FINAL PRODUCT

PROBLEM ANALYSIS

PROBLEM STATEMENT

A new walker design is required to facilitate the need for an inexpensive, reliable and simple way of engaging a one-handed braking system on a walker; while also maintaining a lightweight, transportable, and user-friendly design that still maintains all the walker previous functionality.

DESIGN CRITERIA – CUSTOMERS' NEEDS

Interpreted Needs	Design Criteria	Importance*
User-friendly, one-handed braking	Force Senses	5
Weatherproof	Waterproof enclosure	4
Brakes can be locked	E-Brake Button	5
Does not void warranty	Do not drill	5
Add failsafe braking	Keep manual input	5

* Importance Scale 1 = not important, and 5 = very important

DECISION MATRIX

Criteria	Force Applied	Battery & Life	Cost	Ease of use	Weight	Summary
Concept 1 Weight to engage the brake	4	4	5	3	3	19
Concept 7 Brakes applied by pulling the brake lever engaging a rotary encoder	5	5	4	5	5	24
Concept 9 Brakes applied using a potentiometer dial	5	5	4	4	5	23

BENCHMARKING – SIMPLIFIED

Metrics	Nova Series Cruiser	Dolomite Alpha	EVA Electric Support Walker
Braking System	Weight activated	Hand grip activated	Electronic 2-handed
Force Required (Newtons)	No Hand Strength 0N	< 5N	> 5N
Parking Brake	Yes	No	Yes
Battery Life	N/a	N/a	16 hours
Cost ($)	219.99	1,179.99	3,160.00

BUSINESS MODEL

Direct-to-consumer model

- Allows the distribution of the product directly to our target audience

Advantages:

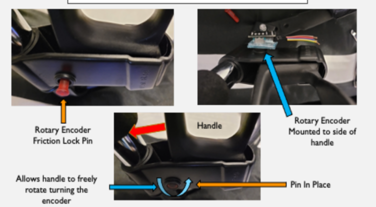
- Direct interaction with the customer allows for an enhanced customer experience.
- Interaction with the customer to optimize their experience with the product.

TARGET SPECIFICATIONS

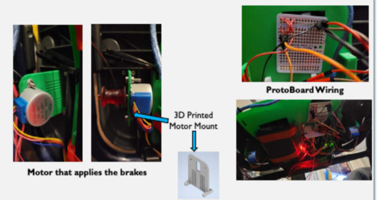
Criteria Summary	Target Metrics	Justification
Force Applied	< 5 lbs.	Easy brake application
Battery Capacity	> 4500 mAh.	All day battery
Cost	< $100	Within Budget
Weight	< 5 additional lbs.	Lightweight and portable

Witty Walkers set out to reinvent the traditional walker, allowing for one handed braking using limited grip strength.

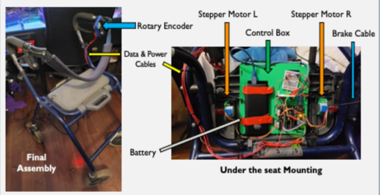
FINAL PROTOTYPE



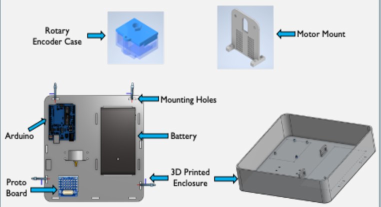
FINAL PROTOTYPE



FINAL PROTOTYPE



Universal Mounting



Witty Walkers

uOttawa

PRODUCT DEVELOPMENT

SOLUTION AND CHOSEN CONCEPT

Concept 7 - Brakes will be applied by pulling the brake lever which engages a rotary encoder.

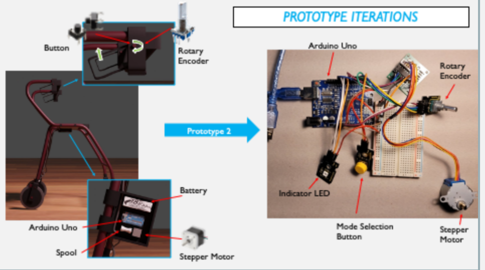
HOW IT WORKS

PULLING THE HANDLE→ ROTATES DIAL ON ROTARY ENCODER → TURNS THE MOTOR→ APPLIES BRAKES

- **Arduino** processes data & rotates a step motor
- **Step motor** will pull the brake cable according to how far the handle is pulled
- Pressing the **"E-Brake"** Button locks the brakes
- **Mode Selector** Button - changes braking sensitivity

***Concept 7** was chosen because it will give us the most adaptability and ability for future growth

PROTOTYPE ITERATIONS



LESSONS LEARNED & TOUGH DECISIONS

- A lesson that was learned by the team was that there's never a wrong idea and that there are different ways to approach problems
  - For example, the suggestion to use zip ties instead of Velcro strips
- One tough decision that was made was the change of the battery type
  - Changed from lithium ion to standard portable USB chargers
  - The lithium-ion battery would have given our group more power to work with, but instead decided the ease of use for the client was more important

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ECONOMICS

- From the chosen business model, a detailed economic report, including a cost profile, a three-year income statement, as well as a break-even statement were developed.

Notable Values	Metric
Manufacturing Cost	$54.51
Sale Price	$100
Break Even Quantity	15, 751 Units

Bill of Materials (BOM)

Material	# Needed (Per unit)	Part cost ($)
Arduino Uno	1	16.98
Velcro Ties	4	1.89
Rotary Encoder (5 pack)	2	2.27
Button	5	1.29
Wire Red (5ft)	1	1.60
Wire Black (5ft)	1	1.60
Stepper Motor	1	10.78
Enclosures	1	5.00
Total	16	54.51

SOLUTION AND CHOSEN CONCEPT

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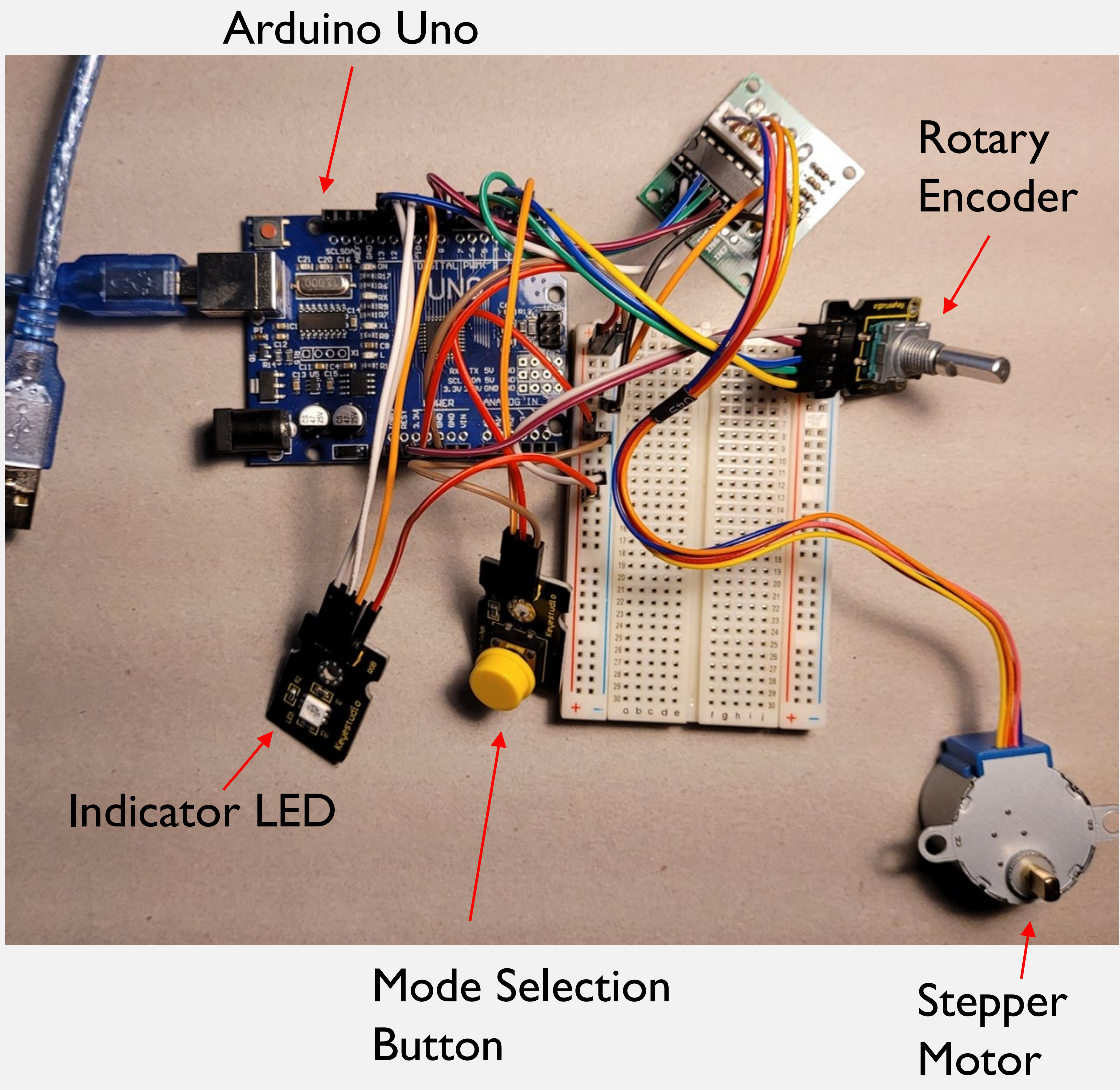
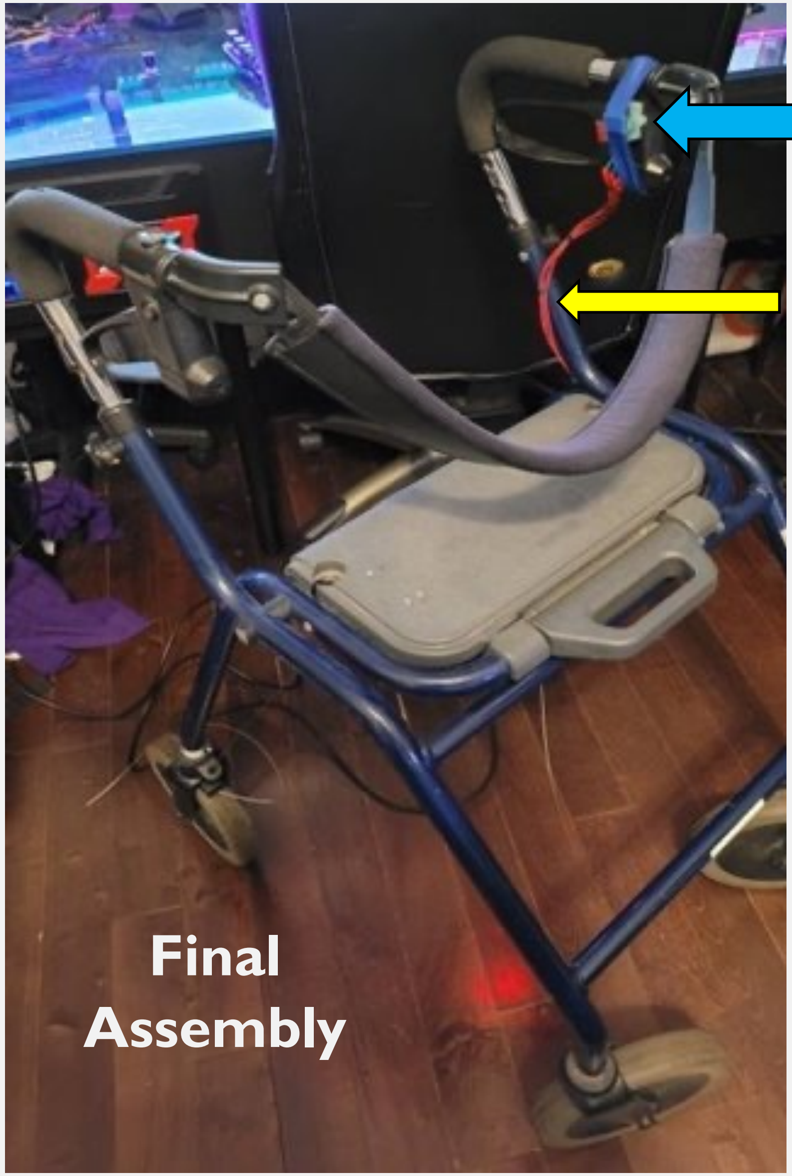
PROTOTYPE ITERATIONS

Prototype 2



FINAL PROTOTYPE



Rotary Encoder

Data & Power
Cables

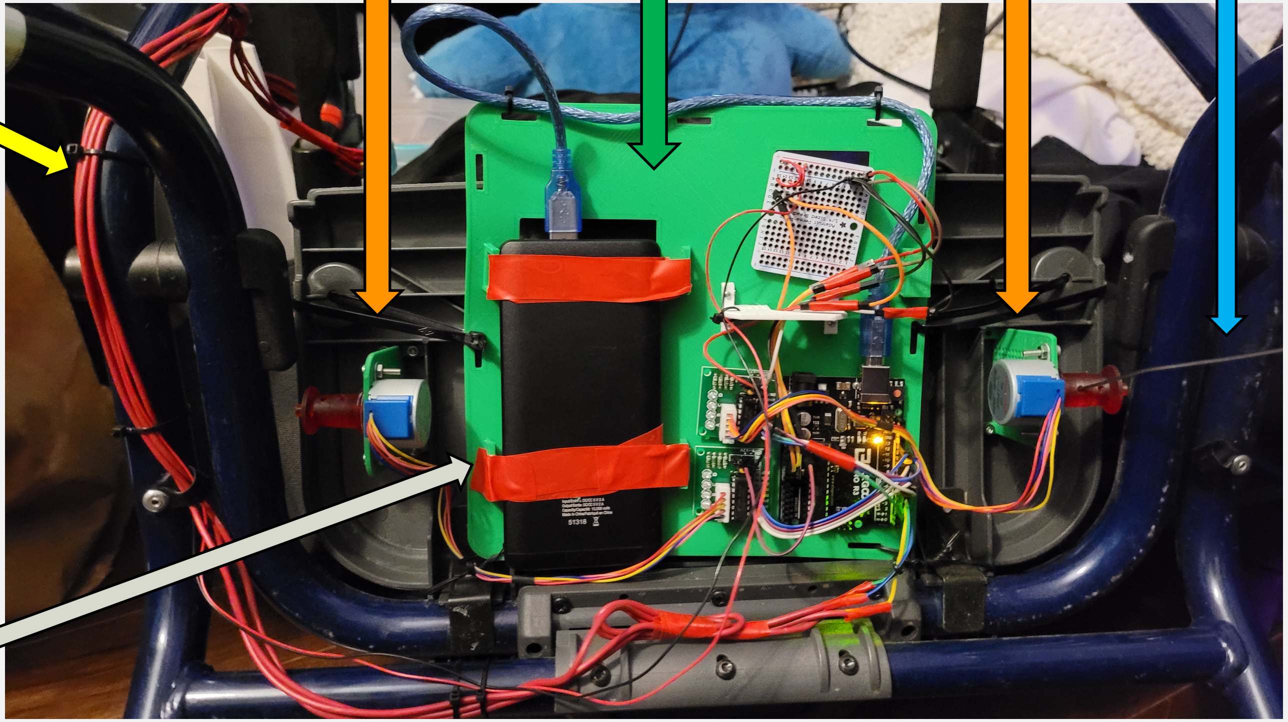
Stepper Motor L

Control Box

Stepper Motor R

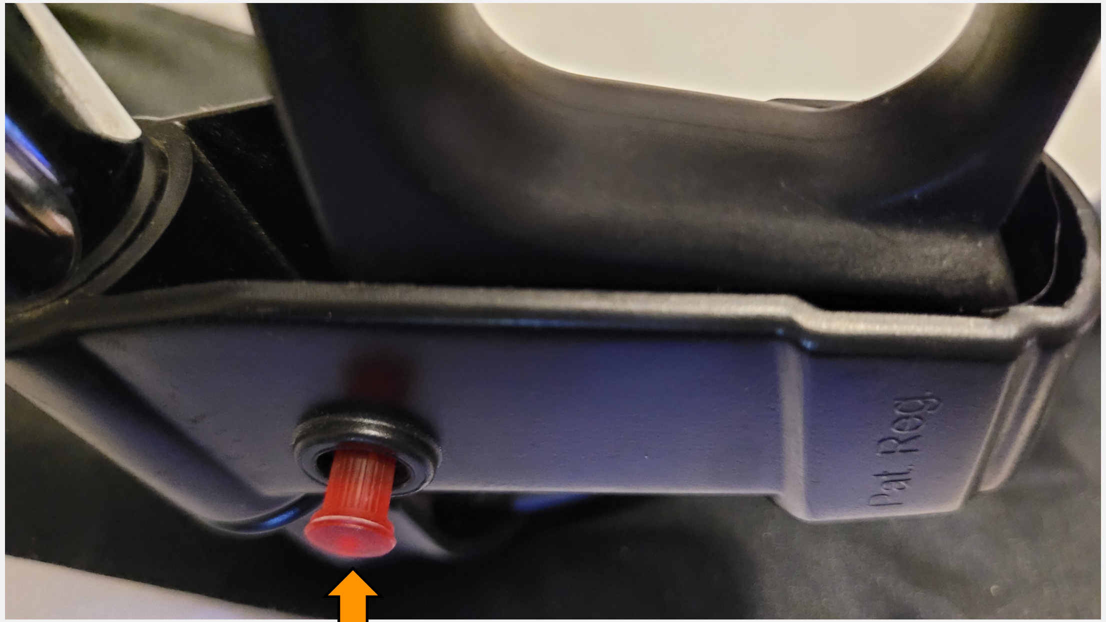
Brake Cable

Battery

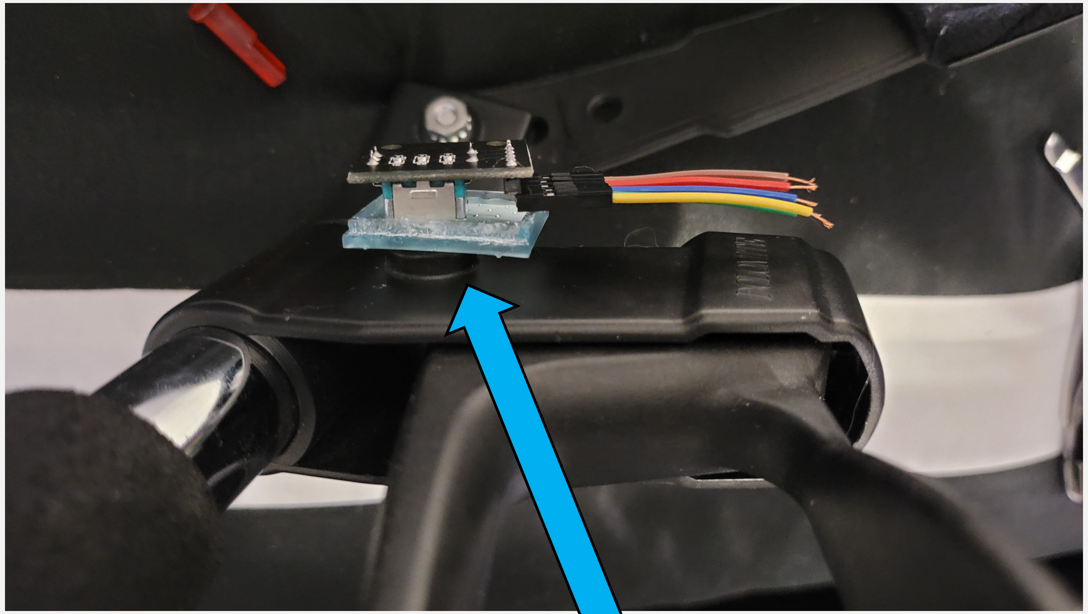


Under the seat Mounting

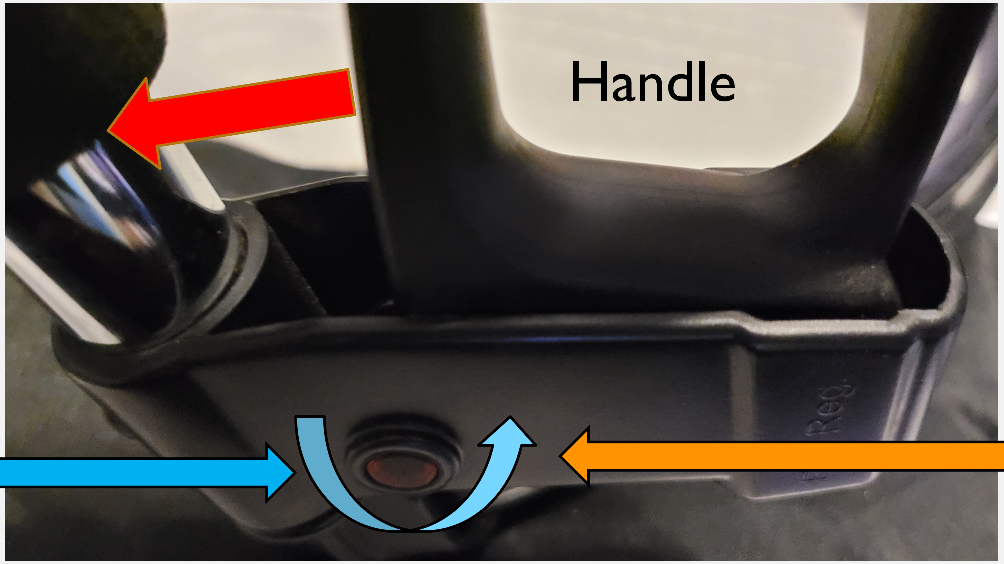
FINAL PROTOTYPE



Rotary Encoder
Friction Lock Pin



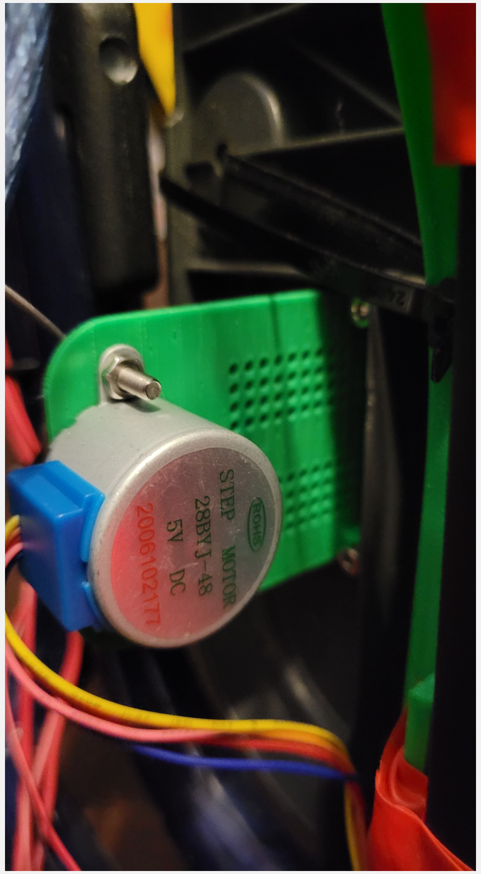
Rotary Encoder
Mounted to side of
handle

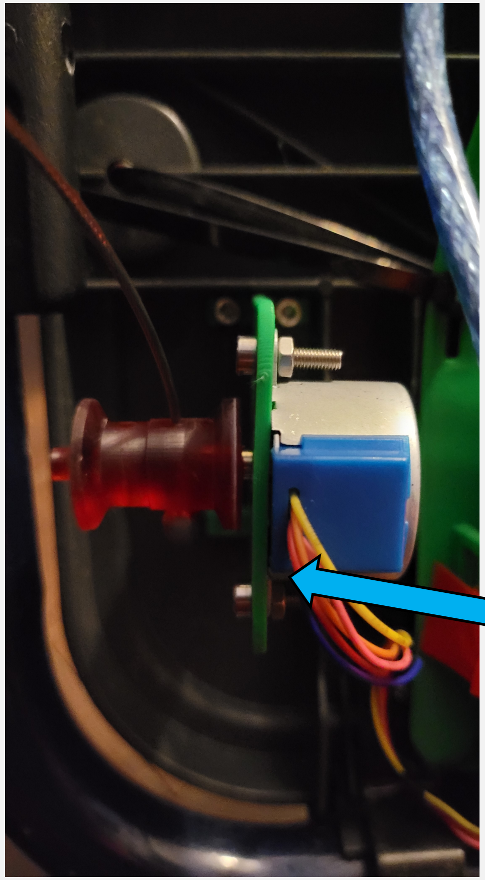


Allows handle to freely
rotate turning the
encoder

Pin In Place

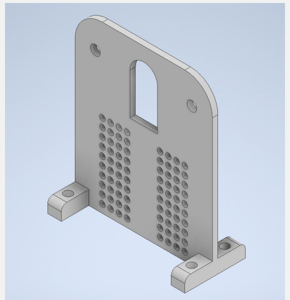
FINAL PROTOTYPE

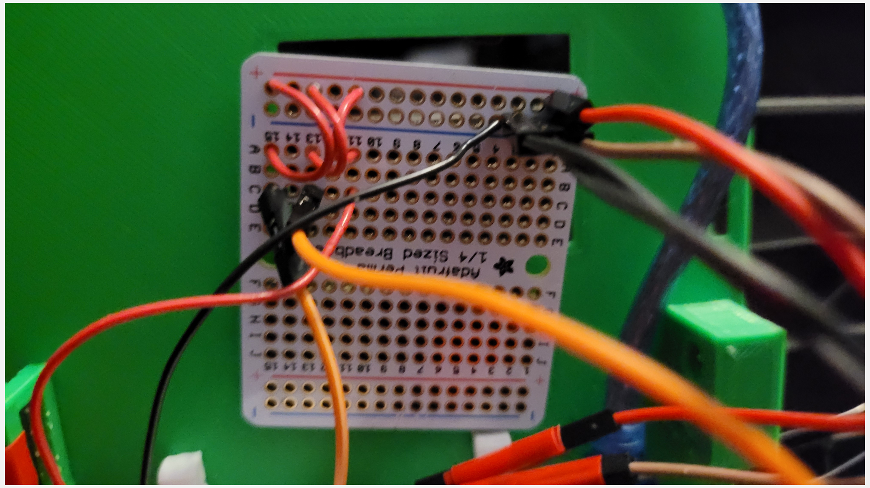




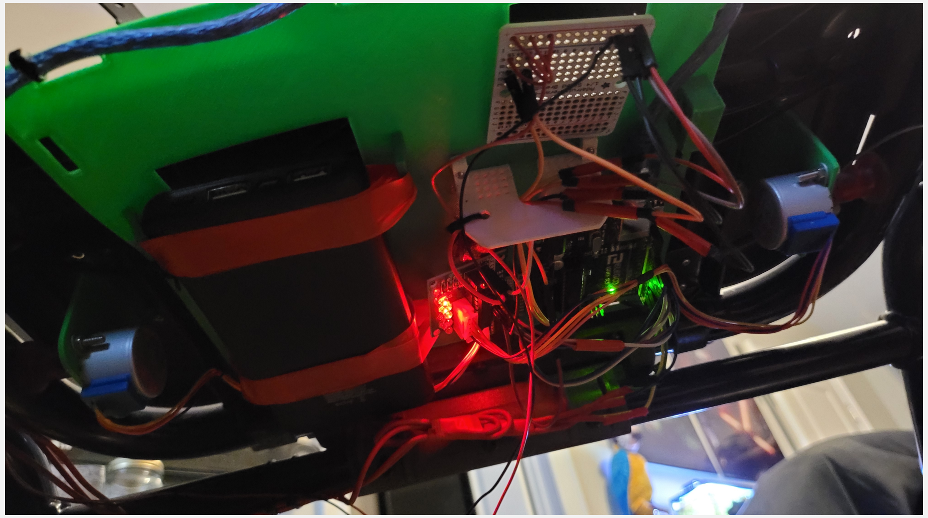
Motor that applies the brakes

3D Printed Motor Mount



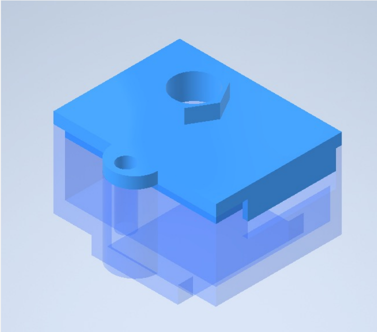


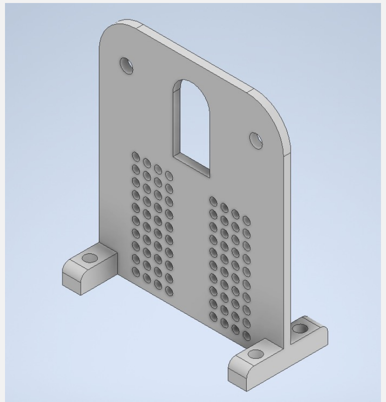
ProtoBoard Wiring



Universal Mounting

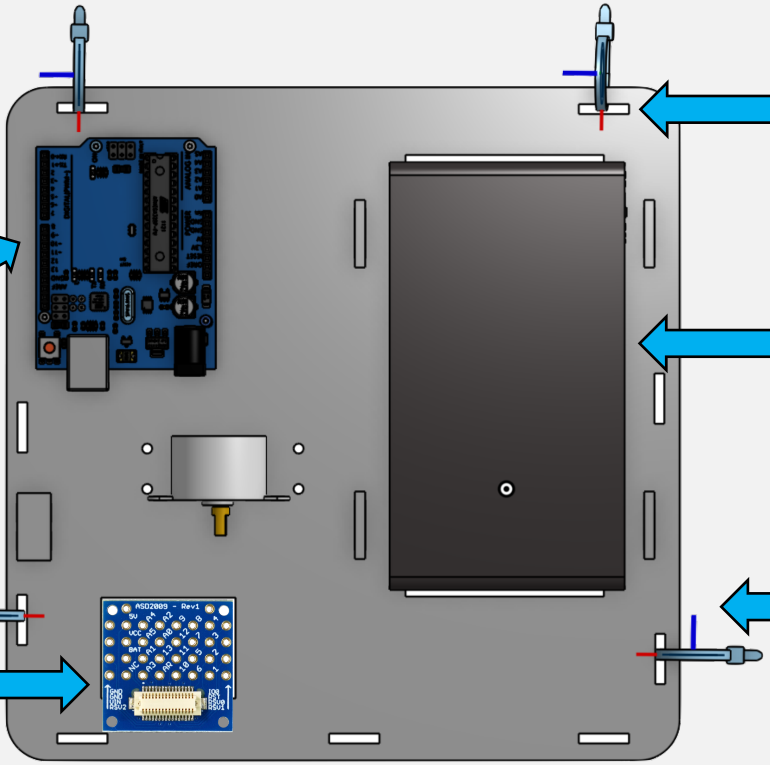
Rotary
Encoder Case





Motor Mount

Arduino

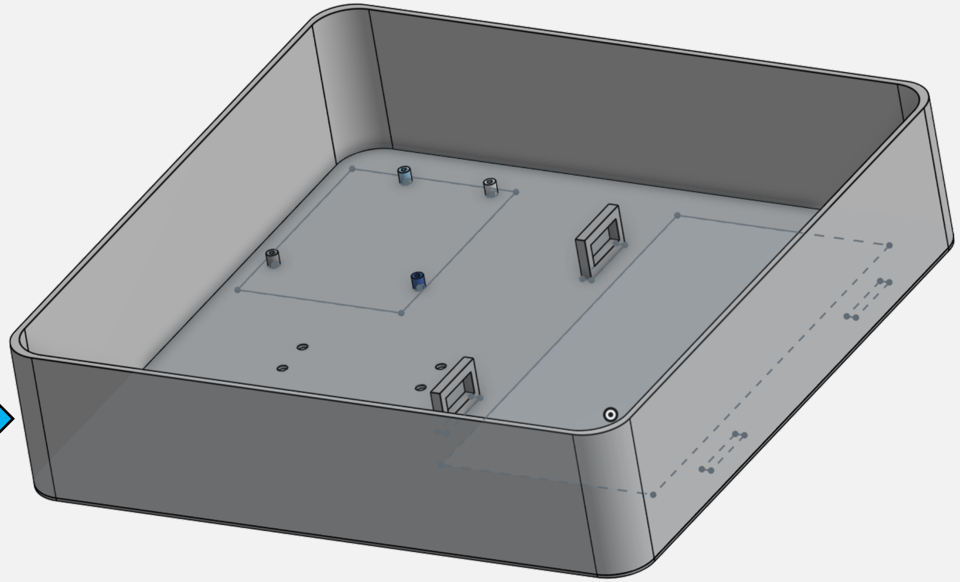


Mounting Holes

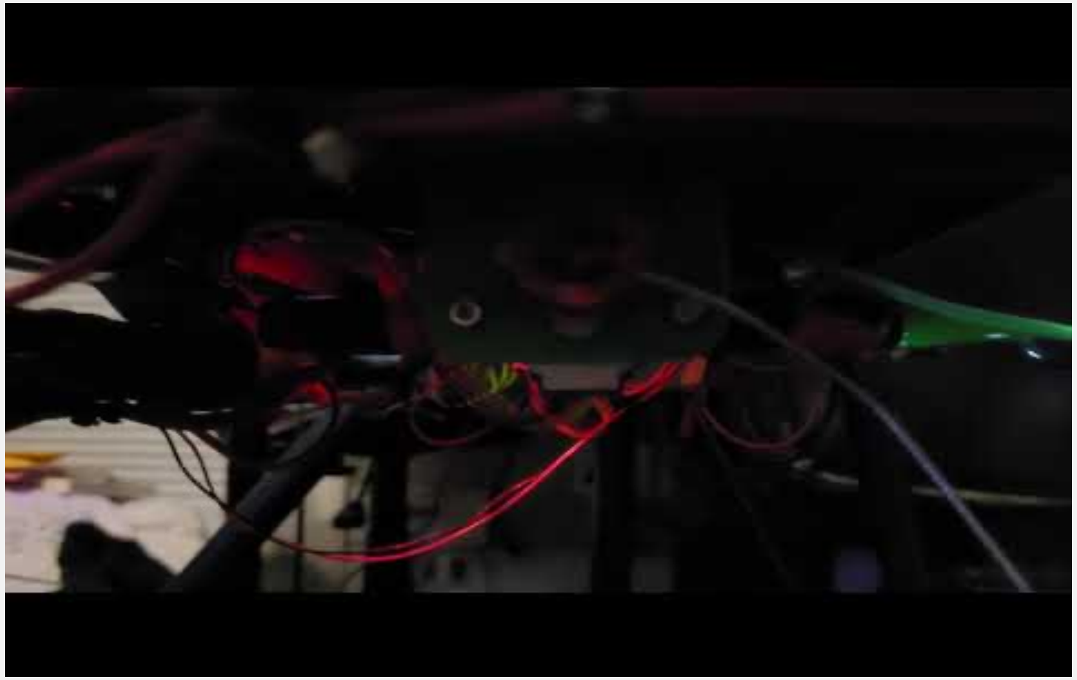
Battery

Proto
Board

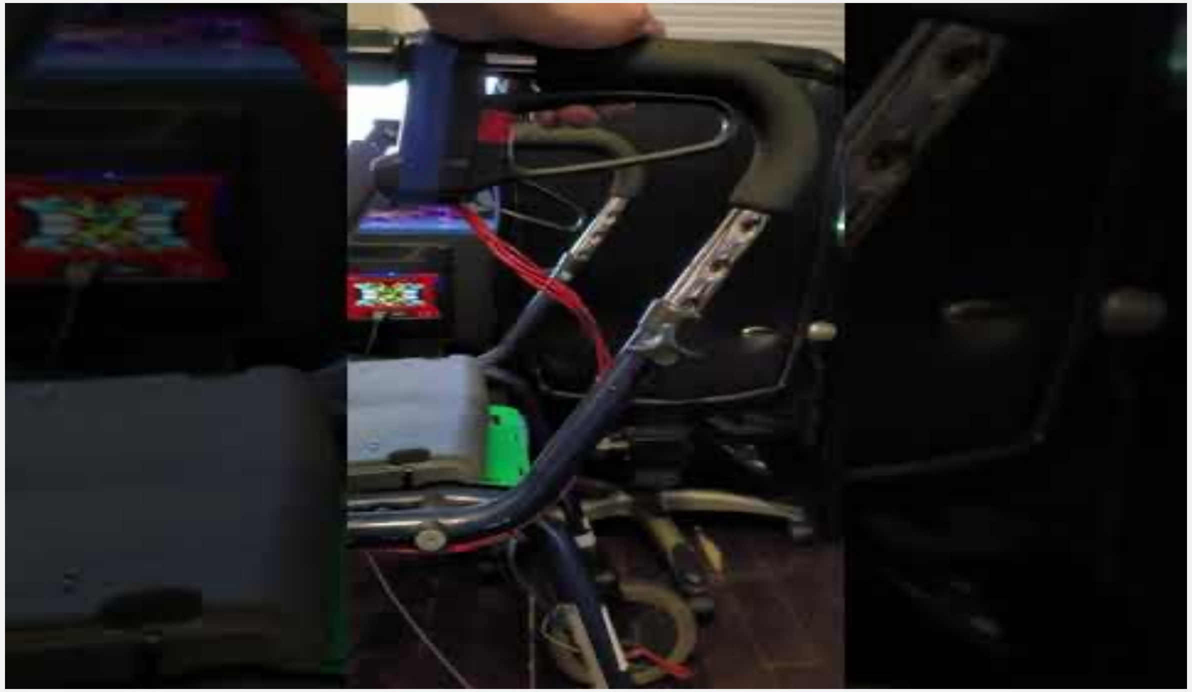
3D Printed
Enclosure



VIDEOS



Motor Braking system



Braking System