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 2 Presentation**   **March 16th, 2021**

AGENDA

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

PROJECT OBJECTIVE

» Develop prosthetic limb with at least two functioning features

◇ Hand wrapping around handle, lifting weight

◇ Elbow able to move vertically 90 degrees
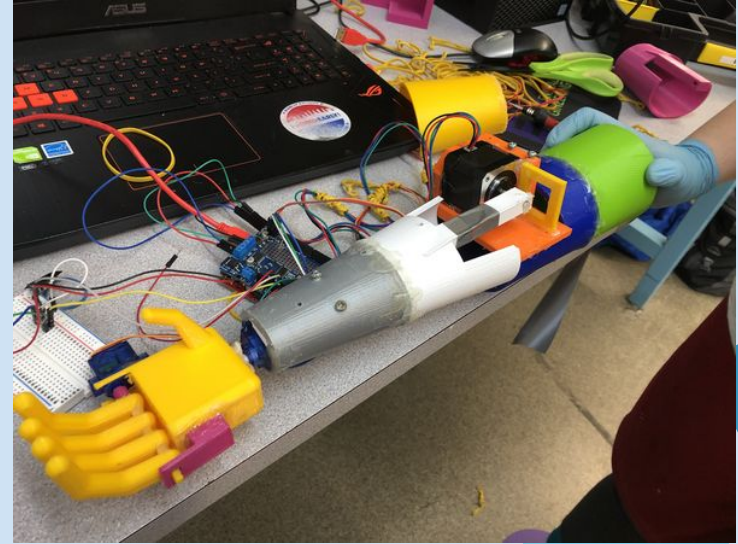
◇ Wrist capable of rotating 180 degrees

Figure 1: Example BMD Project

PROJECT OBJECTIVE

» Initial Fusion 360 Model

» Completed circuit on Fritzing

    ◊ Circuit simulation on Tinkercad
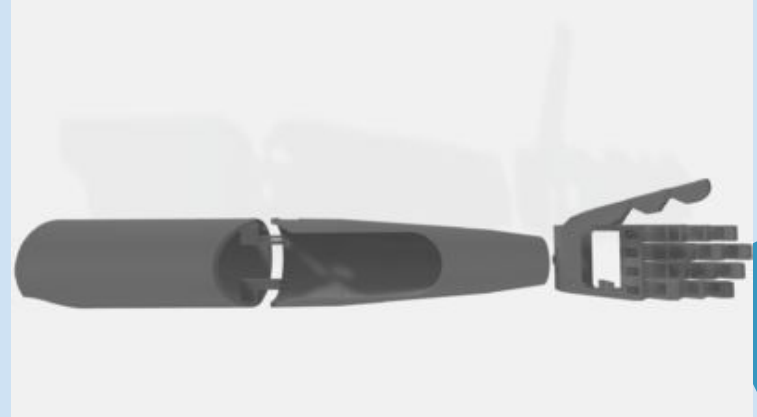
» Potential Extra Credit:

    ◊ Functioning hand

Figure 2: Sample BMD Drawing (NYU Tandon)

BACKGROUND INFORMATION

» Improve healthcare and medical options

» Replace lost limbs

» Save and improve quality of lives

Figure 3: Amputee Using Prosthetic

Figure 4: The Winter Soldier

TECHNICAL DESIGN

» Functioning elbow and wrist

» 2 Hinges

  ◊ 90°-135° Elbow Rotation

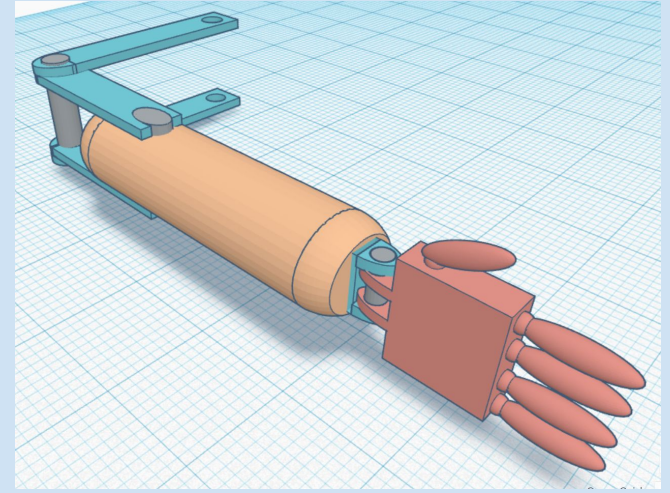 ◊ 180° Wrist Rotation

» Hollow forearm

» Thumb and finger joints

Figure 5: Preliminary CAD Drawing (Isometric)
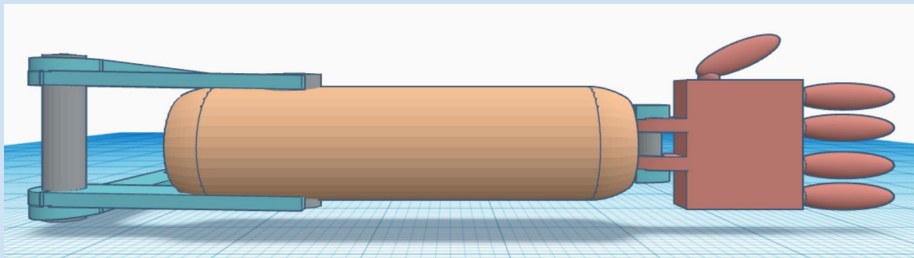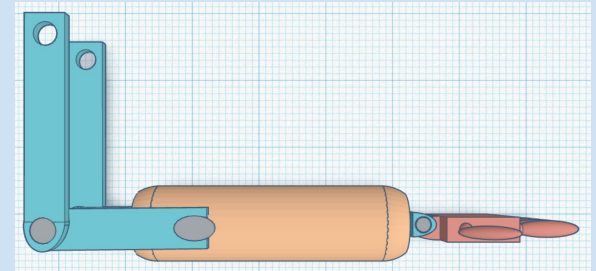

Figure 6: Preliminary CAD Drawing (Front)

Figure 7: Preliminary CAD Drawing (Top)

TECHNICAL DESIGN

» Functioning elbow and wrist

» 2 Hinges

◊ 90°-135° Elbow Rotation

◊ 180° Wrist Rotation

» Hollow forearm

» Thumb and finger joints

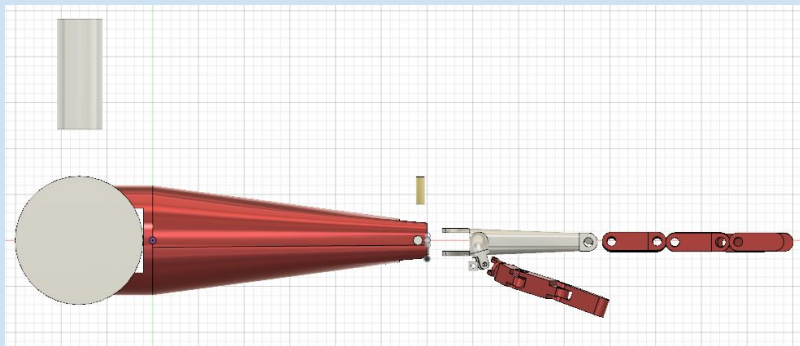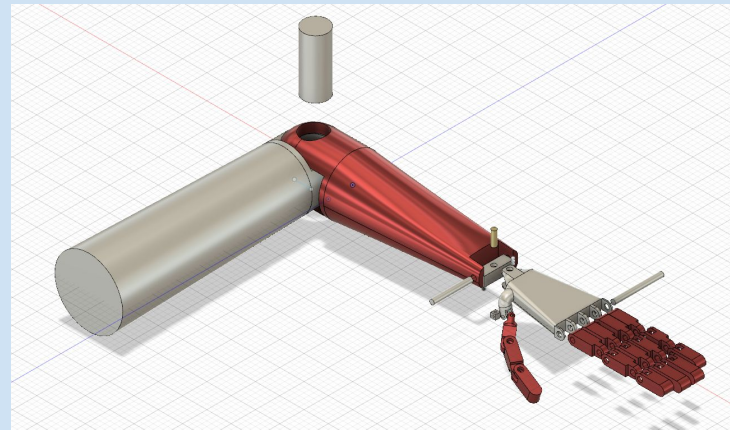**Figure 8: Initial CAD Model (Isometric)**

Figure 9: Initial CAD Model (Front)

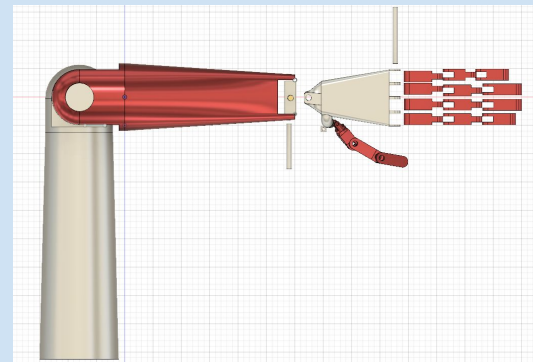**Figure 10: Initial CAD Model (Top)**

TECHNICAL DESIGN

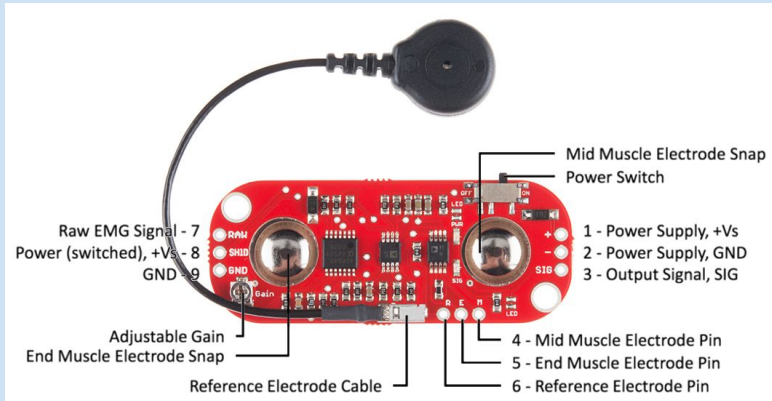» Myoware Muscle Sensor

» Electromyography (EMG)
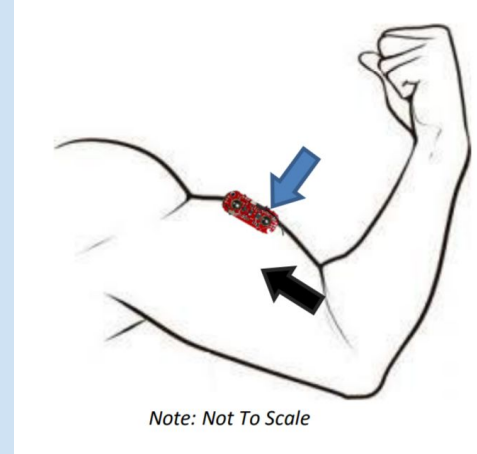
» Servo Motor

Figure 12: Example Sensor Location for Bicep (NYU Tandon)

Figure 11: Muscle Sensor Layout

TECHNICAL DESIGN

» Myoware Muscle Sensor

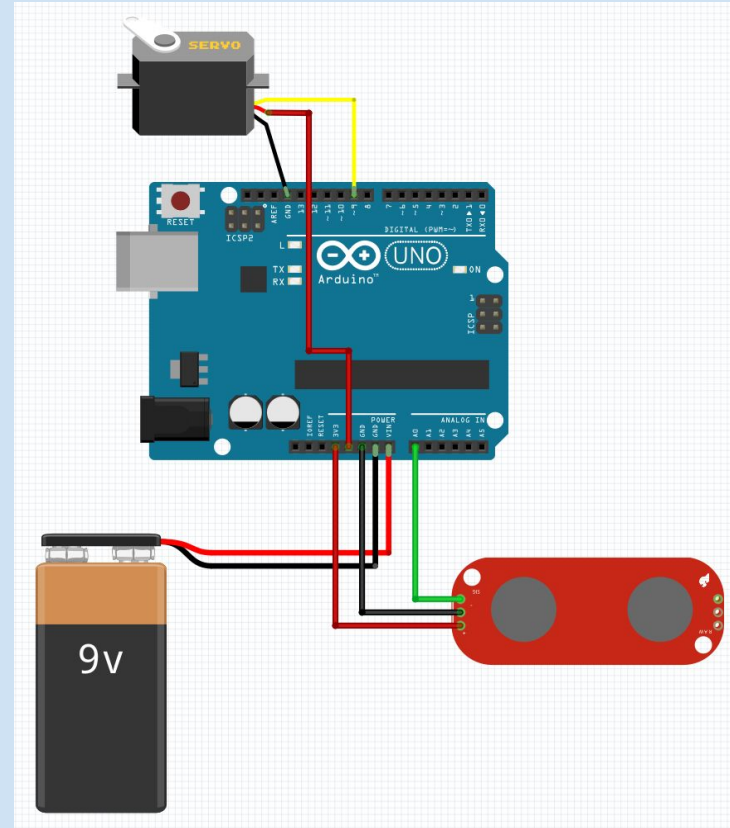» Electromyography (EMG)

» Servo Motor

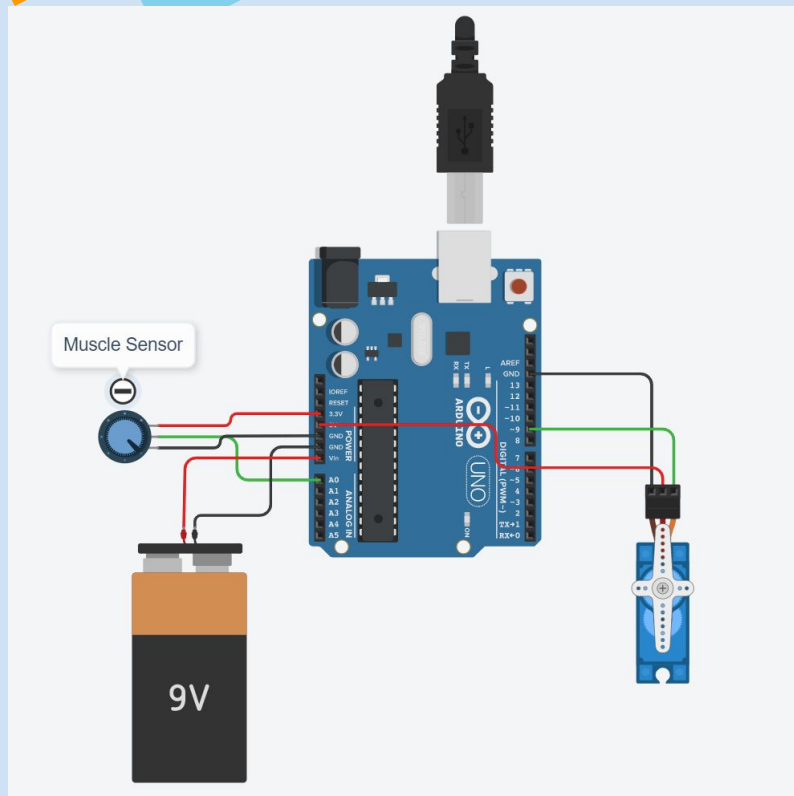**Figure 13: Circuit Diagram (Fritzing)**

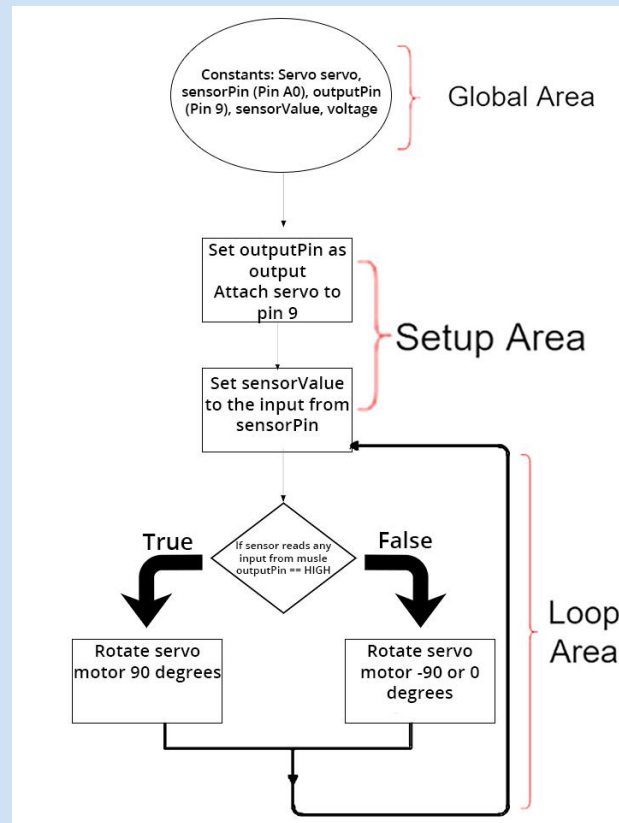# TECHNICAL DESIGN

Figure 14: Circuit Diagram (Tinkercad)

Figure 15: Arduino Code Flowchart

COST ESTIMATE

Table 1: Initial 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
Breadboard	$10.99	1	$10.99
DC motor	$6.89	1	$6.89
Muscle Sensor	$37.99	2	$75.98
Servo (Waterproof, boat/car)	$35.99	1	$35.99
String	$7.99	10	$79.90
Touch Sensor	$11.99	1	$11.99
Projected Labor	$50.00	75	$3,750
Total			$4,145.30

COST ESTIMATE

» Dropped:

◇ Breadboard

◇ Touch sensor

» Cut price by $30

Table 2: Updated Cost Estimate

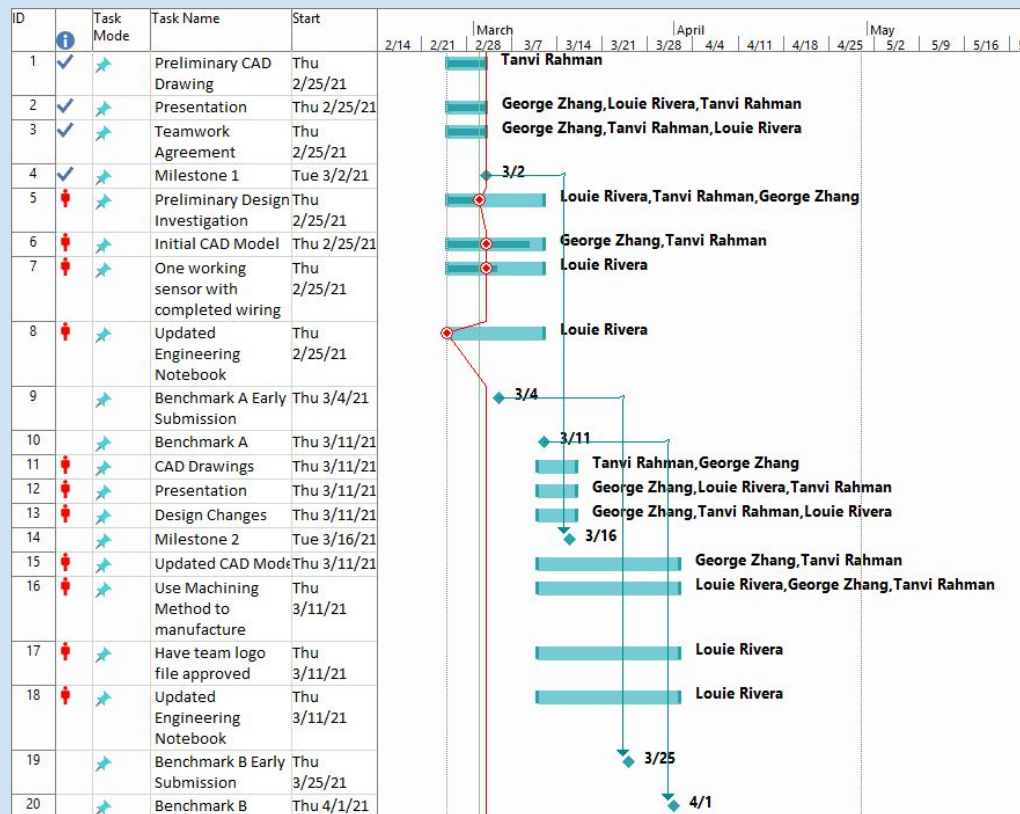| Resource	Cost Per Unit	Quantity	Cost
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Battery (9v)	$6.99	2	$13.98
Muscle Sensor	$37.99	2	$75.98
Servo Motor	$35.99	1	$35.99
String	$7.99	10	$79.90
Projected Labor	$50.00	75	$3,750
Total			$4,115.43

PROJECT SCHEDULE

Figure 16: Initial Project Schedule
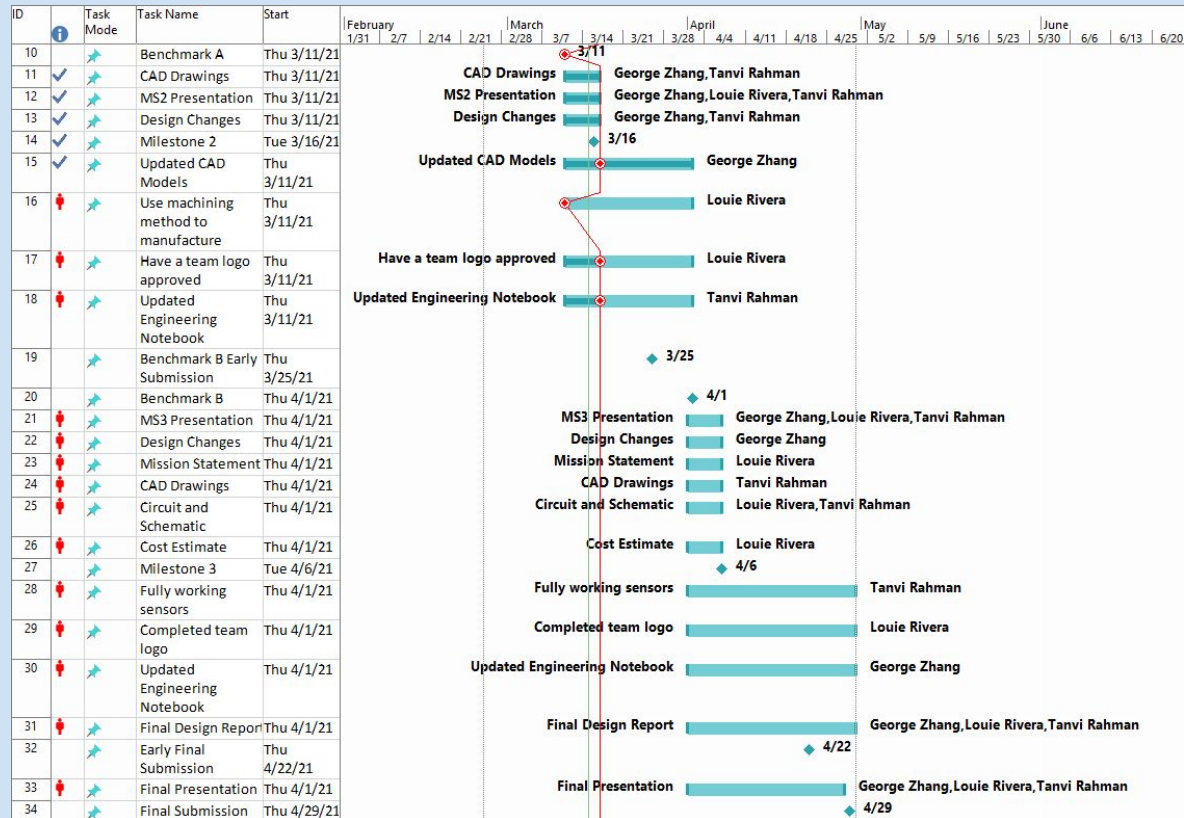
PROJECT SCHEDULE

Figure 17: Updated Project Schedule

SUMMARY

» Ahead of schedule

 ◊ 90% CAD model and 75% circuit completed

 ◊ On track for early benchmark submission.

» Next Milestone:

 ◊ Complete CAD design.

 ◊ Completed sensor and motor integration

 ◊ Complete circuit

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