A Third Hand

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The Helping Hand

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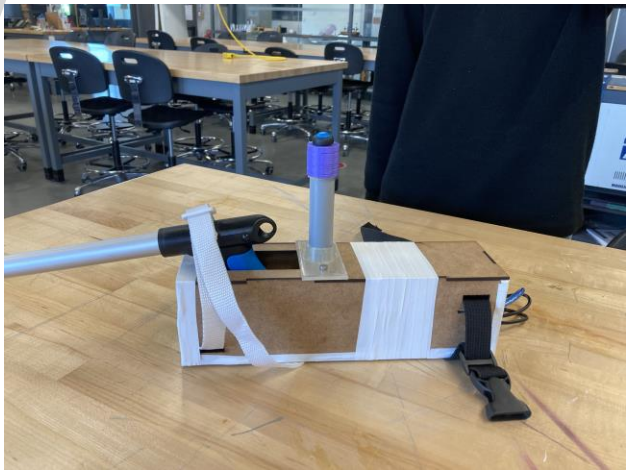
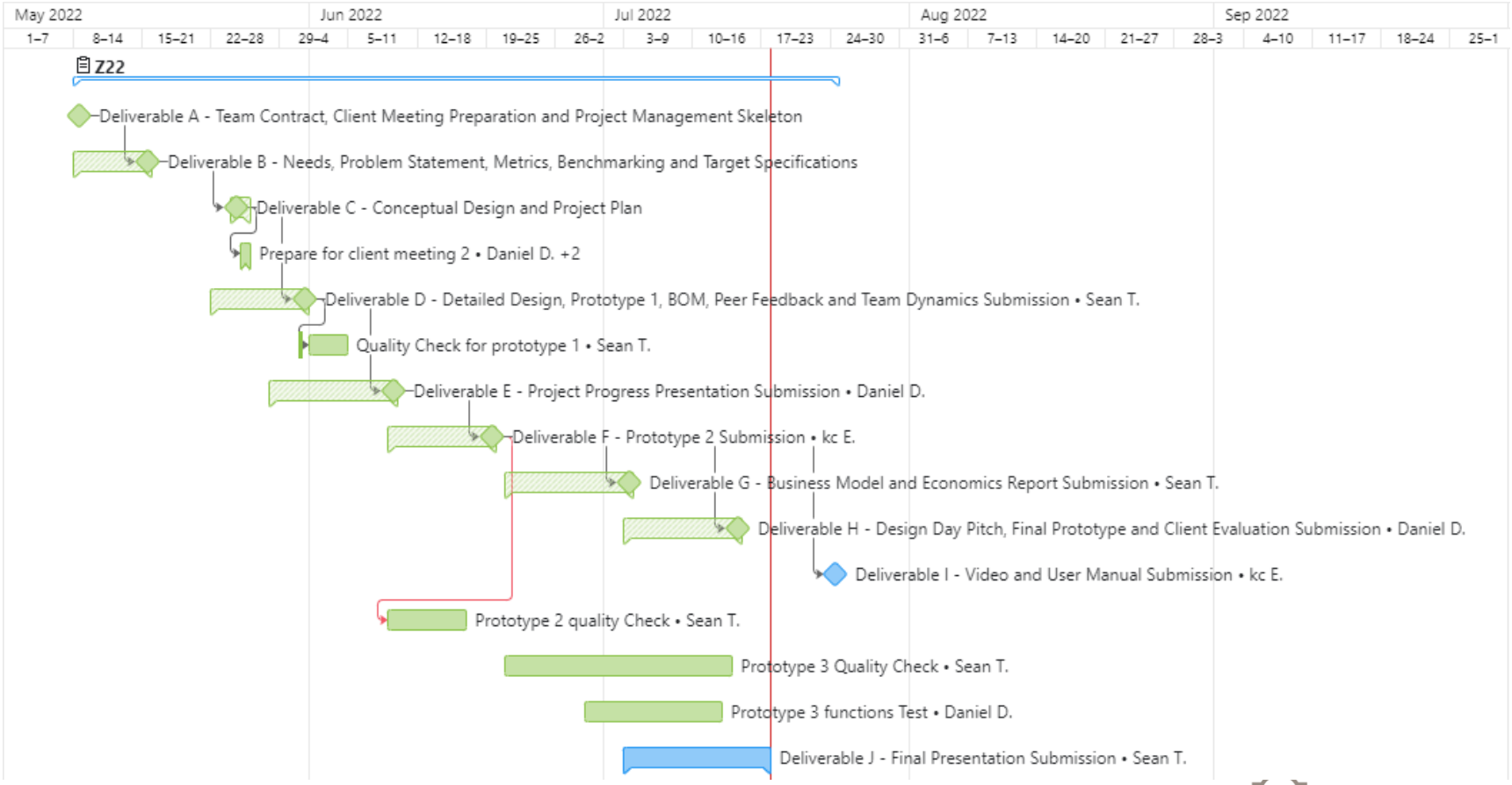


Agenda

- Project Plan
- Defining the Plan
- Design Concepts
- Business Model
- Future Endeavors

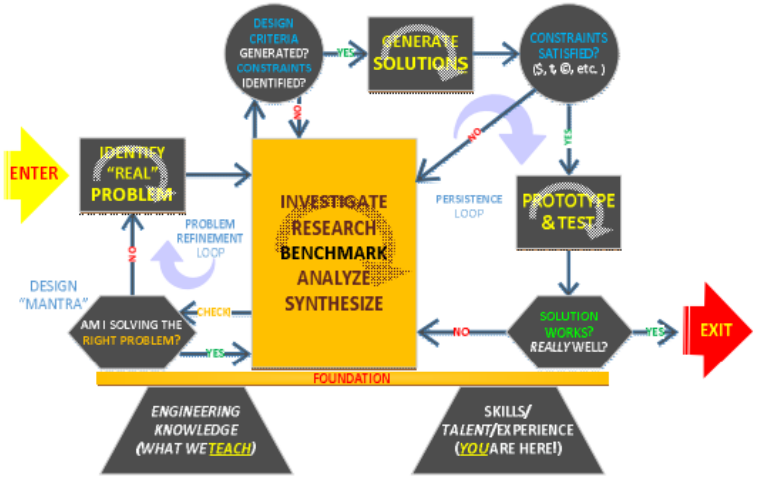
Project Plan



Phase 1: Defining the Plan

Problem Statement

Design Model



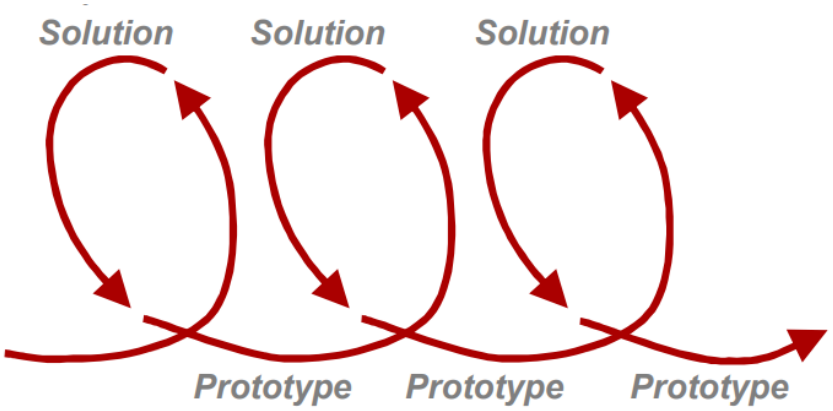


Figure 1: High-Level Decomposition of Power Handle Grabber

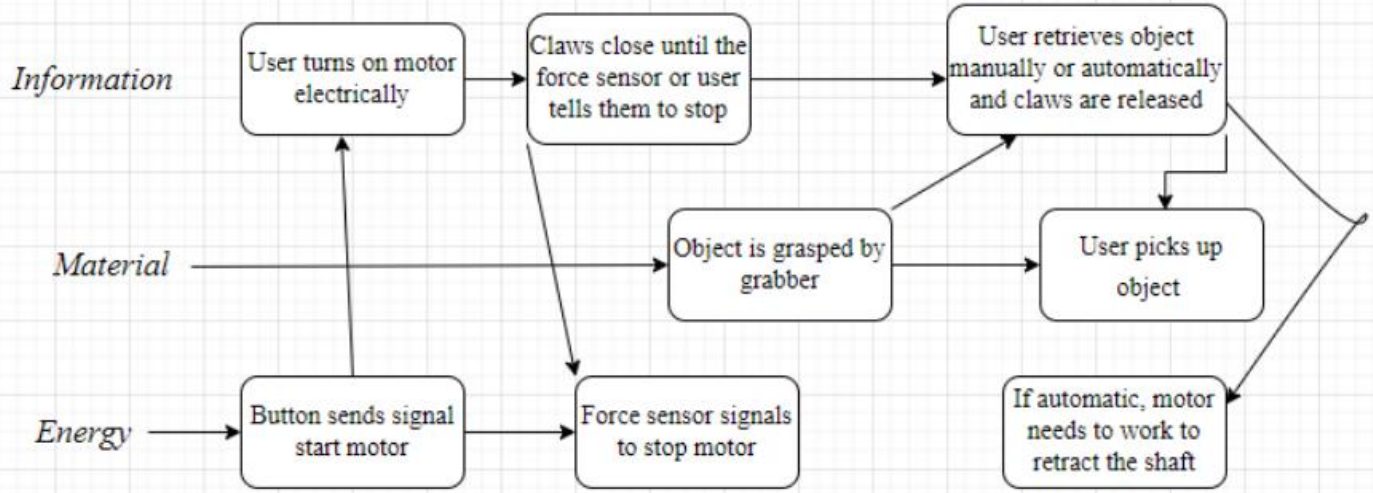


Figure 2: Detailed Functional Decomposition of Power Handle Grabber

Functional Decomposition

Priorities/Needs Specification

	NEED #	PRODUCT NEED	SCORE
1	The Power Grabber	Can Squeeze Grabber Trigger	5
2.	The Power Grabber	Adjustable applied force to trigger	5
3	The Power Grabber	Operates in the rain and harsh weather conditions	2
4	The Power Grabber	Is automatic (motorized)	5
5	The Power Grabber	Is a manageable weight	5
6	The Power Grabber	It is ergonomic for people with arthrogryposis	5
7	The Power Grabber	Can be used for variously designed power grabbers	3
8	The Power Grabber	Is safe for client use	5
9	The Power Grabber	It is aesthetically appealing	1
10	The Power Grabber	Is durable	3
11	The Power Grabber	Is battery efficient	3
12	The Power Grabber	Is portable	5

Target Specifications

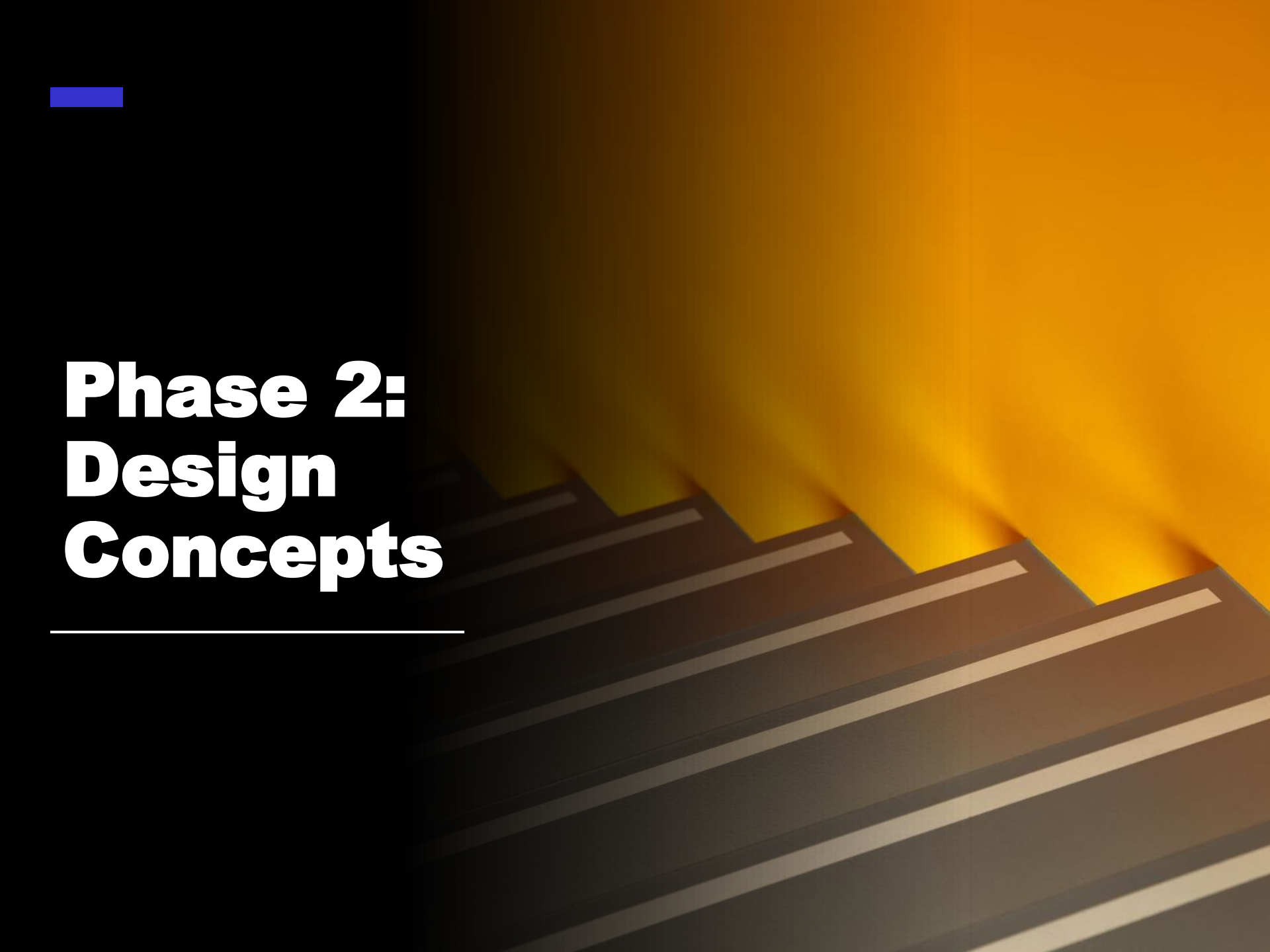
METRIC #	METRIC	UNIT	MARGINAL	TARGET
1	Weight of the Handle	Kilograms	0.9	0.5
2	Grip Force (needed for human)	Newtons	4	2
3	Force applied to Handle	Newtons	16	>32
4	Object Weight (that can be lifted)	Newtons	2.25	>4.5
5	Battery Life	Hours	5	8
6	Cost	Canadian Dollars	150	100

Benchmarking

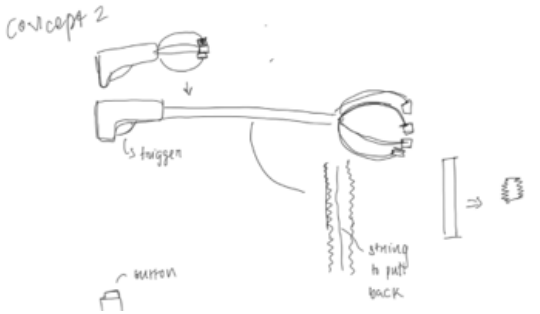
- There is no product on the market similar to one the client wants us to make.
- User benchmarking:
- Majority commented on the great portability of the device.
  Its comfort/ergonomics and ability to grab various objects are areas that could improve.

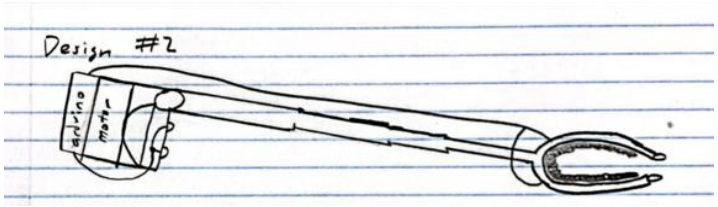
	PRODUCT 1	PRODUCT 2	PRODUCT 3
Product and Features	The Helping Handi-Grip Pro Reacher (Brand: The Helping Hand)	Grabber Reacher Tool,FitPlus Premium Grabber (Brand: FitPlus)	FTH All Stainless Steel Grabber Reacher (Brand: FTH)
cost	$32.99	$35.22	$59.99
length	26-32 inches	32 inches	40 inches
One-handed	Yes	Yes	Yes
Lightw eight	Yes	Yes	Yes
Simple trigger (pistol grip)	No	Yes	Yes
Motorized handle	No	No	No

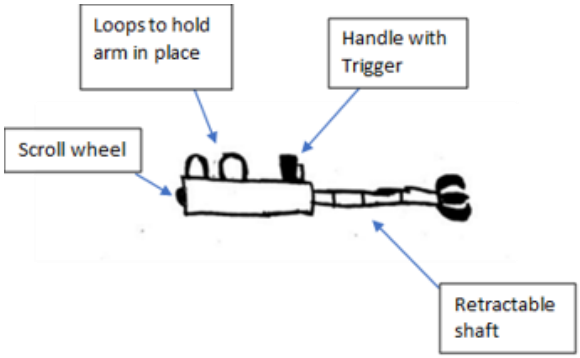
Phase 2: Design Concepts

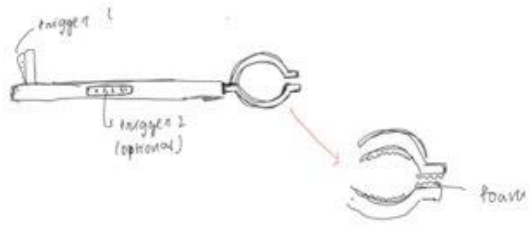


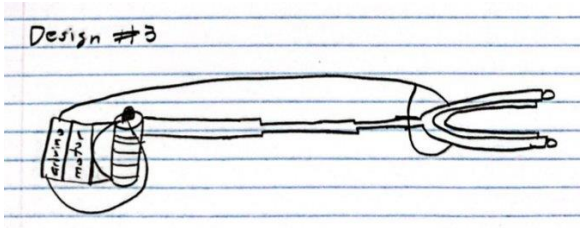
Designs

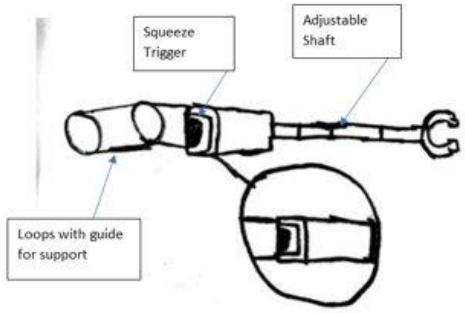

Concept 2
trigger
string to pull back
button


Design #2
driving motor


Loops to hold arm in place
Handle with Trigger
Scroll wheel
Retractable shaft

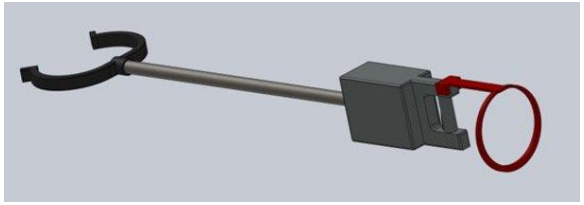

trigger 1
trigger 2 (optional)
foam

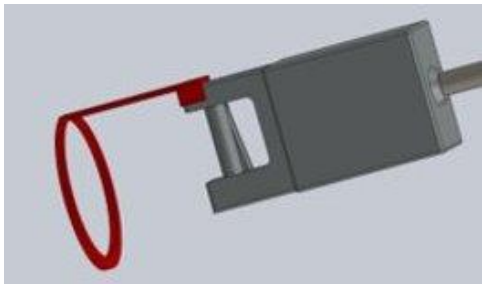

Design #3
driving motor


Squeeze Trigger
Adjustable Shaft
Loops with guide for support

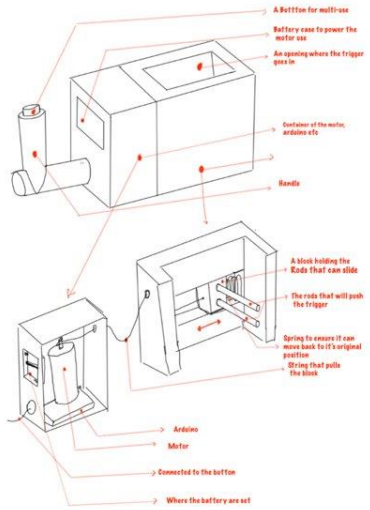
Design

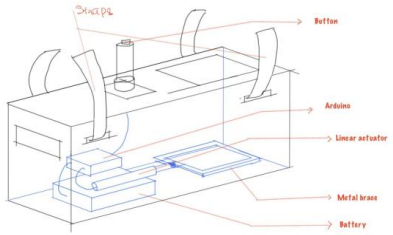
Metric #	Need #	Metric	Unit	Marginal	Target	Final Concept
1	6	Weight of the Grabber	Pounds	1.7	1	Yes
2	8	Length of the Grabber	Inches	16	20	Yes
3	2	Force applied to object	Pounds	1	3	Yes (but may be difficult to keep within boundaries)
4	10	Object Weight	Pounds	1	3	Yes
5	14	Battery Life	Hours	5	8	Yes
6	5	Motor Speed	RPM	N/a	N/a	N/a (we can buy a suitable motor)

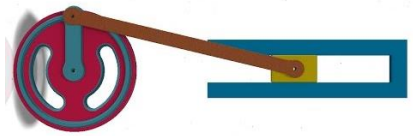


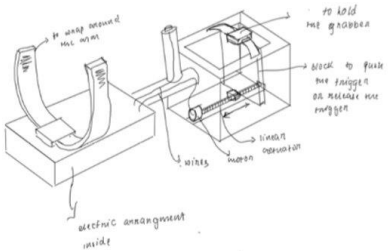


A Setback







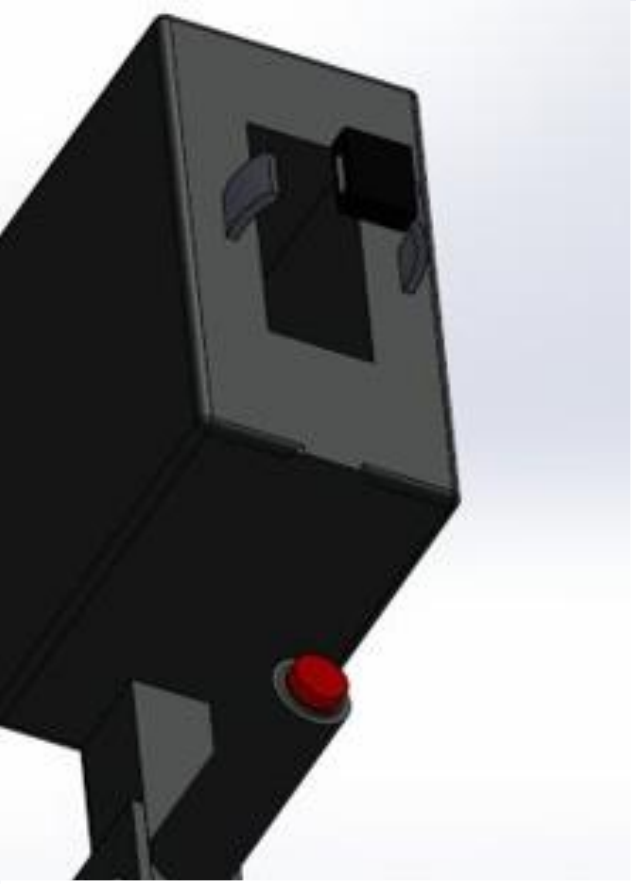


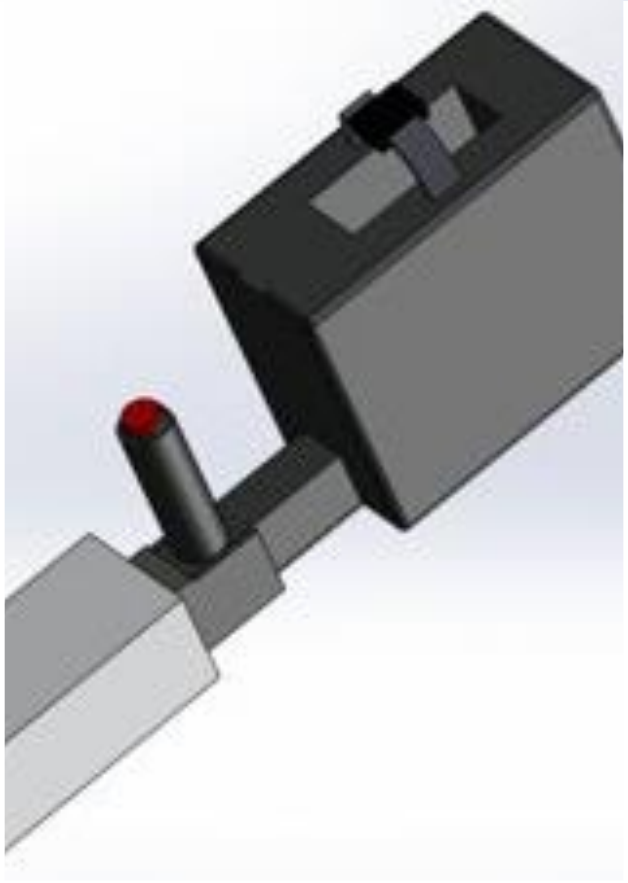
Design Concepts

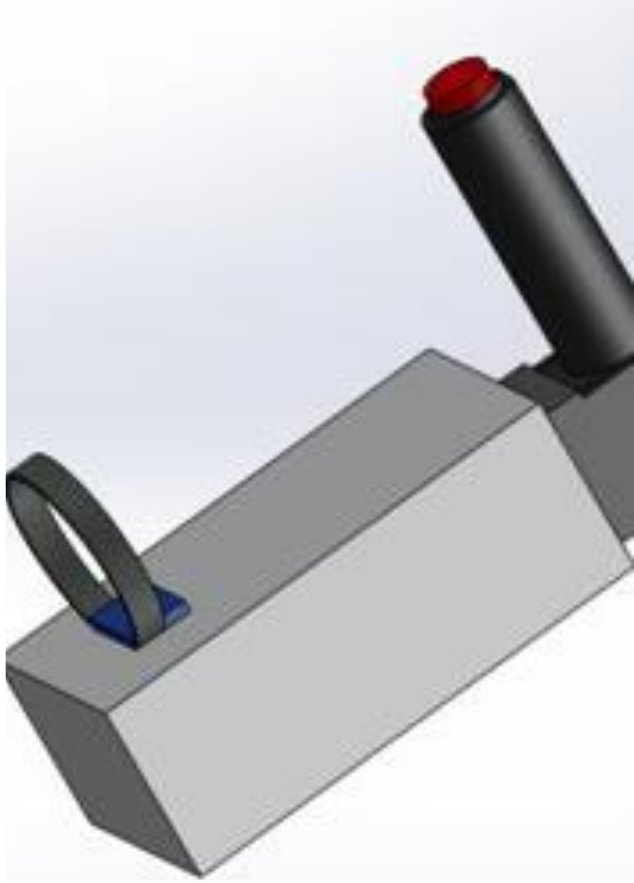
Decision Matrix

- 5 is most Important
- 1 is least Important

Criteria	Linear Actuator	Rotary Linkage	Lead Screw Stepper Motor
Size of System	4	2	3
Weight	4	2	4
Force Applied to Handle	5	3	3
Cost	2	3	3
Total	15	10	13

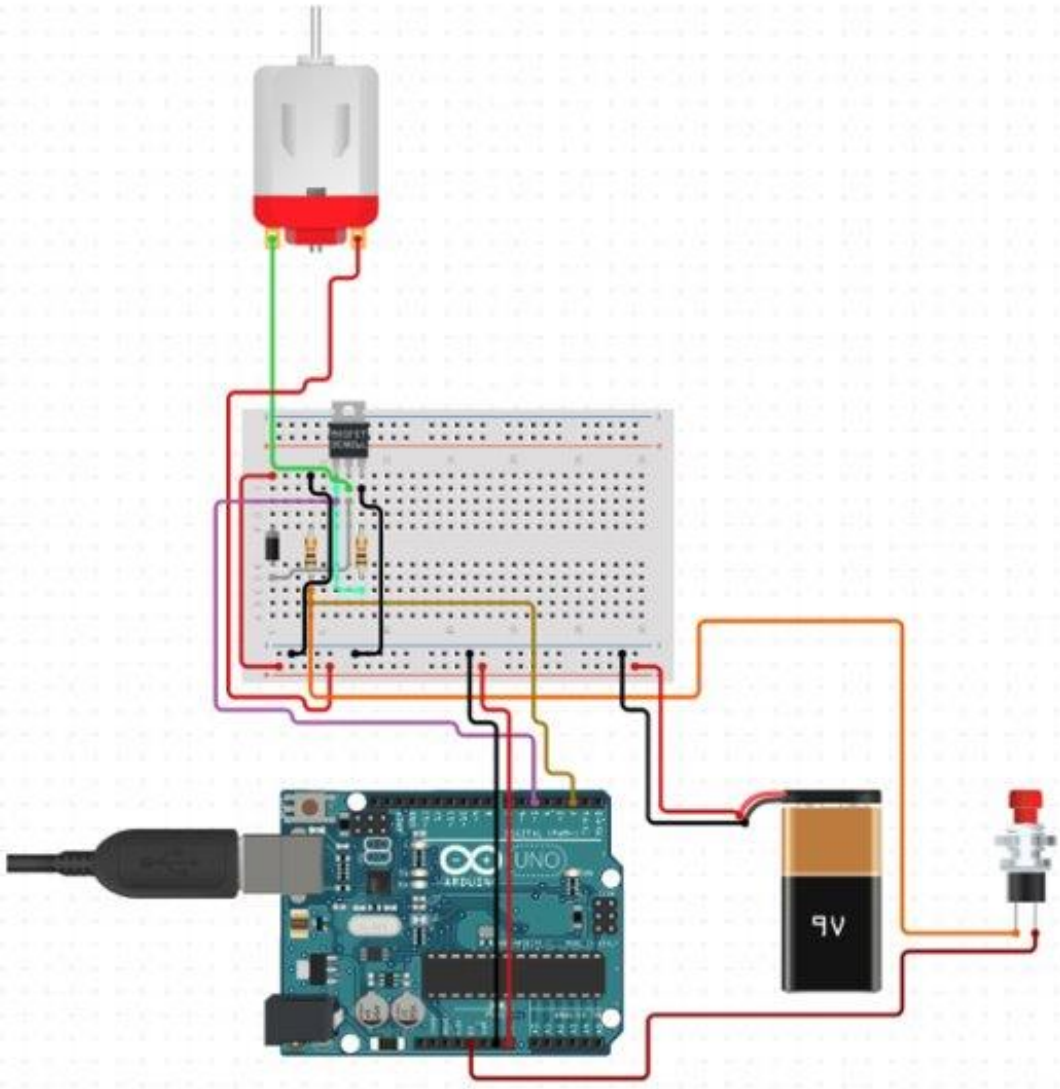




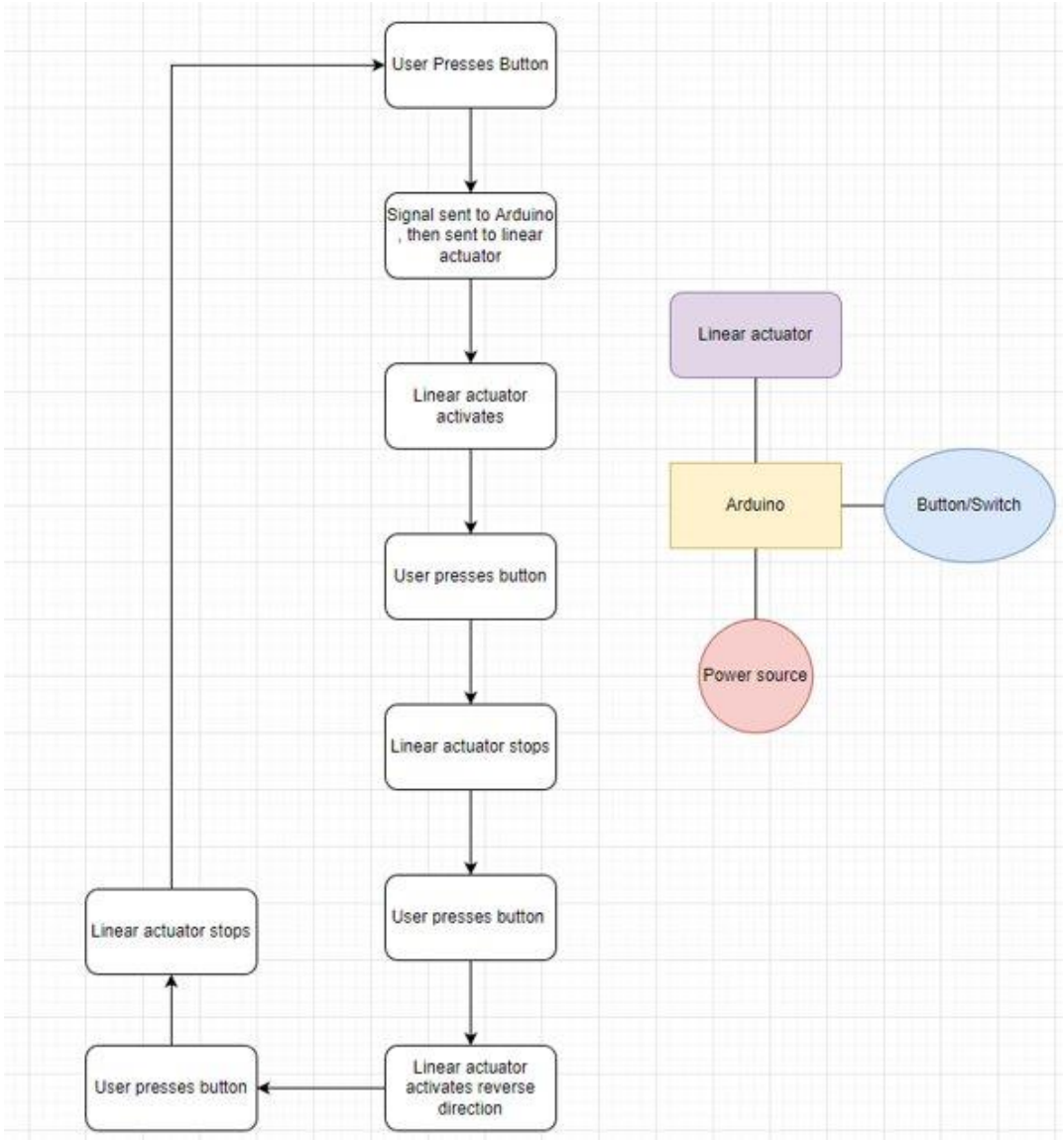


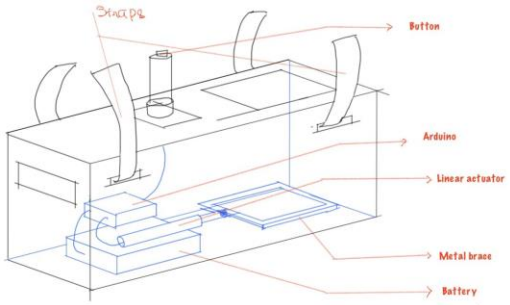
CAD Model

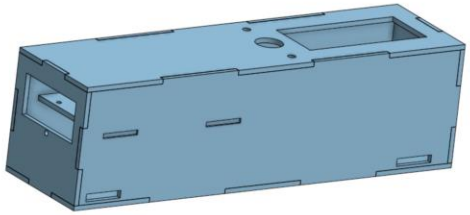
Electrical Concept

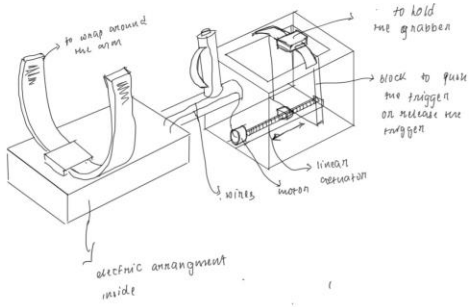


Signal Flow


User Presses Button
Signal sent to Arduino , then sent to linear actuator
Linear actuator activates
User presses button
Linear actuator stops
User presses button
Linear actuator activates reverse direction
User presses button
Linear actuator stops
Linear actuator
Arduino
Button/Switch
Power source







Final Decision

The Math

- Force to Squeeze the Trigger
- 1.6kg x 9.81m/s^2=15.696N (one and half water bottles full)

- Lead Screw =16N
- Linear Actuator=60N

Feasibility Study

Strengths

- Low grip strength
- High amount of support
- Ergonomic
- Lift variety of objects

Weaknesses

- Does not lift heavy objects
- Does not apply to all grabbers

Feasibility Study

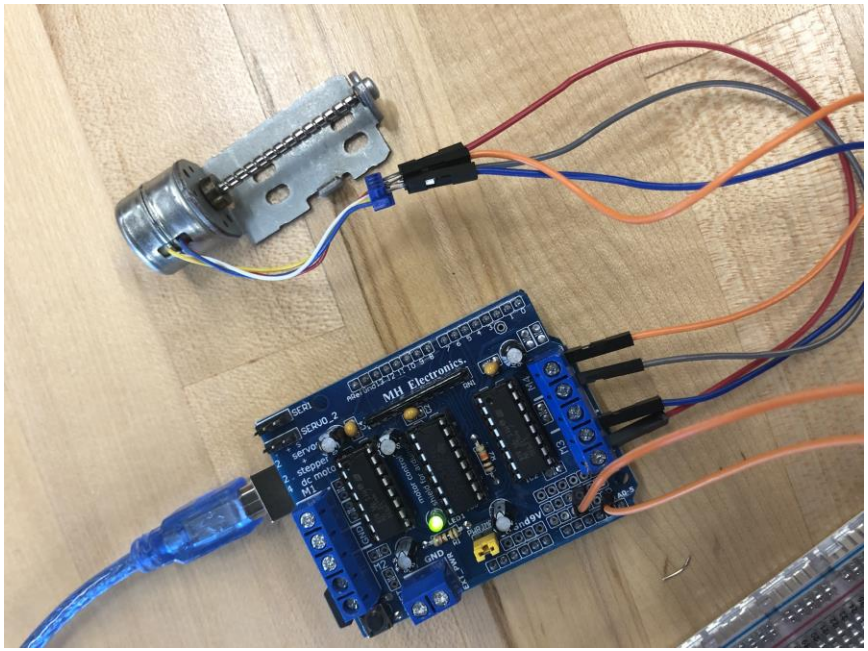
Technical	Portable
Economic	Recyclable
Legal	Unique product
Operational	Operates as intended
Scheduling	Three months

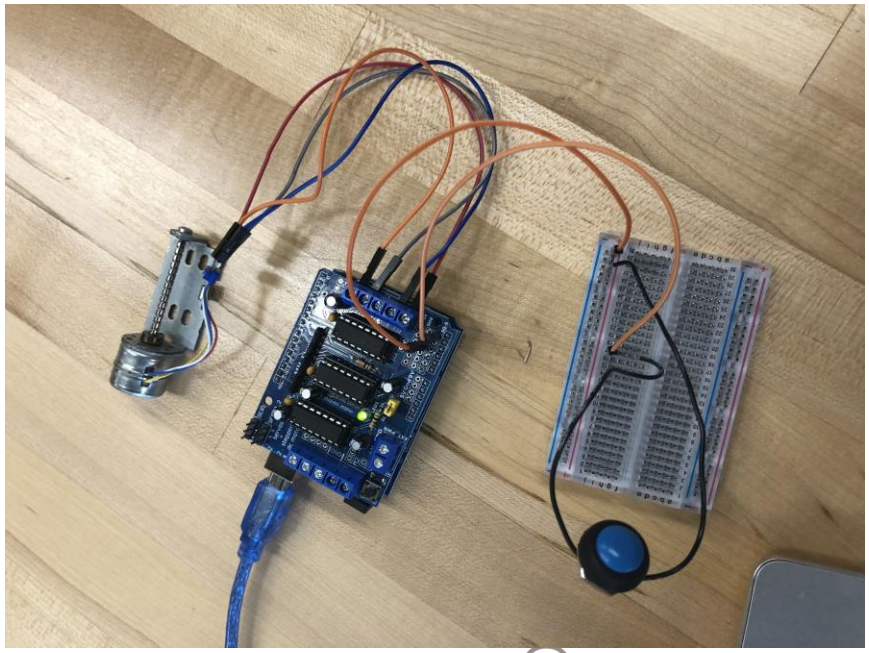
Bill of Materials

Item #	Name	Description	Qty	Cost	Total cost	Source
1	Outer case for Arduino	Laser Cut Wooden Box	1	3.00	3.00	MakerLab
2	Outer case for linear actuator	Laser cut wooden box	1	5.00	5.00	MakerLab
3	Arduino	Arduino Uno	1	9.00	9.00	arduino
5	Batteries	Reachable batteries	1	49.99	49.99	Battery 12V Rechargeable
6	Flange	Plastic 3D modeled	1	0.40	0.40	3D print
7	Linear actuator	Linear actuator	1	32.95	32.95	amazon
8	Strap for Handle	Buckle to keep grabber in place	1	1.99	1.99	
9	Button	Button from MakerLab	1	0.50	0.50	MakerLab
10	PVC Pipe (to support button)	Pipe for handle grip	1	0.40	0.40	MakerLab
14	Wires	Wires to connect motor shield with actuator	8	1.00	1.00	MakerLab
15	Shield	Motor Shield	1	20.00	20.00	MakerLab
16	Glue	Super Glue	1	6.00	6.00	Glue
17	Screws	0.25 inch	4	0.10	0.40	MakerLab
18	Nuts	0.25 inch	4	0.30	1.20	MakerLab
Total project cost:					$131.83	

First Prototype

Second Prototype





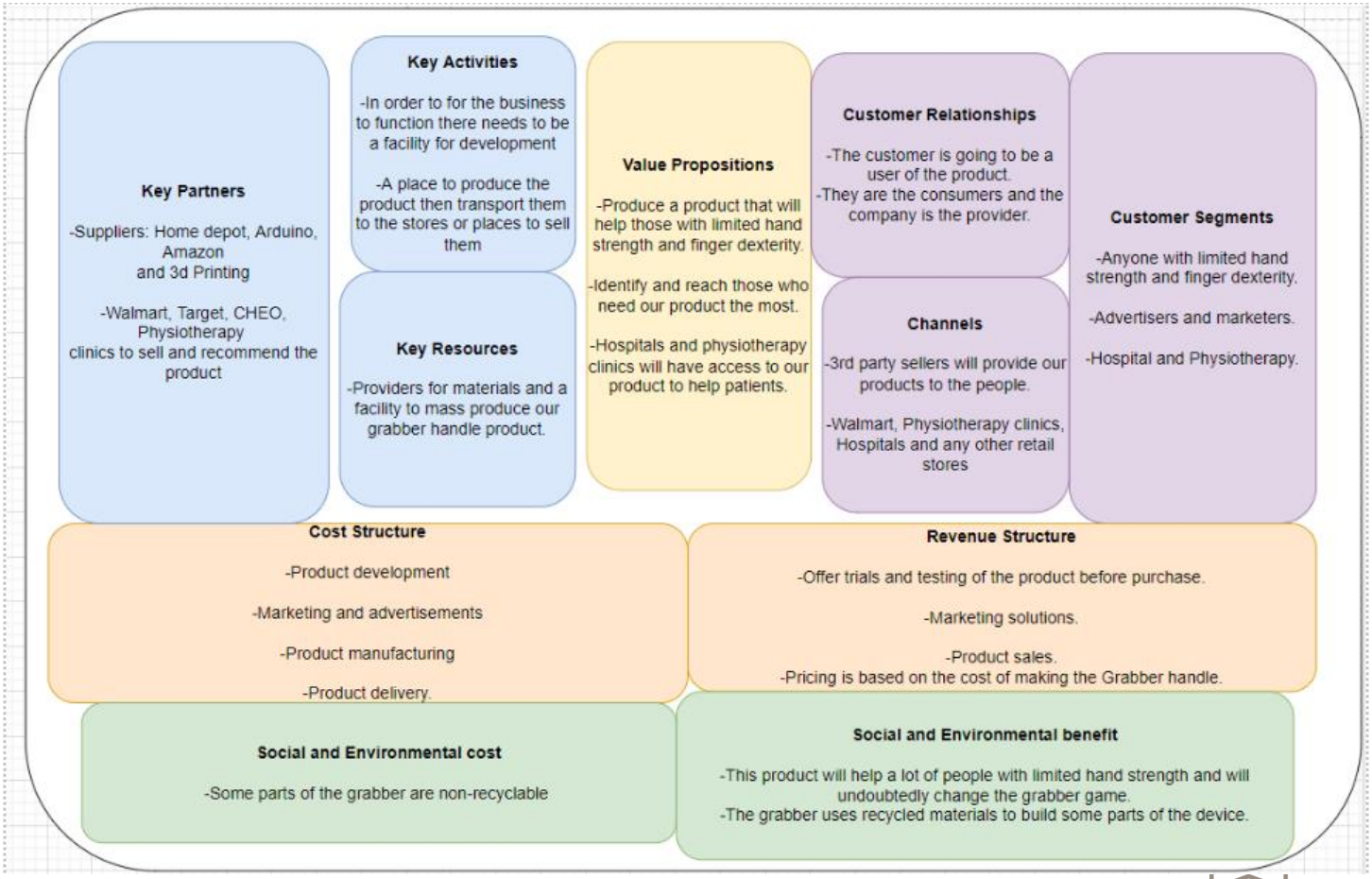
Third Prototype

Phase 3: Business Model

Business Model

- The razor-blade model was decided to be the best.
- Initial product would be sold at a deficit.
- Updated product would be sold for profit.

Triple Bottom Line Business Model



Economics

	1st Year	2nd Year	3rd Year
Sales (Revenue)	$225*2500 = $562,500	$225*3000 = $675,000	$250*3,150 = $787,500
Cost of Goods sold	$150*2750+$160000 = $572,500	$150*3000+$160000 = $610,000	$160*3,000+$160000 = $640,000
Gross profit	-$10,000	$65,000	$147,500
Operating expense:	$3000 + $13,476 + $18,000+$15000 = $49,476	$3000 + $13,476 + +$15000= $31,476	$3000 + $13,476 + +$15000 = $31,476
Marketing	$2000	$2500	$1500
Total operating expenses	$51,476	$33,976	$32,976
Operating income	-$61,476	$31,024	$81,548

Phase 4: Future Endeavors

Lessons Learned

Communication with the client is vital

Failure is expected and iteration is necessary

Group communication and dynamic is key to success

Improvements for The Helping Hand

- Fasteners
- Secure hold on the grabber
- Improve the wrist straps

Thank You for Listening

Any Questions?