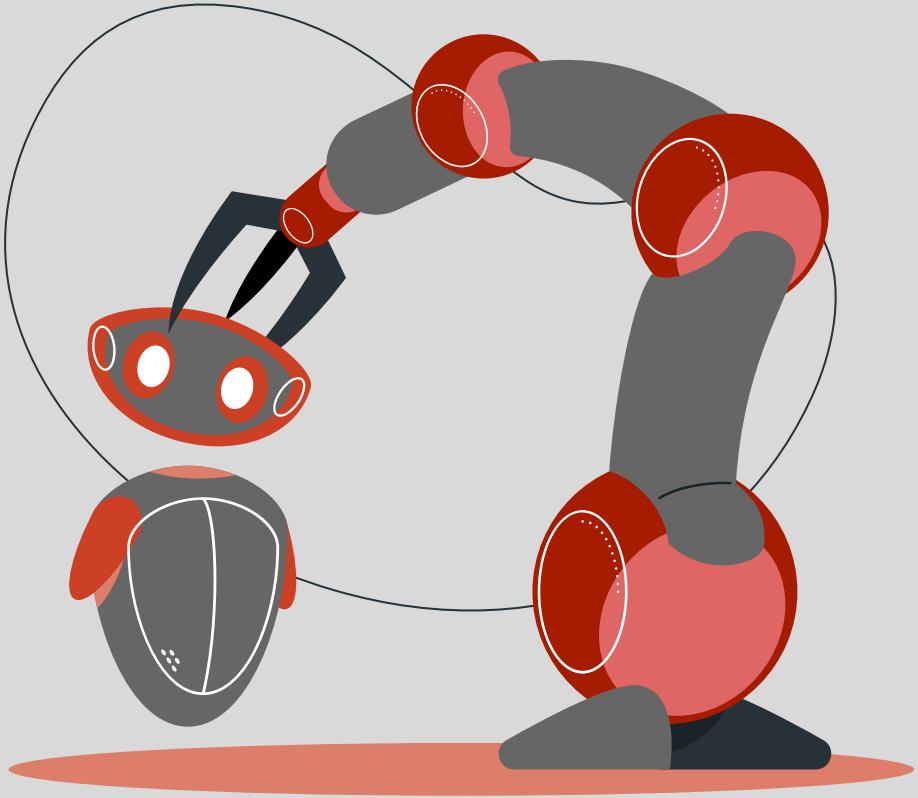
The Spring Soldier

- Brooklyn Bionics -

Head of Production: Louie Rivera
Head of Programming: Tanvi Rahman
Head of Design: George Zhang

EG 1003 Section C2
Milestone 3 Presentation
April 6th, 2021



Agenda

- Project Objective
- Background Information
- Technical Design Description
- Cost Estimate
- Project Schedule
- Summary

Mission Statement

Bridge the gap between human limitation and human potential

Project Objective

- Develop prosthetic limb with at least two functioning features
  - Hand wrapping around handle, lifting weight
  - Elbow able to move vertically 90+ degrees
  - Wrist capable of rotating 180+ degrees

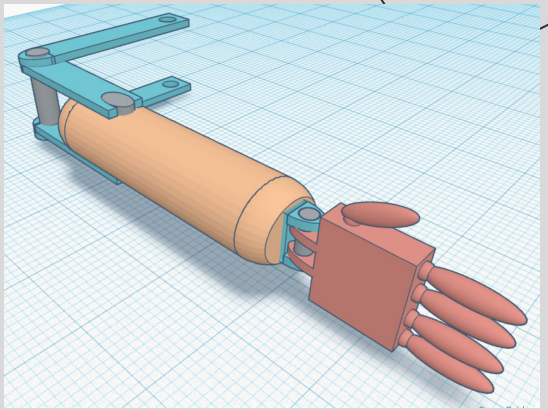


Figure 1: Preliminary Design (Isometric View)

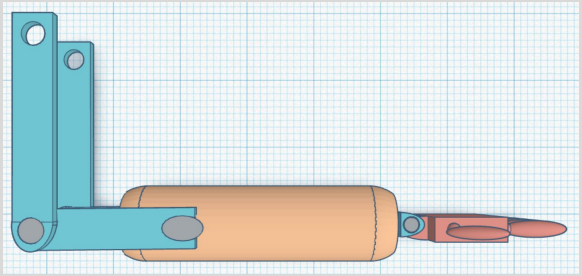


Figure 2: Preliminary Design (Top View)

Project Objective

- Fusion 360 Model
  - Inspired by Metal Gear Solid Bionic Arm
- Completed circuit on Fritzing
  - TinkerCAD Simulation
- Extra Credit
  - Multiple sensors
  - Functioning Hand

Figure 3: Metal Gear Solid ‘Snake’ Arm

Background Information

- Improve healthcare and medical options
- Replace lost limbs
- Save and improve quality of lives

Figure 4: Amputee Using Prosthetic

Figure 5: Daniel Melville Using Hero Arm

Technical Design

- Functioning elbow and wrist
- 2 Hinges
  - 90°–135° Elbow Rotation
  - 180° Wrist Rotation

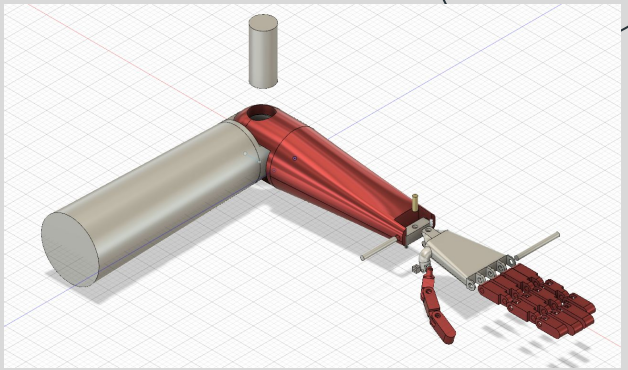


Figure 6: Previous CAD Model (Isometric)

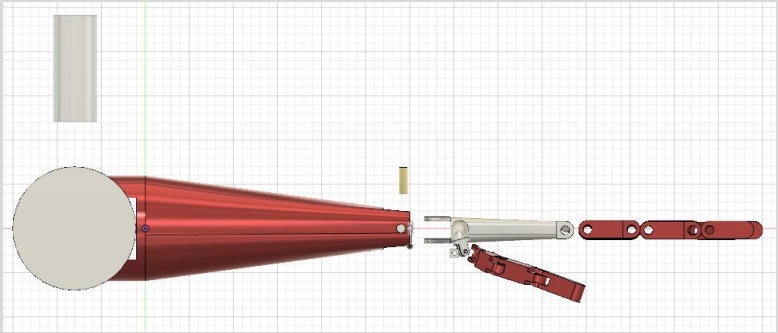


Figure 7: Previous CAD Model (Front)

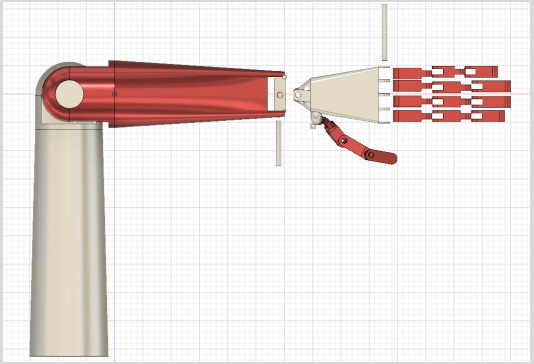


Figure 8: Previous CAD Model (Top)

Technical Design

- Updates & Additions
  - Shortened upper arm connector
  - Add wire slots
  - Hollowed out upper and forearm

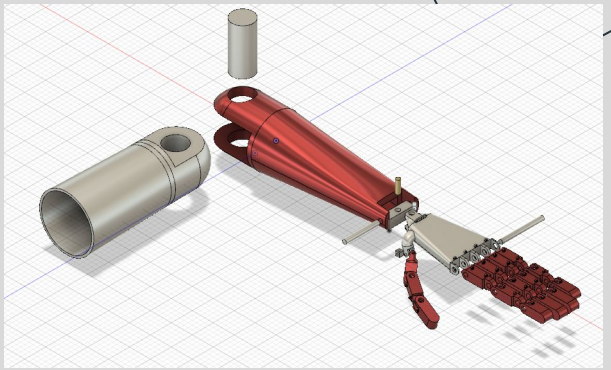


Figure 9: Updated CAD Model (Isometric)

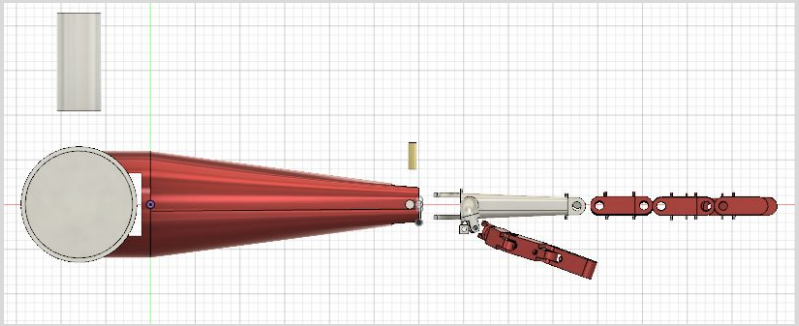


Figure 10: Updated CAD Model (Front)

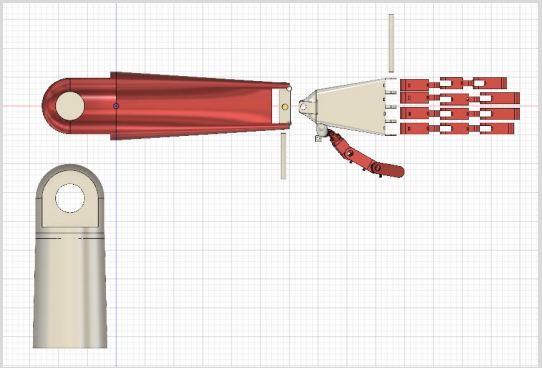


Figure 11: Updated CAD Model (Top)

Technical Design

- Myoware Muscle Sensor
- Electromyography (EMG)
- Servo Motor

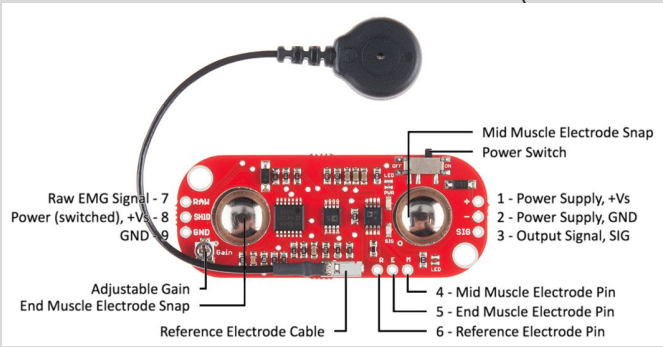


Figure 12: Muscle Sensor Layout

Figure 13: Servo Motor

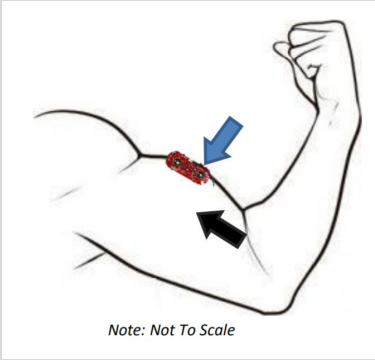


Figure 14: Ideal Sensor Bicep Orientation

Technical Design

- Arduino Microcontroller
- 9V Battery
- Muscle Sensor
- Servo Motor

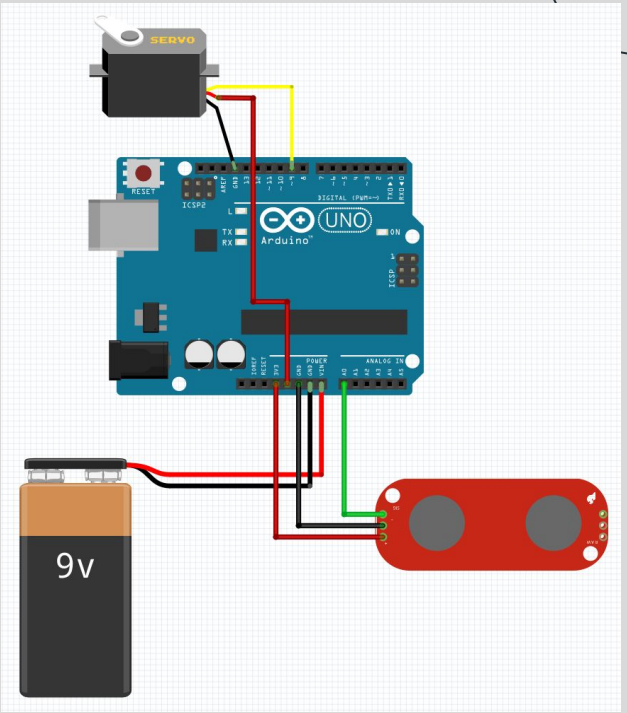


Figure 15: Circuit Diagram (Fritzing)

Technical Design

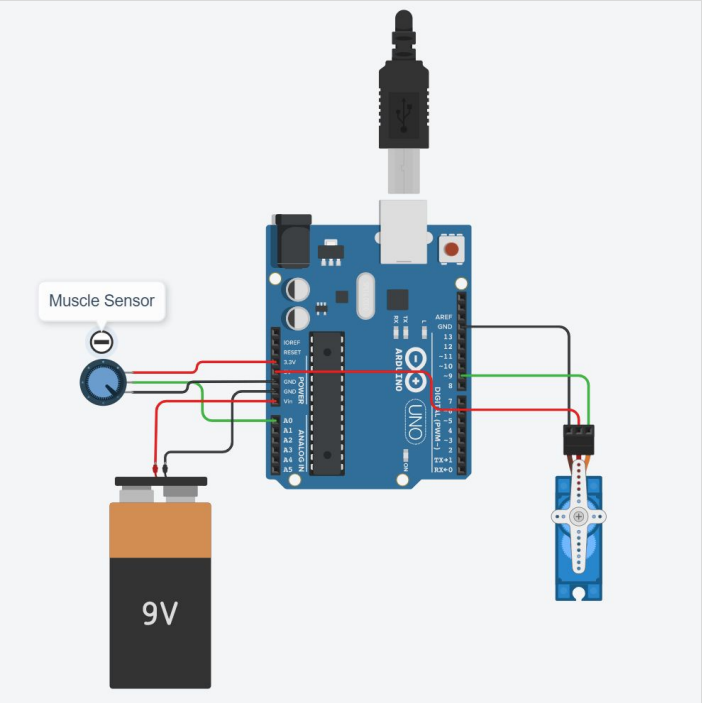


Figure 16: Circuit Diagram (TinkerCAD)

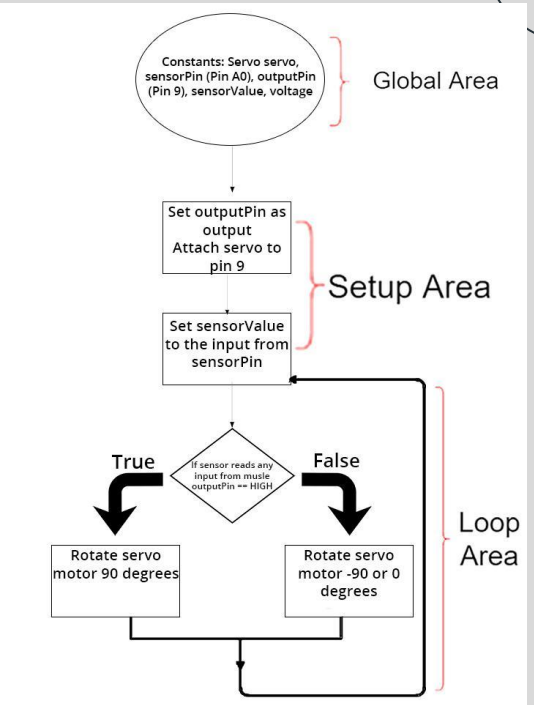


Figure 17: Arduino Code Flowchart

Cost Estimate

Table 1: Previous Cost Estimate

Resource	Cost Per Unit	Quantity	Cost
Plastic Printing Material	$22.99	1	$22.99
Arduino Cable	$5.89	20	$117.80
Arduino Uno Microcontroller (SparkFun Redboard)	$18.79	1	$18.79
Battery (9v)	$6.99	2	$13.98
Muscle Sensor	$37.99	2	$75.98
Servo Motor	$35.99	1	$35.99
String	$7.99	10	$79.90
Projected Labor	$50.00	75	$3,750
Total			$4,115.43

Table 2: Updated Cost Estimate

Resource	Cost Per Unit	Quantity	Cost
Plastic Printing Material	$23.00	1	$23.00
Arduino Cable Pack (40 wires)	$6.00	1	$6.00
Arduino Uno Microcontroller (SparkFun Redboard)	$19.00	1	$19.00
Battery (9V)	$7.00	2	$14.00
Muscle Sensor	$38.00	2	$76.00
Servo Motor	$36.00	3	$108.00
String	$3.99	1	$4.00
Projected Labor	$50.00	75	$3,750
Total			$4,000.00

Project Schedule

ID	Task Mode	Task Name	Start
14		Milestone 2	Tue 3/16/21
15		Updated CAD Models	Thu 3/11/21
16		Have a team logo approved	Thu 3/11/21
17		Updated Engineering Notebook	Thu 3/11/21
18		Benchmark B Early Submission	Thu 3/25/21
19		Benchmark B	Thu 4/1/21
20		MS3 Presentation	Thu 4/1/21
21		Design Changes	Thu 4/1/21
22		Mission Statement	Thu 4/1/21
23		CAD Drawings	Thu 4/1/21
24		Circuit and Schematic	Thu 4/1/21
25		Cost Estimate	Thu 4/1/21
26		Milestone 3	Tue 4/6/21
27		Fully working sensors	Thu 4/1/21
28		Completed team logo	Thu 4/1/21
29		Updated Engineering Notebook	Thu 4/1/21
30		Final Design Report	Thu 4/1/21
31		Early Final Submission	Thu 4/22/21
32		Final Presentation	Thu 4/1/21
33		Final Submission	Thu 4/29/21

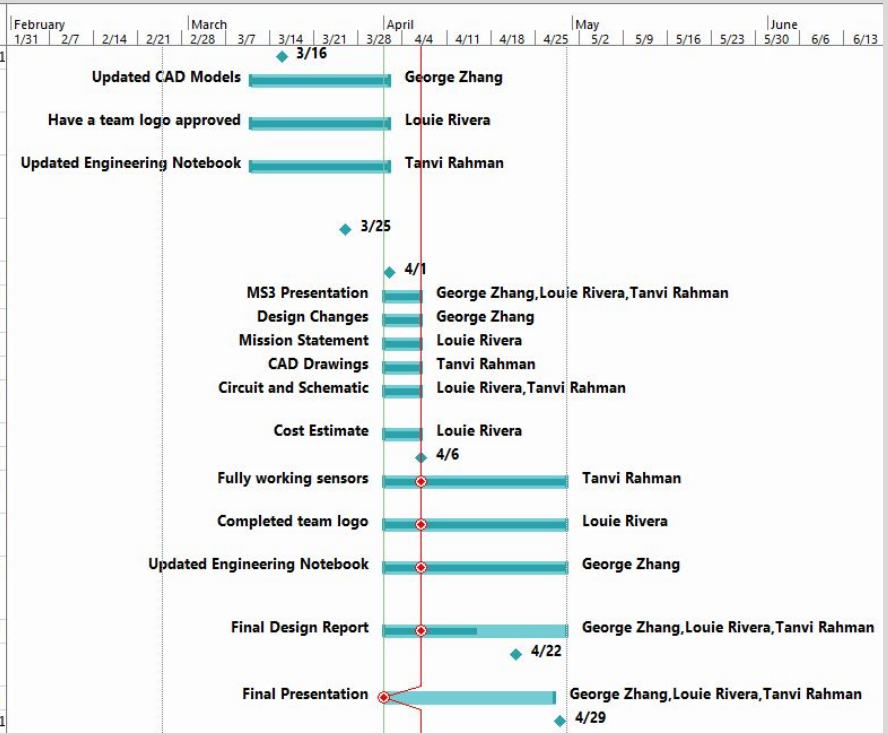


Figure 18: Latest Project Schedule

Summary

- Ahead of Schedule
  - Early Benchmark B submission
  - Completed CAD model
  - Completed circuitry
- For Final Submission:
  - Final design report
  - Final presentation

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