uOttawa

Witty Walkers

FINAL PRESENTATION
WALKER BRAKING SYSTEM

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AGENDA

- **Key Components**
  - Problem Statement
  - Design Criteria/Customer Needs
  - Benchmarking
  - Target Specification
  - Decision Matrix with Concepts
  - Feasibility Study
  - Business Model
  - Economics
- **Decision Made**
  - Solution and Chosen Concept
  - How it works
  - Prototype iterations
- **Trials and Tribulations**
  - Lessons learned
  - Tough Decisions
  - Future work

KEY COMPONENTS

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

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

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

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

FEASIBILITY STUDY

Economic Feasibility (Profitability)	• Yes, our product replaces the need for electric wheelchair which cost $1,400+
Technical Feasibility (Resources Required)	• No, we would have to rent and purchase the necessary tools and equipment
Operational Feasibility (Marketability)	• Yes, the product is predicted to be very marketable
Schedule Feasibility	• 3 months to present a valid prototype • 6-8 months to be able to begin mass production

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.

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

DECISION MADE

SOLUTION AND CHOSEN CONCEPT

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

HOW IT WORKS

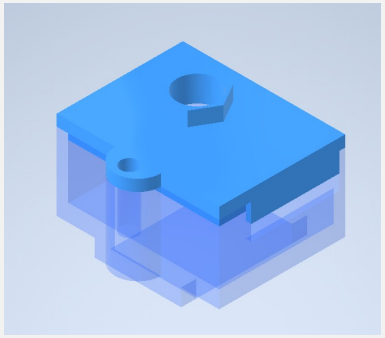
PULLING THE HANDLE→ ROTATES DIAL ON ROTARY ENCODER → TURNS THE MOTOR→ APPLIES BRAKES

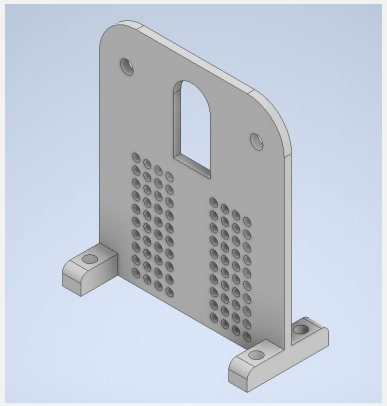
- **Arduino** processes data & rotates a step motor
- **Step motor** will pull the brake cable according to how far the handle is pulled
- Pressing the "**E-Brake**" Button locks the brakes
- **Mode Selector** Button - changes braking sensitivity

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

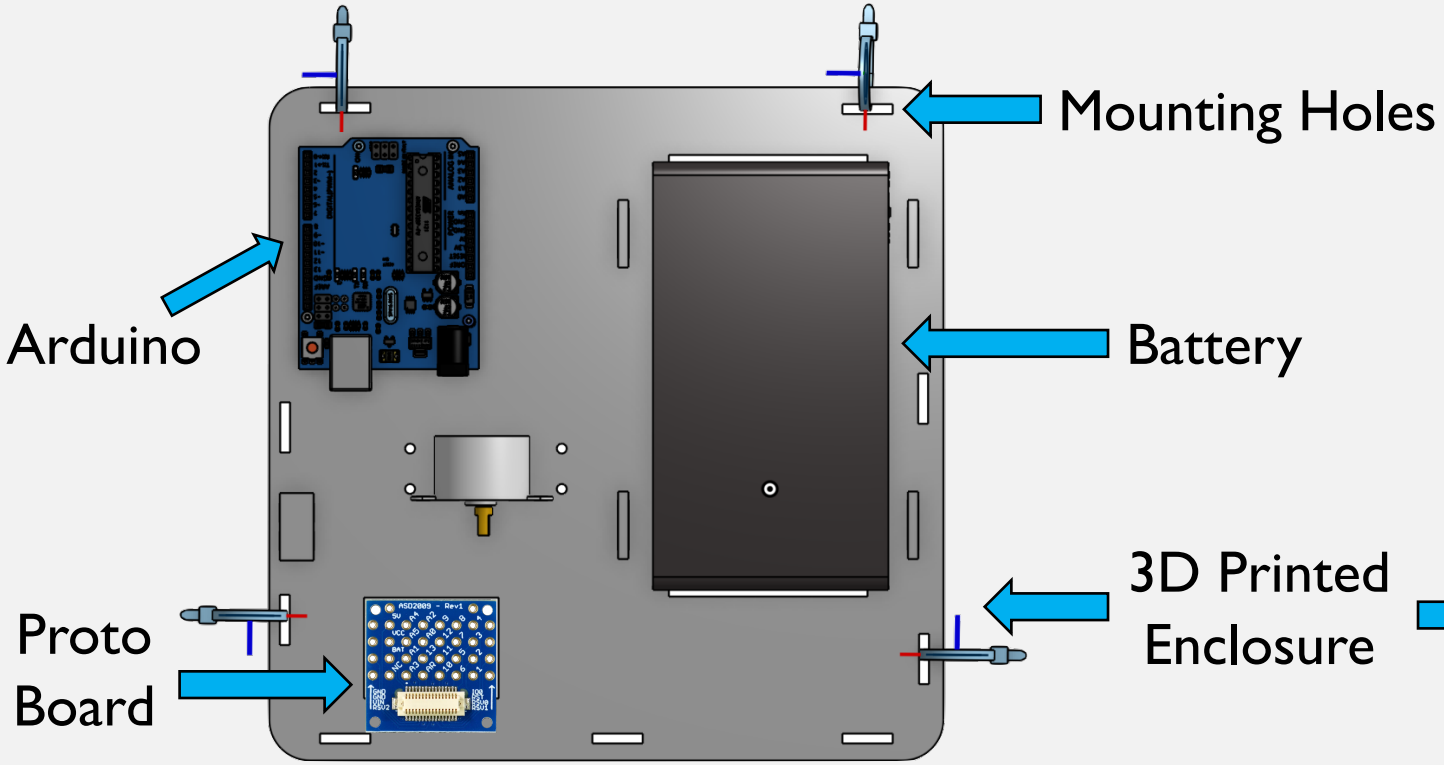
Universal Mounting

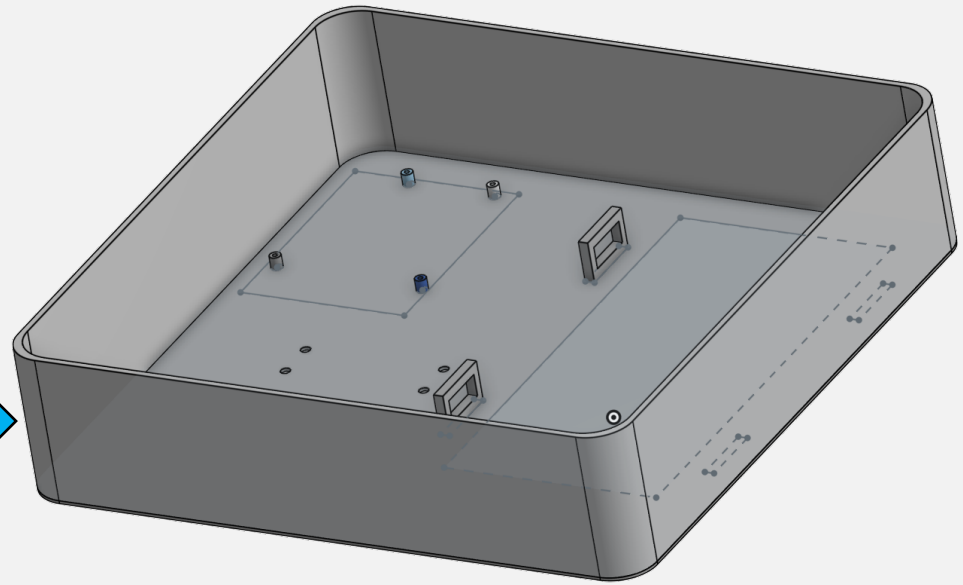
Rotary Encoder Case



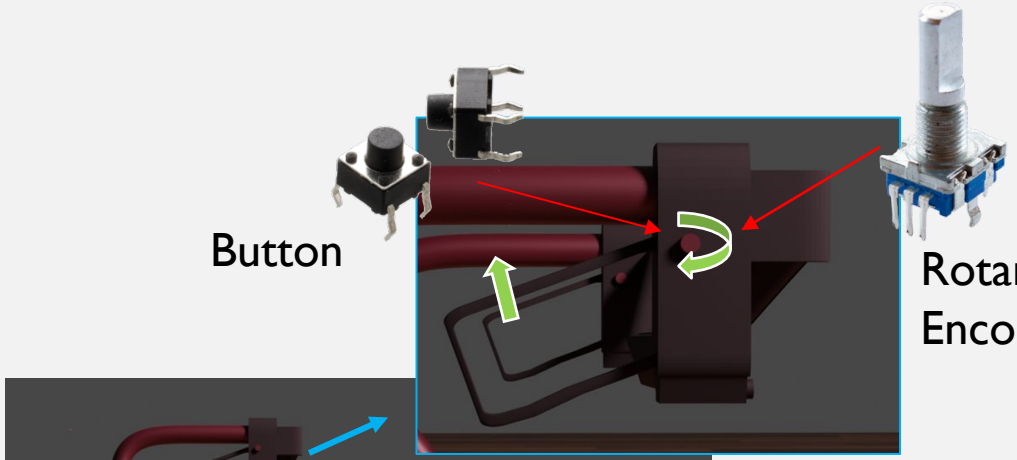


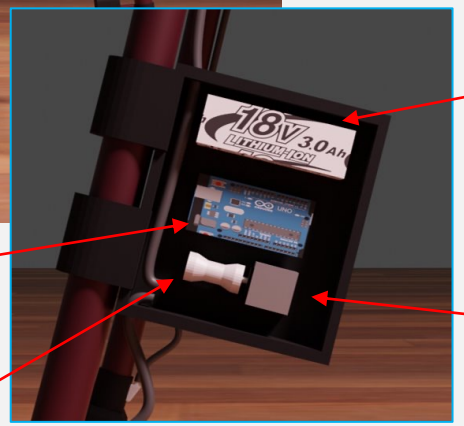
Motor Mount

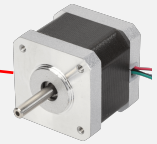




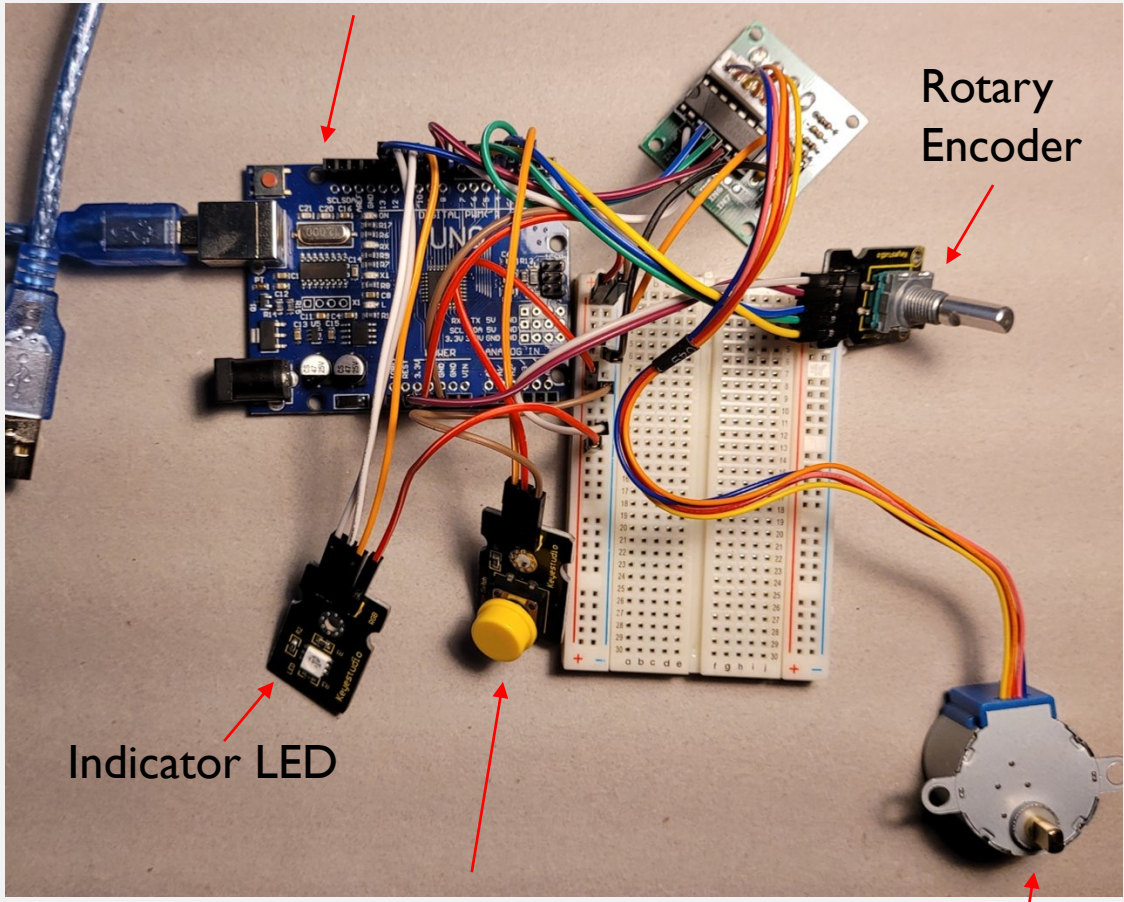
PROTOTYPE ITERATIONS



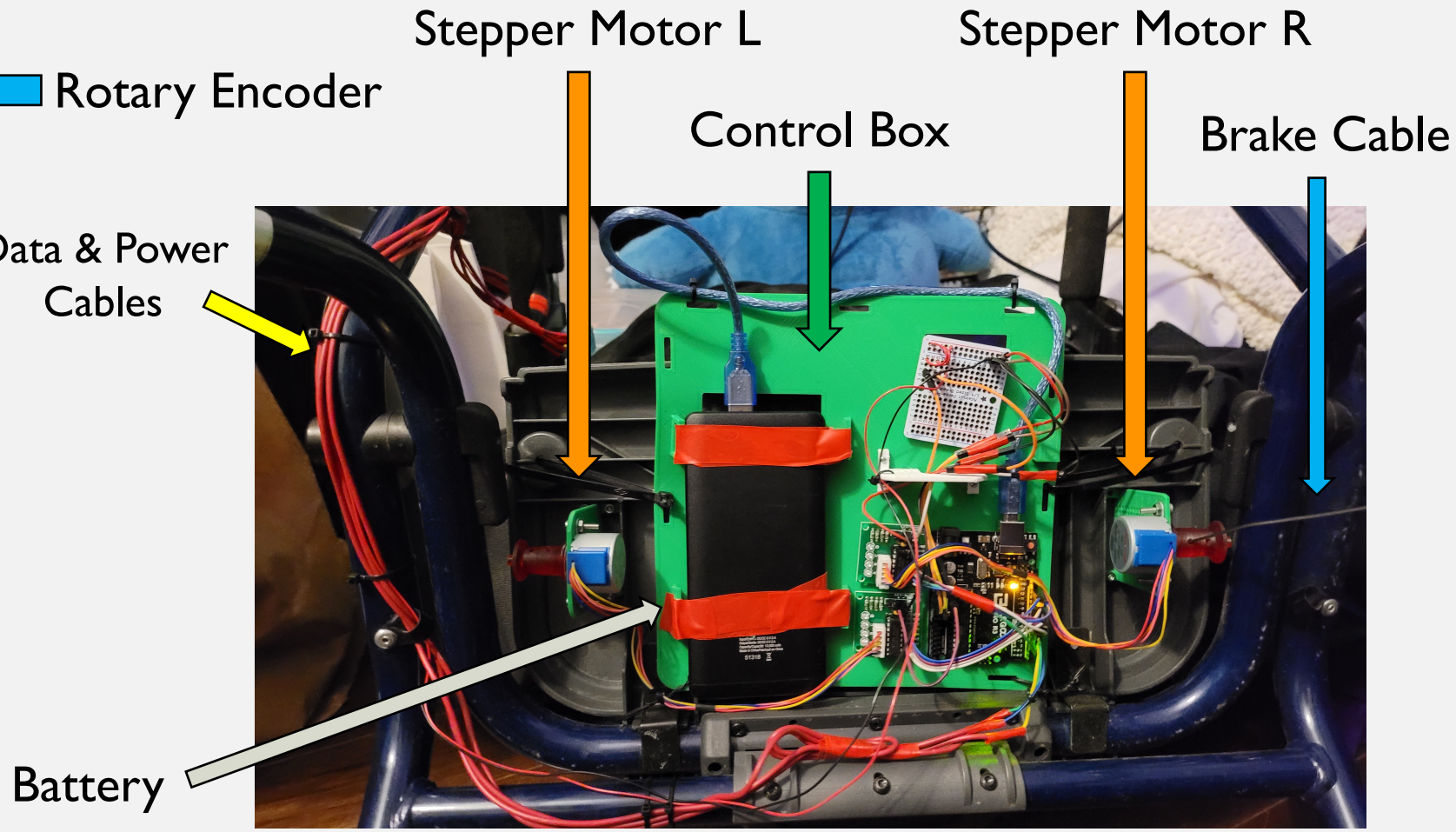




Prototype 2

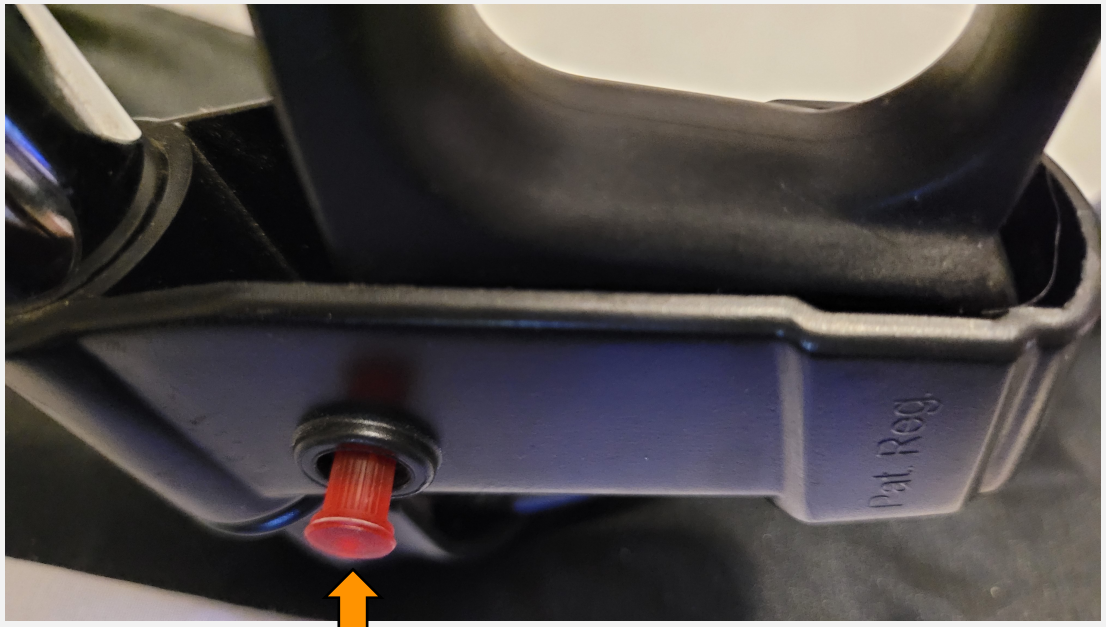


FINAL PROTOTYPE

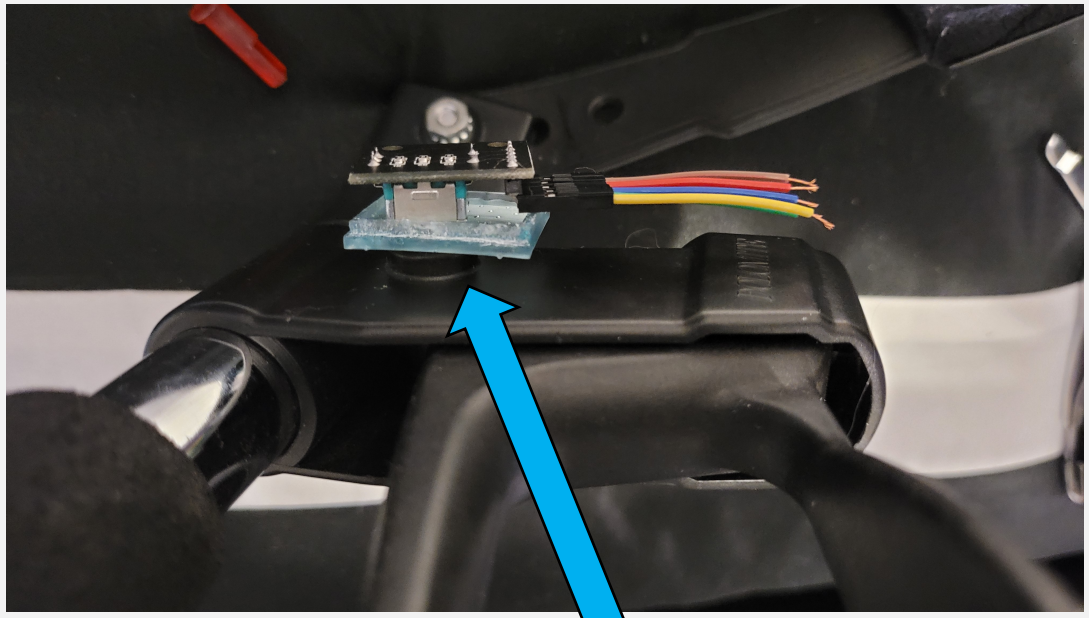


Under the seat Mounting

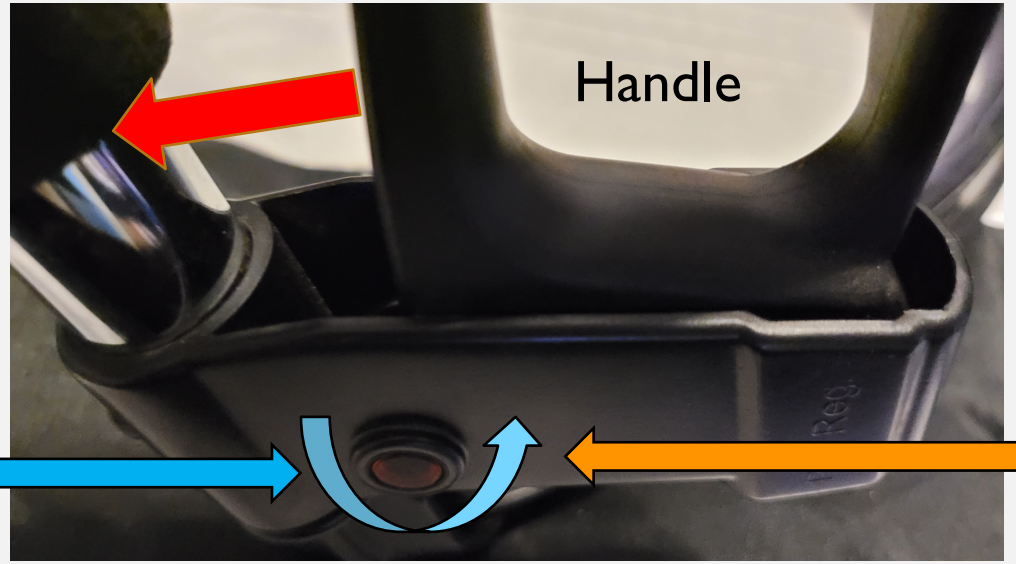
FINAL PROTOTYPE



Rotary Encoder
Friction Lock Pin



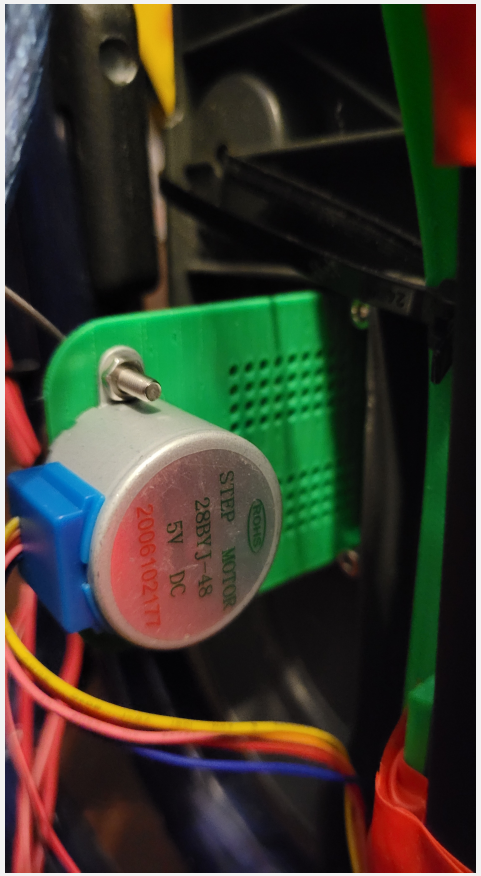
Rotary Encoder
Mounted to side of
handle

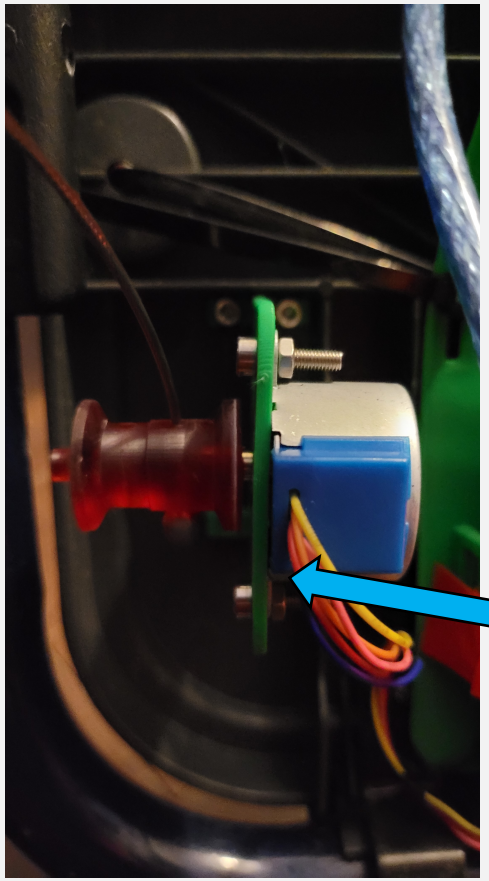


Allows handle to freely
rotate turning the
encoder

Pin In Place

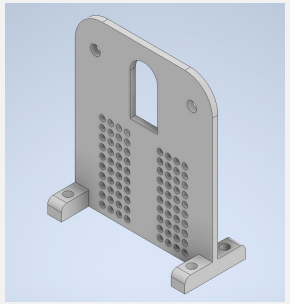
FINAL PROTOTYPE

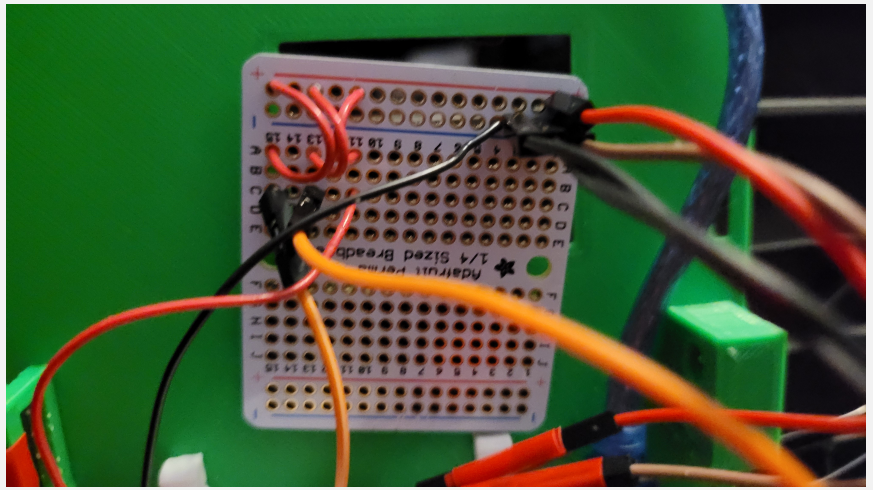




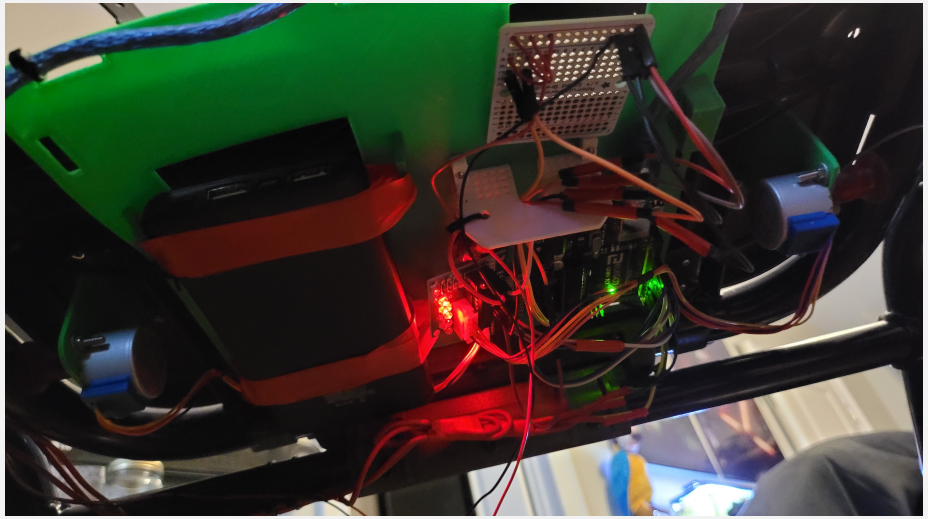
Motor that applies the brakes

3D Printed
Motor Mount





ProtoBoard Wiring



PLEASE SEE VIDEO

TRIALS & TRIBULATIONS

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

FUTURE PLANS

Interpret final feedback from the client

Overall optimization of the prototype, specifically the reliability of system.

One specific area of improvement is the waterproof feature of the braking system.

QUESTIONS?