**แนวทางการใช้งานอินเทอร์เน็ตของสรรพสิ่งในระบบการผลิต**

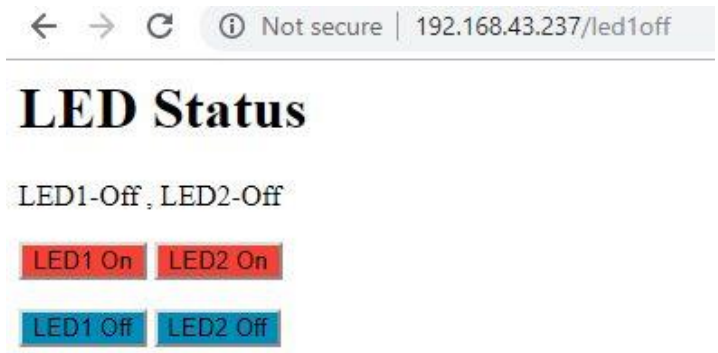
**IoT Approaches to Manufacturing System**

**ชื่อ-สกุล : นายธนพ กาศักดิ์**

**4/4. คำถามท้ายบทเพื่อทดสอบความเข้าใจ**

## Quiz_201 – Web Control 2 LED

- อยากได้ปุ่มสำหรับคุมปิด-เปิด หลอดไฟ LED 2 ดวง
- https://www.colorhexa.com/008cba?fbclid=IwAR3dIZ_gRgDWmREmnzuknLbMxV3pOHy4YIPuLEz8-ZzTOX2VhWxcH2QjLGk



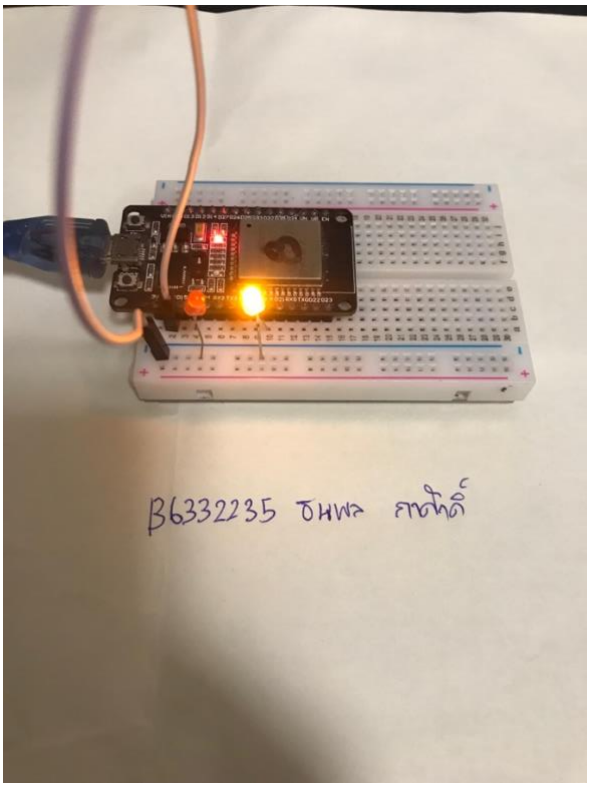

**< Test Code >**

```
#include <WiFi.h>
const char* ssid = "iPhoneOhm";
const char* password = "2444666668888888";


int pinTest = 2;
int pinTest2 = 19;
WiFiServer server(80);
void setup() {
  Serial.begin(115200);
  pinMode(pinTest, OUTPUT);
  pinMode(pinTest2, OUTPUT);  // set the LED pin mode
  delay(10);
  Serial.print("\n\nConnecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
```

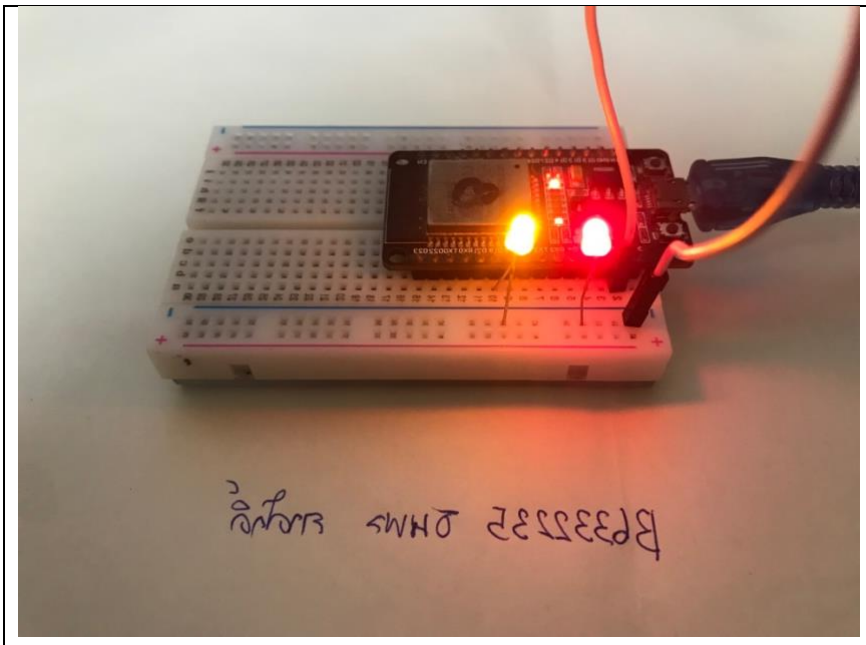
```
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected.");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
  server.begin();
}
int value = 0;
bool LED1_Status = LOW;
bool LED2_Status = LOW;
void loop() {
  digitalWrite(pinTest, LED1_Status);
  digitalWrite(pinTest2, LED2_Status);
  WiFiClient client = server.available();  // listen for incoming clients
  if (client) {                     // if you get a client,
    Serial.println("New Client.");         // print a message out the serial port
    String currentLine = "";                // make a String to hold incoming data from the client
    while (client.connected()) {            // loop while the client's connected
      if (client.available()) {             // if there's bytes to read from the client,
        char c = client.read();             // read a byte, then
        Serial.write(c);                    // print it out the serial monitor
        if (c == '\n') {                    // if the byte is a newline character
          if (currentLine.length() == 0) {
            client.println("HTTP/1.1 200 OK");
            client.println("Content-type:text/html");
            client.println();
            client.println("<html>");
            client.println("<body>");
            client.println("<h1>LED Status</h1>");
            //client.println("<h1>LED2 Status</h1>");
            client.println("<p>");
            if (LED1_Status == HIGH) {
              client.println("LED1-On");
            } else {
              client.println("LED1-Off");
```

```
          }
          if (LED2_Status == HIGH) {
            client.println("LED2-On");
          } else {
            client.println("LED2-Off");
          }
          client.println("<p>");
          //client.println("<a href=\"/ledon\"><button>LED On</button></a>");
          client.println("<a href=\"/LED1-On\"><button style = \"background-color:
#f44336;\">LED1On</button></a>");
          client.println("<a href=\"/LED2-On\"><button style = \"background-color:
#f44336;\">LED2On</button></a>");
          client.println("</p>");
          //client.println("<a href=\"/ledoff\"><button>LED Off</button></a>");
          client.println("<a href=\"/LED1-Off\"><button style = \"background-color:
#008CBA;\">LED1Off</button></a>");
          client.println("<a href=\"/LED2-Off\"><button style = \"background-color:
#008CBA;\">LED2Off</button></a>");
          client.println("<body>");
          client.println("<html>");
          break;
        } else {
          currentLine = "";
        }
      } else if (c != '\r') {
        currentLine += c;
      }
      if (currentLine.endsWith("GET /LED1-On")) LED1_Status = HIGH;
      if (currentLine.endsWith("GET /LED2-On")) LED2_Status = HIGH;
      if (currentLine.endsWith("GET /LED1-Off")) LED1_Status = LOW;
      if (currentLine.endsWith("GET /LED2-Off")) LED2_Status = LOW;
    }
  }
  client.stop();  // close the connection:
  Serial.println("Client Disconnected.");
 }
}
```

**รูปการต่อวงจร – 1**




**รูปการต่อวงจร – 2**



หน้าจอ **Web Control**

# LED Status

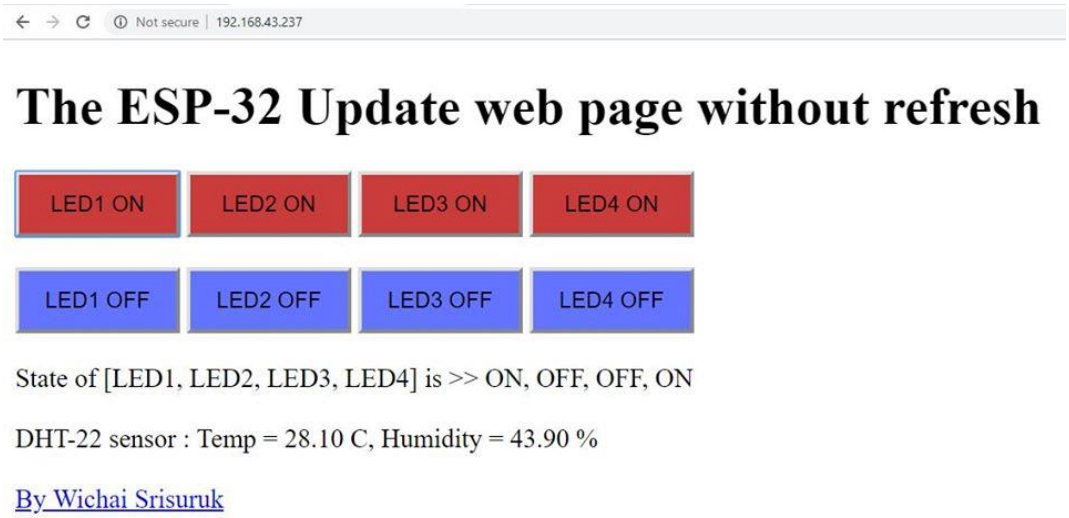
LED1-On LED2-On

LED1On LED2On

LED1Off LED2Off

## Quiz_202 – Web Control 4 LED and Monitor Humid/Temperature

- เพิ่มเติมจาก Q202 อยากได้ปุ่มสำหรับคุมปิด-เปิด หลอดไฟ LED 4 ดวง
- อยากมีกด Link ไปที่หน้า FB ของตัวเอง




< Test Code >

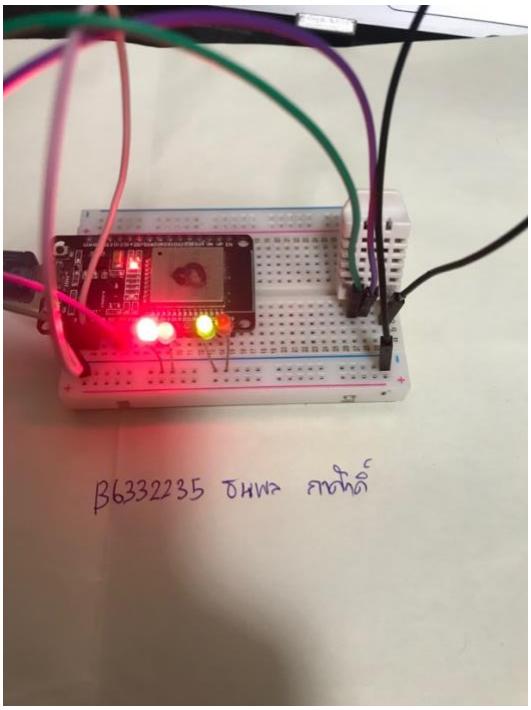
```
#include <WiFi.h>
#include <WiFiClient.h>
#include <WebServer.h>
#include "DHTesp.h"
#include "index.h" //Our HTML webpage contents with javascripts
#define DHT_Pin 4


#define testLED1 18
#define testLED2 19
#define testLED3 22
#define testLED4 23


//SSID and Password of your WiFi router
const char* ssid = "iPhoneOhm";
const char* password = "2444666668888888";
WebServer server(80); //Server on port 80
DHTesp dht;
String ledState1 = "OFF";
String ledState2 = "OFF";
```

```
String ledState3 = "OFF";
String ledState4 = "OFF";
//============================================================
// This routine is executed when you open its IP in browser
//============================================================
void handleRoot() {
  String s = MAIN_page; //Read HTML contents
  server.send(200, "text/html", s); //Send web page
}
void handleADC() {
  float h = dht.getHumidity();
  float t = dht.getTemperature();
  String tmpValue = "Temp = ";
  tmpValue += String(t) + " C, Humidity = ";
  tmpValue += String(h) + " %";
  server.send(200, "text/plane", tmpValue); //Send value to client ajax request
}
void handleLED() {
  String t_state = server.arg("LEDstate"); //Refer xhttp.open("GET", "setLED?LEDstate="+led, true);
  Serial.println(t_state);
  if (t_state == "11") {
    digitalWrite(testLED1, HIGH);  //Feedback parameter
    ledState1 = "ON";
  }
  if (t_state == "10") {
    digitalWrite(testLED1, LOW);  //Feedback parameter
    ledState1 = "OFF";
  }
  if (t_state == "21") {
    digitalWrite(testLED2, HIGH);  //Feedback parameter
    ledState2 = "ON";
  }
  if (t_state == "20") {
    digitalWrite(testLED2, LOW);  //Feedback parameter
    ledState2 = "OFF";
  }
  if (t_state == "31") {
```

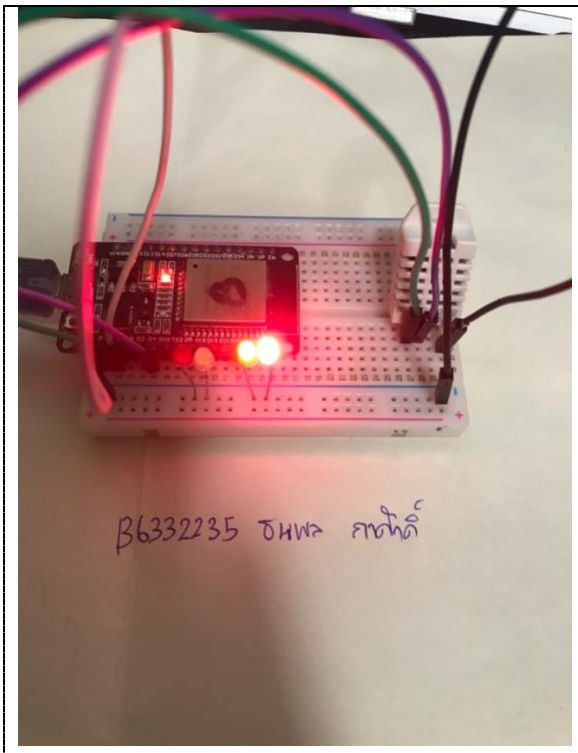
```
    digitalWrite(testLED3, HIGH);  //Feedback parameter
    ledState3 = "ON";
  }
  if (t_state == "30") {
    digitalWrite(testLED3, LOW);  //Feedback parameter
    ledState3 = "OFF";
  }
  if (t_state == "41") {
    digitalWrite(testLED4, HIGH);  //Feedback parameter
    ledState4 = "ON";
  }
  if (t_state == "40") {
    digitalWrite(testLED4, LOW);  //Feedback parameter
    ledState4 = "OFF";
  }
  server.send(200, "text/plane", ledState1 + ", " + ledState2 + ", " + ledState3 + ", " + ledState4); //Send web page
}
void setup(void) {
  Serial.begin(115200);
  dht.setup(DHT_Pin, DHTesp::DHT22); // DHT_Pin D4, DHT22
  pinMode(testLED1, OUTPUT);
  pinMode(testLED2, OUTPUT);
  pinMode(testLED3, OUTPUT);
  pinMode(testLED4, OUTPUT);
  Serial.print("\n\nConnect to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500); Serial.print(".");
  }
  Serial.print("\nConnected "); Serial.println(ssid);
  Serial.print("IP address: "); Serial.println(WiFi.localIP());
  server.on("/", handleRoot);
  server.on("/setLED", handleLED);
  server.on("/readADC", handleADC);
  server.begin();
  Serial.println("HTTP server started");
```

```
}
void loop(void) {
  server.handleClient(); //Handle client requests
}
```

**รูปการต่อวงจร – 1**




**รูปการต่อวงจร – 2**




หน้าจอ **Web Control**

# The ESP-32 Update web page without refresh

LED1 ON | LED2 ON | LED3 ON | LED4 ON

LED1 OFF | LED2 OFF | LED3 OFF | LED4 OFF

State of [LED1, LED2, LED3, LED4] is >> /span>

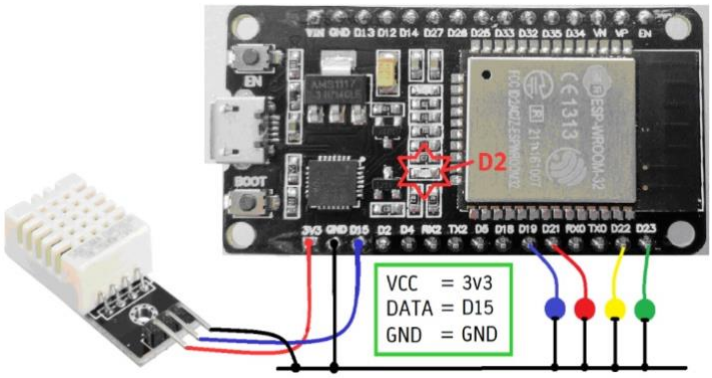
DHT-22 sensor : Temp = 31.70 C, Humidity = 65.80 %

By Tanapon kasak B6332235

## Quiz_203 – Publish

- อ่านค่า DHT-22 แล้วส่งไปยัง MQTT Broker ทุกๆ 5 วินาที
- ควบคุมการแสดงผลให้ 4 LED แสดงผลตามข้อกำหนดดังนี้

| | |
|---|---|
| ✱○○○(Blink) | หากการอ่านค่าแล้วเป็น null, หรือไม่มีเซ็นเซอร์ |
| ●○○○ | ช่วงของอุณหภูมิ (-∞, 24) |
| ●●○○ | ช่วงของอุณหภูมิ [24,26) |
| ●●●○ | ช่วงของอุณหภูมิ [26,28) |
| ●●●● | ช่วงของอุณหภูมิ [28,30) |
| ✱✱✱✱(Blink) | ช่วงของอุณหภูมิ [30,∞) |




**< Test Code >**

```
#include <WiFi.h>
#include <Wire.h>
#include <PubSubClient.h>
#include "DHTesp.h"

DHTesp dht;
#define PinLED1 18
#define PinLED2 19
#define PinLED3 22
#define PinLED4 23
#define DHT22_Pin 4

float h, t;
int blinkStatus = 1;
int LED_PinArray[] = {PinLED1, PinLED2, PinLED3, PinLED4};
int LED_StsArray[] = {0, 0, 0, 0};
```

```
const char* ssid = "iPhoneOhm";
const char* password = "2444666668888888";

const char* mqtt_server = "test.mosquitto.org";
const char* topic1 = "bearish";
String ledState1 = "NA";
WiFiClient espClient;
PubSubClient client(espClient);
long lastMsg = 0;
char msg[50];
int value = 0;
void setup_wifi() {
  delay(10);
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500); Serial.print(".");
  }
  randomSeed(micros());
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}

void reconnect()
{ while (!client.connected()) // Loop until we're reconnected
  { Serial.print("Attempting MQTT connection...");
    String clientId = "ESP8266Client-";
    clientId += String(random(0xffff), HEX); // Create a random client ID
    if (client.connect(clientId.c_str())) // Attempt to connect
    { Serial.println("connected"); // Once connected, publish an announcement...
      client.publish(topic1, "Hello World Pk007"); // ... and resubscribe
      client.subscribe(topic1);
```

```
    } else
    { Serial.print("failed, rc=");
      Serial.print(client.state());
      Serial.println(" try again in 5 seconds");
      delay(5000);
    }
  }
}
void LEDShowStatus(void) {
  if (isnan(t)) {
    blinkStatus = 1 - blinkStatus;
    LED_StsArray[0] = 1;
    LED_StsArray[1] = 0;
    LED_StsArray[2] = 0;
    LED_StsArray[3] = 0;
  }
  if (t < 27) {
    blinkStatus = 1;
    LED_StsArray[0] = 1;
    LED_StsArray[1] = 0;
    LED_StsArray[2] = 0;
    LED_StsArray[3] = 0;
  }
  if (t >= 27) {
    blinkStatus = 1 - blinkStatus;
    LED_StsArray[0] = 1;
    LED_StsArray[1] = 1;
    LED_StsArray[2] = 1;
    LED_StsArray[3] = 1;
  }
  LED_StsArray[1] = 1;
  LED_StsArray[2] = 1;
  LED_StsArray[3] = 1;
  for (int i = 0; i < 4; i++)
    digitalWrite(LED_PinArray[i], LED_StsArray[i] & blinkStatus);
}
void setup()
```

```
{ Serial.begin(115200);
  setup_wifi();
  //Wire.begin(22, 23);
  client.setServer(mqtt_server, 1883);
  dht.setup(DHT22_Pin, DHTesp::DHT22);
  for (int i = 0; i < 4; i++) {
    pinMode(LED_PinArray[i], OUTPUT);
  }
}
void loop()
{
  if (!client.connected()) reconnect();
  client.loop();
  long now = millis();
  if (now - lastMsg > 5000)
  { lastMsg = now;
    ++value;
    //float t = s.readTempC();
    //float h = s.readHumidity();
    delay(dht.getMinimumSamplingPeriod());
    h = dht.getHumidity();
    t = dht.getTemperature();
    sprintf (msg, "TempC: %.2f C, Humidity: %.2f %%", t, h);
    Serial.print("Publish message: ");
    Serial.println(msg);
    client.publish(topic1, msg);
  }
  LEDShowStatus(); delay(250);
  LEDShowStatus(); delay(250);
  LEDShowStatus(); delay(250);
  LEDShowStatus(); delay(250);
  LEDShowStatus(); delay(250);
  LEDShowStatus(); delay(250);
}
```

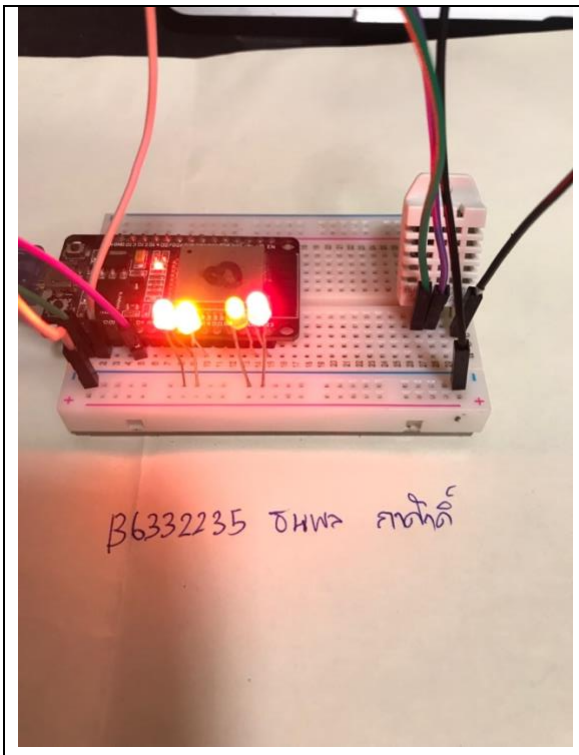
**Index.h**

```
const char MAIN_page[] PROGMEM = R"=====(
```

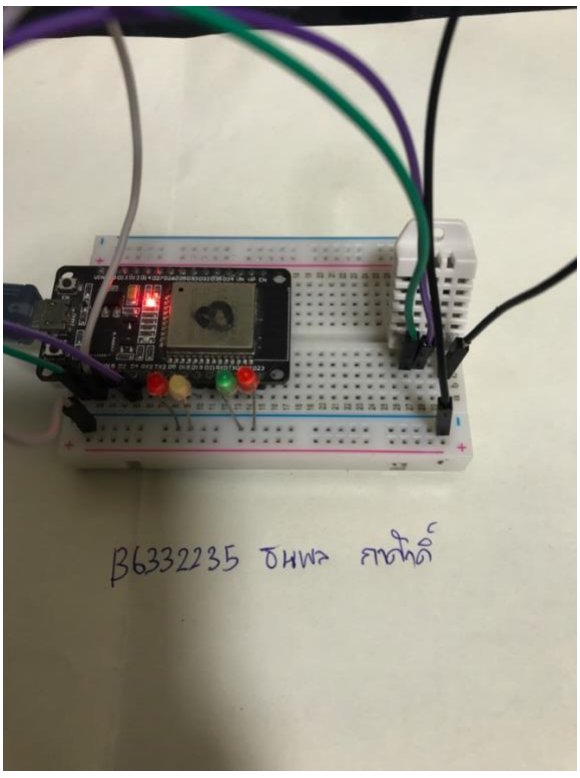
```
<!DOCTYPE html>
<html>
<body>
<div id="demo">
<h1>The ESP-32 Update web page without refresh</h1>
<button type="button" onclick="sendData(11)" style="background: rgb(202, 60,
60);width:100px;height:30px">LED1 ON</button>
<button type="button" onclick="sendData(21)" style="background: rgb(202, 60,
60);width:100px;height:30px">LED2 ON</button>
<button type="button" onclick="sendData(31)" style="background: rgb(202, 60,
60);width:100px;height:30px">LED3 ON</button>
<button type="button" onclick="sendData(41)" style="background: rgb(202, 60,
60);width:100px;height:30px">LED4 ON</button><br><br>
<button type="button" onclick="sendData(10)" style="background:
rgb(100,116,255);width:100px;height:30px">LED1 OFF</button>
<button type="button" onclick="sendData(20)" style="background:
rgb(100,116,255);width:100px;height:30px">LED2 OFF</button>
<button type="button" onclick="sendData(30)" style="background:
rgb(100,116,255);width:100px;height:30px">LED3 OFF</button>
<button type="button" onclick="sendData(40)" style="background:
rgb(100,116,255);width:100px;height:30px">LED4 OFF</button><br><br>
State of [LED1, LED2, LED3, LED4] is >> <span id="LEDState">/span><br>
</div>
<div>
<br>DHT-22 sensor : <span id="ADCValue">0</span><br>
</div>
<script>
function sendData(led) {
var xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = function() {
if (this.readyState == 4 && this.status == 200) {
document.getElementById("LEDState").innerHTML =
this.responseText;
}
};
xhttp.open("GET", "setLED?LEDstate="+led, true);
xhttp.send();
```

```
}
setInterval(function() {
// Call a function repetatively with 2 Second interval
getData();
}, 2000); //2000mSeconds update rate
function getData() {
var xhttp = new XMLHttpRequest();
xhttp.onreadystatechange = function() {
if (this.readyState == 4 && this.status == 200) {
document.getElementById("ADCValue").innerHTML =
this.responseText;
}
};
xhttp.open("GET", "readADC", true);
xhttp.send();
}
</script>
<br><a href="https://www.facebook.com/tanapom.kasak/">By Tanapon kasak B6332235</a>
</body>
</html>
)=====";
```

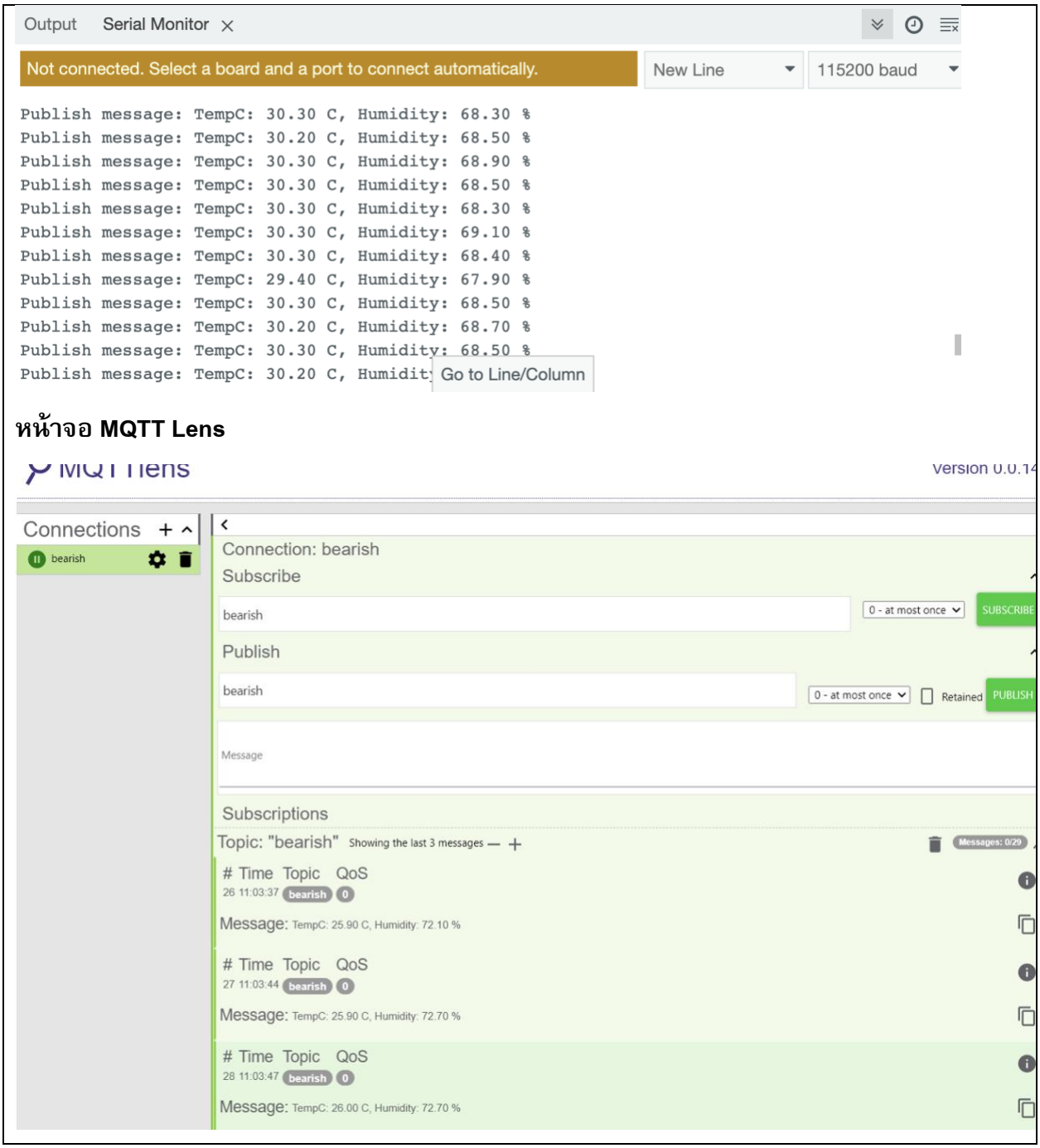
**รูปการต่อวงจร – 1**




**รูปการต่อวงจร – 2**



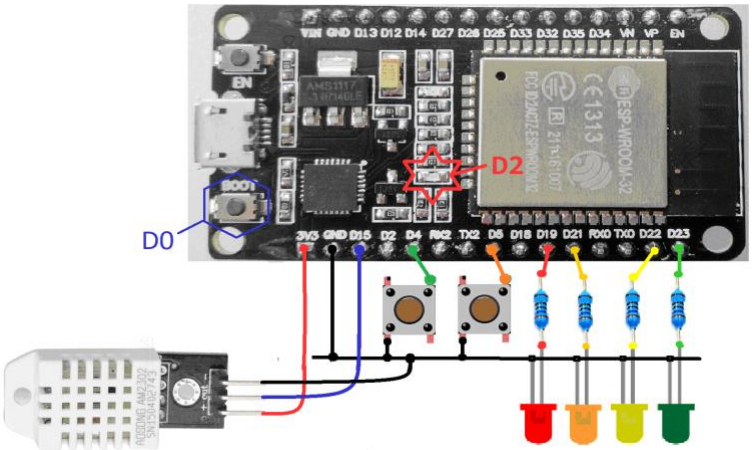

**หน้าจอ Serial Monitor**




**หน้าจอ MQTT Lens**

## Quiz_204 – Publish and Subscribe

- อ่านค่า DHT-22 แล้วส่งไปยัง MQTT Broker ทุกๆ 5 วินาที
- ควบคุมการปิดเปิด 4 LED
- รับค่าสวิตซ์กำหนด SW1 แจ้ง Overheat Alarm, SW2 แจ้ง Intruders Alarm




**< Test Code >**

```
#include <WiFi.h>
#include <Wire.h>
#include <PubSubClient.h>
#include "DHTesp.h"

DHTesp dht;
#define testLED1 18
#define testLED2 19
#define testLED3 22
#define testLED4 23
#define DHT22_Pin 15

const char* ssid = "iPhoneOhm";
const char* password = "2444666668888888";
const char* mqtt_server = "test.mosquitto.org";
const char* topic1 = "bearish";
String ledState1 = "NA";

int pushButton1 = 4;
```

```
int pushButton2 = 5;


WiFiClient espClient;
PubSubClient client(espClient);
long lastMsg = 0;
char msg[50];
int value = 0;
void setup_wifi() {
  delay(10);
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500); Serial.print(".");
  }
  randomSeed(micros());
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
  pinMode(testLED1, OUTPUT);
  pinMode(testLED2, OUTPUT);
  pinMode(testLED3, OUTPUT);
  pinMode(testLED4, OUTPUT);
}
void callback(char* topic, byte* payload, unsigned int length)
{ char myPayLoad[50];
  Serial.print("Message arrived [");
  Serial.print(topic1);
  Serial.print("] ");
  for (int i = 0; i < length; i++)
  { Serial.print((char)payload[i]);
    myPayLoad[i] = payload[i];
    myPayLoad[i + 1] = '\0'; // End of String
  }
  Serial.print("\n ---> "); Serial.println(myPayLoad);
```

```
  myPayLoad[4] = '\0'; // String lessthan 4 Charector
  if ((String)myPayLoad == "ON1") digitalWrite(testLED1, HIGH);
  if ((String)myPayLoad == "OFF1") digitalWrite(testLED1, LOW);
  if ((String)myPayLoad == "ON2") digitalWrite(testLED2, HIGH);
  if ((String)myPayLoad == "OFF2") digitalWrite(testLED2, LOW);
  if ((String)myPayLoad == "ON3") digitalWrite(testLED3, HIGH);
  if ((String)myPayLoad == "OFF3") digitalWrite(testLED3, LOW);
  if ((String)myPayLoad == "ON4") digitalWrite(testLED4, HIGH);
  if ((String)myPayLoad == "OFF4") digitalWrite(testLED4, LOW);
}
void reconnect()
{ while (!client.connected()) // Loop until we're reconnected
  { Serial.print("Attempting MQTT connection...");
    String clientId = "ESP8266Client-";
    clientId += String(random(0xffff), HEX); // Create a random client ID
    if (client.connect(clientId.c_str())) // Attempt to connect
    { Serial.println("connected"); // Once connected, publish an announcement...
      client.publish(topic1, "Hello World Pk007"); // ... and resubscribe
      client.subscribe(topic1);
    } else
    { Serial.print("failed, rc=");
      Serial.print(client.state());
      Serial.println(" try again in 5 seconds");
      delay(5000);
    }
  }
}
void setup()
{ Serial.begin(115200);
  setup_wifi();
  dht.setup(DHT22_Pin, DHTesp::DHT22);
  pinMode(pushButton1, INPUT_PULLUP);
  pinMode(pushButton2, INPUT_PULLUP);
  client.setServer(mqtt_server, 1883);
  client.setCallback(callback);
  pinMode(testLED1, OUTPUT);
  pinMode(testLED2, OUTPUT);
```

```
  pinMode(testLED3, OUTPUT);
  pinMode(testLED4, OUTPUT);
}

void loop()
{
  if (!client.connected()) reconnect();
  client.loop();
  long now = millis();
  if (now - lastMsg > 5000)
  { lastMsg = now;
    ++value;
    float h = dht.getHumidity();
    float t = dht.getTemperature();
    sprintf (msg, "TempC: %.2f C, Humidity: %.2f %%", t, h);
    Serial.print("Publish message: ");
    Serial.println(msg);
    client.publish(topic1, msg);
  }
  if (digitalRead(pushButton1) == 0) {
    sprintf (msg, "Overheat Alarm");
    Serial.println(msg);
    client.publish(topic1, msg);
    delay(500);
  }
  if (digitalRead(pushButton2) == 0) {
    sprintf (msg, "Intruders Alarm");
    Serial.println(msg);
    client.publish(topic1, msg);
    delay(500);
  }
}
```

**รูปการต่อวงจร – 1**

**รูปการต่อวงจร – 2**

**หน้าจอ MQTT Lens**