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PD-B: Needs, Problem Statement, Metrics, Benchmarking and Target Specifications

GNG2101, Section #A01
Team #2

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Table of Contents

List of Tables

1. Introduction

This project involves designing a table for a wheelchair user that contains a retractable tablet holder. The problem is relevant because currently, many wheelchair users have to use multiple desks to go about their tasks. For example, the client has a computer desk and an eating desk, and while this works for her, not every user might have the space to accommodate desks designated for specific tasks. This table design will aim to accommodate most daily needs in one piece of furniture.

The goal of this product is to have a tablet holder built into a wheelchair table so that when the user is not using the tablet, it is out of the way and the table is fully functional for other uses. As well, the tablet should be positionable to best fit the ergonomic requirements of each user.

This will be a useful design because it will provide a multipurpose table that wheelchair users may use, saving space, and reducing the need to move from desk to desk all the time. As well, the tablet holder will be secure (won't break if hit during a muscle spasm), safe (won't pinch), and controllable by the user (self-sufficient) so it will provide an opportunity for some wheelchair users to use a tablet for the first time.

The product that this team will design will ideally be less costly than other alternatives on the market. As well, it will allow the wheelchair user to be self-sufficient as many options on the market require a caregiver to set up a tablet holder.

2. Main Subject Body of the Report

1. List of client statements/observations
    - Two clients: Ana and Paul.
        - Ana does not have a specific problem and would likely not be the user of this product.
        - Paul has a specific product in mind to be adaptable to many wheelchair uses.
    - Tablet uses would be for email, surfing the net, and video calls.
    - Functionality, reliability, and safety should be prioritized above aesthetics.
    - The product must give the user more independence, not less.
    - Product to be a table with a tablet mount. This tablet mount can be stored, brought out, and repositioned remotely.
    - Tablet must lock in place so it cannot be knocked out by spasms.
    - Table must be able to be used for other purposes when the tablet is stowed away.
    - A wheelchair must be able to fit under the table whether the tablet is out or stored away.

1. List of translated and prioritized needs

Table 1. *Needs Definition and Prioritization*

Statement	Need	Priority (1 is low, 5 is high)
Requires Safety: ie. can withstand being hit if the client spams	Safety	5
	Stability	4
Give independence	Ease of use	5
	Reliability	4
Tablet be stored, brought out and repositioned	Adjustability	5
	Tablet stores out of the way	2
	Electric/remote control	4
	Tablet is securable into place	3
Multipurpose table	Full table use available	2
Wheelchair and user must fit below table	Accessible, adjustable for each user	3
Material	Ideally made of fibreglass or plexiglass	1
Development time	To be completed by the end of the semester	5
Within budget	Stay within budget ($100)	4

2.1 Problem statement

To provide wheelchair users with an accessible and reliable way to use a tablet independently. This will consist of a remote controlled height-adjustable table, with a built-in remote controlled tablet holder that can be folded away when not in use.

2.2 List of metrics

Table 2. *List of Metrics with Respective Units*

Functional Metrics

Priority	Need transformed from	Metric	Unit
5	Safety	Force table can withstand	N
		Number of Sharp corners	#
5	Adjustability	Tablet angle range	degrees
		Tablet height range from table	mm
		Tablet distance range (back and forth)	mm
4	Electric/remote control	Ability to use product with remote control/electronics	binary

Non-functional Metrics

Priority	Need transformed from	Metric	Unit
1	Made of fiberglass or plexiglass	Material	Material type
3	Full table use available	Percent of table available when tablet is not in use	%
		Table size	mm x mm
4	Reliability	Expected life time	years
3	Tablet is securable into place	Ability to secure tablet to the table	binary

Constraints

Priority	Need transformed from	Metric	Unit
4	Stay within budget	Cost	$
3	Accessible, adjustable for each user	Table height range	mm
2	Tablet stores out of the way	Tablet visibility when not in use.	Scale of 1-5 (1 is hidden, 5 is visible)
5	To be completed by the end of the semester	Estimated development time	Months

2.3 Benchmarking

Table 3. *Benchmarking of similar Products*

Priority	Metric	Unit	Mountain Mover [1]	Stable Height Angle Adjustable Mobile Laptop Computer Standing Desk [2]	Deluxe Overbed Table – Carex [3]
5	Force the table can withstand	N	222.411	146.784	222.411
	Number of sharp corners	#	0	0	0
4	Expected lifetime	years	1 year warranty	unknown	1 year warranty
5	Tablet angle range	°	360	360	0
	Tablet height range from table	mm	30.48 to 76.2	None	None
	Tablet range (back and forth)	mm	None	None	None
2	Tablet visibility when not in use	Scale	5	5	5
4	Remote controllable/ Electrically Powered	binary	Dual switch directional control	No	Yes
3	Tablet is securable	binary	Yes	Somewhat	No

2	Percent of table available when tablet is not in use	%	~38.8%	~83%	~86.8%
	Table size	mm	H: 304.8 W: 241.3 D: 6.35	W: 680.72 L: 398.78	W: 406.4 L: 838.2
3	Table height range	mm	609.6 to 914.4	650.24 to 850.9	711.2 to 1066.8
1	Material	Material type	Polycarbonate	MDF and metal (type of metal is unspecified)	Not listed but appears to be made of some type of hard plastic
5	Development time	Months	Unknown	Unknown (order online)	Unknown
4	Cost	$	$445	$78.57	$266.49

2.4 Target specifications

Table 4. *Ideal and Target Specifications*

Metric	Unit	**Ideal specification**	**Target specification**
Force the table can withstand	N	400N	200N
Amount of sharp corners	#	0	0
Expected lifetime	years	10 years	At least 5 years
Tablet angle range	°	0-360	0-90
Tablet height range from table	mm	0-761.6	0-380.8
Tablet range (back and forth)	mm	0-1000	0-500
Tablet visibility when not in use.	Scale	1	3
Electric/remote control	Binary	Yes completely controllable remotely/electronically	Tablet adjustment is controllable but table height may not be.
Tablet is securable into place	Binary	Yes	Yes
Percent of table available when tablet is not in use	%	100%	80%
Full table dimensions	mm	1016 x 1219.2	762 x 914.4
Table height range	mm	533.4 to 838.2 [4]	533.4 to 838.2 [4]
Material	Material type	Fibreglass or plexiglass	Fiberglass, plexiglass, shatterproof material
Development time	Months	3	3
Cost	$	$100	$100

2.5 Reflection on the client meeting

The most important observation made during the client interview was the fact that the customer was not aware of the project description and the nature of the interview questions. The client was surprised at the mention of her tablet as she does not have one. She neither uses nor wants to use a tablet. However, the technical advisor of the client expressed extreme interest in the product.

Also, the client is interested in a technology that enables control and functionality by voice recognition software. She is more adapted to using voice recognition for managing emails and other functions on her computer. Therefore, the project will consist of an automated wheelchair table with a retractable tablet holder.

To add to the above, the safety of the device should be the highest priority. The client expressed having spasms. Therefore, the team is going to consider more safety features to protect our client and the tablet in case of involuntary loss of control.

More so, most of the interview questions were rendered void, especially the questions related to the wheelchair tray. However, the team still used their knowledge to come up with questions related to the client's needs on the spot. Thus, enabling the team to gather all the required information.

Furthermore, the time management of the meeting was great. The interview concluded at the scheduled time.

Group participation was good. The team was able to keep track of the details of the interview and asked for clarification where necessary. The project manager made sure of all the information by seeking clarifications of certain ambiguous statements.

Finally, one important lesson during the client interview was “expecting uncertainties”. This may enable the team to run the project even when everything does not go as planned.

3. Conclusions and Recommendations for Future Work

In summary, the client interview was successful. The team was able to identify the client's needs regarding the wheelchair table and tablet holder. The client's statements were translated to clear and concise interpreted needs. The interpreted needs were given ranks based on their importance; five (5) being the most important and one (1) the least important. Also, the interpreted needs enabled the formulation of the problem statement. The problem statement sets the direction of the project for the semester.

More so, the team conducted benchmarking on existing similar products. These products are categorized based on the list of metrics, units, and needs satisfied. The results of the benchmarking are illustrated by the table (3) above. As a result of benchmarking, the team could easily determine the margins of ideal specifications and target specifications as illustrated in the table (4) above. With this done, the team is ready to come up with conceptual ideas to solve the client's problem.

In the future, improvements may be made to the product by adding additional AI features such as voice recognition and eye-tracking to control motion, and operation of the table and tablet holder. These technologies may be used to adjust the table and tablet holder to the proper height and proper angle. These additions could allow the product to be accessible to a wider variety of users.

4. Bibliography

[1] *Mount'n mover WHEELCHAIR mounting systems*. Mount'n Mover. (n.d.). Retrieved September 24, 2021, from https://www.mountnmover.com/products.

[2] *Stable Height Angle Adjustable Mobile Laptop Computer Standing Desk, Laptop Desk Table With 4 Lockable Wheels Stand Desk Cart Tray Side Table for Sofa Bed Office - Wood Tone*. Walmart. (n.d.). Retrieved September 24, 2021, from https://www.walmart.com/ip/Stable-Height-Angle-Adjustable-Mobile-Laptop-Computer-Standing-Desk-Desk-Table-With-4-Lockable-Wheels-Stand-Cart-Tray-Side-Sofa-Bed-Office-Wood-Tone/663916811?athcpid=663916811&athpgid=AthenaItempage&athcgid=null&athznid=si&athieid=v0&athstid=CS098&athguid=_bEGVu6YHTTXKhV1VSZ6I6JqxA4bbOo9aH6z&athancid=null&athposb=2&athena=true&athbdg=L1400.

[3] *Deluxe Overbed table - carex*. Obumex. (n.d.). Retrieved September 24, 2021, from https://obumex.com/product/deluxe-overbed-table-carex.

[4] *Figure A3. Dimensions of Adult-Sized Wheelchairs.* ADA. (n.d.). Retrieved September 24, 2021, from https://www.ada.gov/descript/reg3a/figA3ds.htm.