IEEE Southeast Con Hardware Challenge 2017

Group #1

EEL 4911C

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SOUTHEASTCON TEAM

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F2-P2

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PROJECT DESCRIPTION

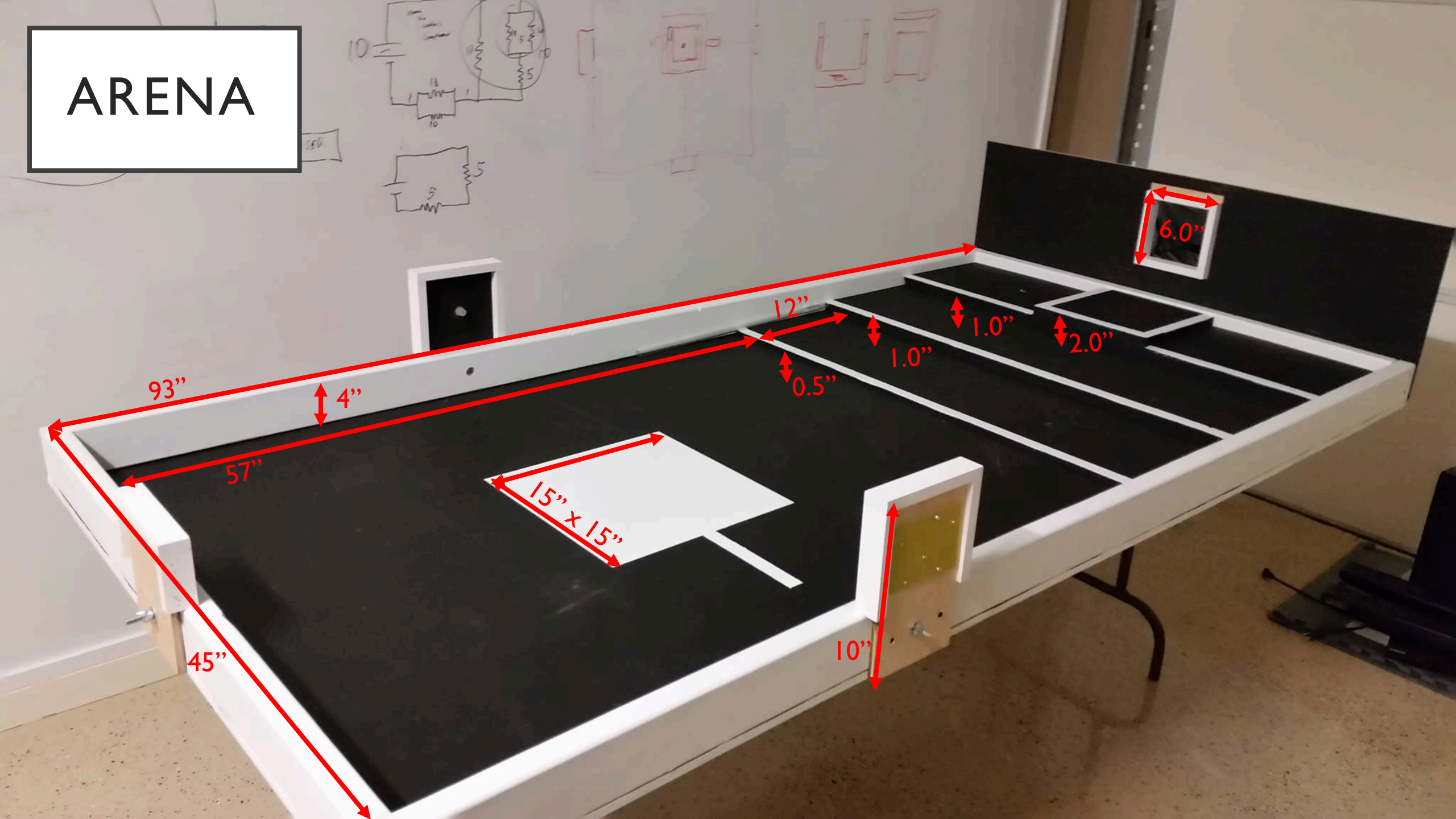
- 2017 IEEE Southeast Con Hardware Challenge
  - March 30
- Objective: Success
- Oct. 9, 2016 Rules
- Autonomous robot

4 STAGES

- Star Wars Themed

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

ARENA



Task	1/9	1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/13	3/20	3/27	4/3	4/10	4/17
Rules and Research															
Testing and Design Implementation															
2017 IEEE Southeast Con Hardware Chall.															
Microcontroller															
Research															
Device Selection															
Coding															
Drive Train															
Drive Train Research															
Motor Controller Selection															
Platform Selection															
Platform Design															
Drive Train Build															
Power supply															
Power Research															
Power Supply Selection															
Parts Ordered															
Robot Chassis															
Chassis Design															
Chasssis Build															
Wiring/Electrical															

Navigation															
Navigation Research															
Sensor Selection															
Parts Ordered															
Sensor Coding															
Implementation															
Stage 1															
Circuit Design															
Parts Ordered															
Code writing															
Display Implementation															
Stage Build															
Stage Test															
Stage 2															
EMF Sensor Research															
Lightsaber Motor Research															
Motor Design															
Sensor Design															
Parts Selection															
Parts Ordered															
Motor Coding															
Sensor Coding															
Stage Build															
Stage Test															

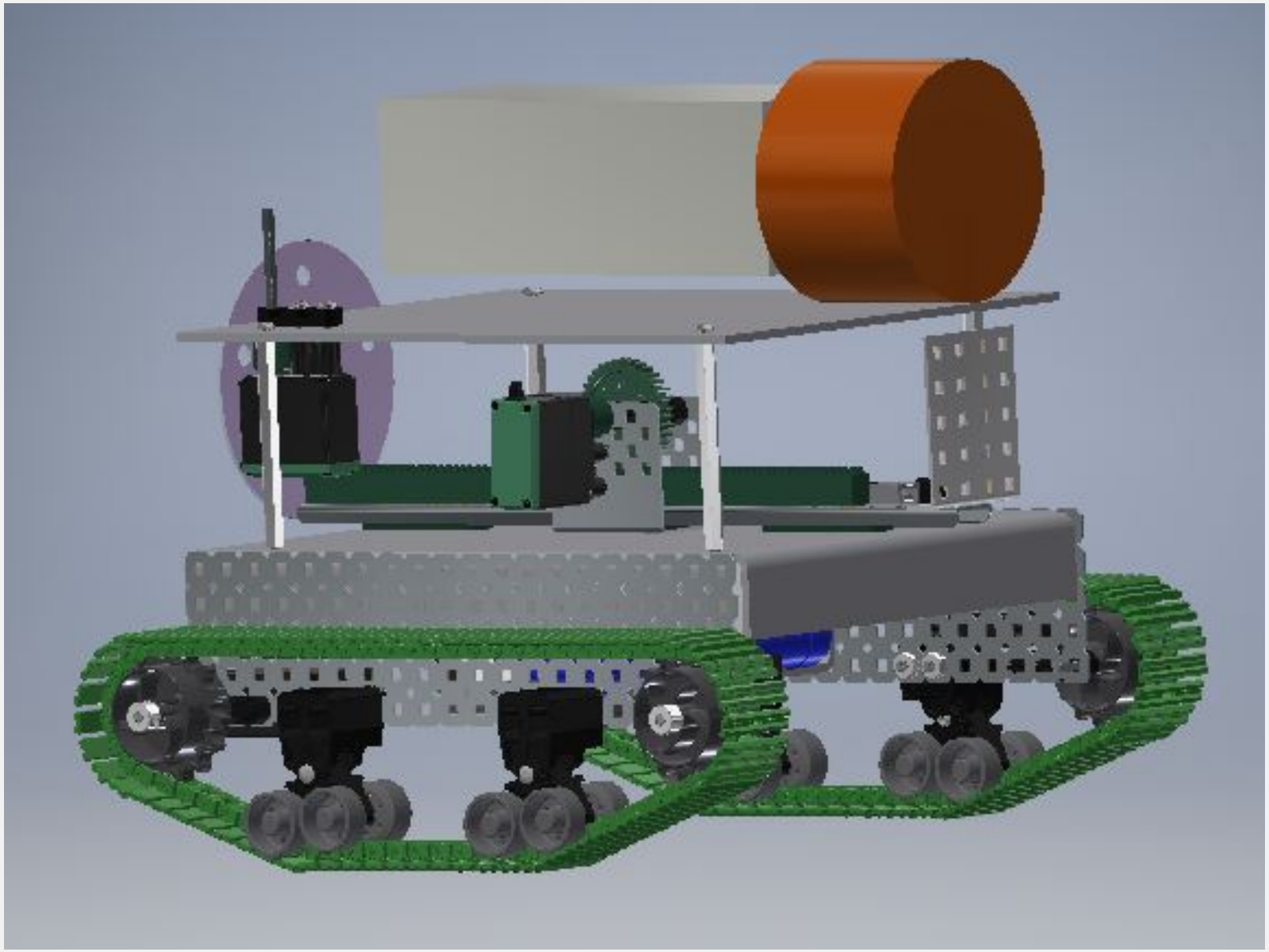
Stage 3															
Motor Research															
Motor Controller Research															
Gripper/ Arm Selection and Design															
Design Selection															
Parts Ordered															
Motor Coding															
Stage Build															
Stage Test															
Stage 4															
Launch Mechanism Research															
Firing Mechanism Design															
Barrel Design															
Propulsion Design															
Part Selection															
Parts Ordered															
Fire Coding															
Stage Build															
Stage Test															

CURRENT PHASE

- Redesign and Implentation
- Movement and navigation
- Final construction

BOT CHASSIS DESIGN

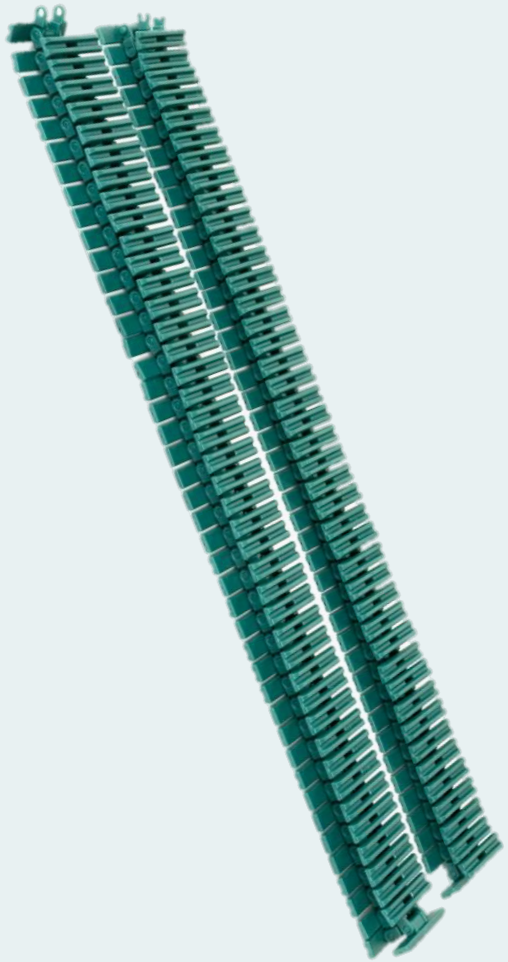
- Starting size must not exceed 12”x12”x12” (as per official Rules)
- Preliminary Research has resulted in the following design aspects
  - Original allowance 2” for each dimension
  - Bot Size 11.5”x11”x10” to allow for possible expansion if needed
  - Perforated to reduce weight



POWER

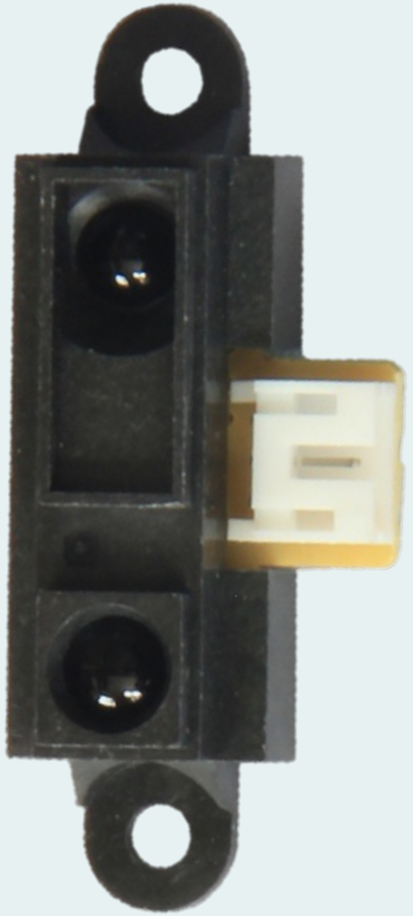
7.2V Robot Battery NiMH 3000mAh

PLATFORM



Tank Tread

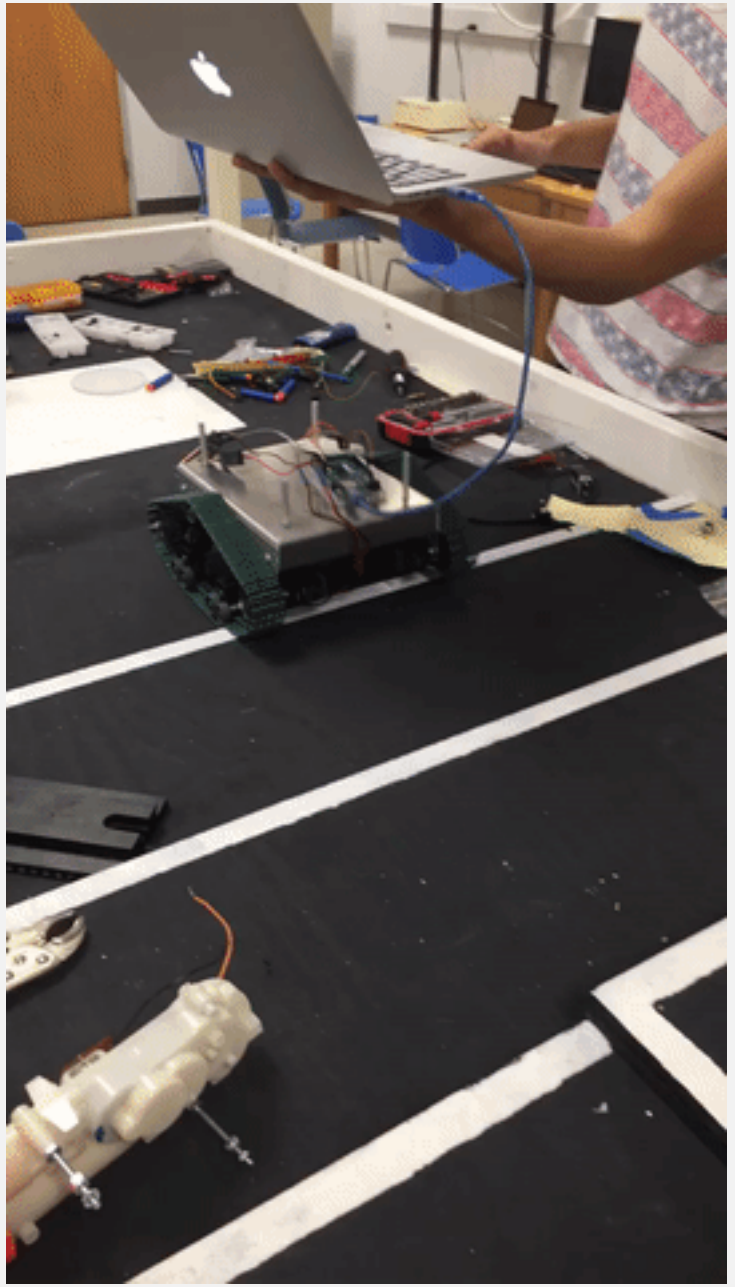
NAVIGATION



IR Sensors

DRIVETRAIN

- Vex Robotics Tank Tread Kit
- Vex Robotics 2-Wire Motor 393
- Vex Robotics Motor Controller
- Stair climbing capability
- 2 mph when powered at 5 volts
- Built & ready for navigation



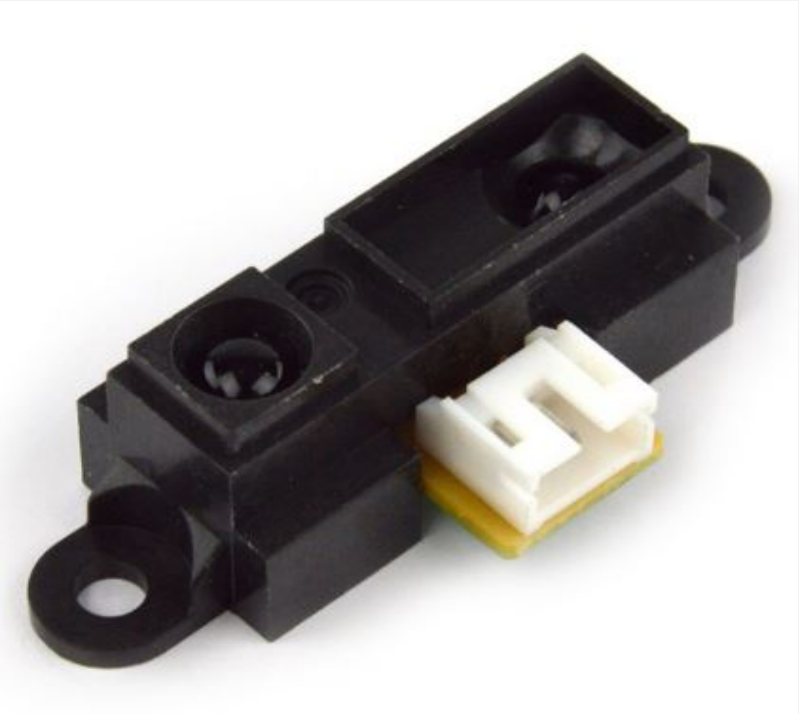
NAVIGATION

Long Range

GP2Y0A02YK0F

20-150cm

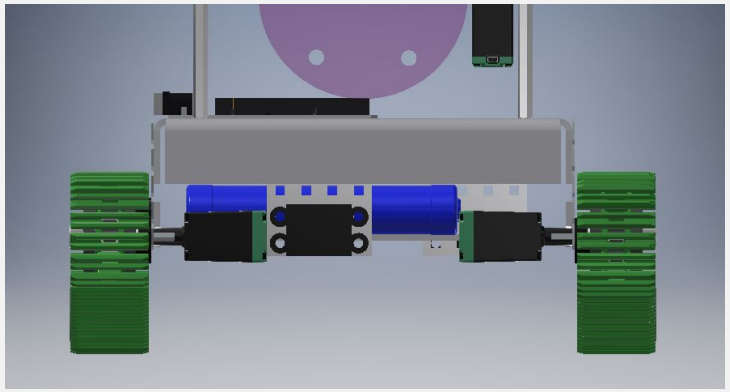
Short Range

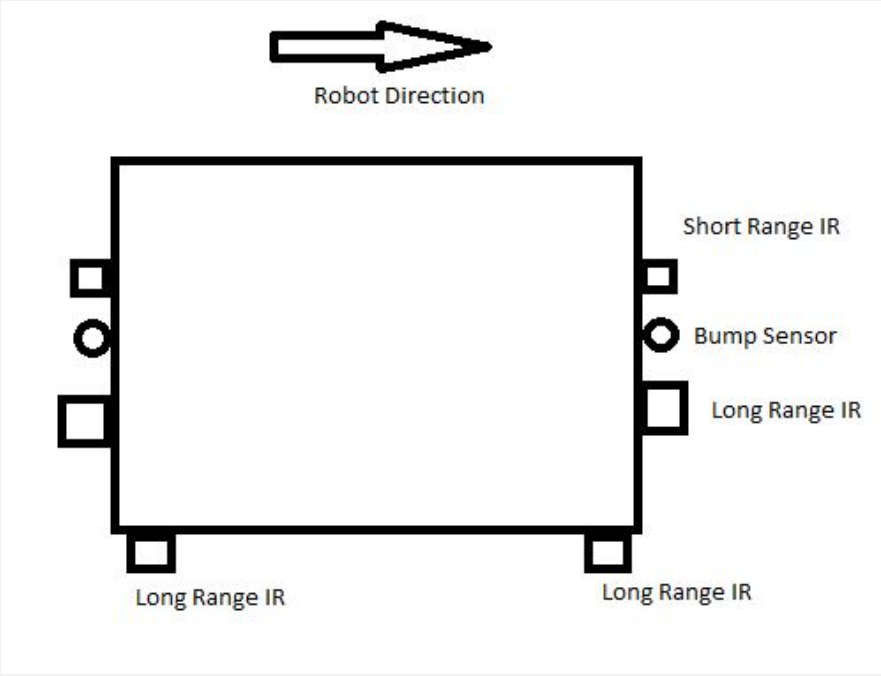


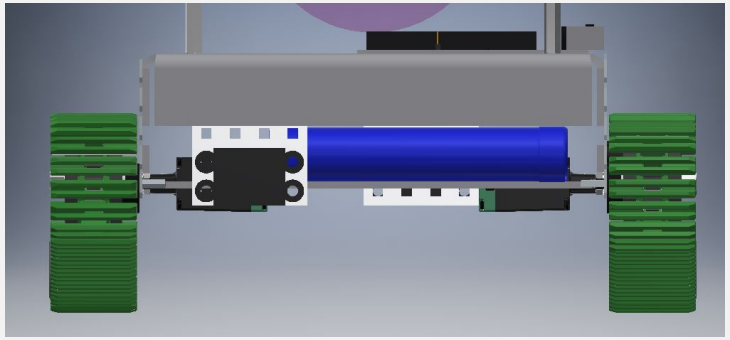
GP2Y0A41SK0F

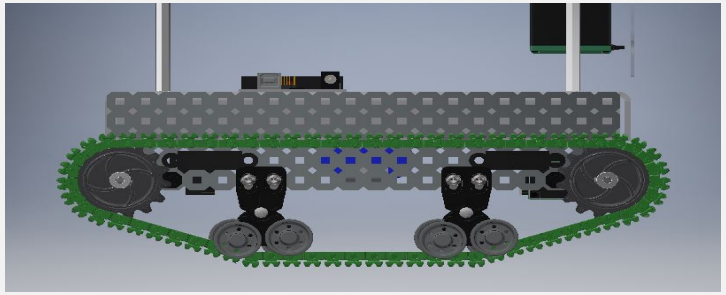
4-30cm

LAYOUT




Robot Direction
Short Range IR
Bump Sensor
Long Range IR
Long Range IR
Long Range IR



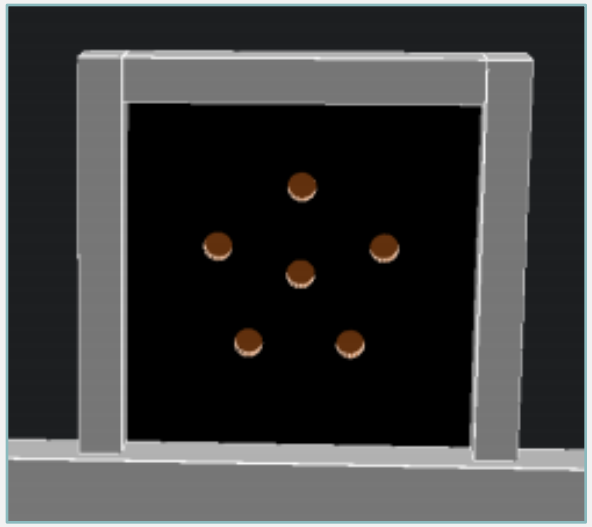


NAVIGATION CODING METHOD

- Basic algorithm for making complex decisions
- Starts with breaking down inputs from sensors into manageable information
- Information is then put into a rule matrix to determine output

STAGE 1 – DESCRIPTION

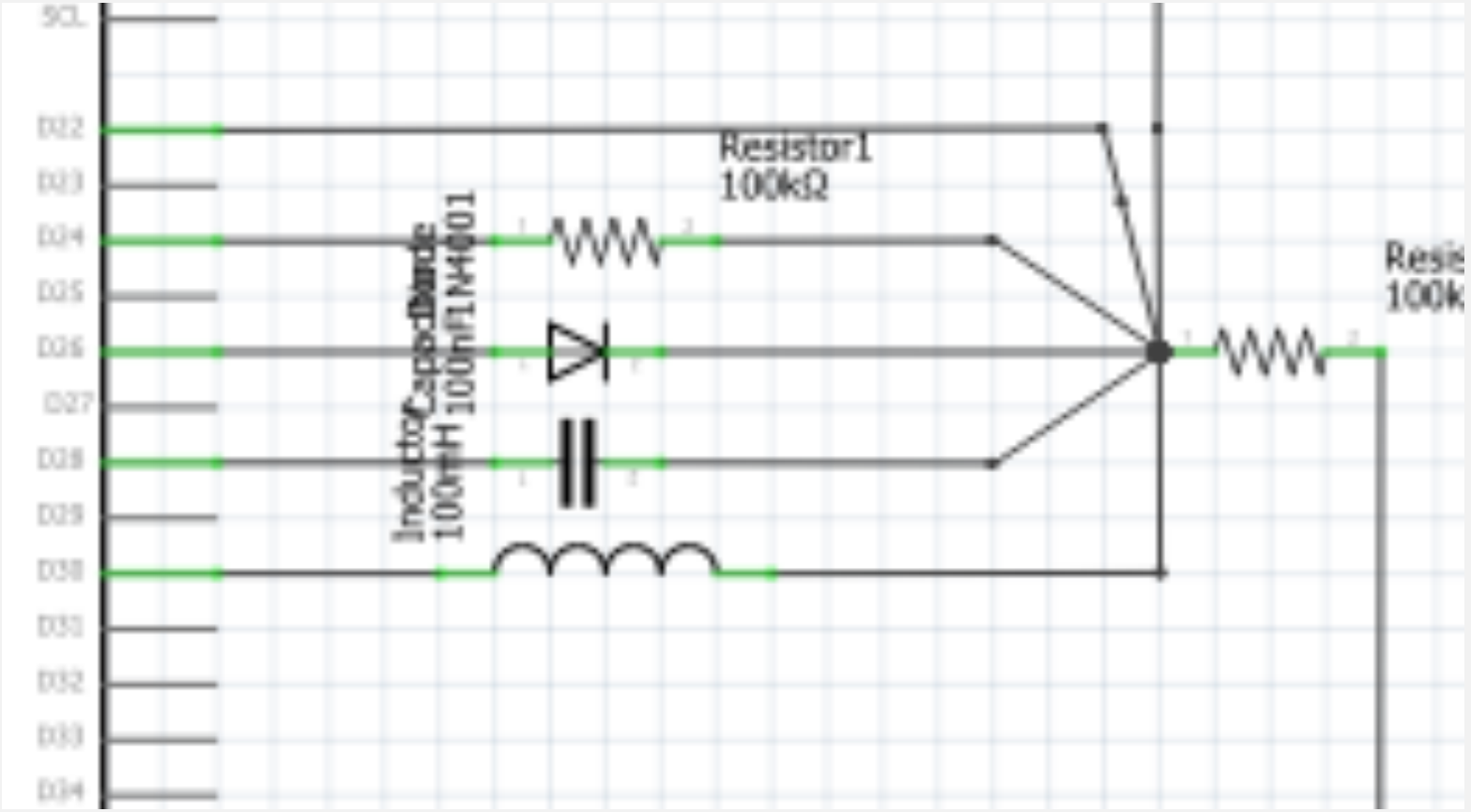
- Rotational dimensions for copper pads are:
  - 1 - 0°
  - 2 - 72°
  - 3 - 144°
  - 4 - 216°
  - 5- 288°
- Center pad is common ground
- Capacitor is non polarized
- Diode can be forward or reversed



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 – SCHEMATIC

- 5 digital pins
- 1 analog pin
- ground



STAGE 1 – PSUEDO CODE

Int Stage1 (int pin)

Set pin to output

Read voltage

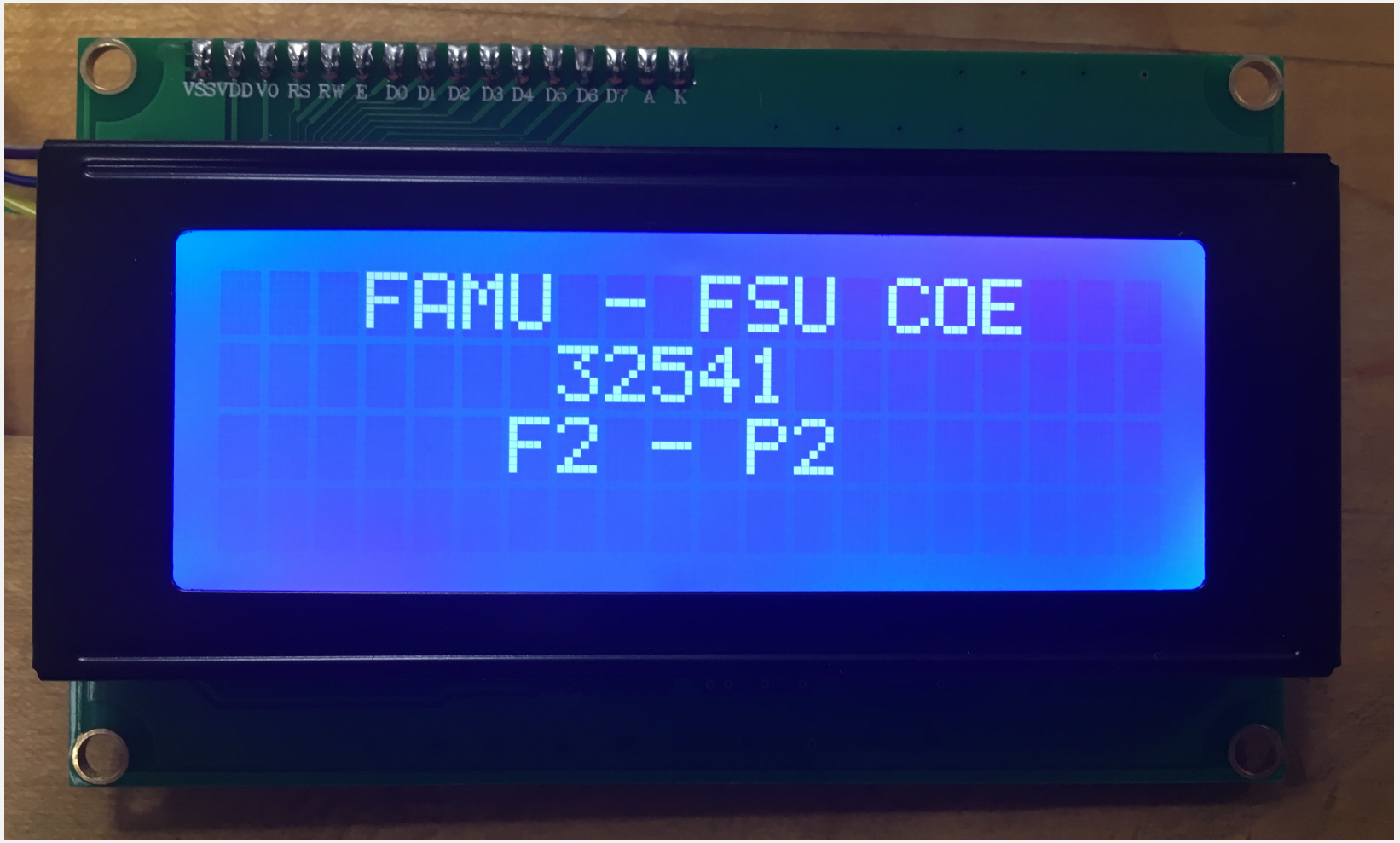
Wait 1 sec

Read voltage2

Return component

- If(voltage > voltage2)
  - Capacitor "3"
- Else If(voltage < voltage2)
  - Inductor "4"
- Else if(voltage = 5)
  - Wire "1"
- Else if (voltage = 2.5)
  - Resistor "2"
- Else
  - Diode "5"

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

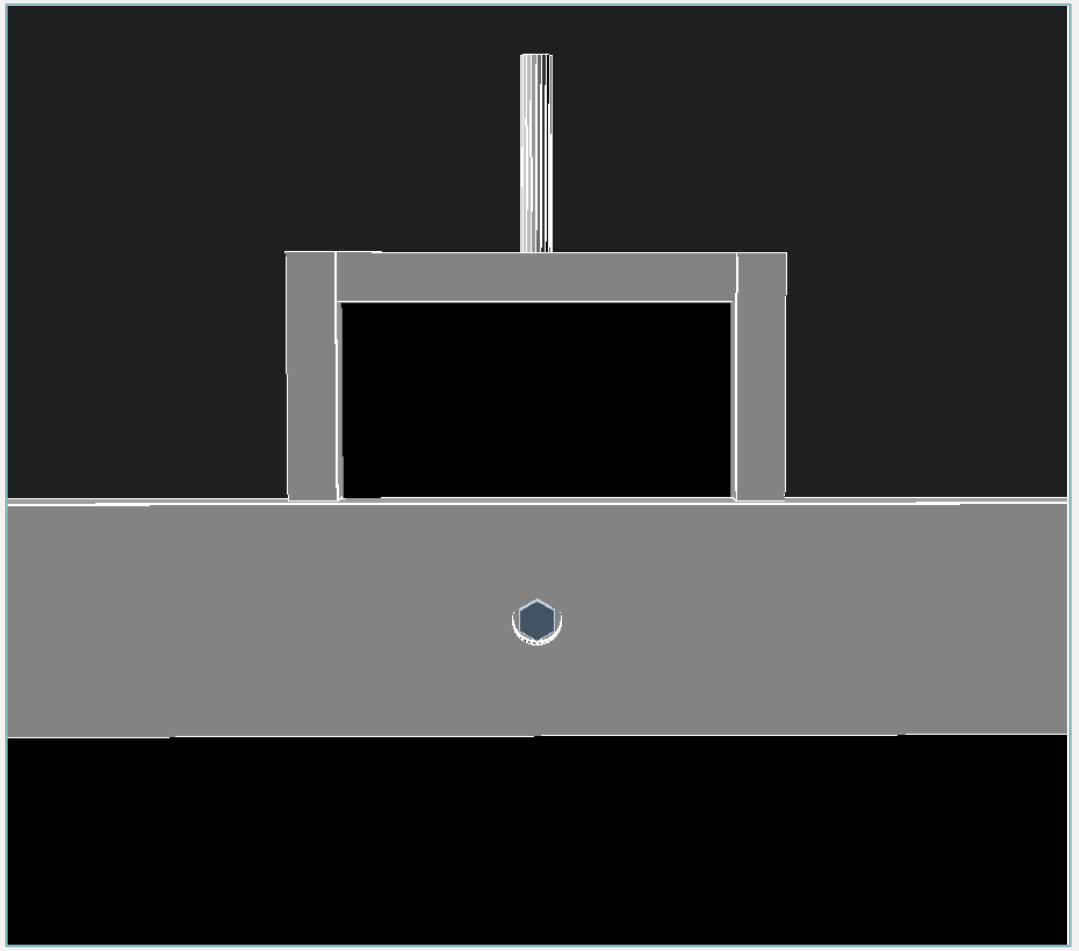


Figure 1: Arena Stage 2 with Lightsaber

STAGE 2 – THE LIGHTSABER

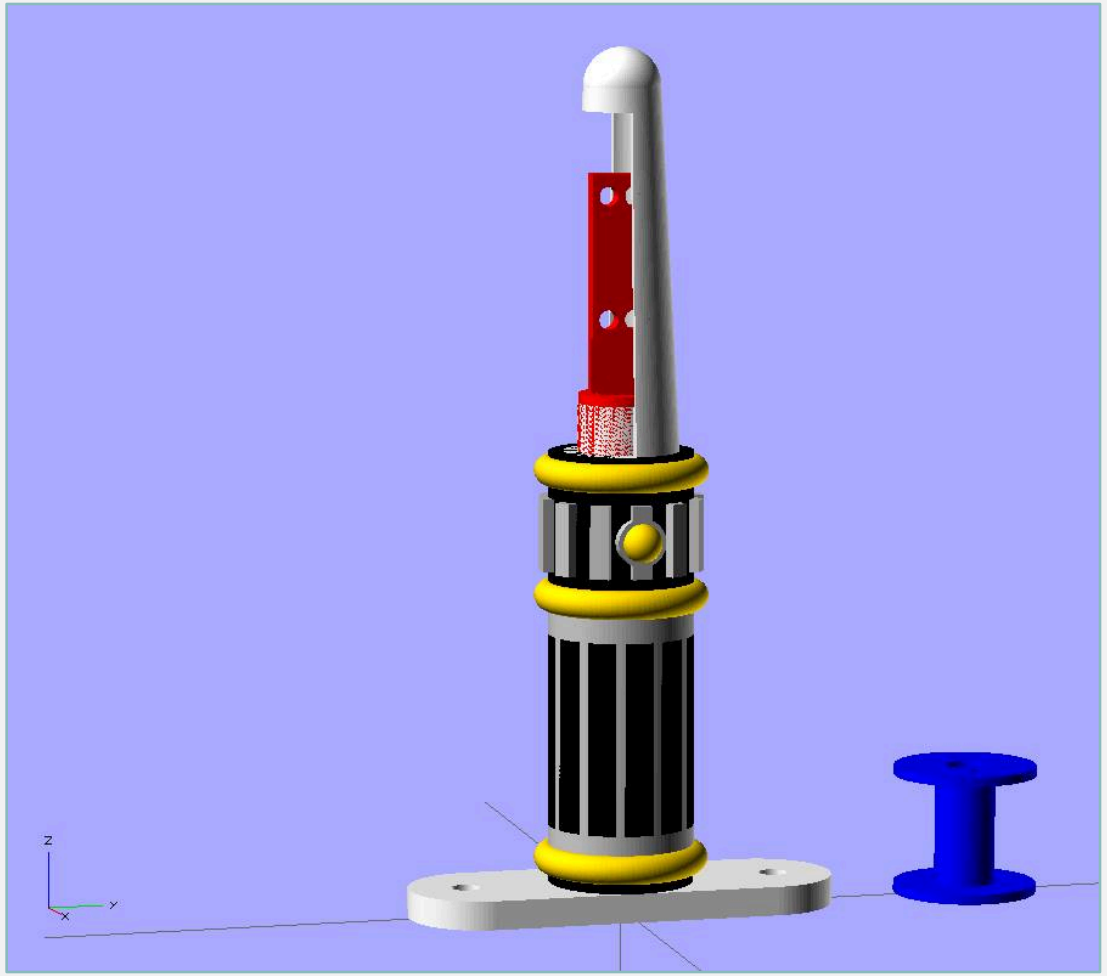


Figure 2: Lightsaber and Bobbin

- Lightsabers!
  - 3” tall Field attached lightsaber
  - Adafruit Medium Vibration Sensor Switch to detect contact made
  - Adafruit LED array to visually indicate contact
    - Red for Points Deducted, Blue for Points Awarded

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

Magnetic Field .5cm from Bolt

Magnetic Field touching Bolt

Magnetic Field behind

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

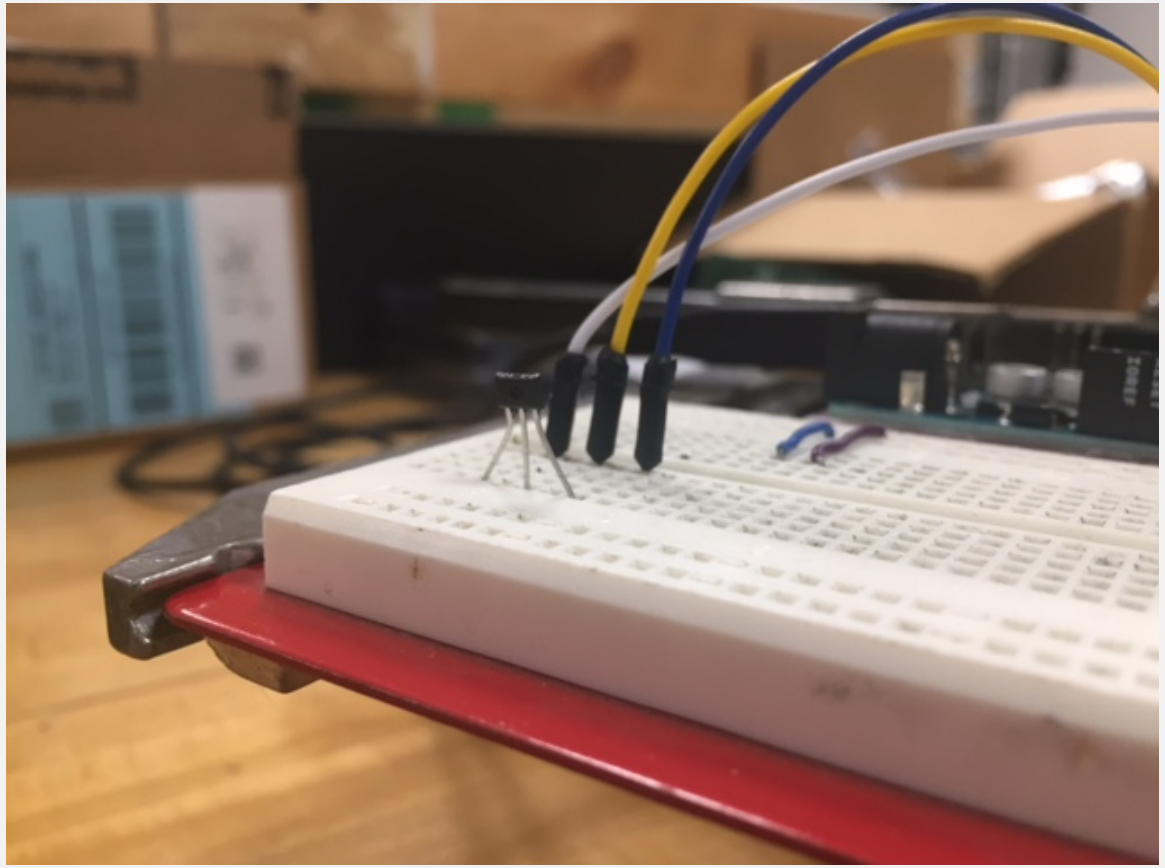
Test Data: No Active Field

```
|----------------------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

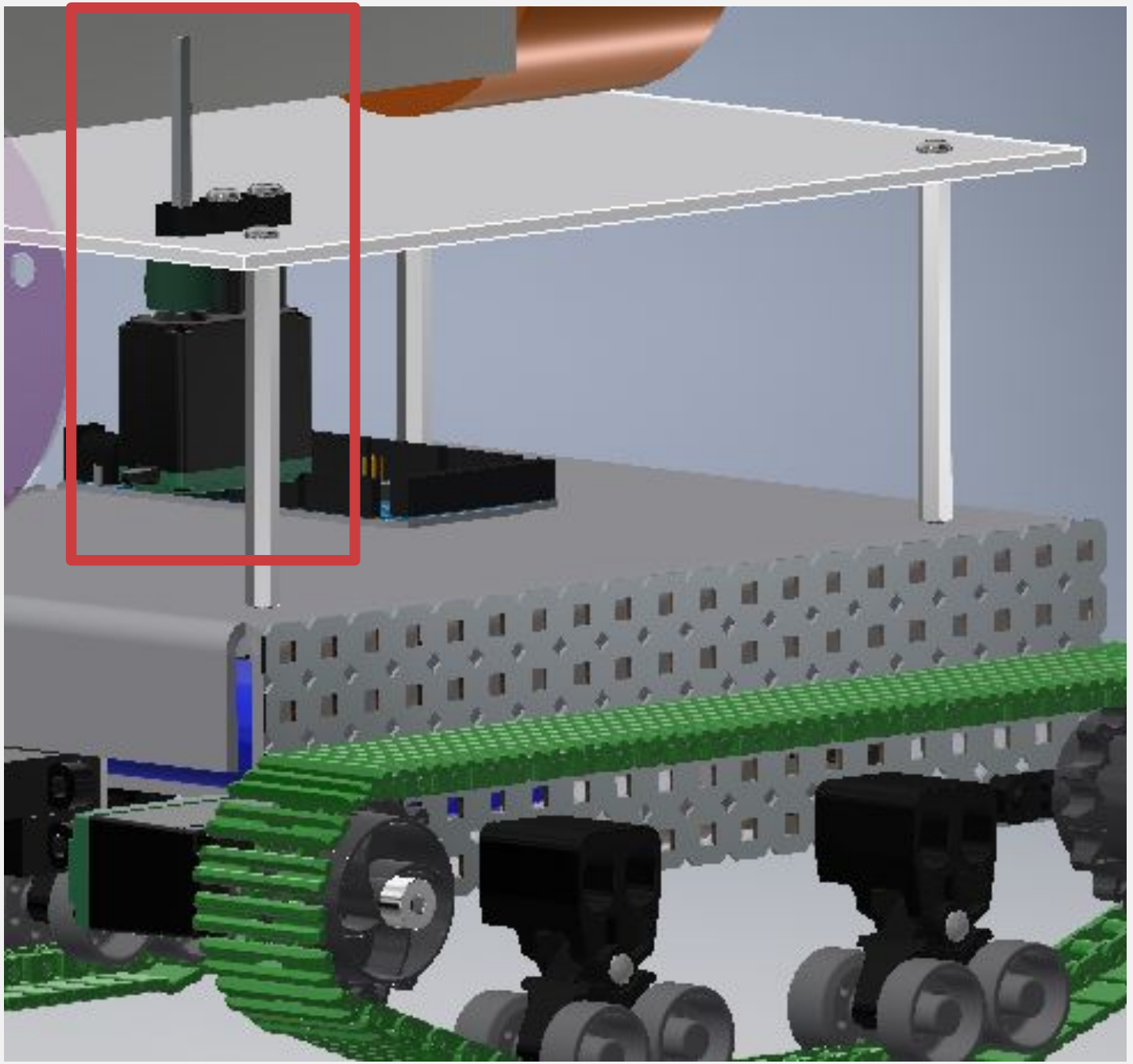


VEX 3-Wire 180 deg Servo Motor

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

Next Steps:

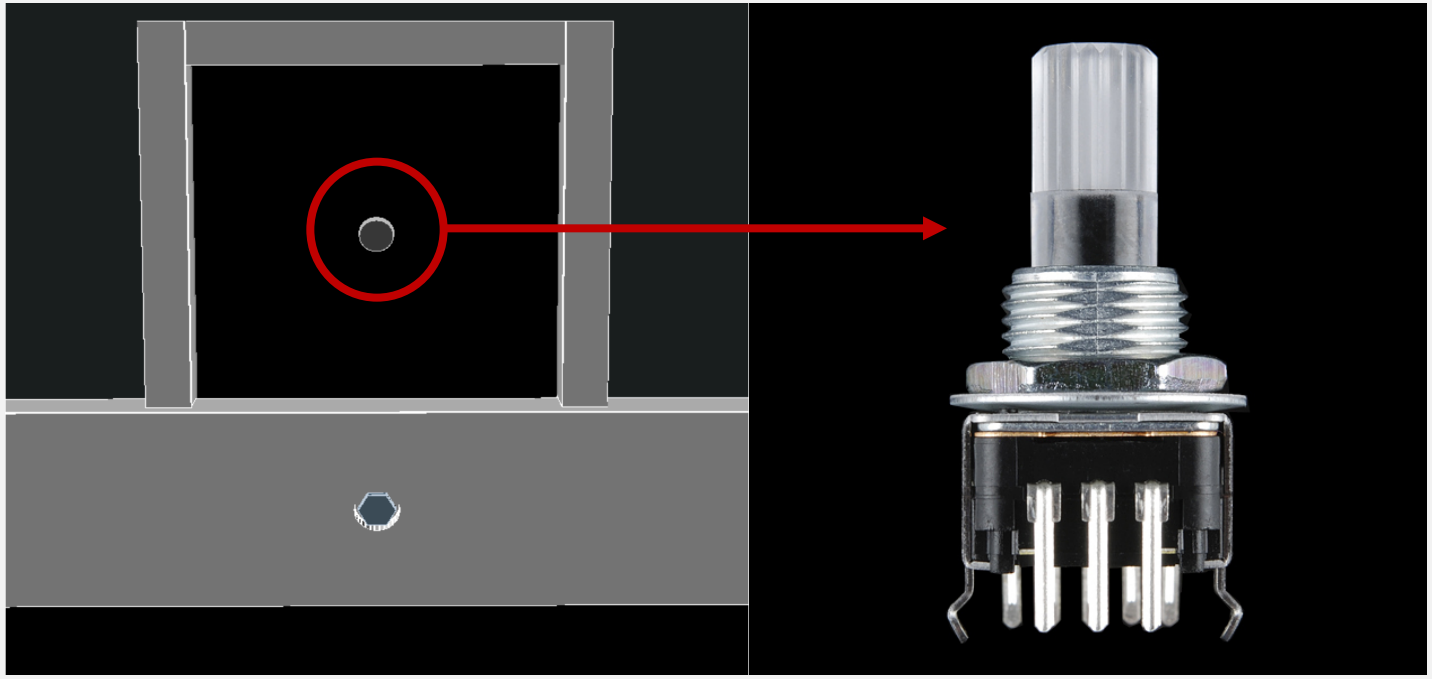
- Fabricate "Lightsaber"
- Fabricate PCB for sensor
- Finalize and "clean-up" code
- Finalize wiring



STAGE 3 – "BRING DOWN THE SHIELDS"

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

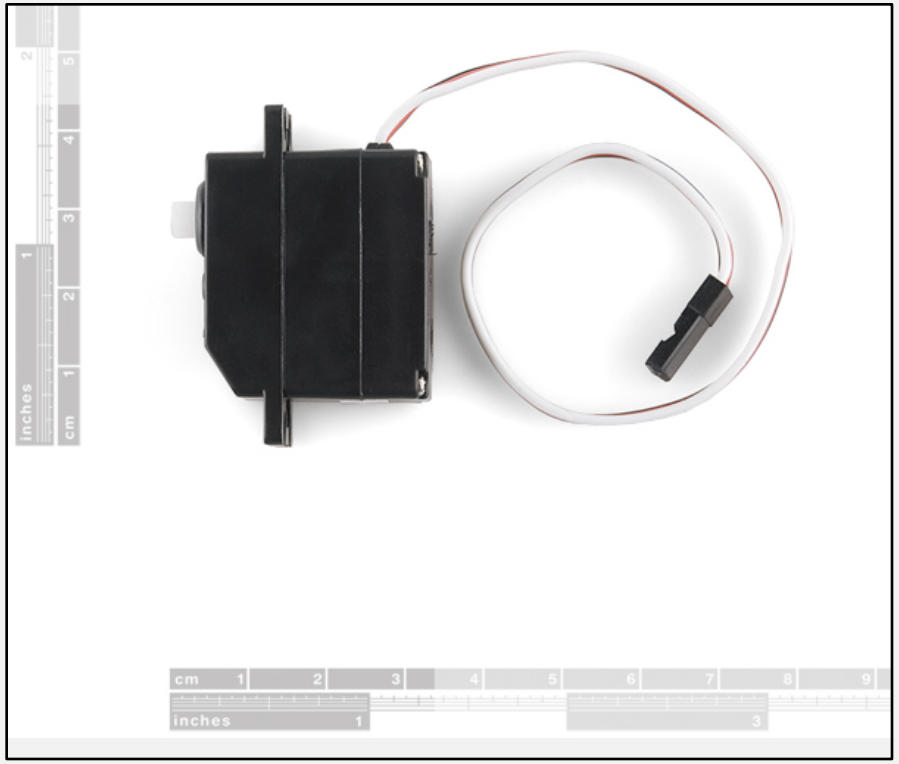
Component	Wire	Resistor	Capacitor	Inductor	Diode
Code	1	2	3	4	5



STAGE 3 – PAST DESIGN

- Continuous Rotation Servo
  - Rotates 360°
  - Easy to implement
  - Not precise enough

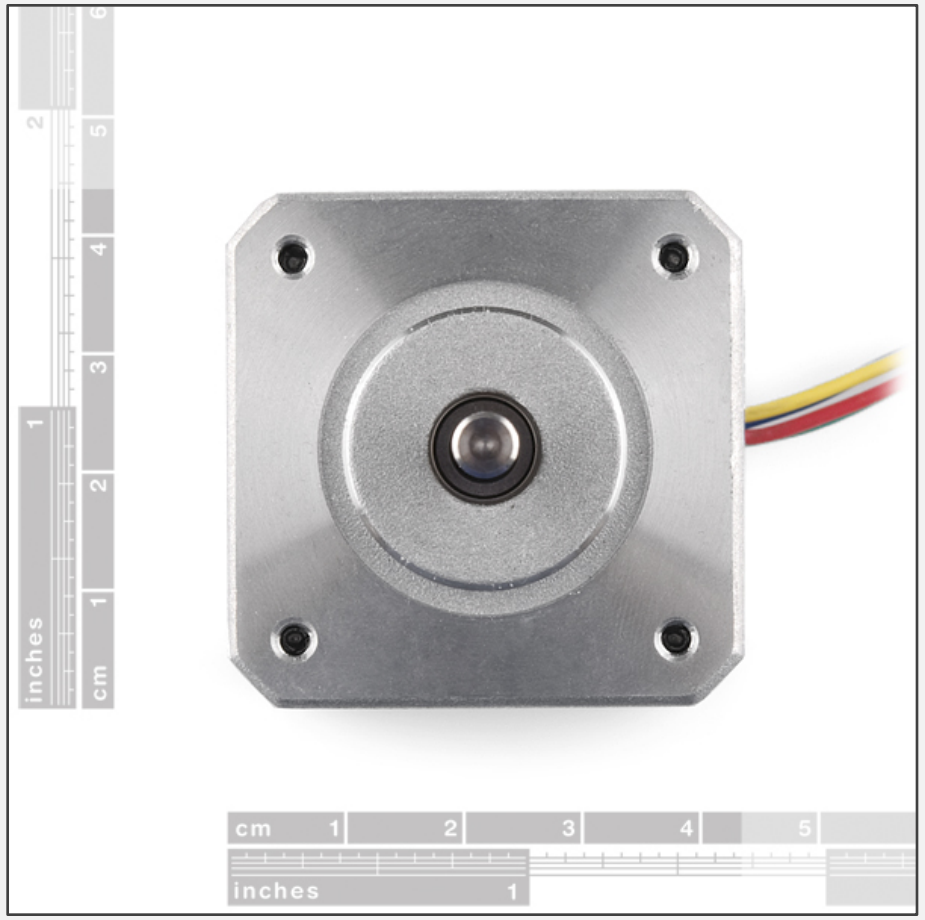
- Foam gripper
  - Easy to design
  - No coding
  - Lacks room for error



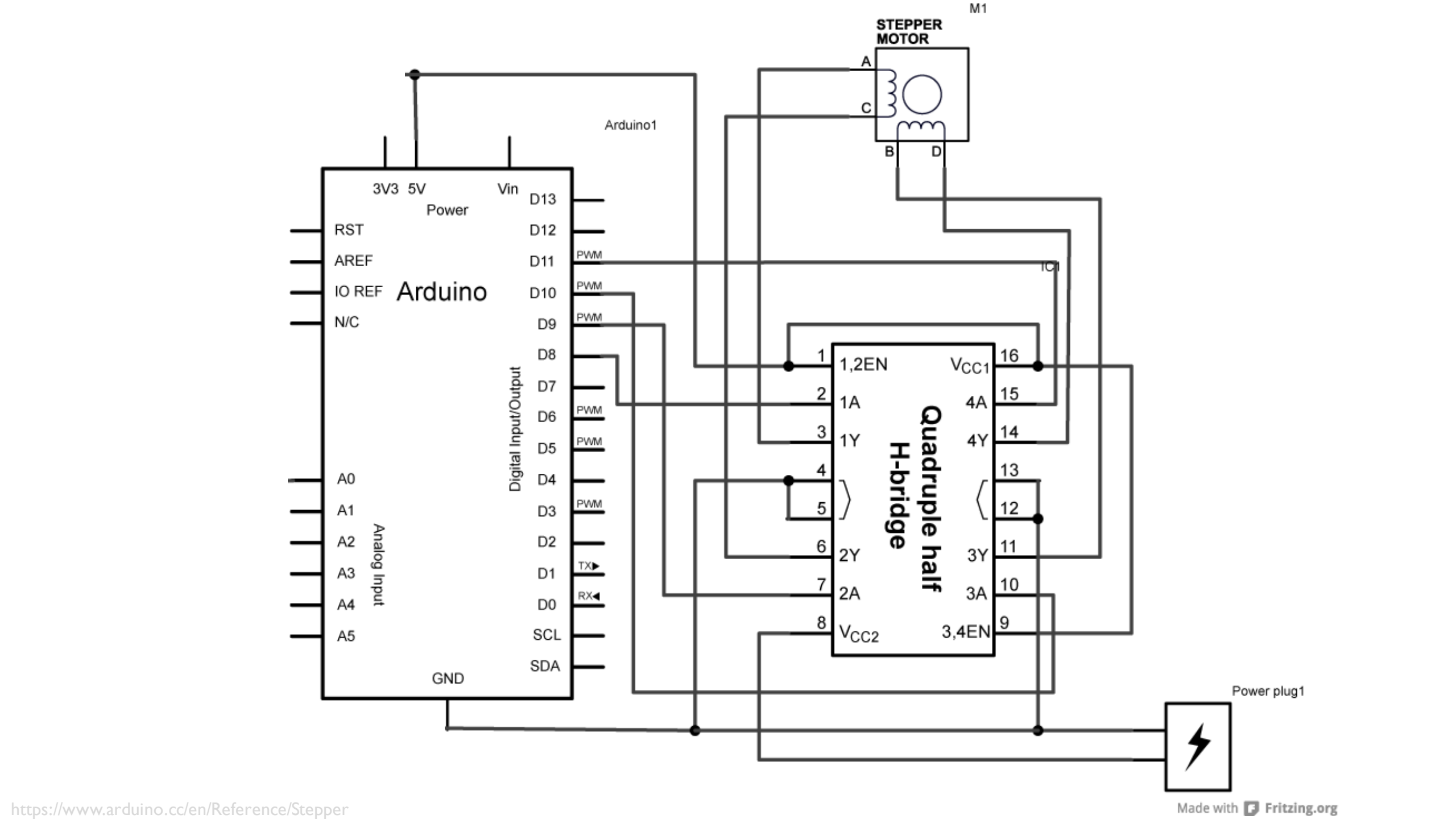
Micro Continuous Rotation Servo

STAGE 3 - NEW APPROACH

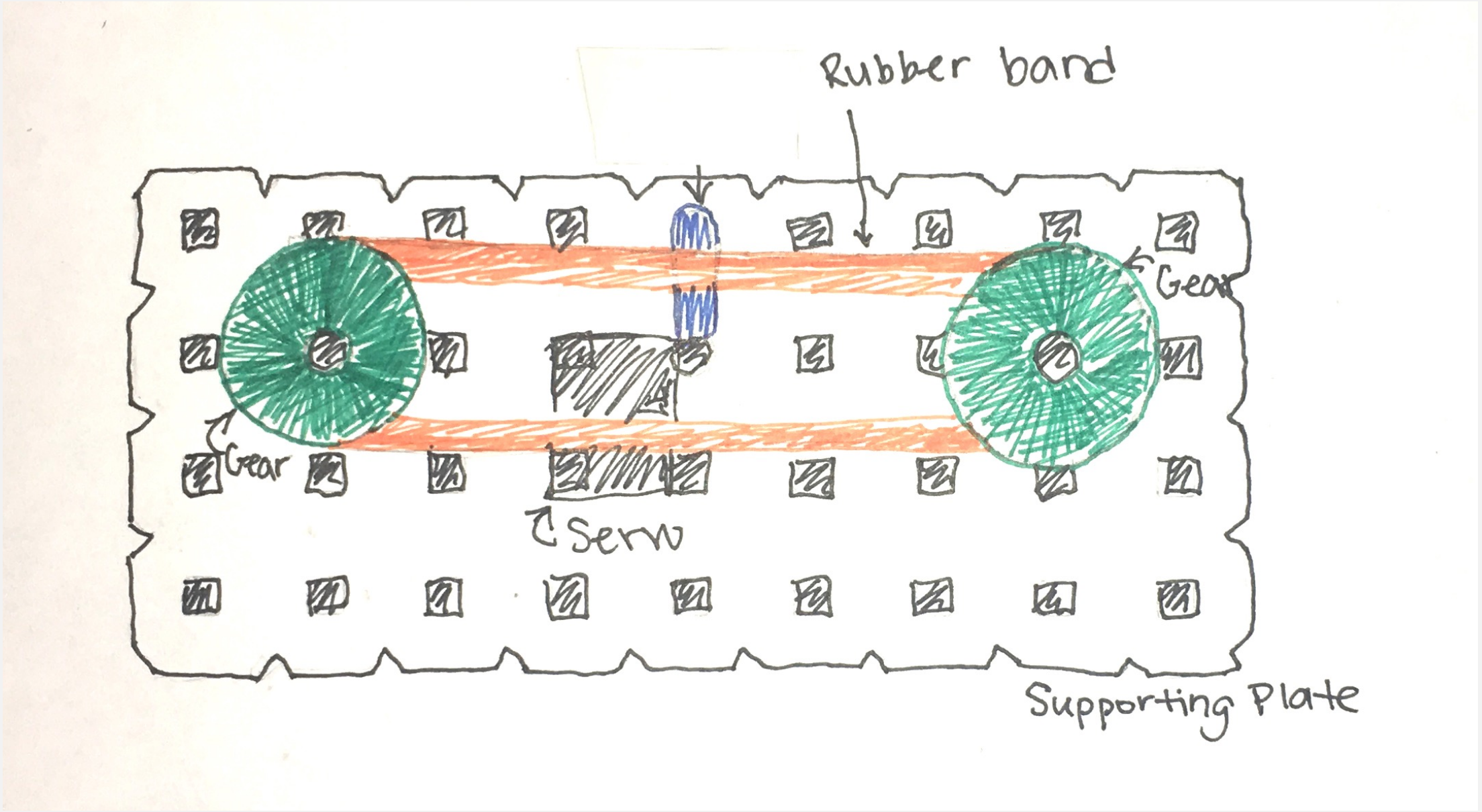
- Stepper Motor
  - Precise due to steps
  - Low speed torque
  - 2-phase bipolar motor with 4 wires
  - H-bridge to reverse current
  - 200 steps
  - No feedback for position



Stepper Motor (Top View)



https://www.arduino.cc/en/Reference/Stepper

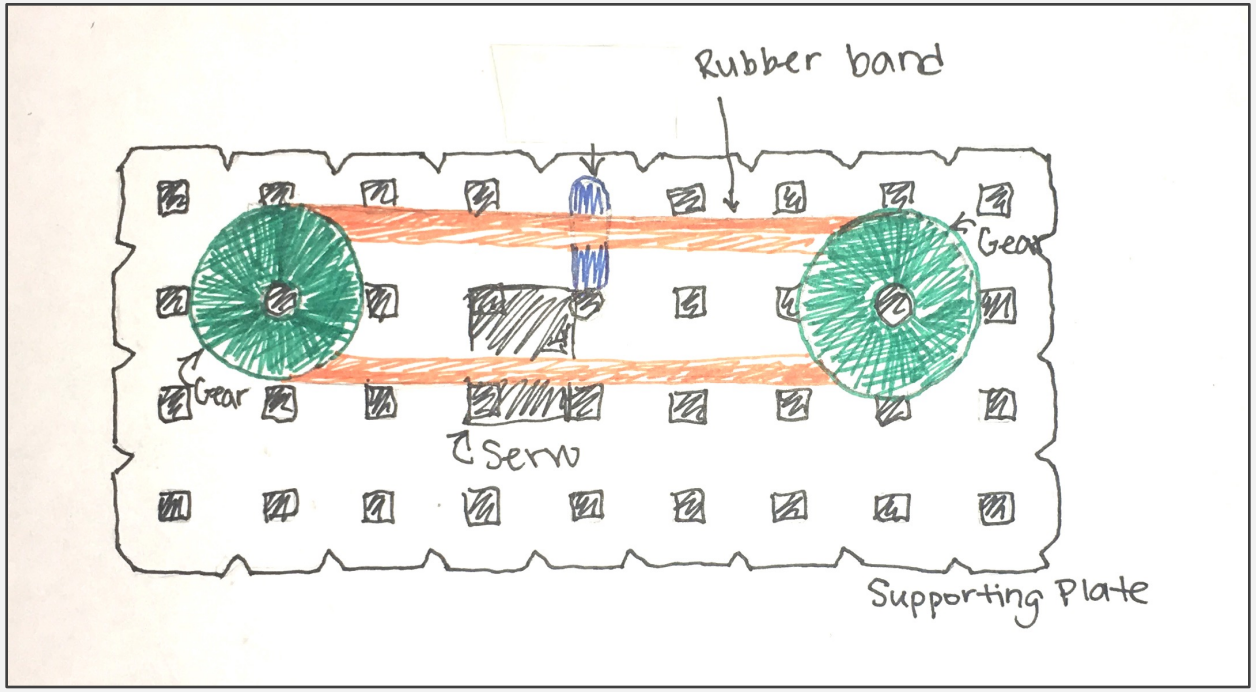


- Two Stepper Motors
- Rubber band
- Servo for tension

STAGE 3 – FUTURE

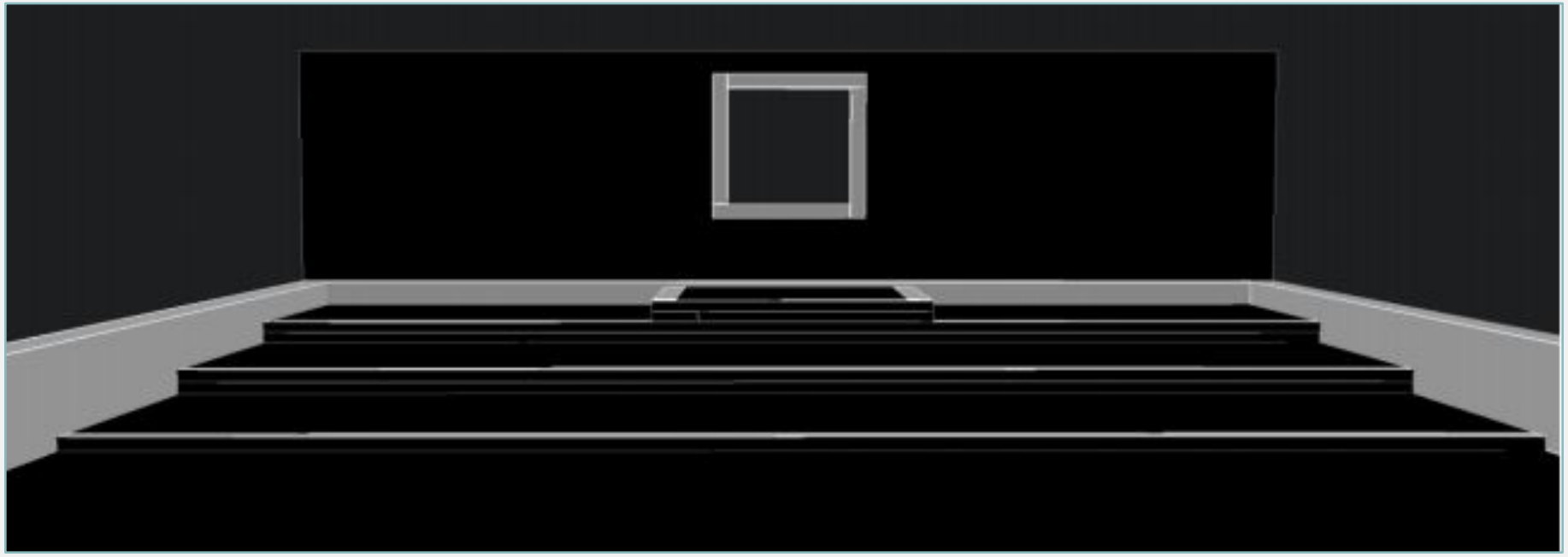
- Ordered second motor
- Adding servo
- Prototype testing ->

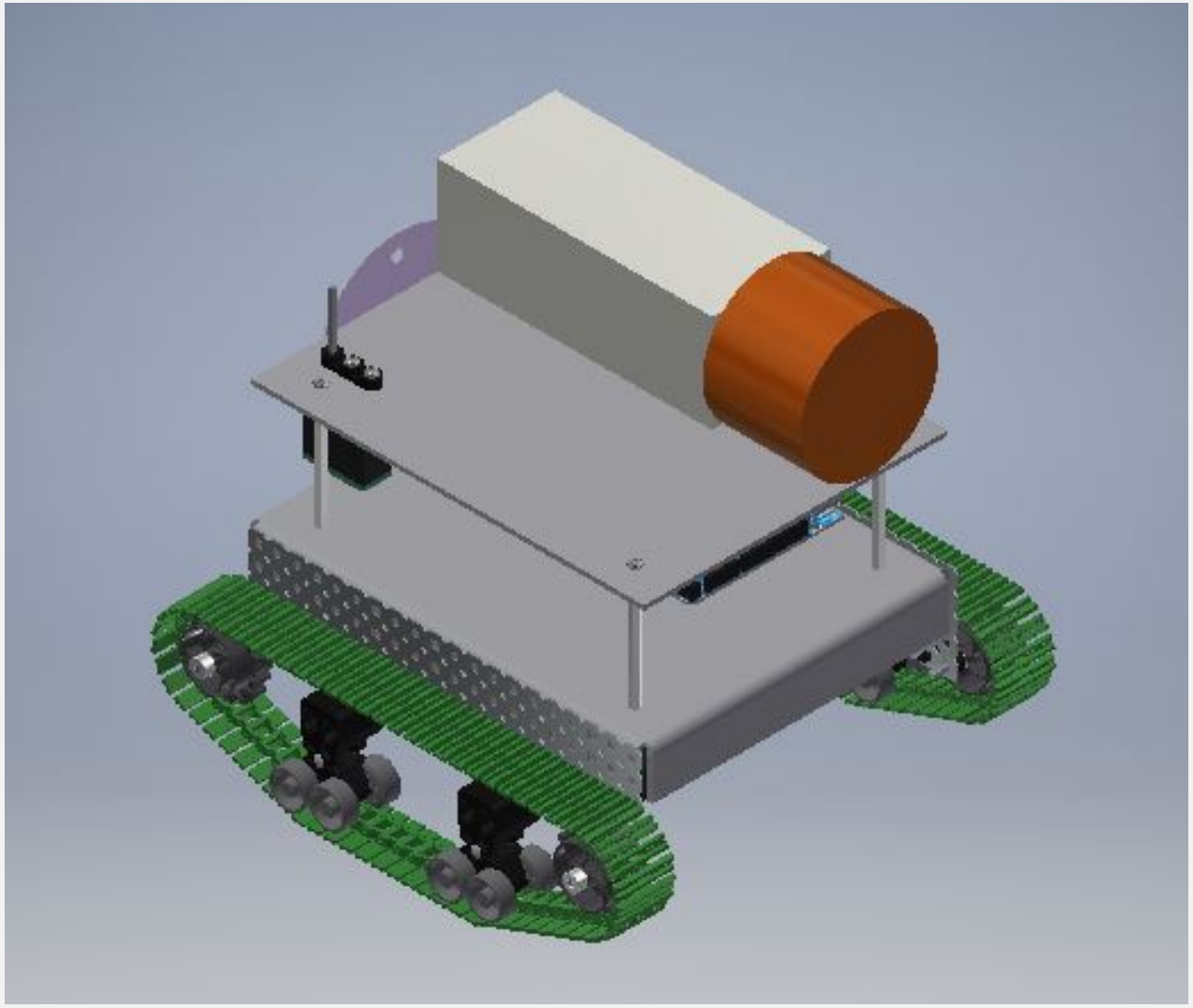
  Real testing



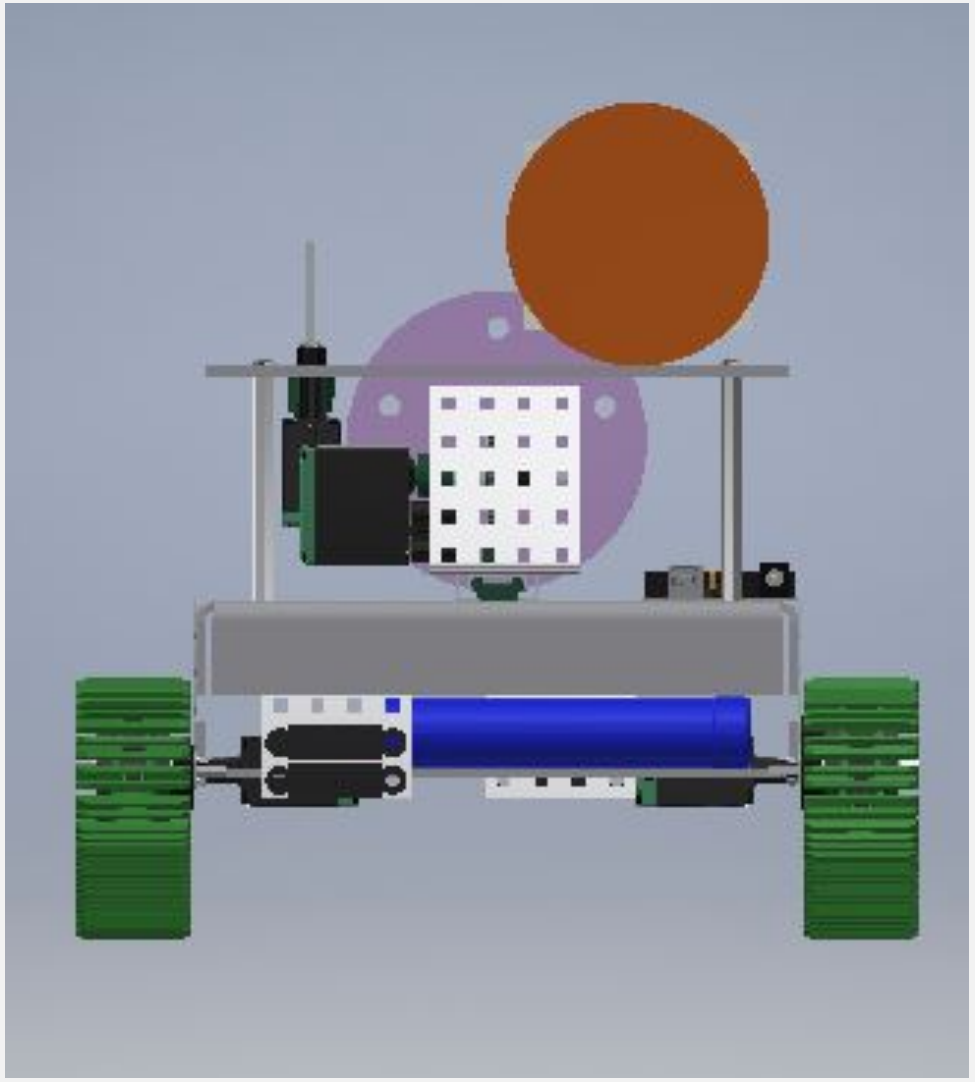
STAGE 4 – DESCRIPTION

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





Top Front View



Front View

BUDGET UPDATE

- Current Spent: $556.73
- Budget Left: $193.27

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
Shipping	1	$21.15

NEXT PHASE

Spring Break:

- Stage to stage movement – March 4th
- All stages finished – March 10th
- Wiring (80%) & Coding (90%) – March 17th

After Break:

- Wiring (100%) & Coding (100%)
- Minor adjustments – March 17th to competition