Team Deliverable D

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Table of Contents

List of Tables:

List of Figures:

Introduction

People all around the world face different types of disabilities which affect their day-to-day tasks. Currently there are existing and developing devices to help people with disabilities to not worry about their limitations and live a ‘regular’ life. However, there is always room for more improvements and innovations to ease daily tasks. The client is a company of occupational therapist that are looking to facilitate the lives of their clients. Currently, they are looking for an adaptive care tool to mitigate the difficulties of people with mobility limitations. This project will aim to aid people with mobility disabilities, specifically to allow them to take care of toddlers and children. Ideally, the stroller and walker combo will ease the user’s life while being as discreet and efficient as possible. The tool will allow the user to navigate and complete their childcare tasks despite their limitations.

This report consists of 6 main sections: prototypes, prototype testing and presentation. In the prototype section we will document various physical and analytical prototypes made to test critical assumptions. These prototypes will be documented through sketches and images taken of the physical models. In the prototype testing section, we will carry out prototype testing to analyse and evaluate the performance of each prototype compared to the target specifications. In this section of the report, we will document our findings in an organized table. Finally, in the presentation section, a link will be provided to the PowerPoint presentation from which we will present our design process thus far, and our various prototypes.

Prototypes

Prototype 1: Force Analysis of Bicycle Brakes

Summary: In our walker-stroller design, we will implement a slowing/stopping brake to maximize the user’s control of the system. In this force analysis, we examine various types of bicycle hand brakes that we may choose to implement in our system down the line. We should assume that the user of this system is physically able to 1. Use a typical handbrake and 2. Physically apply a sufficient amount of force onto the braking system to activate the brakes. The following table documents a force analysis of three common hand braking mechanisms. Moving forward, we will determine how much force the users of this system are physically able to put onto the brakes, in consulting with the client.

Type of Hand	**Force required**	**Force required for**	**Cost**	**Image**

Braking Mechanism	to hard stop	normal deceleration		
Cable brake on straight handlebars	40-50N	20-40N	$25 Amazon	
Cable brake on drop handlebars	75-100N	60-80N	$55 Amazon	

Table 1. Force analysis of bike brakes

<u>Prototype 2: Seat Testing</u>

Summary: During our second client meeting, we presented the idea of having a compact and foldable seat that could be stored out of the way when not in use. When presenting this concept to a project manager, the PM expressed interest in this idea, but wanted to clarify whether the user would physically be able to seat themselves, and lift themselves out of the seat with their mobility restriction. When designing the following prototypes, we took into consideration the average height of existing seating solutions and made the assumption that the user would have enough range of motion to lower and lift themselves to this average height. Secondly, we must ensure that the material used to build the seat will be able to support the weight of the user. In these seat prototypes, an assumption is made that the material selected will meet this need of supporting the user's weight.

Average height of a chair (inches)	18-22 inches [based on average height]
Average weight restriction of a stool (lbs)	300 lbs

Table 2. Seating solution considerations

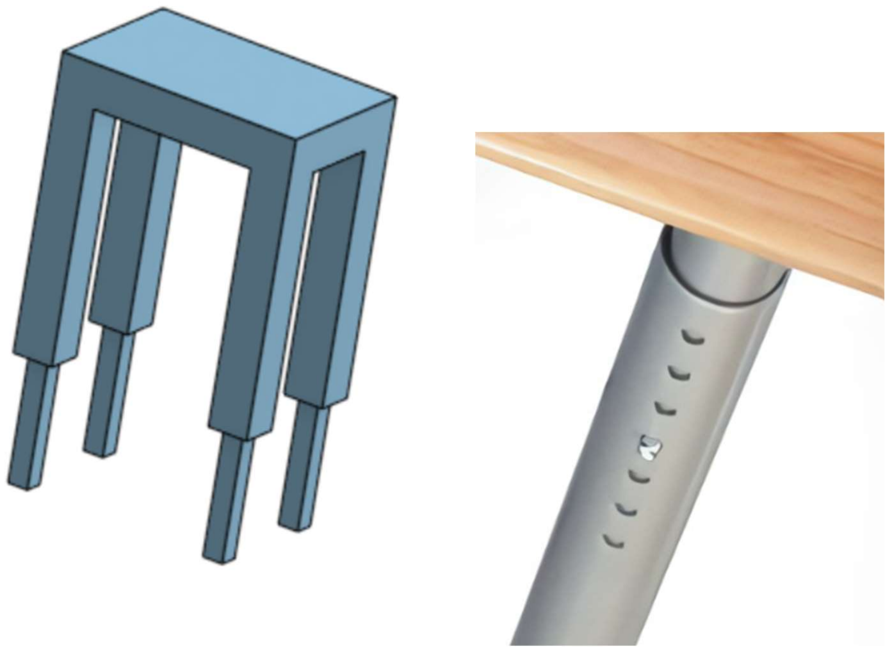

Figure 1. Seating prototype 1; stool with length varying legs

Explanation: The solution documented above will provide a seating solution that varies in height. This variability in height will allow the user to set the seat to a height that best suits them. For example, a user with less range of motion in the knee joints may set the seat to a higher level, whereas a shorter user may lower the height to better suit them. The height of the seat will be maintained through the use of pins and slots (as seen in the figure above; right). The user will push the pin, and adjust the leg of the seat to a comfortable height, then release the pin into the closest slot at that height to “lock” the seat at that height.

<u>Prototype 3: Junction and connection of walker to stroller</u>

Summary:

Average height of an American adult	63-69 inches
Average weight of an American adult	170-200 lbs

Table 3. Height and Weight

Important: The following design must be able to support 754.6 N to 891.8 N of force.

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Figure 2. Junction and Connections

Assumptions: There are a few assumptions that will need to be considered when testing the hand brake system. The first assumption is if the client can physically operate the hand brakes. The second assumption the user can apply the required amount of force to activate the handbrake. Third assumption One break bares on one side depending on and usability of the client. The last assumption width of the wheel should be around 1 ¼".

Testing: For the testing portion of the hand brake system what are team came up with is that we will be taking apart an old bike and using the bike brake. With this old bike break will be testing it out on a used stroller that a family member owns, shopping carts, stroller in shopping malls, etc. From then on out will be studying how much force can the user be able to use on the stroller and making sure the wheels of the stroller don't get affected by the breaks

Prototype 4: System Cohesion:

Summary: Our design team has developed various ideas for each sub concept, but ensuring cohesion between each sub-system was yet to be considered. This comprehensive and physical prototype joins the ideas generated for each sub-concept to help our design team visualize how each component of our system will mesh. A comprehensive prototype like this one is beneficial at this stage in the design process to 1. Visually interpret the ideas we've developed thus far and share them with others 2. Visually identify any components that might be missing from the design.

Testing: The main purpose of this prototype is to act as a "visual summary" of all of our design components thus far and start to consider how we will mesh the components together moving forward.

Figure 3. Comprehensive and physical prototype

Prototype Testing

The prototypes developed for this deliverable were tested against our target specifications to ensure they met the criteria of the project brief. In comparing the prototypes with the target specifications (included below), it was found that all the developed prototypes satisfied the target specifications, or have the potential to meet the target specifications (i.e.. At this stage, we can't determine if the prototype matches the target specifications, but as further developments are made we can ensure that the design meets them.

Characteristic	**Unit**	**Prefer**	**Relation**	**Target value**
Width	Inches	lower/equal	≥	20-27
Length	Inches	Lower	>	43-52
Item weight	kg	Higher	<	22

Max Weight	Pounds	Lower	>	50
Max height	Feet	Lower	>	3
Storage	Kg	equal	=	20
Breaks	N	Higher	<	Depending on the weight
Cost	$	Lower	>	50-1600
Curb height	Inches	Higher	<	6-18

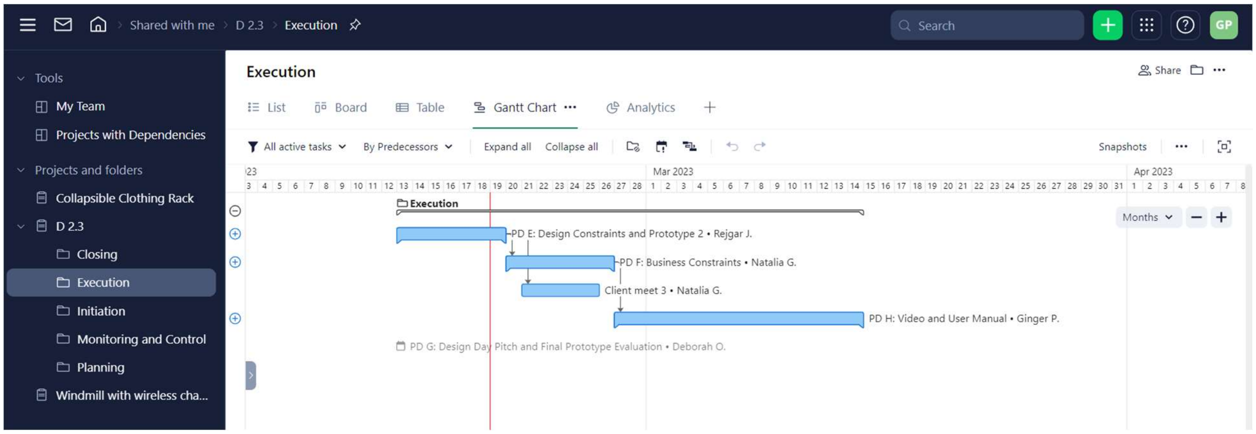
Table 4. Target Specifications

Presentation

During our formal presentation, our group was able to highlight attributes of our design process, and present prototypes of our most up-to-date design. We took the first 5 minutes to present the project brief, interpreted needs, benchmarking, problem statement, target specifications and our early design ideas. Then we presented our detailed design concept, discussed various skills and resources, critical product assumptions, project timeline and specified key components on our bill of materials. We took the remaining 5 minutes to present our various prototypes, discussing the type of prototype, what assumptions were made and what the prototypes were used to test for. After the presentation, our group received both questions and feedback from our peers, which we will use to tailor and optimize our design concept moving forward.

PowerPoint Presentation: Client meeting 2.pptx

Project Plan Update:



Gantt Chart:

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=eVQQr7bUSVGCMULShYOWpjgELrpdHcuj%7CIE2DSNZVHA2DELSTGIYA

References:

Cite: https://bicycles.stackexchange.com/questions/34336/how-much-maximum-force-can-be-applied-by-fingers-on-the-brake-lever#:~:text=A%20normal%20cable%20brake%20on%20flat%20handle%20bar,1%20and%202%29%2C%20depends%20on%20hand%20position%20%28leverage%29.

Cite: https://whataroom.com/blogs/home-garden/everything-you-need-to-know-about-chair-heights#:~:text=The%20seat%20of%20a%20Standard,designed%20and%20built%20with%20arms.

Cite: https://www.bobvila.com/articles/best-step-stools/

Image: https://fineartamerica.com/featured/brake-on-bicycle-handlebar-philip-gatward--dorling-kindersley.html

Image: https://weightweenies.starbike.com/forum/viewtopic.php?t=149480

Image: https://www.pinterest.ca/pin/210684088789052891/