

Creating a Multiple
Traffic Light
Controller with a
Cross Walk and an
Emergency Buzzer
with secured IoT
Control via Web

CEIS 114 FINAL PROJECT COMPONENT – OPTION I



INTRODUCTION

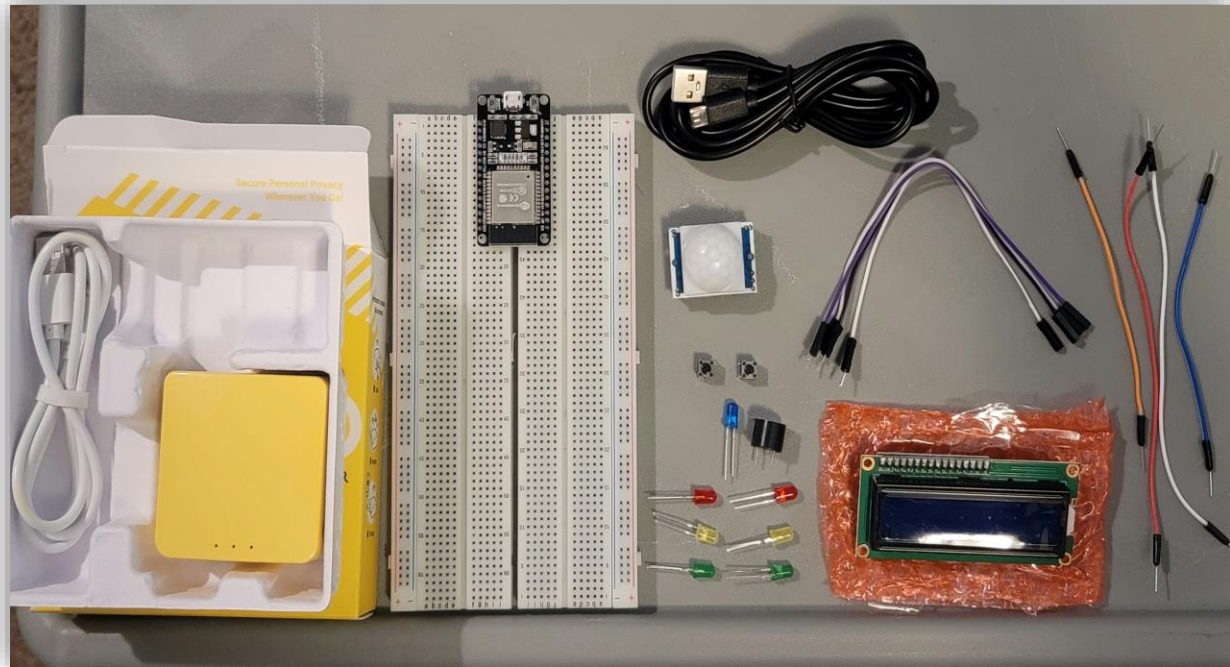
- This presentation documents my learning journey for IoT (internet of things)
- We were tasked with creating a simulation of traffic lights at an intersection
- These traffic lights are required to do the following:
 - Not all cross traffic to be both green at once
 - Allow pedestrians to request a red light / walk scenario
 - Force both directions to have a red light flashing when an emergency button was pressed to allow for emergency vehicles to bypass traffic



WEEK 2

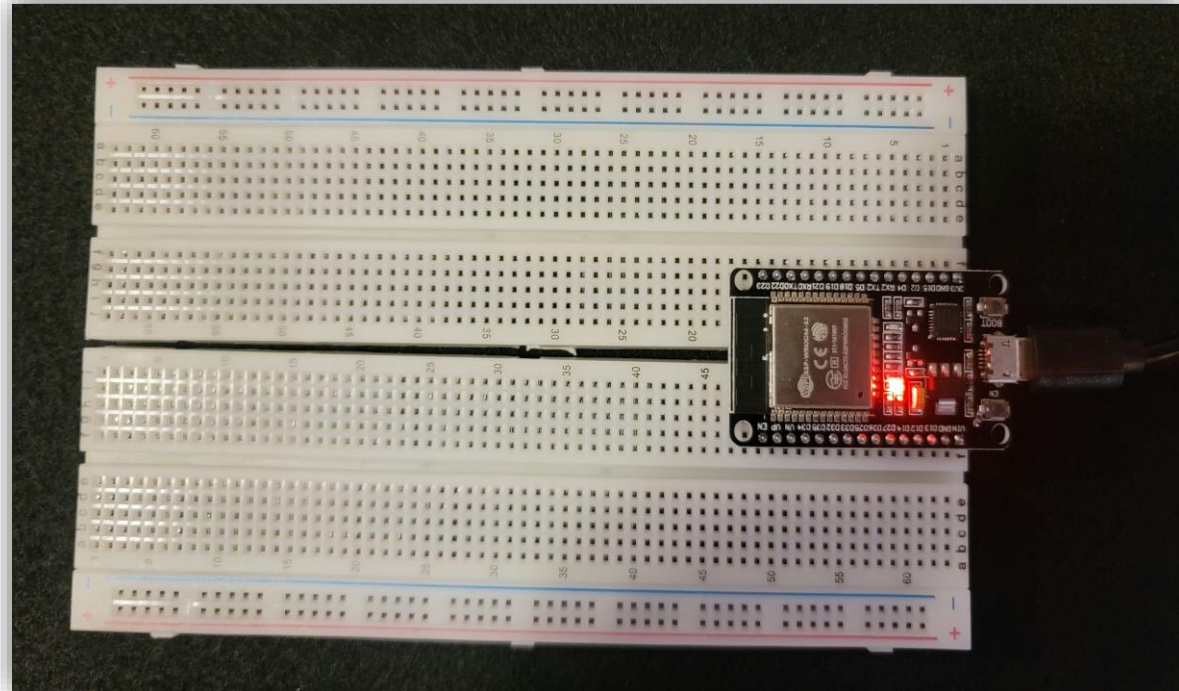
INVENTORY

- ESP 32 Board
- Colored LEDs: Red, Yellow, Green, and Blue
- Wires
- Breadboard(s)
- LCD Unit with I2C Adapter
- Active Buzzer
- Mini Router
- Push Button(s)
- PIR Motion Sensor



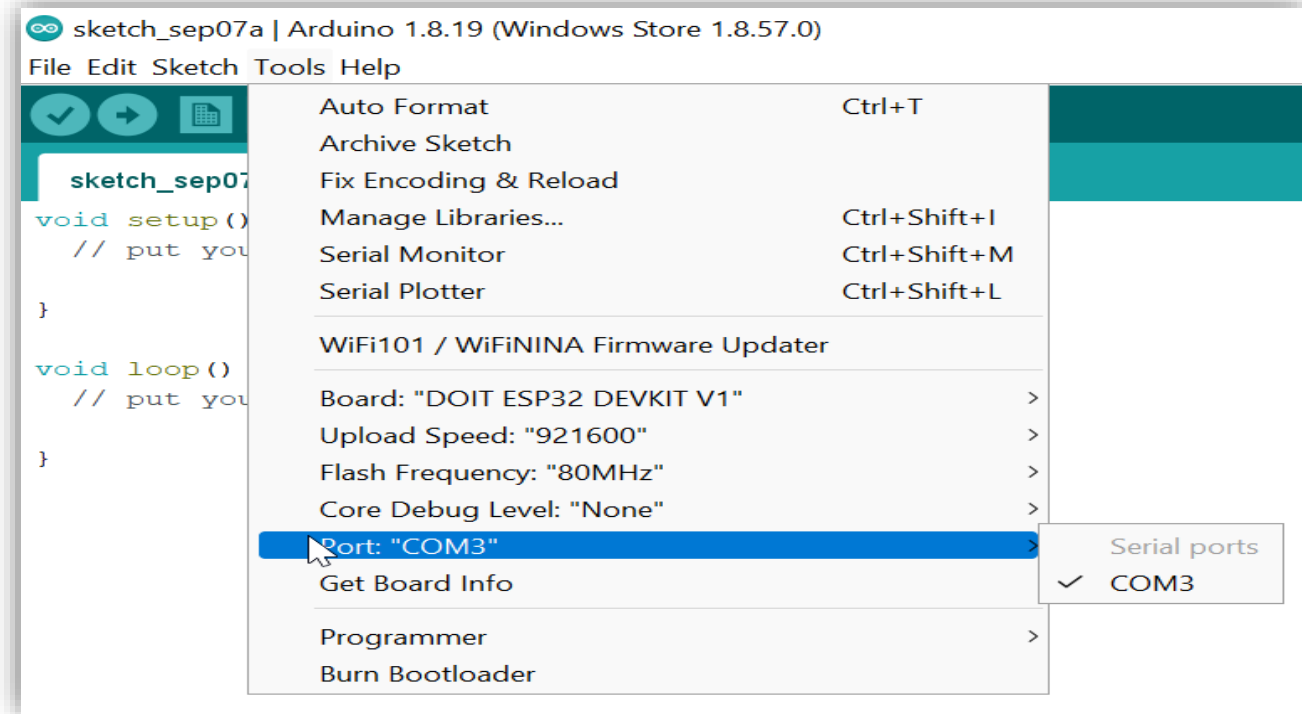
ESP32

- Microcontroller mounted and powered ON



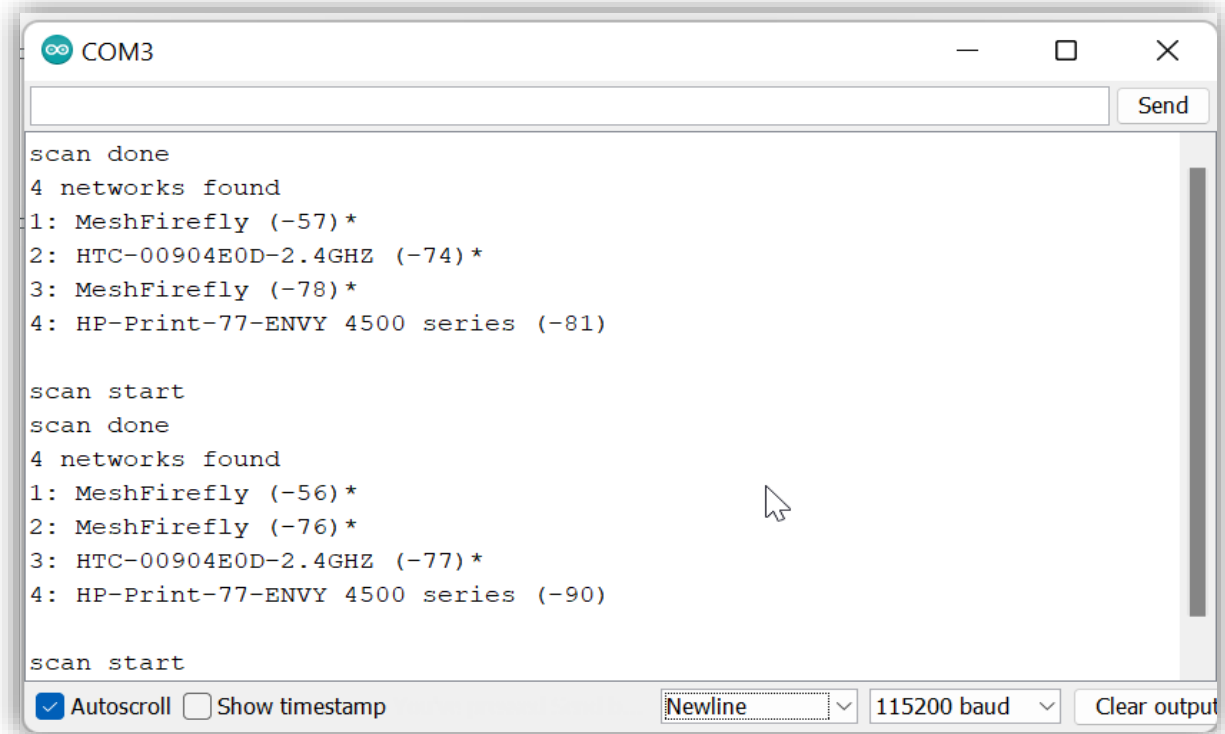
INSTALLATION OF ARDUINO IDE

- Screenshot of Arduino IDE with **Port** selected from Tools menu



ESP32 WI-FI SCAN

- Screenshot of Serial Monitor in Arduino IDE showing the available networks



```
COM3  
scan done  
4 networks found  
1: MeshFirefly (-57)*  
2: HTC-00904E0D-2.4GHZ (-74)*  
3: MeshFirefly (-78)*  
4: HP-Print-77-ENVY 4500 series (-81)  
  
scan start  
scan done  
4 networks found  
1: MeshFirefly (-56)*  
2: MeshFirefly (-76)*  
3: HTC-00904E0D-2.4GHZ (-77)*  
4: HP-Print-77-ENVY 4500 series (-90)  
  
scan start
```

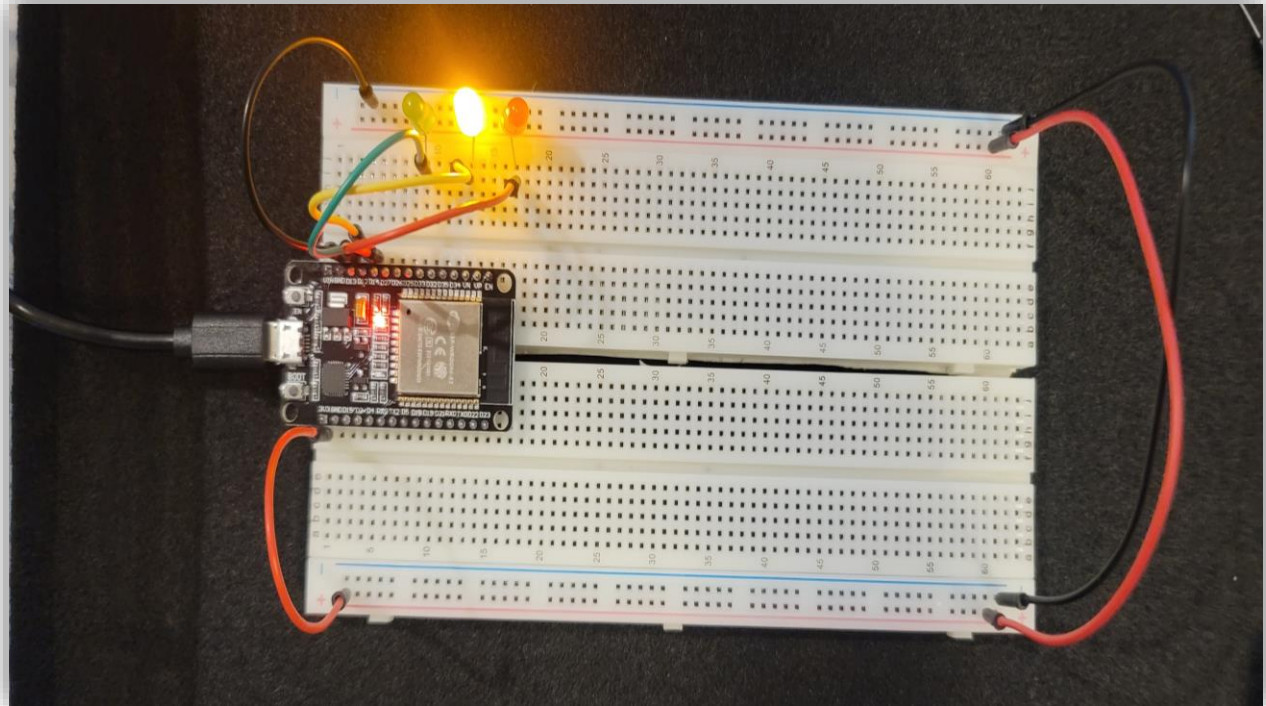
Serial Monitor window showing the output of a Wi-Fi scan. The window title is "COM3". The output shows two scan attempts, each finding four networks. The first scan results are: 1: MeshFirefly (-57)*, 2: HTC-00904E0D-2.4GHZ (-74)*, 3: MeshFirefly (-78)*, 4: HP-Print-77-ENVY 4500 series (-81). The second scan results are: 1: MeshFirefly (-56)*, 2: MeshFirefly (-76)*, 3: HTC-00904E0D-2.4GHZ (-77)*, 4: HP-Print-77-ENVY 4500 series (-90). The window also shows "scan start" and "scan done" messages. The bottom of the window has a status bar with "Autoscroll" checked, "Show timestamp" unchecked, "Newline" selected, "115200 baud" selected, and "Clear output" button.



WEEK 3

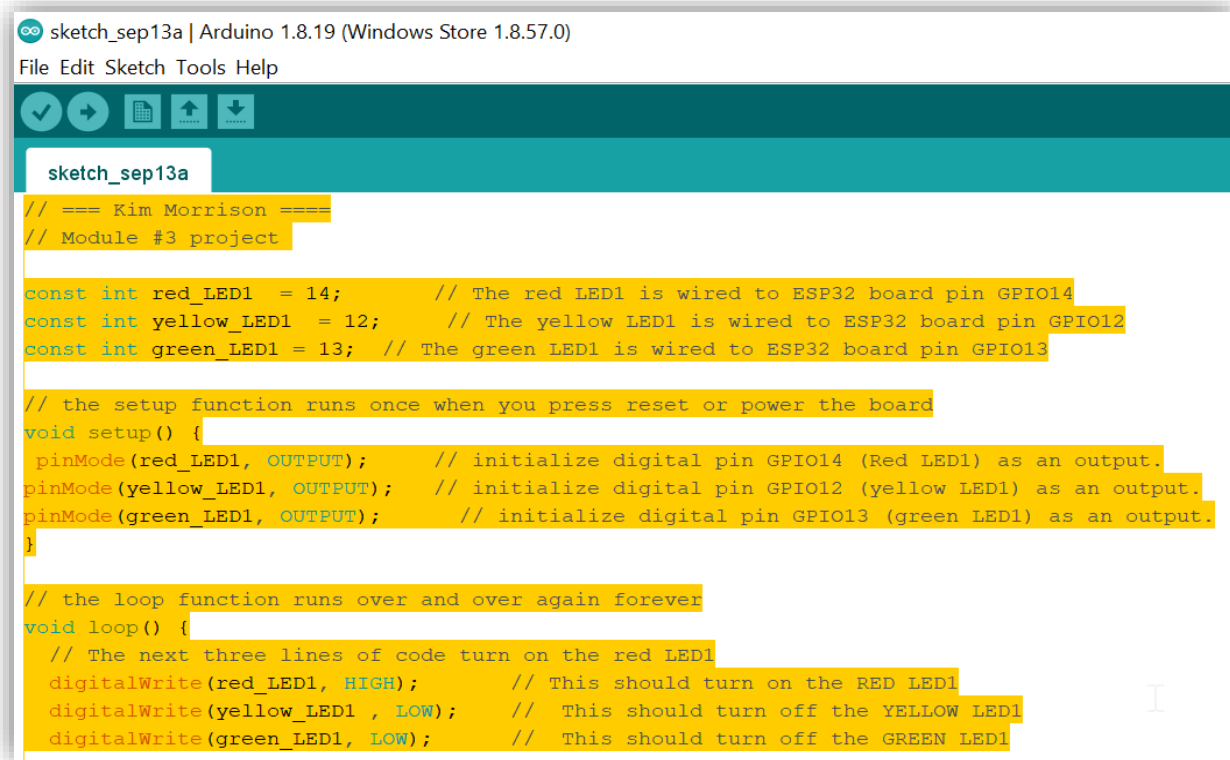
PICTURE OF CIRCUIT WITH WORKING LEDS

- ESP 32 Board
- Colored LEDs: Red, Yellow and Green
- Wires
- Breadboard



SCREENSHOT OF CODE IN ARDUINO IDE

- Screenshot of code in Arduino IDE showing your name in the comment



```
sketch_sep13a | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help

sketch_sep13a
// === Kim Morrison ====
// Module #3 project

const int red_LED1 = 14; // The red LED1 is wired to ESP32 board pin GPIO14
const int yellow_LED1 = 12; // The yellow LED1 is wired to ESP32 board pin GPIO12
const int green_LED1 = 13; // The green LED1 is wired to ESP32 board pin GPIO13

// the setup function runs once when you press reset or power the board
void setup() {
  pinMode(red_LED1, OUTPUT); // initialize digital pin GPIO14 (Red LED1) as an output.
  pinMode(yellow_LED1, OUTPUT); // initialize digital pin GPIO12 (yellow LED1) as an output.
  pinMode(green_LED1, OUTPUT); // initialize digital pin GPIO13 (green LED1) as an output.
}

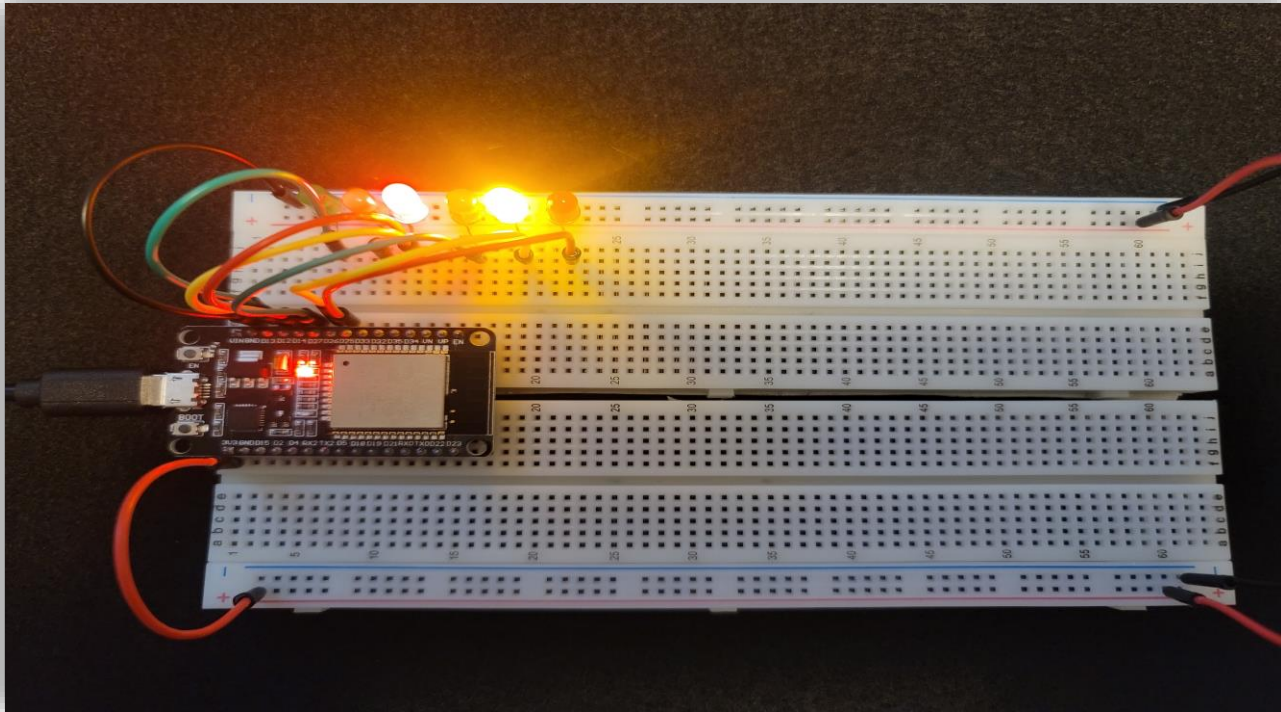
// the loop function runs over and over again forever
void loop() {
  // The next three lines of code turn on the red LED1
  digitalWrite(red_LED1, HIGH); // This should turn on the RED LED1
  digitalWrite(yellow_LED1, LOW); // This should turn off the YELLOW LED1
  digitalWrite(green_LED1, LOW); // This should turn off the GREEN LED1
}
```



WEEK 4

PICTURE OF CIRCUIT WITH WORKING LEDS

- ESP 32 Board
- Colored LEDs: Red, Yellow and Green (two sets)
- Wires
- Breadboard



SCREENSHOT OF CODE IN ARDUINO IDE

- Screenshot of code in Arduino IDE showing **your name in the comment**

```
sketch_sep13a | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help
sketch_sep13a $
// === Kim Morrison ===
// Module #4 project

// Define some labels
const int red_LED1 = 14; // The red LED1 is wired to ESP32 board pin GPIO14
const int yellow_LED1 = 12; // The yellow LED1 is wired to ESP32 board pin GPIO12
const int green_LED1 = 13; // The green LED1 is wired to ESP32 board pin GPIO13
const int red_LED2 = 25; // The red LED2 is wired to Mega board pin GPIO25
const int yellow_LED2 = 26; // The yellow LED2 is wired to Mega board pin GPIO 26
const int green_LED2 = 27; // The green LED2 is wired to Mega board pin GPIO 27

// the setup function runs once when you press reset or power the board
void setup() {
  pinMode(red_LED1, OUTPUT); // initialize digital pin GPIO14 (Red LED1) as an output.
  pinMode(yellow_LED1, OUTPUT); // initialize digital pin GPIO12 (yellow LED1) as an output.
  pinMode(green_LED1, OUTPUT); // initialize digital pin GPIO13 (green LED1) as an output.
  pinMode(red_LED2, OUTPUT); // initialize digital pin GPIO25 (Red LED2) as an output.
  pinMode(yellow_LED2, OUTPUT); // initialize digital pin GPIO26 (yellow LED2) as an output.
  pinMode(green_LED2, OUTPUT); // initialize digital pin GPIO27 (green LED2) as an output.
}

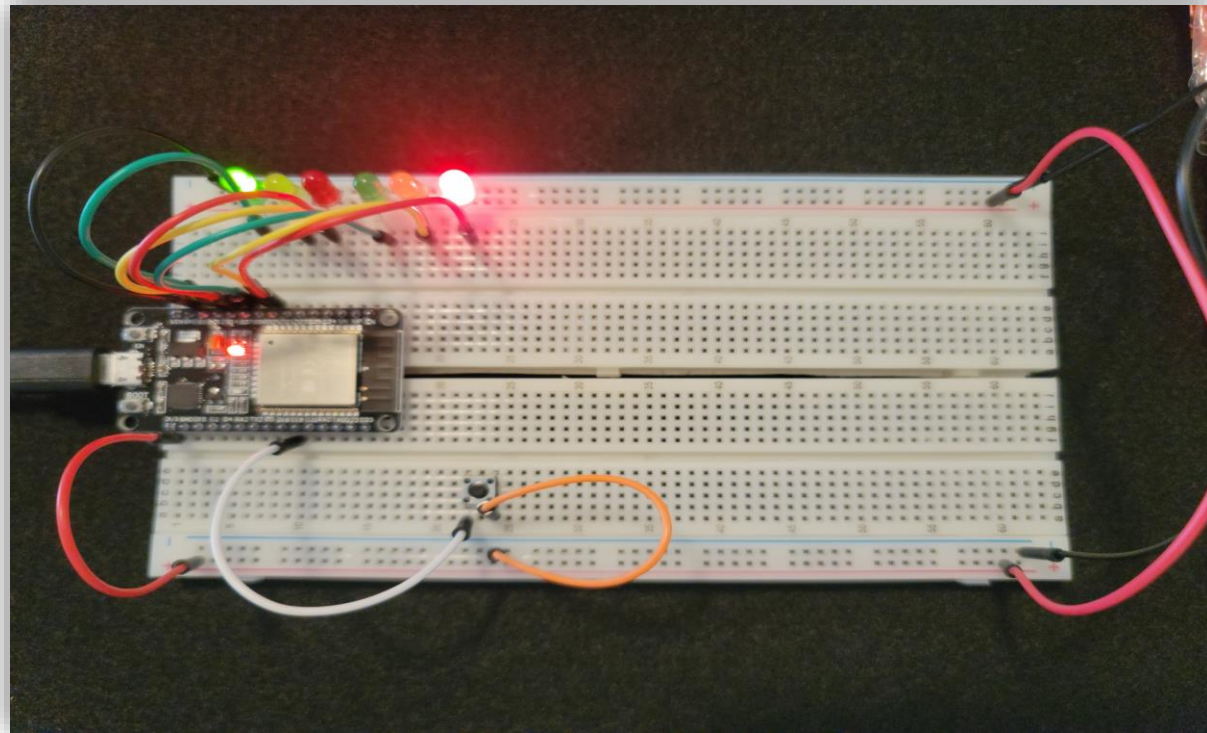
// the loop function runs over and over again forever
void loop() {
  // The next three lines of code turn on the red LED1
  digitalWrite(red_LED1, HIGH); // This should turn on the RED LED1
  digitalWrite(yellow_LED1, LOW); // This should turn off the YELLOW LED1
}
```



WEEK 5

PICTURE OF CIRCUIT WITH WORKING LEDS

- ESP 32 Board
- Colored LEDs: Red, Yellow and Green (two sets)
- Push Button
- Wires
- Breadboard



SCREENSHOT OF CODE IN ARDUINO IDE

- Screenshot of code in Arduino IDE showing your name in the comment

```
sketch_oct02a | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help
sketch_oct02a $
// === Kim Morrison ====
// Module #5 project
const int red_LED1 = 14; // The red LED1 is wired to ESP32 board pin GPIO14
const int yellow_LED1 = 12; // The yellow LED1 is wired to ESP32 board pin GPIO12
const int green_LED1 = 13; // The green LED1 is wired to ESP32 board pin GPIO13
const int red_LED2 = 25; // The red LED2 is wired to Mega board pin GPIO25
const int yellow_LED2 = 26; // The yellow LED2 is wired to Mega board pin GPIO 26
const int green_LED2 = 27; // The green LED2 is wired to Mega board pin GPIO 27

int Xw_value;
const int Xw_button = 19; //Cross Walk button

// the setup function runs once when you press reset or power the board
void setup() {

  pinMode(Xw_button, INPUT_PULLUP); // 0=pressed, 1 = unpressed button
  Serial.begin(115200);
  pinMode(red_LED1, OUTPUT); // initialize digital pin 14 (Red LED1) as an output.
  pinMode(yellow_LED1, OUTPUT); // initialize digital pin 12 (yellow LED1) as an output.
  pinMode(green_LED1, OUTPUT); // initialize digital pin 13 (green LED1) as an output.

  pinMode(red_LED2, OUTPUT); // initialize digital pin 25 (Red LED2) as an output.
  pinMode(yellow_LED2, OUTPUT); // initialize digital pin 26 (yellow LED2) as an output.
  pinMode(green_LED2, OUTPUT); // initialize digital pin 27 (green LED2) as an output.
}
```


SCREENSHOT OF SERIAL MONITOR IN ARDUINO IDE

- Screenshot of output in Serial Monitor

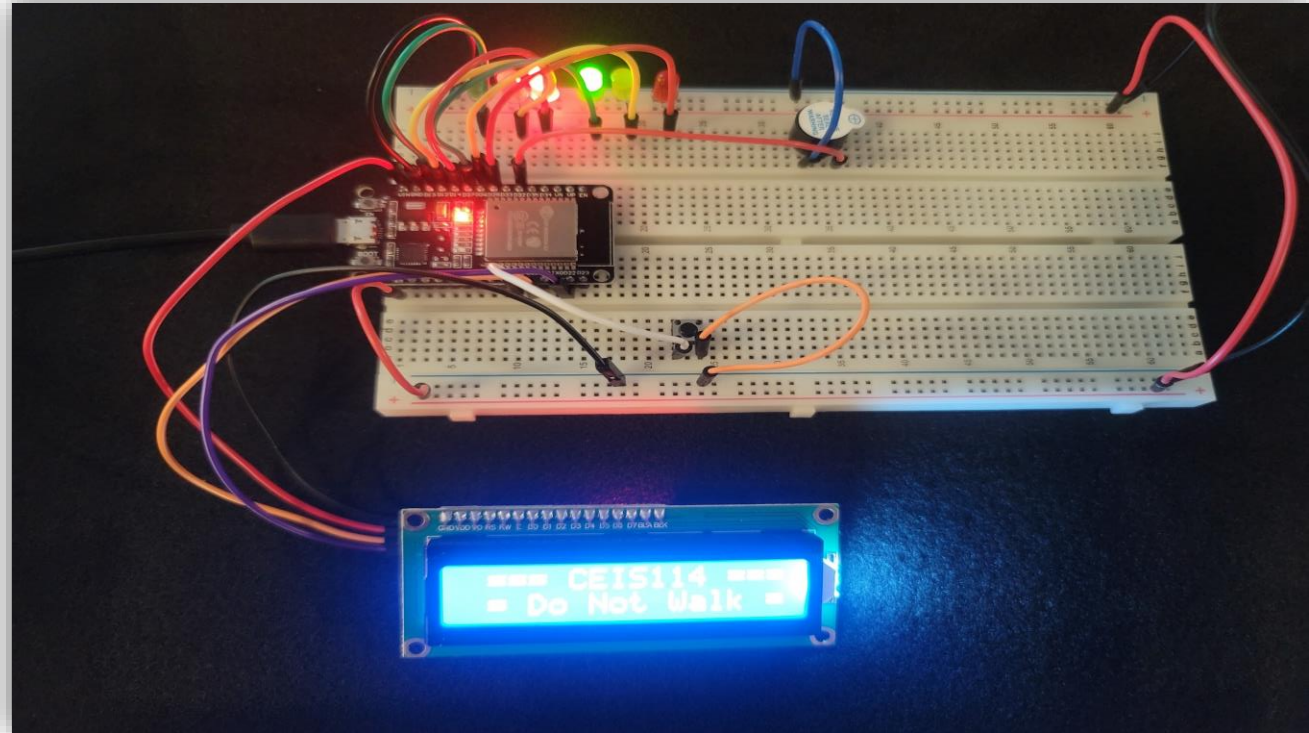
```
COM3
13:22:16.310 -> == Do Not Walk ==
13:22:26.298 -> Count = 10 == Walk ==
13:22:27.337 -> Count = 9 == Walk ==
13:22:28.329 -> Count = 8 == Walk ==
13:22:29.320 -> Count = 7 == Walk ==
13:22:30.313 -> Count = 6 == Walk ==
13:22:31.304 -> Count = 5 == Walk ==
13:22:32.291 -> Count = 4 == Walk ==
13:22:33.316 -> Count = 3 == Walk ==
13:22:34.307 -> Count = 2 == Walk ==
13:22:35.299 -> Count = 1 == Walk ==
13:22:36.293 -> == Do Not Walk ==
```



WEEK 6

PICTURE OF CIRCUIT WITH WORKING LEDS AND LCD DISPLAY

- ESP 32 Board
- Colored LEDs: Red, Yellow and Green (two sets)
- Push Button
- LCD Unit with Message Display
- Wires
- Breadboard



SCREENSHOT OF CODE IN ARDUINO IDE

- Screenshot of code in Arduino IDE showing your name in the comment



```
sketch_oct08a | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help
sketch_oct08a §
#include <LiquidCrystal_I2C.h>

// === Kim Morrison ===
// Module #6 project
#include <Wire.h> //lcd
#include <LiquidCrystal_I2C.h> //lcd
LiquidCrystal_I2C lcd(0x27,16,2); //set the LCD address to 0x3F for a 16 chars and 2-line display
// if it does not work then try 0x3F, if both addresses do not work then run the scan code below

const int bzz=32; // GPIO32 to connect the Buzzer
//===== LCD =====
const int red_LED1 = 14; // The red LED1 is wired to ESP32 board pin GPIO14
const int yellow_LED1 =12; // The yellow LED1 is wired to ESP32 board pin GPIO12
const int green_LED1 = 13; // The green LED1 is wired to ESP32 board pin GPIO13
const int red_LED2 = 25; // The red LED2 is wired to Mega board pin GPIO25
const int yellow_LED2 = 26; // The yellow LED2 is wired to Mega board pin GPIO 26
const int green_LED2 = 27; // The green LED2 is wired to Mega board pin GPIO 27

int Xw_value;
const int Xw_button = 19; //Cross Walk button

void setup() {
  Serial.begin(115200);
  pinMode(Xw_button, INPUT_PULLUP); // 0=pressed, 1 = unpressed button

  lcd.init(); // initialize the lcd
```

SCREENSHOT OF SERIAL MONITOR IN ARDUINO IDE

- Screenshot of output in Serial Monitor

```
COM3
|
|
17:15:44.614 -> == Do Not Walk ==
17:15:54.609 -> Count = 10 == Walk ==
17:15:55.645 -> Count = 9 == Walk ==
17:15:56.684 -> Count = 8 == Walk ==
17:15:57.767 -> Count = 7 == Walk ==
17:15:58.809 -> Count = 6 == Walk ==
17:15:59.846 -> Count = 5 == Walk ==
17:16:00.931 -> Count = 4 == Walk ==
17:16:01.968 -> Count = 3 == Walk ==
17:16:03.053 -> Count = 2 == Walk ==
17:16:04.092 -> Count = 1 == Walk ==
17:16:05.130 -> Count = 0 == Walk ==
17:16:06.262 -> == Do Not Walk ==
```



WEEK 7

FEEDBACK GIVEN TO TEAMMATES



Isaiah Nixon

Wednesday



[CEIS114 Project Template Module 6 Complete .pptx](#) ↓

Hello, class and group. I have decided to do option 2 for my Final Course Project. My process for building these final powerpoint deliverables is as follows: I put together the powerpoint to reflect my progress on the project up to this point, then put together the final portion of the device, and finally I will put together the last portion of the powerpoint to show my finished project and discuss the challenges I faced along the way.

← Reply



Kimberly Morrison (She/Her)

Wednesday



Have you thought about the design of your power point? Adding some color will make your pictures pop and grab the reader's attention.

I think your picture clarity is wonderful.

← Reply

FEEDBACK GIVEN TO TEAMMATES




Noah Locklear

Wednesday



[Presentation 17 \(1\).pdf](#) ↓

This was my module 6 project. I plan on taking all the sides from all the projects and bringing them into one on a Wix website. I will talk about what I have learned and the possible projects in the future that I can use this information.

↩ Reply 



Kimberly Morrison (She/Her)

Thursday



I am very jealous of your LCD picture. Mine needs to be redone.

I think your plan is a good one. One question I have for you, what do you think your biggest challenge was while executing this project?

FEEDBACK REFLECTIONS



Andrea Williams

Oct 11, 2022



Kimberly,

I took a look at your ppt and it looks great. I was amazed at how nicely your jumper wires were placed on your breadboard in each picture you submitted. It looks very professional and the setup of your ppt itself definitely works. I still have to do my final circuit and make my ppt but yours is inspirational. Great job.

↩ Reply  (1 like)

FEEDBACK REFLECTIONS



Robert Vargas

Sunday



Hello Kimberly,

I taken a look at the power point that you gave and it very good so far. Just the thought of being a rough draft, I think you are heading in the right direction for your Final Prestation Project. Many of the pictures provided is very clear and readable. Only thing which is my own opinion is that the challenges slide will be either second or third to the last slide but that just myself. More than that I think the rough draft is very good and neatly done.

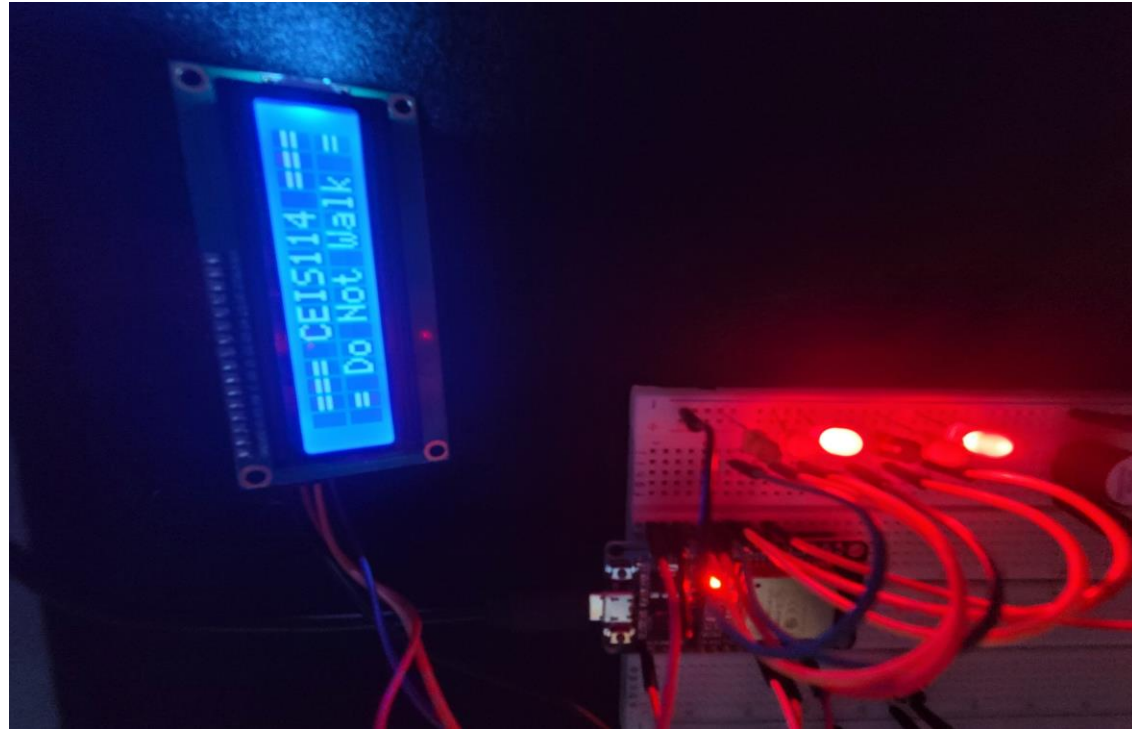
Robert Vargas

A pink highlighter pen is positioned diagonally in the upper left corner of the image, pointing towards the center. The background is a calendar page with dates visible, including 10, 16, 17, 18, 24, and 25. A white rectangular box is overlaid on the calendar, containing the text "WEEK 8 – FINAL COURSE PROJECT".

WEEK 8 – FINAL COURSE PROJECT

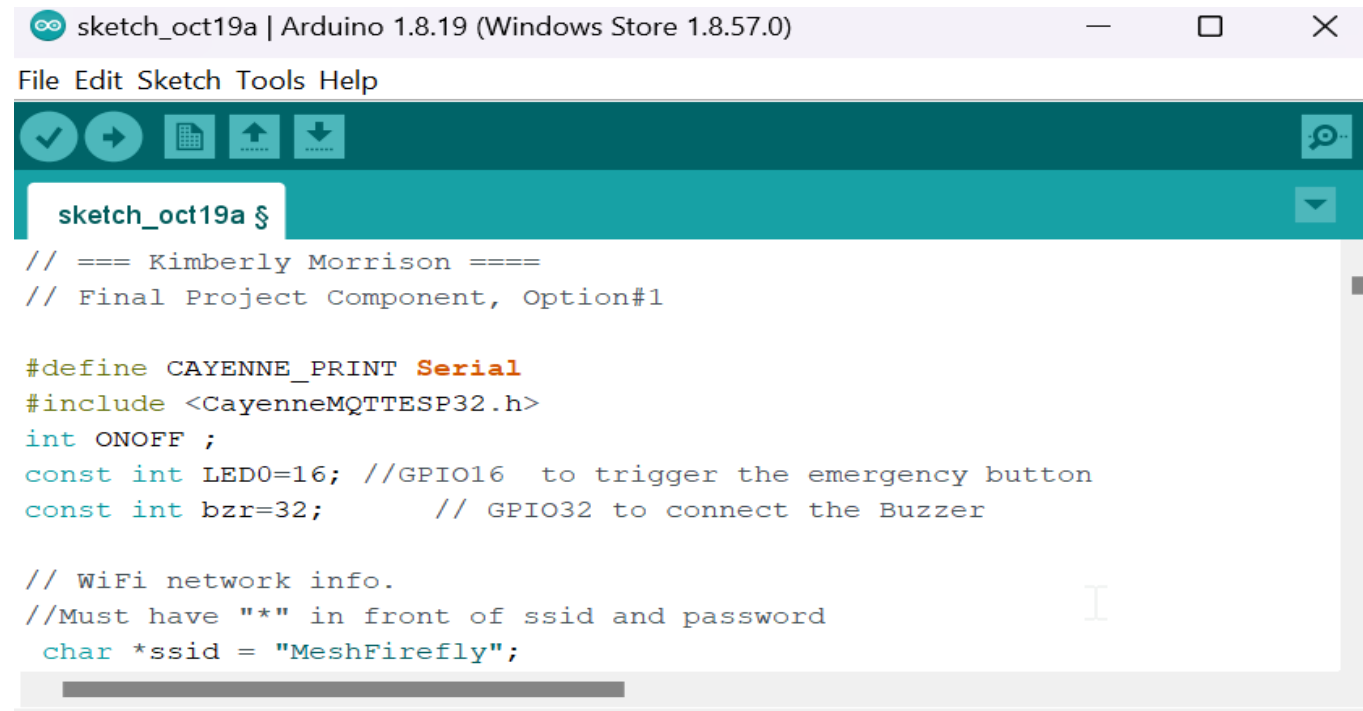
PICTURE OF CIRCUIT WITH WORKING LEDS AND LCD DISPLAY

- ESP 32 Board
- Colored LEDs: Red, Yellow and Green (two sets)
- One Blue LED – Emergency Light
- Push Button
- LCD Unit
- Buzzer
- Wires
- Breadboard



SCREENSHOT OF CODE IN ARDUINO IDE

Screenshot of code in Arduino IDE showing your name in the comment



```
sketch_oct19a | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help
sketch_oct19a §
// === Kimberly Morrison ===
// Final Project Component, Option#1

#define CAYENNE_PRINT Serial
#include <CayenneMQTTESP32.h>
int ONOFF ;
const int LED0=16; //GPIO16 to trigger the emergency button
const int bzc=32; // GPIO32 to connect the Buzzer

// WiFi network info.
//Must have "*" in front of ssid and password
char *ssid = "MeshFirefly";
```

SCREENSHOT OF SERIAL MONITOR IN ARDUINO IDE

Screenshot of output
in Serial Monitor

```
COM3
21:44:26.815 -> == Do Not Walk ==
21:44:37.857 -> == Do Not Walk ==
21:44:48.854 -> == Do Not Walk ==
21:44:59.848 -> Count = 10 == Walk ==
21:45:01.925 -> Count = 9 == Walk ==
21:45:04.001 -> Count = 8 == Walk ==
21:45:06.031 -> Count = 7 == Walk ==
21:45:08.108 -> Count = 6 == Walk ==
21:45:10.180 -> Count = 5 == Walk ==
21:45:12.207 -> Count = 4 == Walk ==
21:45:14.281 -> Count = 3 == Walk ==
21:45:16.356 -> Count = 2 == Walk ==
21:45:18.417 -> Count = 1 == Walk ==
21:45:20.446 -> Count = 0 == Walk ==
21:45:23.560 -> == Do Not Walk ==
```

SCREENSHOT OF SERIAL MONITOR IN ARDUINO IDE

Screenshot of output
in Serial Monitor

```
COM3  
21:46:07.680 -> == Do Not Walk ==  
21:46:18.729 -> == Emergency ==  
21:46:18.729 -> == Do Not Walk ==  
21:46:19.863 -> == Emergency ==  
21:46:19.863 -> == Do Not Walk ==  
21:46:20.949 -> == Emergency ==  
21:46:20.949 -> == Do Not Walk ==  
21:46:22.034 -> == Emergency ==  
21:46:22.082 -> == Do Not Walk ==  
21:46:23.162 -> == Emergency ==  
21:46:23.162 -> == Do Not Walk ==  
21:46:24.247 -> == Emergency ==
```



CHALLENGES

- One of my LEDs refused to light no matter how it was wired, and I had to troubleshoot the issue
- Having to debug code that I did not write to determine why the application failed to upload to the board
- Remembering to hold the reset button on the ESP32 board until the Arduino IDE connected to the board for uploads



SKILLS LEARNED

- Understanding how to troubleshoot small components
- Understanding and being able to identify icons and what they mean for gates on circuit boards
- Better recall of how to determine binary numbers



CONCLUSION

- It was very interesting to see how small components for smart devices have become of the last decade.
- There were lots of ideas shared on how students could continue their engineering journey with this class and the plethora of information on the internet