Bathroom Assist

Presented By: Victor, Jasem, Maanashan, Lemuel, George

Introduction

- Our client is the father of a 7-year-old girl who was born with arthrogryposis, this condition affects her forelimb flexibility and strength
- Our design is meant to aid the user in pulling up and pulling down her pants when she goes to use the bathroom.

Needs and Wants

- Independence: the user wants to be able to go to the washroom alone
- Portability: lightweight and relatively small so that the device is easy to transport
- Adaptability: continue to work as the user gets older
- Usability: easy to use
- Adjustability: the device can be used to pull her pants up and down
- Durability: waterproof and lasts a long time

Customer Statement	Interpreted needs	Importance
Preferably portable	Portable so that the user can use the device outside of the house	3.5
Limited shoulder range	Product is meant to help with the users reach	5
Hard to pull up the pants up the bum	Device helps with reaching the back of her pants	5
Limited strength	Device helps client pull up and down her pants	4
Fit in her backpack	Size of device is small enough to fit the bag or foldable/detachable	3
No allergies	Can be made with any material	1

Target Specifications - Functional Requirements

Metric ID Number	Design Specifications	Ideal Values	Marginal values	Units	Verification Method
1	Adjustable part	= Yes	= Yes	N/A	Test
2	Clamp	= Yes	= Yes	N/A	Test
3	Triggers	= Yes	= Yes	N/A	Test

Target Specifications - Non-Functional Requirements

Metric ID Number	Design Specifications	Units	Verification Method	Ideal Values	Marginal Values
1	Aesthetics	N/A	Analysis	Rabbit Stickers, purple,	Stickers, color
2	Material	N/A	Test/Analysis	Carbon fiber	Aluminum and polymer
3	Safety	N/A	Test	No sharp parts, harmless clamps	No sharp parts, harmless clamps
4	Product Life	Years	Estimate	>= 20	>= 5

Target Specifications - Constraints

Metric ID Number	Design Specifications	Units	Verification Method	Ideal Values	Marginal Values
1	Weight	lbs	Analysis	=< 5	=< 10
2	Size (Height)	in	Analysis	=< 12	=< 14
3	Size (width)	in	Analysis	=< 7	=< 7.5
4	Waterproof	N/A	Test	=Yes	=Yes
5	Cost	$ (CAD)	Estimate	=< 50	=< 85

Benchmarking

Tools Metrics	Importance Weight	Wilming Robotic Exoskeleoton (WREX) 	Assistive Artistic Device: 	Dorking Donner Tights Aid 	Clip and Pull Dressing Aid 
Weight	3	5lbs	0.25 lbs	0.25 lbs	0.15 lbs
Size	4	6'' to 10'', it also can be customized.	Can be customized	380 mm width by 560 mm height with handle by 130mm	Adjustable27-41 In
Cost	5	$2,227.23	<$5	$63	$27.39
Ease of use	4	Medium Requires additional support to wear	Easy to put on and use	Hared Requires additional support to wear	Hared Requires additional support to wear
Effectiveness	5	Support in doing normal activities and may even help in rehabilitation of said medical condition	Assist in drawing, painting.	It is effective in general but not in the user's case	It is effective in general but not in the user's case
Material	5	Acrylonitrile butadiene styrene (**ABS**)	Acrylonitrile butadiene styrene (**ABS**)	Nylon and Plastic	Nylon and Plastic
Durability	4	No Data	No Data	No Data	No Data

Bill of Materials

Item #	Description	Quantity	Unit Cost (CAD)	Extended Cost (CAD) (For students)	Extended Cost (CAD) (For Non-students)	Link
1	PEX-A expansion Pipe	1	$5.90	$5.90	$5.90	PEX-A expansion pipe
2	¾ x ¾ 90 deg INS	2	$1.64	$3.28	$3.28	PEX-A expansion Elbow fitting
3	3-D printing	1	$0	$0	$120.00	
4	Cables	2	$4.95	$9.90	$9.90	
5	Screws	2	$2.50	$5.00	$5.00	
6	Hose	2	$0	$0	N/A	

Concept Overview

- During the project's ideation phase, all five team members of NKECHI proposed five different innovative ideas
- These ideas underwent the empathy phase of the Five Phases of Design
- The client approved a Hulu-like design with a clamp, best suited to meet their needs
- Specifically requested that the device be operated from the front rather than the rear

Design For X

1. **Safety (Design for Safety)**: Features like rounded edges and secure clamps ensure safe usage of the device, preventing accidents.
2. **Durability (Design for Durability)**: High-quality materials and robust construction methods ensure the device remains sturdy and functional over time.
3. **Reusability (Design for Reusability):** Modular components allow for easy assembly and customization, promoting longevity and cost-effectiveness.
4. **Sustainability (Design for Sustainability)**: Eco-friendly materials and practices minimize environmental impact throughout the device's lifecycle.
5. **Adaptability (Design for Adaptability)**: Adjustable features accommodate diverse user needs, enhancing inclusivity and usability

Business Model

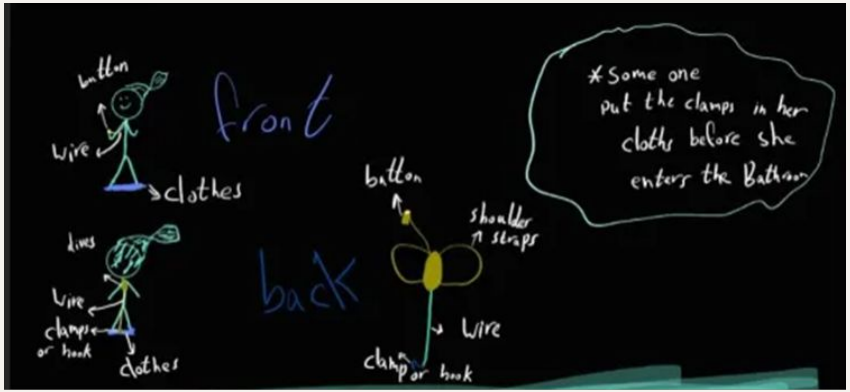
- Business model tailored for this project was the Direct Sales Model
- Emphasizing cost-effectiveness in production through 3D printing technology
- Also using durable materials like wire, screws, sleeves, and stoppers for critical brake components
- A competitive pricing strategy was applied, with the total cost for this project at $24.08, compared to $2,227.73 for an Exoskeleton device made from PVCs

Economic Analysis

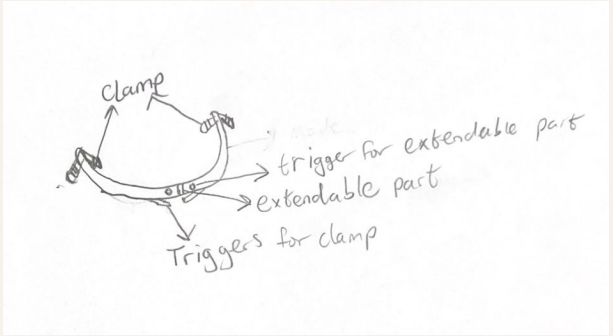
- Revenue projections based on market demand for accessibility devices
- Profitability estimates considering production and distribution expenses, and the expected return on investment (ROI) over a 5-year period were also considered
- Incorporation of two ideation phases ensured thorough exploration and refinement of design concepts
- Leading to the selection of the Hulu-like design with a front-operated clamp as the final prototype

IDEAS

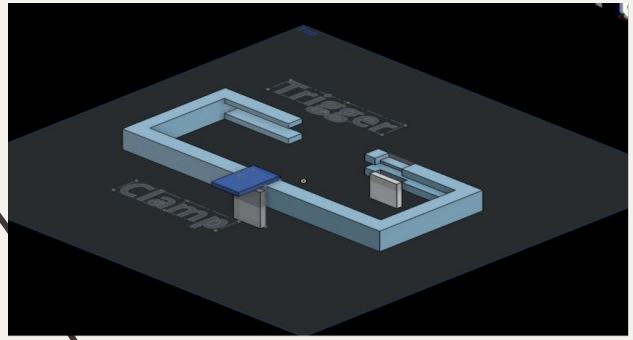
Assistant Bag



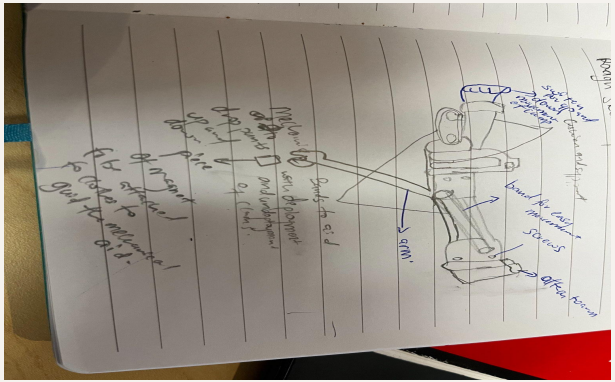
Assistant frame



Assistant frame



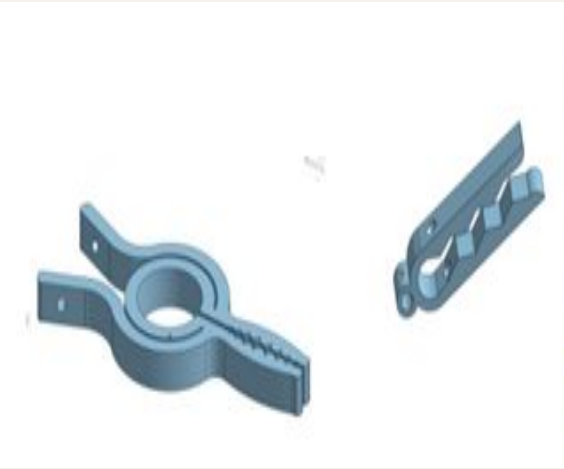
Exoskeleton

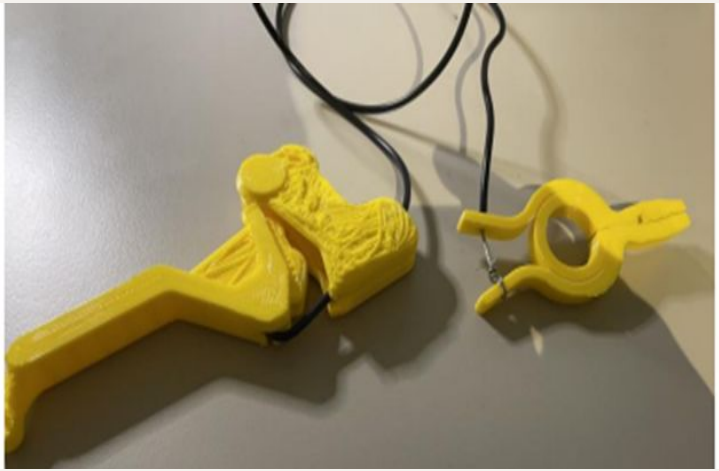


Prototype 1

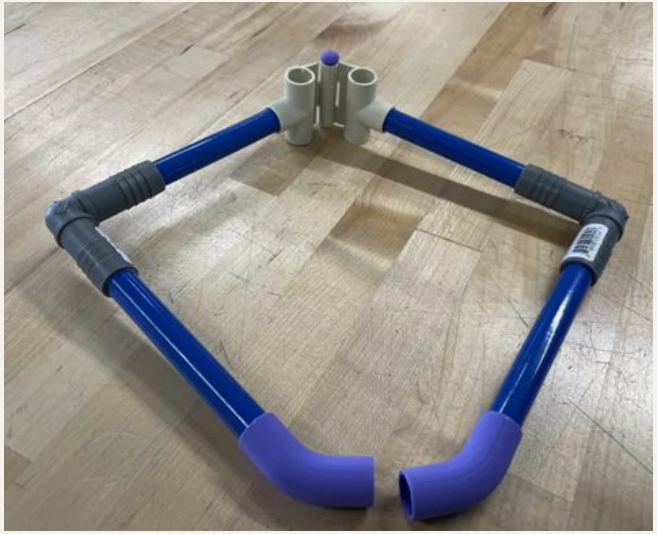
- A simple demonstration using a hula hoop and clothes hangers to prove the concept.

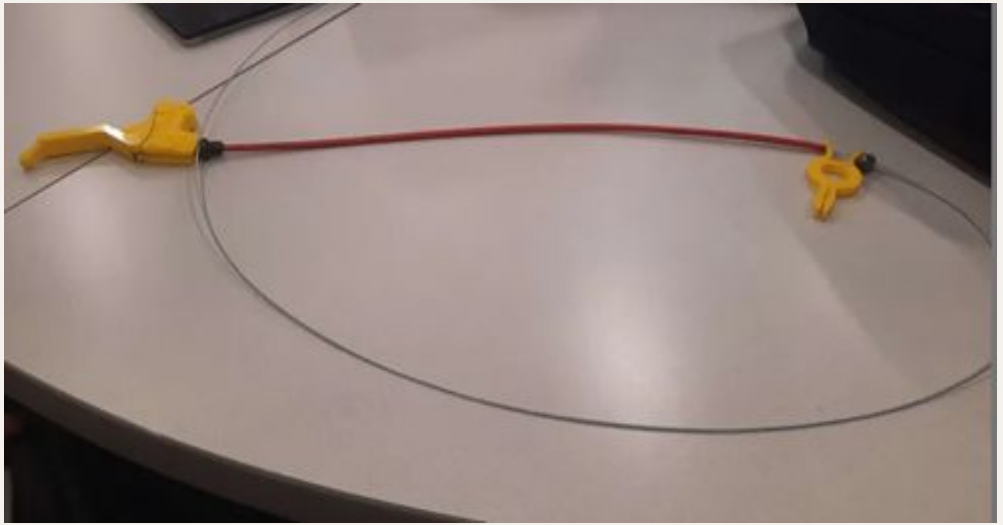
Prototype 2





Final Prototype





Trials and Tribulations

- Coming up with a solution that is practical, easy to implement and useful to our client and the user
- Finding convenient work schedules for all team members
- Finding suitable ways to bring our ideas to reality
- Teammates falling ill and getting major injuries throughout the semester, inhibiting the work the team could get done

Lessons Learned

- Have a clear idea on how ideas work practically and find ways to test them before purchasing materials

- There might be easier ways to execute an idea than initially envisioned, make sure to always look for them

FUTURE WORK: There have been no official talks within the group on possibly working on this project beyond this semester

Conclusion

We are happy with the progress we have made with this project and can not wait to show everyone our final prototype on design day. We have learned a lot from working on this project and we have had fun being teammates for this semester. This is all we have for now and we hope to see you soon.

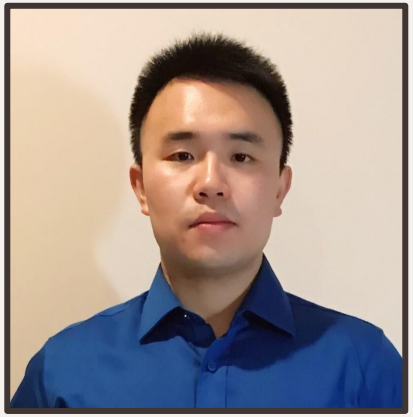
Our team

Maanashan Rudranantha

Lemuel Douglas

Our team

Jasem Alenezi



Gong (Victor) Feng

George Osariemen Omoregie

Thanks!

CREDITS: This presentation template was created by **Slidesgo**, including icons by **Flaticon**, infographics & images by **Freepik**