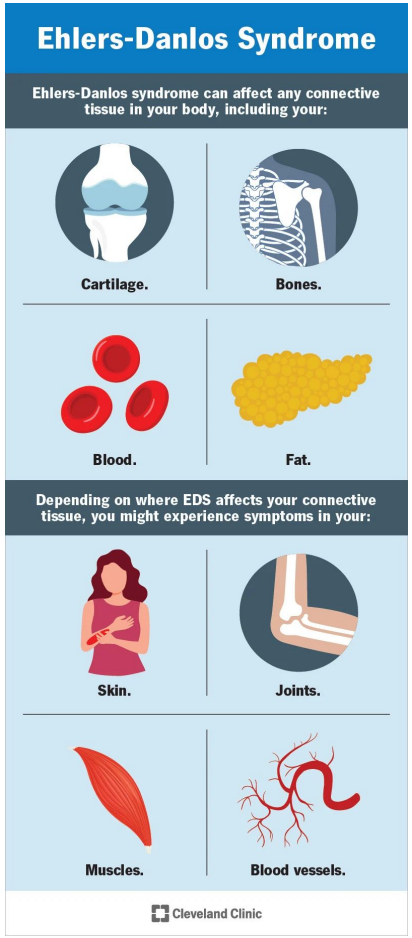
GNG2101 – One Handed Walker Steering System

Final Presentation

Team Z22: The Fast and Fabricating Five (FFF)

Agenda: Project Progress Presentation

1. Empathizing With Our Client
2. Problem Statement
3. Customer Needs
4. Product Benchmarking
5. Target Specifications
6. Business Model Canvas
7. 3-Year Income Statement
8. Feasibility Study
9. Simplified Project Plan
10. Solution Options
11. Early Concepts and Chosen Concept
12. BOM
13. Prototypes
14. Issues Faced, Skills and Lessons Learned
15. Future Work



Ehlers Danlos Syndrome

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Adaptable

Convenient

Portable

Problem Statement

The client requires a **maneuverable**, **lightweight**, **easily attachable** device that allows them to steer the walker **effectively** with one arm through narrow spaces and diverse terrain.

Translated Client Need Statements

Functional (DO)

- Easy to maneuver (easy to carry around - user friendly, easy to take on and off - easy to fold)
- Easily applicable brake system
- Allows for one handed steering of walker

Non-functional (BE)

- Adaptable (works for either arm)
- Durable (different weather types)
- Installable without permanent changes to the walker

Number Priority (most to least importance)	Needs
1	Allows for one handed steering of walker
2	Adaptable (use with either arm)
3	Maneuverable (easy to take on and off and fold)
4	Easily applicable brake system
5	Durable (can be used in different kinds of weather)
6	Installable without permanent changes to the walker

Target Specifications

Characteristics	< > =	Target Value
Folding/Collapsing	=	Yes
Total weight	<	5 pounds
Length	=	55 cm
Length (Folded)	<	25 cm
Adaptable	=	Yes
Time to assemble	<	45 seconds
Time to attach to walker	<	30 seconds
Ease of use	=	Yes
Cost	<	100$ CAD

Business Model Canvas

<table>
<tr><th colspan="5">Triple Bottom Line Business Model Canvas</th></tr>
<tr>
<td rowspan="2">Key Partners
Drive medical
Amazon</td>
<td>Key Activities
Advertisement</td>
<td rowspan="2">Value Proposition
Increase walker safety and accessibility to people with limb or joint disabilities, and/or elders</td>
<td>Customer Relationships
Trusting
Positive
Co-Creation</td>
<td rowspan="2">Customer Segments
People who struggle with limb or joint disabilities
People who want an alternative way to use their walkers</td>
</tr>
<tr>
<td>Key Resources
Walkers</td>
<td>Channels
Field Sales
Amazon Store</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Marketing & Sales</td>
<td colspan="2">Revenue Streams
Product Sales
Warranty</td>
</tr>
<tr>
<td colspan="3">Social and Environmental Cost
Might be seen as useless
Creation of PVC pipes releases dangerous gasses</td>
<td colspan="2">Social and Environmental Benefit
Helps to reduce greenhouse gasses
Helps to reduce energy consumption
Recycled material
Helping People with mobility issues
Inclusivity</td>
</tr>
</table>

Our Business Model: Brick and Mortar

Allows the client to

01
Physically test

02
Make observations

03
Inquire

3-Year Income Statement

3 Year Income Statement			
Particulars	Year 1	Year 2	Year 3
INCOME			
Revenue from Sales	750	350	1500
Revenue from Past Yr inventory		750	300
OPERATING INCOME	750	1100	1800
EXPENDITURE			
Cost of material/unit	120 (10x)	120 (5x)	120(10x)
Labor/Salary	20	20	20
Marketing	30	30	30
Depreciation	10	10	10
Total cost of material (all units/yr)	1200	600	1200
OPERATION EXPENSES	1260	630	1230
Gross Profit for the Yr	-450	470	570

Feasibility Study (TELOS)

Technology: The technology needed to complete our project involves the manufacturing process - 3D printing.

Economics: Dependent on manufacturing and production.

Legal: Confidentiality, safety.

Operational: Iterative engineering design process.

Schedule: Weekly team meetings, design day.

Simplified Project Plan

#	Task	Time												Owner
		Month 1				Month 2				Month 3				
1	Deliverable A	x												All members
2	Deliverable B		x											Tyler
3	Design criteria		x											All members
4	Conceptual design & Project plan			x	x									All members
5	Prototype 1, Tests and Feedback					x	x							Jonathan
6	Prototype 2, Tests and Feedback							x	x					David
7	Prototype 3, Tests and Feedback									x				Elisha
8	Material of Design Day & Presentation										x			All members
9	Production of user manual												x	All members
10	Project closeout												x	All members
Project risks	Delivery delay of important project components + Busy schedules													

X means one week

■ means milestones
- Client Meetings
- Design Day
- Final Presentation

Template retrieved from GNG 2101 lecture 11 slides

Solution Options

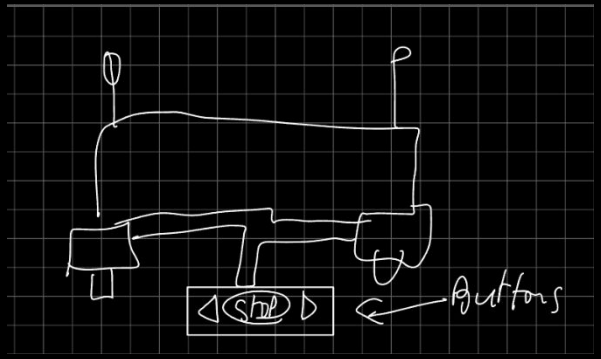
4 Subsystems

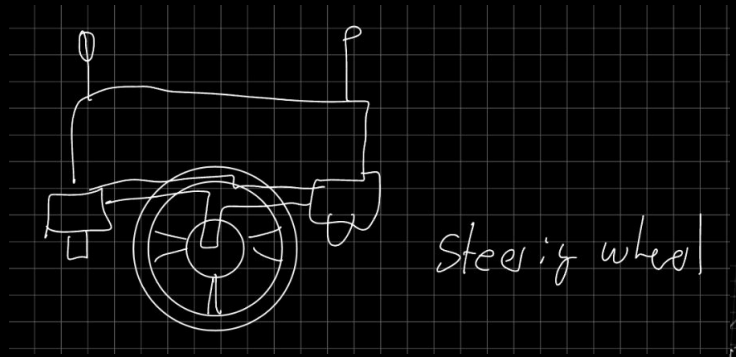
1. Attachment Method
2. Folding Mechanism
3. Steering System
4. Adapting System

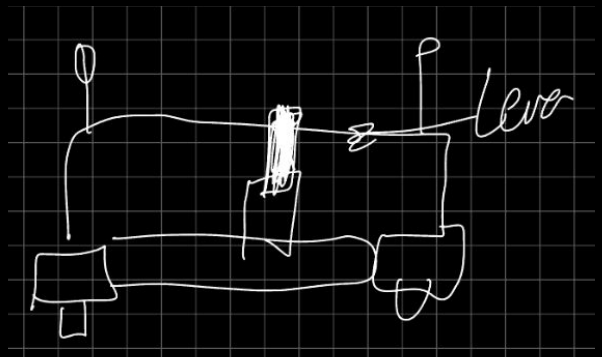
*Solution we selected

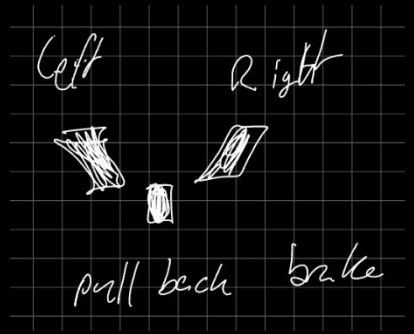
Attachment method (To the walker)	**Folding**	**Steering**	**Adapting** (having system work on both sides)
Snap Clip	Bar aligned with walker's external post	Wheel	Circular clamp that can be tightened using a screw that twists to loosen/tighten, in a similar way to the function of a vice clamp.
Vice Clamp	Telescoping inside of itself	Extended handle	Sliding mount for the steering system.
Magnet	Bar has a pivot point in the middle where the bar can fold in half	Lever system	The mechanism will be able to be attached and removed from either handle. Using a clip-on method the mechanism can be attached and moved around depending on the clients comfort and preferences.
Magnetic weight stack pin		Electronic steering system (Buttons)	

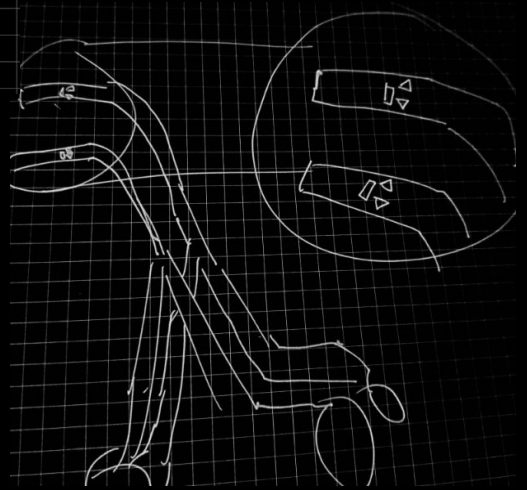
Early Concept Ideas



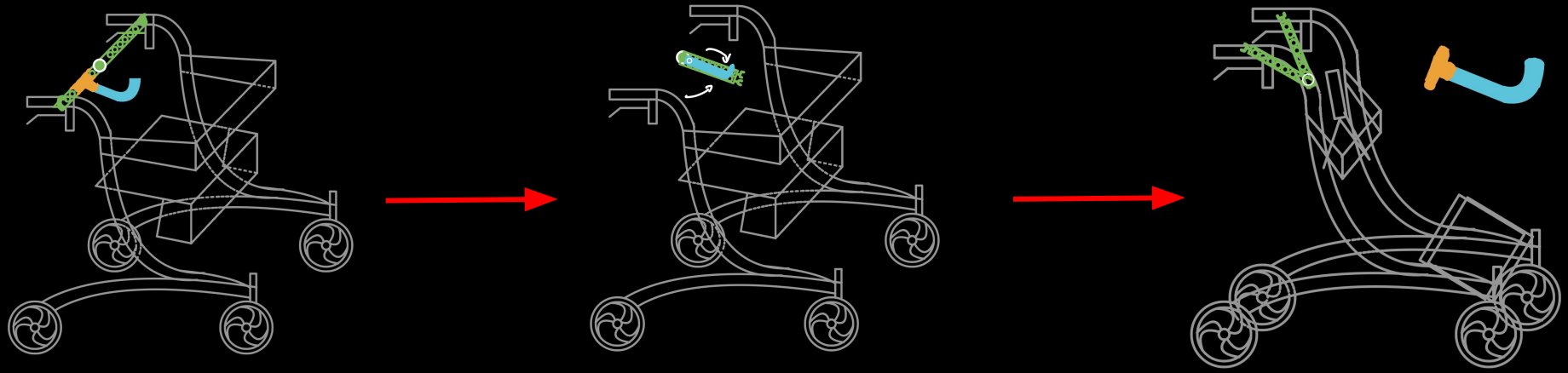








Overview of Chosen Concept

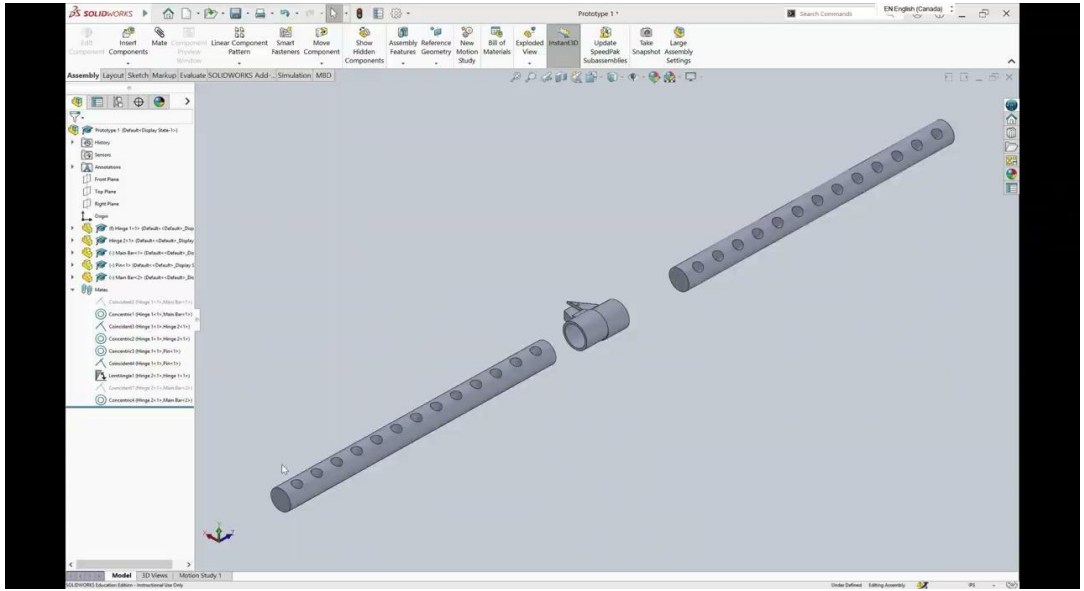


Bill of Materials (BOM)

Final BOM					
Item Number	Part Name	Description	Quantity	Unit Cost	Extended Cost
1	PVC pipe	¾" PVC Pipe	1	$8.86	$8.86
2	Clamp PLA	Used to 3d Print Clamps	1	$0.15/g	$2.72 for 12 g
3	Foam	Used to add padding to main bar and secondary bar.	1	$9.00	$9.00
4	Hinge	Hinge	1	$28.12	$28.12
5	LePage Construction Adhesive	Used to connect main bar to hinge.	1	$9.55	$9.55
6	Nut and bolt	Pack of 10pcs.	10	$3.47	$3.47
7	Stack Weight Pin	Used to attach the secondary handle to the main bar	2	$4.75	$9.50
8	Secondary Bar attachment dock	Dock that will be used to connect the secondary bar to the main bar.	2	$1.33	$2.66
Total	$73.68				

Prototype Testing Plan: Prototype 1

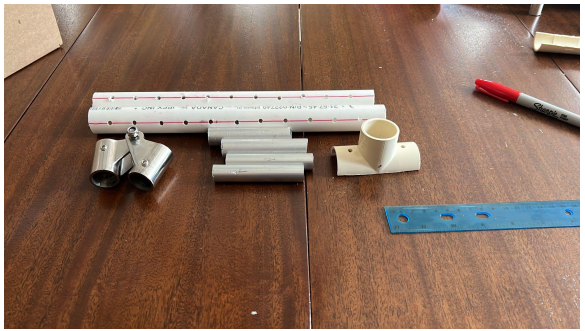
- Analytical and Focused of Low Fidelity
- Used to Test feasibility of selected hinge mechanism



Note: We were not able to get the parts needed for a physical prototype so part specifications were used to create a solidworks model.

Prototype Testing Plan: Prototype 2

- Focused, physical, medium fidelity
- Mainly focused on main bar
- Used to test the strength of the hinge and the main PVC pipes.
- Also used to test if the connection method between the pvc pipes and the hinge was sufficient for everyday use.



Prototype Testing Plan: Prototype 2

Feature	Testing Method	Target Metric	Achieved Value
Total Weight	Scale	< 5 lbs	< 2 lbs
Total Length While Folded	Rulers/Measuring Tape	< 40 cm	38 cm
Weight Supported by main Bar	Use of set weights and rope (Weights)	> 30 lbs (Center of main bar)	> 40 lbs
Length of Main Bar	Rulers/Measuring Tape	< 75 cm	68 cm

Prototype Testing Plan: Prototype 3

- Focused, Physical, High Fidelity
- Used to test the multi-sided function of the secondary bar using the mount and pins
- Also used to test if the glue we used would be strong enough for this application
- Tested the durability of the clamps

Prototype Testing Plan: Prototype 3

Feature	Testing Method	Target Metric	Achieved Value
Total Weight	Scale	< 5 lbs	< 2 lbs
Time to assemble	Timer/Stopwatch	< 45 seconds	< 30 seconds
Time to attach to walker	Timer/Stopwatch	< 30 s	< 5 s

Issues Faced

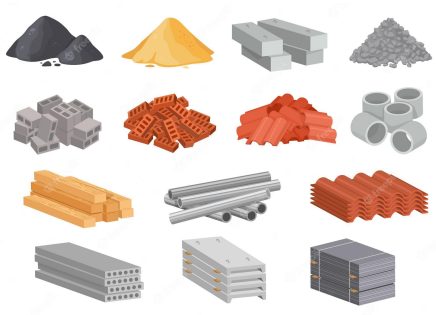
- Not being able to meet with the client in person
- Not being able to physically see the walker we were designing the solution for
- Needing to make some alterations to materials and parts
  - The hinge we were looking at became out of stock, causing us to need to switch our method of attachment between the pvc pipes and the hinge.

Skills Learned

Machining procedures

Designing 3D models

Designing for manufacturing (Picking the right materials)



3D Printing

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Lessons Learned

- Having a proper testing plan allows for the prototyping phase to have much less risk and provide a greater outcome.

- Failure is good if you are able to learn from it and adapt for the next hurdle.

- Understanding the reasoning behind each design process step makes it much easier to completely fulfill the need put forward by the client.

Future Work

- Testing product with client.
- Updating our design to work with any walker.
- Adding a single-handed braking component.
- Continuing to build our business.
  - Generate more ideas based off of customer reviews/feedback.
  - Design our own walker.

Questions?