Lab 2 Arduino Stoplights

IOT IT515R Class

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# I. Objective

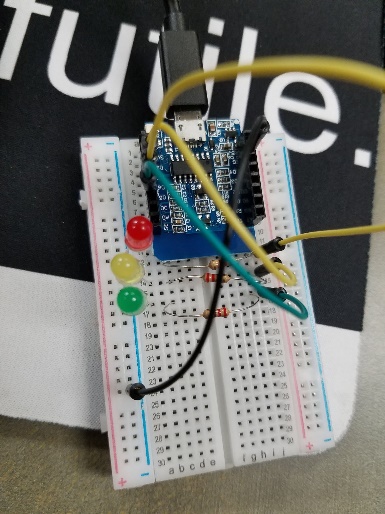
1. Code and create a circuit to turn on and off traffic light colored LEDs (green, yellow, and red) using a website.
2. Create a server to host the GUI for the following functions:
   1. Turning on and off the LEDS
   2. Cycle through which LED is on
   3. Turn off all LEDs

# II. Materials

* 1 Wemos D1 Mini ESP-8266EX Board
* 3 LEDs (Green, Yellow, and Red)
* 3 220 Ω Resistors
* 4 Male to male wires
* 2 Headers
* 1 Breadboard
* Arduino IDE installed
* Micro USB cable (connect computer and board)

# III. Procedure

1. Set up your circuit



1. Include appropriate libraries

#include <ESP8266WiFi.h>

#include <ESP8266mDNS.h>

#include <ESP8266WebServer.h>

#include <WiFiClient.h>

1. Program the following functions:
   1. Turn each LED off and on individually

Example Code:

void TurnGREEN()

//TurnOFF();

AllClear();

digitalWrite(GREEN,HIGH);

//digitalWrite(YELLOW,LOW);

//digitalWrite(RED,LOW);

Serial.println("GREEN");

server.send(302, AutoRespond, WebPage);

}

* 1. Cycle through which LED is on using a regular pattern
  2. Turn off all LEDs

1. Setup for connecting to the wifi

char WifiName[] = "Wifi Name"; //SSID

char Password[] = "Wifi password";

Serial.println("Connection Started"); //Begin Connection to Wifi

Serial.print("IP Address: ");

Serial.println(WiFi.localIP()); //IP assigned to Server by host wifi

1. Setup Server

Server.begin();

1. Make sure functions are sent to server and assigned appropriately (see HTML code in Appendix A)

server.on("/green", TurnGREEN);

server.on("/yellow", TurnYELLOW);

server.on("/red", TurnRED);

server.on("/turnoff", TurnOFF);

server.on ("/cycle", CYCLE);

server.on("/", HOME);

1. Have the server listen for clients/users

void loop() { // put your main code here, to run repeatedly:

server.handleClient(); //Listen for clients (Connections to the webpage)

}

# IV. Links

* Github: <https://github.com/Sh0rtyTheCircuit/WemosTrafficLights>
* Blog: <http://ideatethecreate.blogspot.com/2018/10/iot-lab-2-arduino-stoplight.html>

# V. Thought Questions

1. What are some key differences between developing this lab on a Raspberry Pi, and developing on Arduino?

|  |  |
| --- | --- |
| **Raspberry Pi** | **Arduino** |
| Mini Computer | Microcontroller |
| Python | C++ |
| Is the computer | Needs to be connected to a computer |
| Used Threads to check input | Used Site refreshes to check new input |

1. What are the strengths and trade-offs of each of these platforms?

**Strengths**

|  |  |
| --- | --- |
| **Raspberry Pi** | **Arduino** |
| Python is easier than C++ | Portable |
| Does not need a computer | Cheap |
| Portable | Arduino IDE compiles and lets you know if the code will work without uploading |

**Weaknesses**

|  |  |
| --- | --- |
| **Raspberry Pi** | **Arduino** |
| Need to have a computer screen, keyboard, mouse, and Ethernet cable available. | Can you any available computer to code |
| Slower than normal computers | Uses C++ (harder to use than Python) |
| Portable |  |

1. How familiar were you with the Arduino platform prior to this lab?

I used Arduinos a few years ago but I forgot how to use it.

1. What was the biggest challenge you overcame in this lab?

Biggest challenge was getting the webpage to work correctly. I had trouble loading it, making the buttons work, and having the LEDs go off accordingly.

1. Please estimate the total time you spent on this lab and report.

20 hours

# VI. Sources

* <https://ruslanspivak.com/lsbaws-part1/>
* <https://www.instructables.com/id/Wemos-ESP8266-Getting-Started-Guide-Wemos-101/>
* <https://wiki.wemos.cc/tutorials:get_started:get_started_in_arduino>
* <https://www.arduino.cc/en/Tutorial-0007/DigitalWrite>
* <https://www.arduino.cc/en/Tutorial/Button>
* <https://www.arduino.cc/en/Serial/Print>
* <http://www.iotlearning.net/code/esp8266-code/wemos-flash-led-off-webserver-example.php>

# VII. Appendix A

#include <ESP8266WiFi.h>

#include <ESP8266mDNS.h>

#include <ESP8266WebServer.h>

#include <WiFiClient.h>

//#include <avr/wdt.h> Watchdog timer library

// #### LED Pin Setup #### //

int GREEN = D5;

int YELLOW = D7;

int RED = D6;

// ##### Wifi Connection Setup #### //

char WifiName[] = "Verizon-SM-G935V"; //SSID

char Password[] = "password";

ESP8266WebServer server(80); //Server is on Port 80

// #### Web Page Setup #### //

char WebPage[] = "<html><title><Choose Wisely></title><body><form action=\"/green\"><button>Green</button></form><br><form action=\"/yellow\"><button>Yellow</button></form><br><form action=\"/red\"><button>Red</button></form><br><form action=\"/turnoff\"><button>Clear</button></form><br><form action=\"/cycle\"><button>Cycle</button></form><br></body></html>";

char AutoRespond[] = "text/html\nRefresh: 1"; //header: content type/conent type\ how often refresh

void NoClient(){

server.send(404);

Serial.println("Reconnecting to server");

}

void HOME(){ //HomePage

server.send(302, AutoRespond, WebPage);

Serial.println("Home Page Opened");

}

// #### LED Functions Setup #### //

void TurnGREEN(){

//TurnOFF();

AllClear();

digitalWrite(GREEN,HIGH);

//digitalWrite(YELLOW,LOW);

//digitalWrite(RED,LOW);

Serial.println("GREEN");

server.send(302, AutoRespond, WebPage);

}

void TurnYELLOW(){

//TurnOFF();

AllClear();

digitalWrite(YELLOW,HIGH);

//digitalWrite(GREEN,LOW);

//digitalWrite(RED,LOW);

Serial.println("YELLOW");

server.send(302, AutoRespond, WebPage);

}

void TurnRED(){

AllClear();

digitalWrite(RED,HIGH);

Serial.println("RED");

server.send(302, AutoRespond, WebPage);

}

void TurnOFF(){

AllClear();

Serial.println("All Clear");

server.send(302, AutoRespond, WebPage);

}

void AllClear(){

digitalWrite(GREEN,LOW);

digitalWrite(YELLOW,LOW);

digitalWrite(RED,LOW);

}

void CYCLE(){

//TurnOFF(); Don't do this. Sends same cmd to server twice: "server.send(302, AutoRespond, WebPage)" = confuses server - times out program

AllClear();

Serial.println("Cycling");

digitalWrite(GREEN,HIGH);

delay(2000); //Wait 2 seconds

digitalWrite(GREEN,LOW);

digitalWrite(YELLOW,HIGH);

delay(2000);

digitalWrite(YELLOW,LOW);

digitalWrite(RED,HIGH);

delay(2000);

server.send(302, AutoRespond, WebPage);

}

void setup() {

// put your setup code here, to run once:

pinMode(GREEN,OUTPUT);

pinMode(YELLOW,OUTPUT);

pinMode(RED,OUTPUT);

Serial.begin(115200); //Starts the Serial Monitor (Input printed on screen)

WiFi.begin(WifiName,Password);

while (WiFi.status() !=WL\_CONNECTED){ //If not connected to Wifi, delay until connected

delay (2000);

Serial.println("Finding a Connection...");

}

Serial.println("Connection Started"); //Begin Connection to Wifi

Serial.print("IP Address: ");

Serial.println(WiFi.localIP()); //IP assigned to Server by host wifi

// #### Activate Functions #### //

//If "/ " is seen in the URL, do this function

server.on("/green", TurnGREEN);

server.on("/yellow", TurnYELLOW);

server.on("/red", TurnRED);

server.on("/turnoff", TurnOFF);

server.on ("/cycle", CYCLE);

server.on("/", HOME);

server.onNotFound(NoClient); //When client not found

server.begin();

Serial.println("Server Ready");

}

void loop() { // put your main code here, to run repeatedly:

server.handleClient(); //Listen for clients (Connections to the webpage)

}