Deliverable D - Detailed Design and BOM

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Introduction

During the second meeting with the client, our team presented the current plans and reassessed the importance of certain needs and features. The team took notes and explained our current plans and potential changes to gauge the client's reactions. We took the client's feedback on the current prototype and made modifications to the design. The team also presented future steps to complete the product and received recommendations from the client on how to follow through. From this meeting, we developed a timeline of development, realistic expectations for the product, and a bill of materials.

D.1 Client Meeting 2 Summary

During the second client meeting, we presented our global concept. Our global concept had a feature integrated to hang the product on the wall. The client explained that this is not necessary and so it will not be present in any future prototypes. The client appreciated the compactness of the product and all the safety measures in place to keep the user from moving. They raised an important point which our team did not think of, which was to make sure the bottom wheel support bar is not too high to let the wheelchair footrests be able to pass over them. Finally, the client informed us that they have a partner that does upholstering for their gym equipment. Because of this, it is important that we attach the knee stopper cushion to a material capable of being stapled, such as wood, so that it can be replaced in the future if needed. We have divided the product into more subsystems, such as the wheel stopper and knee stopper. This is because both systems need careful thought and execution in order to better accommodate the needs of the client.

D.2 Final concept

1- Wheelchair Dimensions:
You can find wheelchair dimension guidelines online, we used this one below:
https://www.un.org/esa/socdev/enable/designm/AD5-02.htm
These guidelines are essential for creating spaces that accommodate wheelchairs properly.

2- Telescoping Tube Sizing:
For information on telescoping tube sizing, we referenced this source:
https://www.exercise-equipment-parts.com/telescopic-tubing.html
Exercise Equipment Parts - Telescopic Tubing. This resource provides valuable information for selecting the right telescoping tubes for your specific needs.

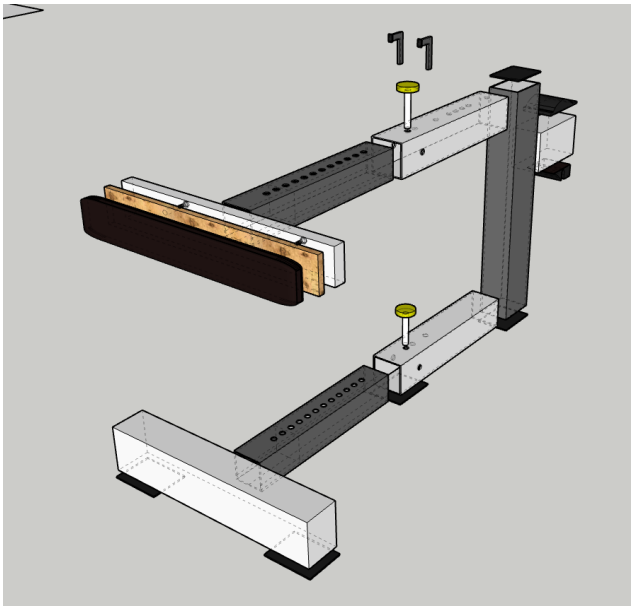

Figure 1: Deconstructed Updated Concept

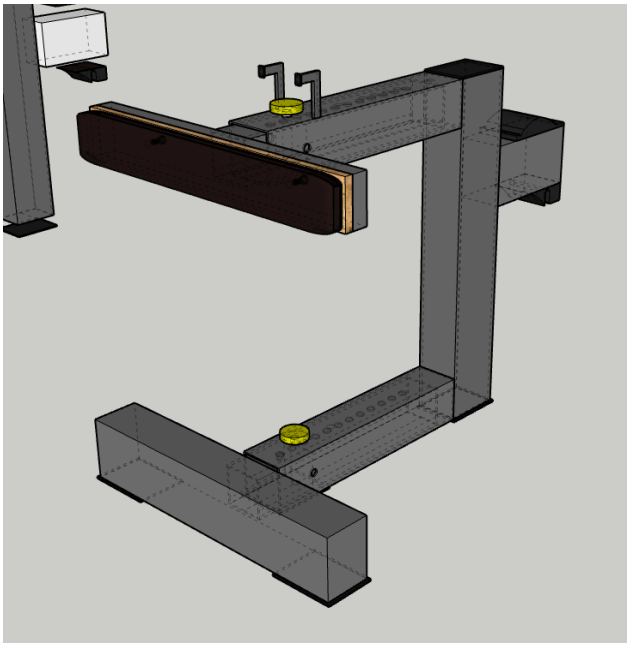

Figure 2: Constructed Updated Concept

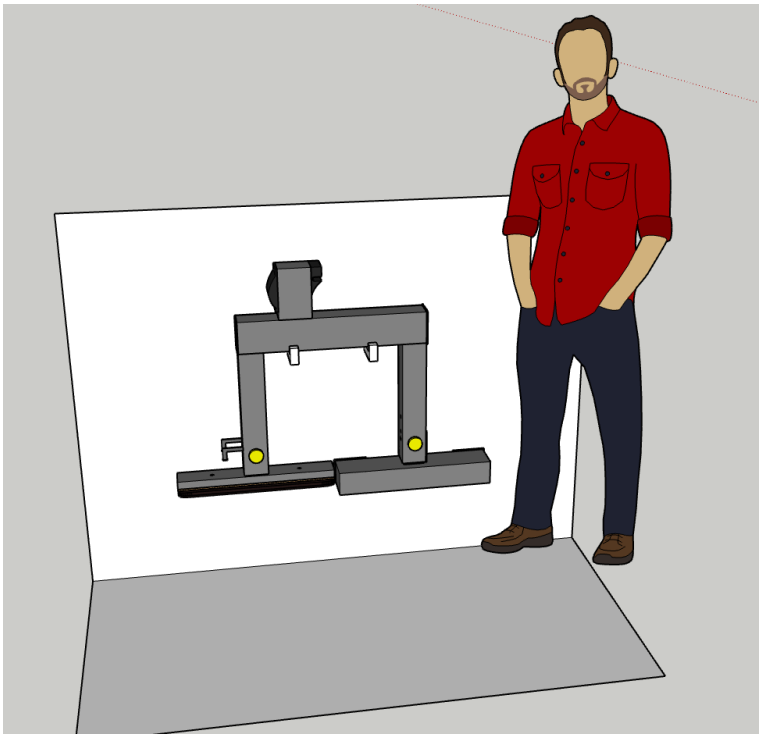

Figure 3: Portability and Storage of Updated Concept

In this design, the inclusion of a smaller tube within a larger one is a way to make portability possible in this device. This feature also grants the adapter adaptability, making it well-suited for accommodating wheelchairs of various sizes. By allowing for adjustments, this design caters to the specific needs and preferences of users, ensuring their comfort and accessibility while using the rowing machine.

The incorporation of pins in this design is to help store the device on the wall while also being used for the height adjustments. These pins play a pivotal role in enhancing the functionality of the adapter. They securely hold the tubes in place, allowing the device to be stable and work properly.

Additionally, the enhanced portability of this design and its ease of assembly and disassembly transforms it into a highly convenient and transportable solution which the client requested. This adaptability not only empowers users to engage in their fitness routines wherever they choose, but also offers flexibility in their exercise environment.

The latching subsystem is attached to the main tube body with fasteners such as bolts that will keep the latch in place. All tubing will hopefully be welded but since our group knows the difficulties of welding aluminium, we have a contingency plan of using bolts and nuts to keep

the tubes together. We have to be careful to make sure the bolts that would keep the pieces in place do not interfere with the telescoping tube subsystems as well. The rubber feet will simply be glued with adhesives to the bottom of the pieces. At this stage, the bar holder is simply pieces of metal that protrude from the knee stopper piece that will hold the handlebar in place. This will also hopefully be welded for maximum strength. The inner telescoping tubes will be free to be taken out of the bigger tubes for storage and modularity.

D.3 List of Skills

For our concept, many technical machining skills will be required, such as lathing, drilling, perhaps milling, and welding. Courses such as GNG1103 and this GNG2101 have given us the opportunity to learn the basics of these skills with the help of prelabs and sessions in the Manufacturing Training Center. A skill that we will need to learn is welding, as none of the group members have welding capabilities. Training pre-labs for MIG and TIG welding are available on MakerRepo. We also have skills in Computer Aided-Design (CAD) such as Solidworks which help us develop detailed designs of what we are working on and for prototyping testing.

Resources at our disposal are the Makerspace and the previously mentioned training center. These centers give us access to other important prototyping resources such as 3D printing and laser cutting. These centers also have scrap material which we can use for our early low-fidelity prototypes. We also have access to the Internet for buying materials.

D.4 Timeline Assessment

Following our Wrike plan, our team feels that approximately one week per deliverable is a feasible and realistic timeline. Reading week gives us the opportunity to work on the project without interruptions. Each team member will be tasked with making each subsystem, with collaboration in between, to lessen the workload of each member and speed up the assembly process of the concept. Each member has a free block between periods where they can work on their task, either at Makerspace, Brunsfield Manufacturing Center or even work on it at home. It is up to each member to make sure their task is completed, even if multiple members are working on the same task.

D.5 Critical Product Assumptions

Our team has made a few assumptions in the development of our design. Firstly we have assumed that our product will not be used for advanced, high intensity workouts that could cause

the rowing machine to slide when our attachment is being used. This was specified to us by the clients during the second client meeting. The client also mentioned that they wish to complete the upholstery using their own partners, and therefore we are assuming they require a material that can be stapled such as wood on the knee stopper for whenever they wish to replace the prototype upholstery. Assumptions relating to the specifications of the product itself include assuming the correct height for the knee stopper as well as the height of the holder for the handle. We have assumed the height to place those based on the average heights of wheelchairs, however they are not all the same exact height. Finally, with regards to materials themselves, we have assumed that we will be able to acquire the same connector that the Concept2 rowing machine uses to attach itself to its seat.

D.6 Bill of Materials

Item Name	Description	Unit of Measure	Quantity	Unit Cost	Extended Cost
Telescopic Aluminum Tubin	Used in frame of design(3"x4")	ft	3	$ 33.61	$ 100.83
Aluminum Tubing	Used in frame of design(3"x3")	ft	3	$ 20.55	$ 61.65
Rivets	Used to attatch frame pieces together	Units	100	$ 0.08	$ 8.45
Faux Leather	Used in apholstery process	Sheet	1	$ 11.99	$ 11.99
Foam	Used in apholstery process	sq/ft	2	$ 4.93	$ 9.86
Staples	Used in apholstery process	Units	30	$ 0.53	$ 16.00
Plywood	Used in apholstery process(24"x3"x1/2")(Cost will	sq/ft	1	$ 10.00	$ 10.00
Bolts	Used in apholstery process(1/2"-10/32)	Units	100	$ 0.16	$ 16.41
Aluminum Sheet	Used to make brackets(.125" thick)	sq/ft	1.25	$ 27.47	$ 34.34
Thread Inserts	Used in the apholstery process	Units	4	$ 2.80	$ 11.20
End Caps	Used to make ends of tubing safer	Units	8	$ 1.87	$ 14.99
PN 1251	Used in adapter assembly	Units	2	$ 0.20	$ 0.40
PN 1038	Used in adapter assembly	Units	2	$ 0.20	$ 0.40
PN 1204	Used in adapter assembly	Units	2	$ 0.80	$ 1.60
PN 1153	Used in adapter assembly	Units	1	$ 2.40	$ 2.40
PN 1062	Used in adapter assembly	Units	1	$ 2.10	$ 2.10
PN 1039	Used in adapter assembly	Units	1	$ 0.95	$ 0.95
PN 1154	Used in adapter assembly	Units	1	$ 2.55	$ 2.55
PN 1244	Used in adapter assembly	Units	2	$ 0.10	$ 0.20
Felt Pads	Used to protect flooring(3x4x1/8")(Need 5)	sq/in	12	$ 1.41	$ 16.91
Weight Pin	Used to hold tesecoping tubing in desired positio	Units	2	$ 1.85	$ 3.70
Total Cost					$ 326.93

This final cost of 326.93 is not representative of the cost of materials involved in one completed device. This cost is the net cost of purchasing all products, some of which will not be used in the manufacturing process. An example of this is the total amount of staples purchased vs staples used during the upholstery process. Due to the nature of the industry staples are sold in bulk quantities of 2400 per container, although we only need approx 25.

Furthermore not all components need to be purchased. Items such as staples, faux leather, and foam are all components owned by team members, but still need to be listed in this initial version of the BOM.

Conclusion

In this deliverable, the team reevaluated the initial prototype and improved the design based on the client's feedback. The timeline and cost of the plan was evaluated and quantified based on reasonable and justifiable assumptions of creation and use. Working on the deliverable helped us gain a better understanding of the feasibility and realistic labour and cost associated with the product. With a clear plan for the future, the team is motivated and excited to continue working with the client to develop a satisfying end product that exceeds the client's expectations.