



FAMU-FSU
Engineering

SoutheastCon 2020 Hardware Competition

Virtual Design Review 4



Team Introductions



Isabel Barnola
*Lead Software
Engineer*



David Bowen
*Lead Robotics
Engineer*



Diego Campos
*Lead Signal
Process Engineer*



Alex Ndekeng
*Lead Power
Systems
Engineer*



Abiel Souverain
*Lead Design
Engineer*

Sponsor and Advisor



FAMU-FSU
College of Engineering



Engineering Mentor
Jerris Hooker, Ph.D.



Academic Advisor
Bruce A. Harvey, Ph.D.



Objective

The objective of the project is to build an autonomous robot with the capabilities of completing at least one of the two challenges set for the 2020 SoutheastCon hardware competition.

Alex Ndekeng

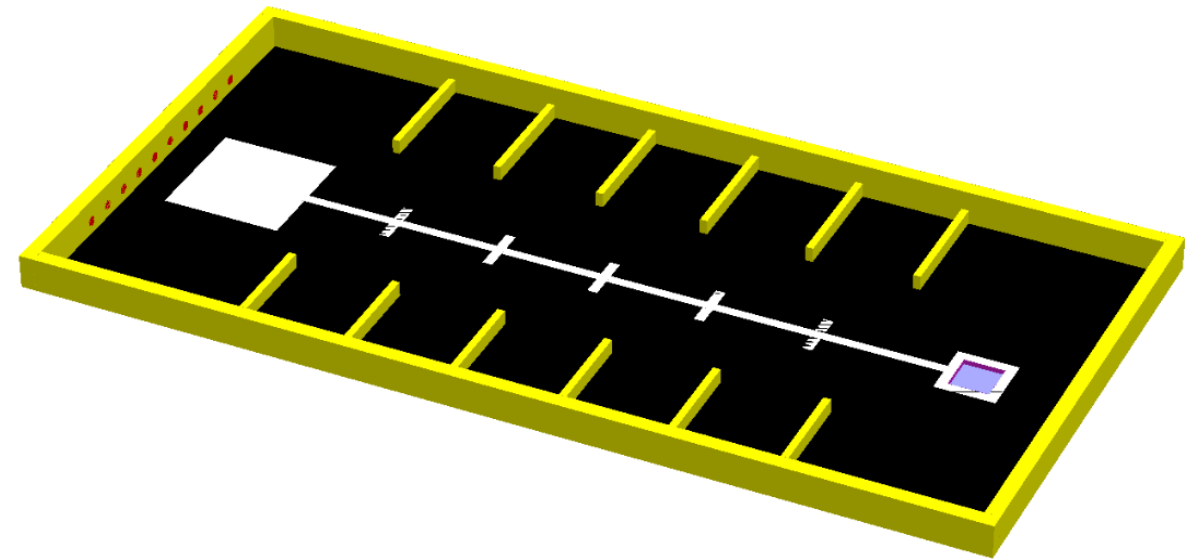


Project Background

Alex Ndekeng

2020 Southeast Con hardware competition

- 1st challenge: accurately stack Lego Duplo blocks representing the digits of pi.
- 2nd Challenge: push buttons in an order that represents the digits of pi



Description	Number of points
Total stack sequenced correctly	$20 * N * N$
Additional stack not sequenced correctly	$N * N$
Total button presses sequenced correctly	$10 * N$
Additional button presses not sequenced correctly	N (max of 100 counted)

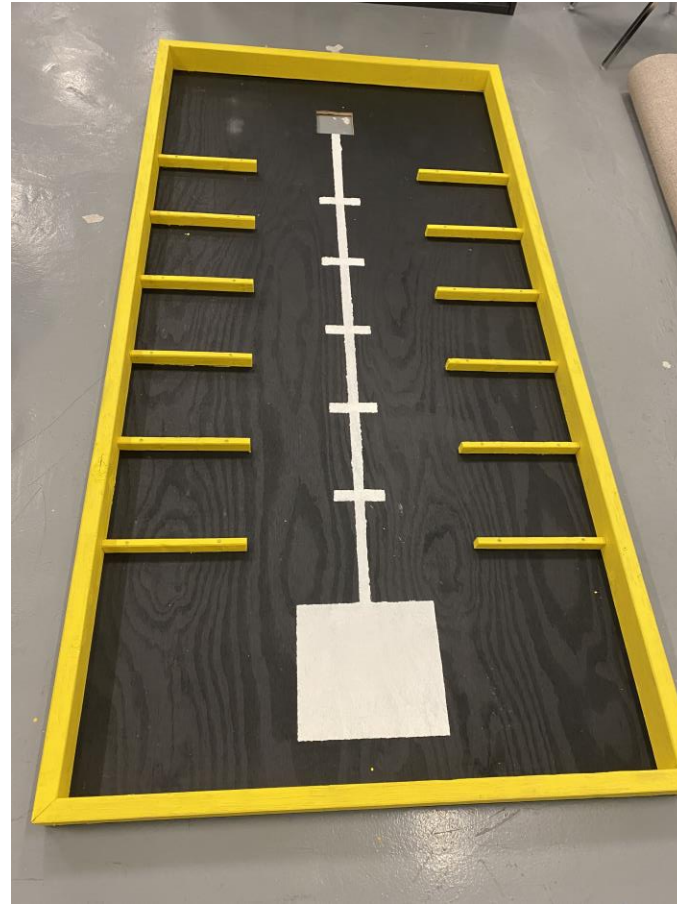
Alex Ndekeng

Customer Needs

- We're having our customers be the same as our primary and secondary markets as well as our stakeholders
- 12"x12"x12" autonomous Robot
- Ability to pick up to pick up Lego blocks and stack them
- Ability to stack Legos or push buttons in the order of the numbers of pi
- Navigate through the arena

Alex Ndekeng

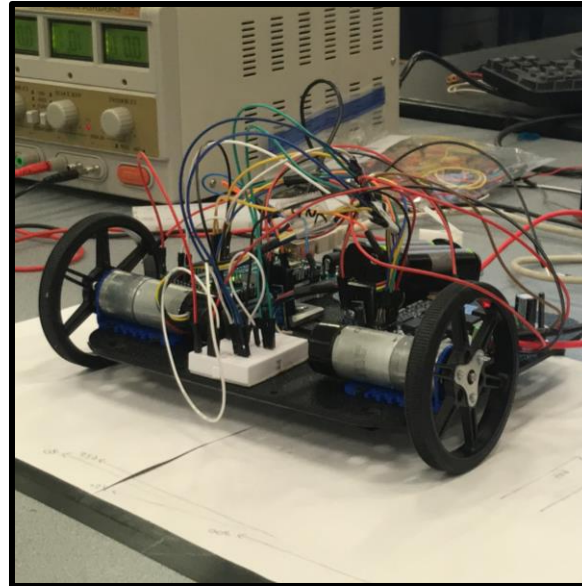
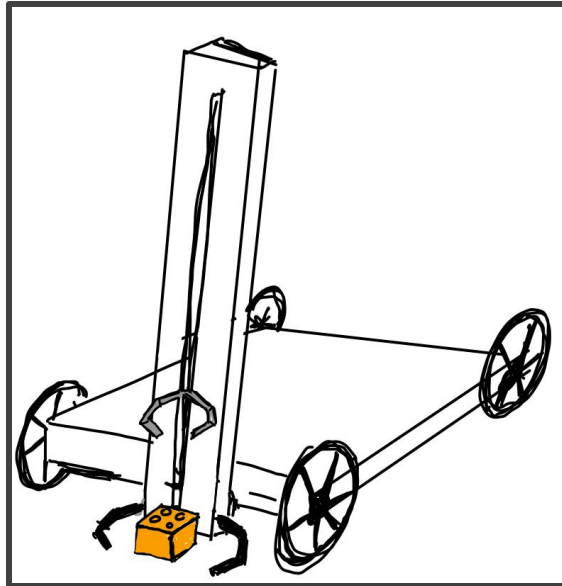
Built Practice Playground



Components

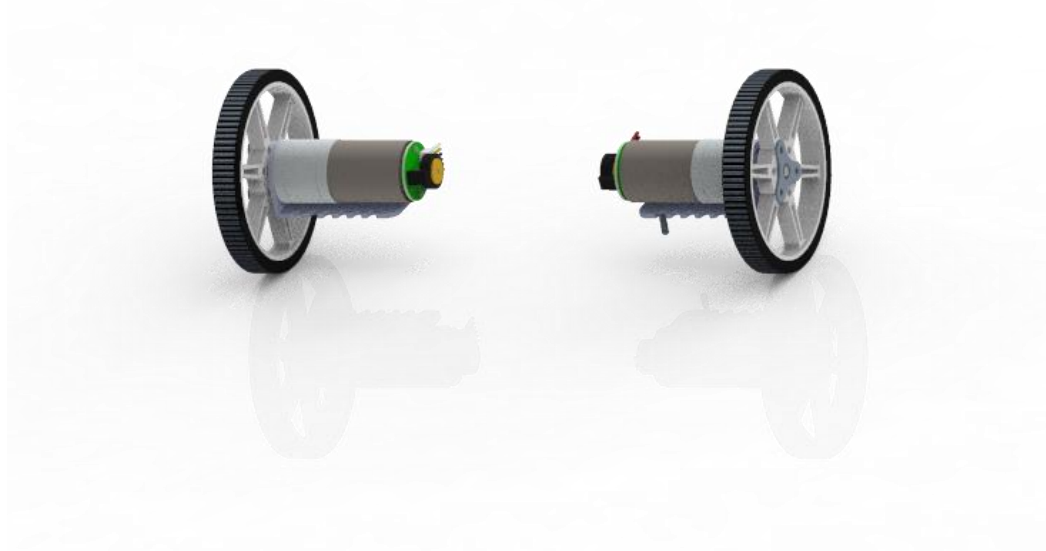
Abiel Souverain

Ezio



Abiel Souverain

Components



- Driving Motors – 99:1 gearbox
- Wheels – 80x10mm
- 6V
- 6.5A Stall Current
- 1A Running Current

Abiel Souverain

Parallel Gripper

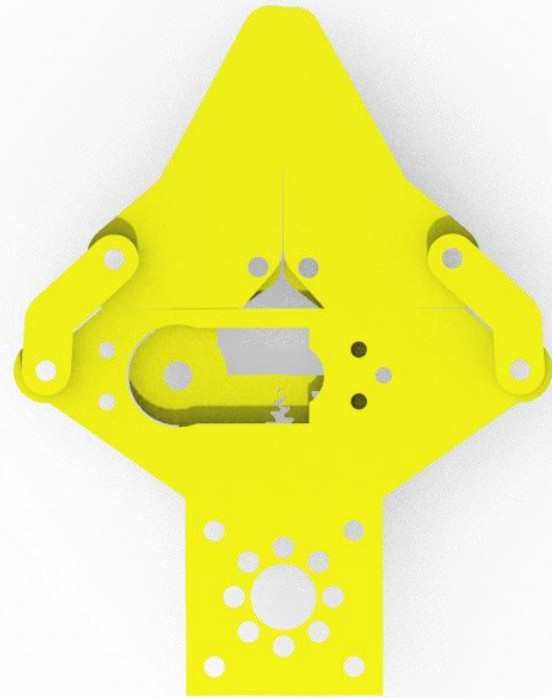


- Model is based on this gripper from Servo City

Abiel Souverain

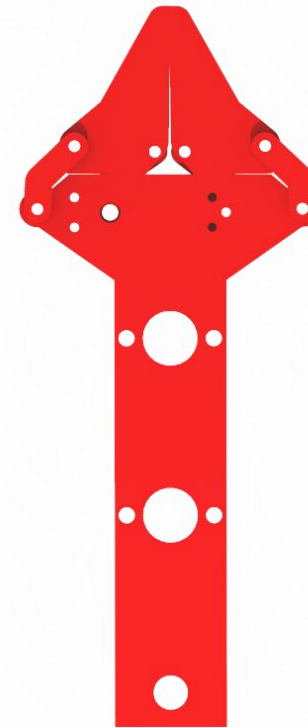
Components

5.23 in



Lower Claw

5.30 in



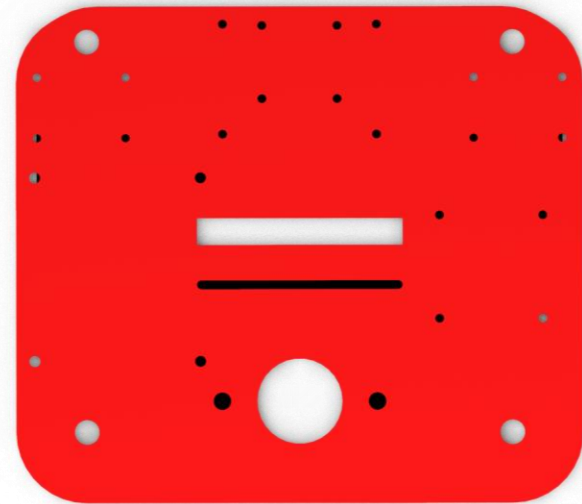
Upper Claw

Abiel Souverain

Components – Laser cut bases

Lower
Base

7.00 in



8.00 in

7.00 in

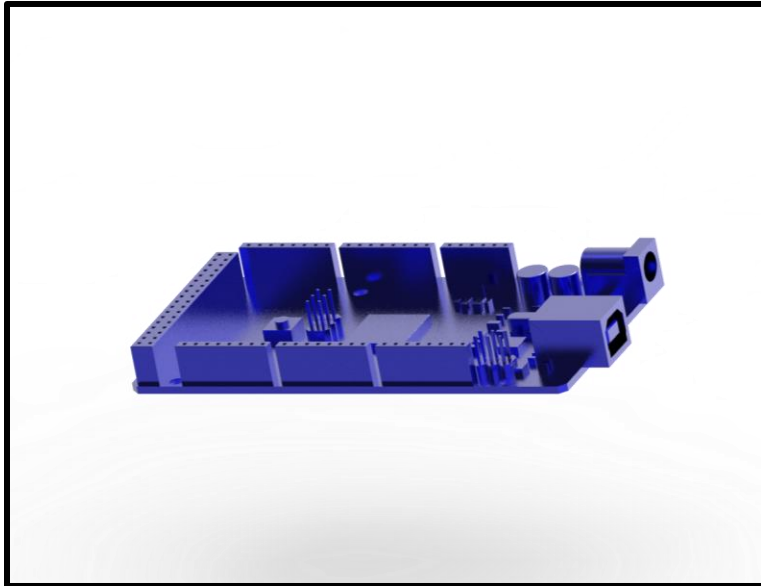


Upper
Base

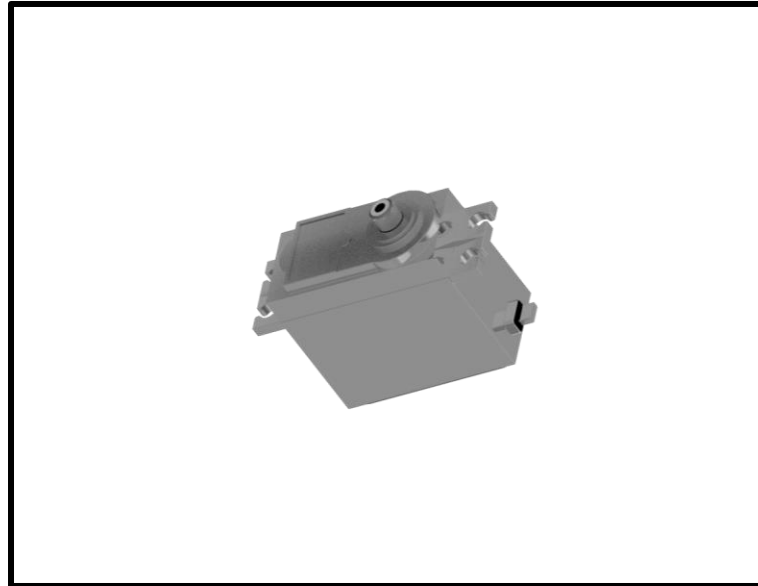
8.00 in

Abiel Souverain

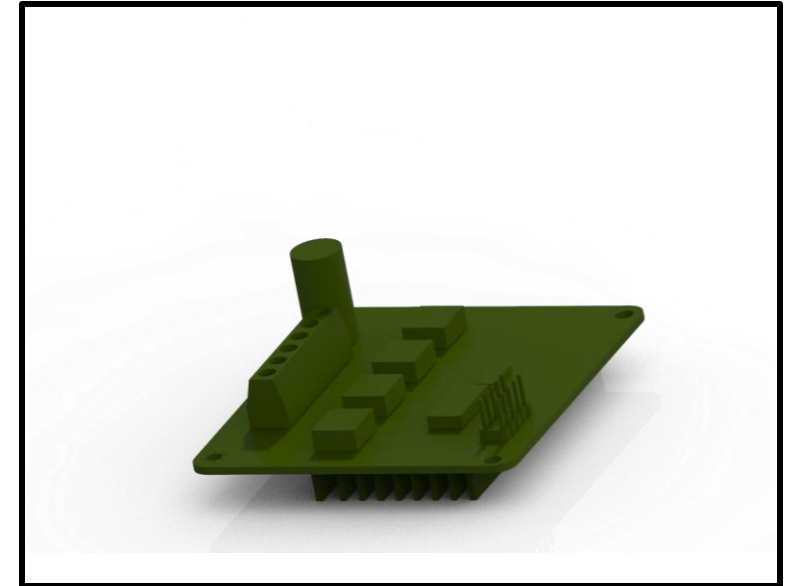
Components



Arduino Mega



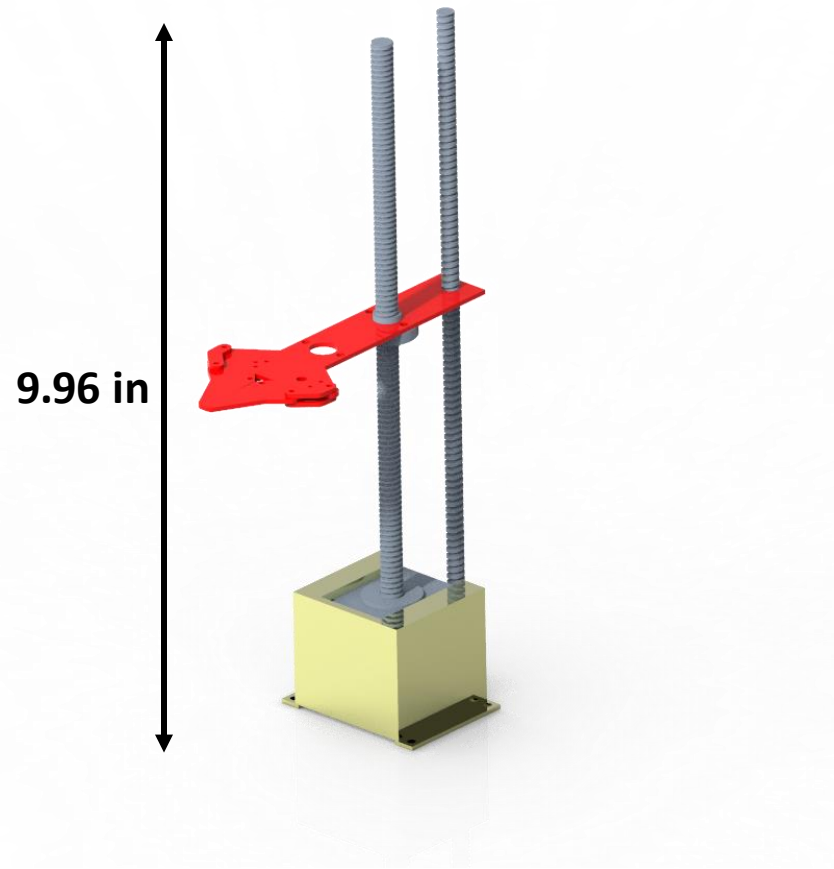
Servo Motor



DC Motor Driver

Abiel Souverain

Components – Elevator Assembly



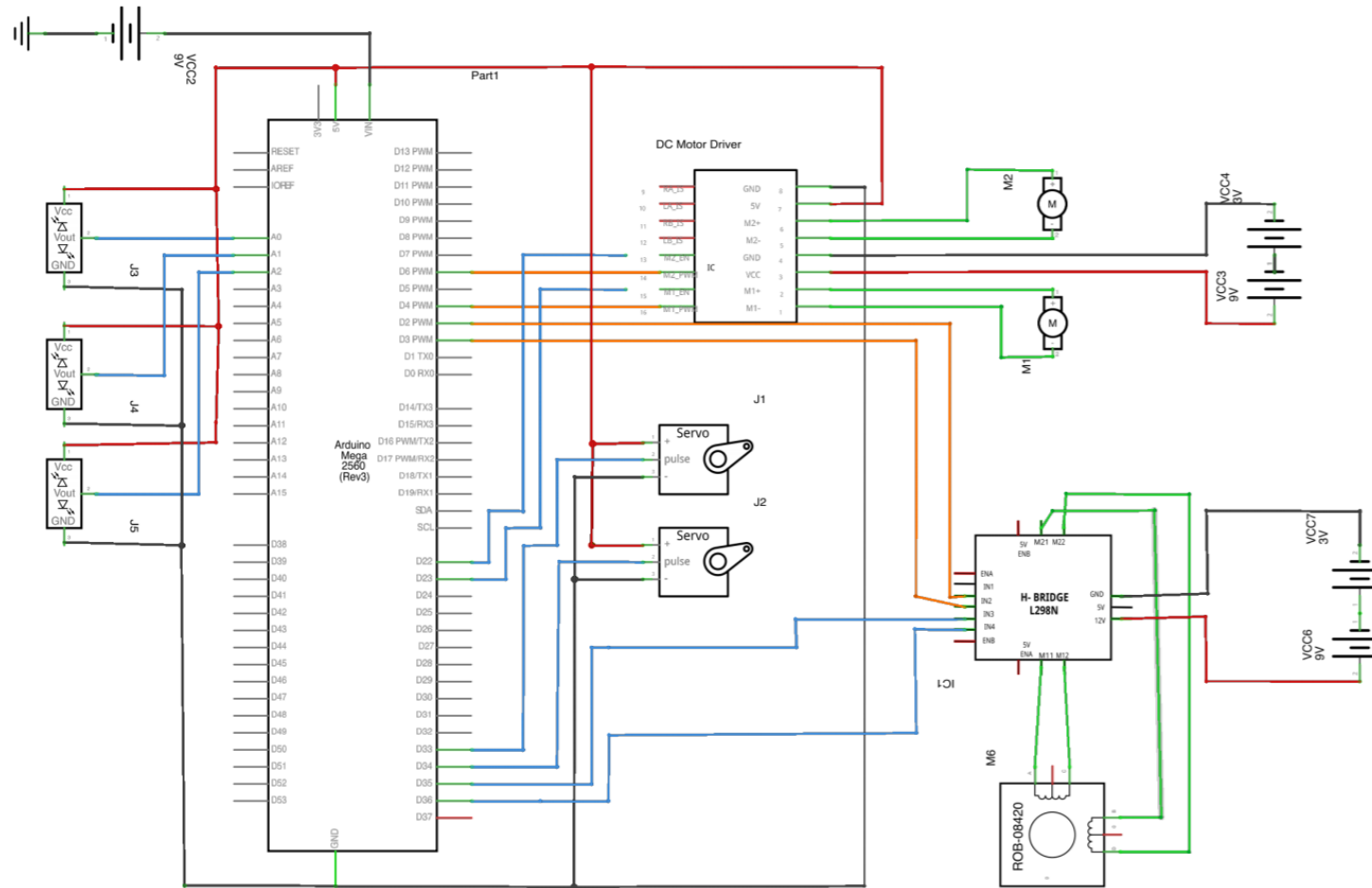
- Stepper motor with lead screw
- Geared Claw – servo controlled
- Guide Rod

Abiel Souverain

Wiring Diagram

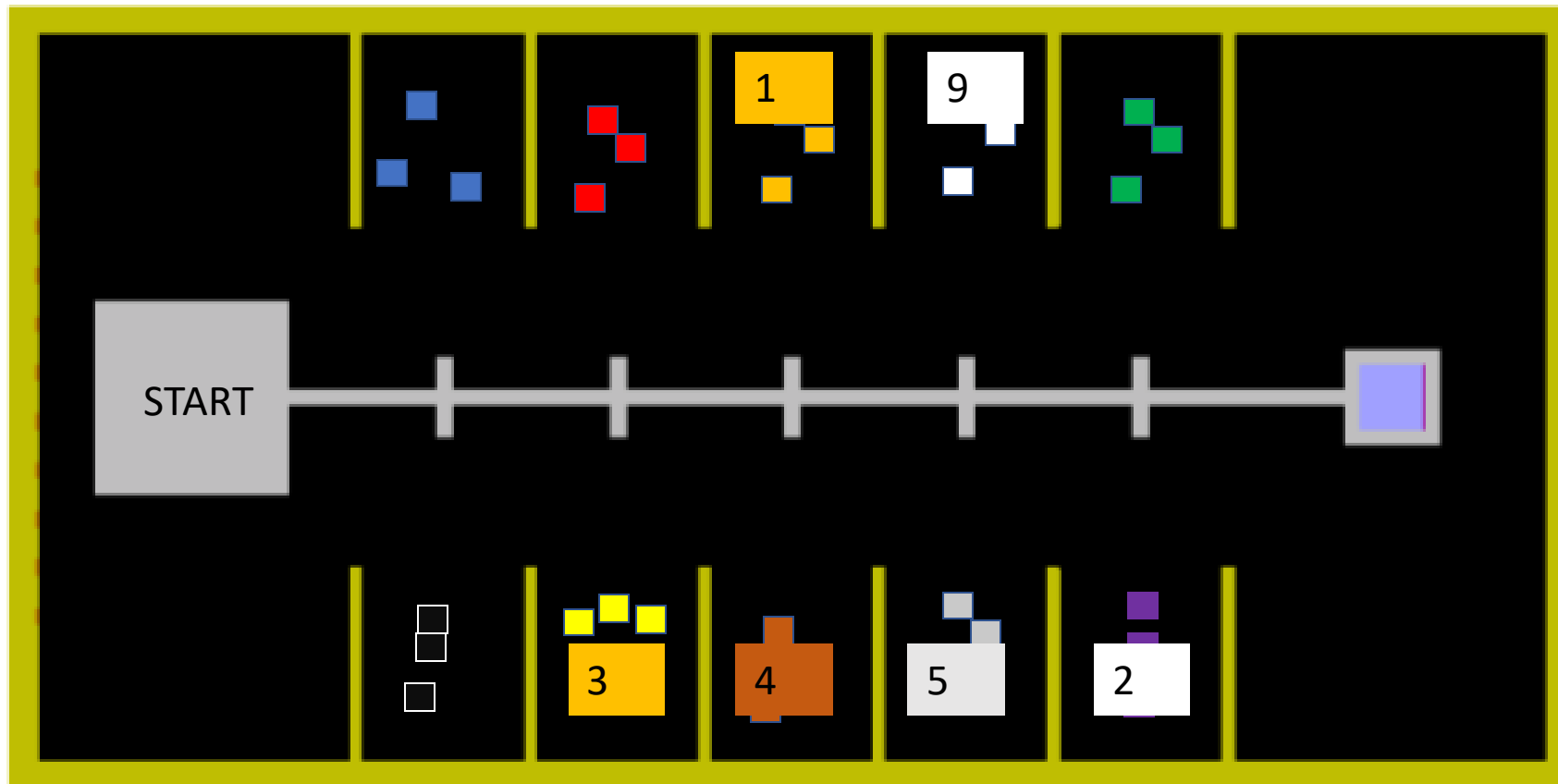
Diego Campos

Wiring Diagram



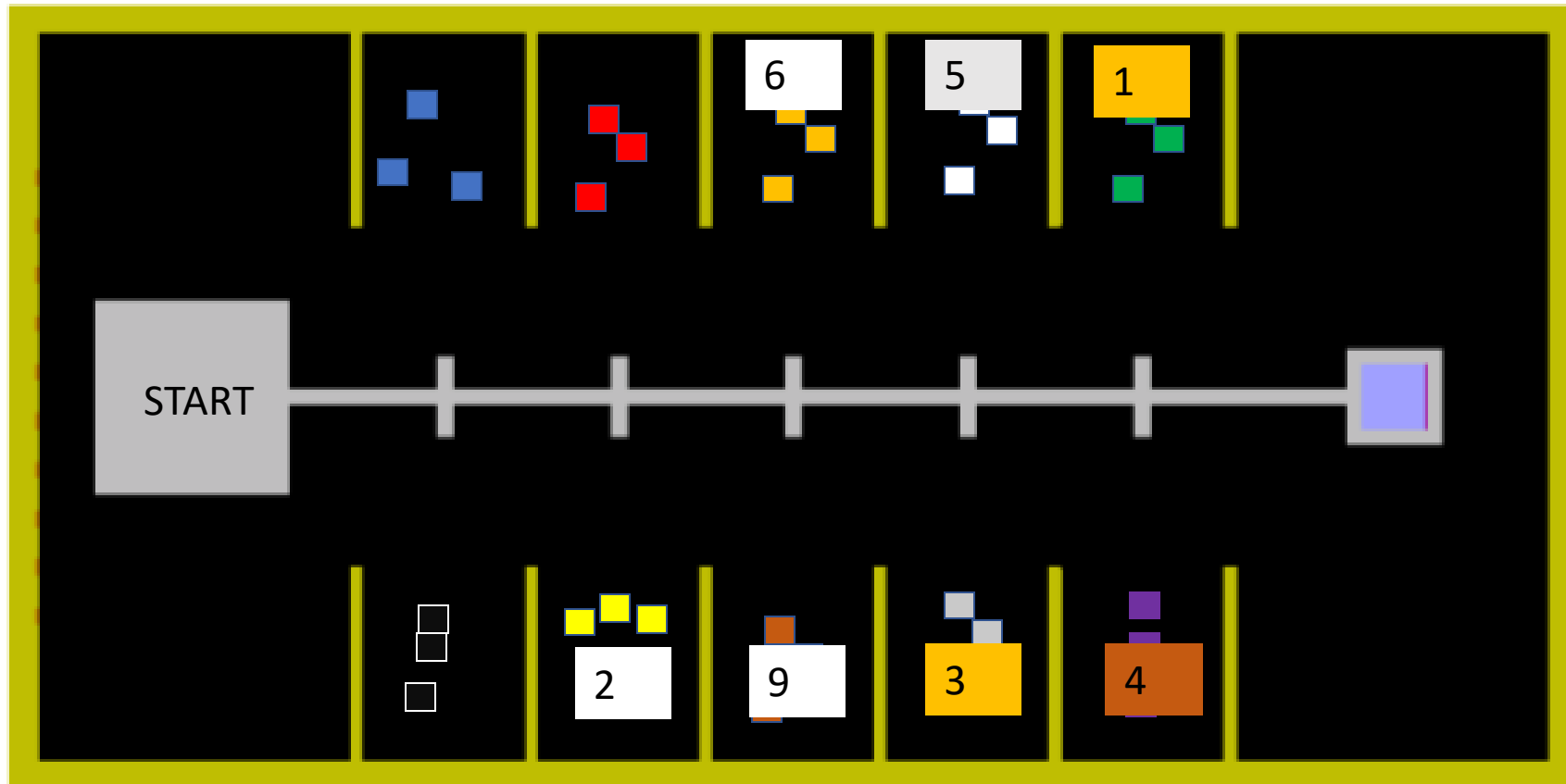
Diego Campos

Block Layout for 7 numbers



Diego Campos

Block Layout for 10 numbers



Diego Campos

Code

Isabel Barnola

Pseudocode – 7 blocks

```

1  stacking_challenge()
2  {
3      // Block 3
4      line_following(n = 2) // navigate over n white lines
5      turn(right)          // rotate - 90 degrees
6      stacking()           // Stack lego - Value = 3
7      position = 2
8      // Block 1
9      turn(left)
10     line_following(1)
11     turn(left)
12     stacking()
13     position = 3
14     last_stack(position,left) // check if time == deadline - go to end
15     // Block 4
16     turn(right)
17     turn(right)
18     stacking()
19     position = 3
20     last_stack(position,right) // check if time == deadline - go to end
21     // Block 1
22     turn(left)
23     turn(left)
24     stacking()
25     position = 3
26     last_stack(position,left) // check if time == deadline - go to end
27
28     // Block 5
29     turn(right)
30     line_following(n = 1)
31     turn(right)
32     stacking()
33     position = 4
34     last_stack(position,right) // check if time == deadline - go to end
35     // Block 9
36     turn(left)
37     turn(left)
38     stacking()
39     position = 4
40     last_stack(position,left) // check if time == deadline - go to end
41     // Block 2
42     turn(right)
43     line_following(n = 1)
44     turn(right)
45     stacking()
46     //END
47     turn(left)
48     line_following(n =1 )
49     stacking()
50     drive_backwards()
51 }

```

Isabel Barnola

Pseudocode – Main functions

```
line_following(int num_lines)
{
    // follow line
    // count vertical lines
    // stop when count = num_lines
    // uses turn_l, turn_r,
    //     advance and stop
}

turn (int direction) // right or left
{
    // turn 90 degrees to direction
    last_stack(int position,int dir )
    {
        // not enough time – stack at the goal
        turn(dir)
        line_following(5-position)
    }
}
```

```
stacking()
{
    // approach block until its detected
    go_to_block();
    pick_block()
    {
        // activate claw1
        // lead screw – down
        // deactivate claw2
        // lead screw – up
        // activate claw2
        // deactivate claw1
        // lead screw – up
    }
    // drive back to vertical line
    drive_backwards( num_turns)
}
```

Isabel Barnola

Main functions What is done?

What is done?

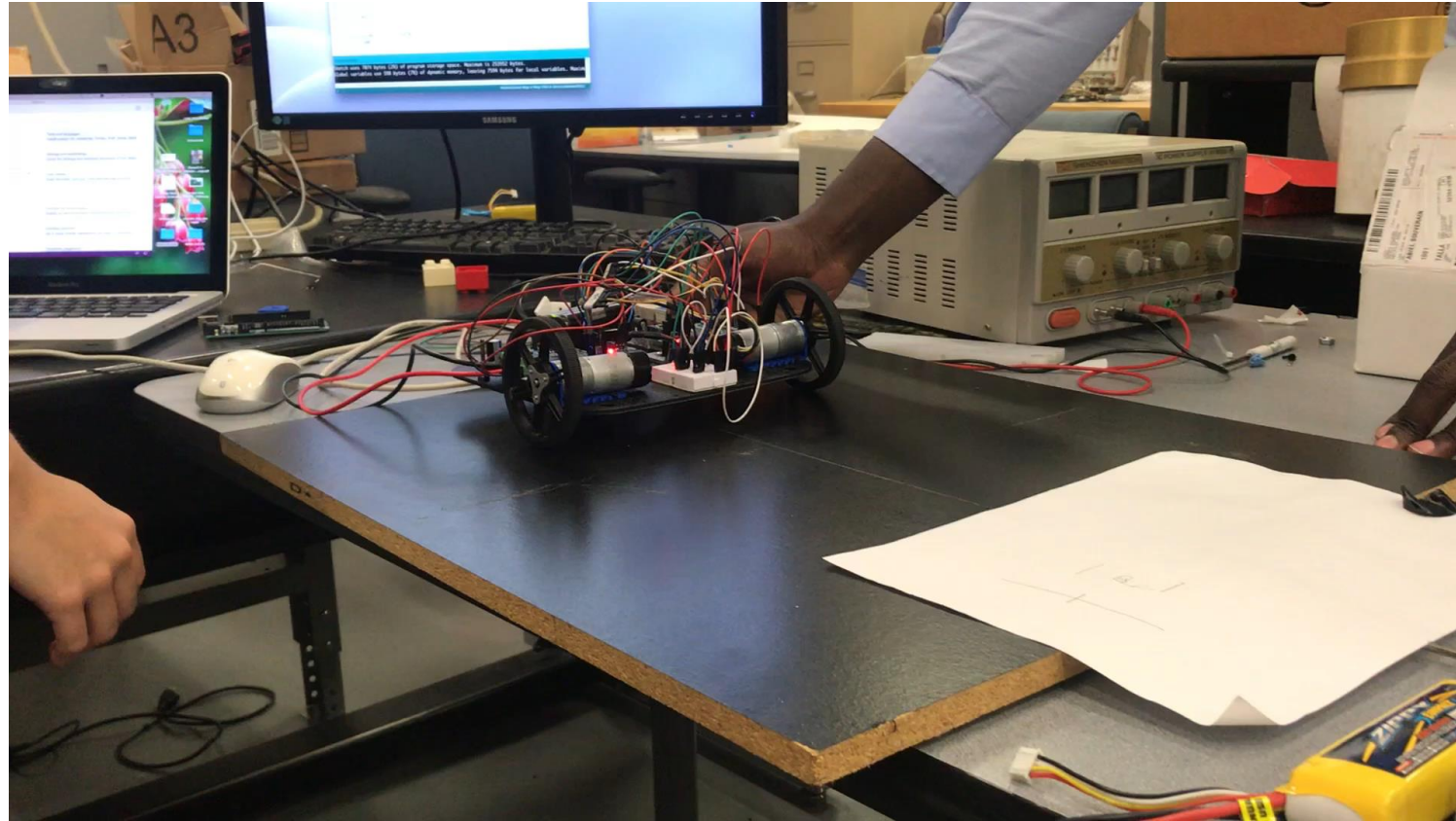
- Line_following ✓
 - Robot stops after line
 - Velocity has to be slowed down
 - IR sensors must be attached to interrupt
- Turn ✓
 - Robot turns very close to 90 degrees
- Last_stack() ✓
 - Combination of turn and line_following

To do

- Stacking()
 - go_to_block()
 - Pick(block)
- drive_backwards

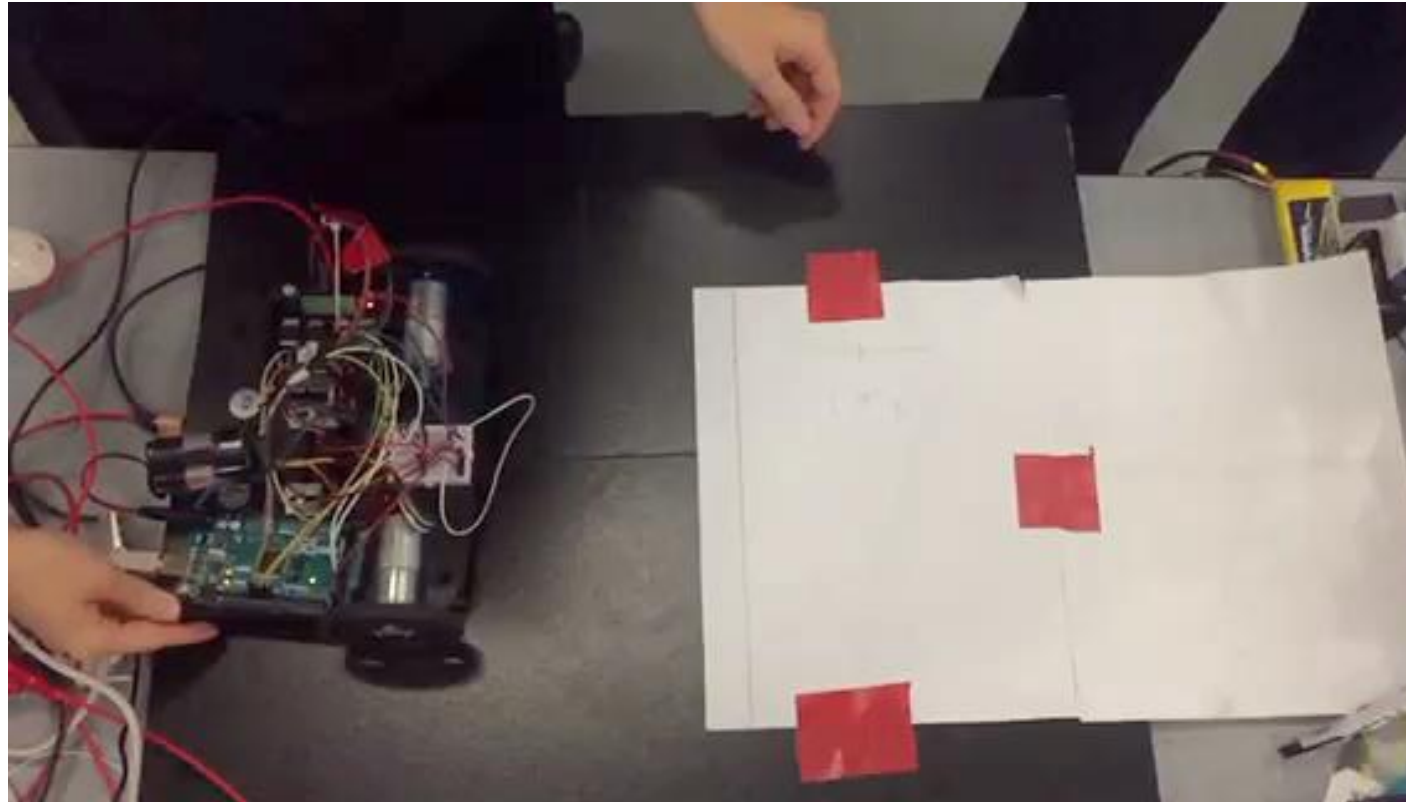
Isabel Barnola

Line following - Testing



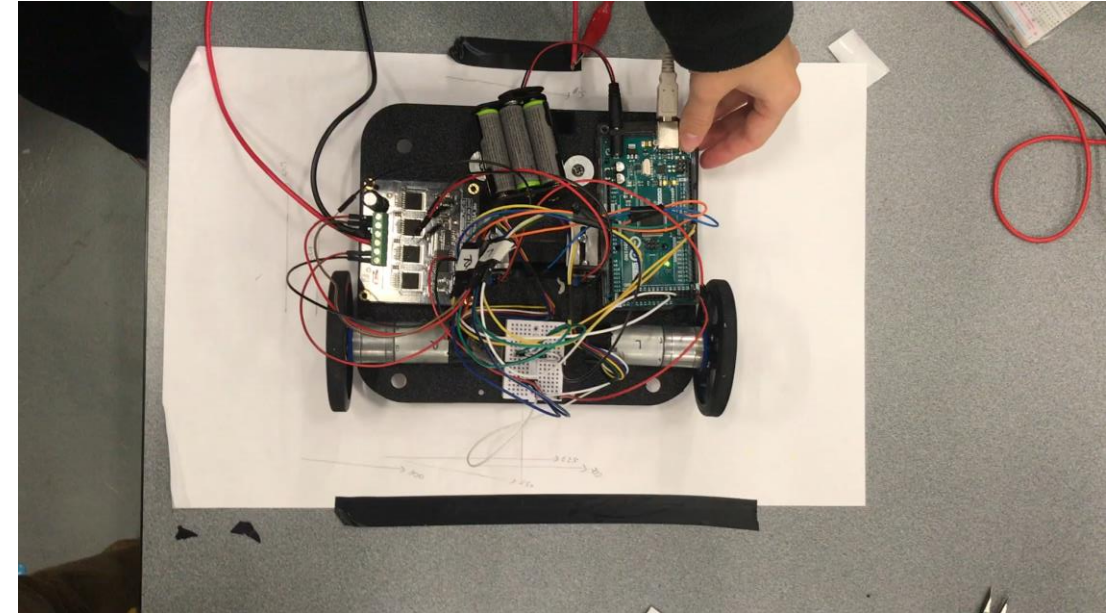
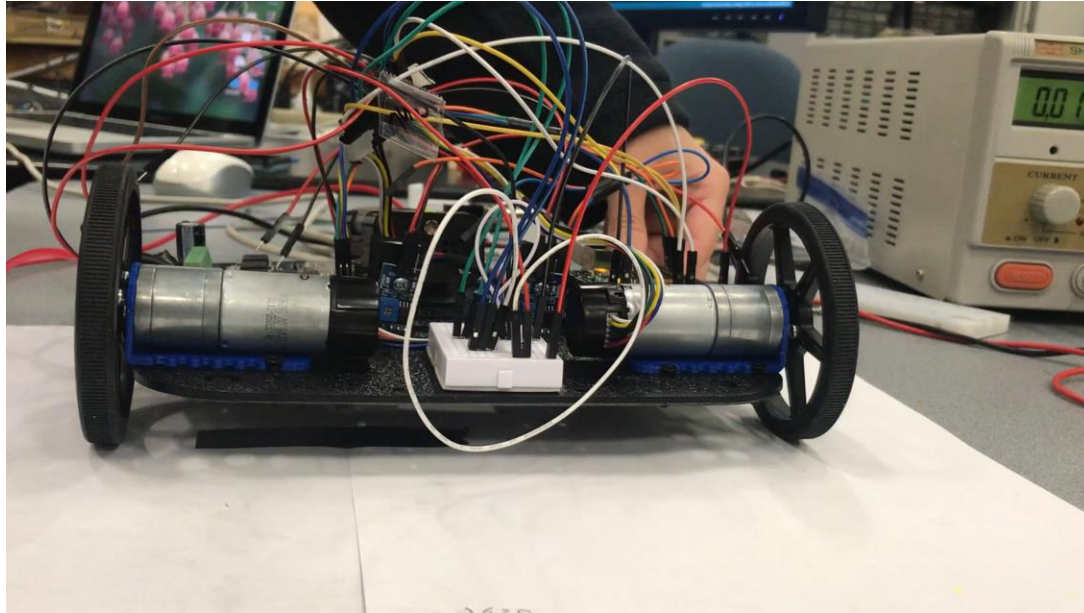
Isabel Barnola

Line Following - Testing



Isabel Barnola

Programming

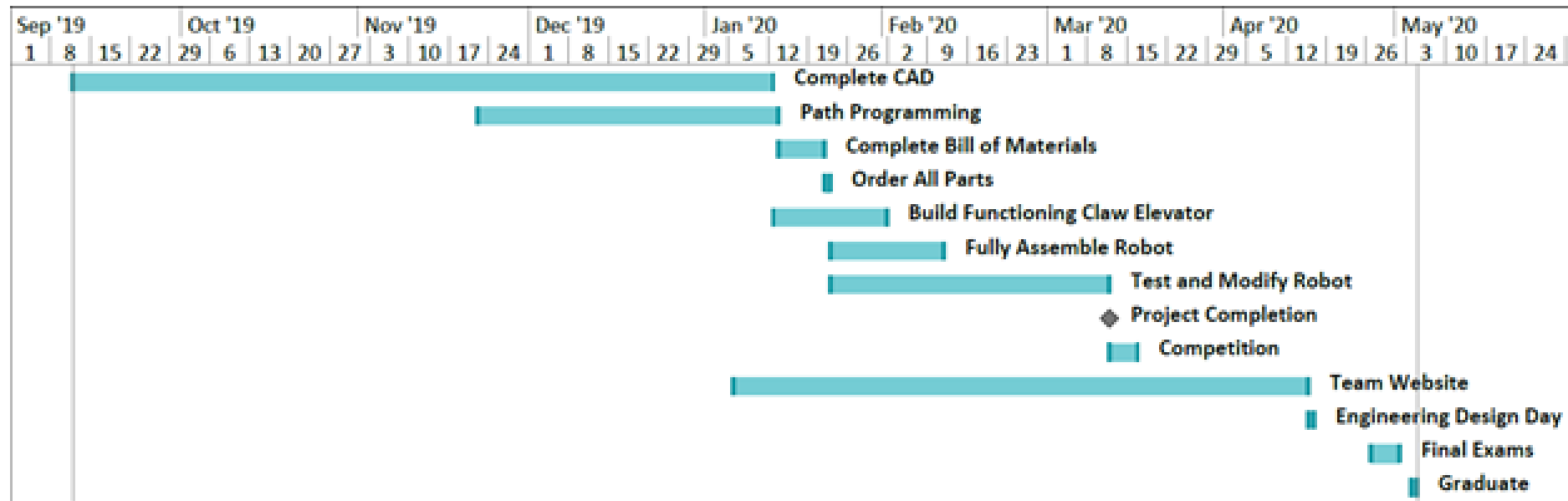


Isabel Barnola

Timeline

David Bowen

Timeline



David Bowen

Revised Timeline

1. Programming – March 1, 2020
2. Functioning claw elevator – 1 week after parts arrive
3. Completed CAD – February 23, 2020
4. Fully assembled robot – Dependent on 2.
5. Competition – March 12-15, 2020

David Bowen

Obstacles

- Power/Batteries
- Path Programming
- Parts being shipped
- Encoders
- Motor speed

David Bowen



Parts Ordered

- Stepper motor with lead screw
- ABS sheets
- DC motor driver
- 12V High current battery pack
- 9V Batteries
- Hardware

David Bowen

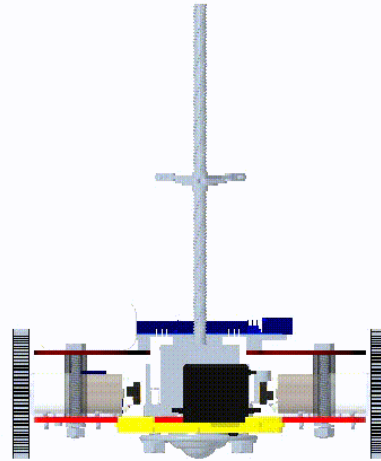
4 Most Important Points

1. Discussed physical components
2. Discussed wiring and programming
3. Obstacles/revised timeline
4. Waiting on parts to arrive

David Bowen

Thank you for your time.

Team Email: southeastcon@admin.my.fsu.edu



Review

Current Progress

Revised Timeline

Future Work

David Bowen