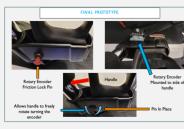
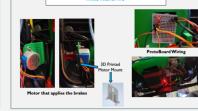
FINAL PRODUCT

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 CRI	TERIA - CUSTOME	RS' NEEDS		1							
1.0	erpreted Needs	Design Criteri		tarce*			DI		ATRI	(_	
	riendly one-handed braking	Force Senses		5		Criteria Concept I	Parts Applied	Ration & Life	C	East of an	****	Rawreary
	Watherproof	Weserproof enclose				tigte to orgage the brake	•	•		-	2	
	kes can be locked	E-Brake Button Do not drill		-		dan applied by palling the brains lower angaging		•	•	•		- 14
	Add failads braking Kaop manal input					Concept 8						
* logorary	*Togermen.blail 1 = not proposed a long 1 1 4 4 1 23							23				
Realing System Braking System Force Required (Marview) Parting Brake Battery Life Cost (3)	BENCHS None Series Cro Weight actives Non-Hard Series No. No. No. No. No. No. No. No.		ED Decrete Second S S S S S S S S S S S S S S S S S S S	N 6.		Direct-to-con Allows the 4 Advantage: Direct inser- experience. Insertion product.	iumer m listribution taction wit	n of the produc	s directly er allows	for an esh	innced ca	atomar
		Criteria Sum Force Applie	mary	T SPE	Metrics		stificat	tion				
		Battery Capa	city	> 4500		All	day ba	ttery	_			
	-	Cost		< \$			thin Bu	•	_			
		Weight		< 5 additi	ional Ibs.	Lightwei	ght and	i portable				

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









Universal Mounting





PRODUCT DEVELOPMENT

	501	UTION AND C		ICEPT	
	Concept 7 - Brakes w	ill be applied by pulling t	he brake lever which	engages a rotary encoder.	
		HOW	ITWORKS		
PULLIN	IG THE HANDLE \rightarrow RO	ITATES DIAL ON ROTAR	$Y ENCODER \rightarrow TUP$	INS THE MOTOR \rightarrow APPLIE	S BRAKES
	Step motor wil Pressing the "E-E Mode Selector	sses data & rotates a step Il pull the brake cable acc Brake" Button locks the r Button - changes brakin	ording to how far th brakes g sensitivity		
	Concept 7 was chosen	n because it will give us t	ie most adaptability :	nd ability for future growth	
Butte		Prototype 2 Prototype 2 Bastery Stepper Motor		DTYPE ITERATIONS relation Uno LED LED Mode Selection Button	Ratery Ecoder
	A lesson that was le different ways to app For example, the : One tough decision Changed from lith	proach problems suggestion to use zip tie: that was made was the hium ion to standard por	that there's never a i instead of Velcro str change of the battery table USB chargers	wrong idea and that there i	

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: I = 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 I 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

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	\$54.5I		
Sale Price	\$100		
Break Even Quantity	15, 751 Units		

Bill of Materials (BOM)

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

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 \rightarrow ROTATES DIAL ON ROTARY ENCODER \rightarrow TURNS THE MOTOR \rightarrow 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

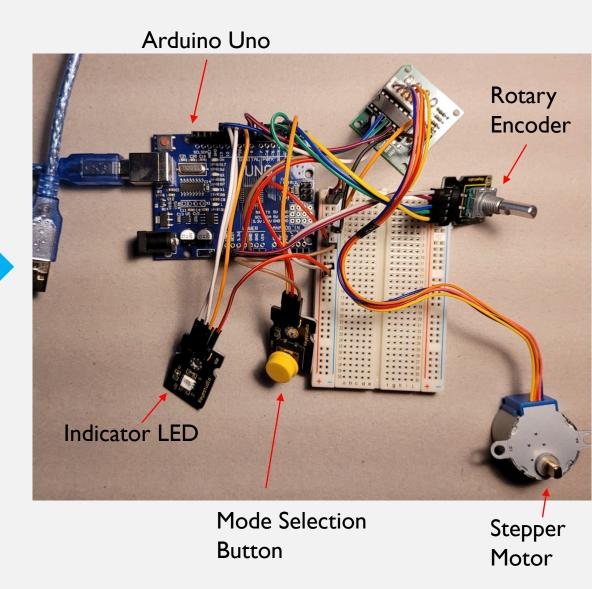
LESSONS LEARNED & TOUGH DECISIONS

- 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

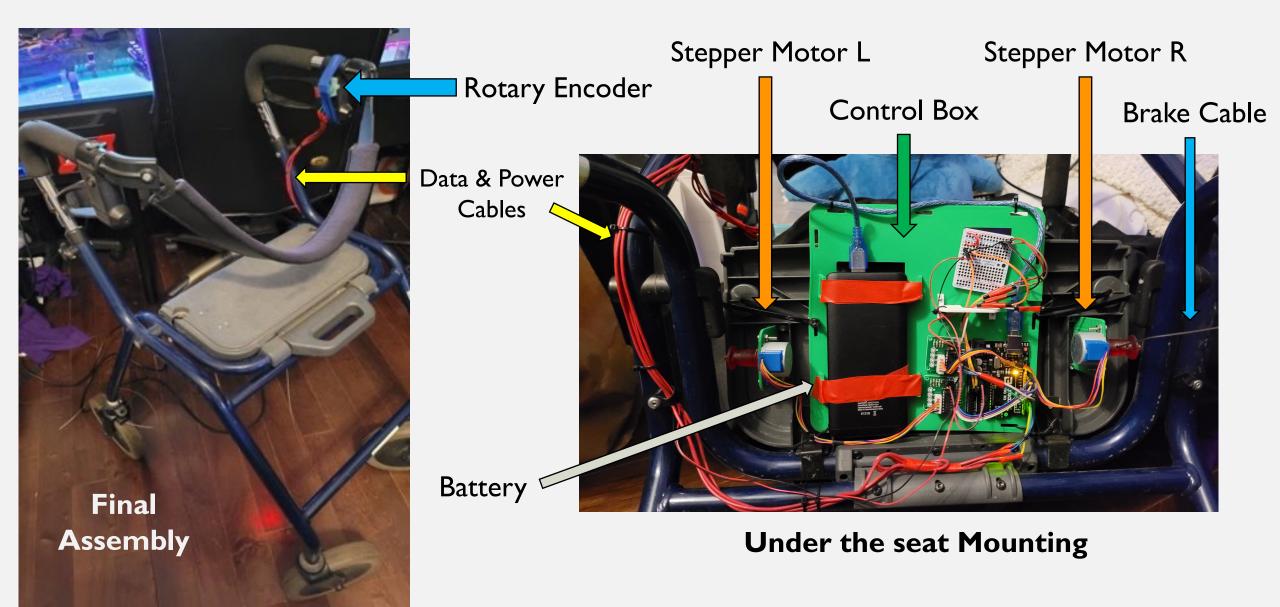
- One tough decision that was made was the change of the battery type
 - Changed from lithium ion to standard portable USB chargers
 - The lithium-ion battery would have given our group more power to work with, but instead decided the ease of use for the client was more important



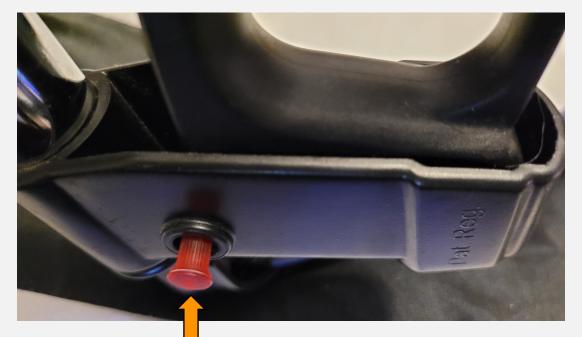
PROTOTYPE ITERATIONS



FINAL PROTOTYPE



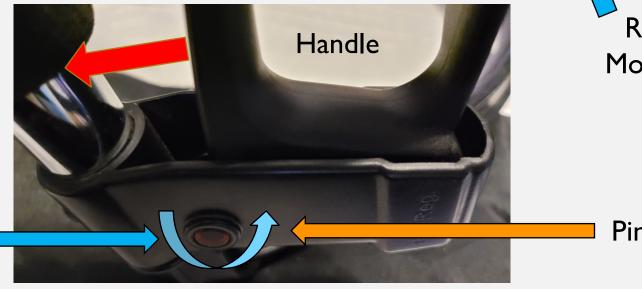
FINAL PROTOTYPE





Rotary Encoder Friction Lock Pin

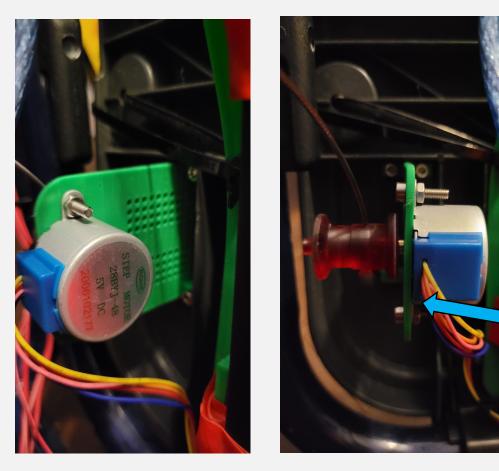
Allows handle to freely rotate turning the encoder



Rotary Encoder Mounted to side of handle

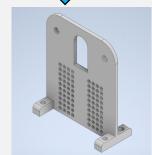
Pin In Place

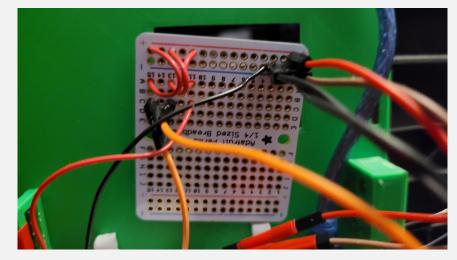
FINAL PROTOTYPE



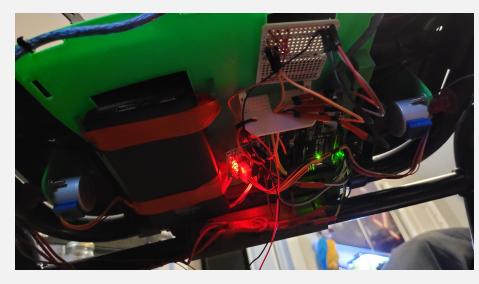
Motor that applies the brakes

3D Printed Motor Mount





ProtoBoard Wiring

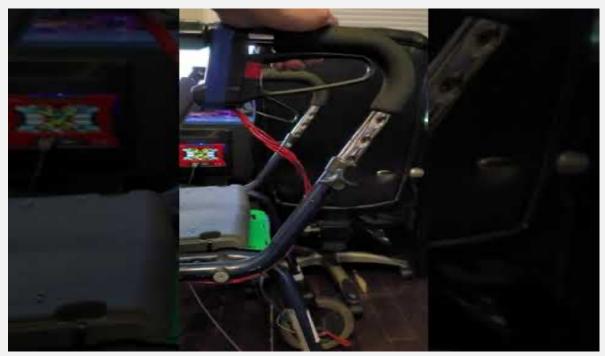


Universal Mounting

Rotary Motor Mount Encoder Case **Mounting Holes** Arduino Battery 0 **3D** Printed Proto Enclosure Board

VIDEOS





Motor Braking system

Braking System