uOttawa

GNG 2101

A 2.3
One-Handed
Walker Steering

By: Defne, Ekin, Jérémie, Jorge, and Saheel

Client meetings

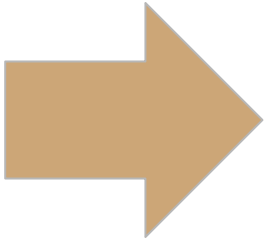
3 client meetings throughout the semester.

- Input
- General feedback
- Updates on the requirements
- Discuss possible new ideas (iterations)

Problem analysis

- **Client Statements**

1. I want the device to be long-lasting, be permanent
2. I want to be able to walk over snow banks
3. I want the device to be detachable and versatile
4. I want the device to be stable, balance is key
5. I want the device to be able to fold on itself…



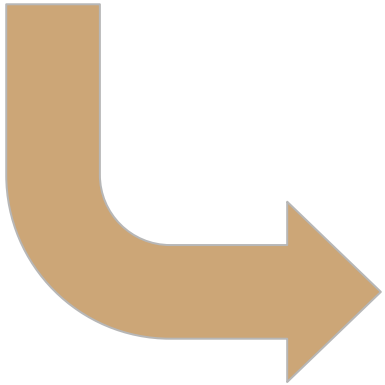
- **Translated customer needs**

#	Need	Imp
1	The device lasts a long time	4
2	The device can endure extreme weather conditions (snow, rain, cold and heat)	3
3	The brackets can be on installed easily on any walker	5
4	The fasteners fit tight	4
5	The device allows an easy installation without making permanent changes to the walker…	3

“A need exists for walker users with one operational arm to safely and easily steer the walker with a straightforward, attachable device that is versatile, durable, and cost effective.”

Metrics

Needs List



Metric #	Needs #	Metric	Unit
1	9	Force required to use device	N
2	9	Manoeuvrability (Turning Radius)	m
3	9	Agility (Rotational speed)	deg/s
4	8	Total weight	kg
5	7	Dimension	m^3
6	2,7,1	Reliability (MTBF)	h
7	1,8	Material	N/A
8	3,5	Detachability (Time to assemble)	min
9	4,9,10	Ease of use	N/A
10	6	Cost	CAD

Benchmarking

Specification	Importance (Weight)	Nitro Euro Style Walker Rollator.	Electric Wheelchair	Manual Wheelchair
Make		Drive Medical	Fold and Travel	Medline
Cost (CAD)	5	400	2900	287
Load Limit (N)	3	1300	1470	1332.8
Material	2	Aluminium	Aluminium	Aluminium
Dimension (cm)	3	70.5 x 58.4 x 92.2 cm	72.2 x 62.5 x 95.5 cm	80 x 64.8 x 92.7 cm
Ease of Installation	4	3	2	2
Force required (N)	5	10	1	130
Manoeuvrability	4	3	2	1
Agility	3	1	3	2
Reliability	4	3	1	2
Total		83	60	67

No previous attempts found

Benchmarking done for components and devices with similar purpose (steering)

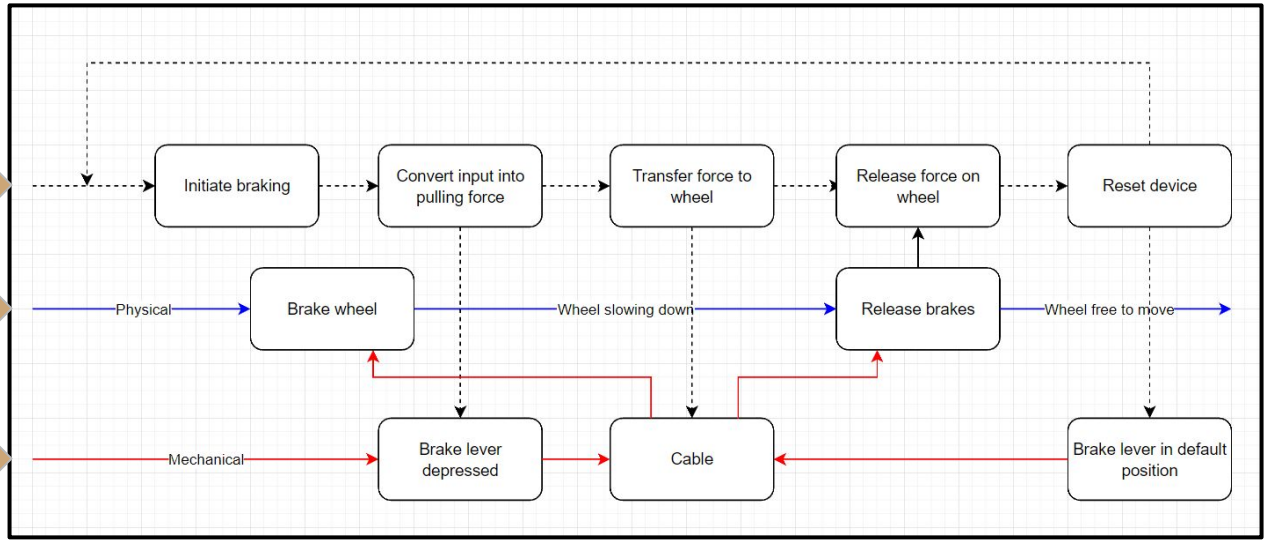
Target Specifications

Metric #	Functional Requirements	Relation	Value	Unit	Verification Method
1	Force required to use device	<	10	N	Test
2	Manoeuvrability (Turning Radius)	<	2	m	Test
3	Agility (Rotational speed)	>	30	$deg.s^{-1}$	Test
#	**Non-Functional Requirements**	**Relation**	**Value**		
4	Total weight	<	8.5	kg	Test
5	Dimension	<	0.55	m^3	Test
6	Reliability (MTBF)	>	2500	h	Estimate
7	Material	-	Aluminium	N/A	Analysis
8	Detachability (Time to assemble)	<	20	min	Test
9	Ease of use	-	-	N/A	Test
#	**Constraints**	**Relation**	**Value**	**Unit**	
10	Cost	<	100	CAD	Given
11	Time to complete project	<	1/12/2022	Date	Given

Functional decomposition

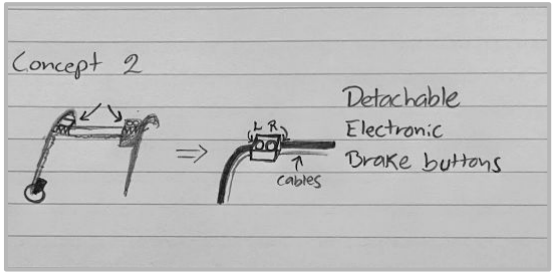
Decomposition of all needs into logical separable Tasks

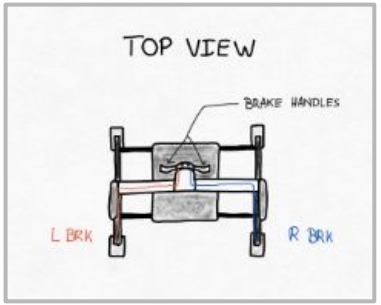
1. Logical
2. Physical
3. Mechanical

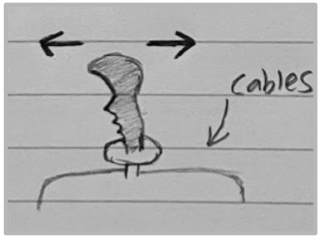


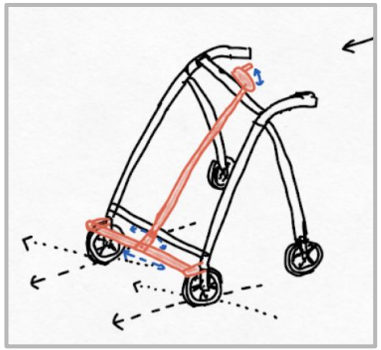
Ideation

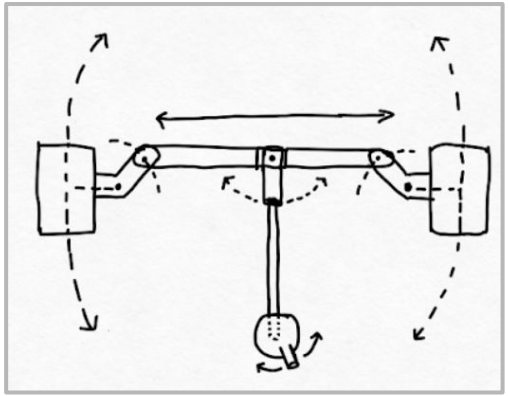
15 **Ideas / Sketches**

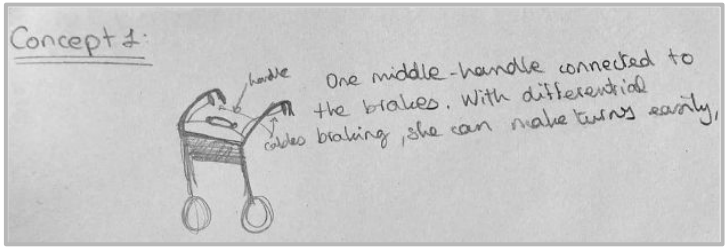












Decision Matrix

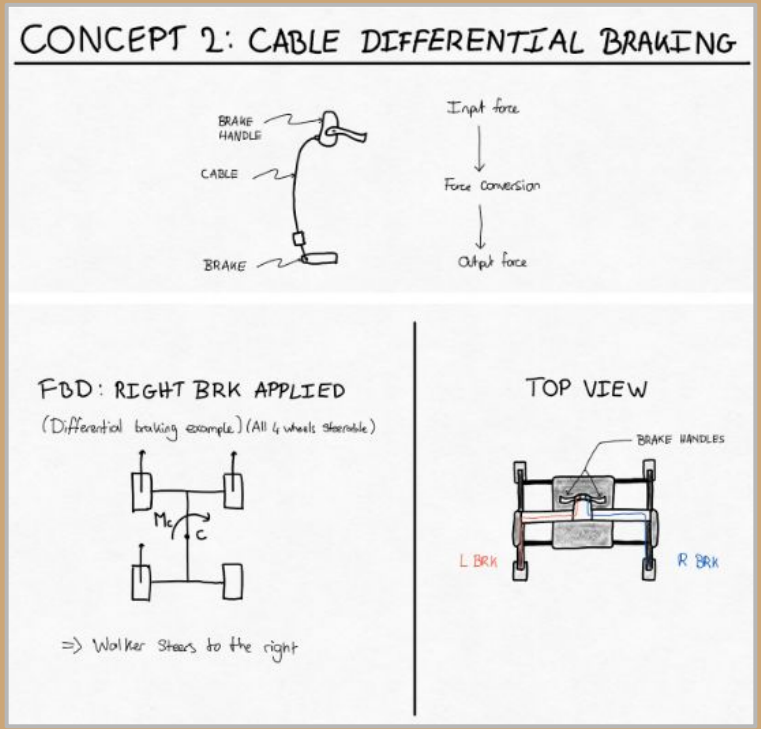
Concept Options (Part 1 of 3)											
Selection criteria	Weight	**Defne** Concept 1		**Defne** Concept 2		**Defne** Concept 3		**Jérémie** Concept 1		**Jérémie** Concept 2	
Force required	0.15	**5**	0.75	**9**	1.35	**8**	1.2	**5**	0.75	**10**	1.5
Maneuverability	0.13	**5**	0.65	**7**	0.91	**8**	1.04	**4**	0.52	**8**	1.04
Cost	0.13	**5**	0.65	**6**	0.78	**6**	0.78	**5**	0.65	**1**	0.13
Total weight	0.15	**5**	0.75	**4**	0.6	**5**	0.60	**5**	0.75	**4**	0.60
Dimension	0.11	**5**	0.55	**3**	0.33	**6**	0.66	**7**	0.77	**7**	0.77
Reliability	0.11	**5**	0.55	**5**	0.55	**6**	0.66	**7**	0.77	**3**	0.33
Material	0.07	**5**	0.35	**4**	0.35	**5**	0.35	**5**	0.35	**3**	0.21
Ease of installation	0.15	**5**	0.75	**6**	0.9	**5**	0.75	**4**	0.6	**3**	0.21
Total Score		**Ref. = 5**		**5.77**		**6.04**		**5.16**		**4.79**	

Concept Options (Part 2 of 3)											
Selection criteria	Weight	**Jérémie** Concept 3		**Jorge** Concept 1		**Jorge** Concept 2		**Jorge** Concept 3		**Saheel** Concept 1	
Force required	0.15	**10**	1.5	**4**	0.6	**10**	1.5	**5**	0.75	**10**	1.5
Maneuverability	0.13	**8**	1.04	**5**	0.65	**7**	0.91	**7**	0.91	**8**	1.04
Cost	0.13	**1**	0.13	**7**	0.91	**2**	0.26	**5**	0.65	**4**	0.52
Total weight	0.15	**3**	0.45	**5**	0.75	**3**	0.45	**4**	0.60	**5**	0.75
Dimension	0.11	**4**	0.44	**5**	0.55	**1**	0.11	**4**	0.44	**5**	0.55
Reliability	0.11	**1**	0.11	**6**	0.66	**1**	0.11	**6**	0.66	**4**	0.44
Material	0.07	**1**	0.07	**1**	0.07	**2**	0.14	**3**	0.21	**5**	0.35
Ease of installation	0.15	**1**	0.15	**3**	0.45	**1**	0.15	**3**	0.45	**2**	0.3
Total Score		**3.89**		**4.64**		**3.63**		**4.67**		**5.45**	

Concept Options (Part 3 of 3)											
Selection criteria	Weight	**Saheel** Concept 2		**Saheel** Concept 3		**Sarp Ekin** Concept 1		**Sarp Ekin** Concept 2		**Sarp Ekin** Concept 3	
Force required	0.15	**10**	1.15	**4**	0.6	**4**	0.6	**5**	0.75	**10**	1.50
Maneuverability	0.13	**7**	0.91	**6**	0.78	**6**	0.78	**3**	0.39	**6**	0.78
Cost	0.13	**8**	1.04	**1**	0.13	**5**	0.65	**5**	0.65	**1**	0.13
Total weight	0.15	**7**	1.05	**2**	0.3	**7**	1.05	**2**	0.30	**1**	0.15
Dimension	0.11	**7**	0.77	**2**	0.22	**7**	0.77	**5**	0.55	**3**	0.33
Reliability	0.11	**8**	0.88	**4**	0.44	**2**	0.22	**5**	0.55	**4**	0.44
Material	0.07	**6**	0.42	**3**	0.21	**5**	0.35	**5**	0.35	**5**	0.35
Ease of installation	0.15	**9**	1.35	**1**	0.15	**5**	0.75	**1**	0.15	**2**	0.30
		7.57		**2.83**		**5.17**		**3.69**		**3.98**	

Winner concept

Final Concept Decision



Positives

- Low price point
- Ease of installation
- Reliability
- Ease of Use

VS

Negatives

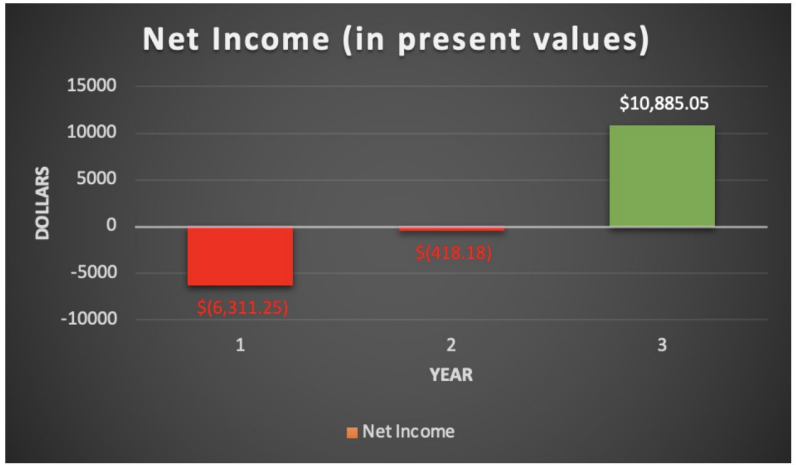
- Complexity
- Maneuverability
- Weight

Bill of materials

Bill of Materials			
Material required	**Amount**	**Cost (shipping included)**	**Link**
Brake wire with black tubing	10 pcs	$12.29	https://amzn.to/3MfO362
Plastic Brake Handles	2 pcs	$15.99	https://amzn.to/3CKcw0n
Galvanized Steel Pipe 6063-T6	1 pc	$32.49	https://amzn.to/3fUZOTu
Sail tie Optiparts	1 pack	$19.35	https://bit.ly/3T5VChR
Scotch-Mount ½" x 15"	1 pack	$15.50	https://amzn.to/3fSzGIW
Total Cost =		$95.62	

- **Preliminary**
- **Under $100 dollars**
- **Shipping included**
- **Additional material considered***

Economics & Business Model



Net Income Analysis (PV)			
Year	Total Revenues	Total Costs	Net Income
1	$ 12,500.00	$ 18,811.25	$ (6,311.25)
2	$ 27,267.77	$27,685.95	$ (418.18)
3	$ 58,593.54	$47,708.49	$ 10,885.05

Net Income NPV (for 3 years) ---> $ 4,155.62

Key Partners

Warehouse and delivery workers
Assembly workers assemble the product.
Insurance company

Key Activities

Marketing
R&D
Customer service
Production

Key Resources

Materials for the product: Brake wires, Steel bar, bike brakes and attachment blocks.

Warehouse/assembly workers

Value Propositions

We are presenting a single handed walker steering device which is easily attachable/detachable to different types of walkers. This device will facilitate the use of the walker when the user has only one operational arm.

Customer Relationships

Direct relationship
Personal assistance

Channels

Online/website
Amazon Store
eBay

Customer Segments

Customers who are: walker users, with one functioning arm and who have mobility difficulties.

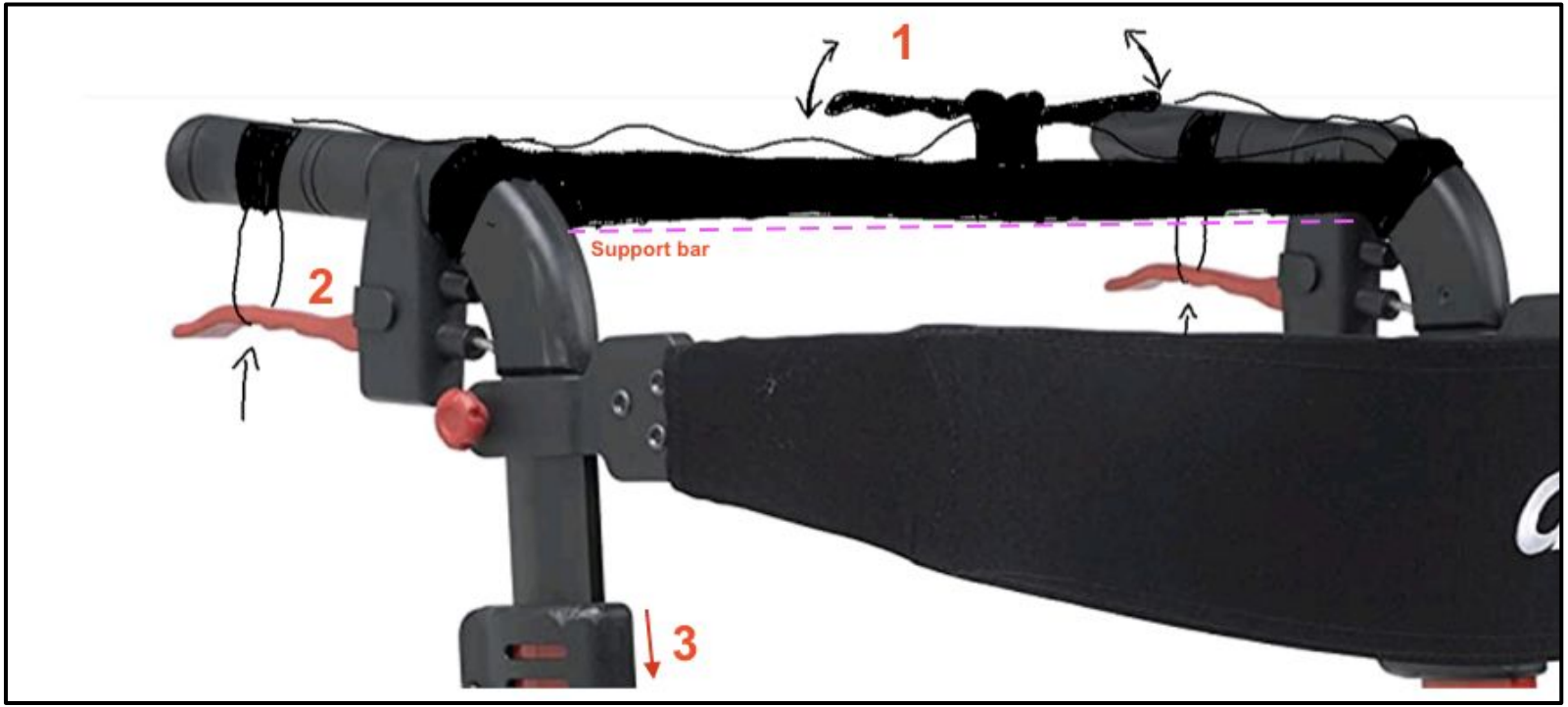
Cost Structure

Marketing and sales
Materials
Product Development

Revenue streams

Sales
Sponsorships
Services

First Prototype -> Low fidelity



Testing -> (focused & analytical)

1. Brake displacement testing

$X_{Lever1} = 8.3\,cm$
$X_{Lever2} = 1.8\,cm$
$X_{Wire1} = 2.7\,cm$
$X_{Wire2} = 5.2\,cm$

$$\text{displacement ratio} = \frac{|\Delta X_{wire}|}{|\Delta X_{Lever}|}$$

$$= \frac{|2.7-5.2|}{|8.3-1.8|}$$

$$= 0.385$$

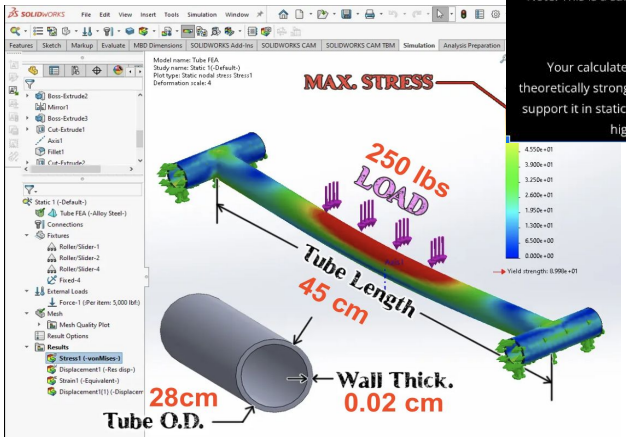
Figure 1

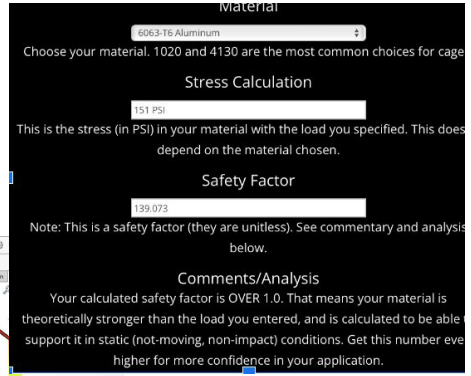
Figure 2

Figure 3

Figure 4

2. Cross Bar Weight Distribution Testing





Second Prototype -› medium fidelity

- Physical
- Medium Fidelity
- Reuse Materials For Final Product

Testing

Subsystems compatibility testing

Fastener testing

Final Product & Demonstration

Future of this Design

Thank you