



Smart Home Automation & Security System

CEIS101 IOT COURSE PROJECT

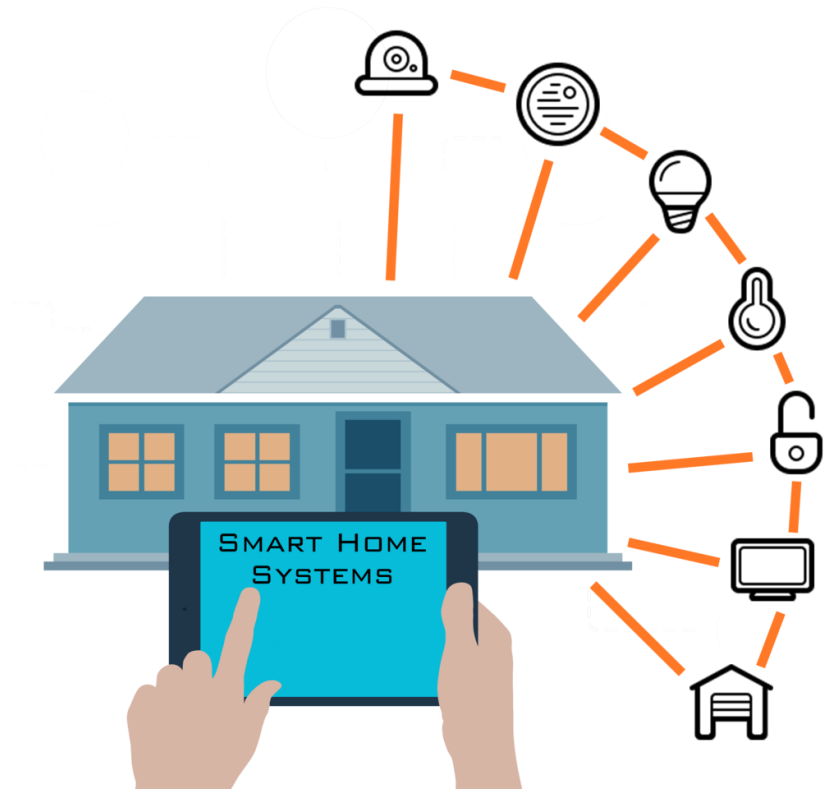
SEPT 2020

PRESENTED BY NYDA SIMMONDS

“The truth is, homes change over time – and technology has to adapt, not try to do everything at once.”

- TONY FADELL, FOUNDER & CEO, NEST LABS

The Task



Create a smart home automation and security system with little to no previous experience by:

1. Designing the prototype in Tinkercad
2. Building the hardware with the components from the IoT Tech Core Kit
3. Programming the device with Arduino IDE

Deliverables

Over the 8 weeks of the course each deliverable built on the previous one to form a completed project.



The home system used different devices to monitor the condition of the home.

Door Sensor – Check if the door is open or closed

Distance Sensor – Monitor for possible home intruder

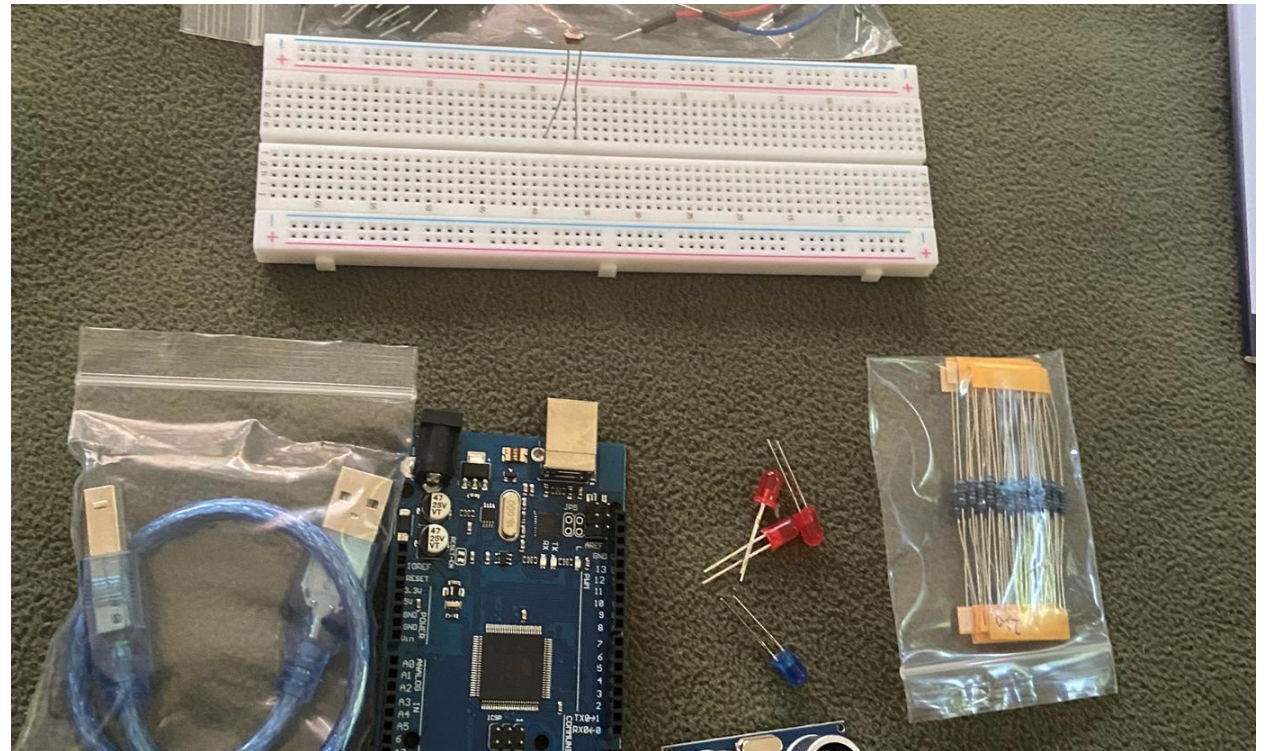
Automated Lights – Lights that turn on when it is dark

Assembling Tools

All of the hardware used in this project is from the UCTRONICS Ultimate Starter Kit for Arduino KB0003.

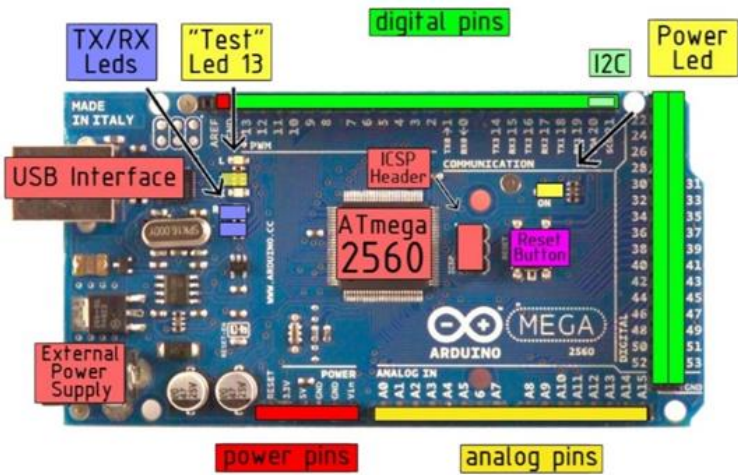
The code for the device is programmed in Arduino.

Tinkercad is used to first simulate the circuit board build and test code logic.



Inventory of Parts

Arduino Mega 2560



Resistor (10kΩ)



Passive Buzzer



Ultrasonic Distance Sensor HC-SR04



Photocell



USB Type B Cable

Breadboard



LED



Wires

*This is a labeled view of each component from the previous slide. Photos are not to actual scale of parts.

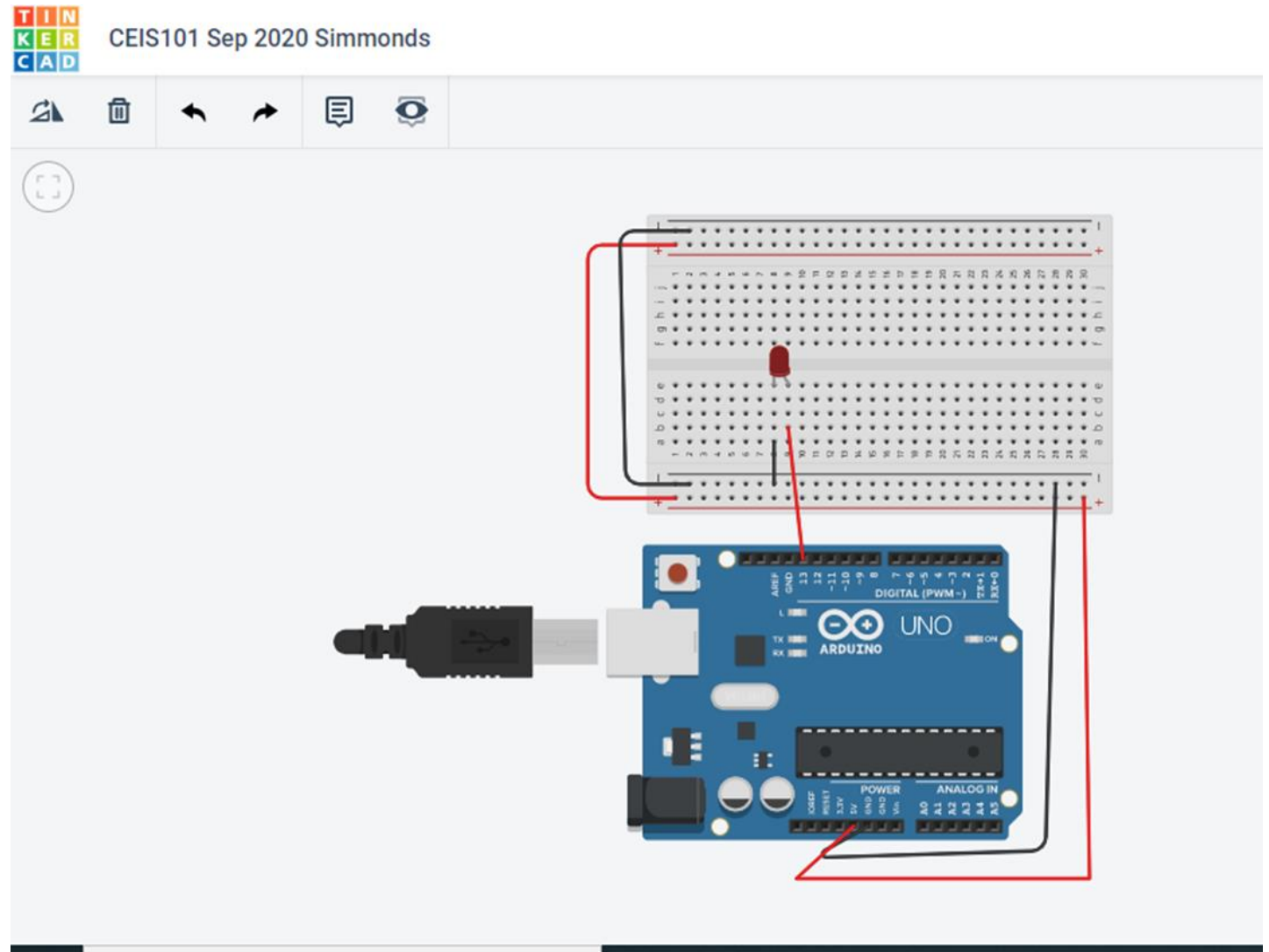
Building a Circuit Board with Tinkercad

Circuit Screenshot

In Tinkercard we created a circuit with a blinking LED light.

The following slides show the code and the code in use.

Notice that when the code is running the LED lights up.



Circuit with Code Screenshot

The screenshot displays the TinkerCAD interface for a project titled "CEIS101 Sep 2020 Simmonds". The workspace shows an Arduino Uno R3 board connected to a breadboard. A red LED is connected to the breadboard, with its anode to digital pin 0 and its cathode to ground. The code editor on the right contains the following blocks:

- set built-in LED to HIGH
- set pin 0 to HIGH
- set pin 3 to 0
- rotate servo on pin 0 to 0 degrees
- play speaker on pin 0 with tone 6
- turn off speaker on pin 0
- print to serial monitor "hello world" with

The interface also includes a "Blocks" palette with categories like Output, Input, Control, Math, and Variables. The code editor shows a sequence of blocks for setting pins and controlling hardware components.

Code Running Screenshot

The screenshot displays the Arduino IDE simulator interface. At the top left, the text "KER CAD CEIS101 Sep 2020 Simmonds" is visible. The top right corner shows "Saved" and a user profile icon. The main workspace is divided into three sections:

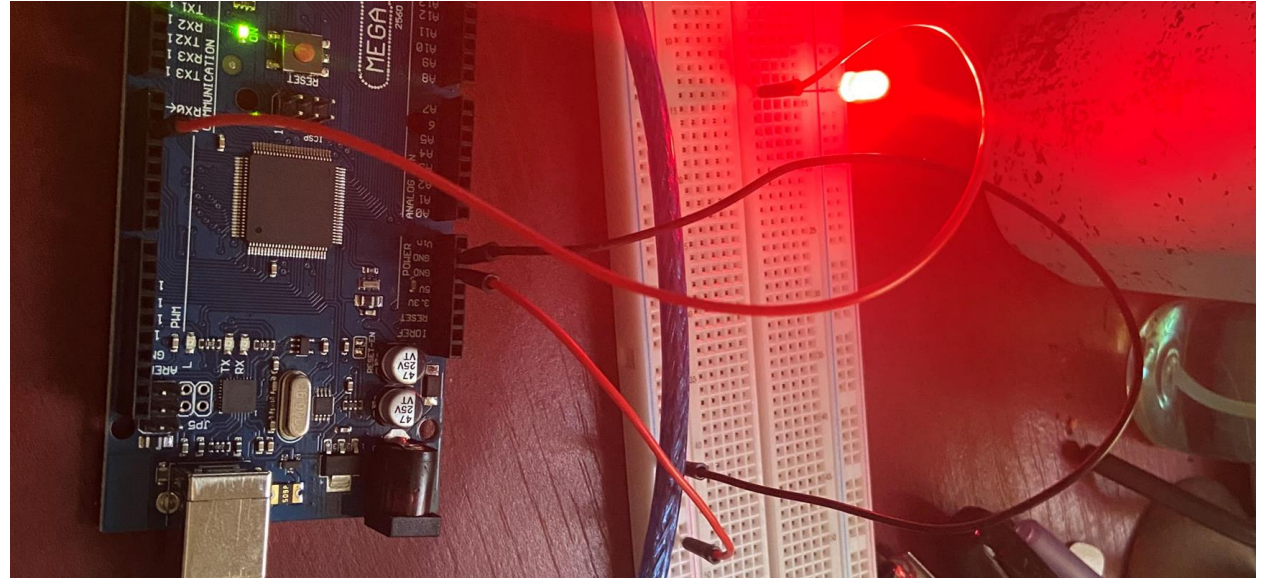
- Left Panel:** A breadboard circuit diagram. A red LED is connected to a digital pin on the breadboard. The breadboard is connected to an Arduino Uno R3 board. Red lines indicate the wiring connections between the breadboard and the board's pins.
- Middle Panel (Blocks):** A list of code blocks categorized by function: Output (blue), Input (purple), Notation (grey), Control (orange), Math (green), and Variables (pink). The visible code blocks include:
 - set built-in LED to HIGH
 - set pin 0 to HIGH
 - set pin 3 to 0
 - rotate servo on pin 0 to 0 degrees
 - play speaker on pin 0 with tone 6
 - turn off speaker on pin 0
 - print to serial monitor hello world with
- Right Panel:** A preview of the code blocks, showing a sequence of operations:
 - set pin 13 to HIGH
 - wait 1 secs
 - set pin 13 to LOW
 - wait 1 secs

At the bottom of the interface, there is a "Serial Monitor" tab.

Building a Circuit Board with Arduino

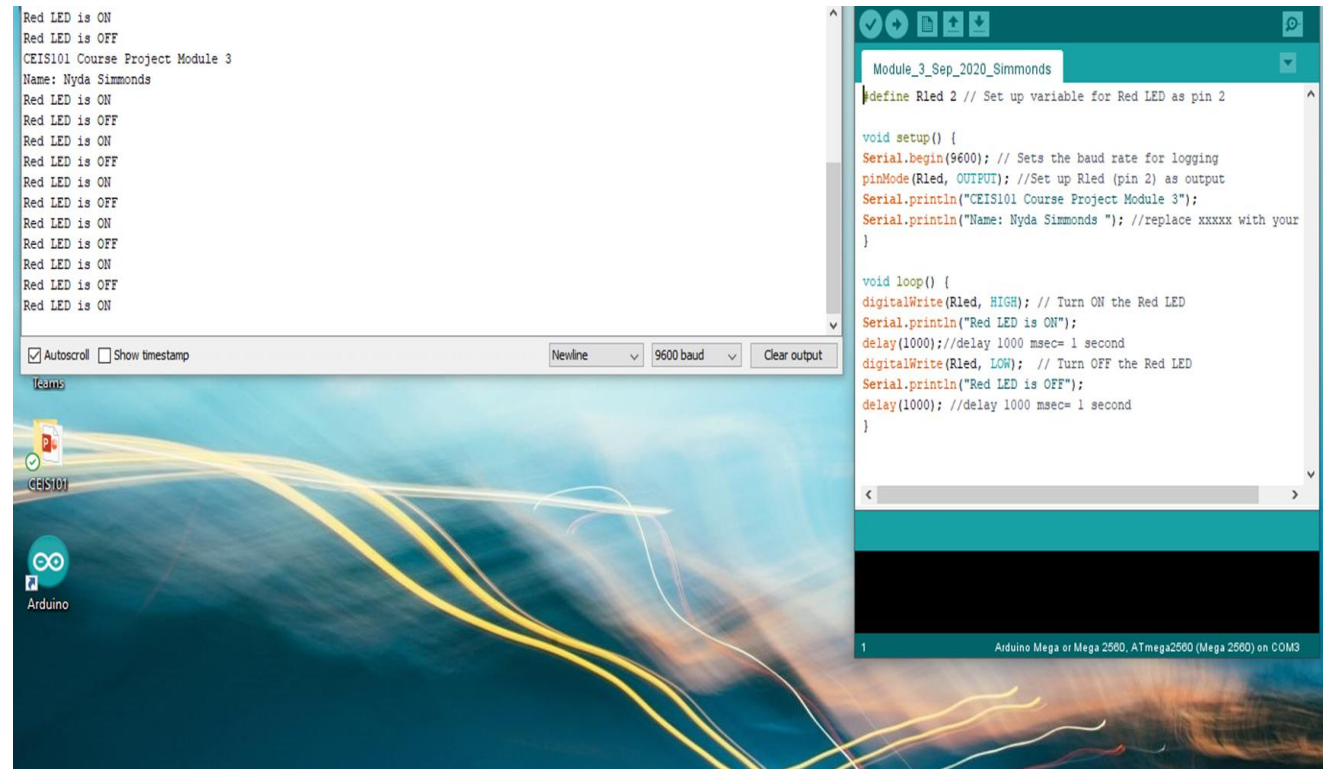
Circuit with red LED on

Once we had built and programmed the Circuit board in Tinkercad it was time to test our design with the Arduino toolkit.



Serial Monitor Screenshot

The serial Monitor shows the code running and that the LED light is turning on and off.



Adding The Door Sensor

Component Functionality

- Green LED to indicate no security issue
- Yellow & Red LED to indicate security issue and to scare off a possible intruder
- Passive Buzzer to sound the alarm and scare of a possible intruder
- Blue Wire to emulate home entrance door

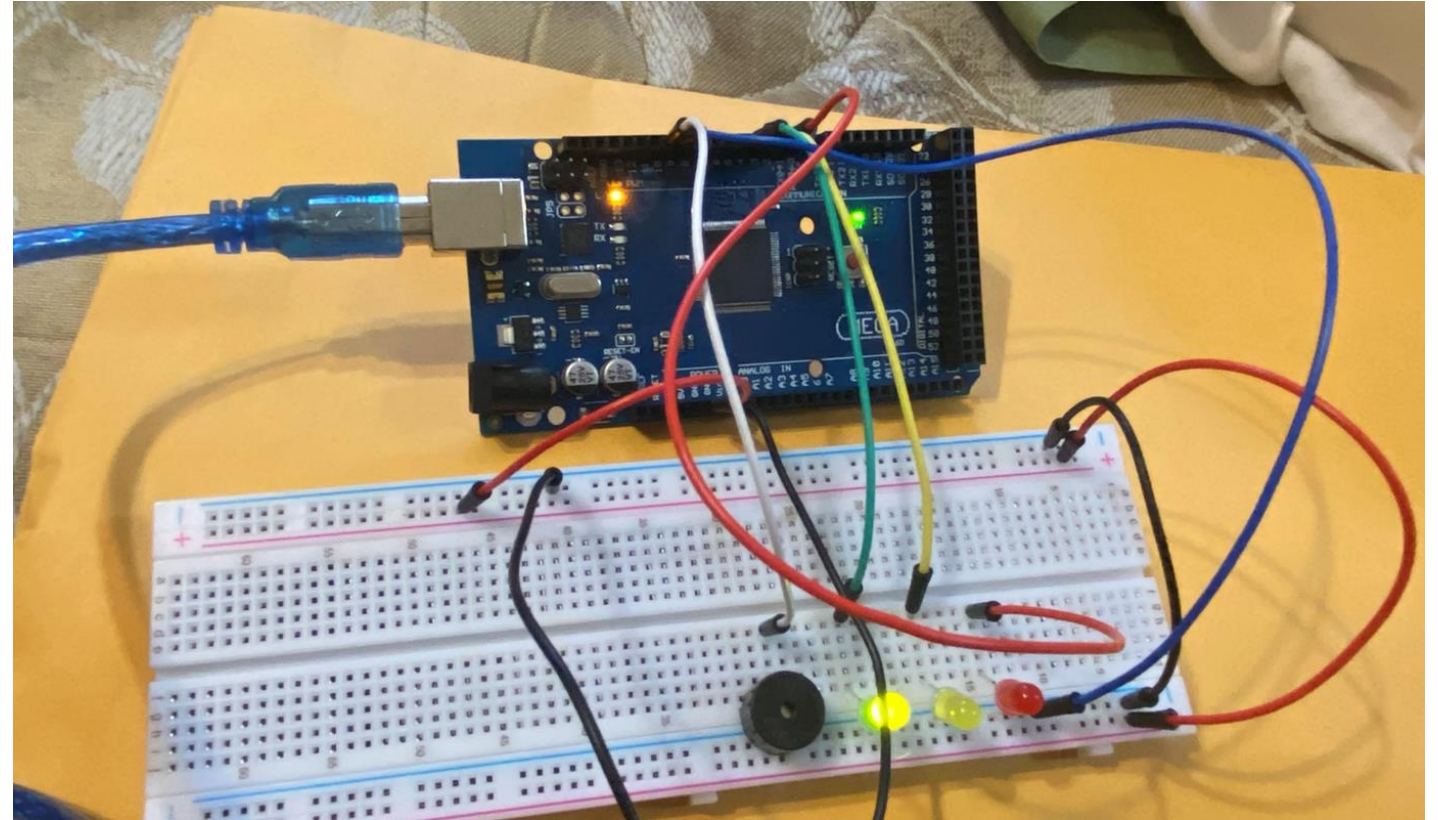
Circuit of door closed with Green LED on

Green LED is on.

Blue wire is connected to breadboard.

Door is closed.

Home is secure.

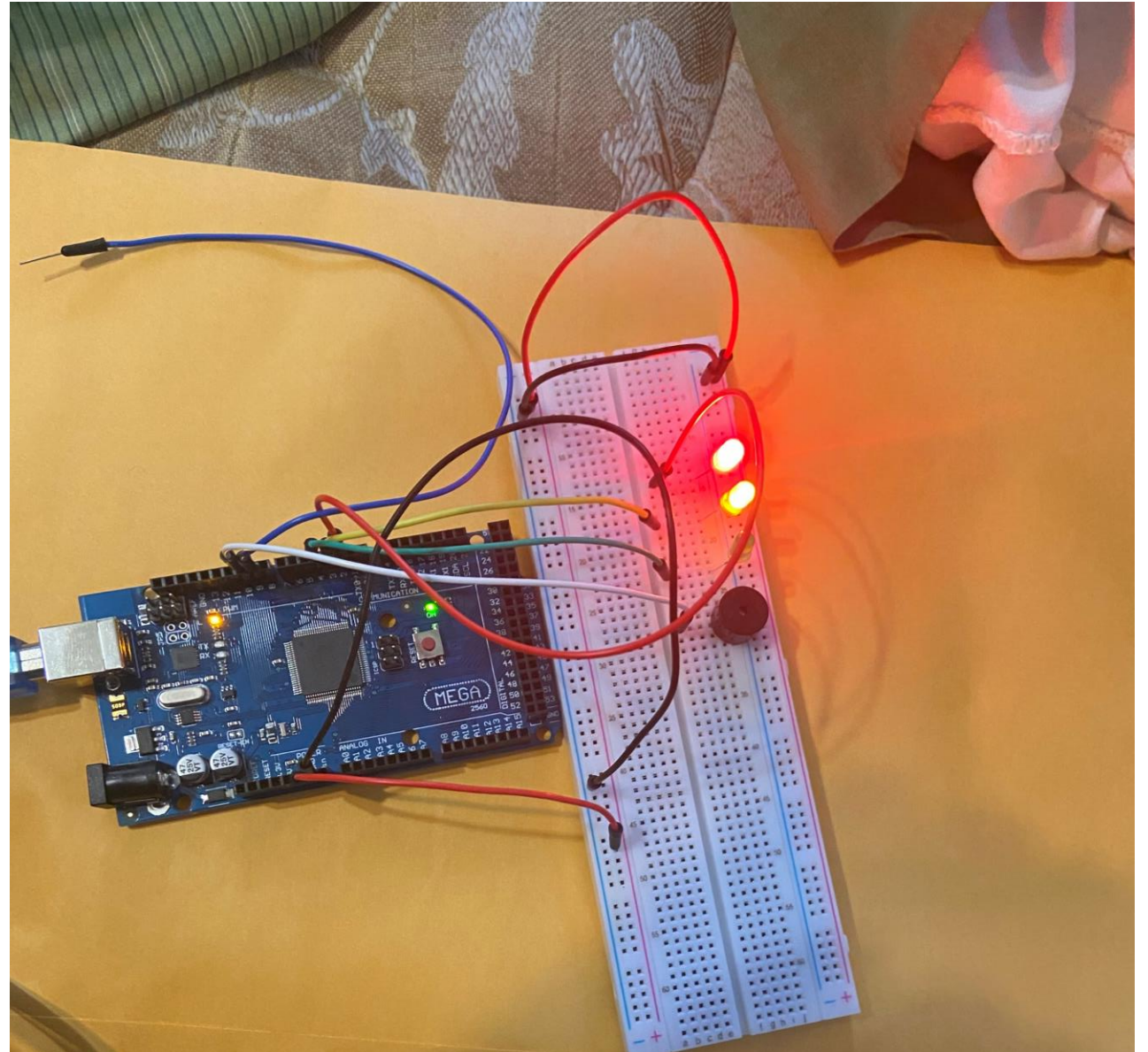


Circuit of door open with Green LED OFF

The red and the yellow lights are both on indicating that there is a security issue.

The blue wire is not connected to the breadboard signaling that the door is open.

Also currently in this photo the alarm is buzzing.



Screenshot of Arduino Code

Week_4_Sep_2020_NSimmonds

```
#define Rled 2
#define Yled 3
#define Gled 4
#define buzzer 10
#define door 9
#define delaytime 100 // === Second run, change to 100

void setup() {
  Serial.begin(9600); // Set the baud rate
  Serial.println("CEIS101 Course Project Module 4");
  Serial.println("Name: Nyda Simmonds "); //replace xxxxx with your name

  pinMode(Rled, OUTPUT);
  pinMode(Yled, OUTPUT);
  pinMode(Gled, OUTPUT);
  pinMode(buzzer, OUTPUT);
  digitalWrite(buzzer, LOW);
  pinMode(door, INPUT_PULLUP); //door sensor
}

void loop() {
  int value=digitalRead(door);
  if(value == 0) { // Door closed, no security threat
    digitalWrite(Rled, LOW);
    digitalWrite(Yled, LOW);
    digitalWrite(Gled, HIGH);
    digitalWrite(buzzer, LOW);
  }
  else{ // Door open, security threat
    Serial.println("Door is open. Security Alert! ");
  }
}
```


Adding Distance Sensor to Smart Home & Analyzing Data

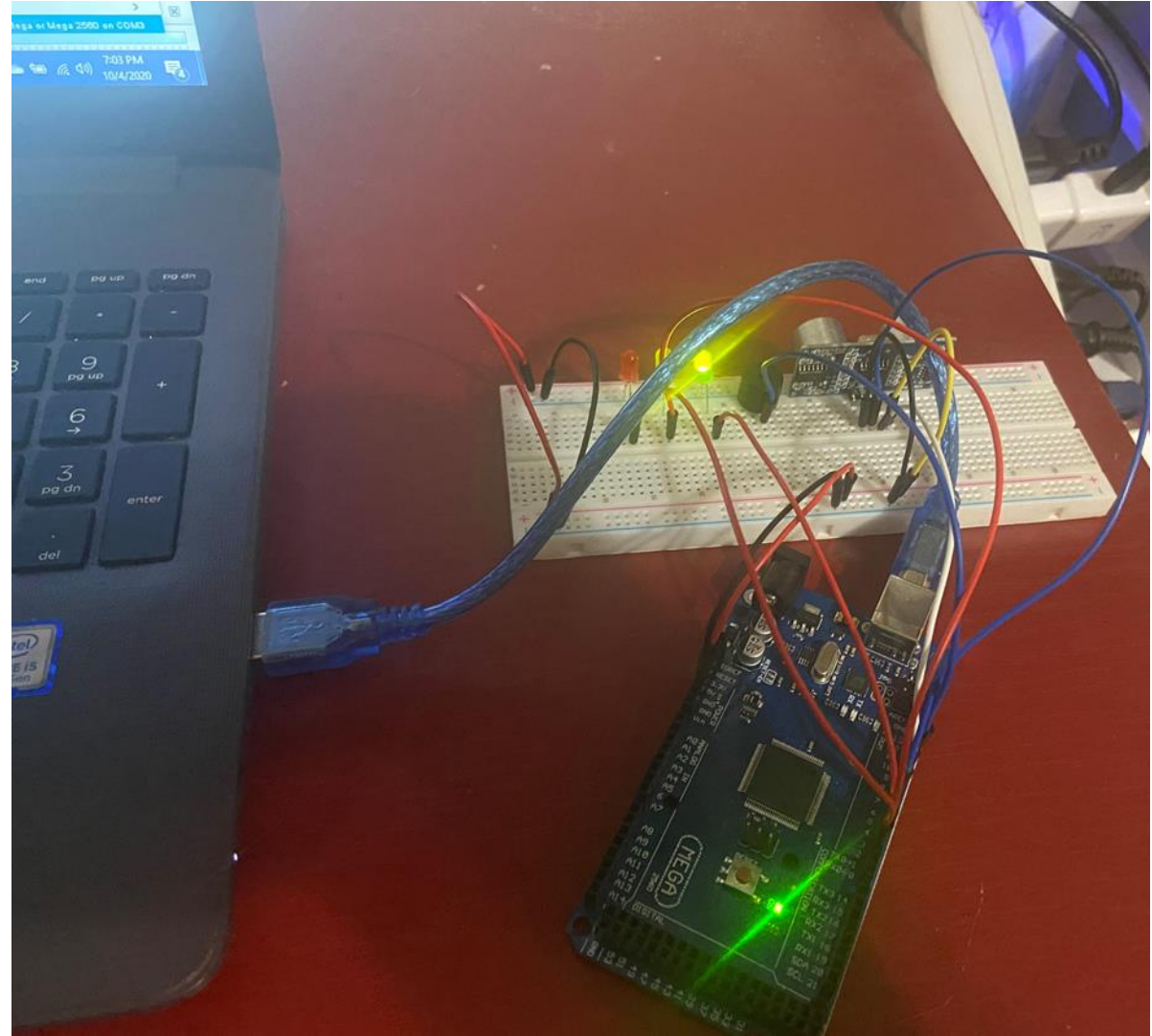
Component Functionality

- Buzzer tone will change as the object gets closet to the ultrasonic sensor.
- Green LED indicates no security risk or out of range. If an object is less that 12 inches away message will be displayed on the serial monitor.
- Yellow LED will indicate a warning. If the object is between 6inches and 12 inches away a message of possible intruder will be displayed on the serial monitor.
- Red LED will indicate a high security risk when the object is less that 6inches away.

Circuit with green LED on

No intruder.

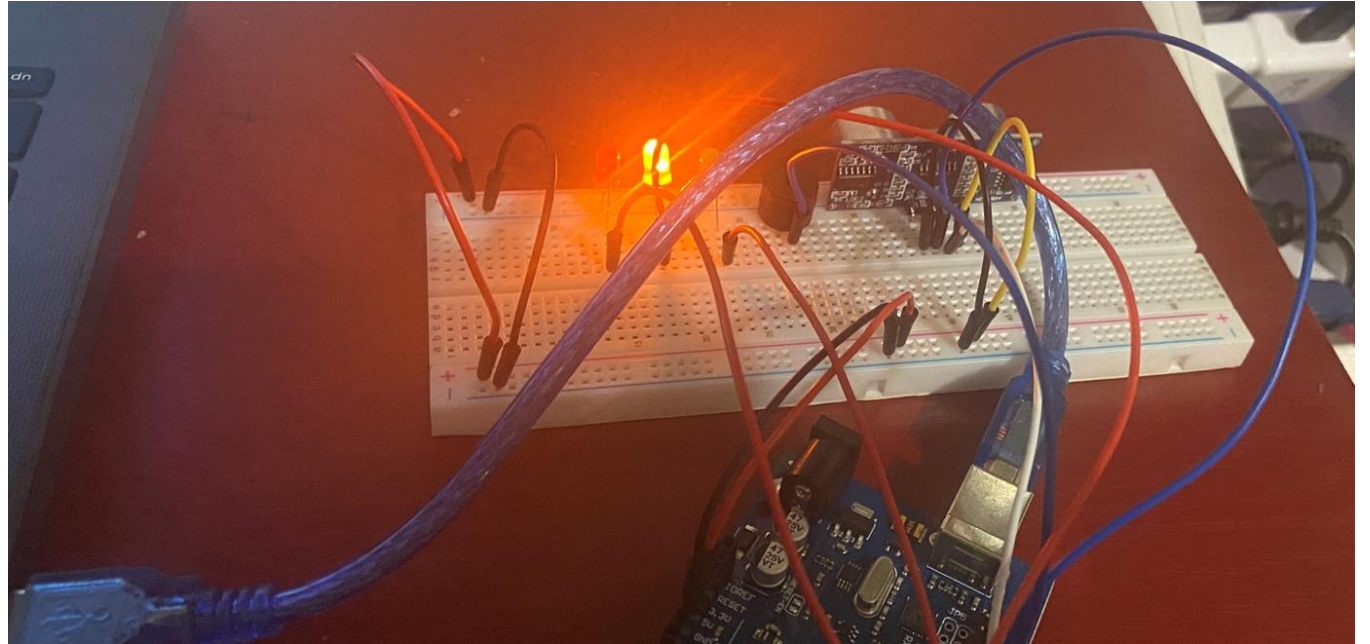
Home is secure.



Circuit with yellow LED on

Warning.

An object is between 6 or 12
inches away from the door.



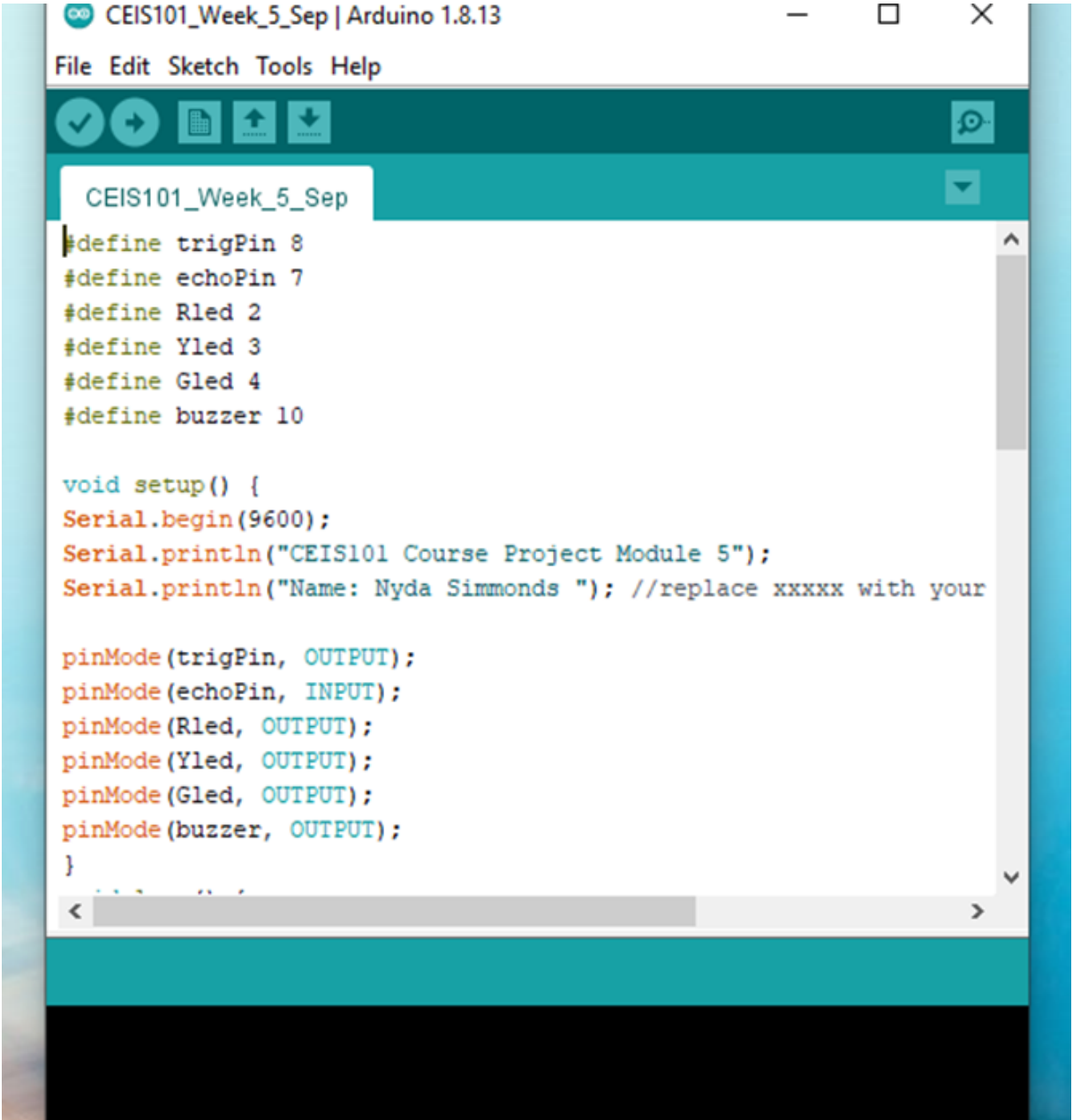
Circuit with red LED on

High Security Risk.

An object is less than 6 inches
away from the door.



Arduino Code



```
CEIS101_Week_5_Sep | Arduino 1.8.13
File Edit Sketch Tools Help
CEIS101_Week_5_Sep
#define trigPin 8
#define echoPin 7
#define Rled 2
#define Yled 3
#define Gled 4
#define buzzer 10

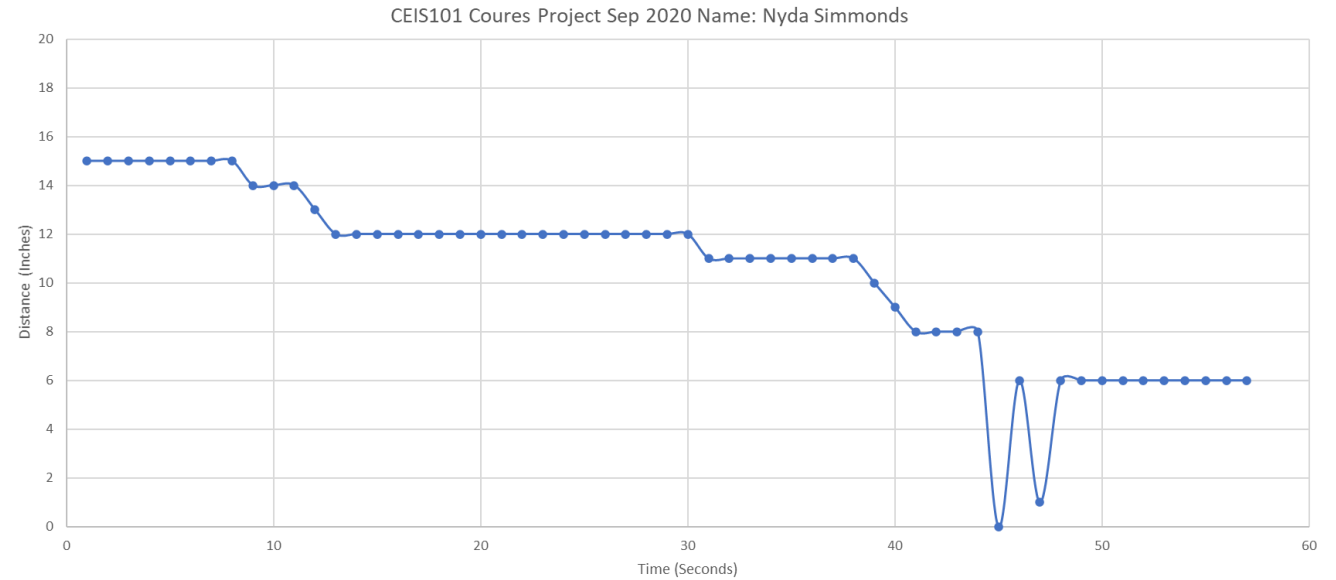
void setup() {
  Serial.begin(9600);
  Serial.println("CEIS101 Course Project Module 5");
  Serial.println("Name: Nyda Simmonds "); //replace xxxxx with your

  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(Rled, OUTPUT);
  pinMode(Yled, OUTPUT);
  pinMode(Gled, OUTPUT);
  pinMode(buzzer, OUTPUT);
}
```

Plot of data (graph from Excel)

Visualized data of when there was
a warning or an intruder.

This scatterplot shows the
distance over time.



Adding Automated Lights

Component Function

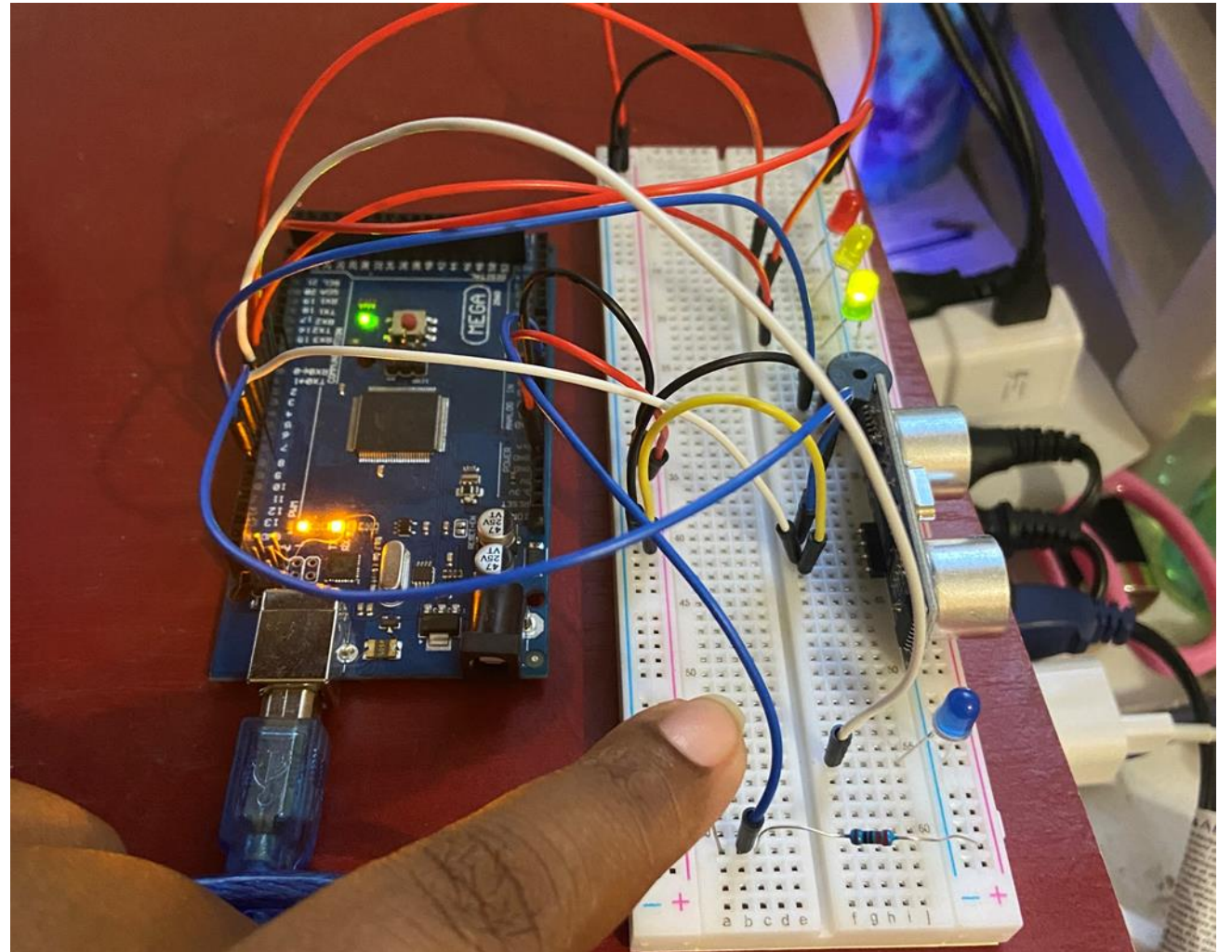
The photocell is also known as a light-dependent resistor or photoresistor.

In our home security system it acts as the light sensor.

The light sensor is a resistor whose value changes depending on the amount of light that hits it.

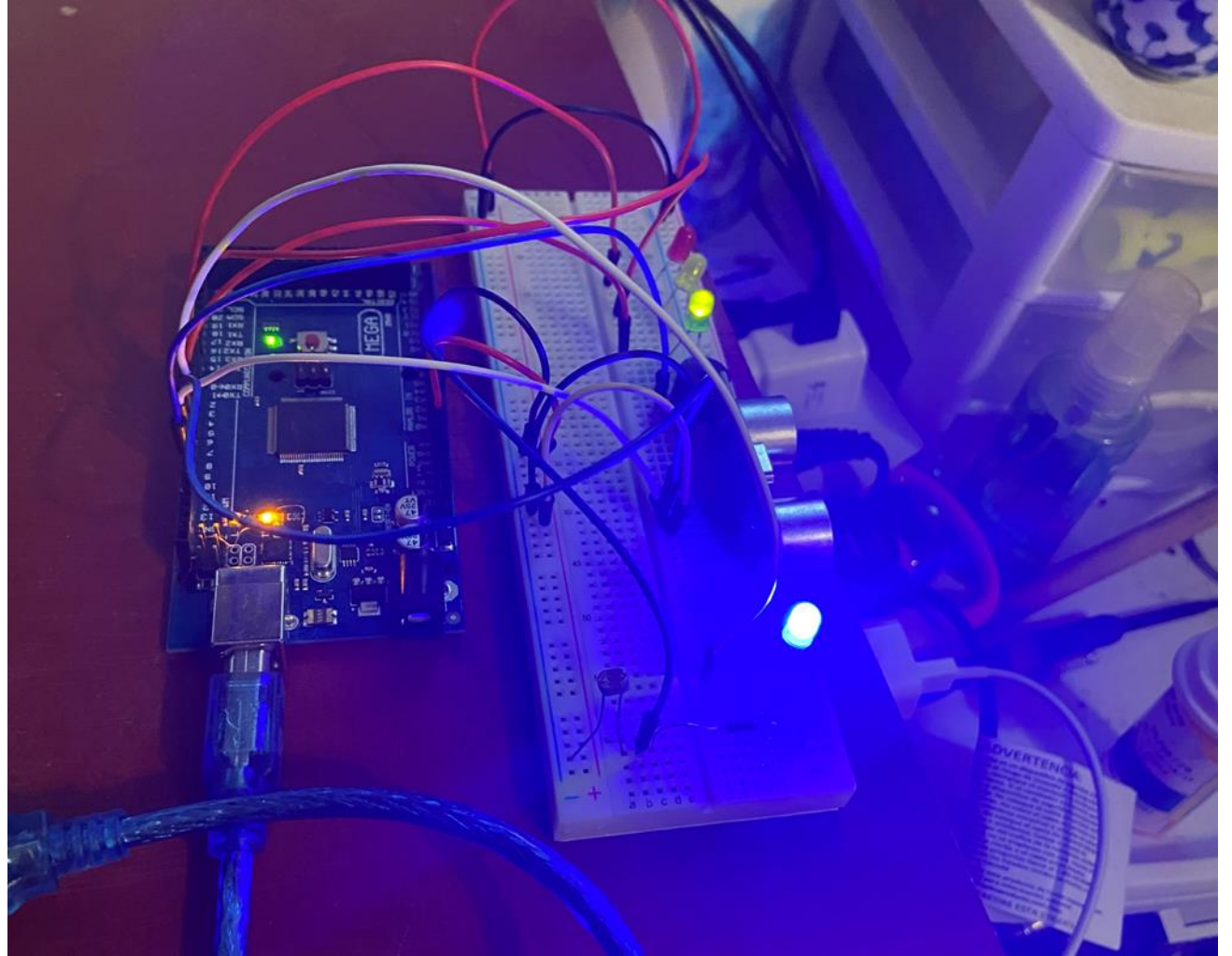
Circuit with automated LED off

Light sensor is being covered with my finger in this image to show off.



Circuit with automated LED on

Light sensor uncovered with blue light on.



Challenges Faced

Week 5 Headache

Adding the motion sensor was the most difficult task for me.

At first it would not register any number at all.

I had to rebuild from week three and rewire the entire project.



Career Skills Acquired

Software to Hardware

Majority of my DeVry education has been in learning programming languages like C++, ASP.Net and SQL, it was nice to get my hands dirty working with building circuits from breadboard up to create something.



Other Skills

SOFT SKILLS

Adaptability
Accountability
Critical Thinking
Time Management

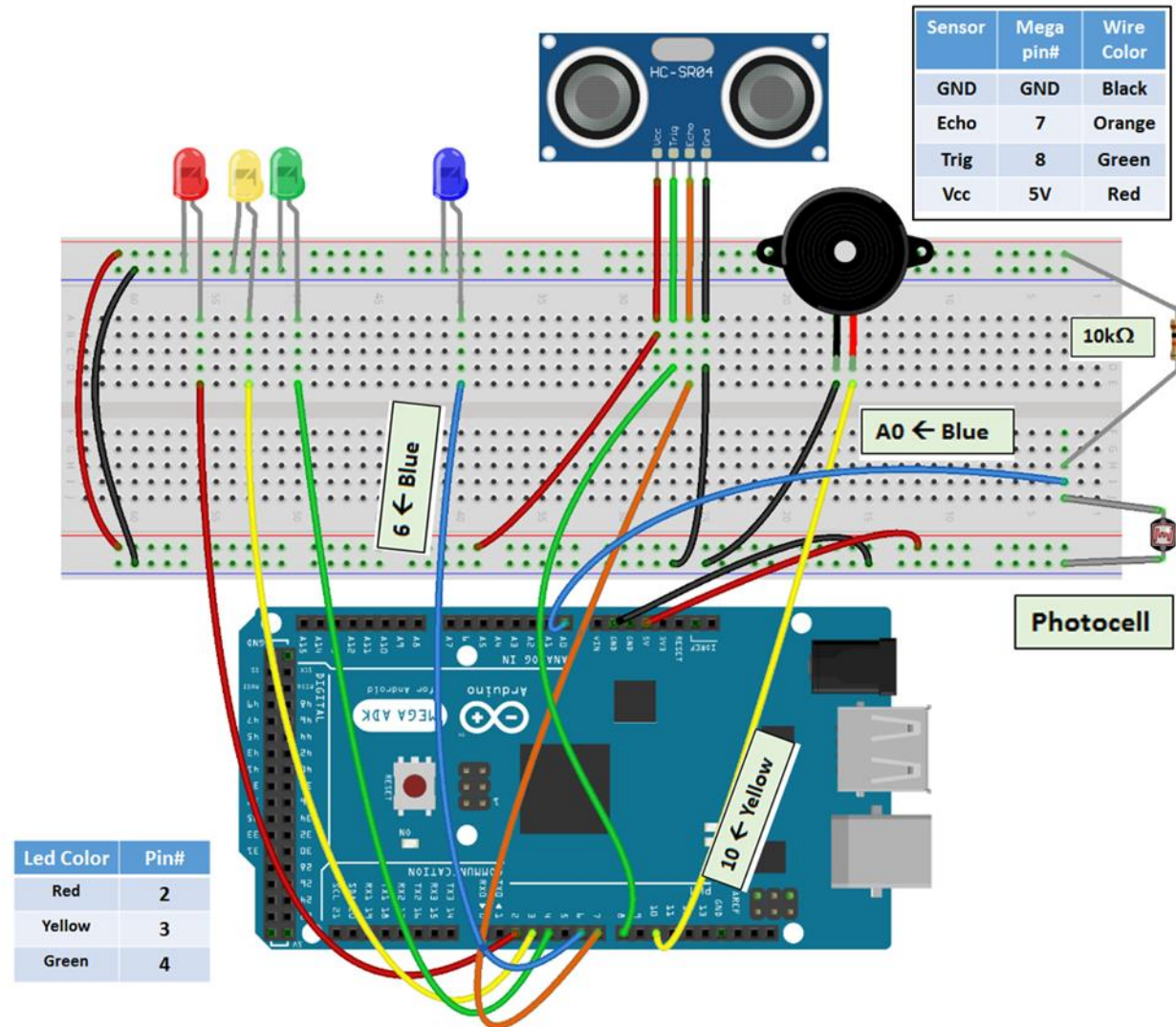
HARD SKILLS

Device Knowledge
Coding/Programming
Automation
Security Awareness

Conclusion

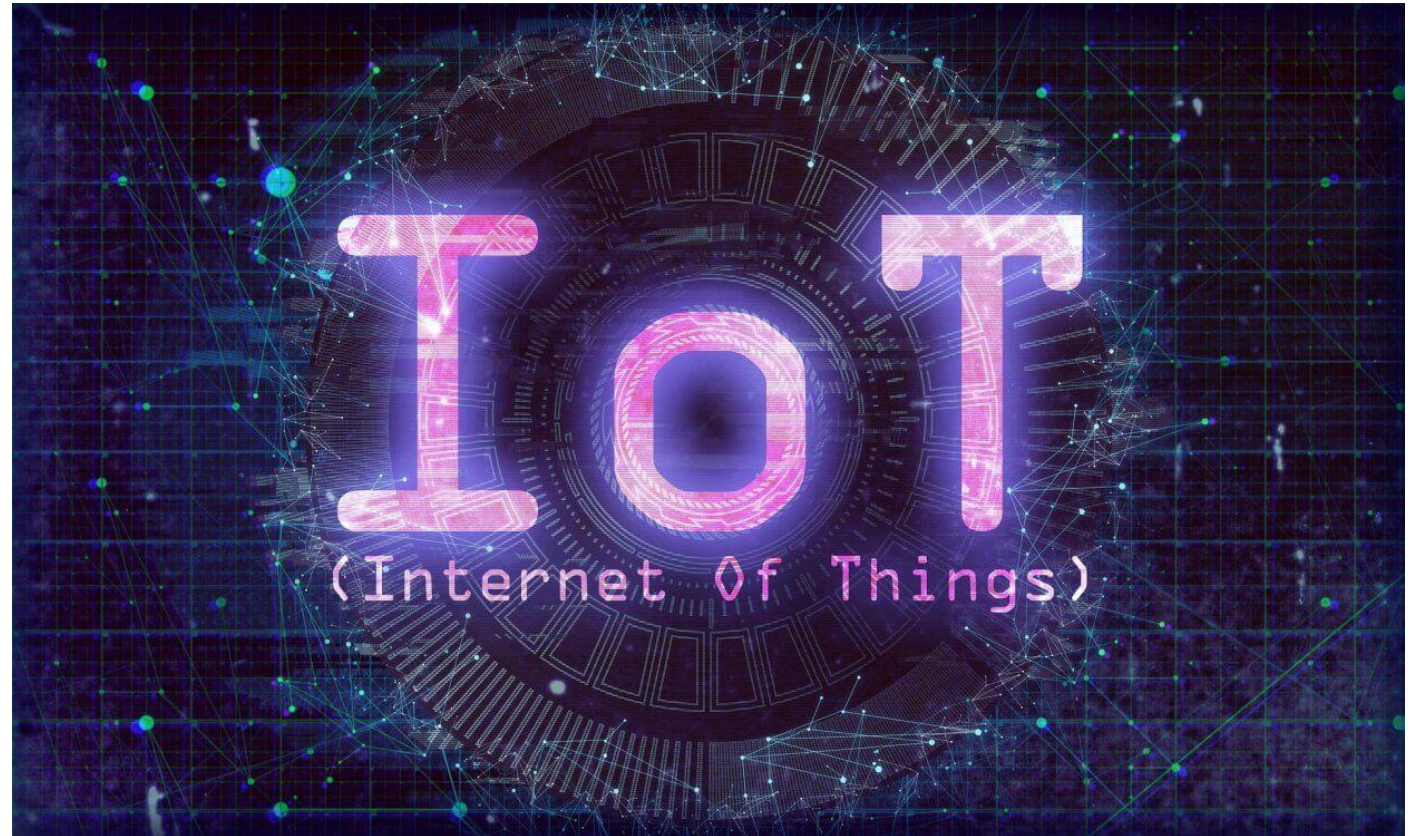
Final Project

This is a model of what the finale project should look like with all its components in the proper places.



The IoT and Us

With the rapid advancement of technology it is important that we as creators and consumers are innovative and vigilant with the ways we use technology to enrich our daily lives without tacking the progress we have made for granted.





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