



EGR101

SIMULATION

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PROBLEM

- ❖ COVID-19 makes hands-on BOE-Bot construction difficult
- ❖ Parallax BOE-Bots cost **\$119.95** per kit
- •
- ❖ Replacement cardboard kits cost **\$85** each
- ❖ Needed a way of conducting course activities virtually

Part	Amount	Price	Total
Parallax Continuous Rotation Servo	2	17.99	35.98
1" Tail Wheel Ball	1	3.95	3.95
Battery Holder 5-AA Barrel Jack	1	3.99	3.99
Robot Wheel & Molded Tire for Servos (pair)	1	4.95	4.95
SparkFun Line Sensor Breakout - QRE1113 (Analog)	2	2.95	5.9
REXQualis - Arduino kit	1	30.99	30.99
SubTotal			85.76



Parallax BOEBot
Robot for Arduino
Kit

\$119.95
Adafruit Industries

PROJECT OVERVIEW

Application virtualizes all aspects of the EGR 101 Project:

- Component Configuration
- Wiring
- Coding IDE
- 3D Simulation
- Packaging Configuration



CONSTRAINTS

Accessibility:

- ❖ Multiple Operating Systems
- ❖ Low-End Optimal Performance
- ❖ Colorblind Assistance

Scope:

- ❖ Only simulate components that are required in the course





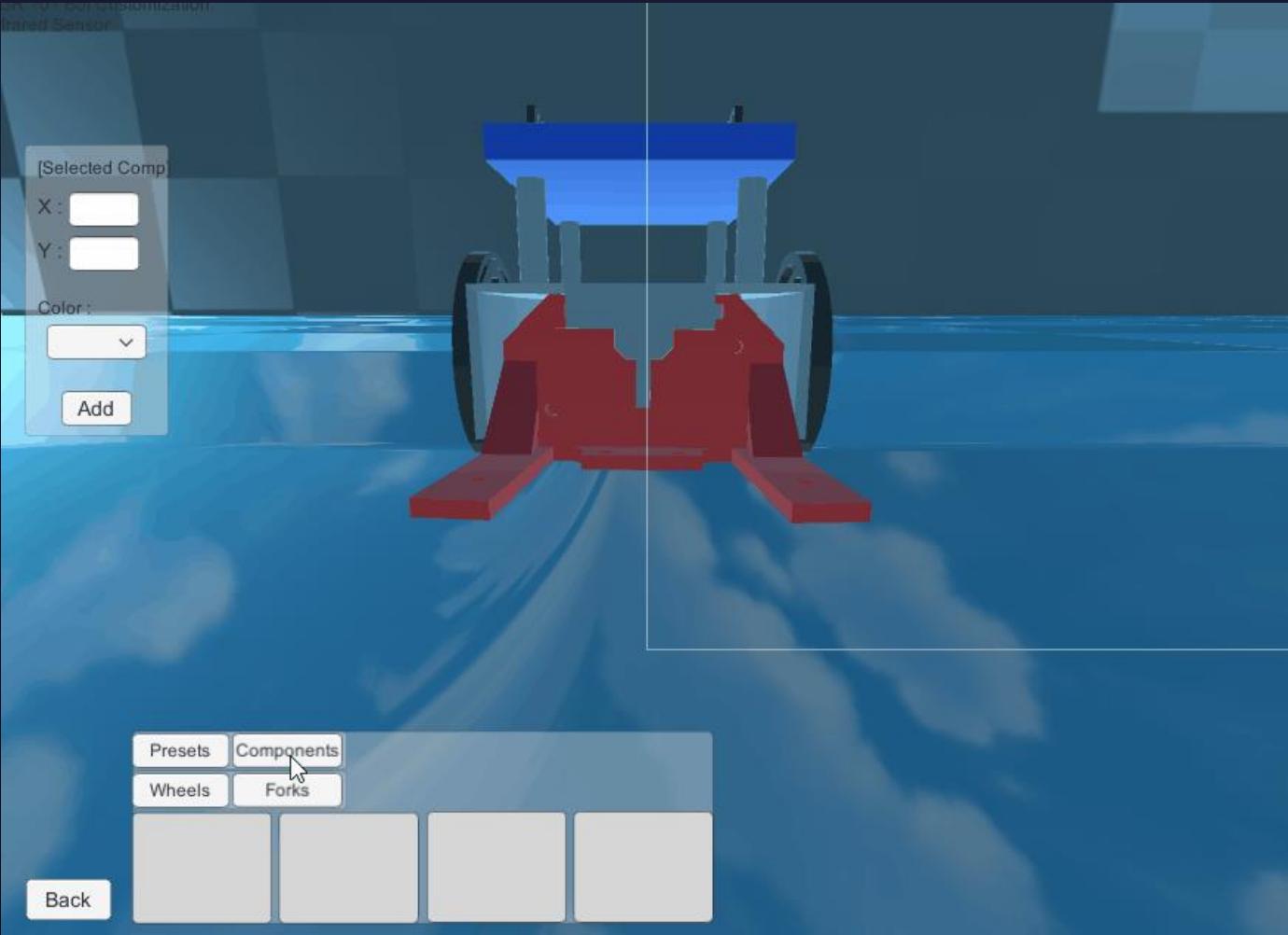
LIST OF FEATURES

- ❖ Bot Customization
 - ❖ Wiring
 - ❖ Arduino IDE
 - ❖ Arduino Emulation
 - ❖ 3D Simulation
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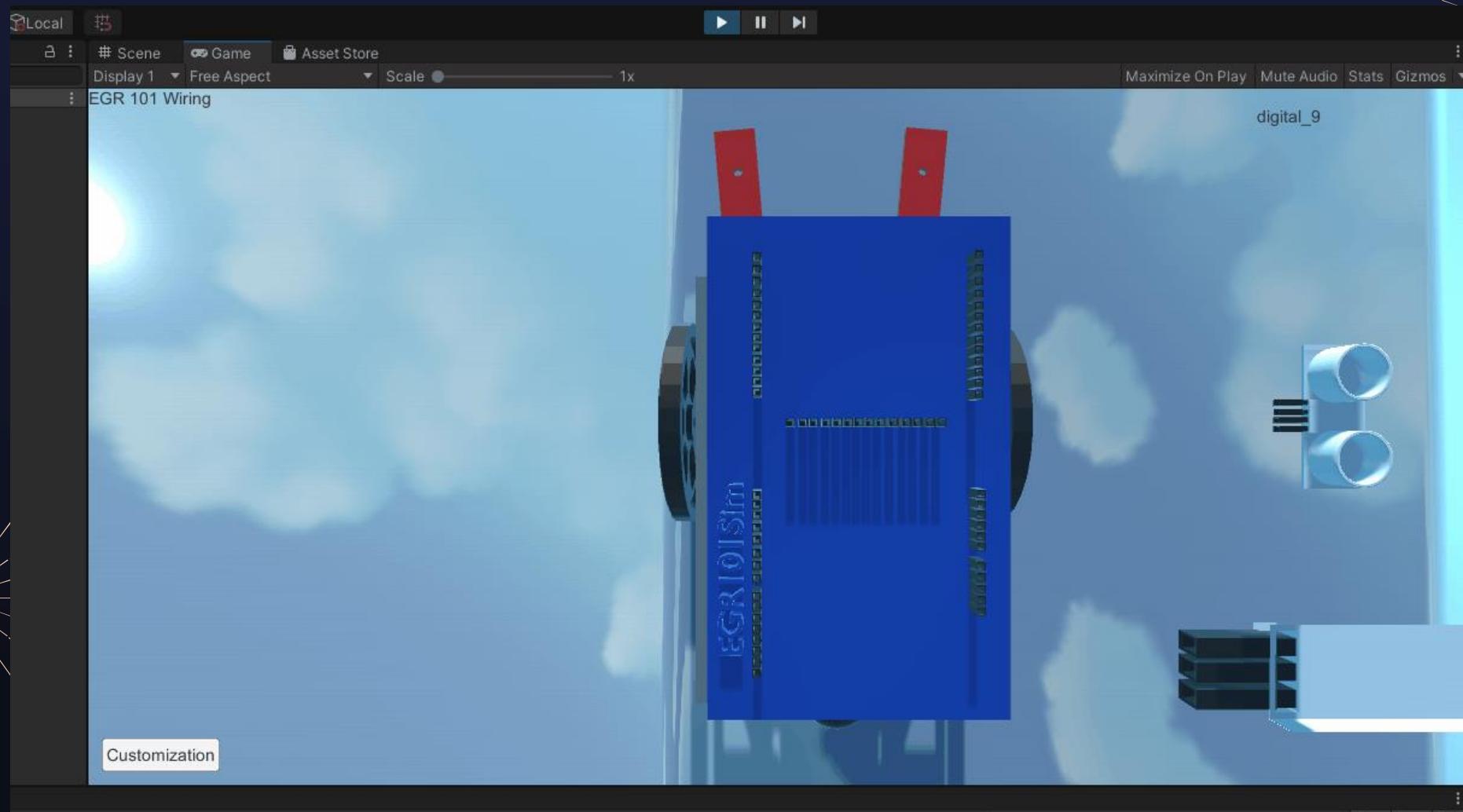
BOT CUSTOMIZATION



BOT CUSTOMIZATION



WIRING



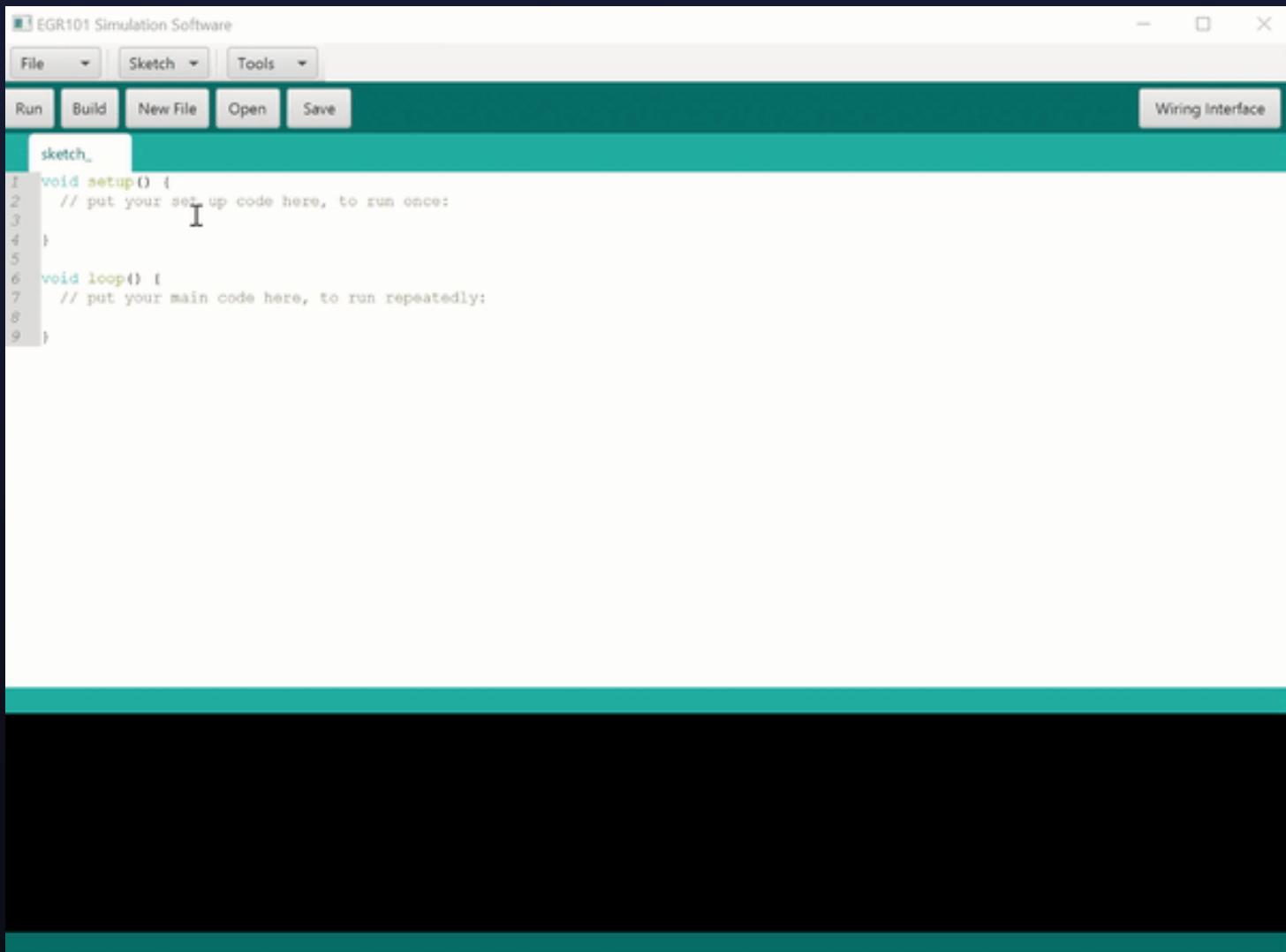
ARDUINO IDE

Working replica of the Arduino IDE:

- ❖ Interprets and compiles Arduino code
- ❖ Keyword coloring and line numbers
- ❖ Errors display in console output



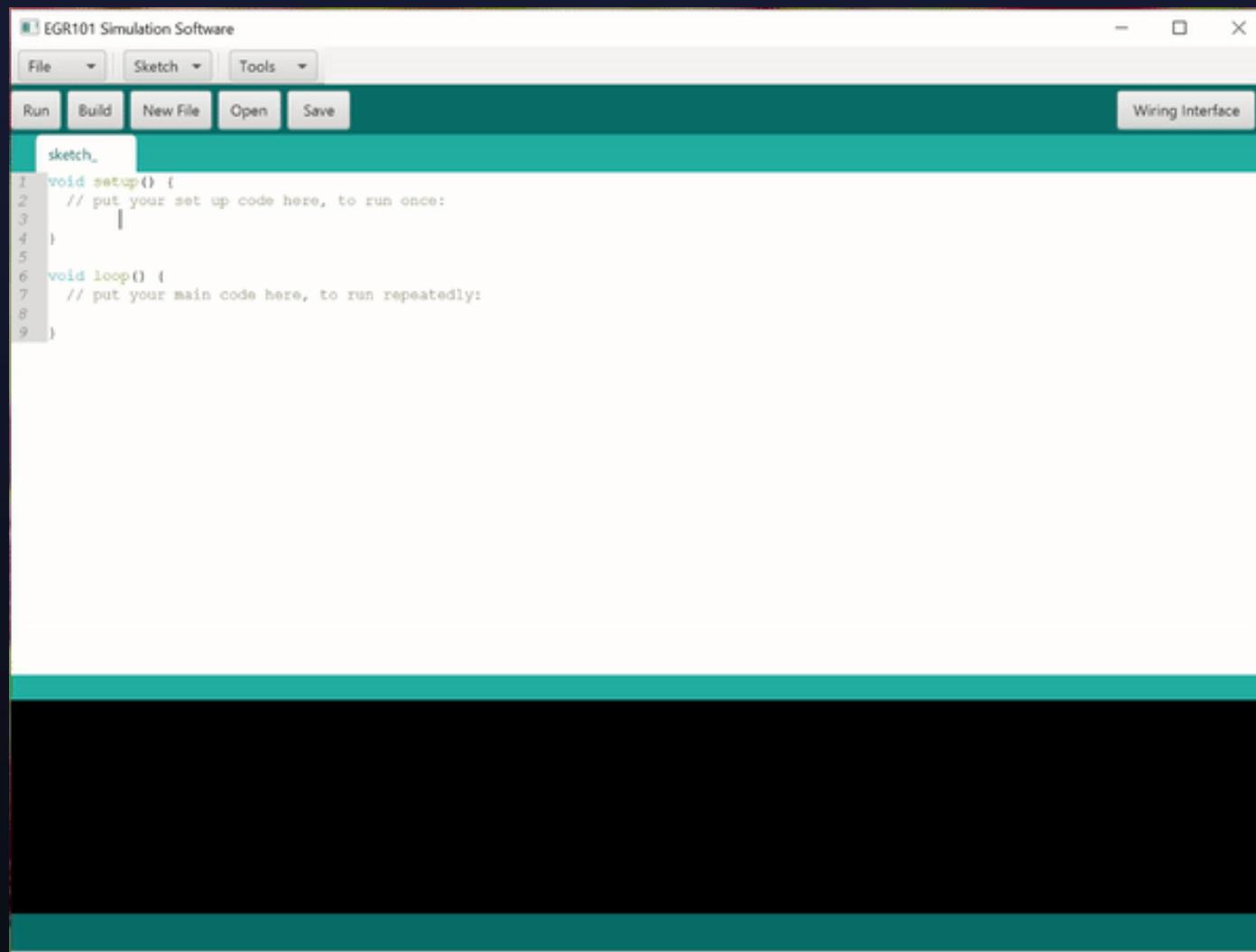
ARDUINO IDE



The image shows a screenshot of the Arduino IDE interface. The title bar reads "EGR101 Simulation Software". The menu bar includes "File", "Sketch", "Tools", "Run", "Build", "New File", "Open", "Save", and "Wiring Interface". The main area displays a code editor with the following content:

```
sketch_
1 void setup() {
2     // put your set-up code here, to run once:
3
4 }
5
6 void loop() {
7     // put your main code here, to run repeatedly:
8
9 }
```

ARDUINO IDE



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4
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8 }
```



ARDUINO EMULATION

- ❖ Simulate wired connections between pins
 - Voltage, Current, Resistance
- ❖ Simulate Component Functionality
 - Is the component powered?
 - Is the component grounded?
- ❖ Simulate Arduino Behavior changes related to code
 - I/O Voltage Writing
 - Time Delays

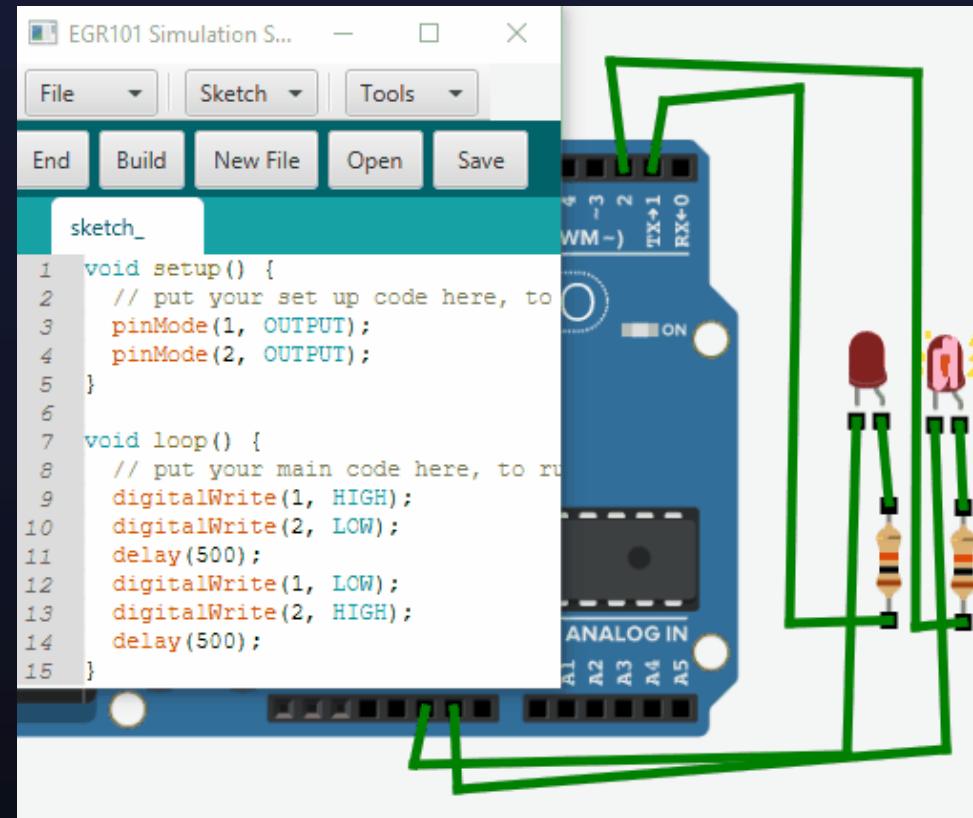
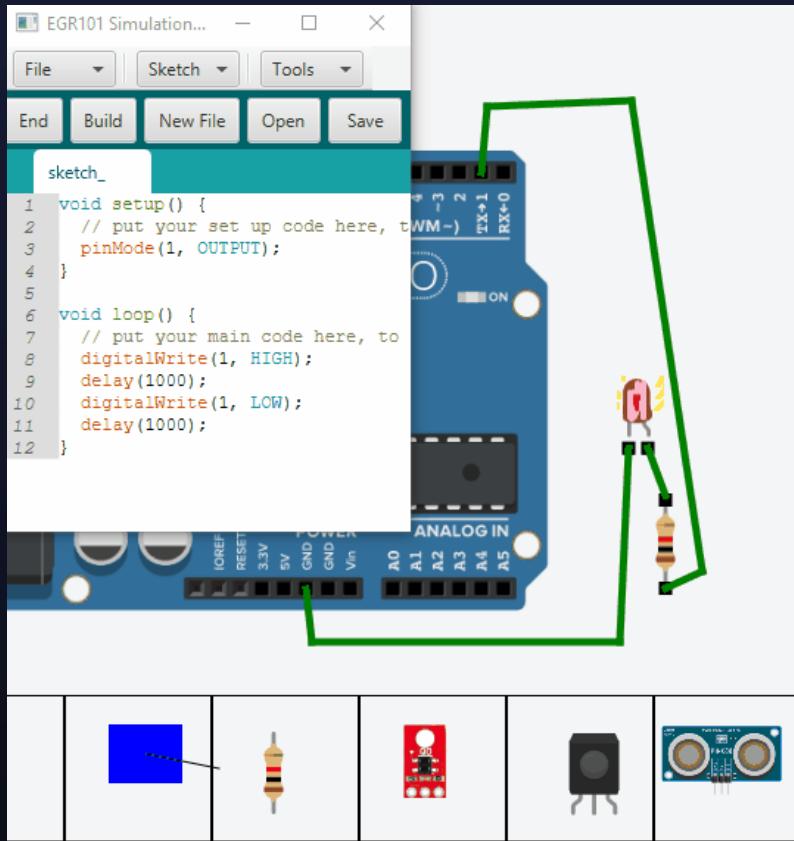
ARDUINO EMULATION (CONT'D)

Simulation of these specific components:

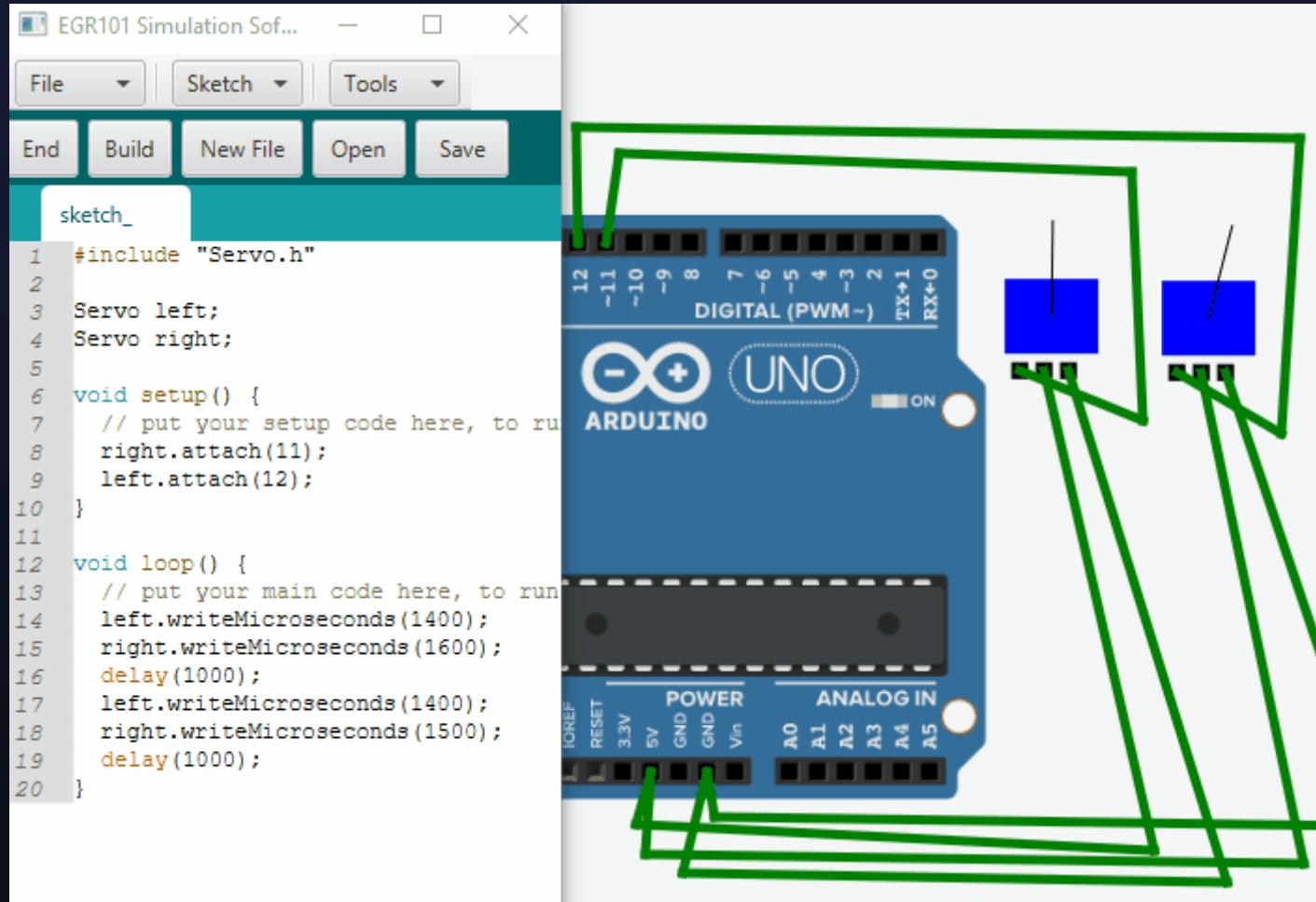
- ❖ LEDs
- ❖ Resistors
- ❖ Servo Motor
- ❖ Line-reading IR
- ❖ Distance-measuring IR
- ❖ Ultrasonic



LEDS



CONTINUOUS SERVO MOTORS



LINE READING IR SENSORS

EGR101 Simulation Software

File Sketch Tools

End Build New File Open Save

sketch_

```
1 #include "Servo.h"
2
3 Servo l;
4 Servo r;
5
6 void setup() {
7     // put your setup code here, to run once:
8     pinMode(A1, INPUT);
9     pinMode(A2, INPUT);
10
11    l.attach(1);
12    r.attach(2);
13 }
14
15 void loop() {
16     // put your main code here, to run repeatedly:
17
18     if(analogRead(A1) > 800) {
19         l.writeMicroseconds(1600);
20         r.writeMicroseconds(1600);
21
22     } else if( analogRead(A2) > 800 ) {
23         l.writeMicroseconds(1400);
24         r.writeMicroseconds(1400);
25     } else {
26         l.writeMicroseconds(1400);
27         r.writeMicroseconds(1600);
28     }
29 }
```

Wiring GUI

input or an output.

Wiring Interface

UNO

DIGITAL (PWM -)

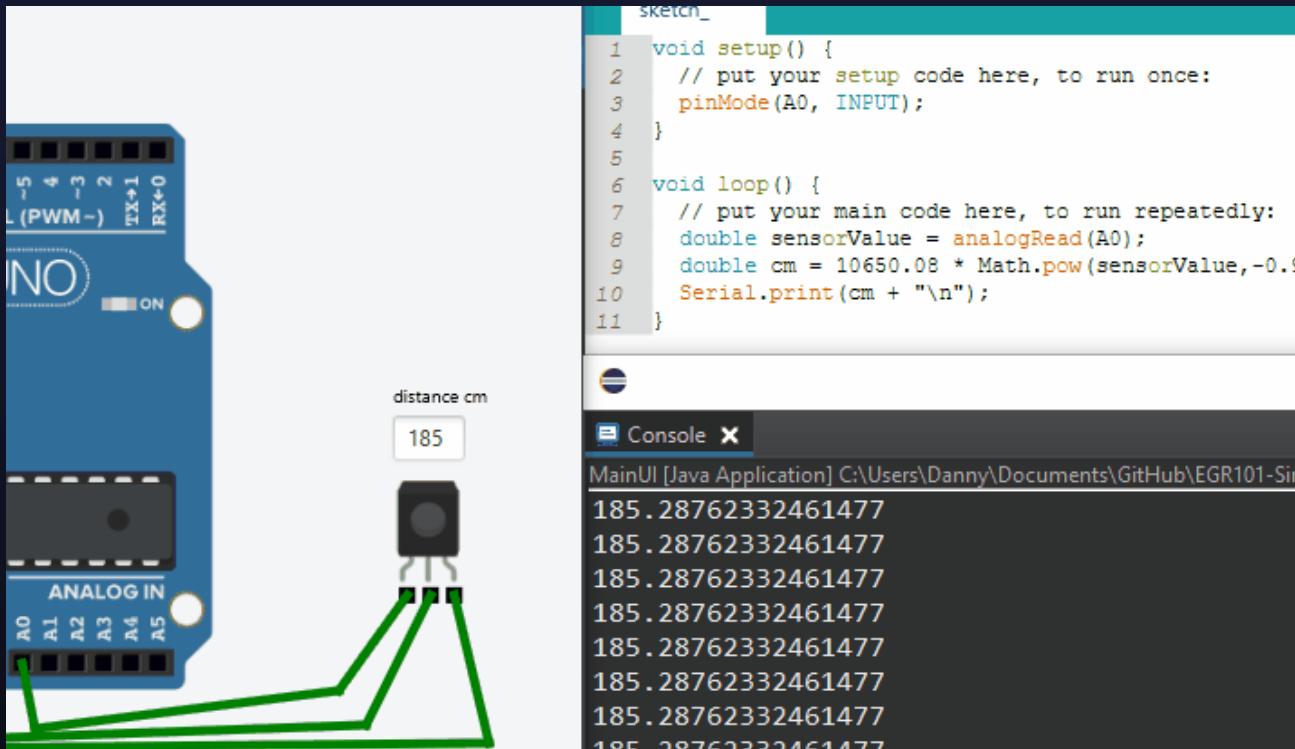
light reflect %

light reflect %

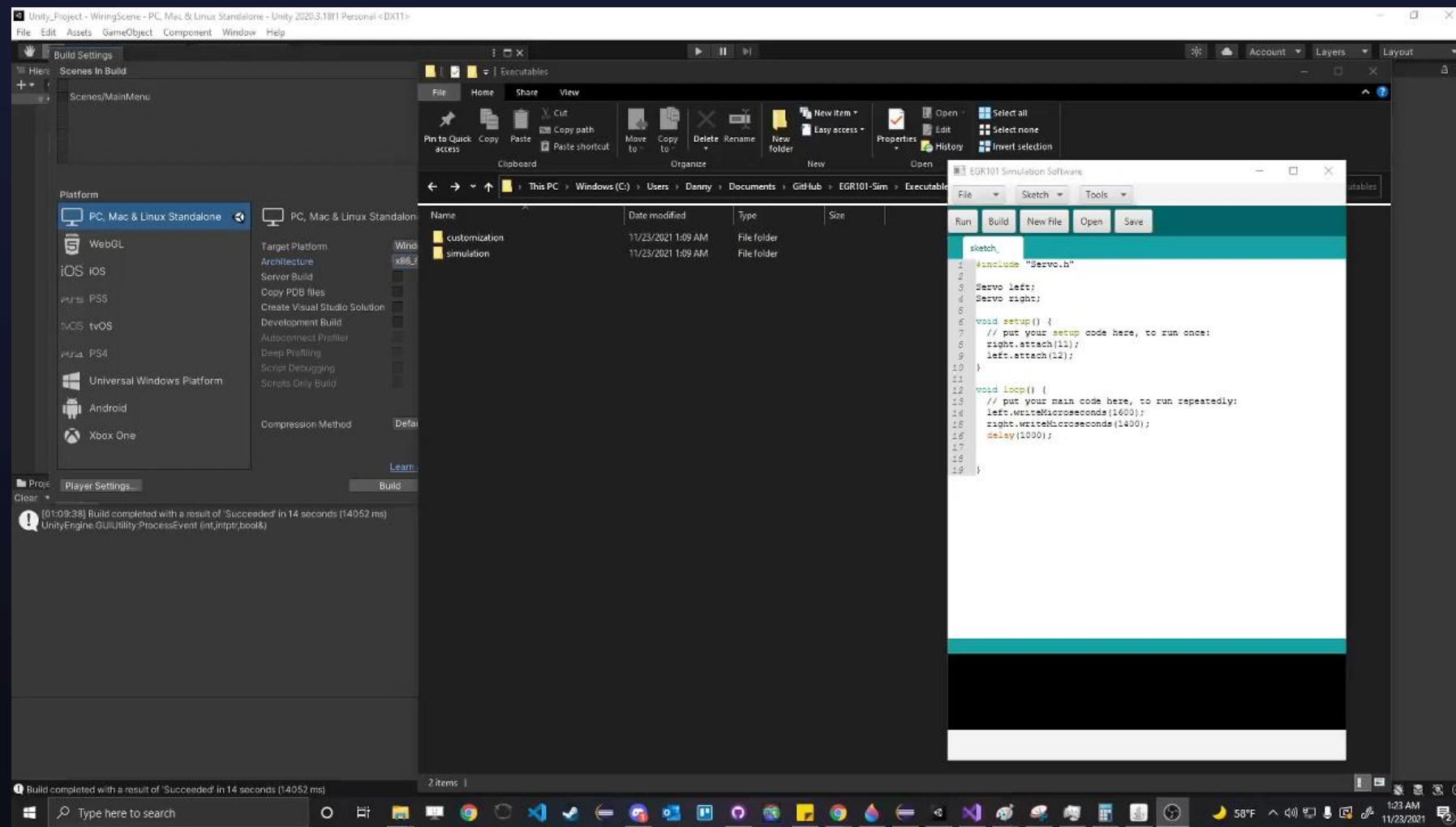
Components shown in the library:

- Resistor
- Blue square component (likely a logic inverter or similar)
- Red cylindrical component (likely a diode)
- Red cylindrical component (likely a diode)
- Black cylindrical component (likely a transistor)
- Blue circular component with a green center (likely an IR sensor)

DISTANCE MEASURING IR & ULTRASONIC SENSOR



SIMULATION



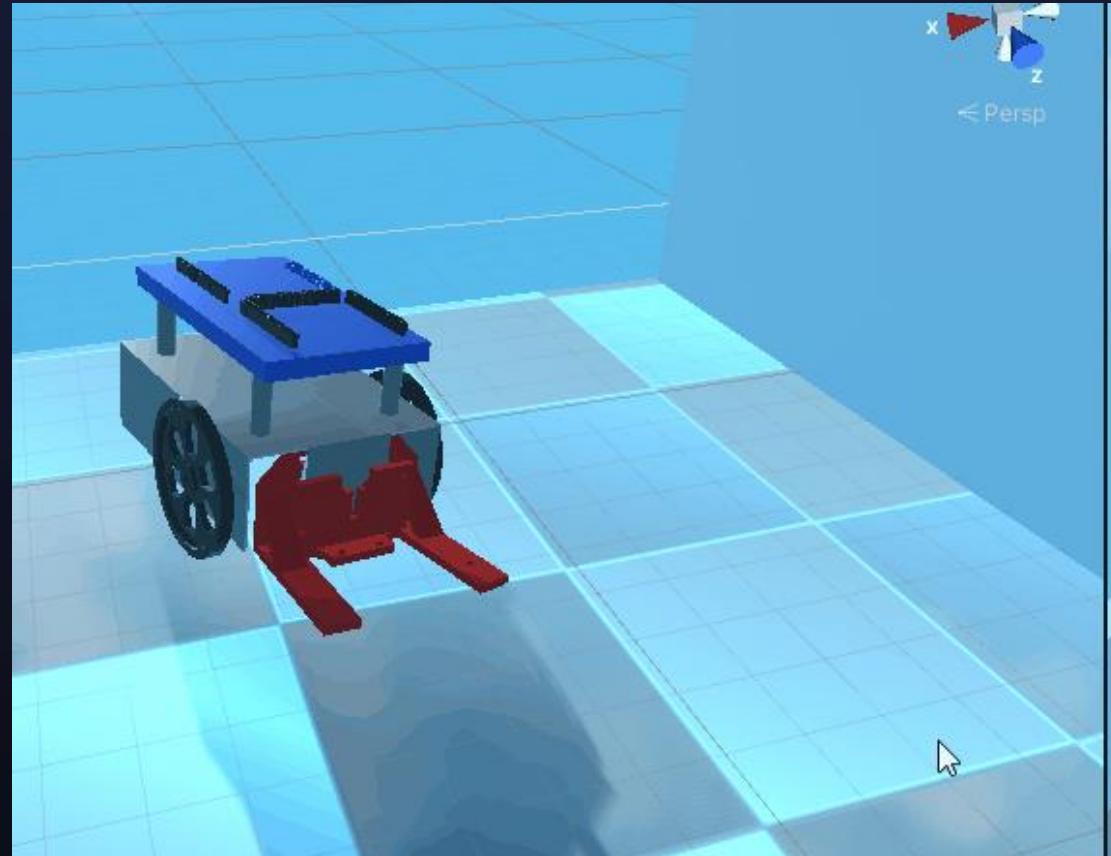
POSSIBLE ISSUES/RESOLUTIONS

ISSUE	RESOLUTION
Lack of security in Arduino accessibility modifiers.	Privatize variables and functions.
TCP could be resource heavy.	Could switch to a UDP.
Performance with current Lighting.	Optimize workflow.

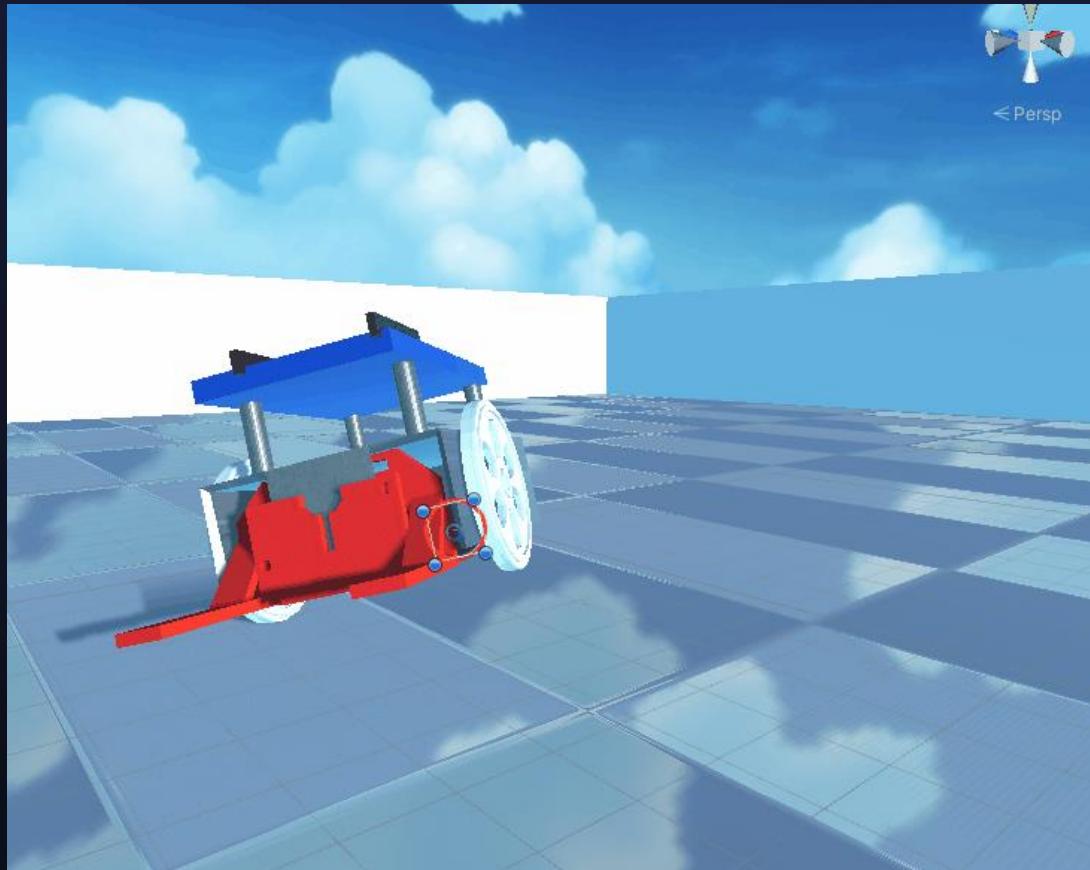
FUTURE PLANS

- ❖ Finish bot customization GUI
 - Get better pictures for UI elements
 - Preset functionality
 - Snap and drop component functionality
- ❖ Polish UI
- ❖ Re-work Wiring and Customization so that changes show on the Simulation

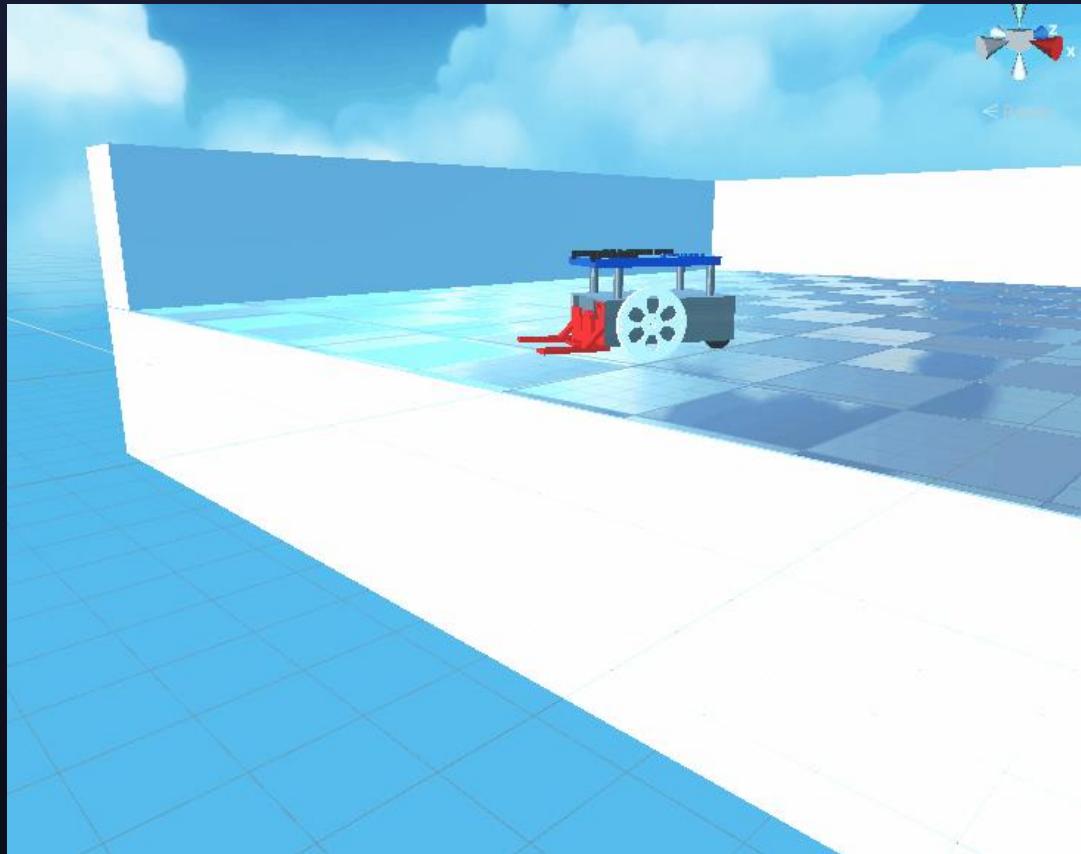
BLOOPERS



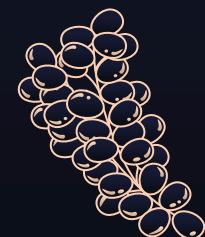
BLOOPERS



BLOOPERS



BLOOPERS



THANK YOU!

QUESTIONS?

