

# Security System

CEIS101 Final Course Project

**January 2024**

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# Introduction

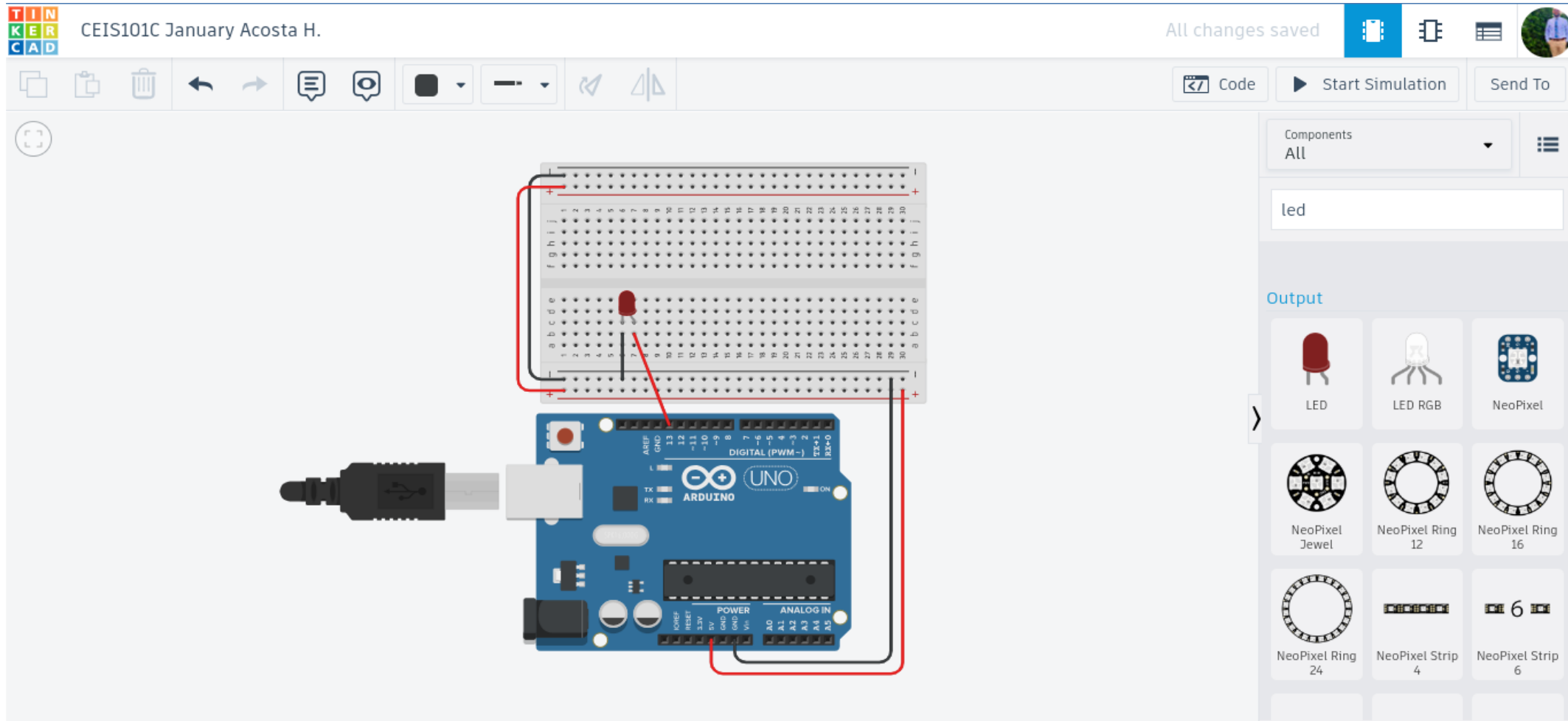
- The objective of this project is to create a smart home automation and security system using an integrated IoT system. The project is comprised of six parts that will progressively build on each other to produce a prototype which includes various devices such as a door sensor, distance sensor, and automated lights.
- The following tools were used in the project: Tinkercad for computer-aided design (CAD), Arduino Uno, Breadboard, 10k $\Omega$  resistor, LEDs, Ultrasonic Sensor, Active Buzzer, Photoresistor, wires, and a slide switch.

# CEIS101

## Module 2

Circuit Simulation in Tinkercad

# Circuit



# Code

TIN KER CAD CEIS101C January Acosta H.

All changes saved

Code Start Simulation Send To

1 (Arduino Uno R3)

Blocks + Text

- Output
- Input
- Notation
- Control
- Math
- Variables

on start

forever

wait 1 secs

repeat 10 times

repeat while

Serial Monitor

set pin 13 to HIGH

wait 1 secs

set pin 13 to LOW

wait 1 secs

```

1 // C++ code
2 //
3 void setup()
4 {
5   pinMode(13, OUTPUT);
6 }
7
8 void loop()
9 {
10  digitalWrite(13, HIGH);
11  delay(1000); // Wait for 1000 millisecond(s)
12  digitalWrite(13, LOW);
13  delay(1000); // Wait for 1000 millisecond(s)
14 }

```

# Module 2 Objective

- The objective of this module is to introduce the concept of simulation using a virtual emulator, familiarize myself with the hardware components required to build a physical system, understand programming logic and design of hardware, and learn about error handling principles in operating systems.

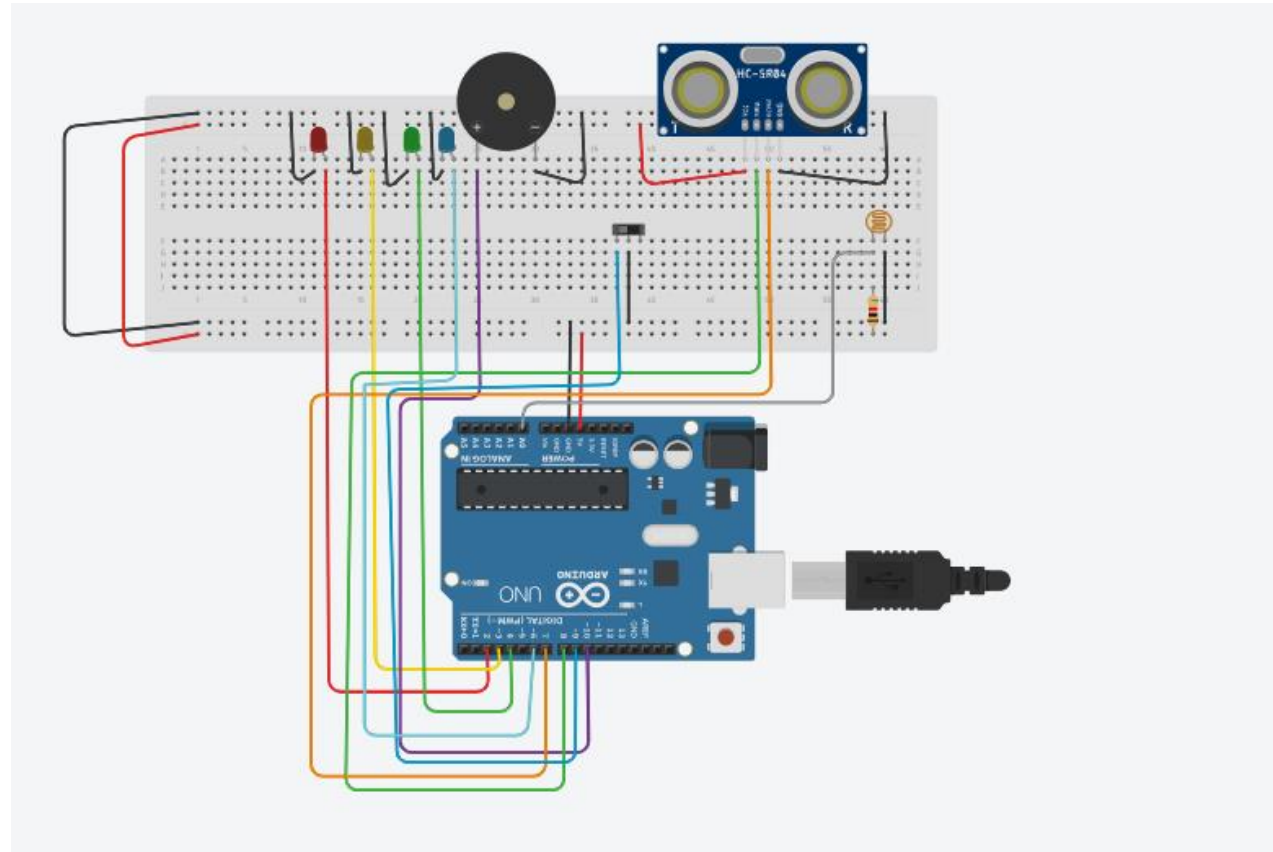
# CEIS101

## Module 3

Inventory of Parts, Circuit Building, and Displaying Messages

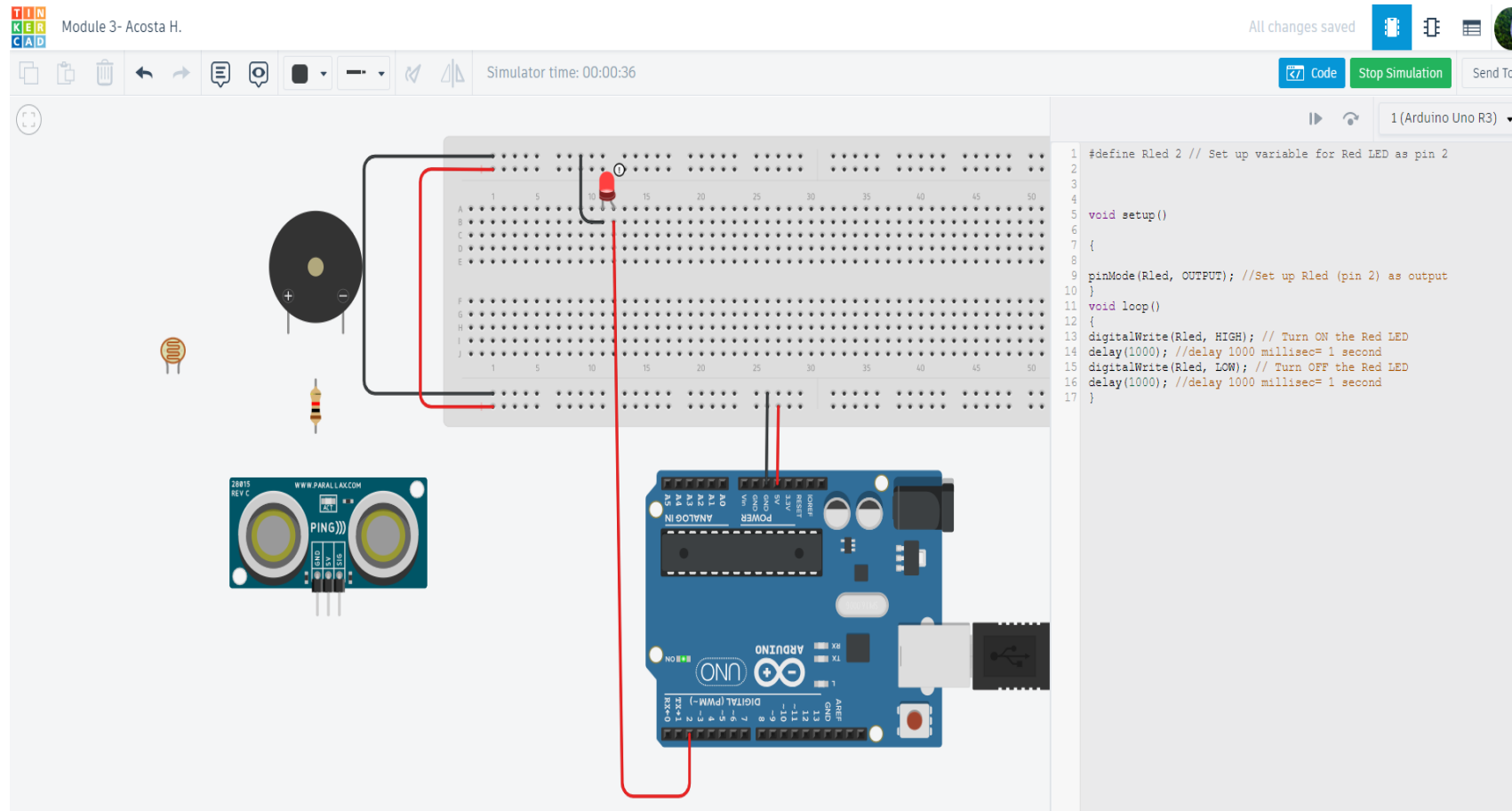
# Organization of Project Components

- Arduino Uno
- Breadboard
- Resistor 10k $\Omega$
- LEDs
- Ultrasonic Sensor
- Active Buzzer
- Photoresistor
- Wires

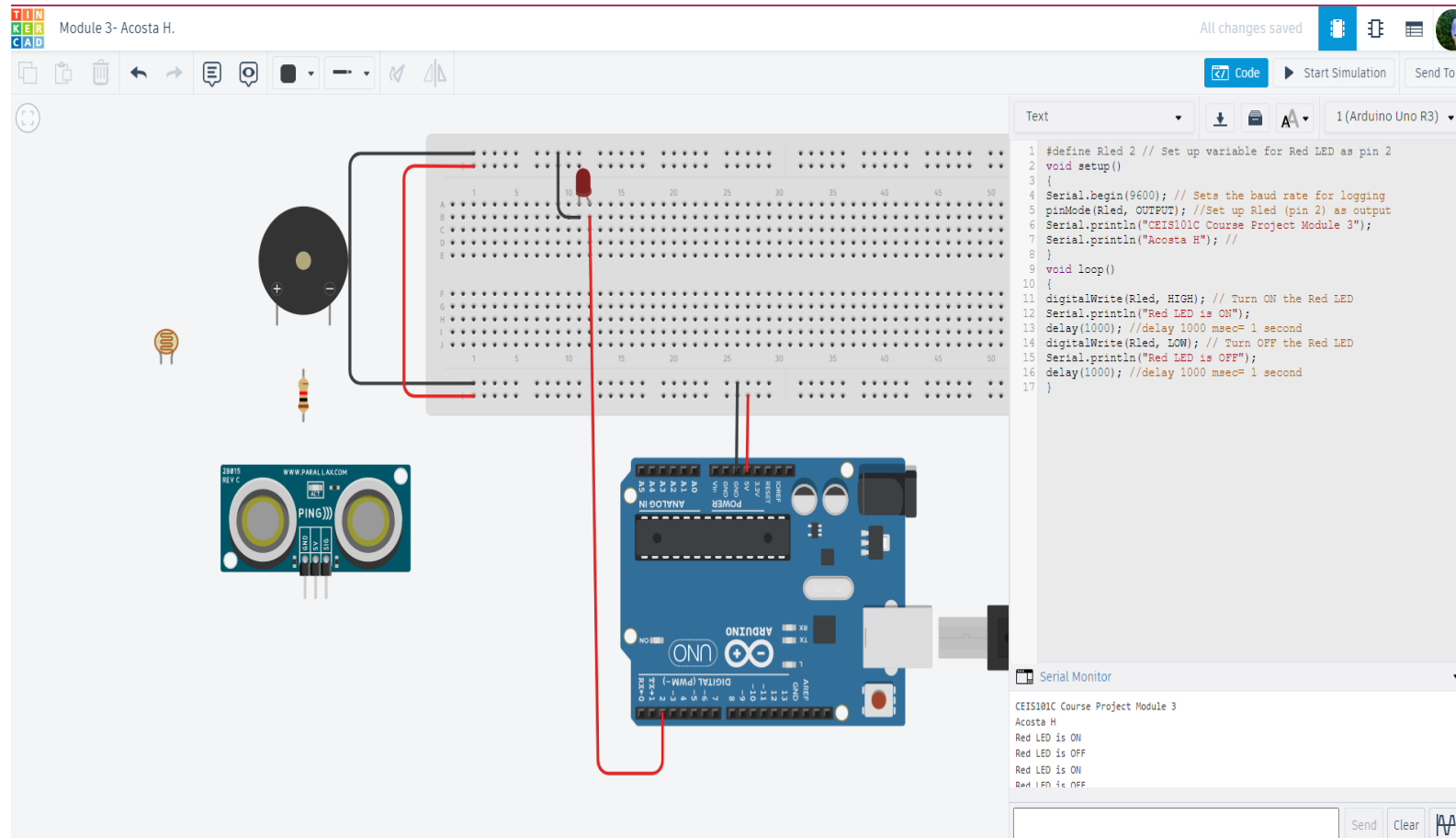




# Circuit with red LED on



# Serial Monitor



# Module 3 Objective

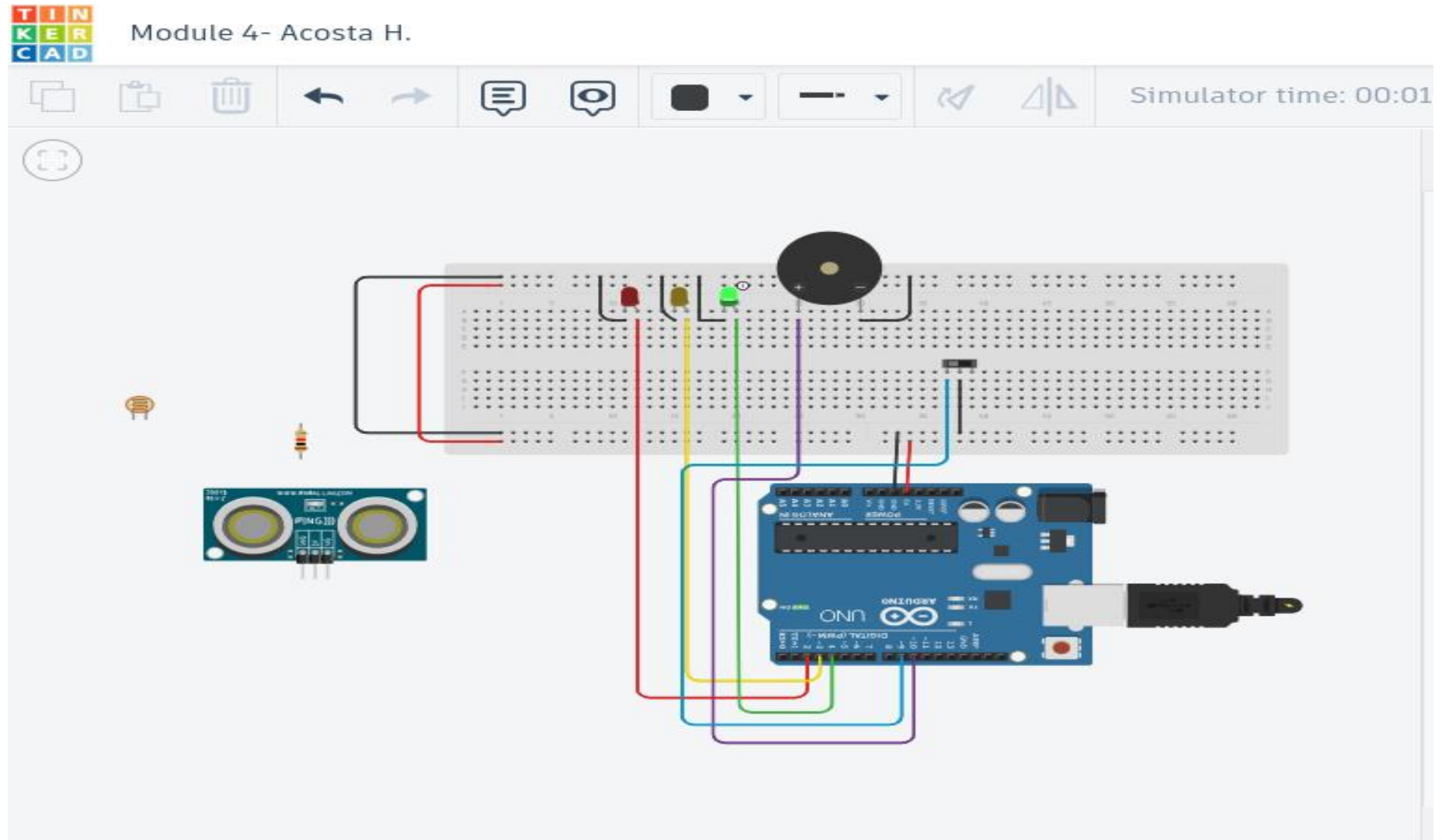
- The objective of this module is to acquaint myself with the hardware components required for the project, to gain knowledge of building circuits with LEDs (Light Emitting Diode), program LEDs, initialize the Serial Monitor, and send messages to it.

# CEIS101

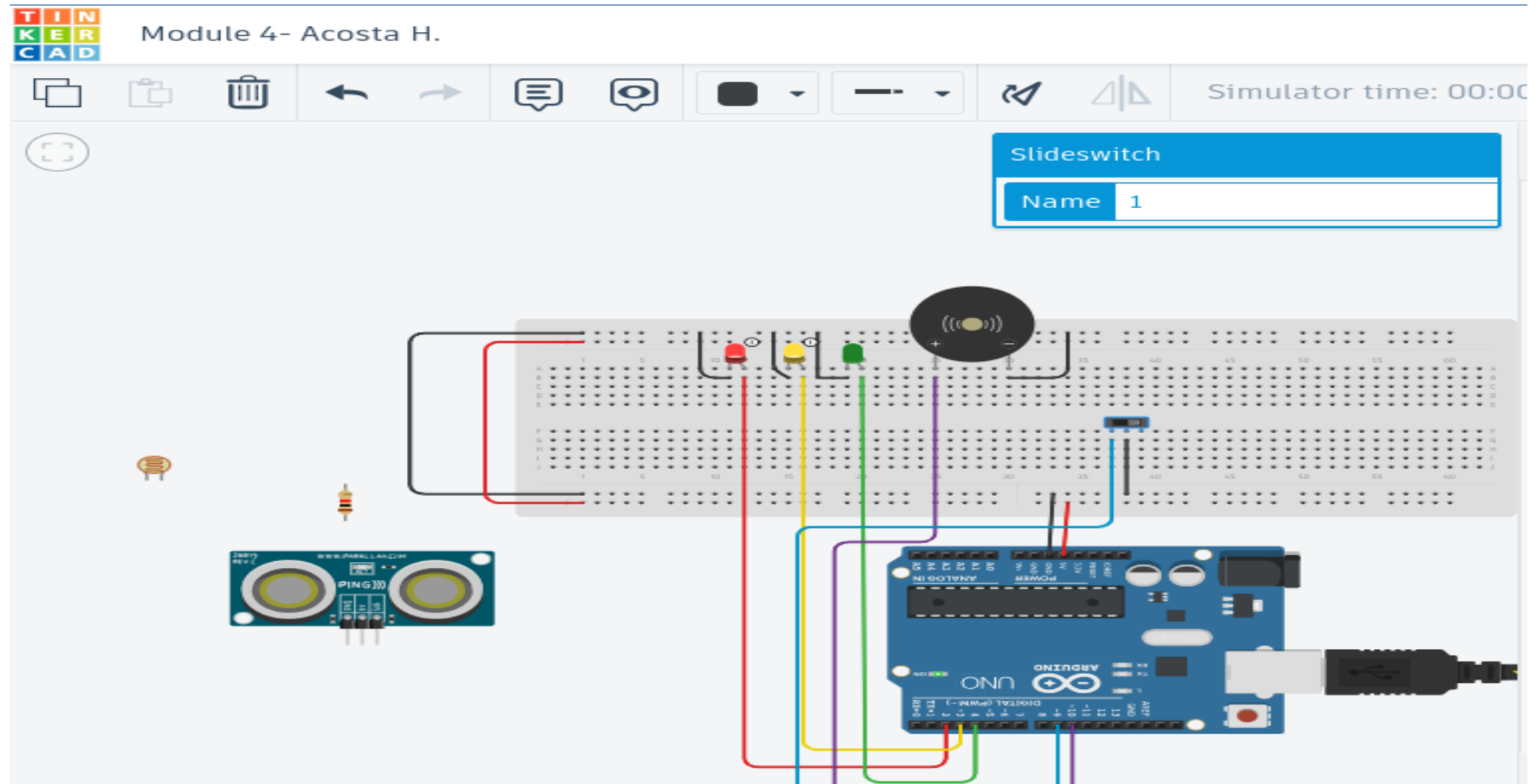
## Module 4

Adding Door Sensor to Smart Home System

# Circuit of door closed with Green LED ON

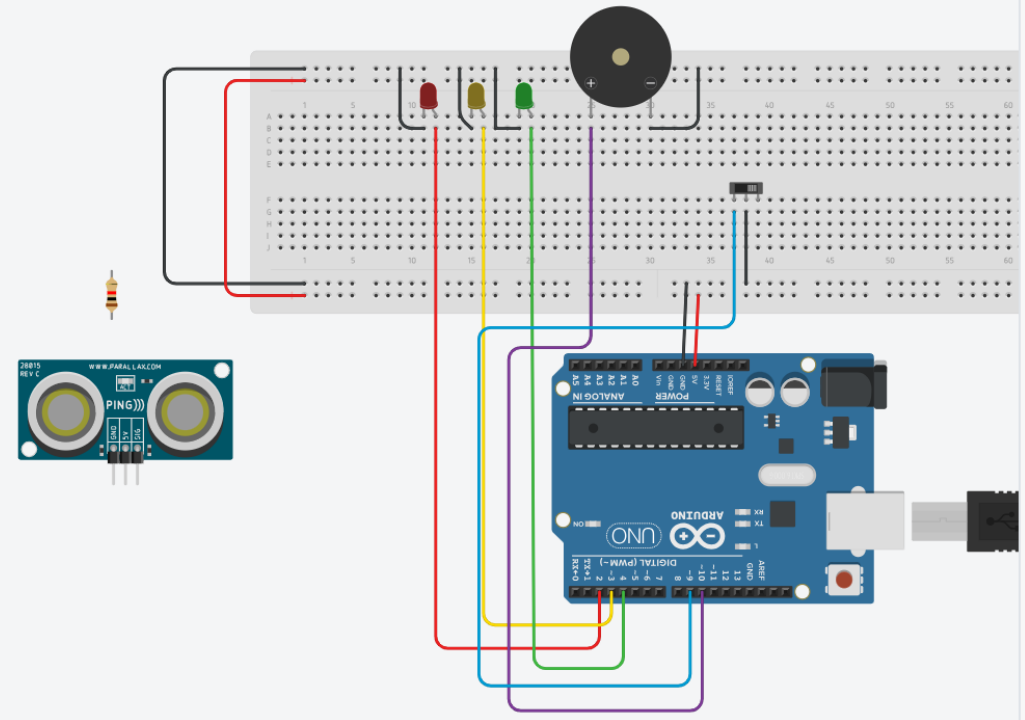


# Circuit of door open with Green LED OFF



# Arduino Code

TINKERCAD Module 4- Acosta H.



Code Editor (1 (Arduino Uno R3))

```

1 #define Rled 2
2 #define Yled 3
3 #define Gled 4
4 #define buzzer 10
5 #define door 9
6 #define delaytime 100 // === Second run, change to 100
7 void setup() {
8   Serial.begin(9600); // Set the baud rate
9   Serial.println("CEIS101C Course Project Module 4");
10  Serial.println("Name: Acosta H "); //replace xxxxx with your name
11  pinMode(Rled, OUTPUT);
12  pinMode(Yled, OUTPUT);
13  pinMode(Gled, OUTPUT);
14  pinMode(buzzer, OUTPUT);
15  digitalWrite(buzzer, LOW);
16  pinMode(door, INPUT_PULLUP); //door sensor
17 }
18 void loop() {
19   int value=digitalRead(door);
20   if(value == 0) { // Door closed, no security threat
21     digitalWrite(Rled, LOW);
22     digitalWrite(Yled, LOW);
23     digitalWrite(Gled, HIGH);
24     noTone(buzzer);
25   }
26   else { // Door open, security threat
27     Serial.println("Door is open. Security Alert! ");
28     digitalWrite(Rled, HIGH);
29     digitalWrite(Yled, HIGH);
30     tone(buzzer, 500);
31     digitalWrite(Gled, LOW);
32     delay(delaytime);
33     digitalWrite(Rled, LOW);
34     digitalWrite(Yled, LOW);
35     digitalWrite(buzzer, LOW);
36     noTone(buzzer);
37     delay(delaytime);
38   } // end of else
39 } //end of loop
  
```

# Serial Monitor

TINKERCAD Module 4- Acosta H.

All changes saved

Simulator time: 00:00:01.753

Code Stop Simulation Send To

1 (Arduino Uno R3)

```

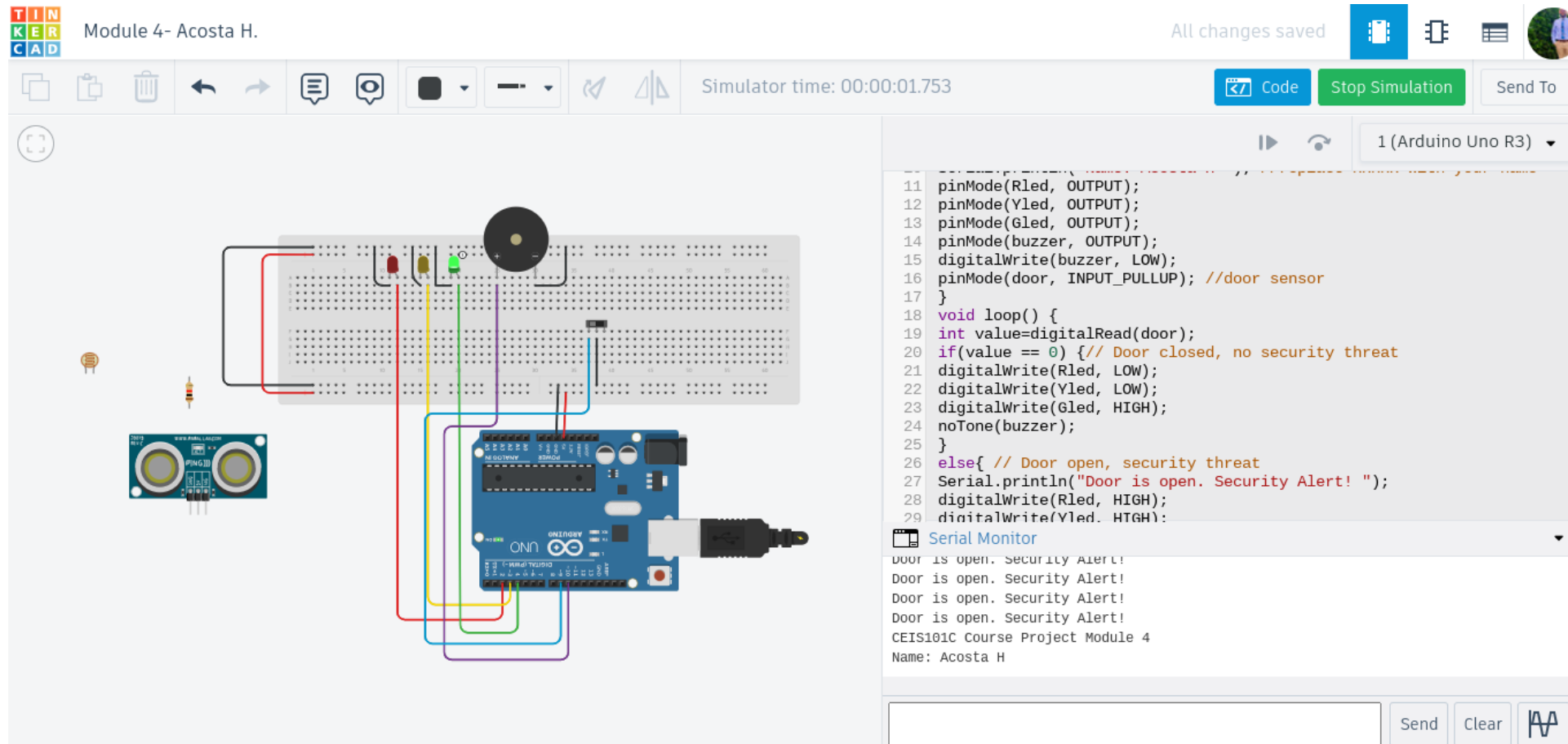
11 pinMode(Rled, OUTPUT);
12 pinMode(Yled, OUTPUT);
13 pinMode(Gled, OUTPUT);
14 pinMode(buzzer, OUTPUT);
15 digitalWrite(buzzer, LOW);
16 pinMode(door, INPUT_PULLUP); //door sensor
17 }
18 void loop() {
19   int value=digitalRead(door);
20   if(value == 0) { // Door closed, no security threat
21     digitalWrite(Rled, LOW);
22     digitalWrite(Yled, LOW);
23     digitalWrite(Gled, HIGH);
24     noTone(buzzer);
25   }
26   else{ // Door open, security threat
27     Serial.println("Door is open. Security Alert! ");
28     digitalWrite(Rled, HIGH);
29     digitalWrite(Yled, HIGH);

```

Serial Monitor

Door is open. Security Alert!  
 Door is open. Security Alert!  
 Door is open. Security Alert!  
 Door is open. Security Alert!  
 CEIS101C Course Project Module 4  
 Name: Acosta H

Send Clear





# Module 4 Objective

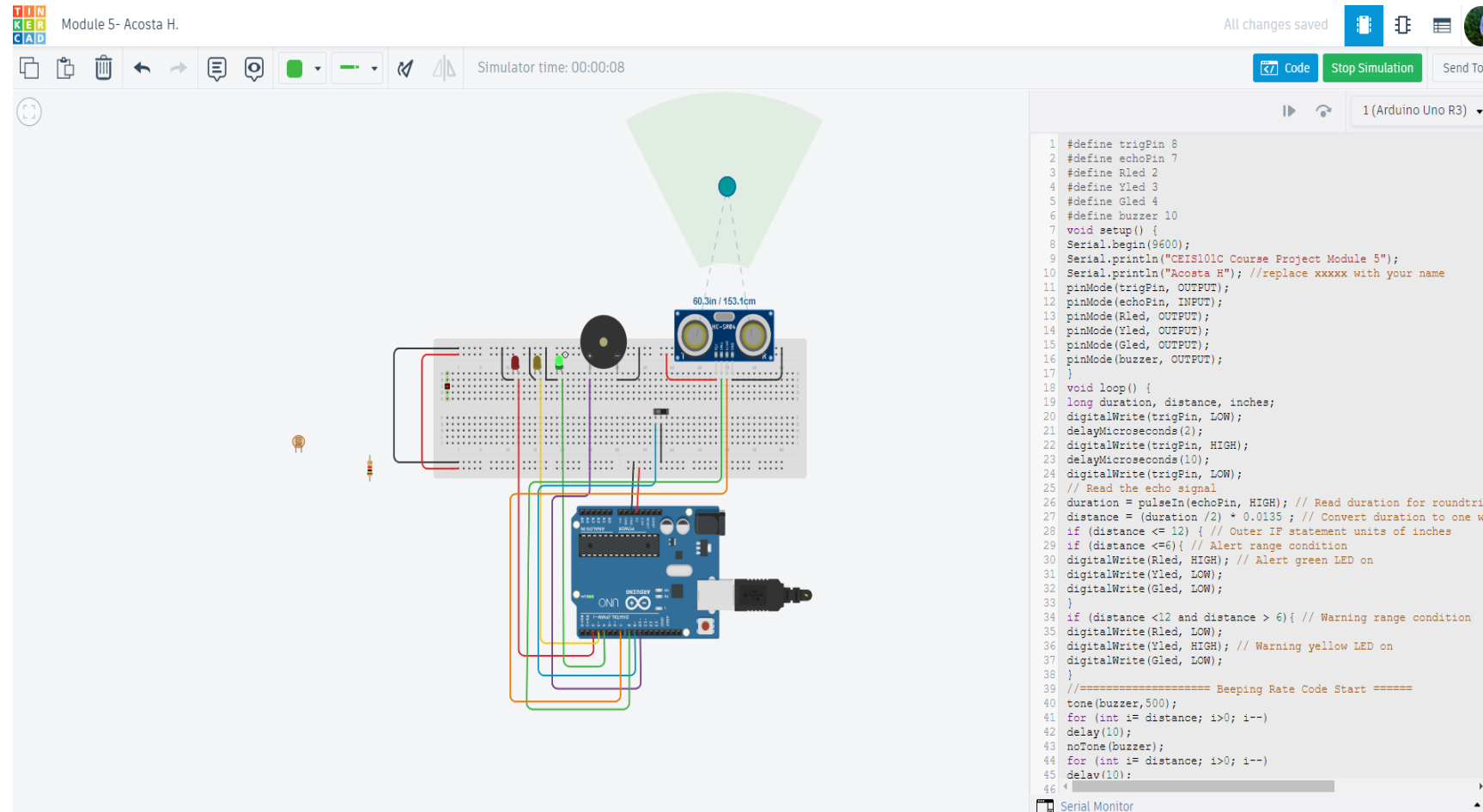
- The objective of this module is to connect multiple LEDs to the Arduino board, connect a buzzer to it, and a wire to simulate an open or closed door, integrate an alarm into a security system to become dramatically more effective and It's important to become familiar with conditional programming instructions. Conditional statements in Programming, also known as decision-making statements, allow a program to perform different actions based on whether a certain condition is true or false.

# CEIS101

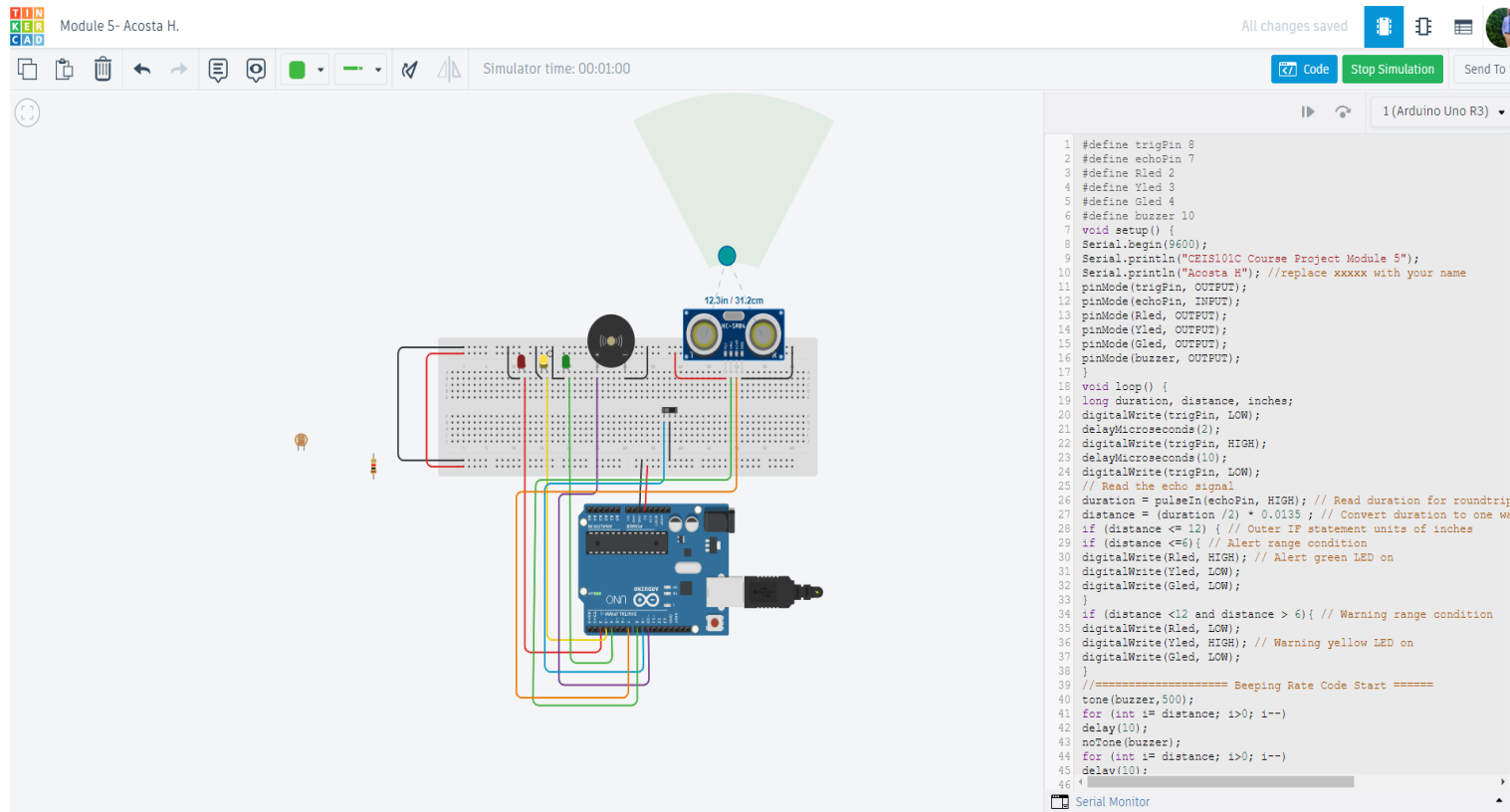
## Module 5

Adding Distance Sensor to Smart Home System  
and Conducting Data Analysis

# Circuit with green LED on



# Circuit with yellow LED on



# Circuit with red LED on

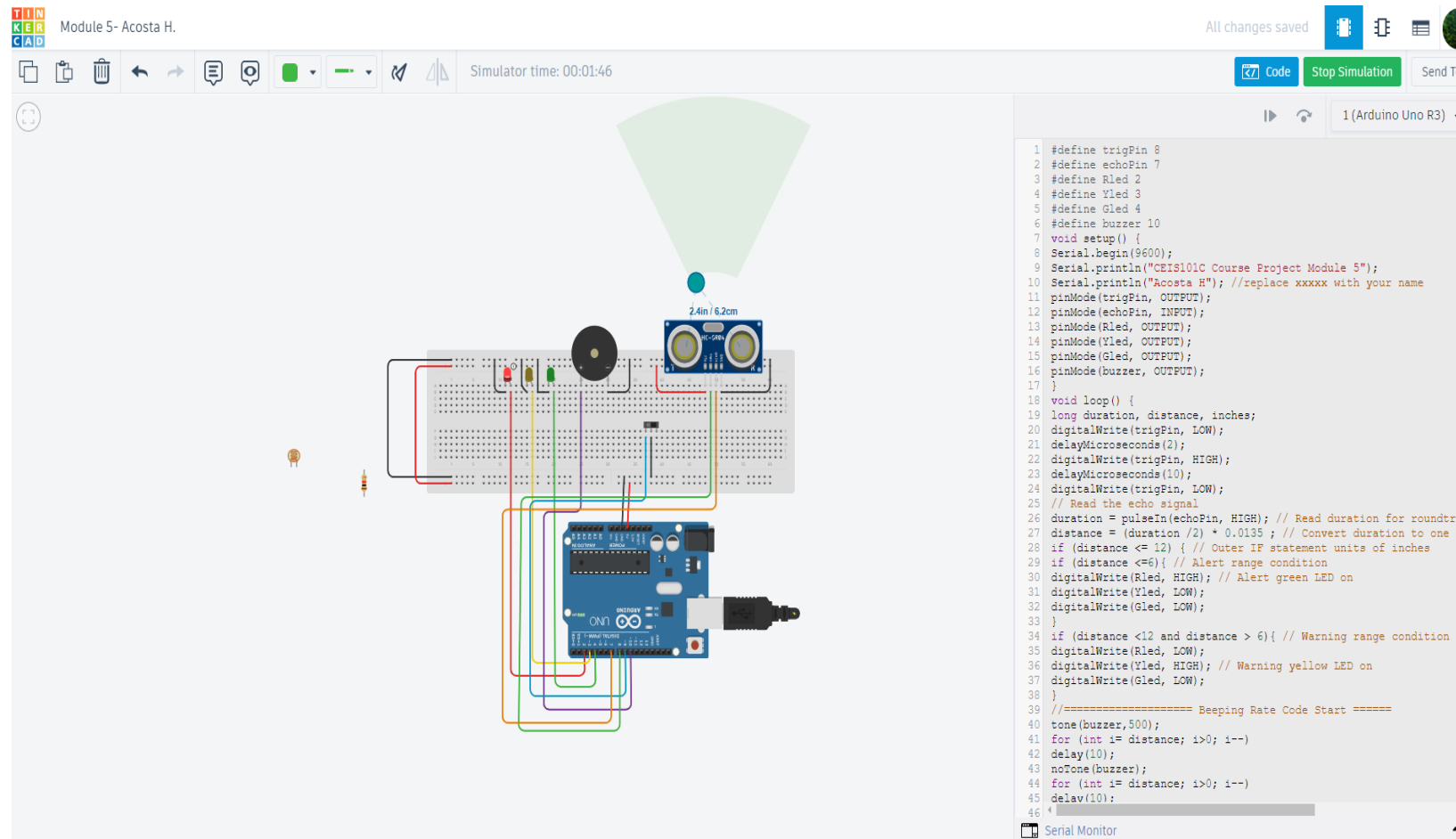
Module 5- Acosta H.

Simulator time: 00:01:46

All changes saved

Code Stop Simulation Send To

1 (Arduino Uno R3)



```

1 #define trigPin 8
2 #define echoPin 7
3 #define Rled 2
4 #define Yled 3
5 #define Gled 4
6 #define buzzer 10
7 void setup() {
8   Serial.begin(9600);
9   Serial.println("CEIS101C Course Project Module 5");
10  Serial.println("Acosta H"); //replace xxxxx with your name
11  pinMode(trigPin, OUTPUT);
12  pinMode(echoPin, INPUT);
13  pinMode(Rled, OUTPUT);
14  pinMode(Yled, OUTPUT);
15  pinMode(Gled, OUTPUT);
16  pinMode(buzzer, OUTPUT);
17 }
18 void loop() {
19   long duration, distance, inches;
20   digitalWrite(trigPin, LOW);
21   delayMicroseconds(2);
22   digitalWrite(trigPin, HIGH);
23   delayMicroseconds(10);
24   digitalWrite(trigPin, LOW);
25   // Read the echo signal
26   duration = pulseIn(echoPin, HIGH); // Read duration for roundtrip
27   distance = (duration / 2) * 0.0135; // Convert duration to one way
28   if (distance <= 12) { // Outer IF statement units of inches
29     if (distance <= 6) { // Alert range condition
30       digitalWrite(Rled, HIGH); // Alert green LED on
31       digitalWrite(Yled, LOW);
32       digitalWrite(Gled, LOW);
33     }
34     if (distance <12 and distance > 6) { // Warning range condition
35       digitalWrite(Rled, LOW);
36       digitalWrite(Yled, HIGH); // Warning yellow LED on
37       digitalWrite(Gled, LOW);
38     }
39     //===== Beeping Rate Code Start =====
40     tone(buzzer,500);
41     for (int i= distance; i>0; i--)
42       delay(10);
43     noTone(buzzer);
44     for (int i= distance; i>0; i--)
45       delay(10);
46   }

```

Serial Monitor

# Arduino Code

All changes saved

Code Start Simulation Send To

Text 1 (Arduino Uno R3)

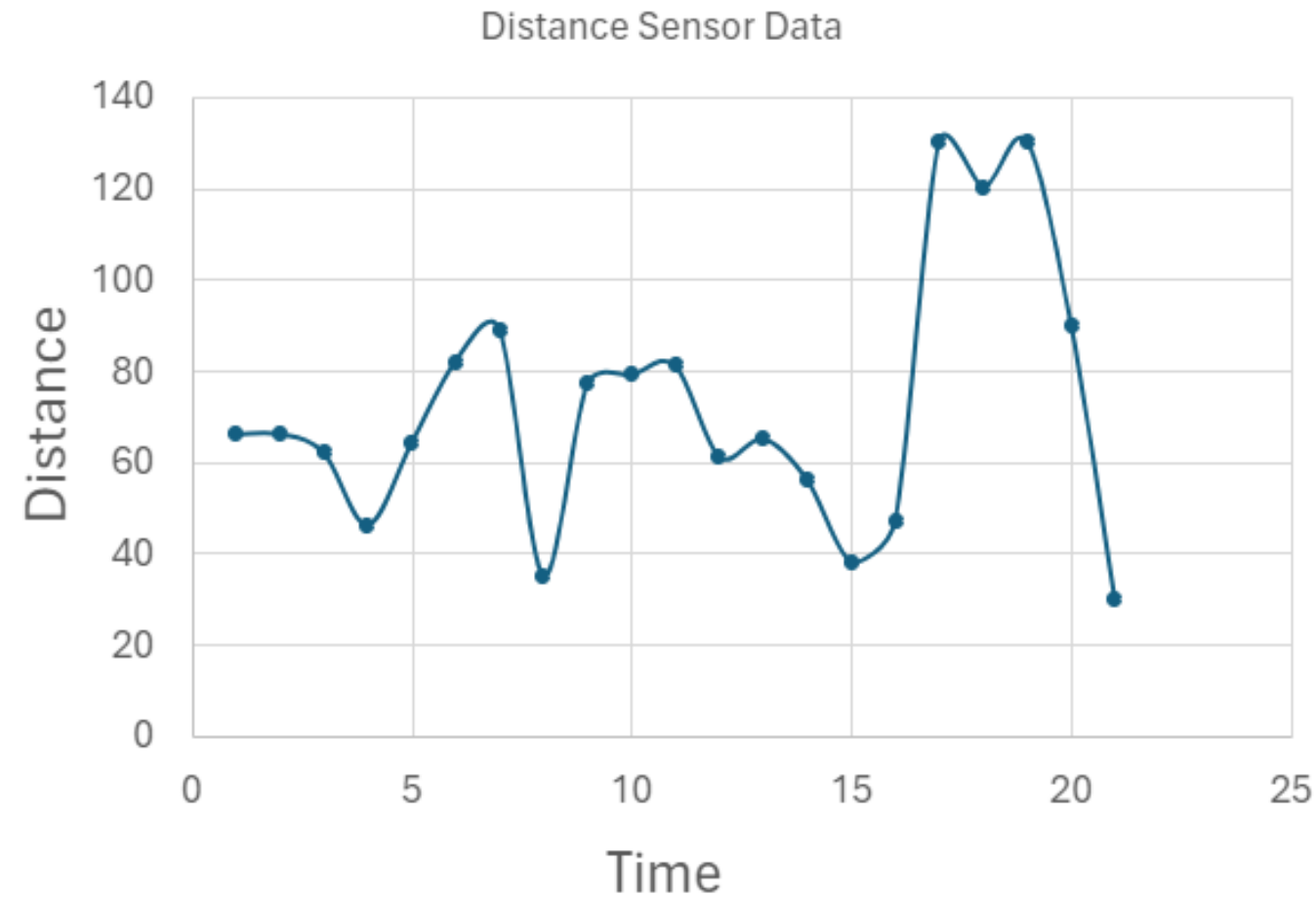
```

1 #define trigPin 8
2 #define echoPin 7
3 #define Rled 2
4 #define Yled 3
5 #define Gled 4
6 #define buzzer 10
7 void setup() {
8   Serial.begin(9600);
9   Serial.println("CEIS101C Course Project Module 5");
10  Serial.println("Acosta H"); //replace xxxxx with your name
11  pinMode(trigPin, OUTPUT);
12  pinMode(echoPin, INPUT);
13  pinMode(Rled, OUTPUT);
14  pinMode(Yled, OUTPUT);
15  pinMode(Gled, OUTPUT);
16  pinMode(buzzer, OUTPUT);
17 }
18 void loop() {
19   long duration, distance, inches;
20   digitalWrite(trigPin, LOW);
21   delayMicroseconds(2);
22   digitalWrite(trigPin, HIGH);
23   delayMicroseconds(10);
24   digitalWrite(trigPin, LOW);
25   // Read the echo signal
26   duration = pulseIn(echoPin, HIGH); // Read duration for roundtrip
27   distance = (duration / 2) * 0.0135; // Convert duration to one way
28   if (distance <= 12) { // Outer IF statement units of inches
29     if (distance <= 6) { // Alert range condition
30       digitalWrite(Rled, HIGH); // Alert green LED on
31       digitalWrite(Yled, LOW);
32       digitalWrite(Gled, LOW);
33     }
34     if (distance < 12 and distance > 6) { // Warning range condition
35       digitalWrite(Rled, LOW);
36       digitalWrite(Yled, HIGH); // Warning yellow LED on
37       digitalWrite(Gled, LOW);
38     }
39     //===== Beeping Rate Code Start =====
40     tone(buzzer, 500);
41     for (int i= distance; i>0; i--)
42       delay(10);
43     noTone(buzzer);
44     for (int i= distance; i>0; i--)
45       delay(10);
46   }

```

Serial Monitor

# Plot of data



# Module 5 Objective

- The objective of this module was to connect an ultrasonic range finder to the Arduino board and write code that utilizes the ultrasonic range finder, You can use them to find the distance to an object, or to detect when something is near the sensor like a motion detector, make the buzzer produce sounds through code when the distance is too close, display data to the Toggle plotter, and analyze data generated by sensors.

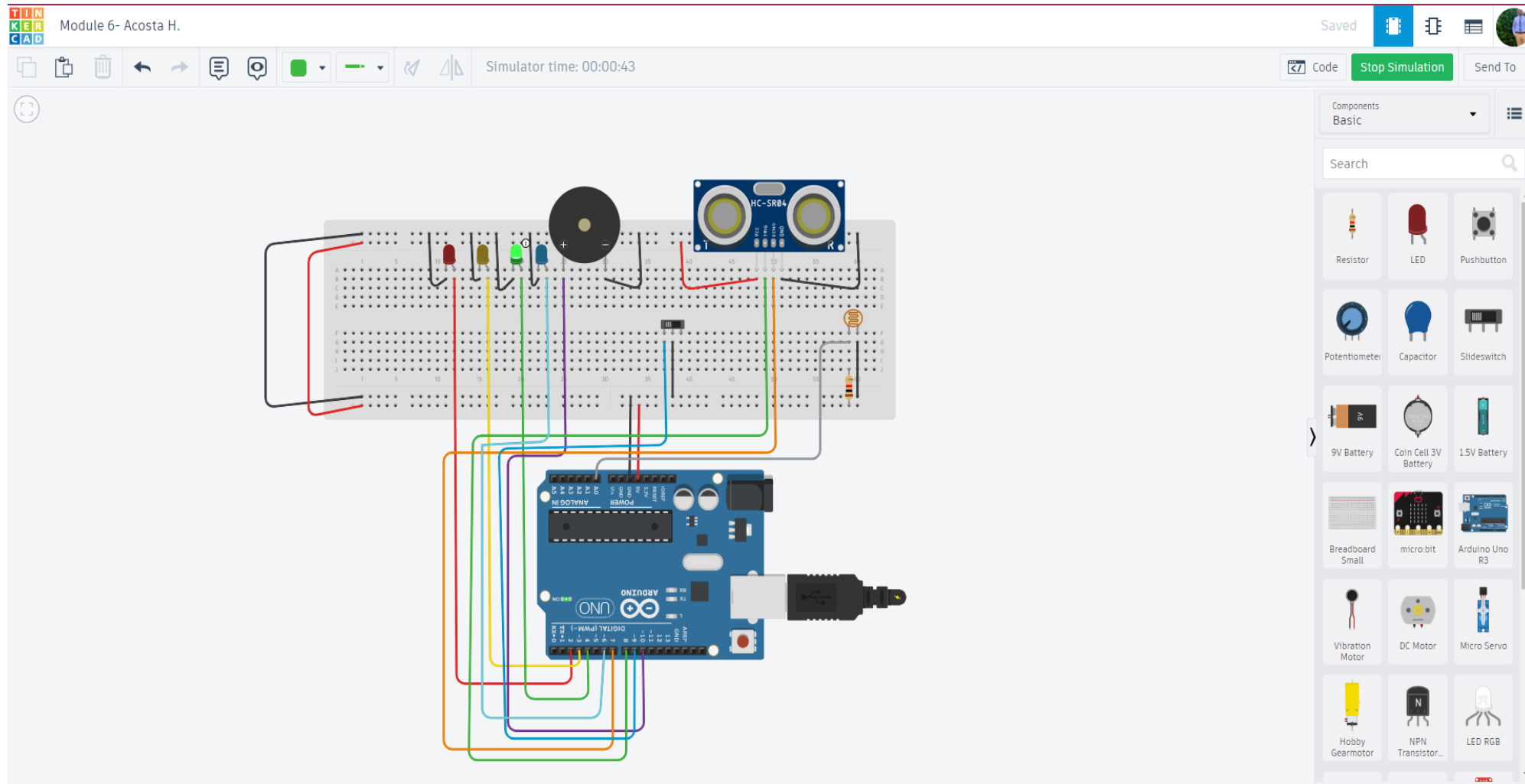


# CEIS101C

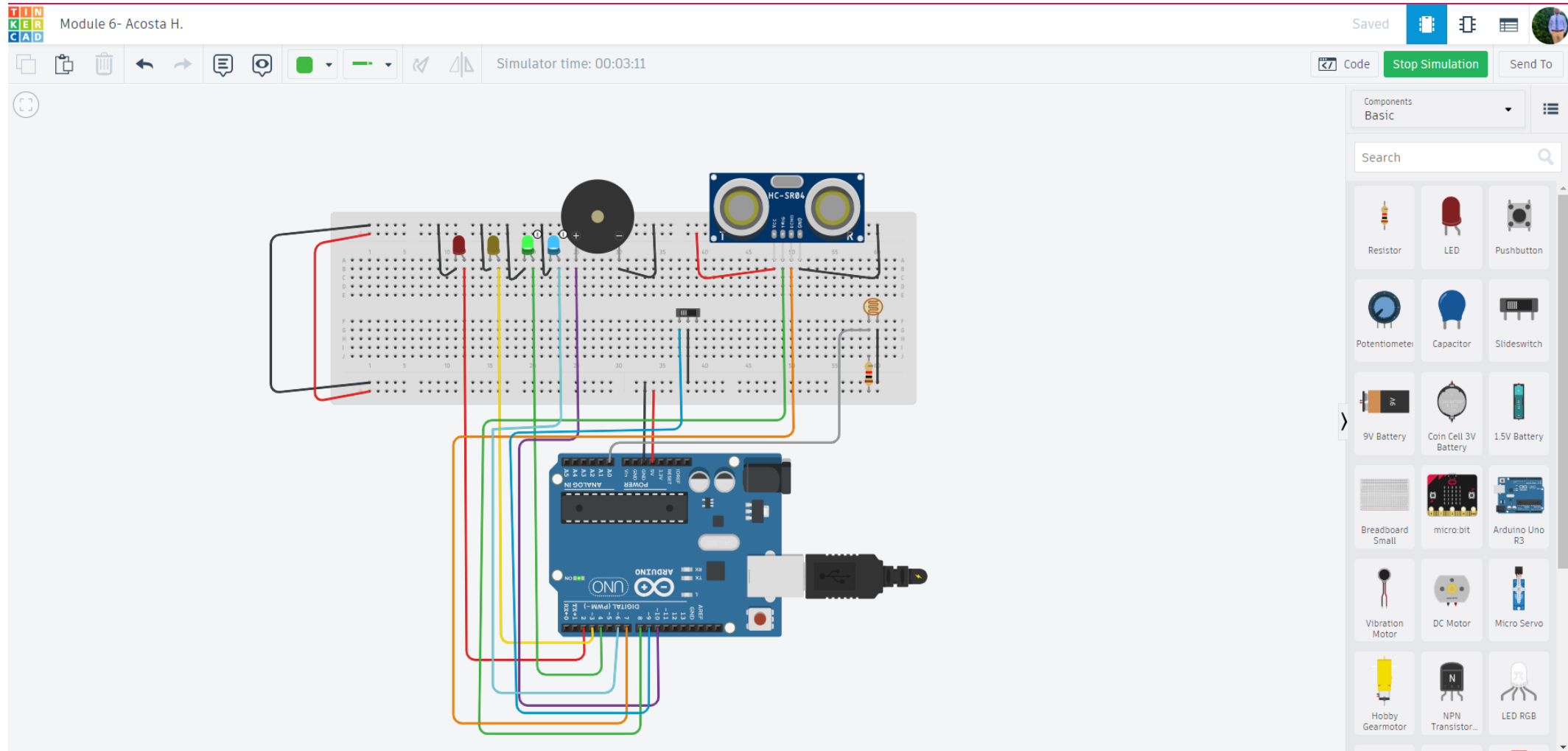
## Module 6

Adding Automated Light to Smart Home System

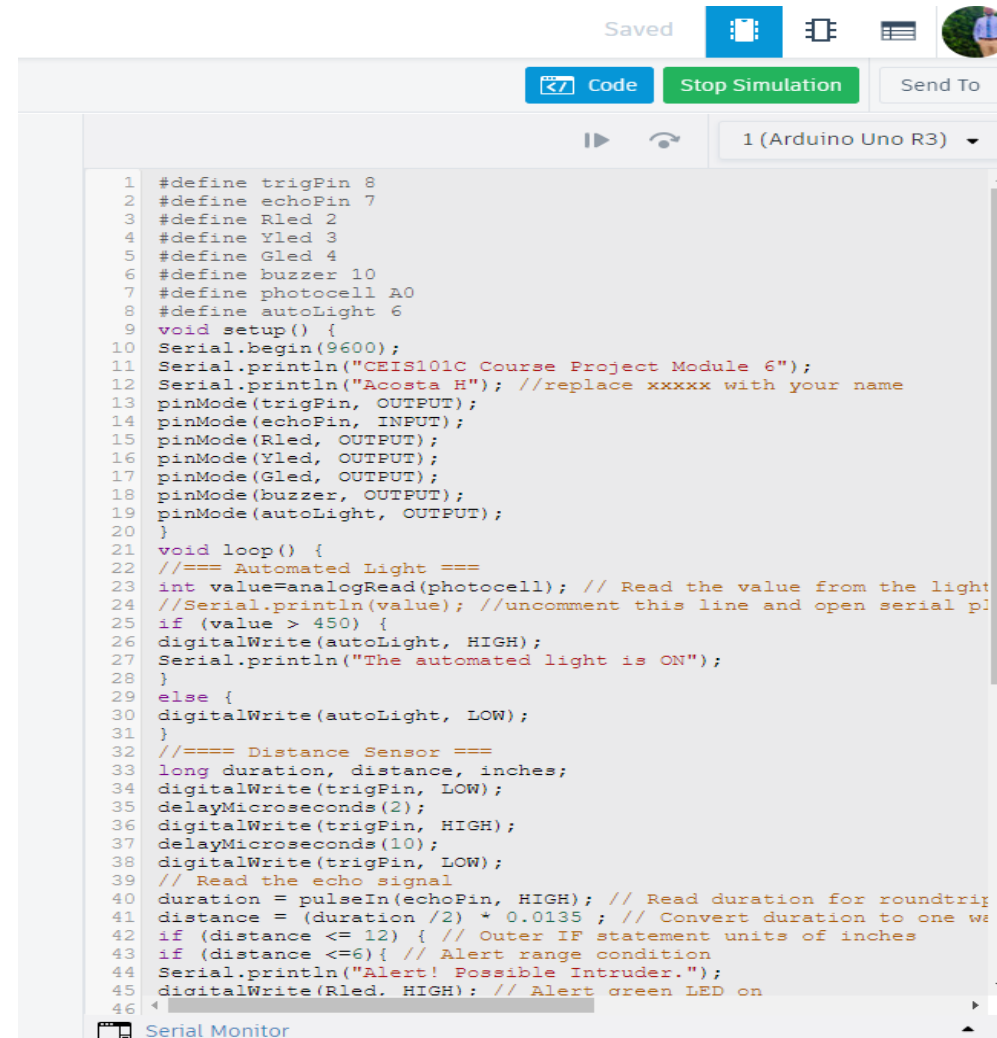
# Circuit with automated LED off



# Circuit with automated LED on



# Arduino Code

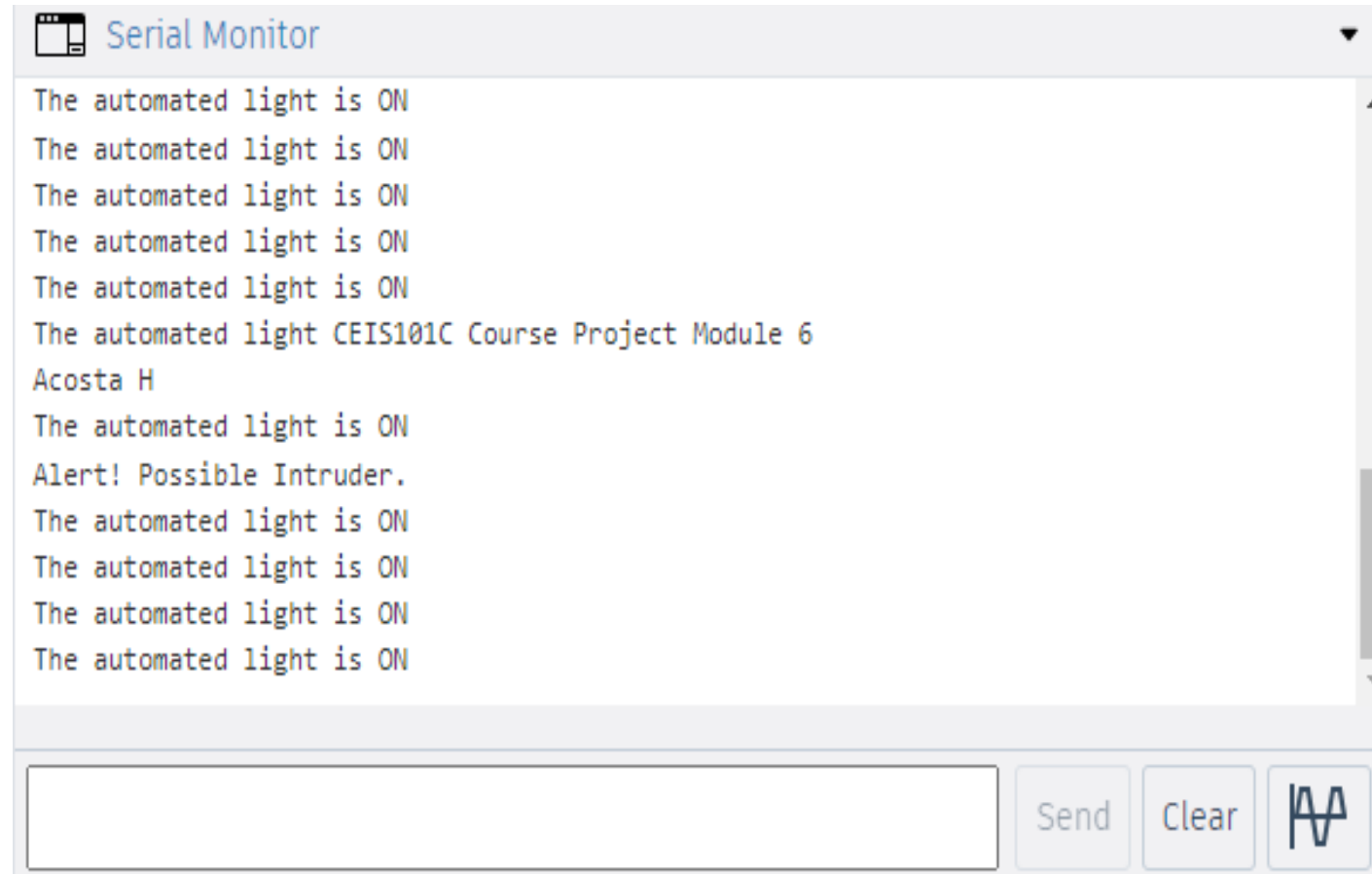


```

1 #define trigPin 8
2 #define echoPin 7
3 #define Rled 2
4 #define Yled 3
5 #define Gled 4
6 #define buzzer 10
7 #define photocell A0
8 #define autoLight 6
9 void setup() {
10   Serial.begin(9600);
11   Serial.println("CEIS101C Course Project Module 6");
12   Serial.println("Acosta H"); //replace xxxxxx with your name
13   pinMode(trigPin, OUTPUT);
14   pinMode(echoPin, INPUT);
15   pinMode(Rled, OUTPUT);
16   pinMode(Yled, OUTPUT);
17   pinMode(Gled, OUTPUT);
18   pinMode(buzzer, OUTPUT);
19   pinMode(autoLight, OUTPUT);
20 }
21 void loop() {
22   //=== Automated Light ===
23   int value=analogRead(photocell); // Read the value from the light
24   //Serial.println(value); //uncomment this line and open serial pl
25   if (value > 450) {
26     digitalWrite(autoLight, HIGH);
27     Serial.println("The automated light is ON");
28   }
29   else {
30     digitalWrite(autoLight, LOW);
31   }
32   //==== Distance Sensor ====
33   long duration, distance, inches;
34   digitalWrite(trigPin, LOW);
35   delayMicroseconds(2);
36   digitalWrite(trigPin, HIGH);
37   delayMicroseconds(10);
38   digitalWrite(trigPin, LOW);
39   // Read the echo signal
40   duration = pulseIn(echoPin, HIGH); // Read duration for roundtrip
41   distance = (duration / 2) * 0.0135 ; // Convert duration to one way
42   if (distance <= 12) { // Outer IF statement units of inches
43     if (distance <=6){ // Alert range condition
44       Serial.println("Alert! Possible Intruder.");
45       digitalWrite(Rled, HIGH); // Alert green LED on
46

```

# Serial Monitor



# Module 6 Objective

- The objective of this module was to connect a light sensor to an Arduino board and develop a code that communicates with the sensor causing the lights to turn on based on the sensor reading.

# Challenges/Lessons Learned

- While working on module 4 to add an automated light switch to the smart home system, I faced a challenge with my code. I encountered two alarms on lines 22 and 31 which prevented me from running the program. Due to this issue, I was unable to see the LED lights turn on.
- To overcome these challenges, I followed a systematic approach. Firstly, I observed others who encountered similar problems. Then, I carefully analyzed my code to identify any errors such as typos. Recently, I encountered a similar problem with an LED light function. Upon monitoring the code, I realized that the comments were placed on the wrong lines. I revised the comments and placed them on the correct lines, I re-ran the code, and the LED light function worked as expected.
- The lesson I learned is that it's important to pay close attention to details, especially when working with code. Learn the commands well.

# Career Skills

The skills I develop to benefit my career in this project are the following:

- Programming
- Circuit Design
- Troubleshooting
- Connect cables
- Change the color to LED lights
- Sensor reading



# Career Skills

The competencies that I gain in this project to advance in my career are the following:

- Project design
- Project solving
- Data analysis
- Organization
- Analytical skills
- Adaptability

# Conclusion

In this project, I have designed a smart home automation and security system using Tinkercad and the Arduino IDE. This project has helped me gain knowledge in circuit design, programming, and the Arduino IDE. By creating a visual chart of the system, I developed my analytical thinking, which is essential for the project's success. This project aims to help others secure their homes, feel peace of mind, and avoid feeling vulnerable to the dangers they may face within their own homes.

# References

- I have been using the training and classes provided by Professor LaQuata Sumter at DeVry University.