IEEE Southeast Con Hardware Challenge 2017

Group #1

EEL 4911C

Advisor: Dr. Harvey

Instructor: Dr. Hooker

Reviewers: Dr. Roberts & Dr. Yu

SOUTHEASTCON TEAM

Michael Pelletier
Computer Engineer
Project Manager

Colin Fortner
Electrical Engineer
Financial Advisor

F2-P2

Hunter Fitch
Electrical Engineer
Lead Mechanical Designer

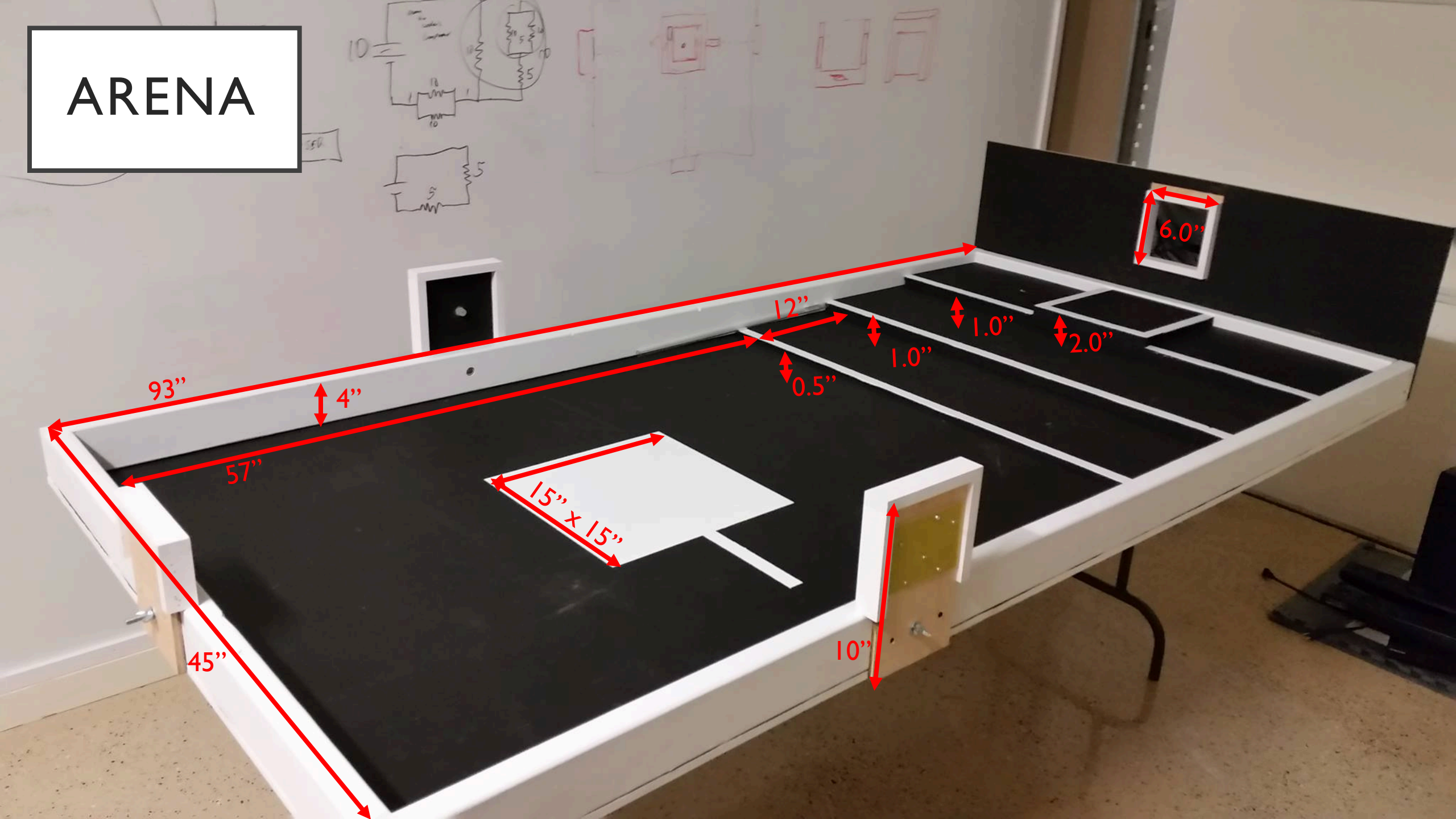
Nicole Perry
Electrical Engineer
Lead Electrical Designer

OBJECTIVE

- IEEE SoutheastCon Hardware Challenge

- Star Wars Themed
- "Uncovering the Unknown"
- "Lightsaber Duel"
- "Bring Down the Shields"
- "Launch a Proton Torpedo"

ARENA



ROBOT DESIGN

- Within 12 x 12 x12 constraints
- L: 11.5”
- W: 11.8”
- H: 10”

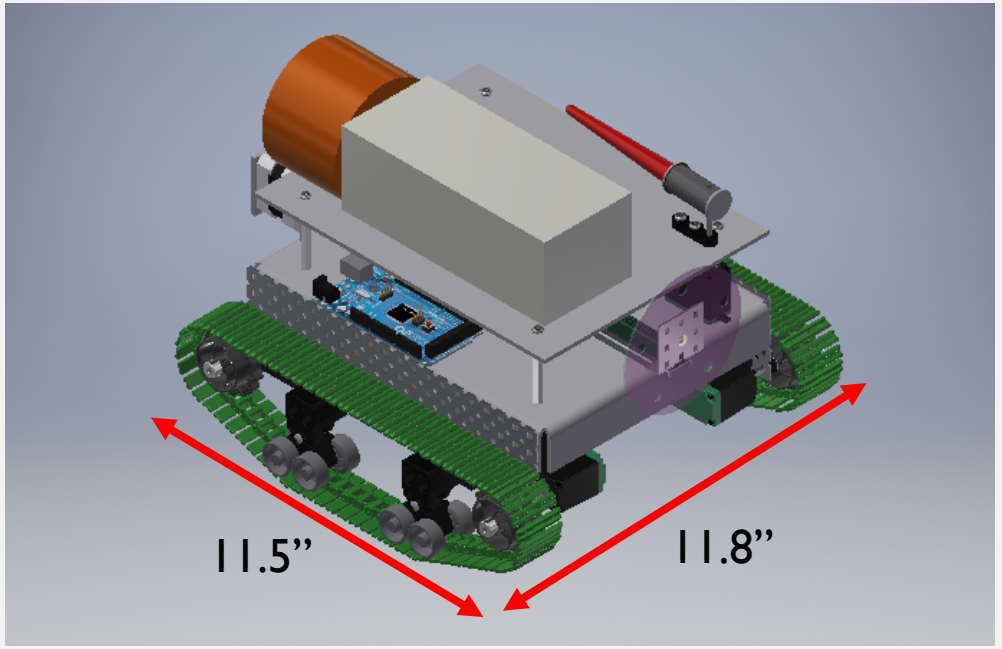


Figure 1: Robot Design (Top Down)

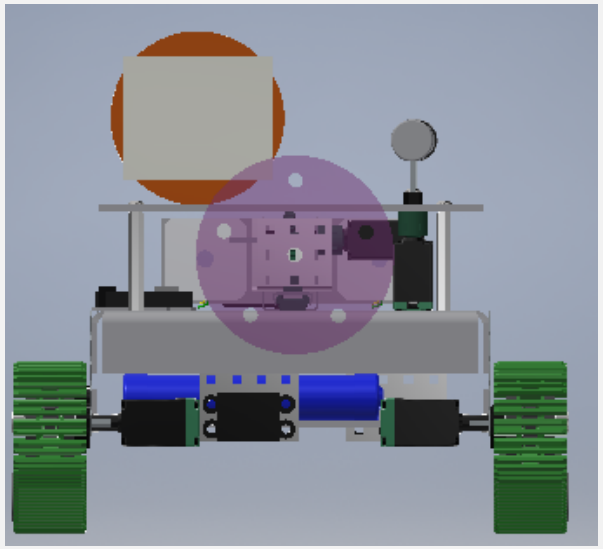


Figure 2: Robot Design (Rear)

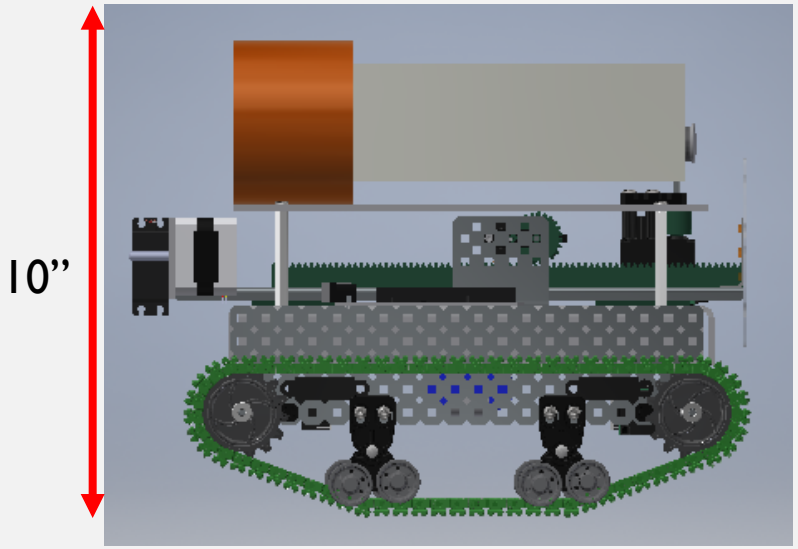


Figure 3: Robot Design (Left Side)

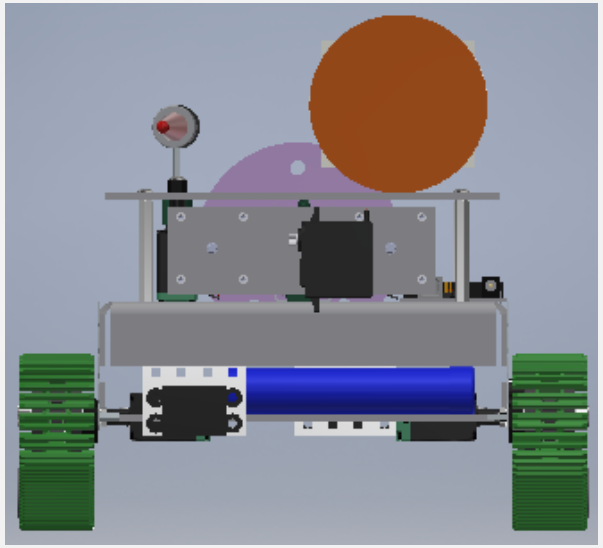
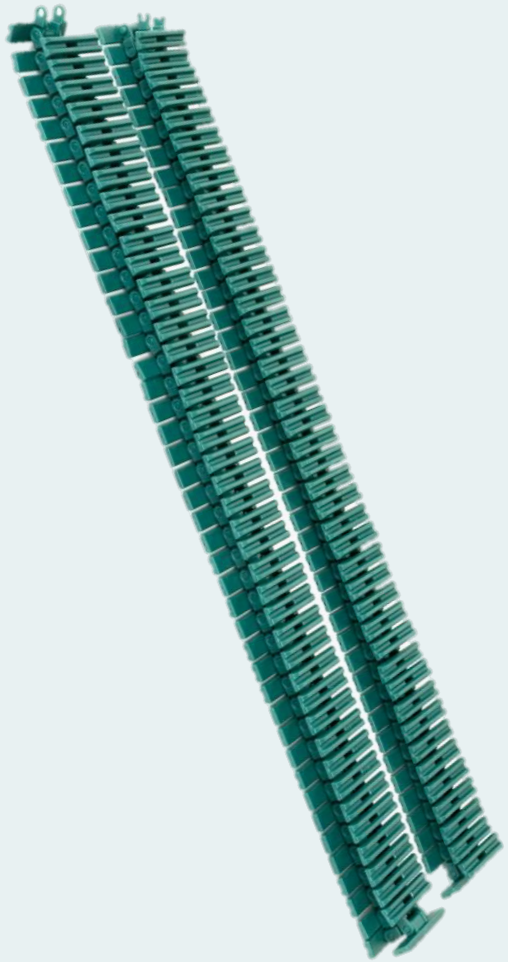


Figure 4: Robot Design (Front)

POWER

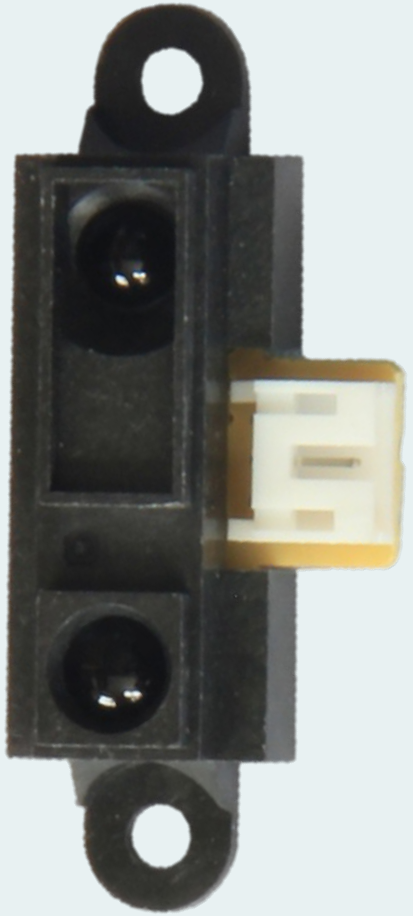
7.2V Robot Battery NiMH 3000mAh

PLATFORM



Tank Tread

NAVIGATION



IR Sensors

STAGE 1 – DESCRIPTION

- Rotational dimensions for brass pads are:
  - 1 - 0°
  - 2 - 72°
  - 3 - 144°
  - 4 - 216°
  - 5- 288°
- Center pad is common ground
- Capacitor is non polarized
- Diode can be forward or reversed

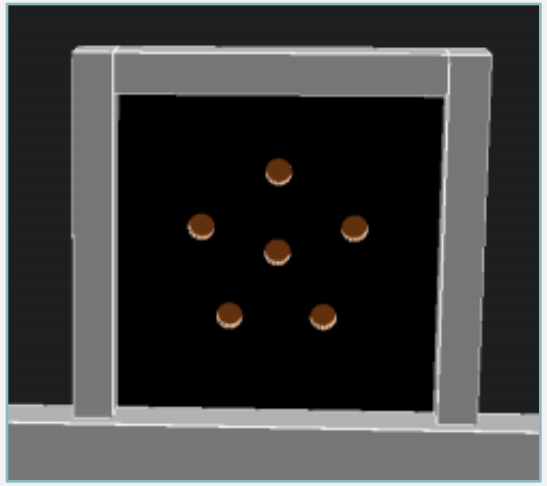


Figure 1: Stage 1 Arena Design

Table 1: Component to Code Values

Code	Component type	Component value
1	Wire	N/A
2	Resistor	10K, 10% tolerance
3	Capacitor	0.1uF, non polarized
4	Inductor	500mH
5	Diode	IN4001–cathode/anode can be oriented in either direction

STAGE 1 - HARDWARE

- 6 Prongs to attach to each hole

- Tapered ends to allow more error

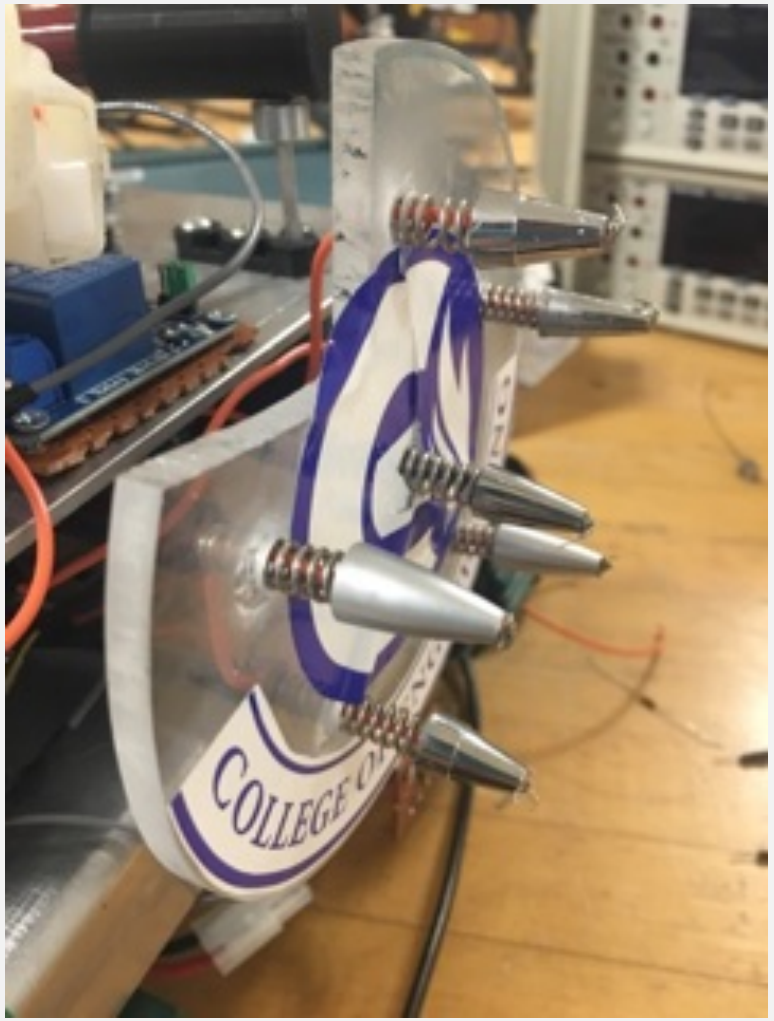


Figure 1: Stage 1 Design

STAGE 1 – IMPLEMENTATION

- 5 digital pins
- 1 analog pin
- Series resistor in middle pad

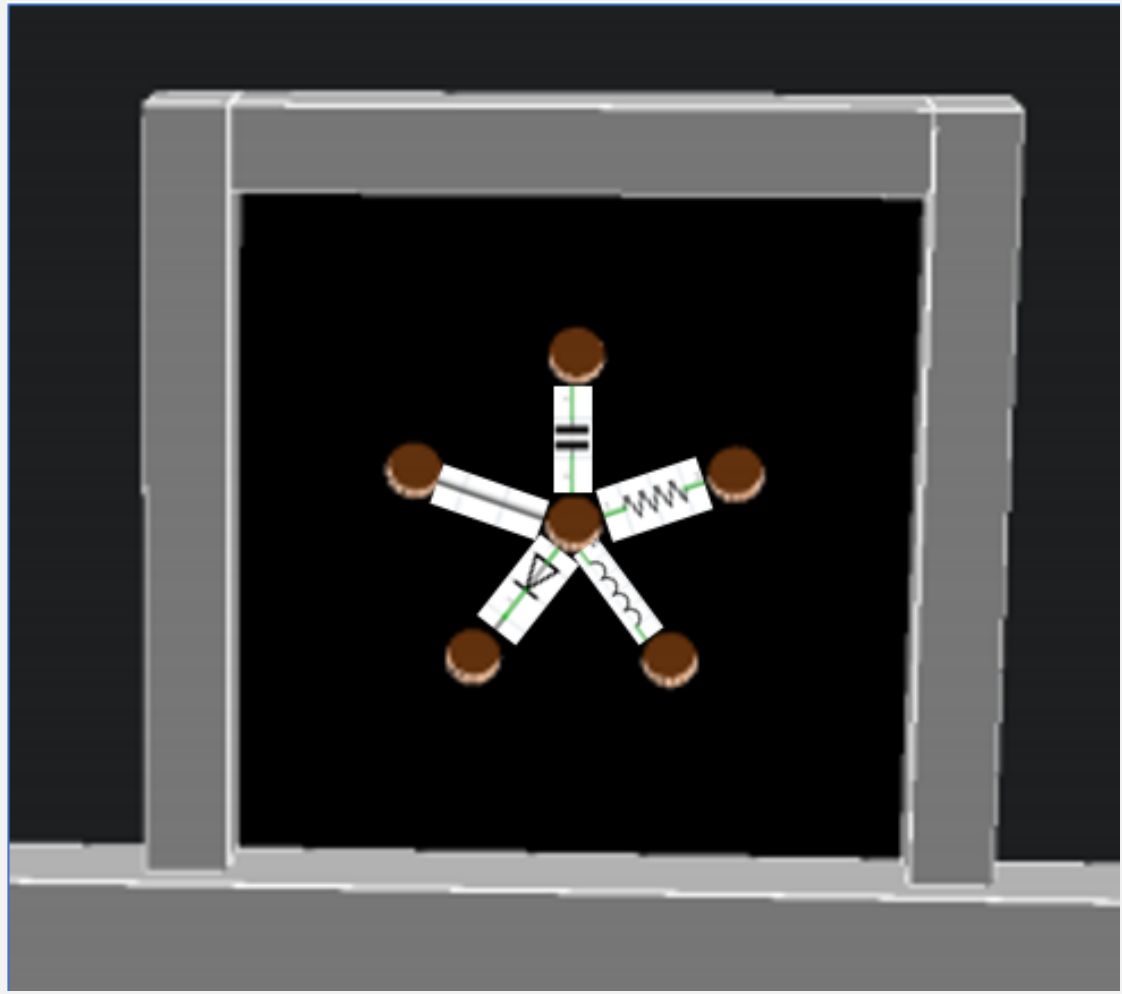
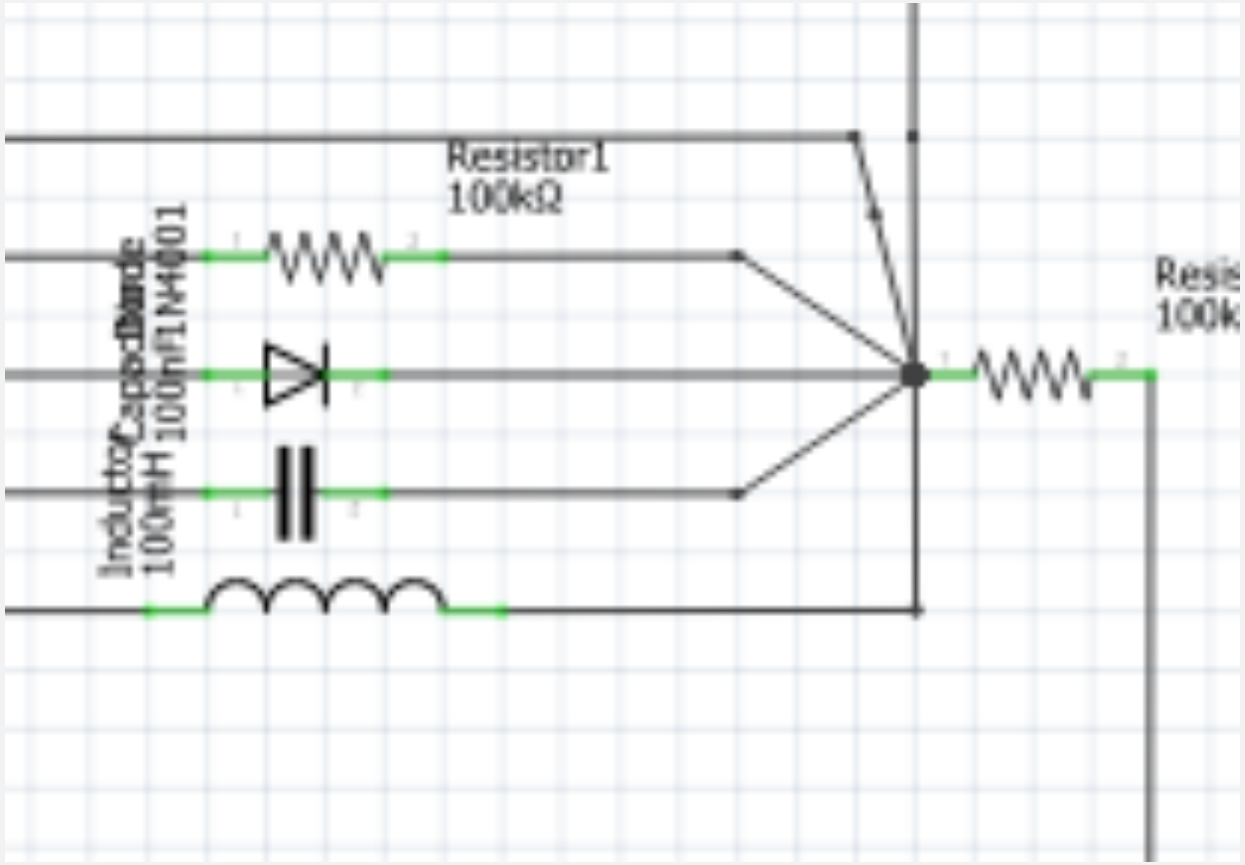


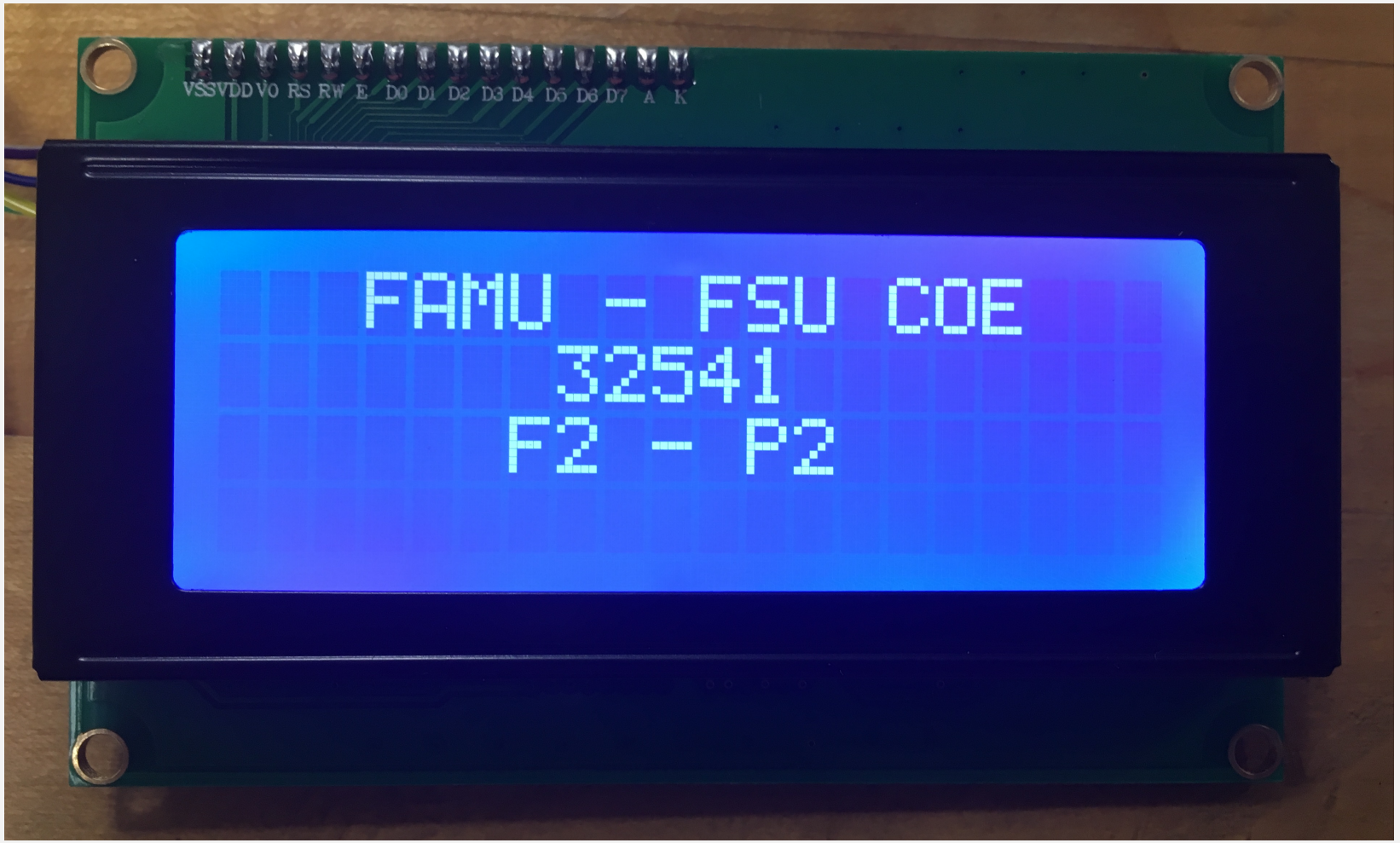
Figure 1: Stage 1 Arena Design

STAGE 1 – IMPLEMENTATION

- 5 digital pins
- 1 analog pin
- Series resistor in middle pad



CODE OUTPUT


VSSVDDV0 RS RW E D0 D1 D2 D3 D4 D5 D6 D7 A K
FAMU - FSU COE
32541
F2 - P2

STAGE 2 – "LIGHTSABER DUEL"

- Detect Electromagnetic Field induced
  - 1 amp supplied to a 40 turns of #20 copper wire wound around a 0.5" bobbin
  - Active for 2 seconds randomly during a 30 second round interval
    - Started by robot contact
    - 4 active periods during the round with the final activation at 28 seconds

Figure 1: Stage 2 Layout Front (Left); Stage 2 Back (Top)

STAGE 2 - "'THE FORCE IS STRONG WITH THIS ONCE' – OBI WAN"

- Allegro A1302KUA-T Hall Effect Sensor
- 1.3 G/mV
- Implemented with Arduino Code

Test Data: No Active Field

```
|----------------------0----------------------|-5Gauss
|----------------------0----------------------|-7Gauss
|----------------------0----------------------|-5Gauss
|----------------------0----------------------|-7Gauss
|----------------------0----------------------|-5Gauss
|----------------------0----------------------|-7Gauss
```

Test Data: Active Magnetic Field

```
|----------------------0----------------------|-7Gauss
|----------------------0----------------------|-7Gauss
|----------------------0----------------------|-7Gauss
|----------------------0----------------------|-8Gauss
|----------------------0----------------------|-8Gauss
|----------------------0----------------------|-8Gauss
```

ΔB ~ 1-2 Guass

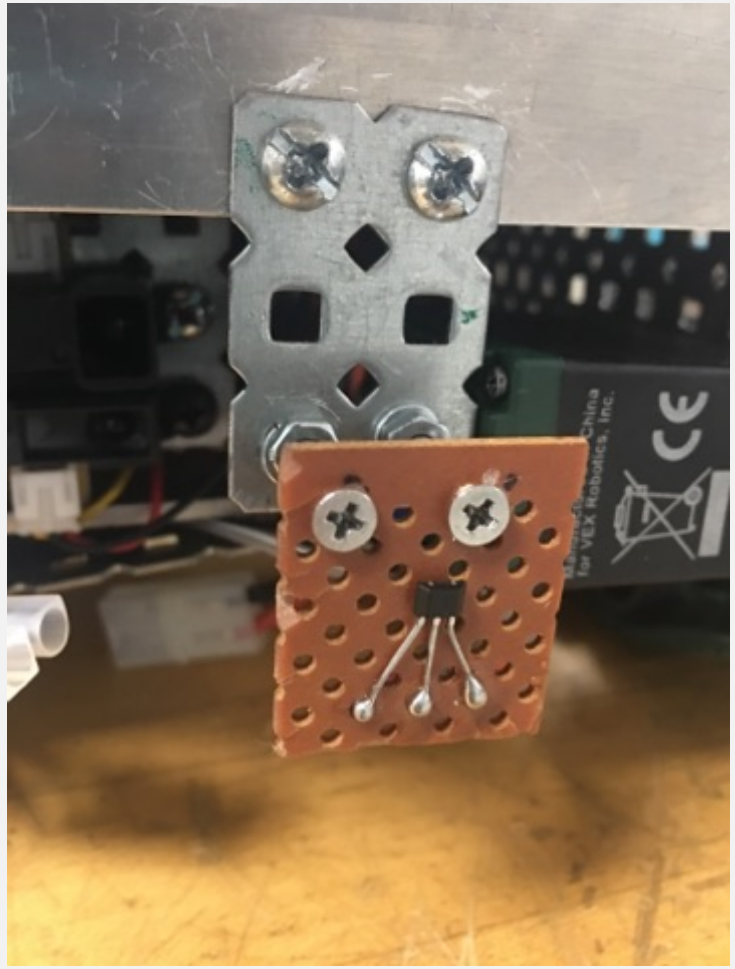


Figure 1: Stage 2 Sensor

VEX 3-Wire 180 deg Servo Motor

- Arduino Code to activate when magnet active
- Powered by robot Battery

Potential Improvements

- The original Servo motor was too slow and too weak
- Faster, Stronger Servo

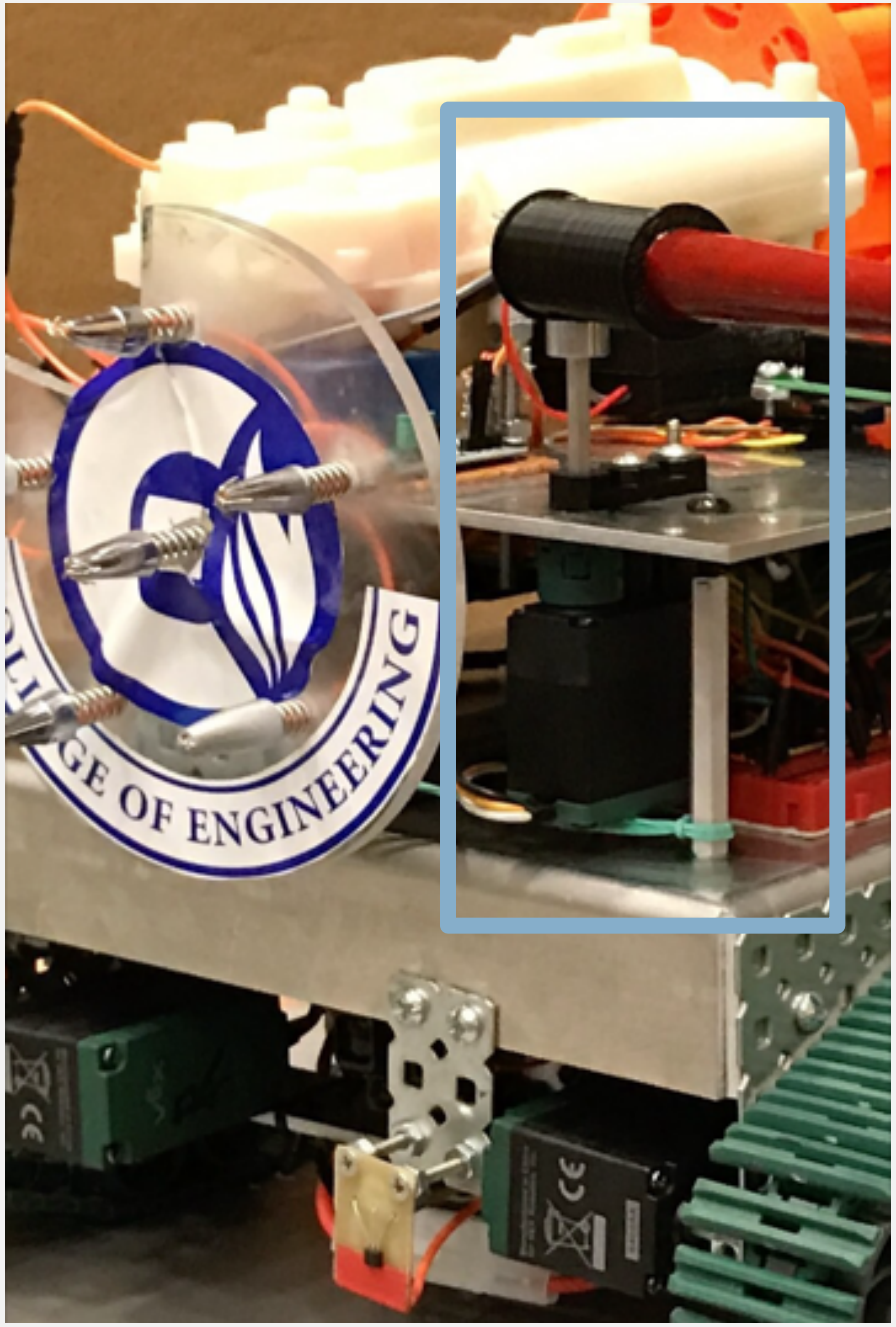


Figure 1: Stage 2 Design

STAGE 3 – "BRING DOWN THE SHIELDS"

- Implement Stage 1 Code
- Quadrature Encoder
  - Records direction and
  - number of turns
- 360° represents a value of one
- Number of turns = Digit
- Direction changes = Next Digit
- Five Digits

Component	Wire	Resistor	Capacitor	Inductor	Diode
Code	1	2	3	4	5

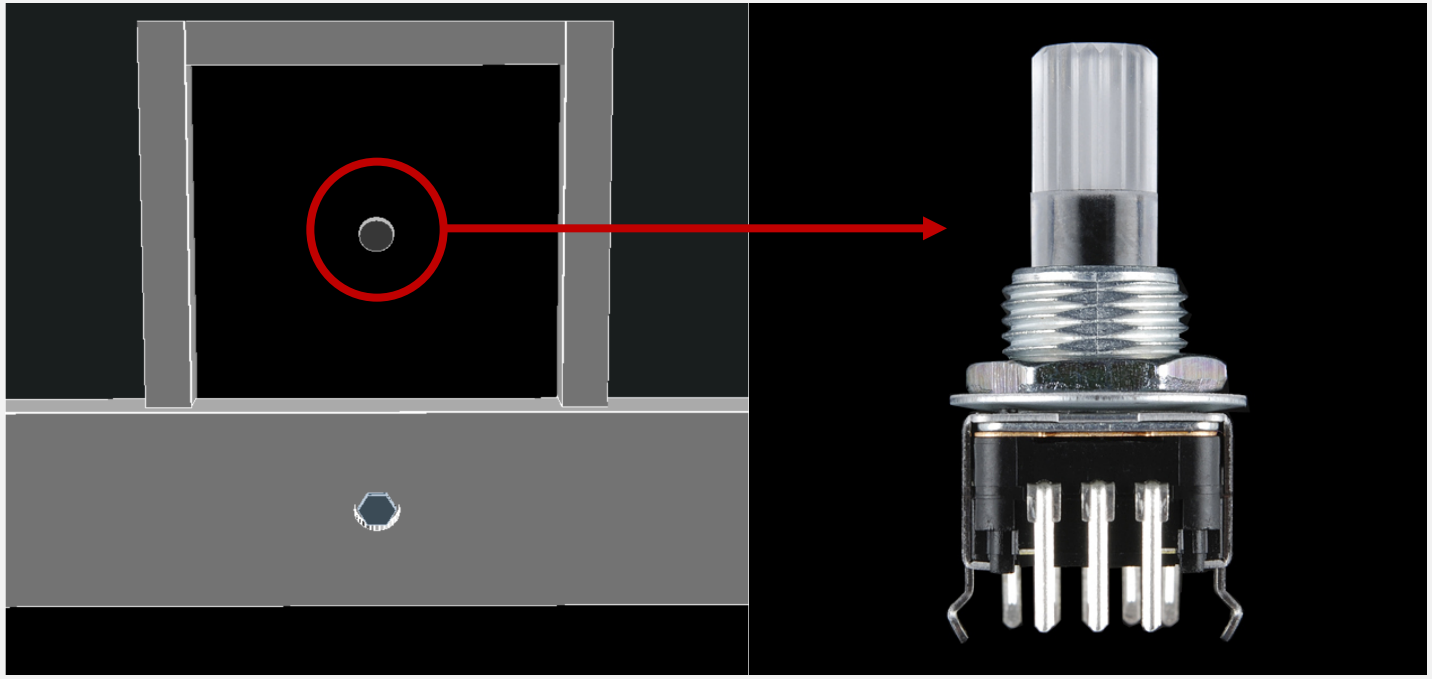


Figure 1: Stage 3 Arena Design

STAGE 3 - NEW APPROACH

- 2 Stepper Motors
  - Precise due to steps
  - Low speed torque
- Rubber Band
- Micro servo to hold band

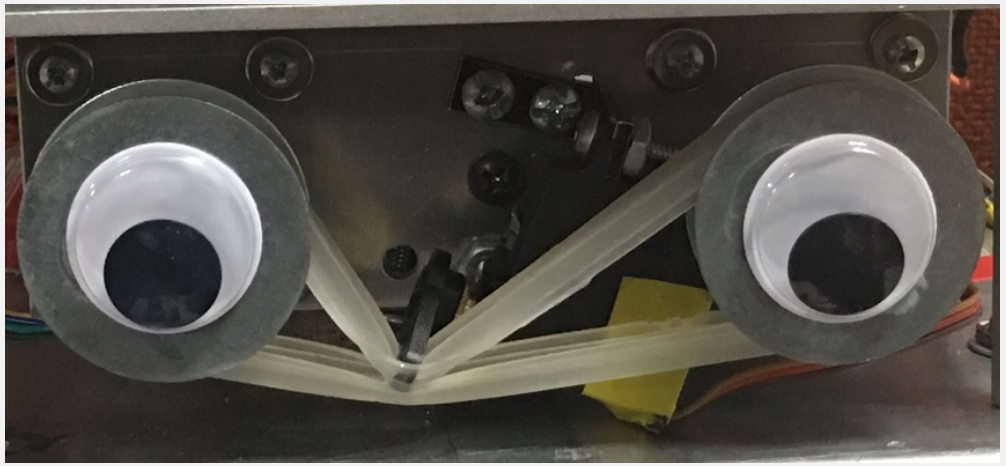


Figure 1: Stage 3 Design

- Update
  - Change gear to have a better turning ratio

STAGE 4 – DESCRIPTION

- 6”x 6”, 3.5” above the top step
- The target area is roughly 7” from the starting arena area
- Launching Position

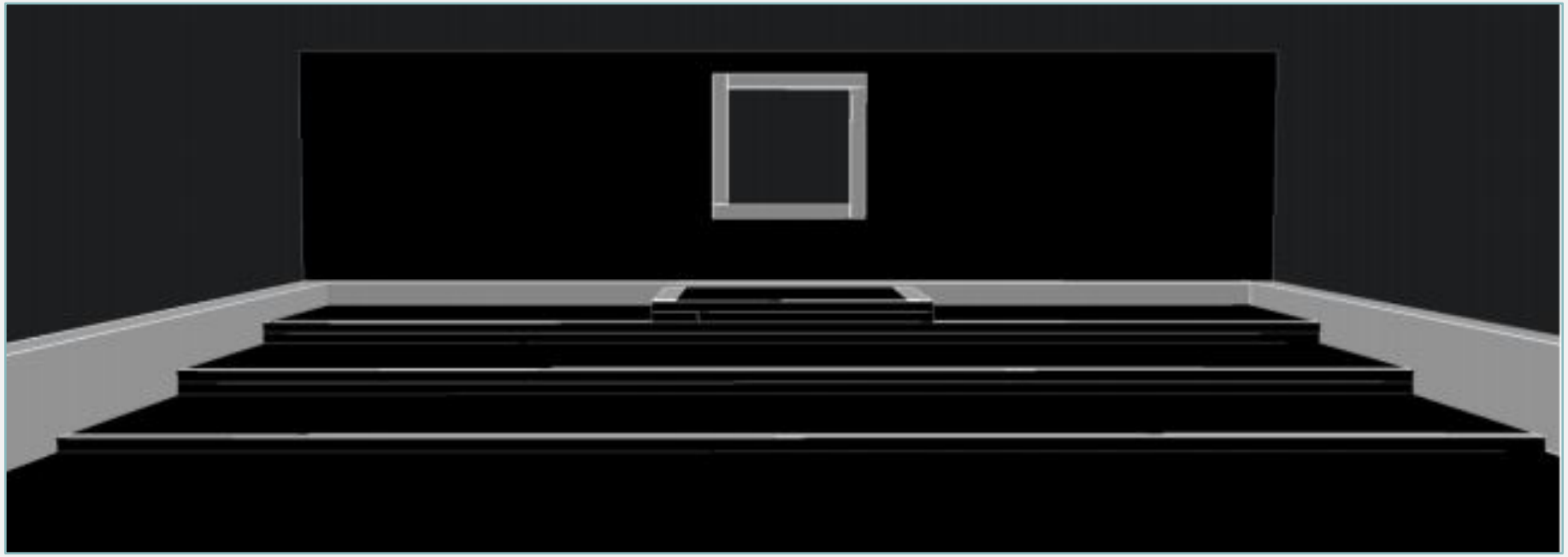


Figure 1: Stage 4 Arena Design

STAGE 4 – FIRING PLATFORM

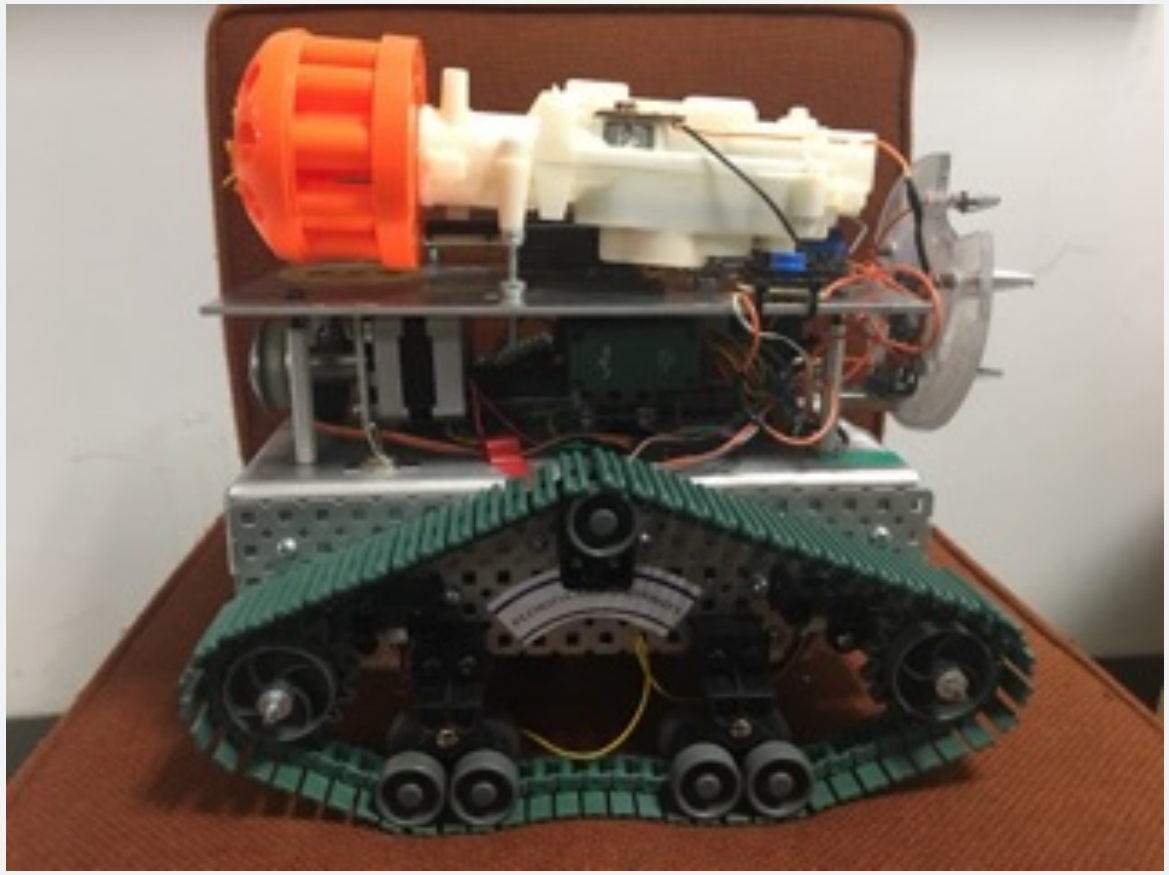


Figure 1: Side View

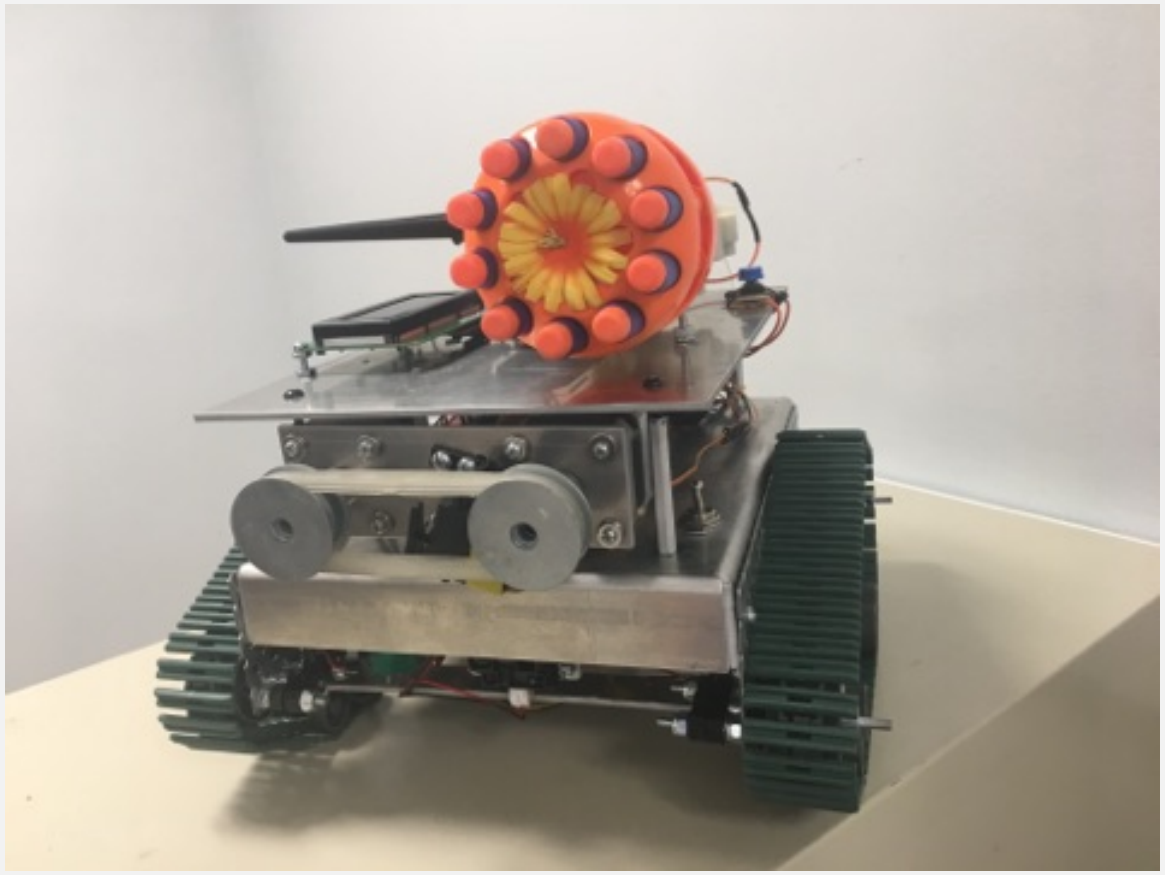


Figure 2: Front View

PROJECT BUDGET

Product	Qty	Total
Rotary Encoder	1	$3.95
Clear Plastic Knob	1	$0.95
Continuous Servo	1	$11.95
Drivetrain	1	$78.93
Arduino Mega	2	$73.98
Magnetic Sensor	1	$2.00
IR Sensors	8	$108.20
Hardware	1	$34.19
Chassis	1	$32.25
Hall Effect Sensors	4	$10.27
Misc. Vex	1	$98.99
Misc. RobotShop	1	$79.92
Misc. Hardware	1	$191.90
Shipping	1	$21.15

PROJECT RESULTS & CHANGES

- Successful at completing stages
- Short circuit during competition
- Changes
  - Drivetrain
    - Original design: tank treads for stair climbing
    - Omni-directional wheels
  - Navigation

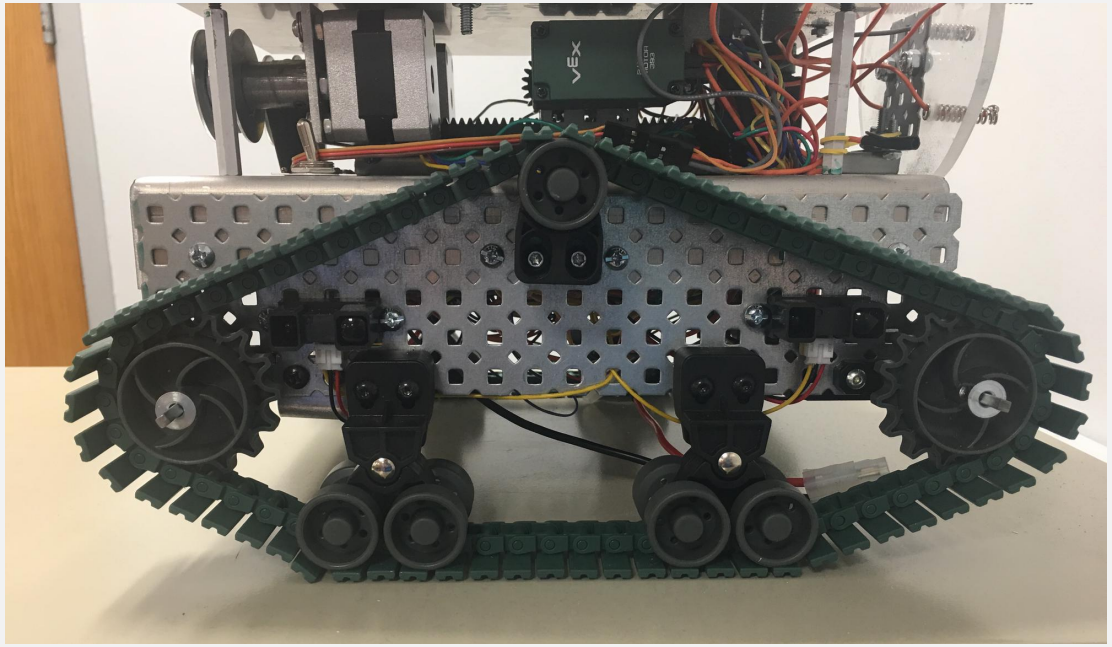


Figure 1: Track Design