Deliverable E - Prototype 1, Project Progress Presentation, Peer Feedback and Team Dynamics

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Table of Contents

Introduction 3
E.1 Prototype 1 3
    E.1.1 Prototype documentation 3
    E.1.2 Prototype Testing 5
Conclusion 6

List of Figures

Figure 1: Detailed Concept……..……....……3
Figure 2: Prototype 1 ……..……3
Figure 3: Detailed Concept in Storage Configuration ……..…..……...……..4
Figure 4: Prototype 1 in Storage Configuration……..……4
Figure 5: Prototype 1 in User Configuration……..……5

Introduction

In this deliverable, we continue to update and iterate on our previous designs. We also developed our first prototype as a proof of concept to visualize our dimensions and test their viability. Through testing, this prototype allowed us to continue to edit specifications on our design and improve on them. We also prepared a project progress presentation to be given in our next lab session on Wednesday, October 18th.

E.1 Prototype 1

For this prototype, our group thought that a physical and comprehensive prototype would be the most advantageous at this point in our project plan. This helped visualize our concept and compare what it might look like against our assumptions and target specifications. Some of the subsystems integrated into this prototype are the extendable wheel stopper and knee pad. This physical model was very useful for testing as it gives us a point of reference for future designs in terms of measurements and feasibility of certain systems.

E.1.1 Prototype documentation

For this prototype, we used materials found about, such as cardboard and duct tape. This allowed us to experiment with the design without a material cost which could become a sunk cost if we find that the design does not meet our specifications. Subsystems missing from this prototype are the latching mechanism and the handlebar holder; these will be added in the next prototype

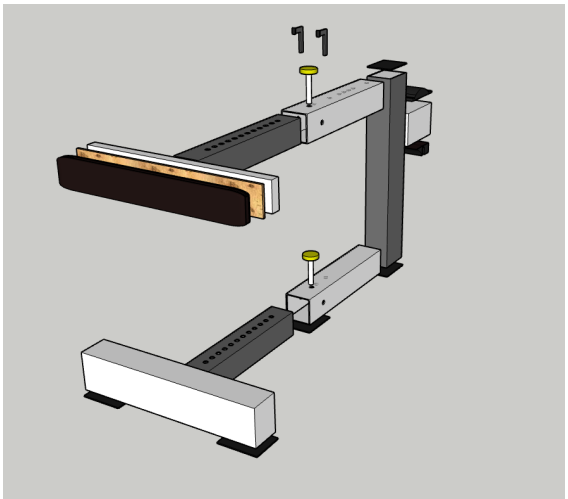

Figure 1: Detailed concept

Figure 2: Prototype 1

Using this prototype, we were able to also physically see the size of the product when it's in its storage configuration. This is done by removing the extendable wheel stopper and knee rest and turning them 90◦ and inserting them back. This reduces the overall size of the product and makes it easy to hang in on a wall or in small areas.

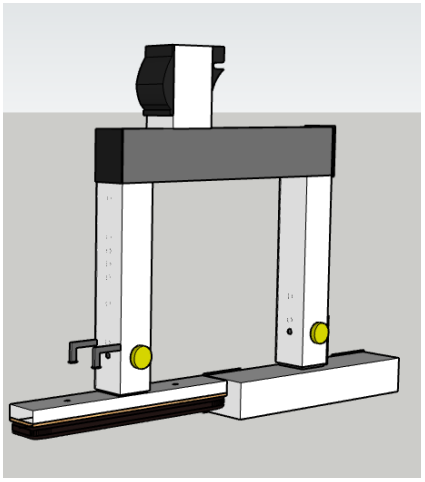

Figure 3: Detailed concept
In storage configuration

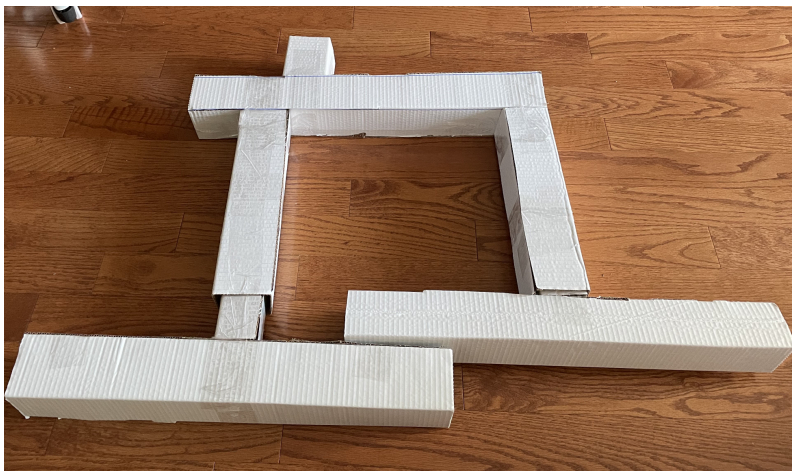

Figure 4: Prototype 1 in storage configuration

Previously, our team made assumptions about our product based on the information we have. Some of these assumptions include the knee stopper and wheel stopper heights. These were based on standards for wheelchair dimensions that stated that the maximum height of the footrests on wheelchairs was 8 inches and the maximum width a wheelchair could be was 27 inches.[1] Using this prototype, we were able to simulate what it would be like to use the product.

[1] Accessibility Design Manual : 5-Appendices : 2-Anthropometrics 1/2

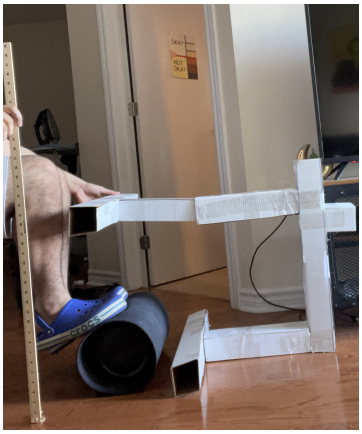

Figure 5: Prototype 1 with user simulation

As seen, the knee rest lies below the knee and now we know that we need to raise the knee stopper in future prototypes.

A disadvantage of this prototype is that since it's made of cardboard and missing some subsystems, it is not possible to determine the weight and thus the portability of the product. In future prototypes, we will have to test the strength of different assembly methods such as fasteners and welding when using metals.

E.1.2 Prototype Testing

Target Specification	Expected Value	Actual Value
Adjustability (Height of Cable holder)	Between 20-30 inches	22 inches (height of knee stopper)
Supported Weight	≥ 20 kg	N/a
Attachment Set Up/Removal Time	≤ 5 minutes	N/a
Product Weight	＜30 kg	N/a
Cost	≤ $100	$12
Latching system	Yes	No
Dimensions of product	≤ 3x3x3 ft^3	≤ 3x3x3 ft^3

The assumptions we are trying to verify with this prototype are our critical original assumptions and if the UN's wheelchair dimension diagrams are accurate. Additionally, we wanted to verify that our math for the weight of the object matched, which after looking at material weight calculators and calculating our estimated weight manually, matched almost perfectly with aluminum being 1/3rd the weight of steel.

For the height of the product, we tested it simply by measuring the height of the prototype. We are unable to test the supported weight of the product since it is made of cardboard and does not attach to the actual rower machine. The same logic applies to the attachment and removal time. The product weight, since its weight of cardboard, is not a good metric to measure as it is not the same material that the final product will be. The cost of the whole prototype was 12$ and the dimensions, as measured, are within our acceptable values.

Conclusion

In this deliverable, the team updated our design, created our first prototype, and tested it to improve on our product and its specifications. We were able to use the prototype to notice some areas of improvement and confirm some of our prior assumptions. In the coming weeks, we will be beginning to order materials so we can begin development on our second prototype for the next deliverable.