plastic clamps, as shown in Isaac's 3rd concept. There are two portions to the handling bar, which detach from each other using a "twist-lock" mechanism.

Concept 2

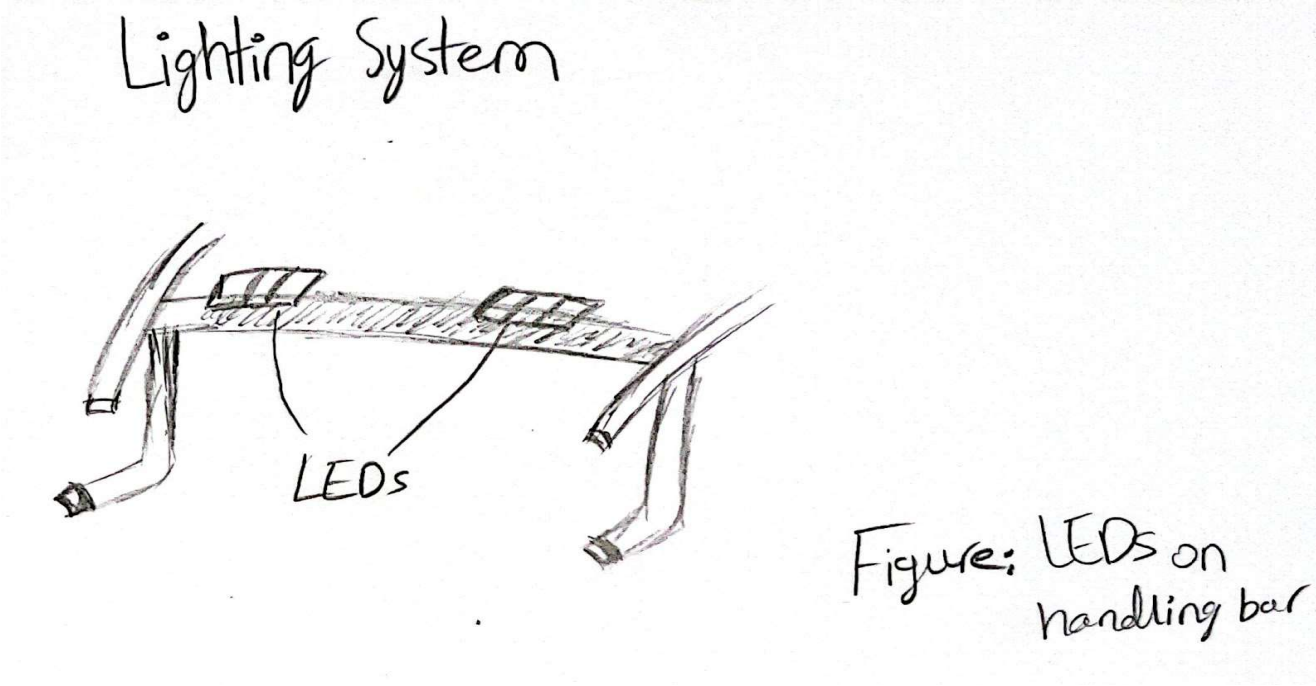

Figure 15: "Lighting System"

For the lighting system, an appropriate array of 6-12 low-power consuming LEDs may be fitted to a housing attached to the holes drilled inside the handling bar using screws, with any wires connecting the LEDs to the battery being hidden inside the bar itself. In order to keep the design dynamic, the LEDs can be switched out if they stop working by detaching them from the housing.

Concept 3

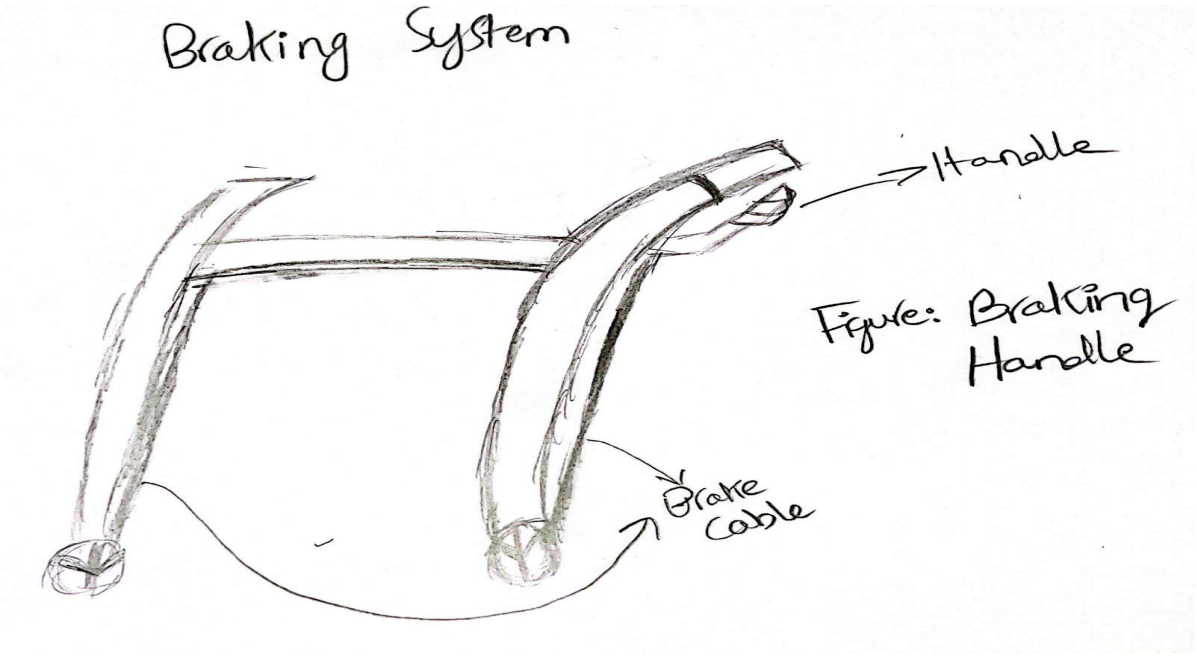

Figure 16: "Braking System"

The new braking system utilises the braking system of the walker by attaching a braking handle (as shown in the figure above) on the handling bar and then running brake cables from the handle to the wheels (the brakes). The braking handle, covered with indented soft rubber, when pulled, causes the braking cables to get taut and activates the pre-existing braking system of the walker.

Chosen Concept

After individual concept generation, the group looked over each design and listened to the reasoning behind each one. From there, as a group, a final concept was made, using different attributes from different concepts, and from the target specifications devised.

Provided below are sketches and models of what the final design should resemble:

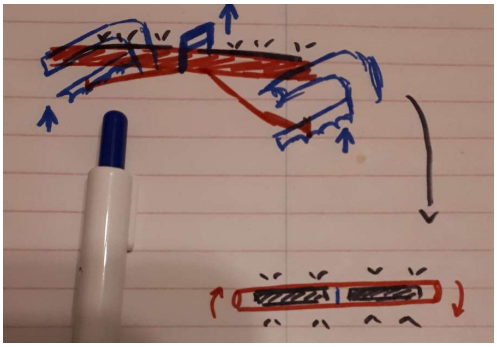

Figure 17: "Handle, Braking & Folding"

In our final concept (seen above in figure 17), we incorporated the braking, handling and folding systems all into the single handling bar as per the concepts provided by the whole group. For the lighting system, Gautam's idea of a platform light bar along with Shehryar's idea of building a housing for the lightbar and lacing the bar itself with the wires, cables and batteries required to power the LEDs and activating the braking system were chosen. Along with that, the folding mechanism i.e. the twist-lock function conceptualised by Shehryar was chosen. The connections to attach the handle to the walker and the braking handle will be formulated as per Isaac's design using braking cables and plastic clamps.

Figure 18: "Twist-lock"

Using plastic fasteners as the connections of the attachment makes it easy for the client to detach or reattach the attachment on the fly, taking around 3 minutes, assuming perfect conditions. This is seemingly better than our specified target (see deliverable B - Target Specifications). These plastic fasteners are not unique either, as they are readily available in most hardwares stores. Along with that, as the bar can break down into two smaller pieces by twisting from the middle (see figure 18 - a model for the twist lock), it occupies less space and makes it easy for the client to handle.

Using durable reinforced plastic makes the handle lighter, closer to our ideal aim of 5 lbs (see deliverable B - Target Specifications) and cheaper to fabricate, also puts less strain on the plastic fasteners; we do not have to worry about the rate of corrosion either. However, in order to increase the weight capacity of our attachment, we might have to utilise a metal, preferably aluminium. The pathway light utilises the use of low power draining LEDs so the client saves approximately 17 dollars per year, considering she will not have to change her batteries every now and then. Forming a housing for the lightbar helps switching out the LEDs in case any of them go out. The additional braking handle being conveniently placed in the middle of the bar gives the client easy access to braking without reaching for the walker's handles, thus mitigating

any concerns of injury due to loss of balance or overreaching. It also allows easy carrying for when the handle is detached.

The bar design itself allows the client to use any of her arms to handle the walker, avoiding any complexities in design. It keeps the production cost low and user repairs easy. It acts as a base to house any wiring, batteries, cables and/or components allowing for a comprehensive design with additional features. The bar also incorporates the use of soft rubber on the braking handle and some areas of the bar (the parts most likely to be touched), to make for comfortable handling during winter time and to increase grip. The bar also stays out of the way of the client's slings (see Deliverable B - Customer needs). Considering all the materials and equipment required for building this attachment, the finished product will cost us less than our allocated funds of $100, as per target, due to easily sourced parts and a simplistic design.

The twist-lock function does cause some to raise their eyebrows, as the brake handle requires the braking cables to be connected all the time, and if one part does twist away, there is always a danger of any lines/cables getting caught up in the mechanism and getting mangled. In order to tackle this, we plan to tape all cables/wiring together and then supergluing it to sides of the inside of the bar.

Project Plan

Below is an image of the updated project plan for this past week;

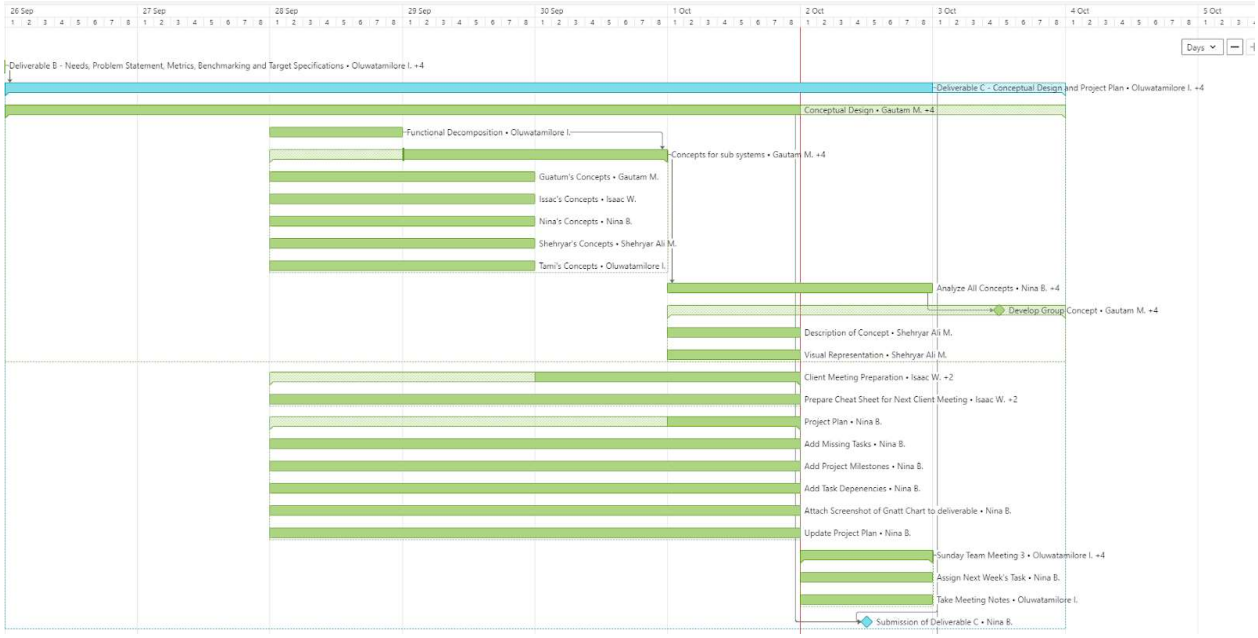

Figure 19: Wrike Screenshots for Deliverable C

For this week, the timing of tasks was changed after having a quick team meeting on Wednesday, the 28th of October. Additionally, 2 milestones were made for this week, with the first milestone being the conceptualization of our final approach for the client and their problem, and

the second milestone being the submission of Deliverable C, as this marks the start of the prototyping process for our design.

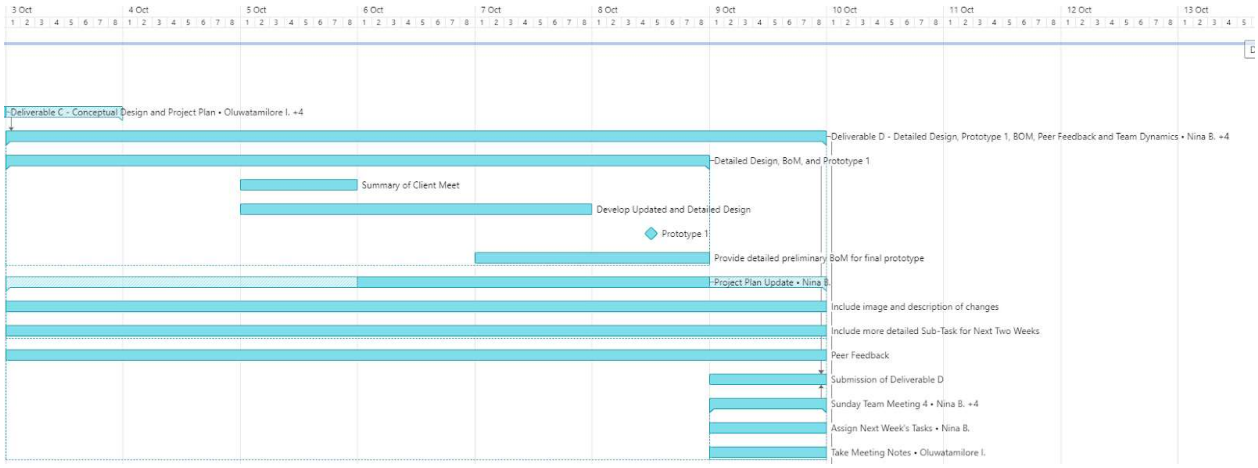

Figure 20: Wrike Screenshots for Deliverable D

Figure 19 shows what is so far planned for the next upcoming week, with a milestone in place for the first prototype being created. Other than that, the next week follows similarly to the previous week's plans when they start out, with tasks being filled as the group gets a better idea of what needs to be done and the task's priorities.

Client Meeting Preparation

Meeting Plan:

1. Ask questions to verify or update metrics and target specifications (5 mins)
2. Present sketches of group design concept and explain what needs it can meet (10 mins)
3. Ask the client to provide feedback on our concept and use prompts if the client has trouble providing feedback (5 mins)

Questions:

1. What weight do you estimate would make our product too heavy for you to use comfortably and efficiently? How about in the future?
2. How tall are you, and from your experience, what is a comfortable height range for your walker?
3. Do you see yourself using this for long or short periods at a time? (i.e., how often will you be putting our product on and off again?)
4. How much do you use the walker for support? (i.e., just to stabilise or do you lean on it?)
5. Do you put groceries or other items on your walker?
6. How easy or difficult do you typically find your walker to push when you use both arms?
7. What lifetime are you expecting or wanting from our product?
8. You mentioned you sometimes take taxis. How often do you use one, and how long do you estimate it takes you to fold up your walker before getting in?
9. You also mentioned that a light would be useful. Are you often in a position where one would be helpful or necessary, and how much of the ground ahead of you would you like to see?

Feedback Prompts:

1. What do you like about our concept? (i.e., looks, complexity, function, etc.)
2. Are there any aspects that absolutely must stay or absolutely must not be included?
3. Is there anything we missed?
4. Are there any new ideas or needs you've thought of since our last meeting?
5. What do you not like about our concept?
6. Do you have any concerns about our concept?