Design of a Walker Brake System

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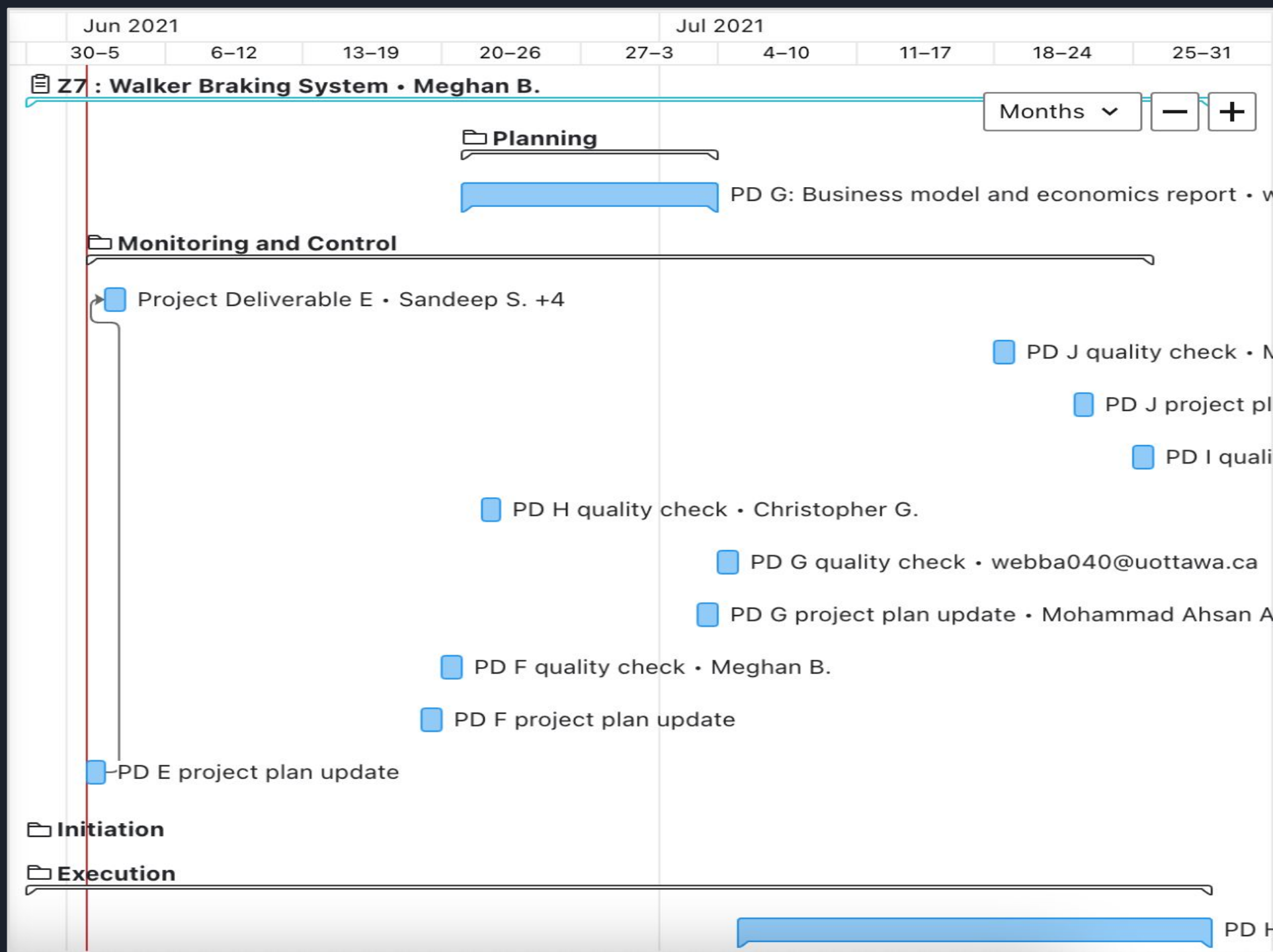
Project Plan

- 1 - 2 meetings a week to discuss the tasks.
- Chat over Discord
- Wrike Gantt Chart



Prioritized Clients Needs

ID	Need		Rating
1	The walker brake	has an interactive system that requires limited hand grip strength.	5
2	The walker brake	system that has a low force threshold.	5
3	The walker brake	only has one interactive component needed to be able to stop both sides of the walker.	5
4	The walker brake	comes to a gradual stop.	5
5	The walker brake	is waterproof/weatherproof.	4
6	The walker brake	is foldable.	3
7	The walker brake	is safe for client use.	5
8	The walker brake	is light and portable as possible.	4
9	The walker brake	has to fit in a car.	3
10	The walker brake	retains the structural integrity of the actual walker.	5
11	The walker brake	has a failsafe mechanism.	5
12	The walker brake	has ergonomic features (such as having a braking mechanism close to handle).	3

Problem Statement

The clients require a safe, universal braking system to stop the motion of a walker gradually while using minimal grip strength and a single user interface. The brake system needs to be lightweight, ergonomic and foldable without altering the structural integrity of the walker.

Benchmarking

#1

#2

#3

Product and Feature	1. Piper Series Walker by Evolution Walkers	2. Glider Plus Adjustable Rollator	3. Rollator Walker by KMINA PRO
Cost	US$439.35	£195	$149.99
One handed braking system	Yes	Yes	Yes
Lightweight	Yes (12 lbs for smallest size)	Yes (6.5 kg, 14.3 lbs)	Yes
Foldable	Yes	Yes	Yes
Failsafe mechanism	No	No	No
Brakes can be activated with low grip strength	Yes	Yes	Yes
Lockable brakes	Yes	Yes	Yes
waterproof/ weatherproof	Yes	Yes (Optional Add-On)	Yes
gradual stop	Yes	Yes	Yes

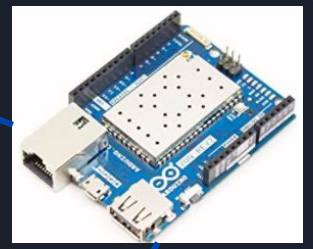
Target Specifications

Metric ID	Need ID	Metric	Units	Marginal Value	Ideal Value
1	8	Total weight of the walker	lbs	13	<15
2	6, 9	Dimensions of walker (l x w)	in	22 x 23	N/A
3	4	Stopping distance	in	-	12
4	1, 2	Load exerted to brake	Low/High	-	Low
5	11, 12	Size of braking mechanism	in	-	<22 x <23 x <31
6	N/A	Cost	$CAD	-	<100
7	3, 12	One-hand interaction with brake	Yes/No	Yes	Yes
8	5	Weather resistance / Waterproof	Yes/No	Yes	Yes
9	7, 10	Safe for client use	Yes/No	Yes	Yes
10	6,9	Height of handles	in	31	31.5

Concept #1

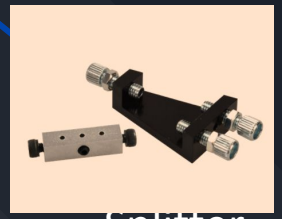
3D printed ergonomic handle.

Arduino board located inside a sealed handle.

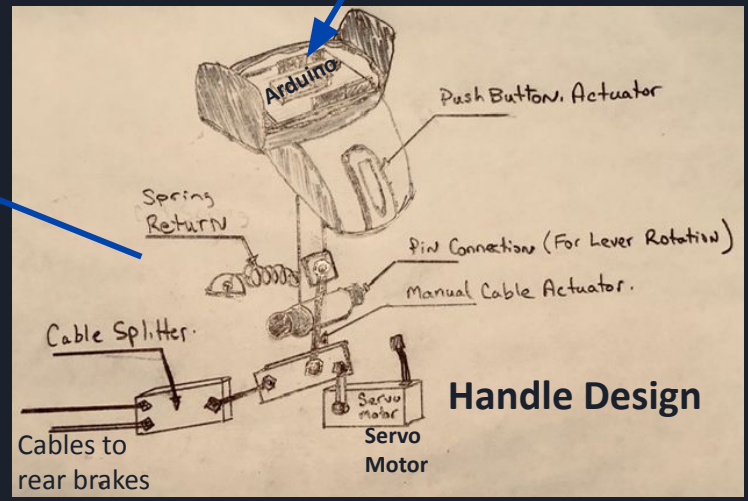


Push Button Micro Limit Switch.

Servo Motor

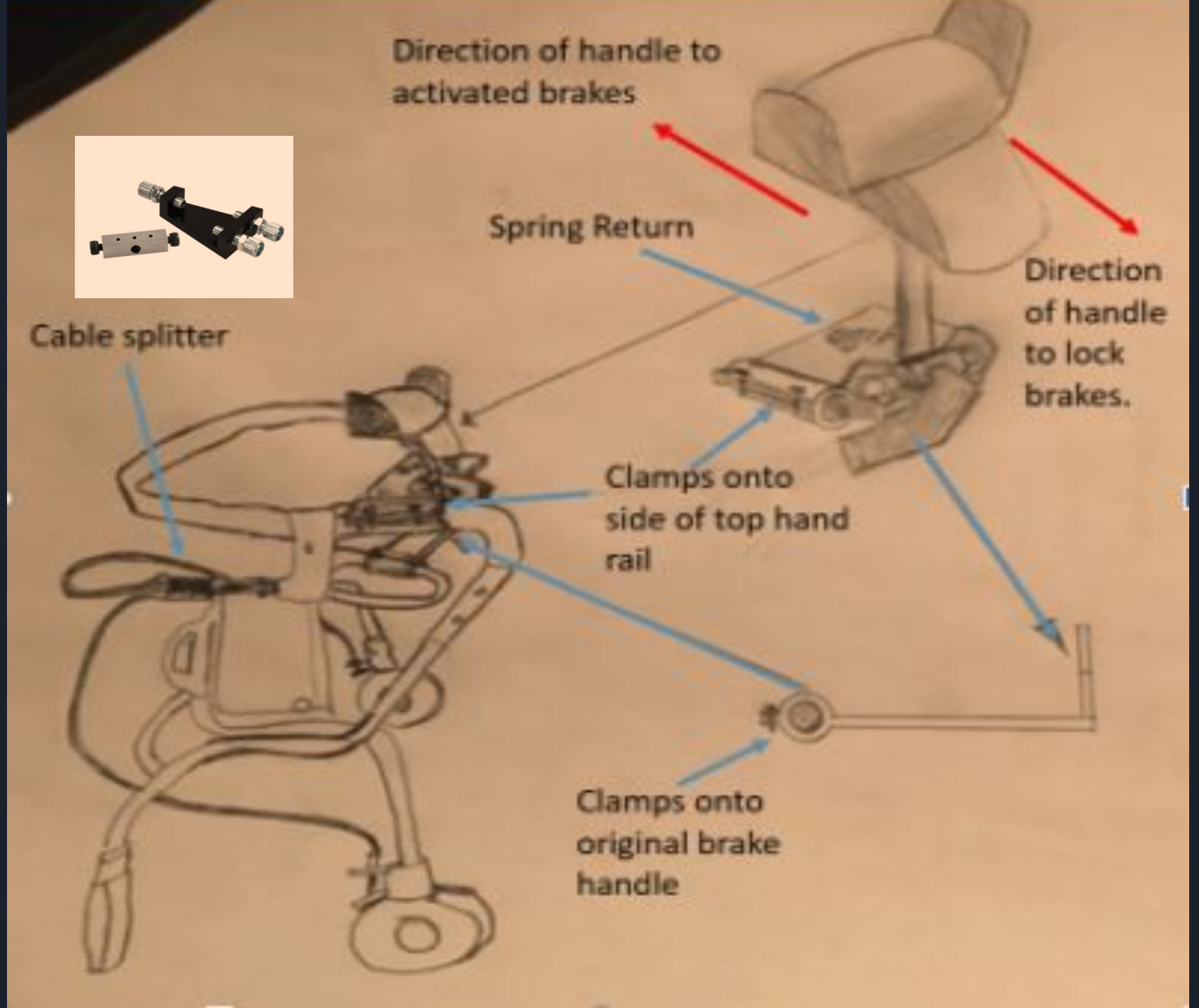


Splitter

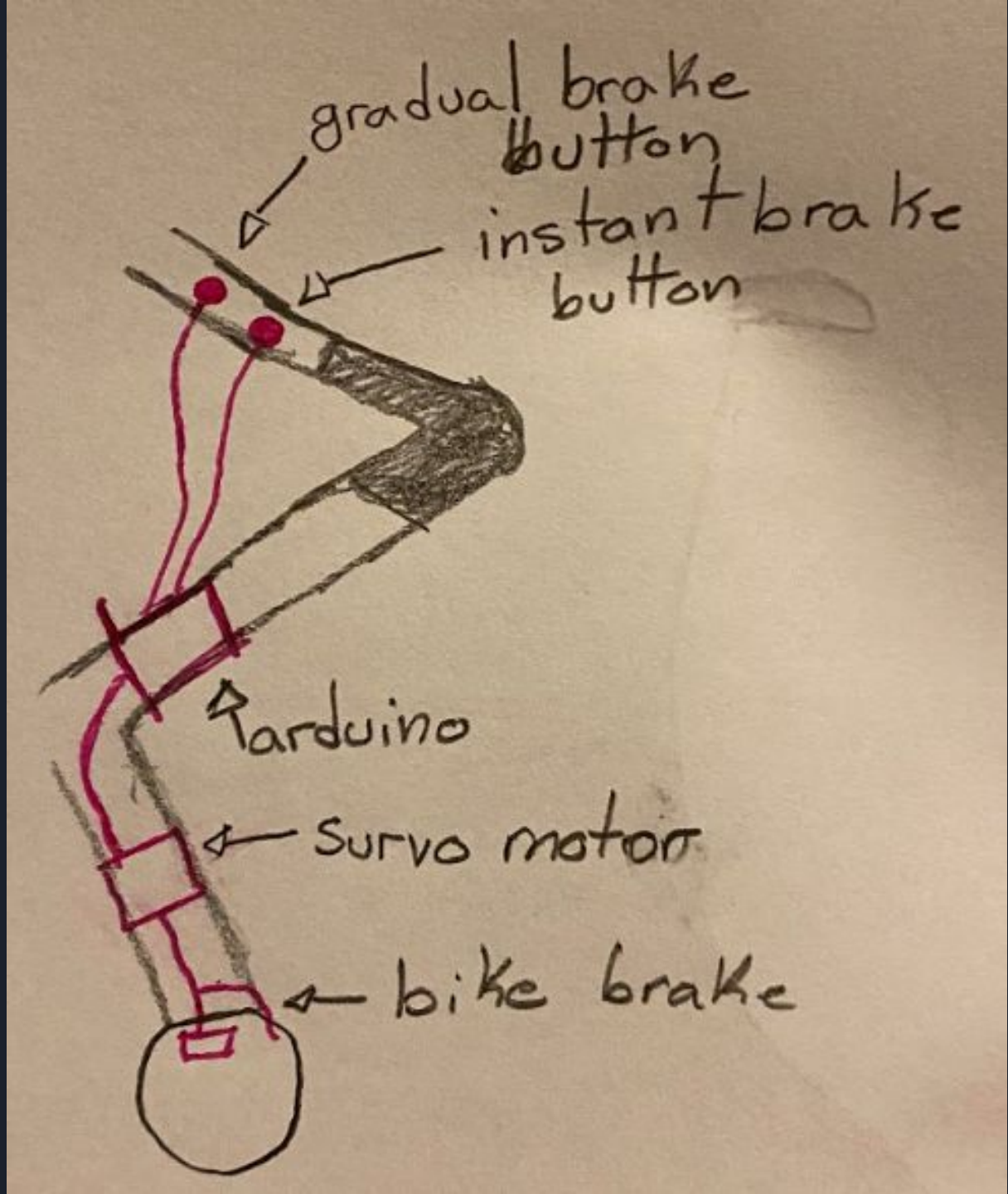


Handle Design

Concept #2

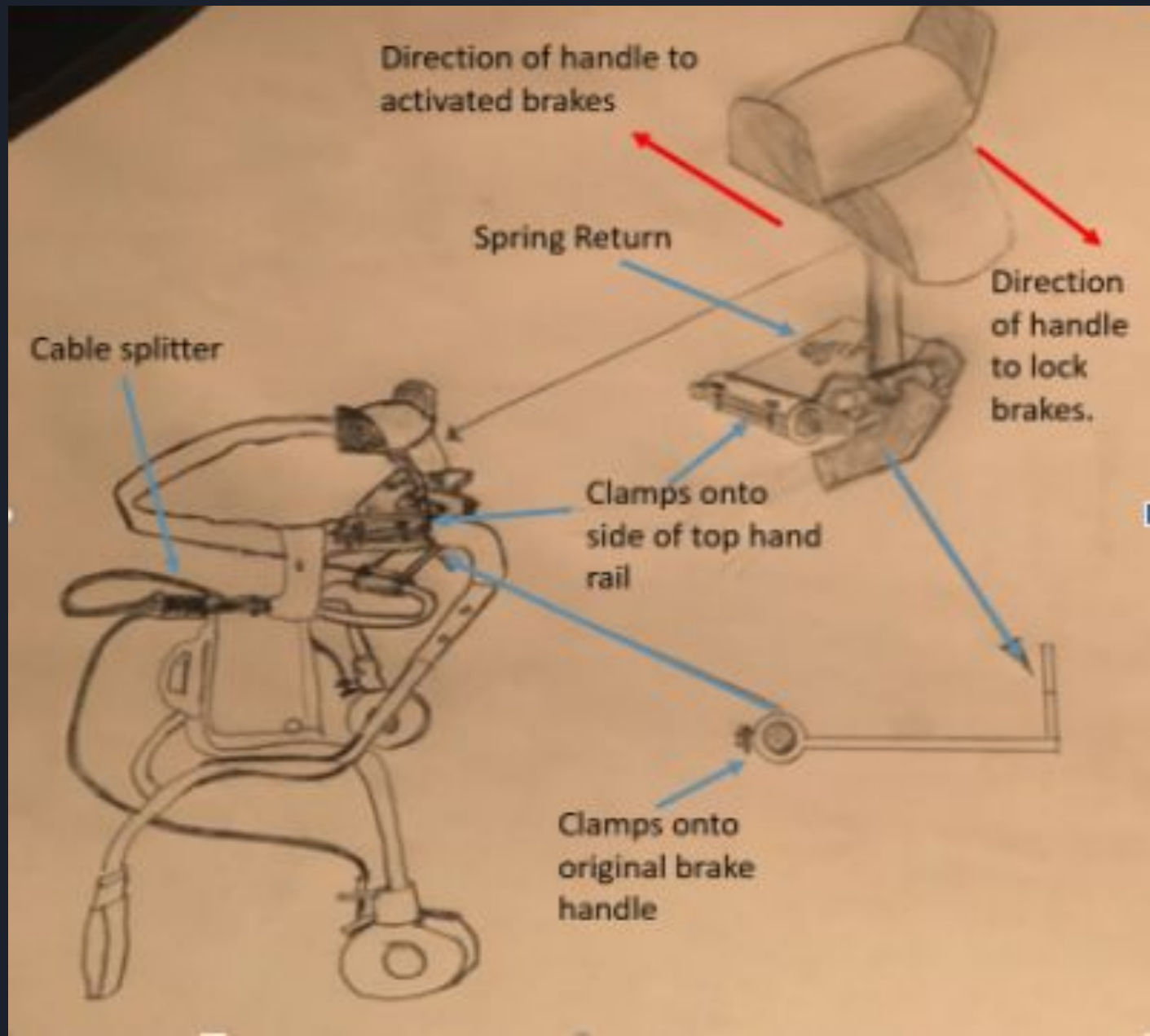

Direction of handle to activated brakes
Spring Return
Direction of handle to lock brakes.
Cable splitter
Clamps onto side of top hand rail
Clamps onto original brake handle

Concept #3


gradual brake button
instant brake button
arduino
servo motor
bike brake

Selection of Concept #2 from Decision Matrix

- One-hand interaction component.
- Requires minimal grip strength.
- Has gradual braking feature.
- Ensures a waterproof system.
- Lightweight and foldable.
- Maximizes safety with lockable brakes.



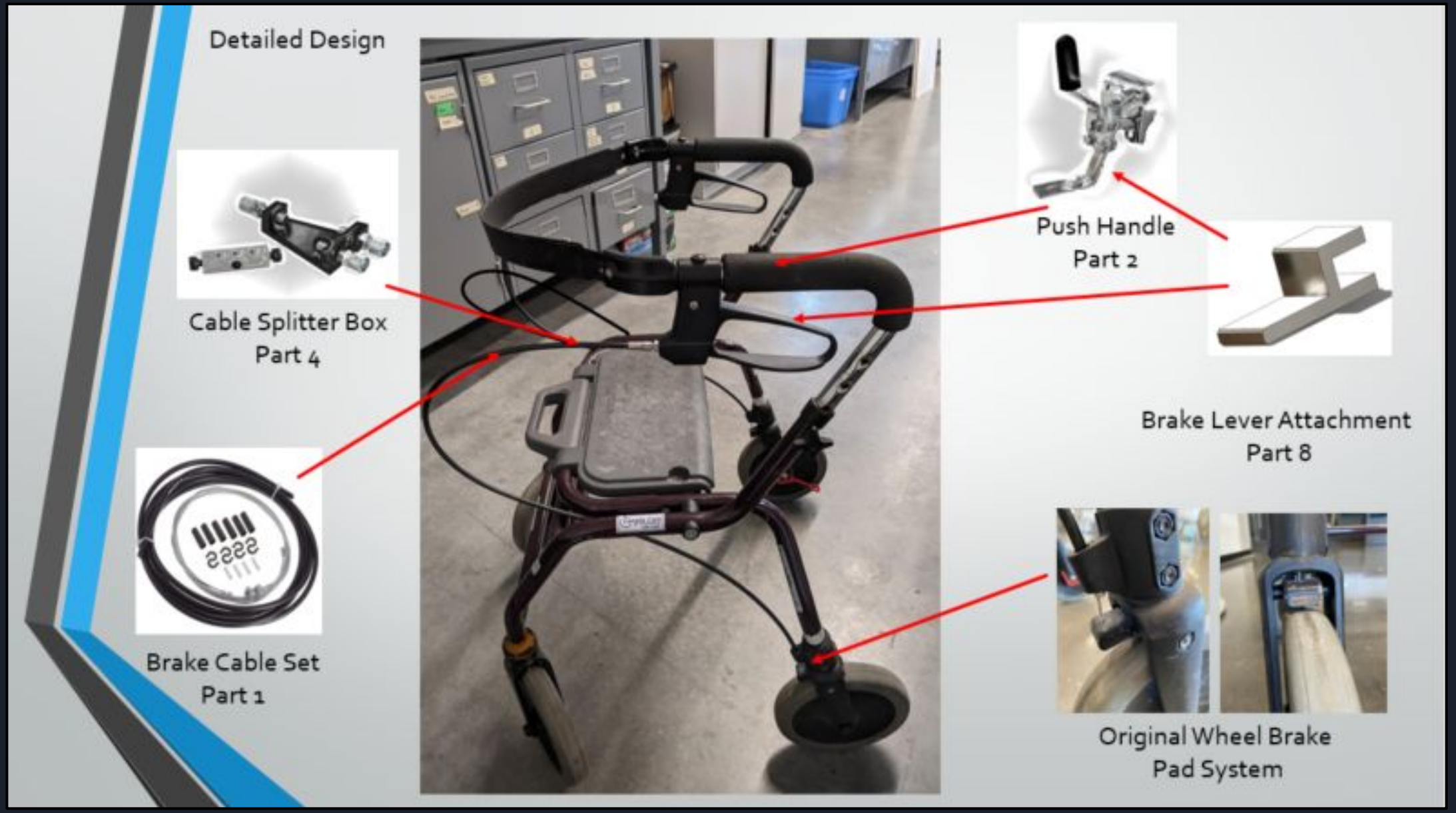
Client Feedback

1) Wants brake handle to be set vertically.
2) Would like lockable brakes.
3) Desired foldable bars.
4) Releasing of brakes must work.
5) Keep the design simple.

Feedback-Based Changes

1) Orientation of manual push handle was changed from horizontal to vertical.
2) Electrical components were tossed aside.
3) Universal Design:
   - One-hand interaction component to be placed on either side of walker.

Detailed Design



Bill of Materials

ID	Part Name	Description	Qty	Units	Unit Cost ($CAD)	Total Cost ($CAD)
1	Cables	Metal cables from bike	1	ea	$17.98	$17.98 (Link)
2	Push handle	Brake lever Push handle	1	ea	$18.52	$18.52 (Link)
3	Brake pads	Brake pads located on both wheels	2	ea	$0	$0
4	Cable splitter	Cable splitter box to connect both brakes to a singular handle	1	ea	$21.72	$21.72 (Link)
5	Screws	Socket head cap screw 10-32 x 0.75	3	ea	$0	$0
6	Cable connector	Square ½”x ½” keystock	1	ea	$0	$0
7	Walker	Dolomite Legacy 450 Walker	1	ea	$0	$0
8	Brake lever attachment	Custom made lever attachment to connect existing walker brake handle to the push brake lever handle attachment	1	ea	$0	$0
Total			11	-	$58.22	

Prototype 1 - Purpose and Testing

Purpose:

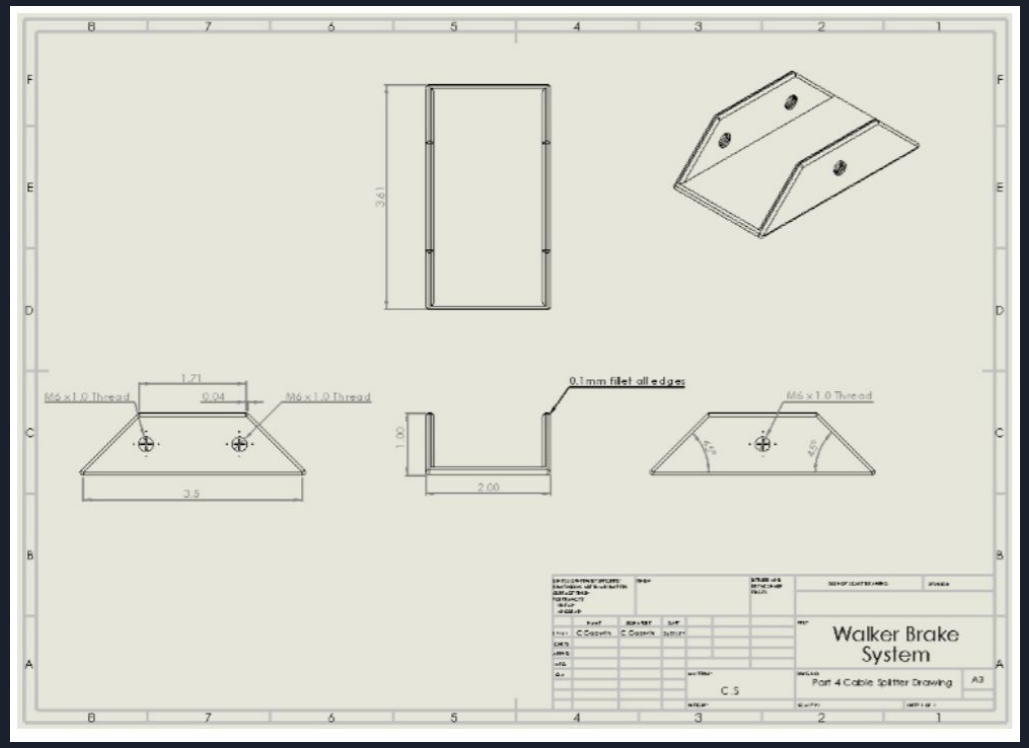
- Test functionality of a critical system (brake splitter).

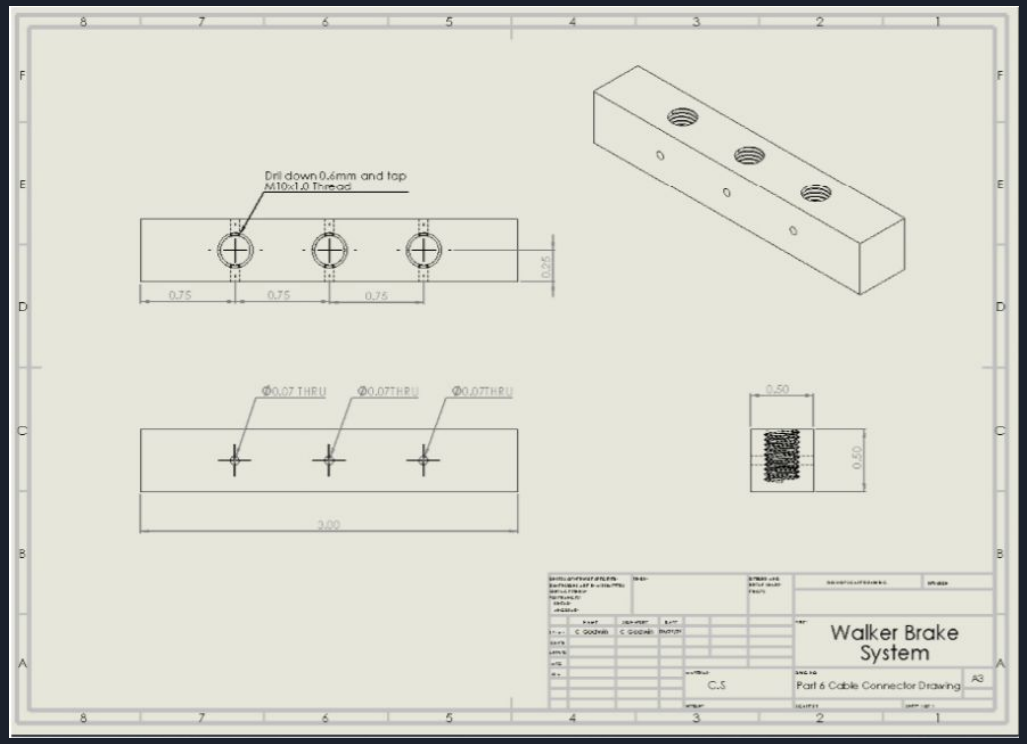
Testing:

- Test was performed on a bicycle to simulate the brake cable mechanics of the walker.
- Test consisted of activating a single brake lever 20 successive times to ensure system safety.
- Tested against 4 of the established Target Specifications:

1) Force required to brake both wheels
2) Activation of brakes with one hand
3) Safe for client use
4) Cost

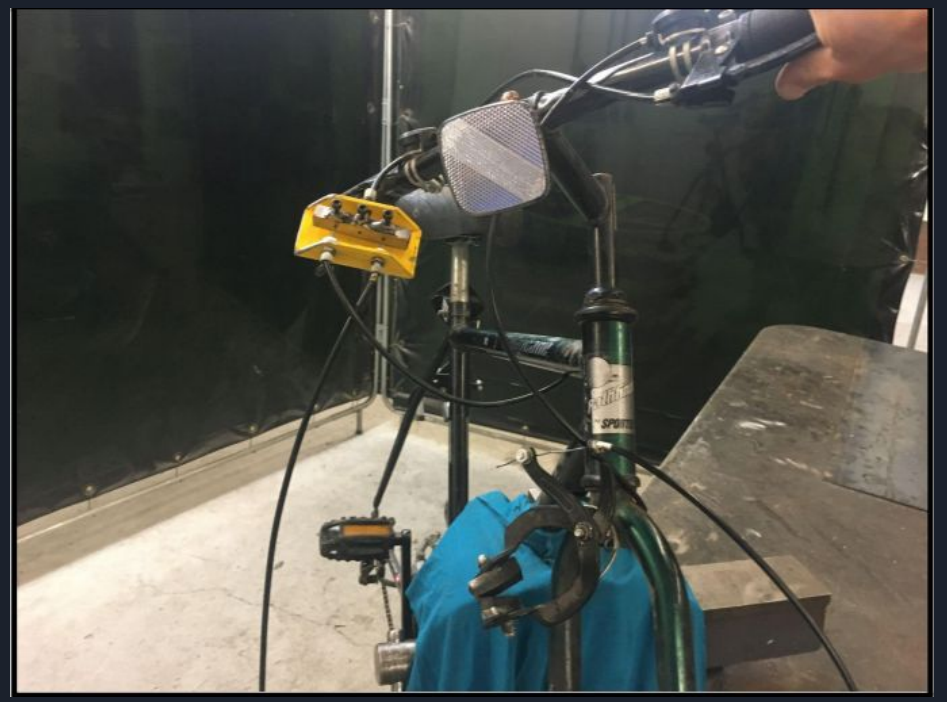
Prototype 1 - Brake Splitter Design





Prototype 1 - Brake Splitter Test Results

Metric ID	Need ID	Metric	Units	Marginal Value	Ideal Value	Actual Value
1	8	Total weight of the walker	lbs	13	<15	N/A
2	6, 9	Dimensions of walker (l x w)	in	22 x 23	N/A	N/A
3	4	Stopping distance	in	-	12	N/A
4	1, 2	Load exerted to brake	Low/High	-	Low	Med
5	11, 12	Size of braking mechanism	in	-	<22 x <23 x <31	N/A
6	N/A	Cost	$CAD	-	<100	0
7	3, 12	One-hand interaction with brake	Yes/No	Yes	Yes	Yes
8	5	Weather resistance / Waterproof	Yes/No	Yes	Yes	N/A
9	7, 10	Safe for client use	Yes/No	Yes	Yes	Yes
10	6,9	Height of handles	in	31	31.5	N/a



Future Plans

Next steps:

Prototype 2 push handle and brake lever attachment operation.

Criteria for Prototype 2:

1) Simple / easy to fix universal handle design.

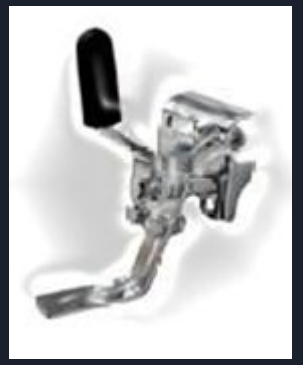
2) One hand use of handle (Push/Pull operation).

3) Minimal force to activate brakes.

4) Brake Operation (Gradual and Locking).

5) Walker integrity.

6) Maintain Portability.



Push Handle

Brake Lever Attachment

Horizontal Brake Handle

Vertical Brake Handle