The Spring Soldier

- Brooklyn Bionics -

Head of Programming: Louie Rivera

Head of Production: Tanvi Rahman

Head of Design: George Zhang

EG 1003 Section C2 Milestone 1 Presentation March 2nd, 2021

Agenda

- Project Objective Design
- Background Info
- Technical Design Description
- Cost Estimate
- Project Schedule
- Teamwork Agreement
- Summary

Project Objective Slide

- Develop an artificial limb
  - Contains a hand, wrist, and elbow
- TinkerCAD Preliminary Model
- Rebuild model on Fusion 360
- Program sensors on TinkerCAD and Arduino

Extra credit points we are aiming for:

- Neural Control Component - Backyard Brains
- 3 Functioning Parts

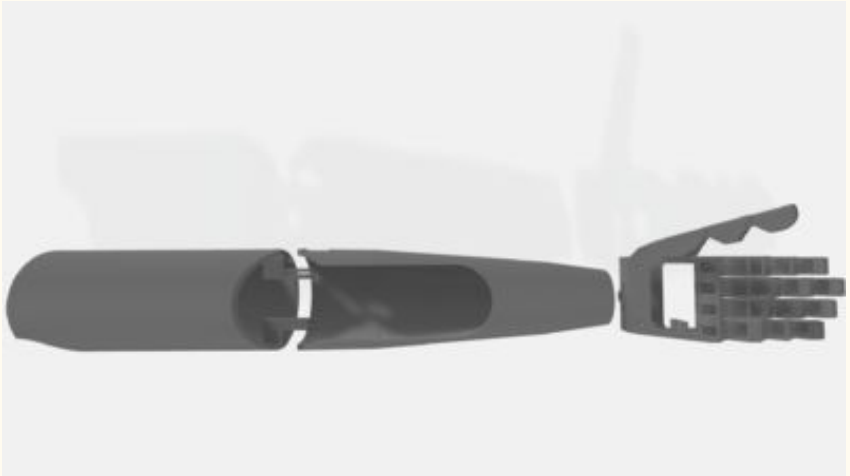

Figure 1: Sample BMD Drawing (NYU Tandon)

Background Information

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

Figure 3: The Winter Soldier

Figure 2: Amputee Using Prosthetic

Background Information

- Prosthetic hand with at least 2 functioning features
  - Hand capable of wrapping around a shopping bag handle
  - Wrist capable of rotating 180 degrees
  - Elbow capable of moving 90 degrees

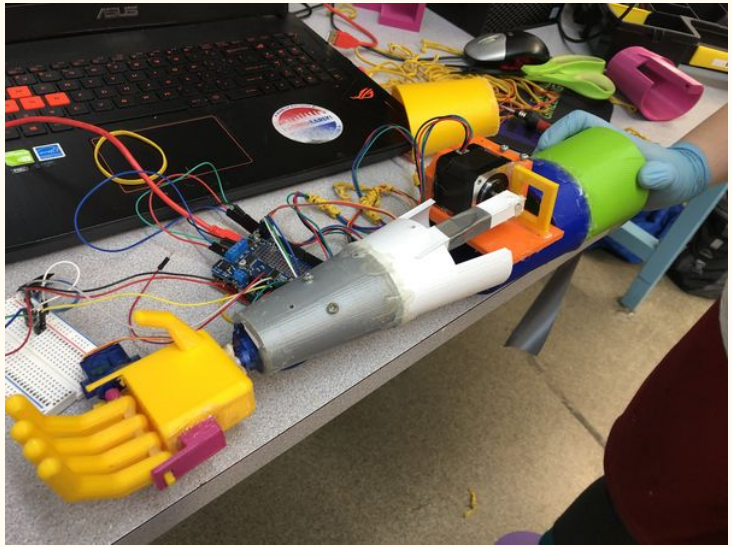

Figure 4: Example BMD Project

Technical Design Description

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

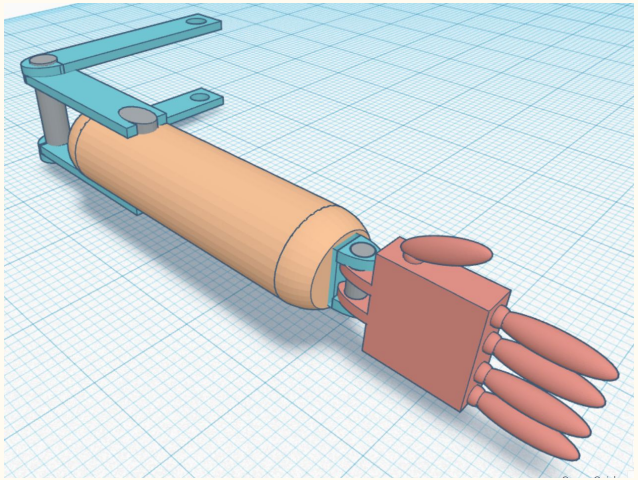

Figure 5: Preliminary CAD Drawing (Isometric)

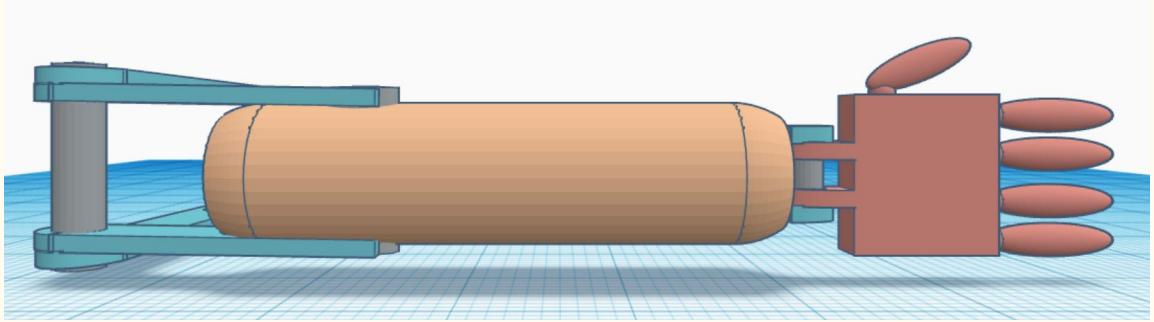

Figure 6: Preliminary CAD Drawing (Front)

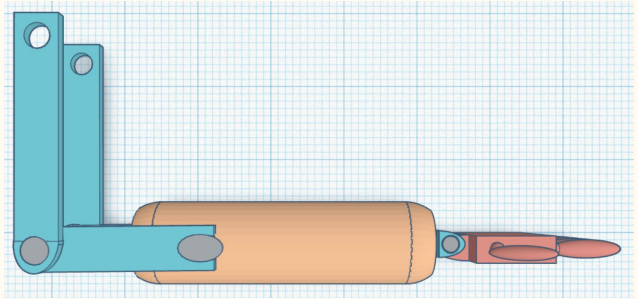

Figure 7: Preliminary CAD Drawing (Top)

Technical Design Description

- Myoware Muscle Sensor
- Electromyography (EMG)
- analogRead()

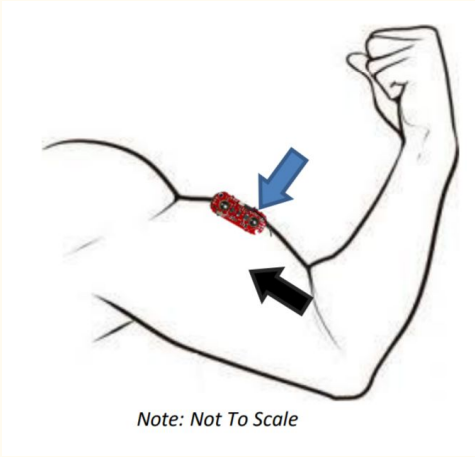

Figure 8: Example Sensor Location for Bicep (NYU Tandon)

```
// the setup routine runs once when you press reset:
void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
}

// the loop routine runs over and over again forever:
void loop() {
  // read the input on analog pin 0:
  int sensorValue = analogRead(A0);
  float voltage = sensorValue * (5.0/1023.0);
  // print out the value you read:
  Serial.println(sensorValue);
  delay(1);        // delay in between reads for stability
}
```

Figure 9: Arduino Code Snapshot

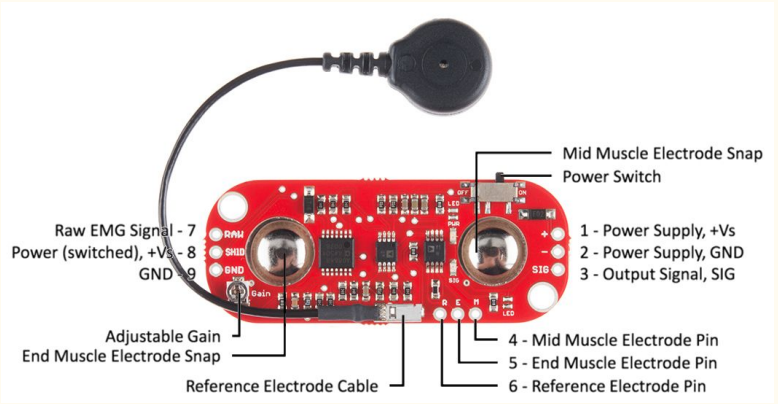

Figure 10: Muscle Sensor Layout

Cost Estimate

Table 1: Cost Estimate

Resource	Cost Per Unit	Quantity	Cost
Plastic Printing Material	$0.00	1	0
Arduino Cable	$0.00	20	0
Arduino Uno Microcontroller (SparkFun Redboard)	$0.00	1	0
Battery (9v)	$0.00	2	0
Breadboard	$0.00	1	0
DC motor	$0.00	1	0
Muscle Sensor	$0.00	2	0
Servo (Waterproof, boat/car)	$0.00	1	0
String	$0.00	10	0
Touch Sensor	$0.00	1	0
Projected Labor	$50.00	75	$3,750
Total			$3,750

Project Schedule

ID	Task Mode	Task Name	Start
1		Preliminary CAD Drawing	Thu 2/25/21
2		Presentation	Thu 2/25/21
3		Teamwork Agreement	Thu 2/25/21
4		Milestone 1	Tue 3/2/21
5		Preliminary Design Investigation	Thu 2/25/21
6		Initial CAD Model	Thu 2/25/21
7		One working sensor with completed wiring	Thu 2/25/21
8		Updated Engineering Notebook	Thu 2/25/21
9		Benchmark A Early Submission	Thu 3/4/21
10		Benchmark A	Thu 3/11/21
11		CAD Drawings	Thu 3/11/21
12		Presentation	Thu 3/11/21
13		Design Changes	Thu 3/11/21
14		Milestone 2	Tue 3/16/21
15		Updated CAD Mode	Thu 3/11/21
16		Use Machining Method to manufacture	Thu 3/11/21
17		Have team logo file approved	Thu 3/11/21
18		Updated Engineering Notebook	Thu 3/11/21
19		Benchmark B Early Submission	Thu 3/25/21
20		Benchmark B	Thu 4/1/21

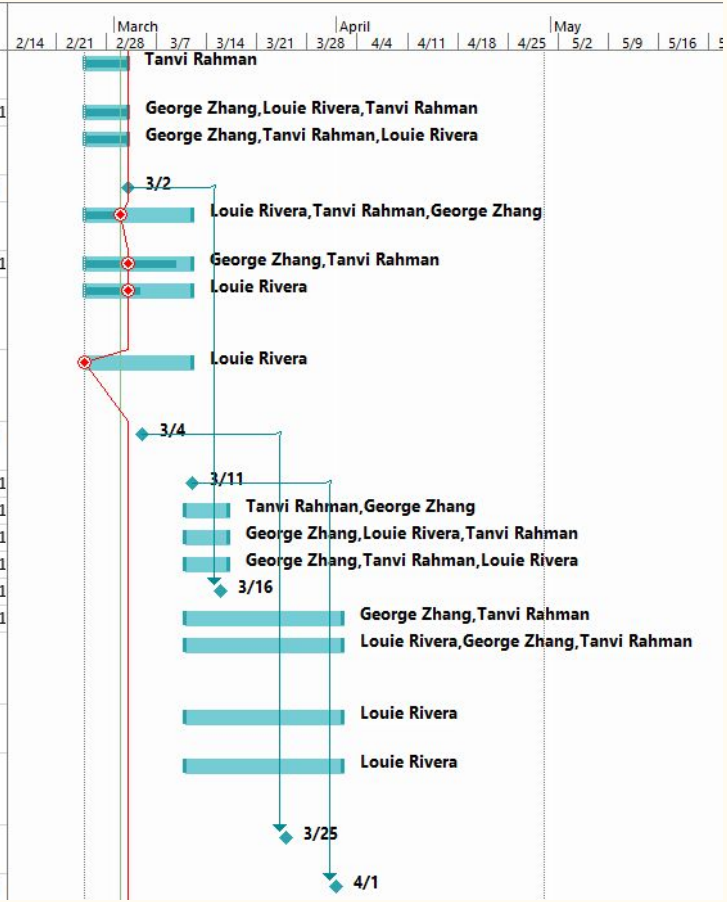

Figure 11: Project Schedule

Teamwork Agreement

- Discord, Google Docs, and Gmail
- Weekly Discord calls Saturday at 4:00PM EST
- Vote on Disagreements
- Members who fail to meet task goals are expected to makeup for missed work
- Even split between all tasks for fair work

Figure 12: Louie and George in Agreement

Summary

- On track for early Benchmark submission
- On “budget”

Next steps for Milestone 2:

- Circuit diagram
- Code flowchart
- Complete CAD design on Fusion 360

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