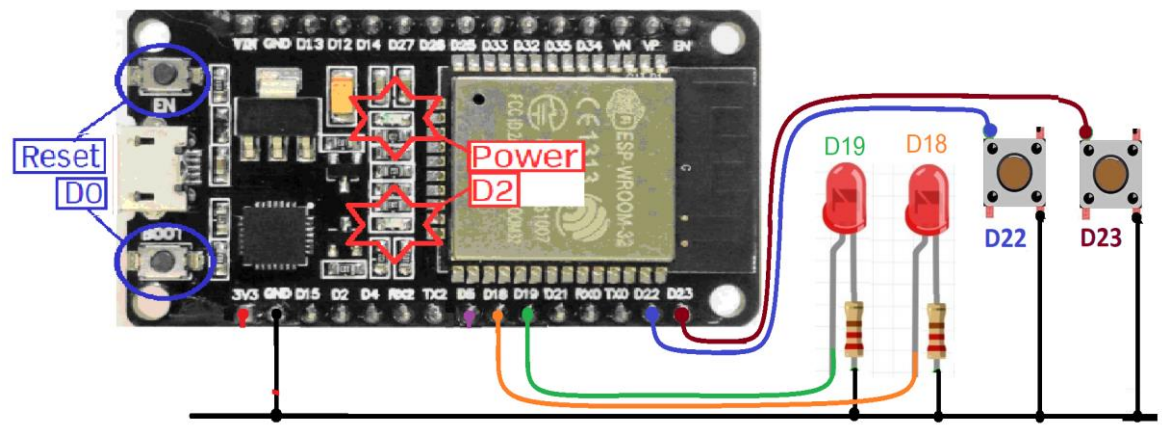
การควบคุมเครื่องจักรอัจฉริยะโดยใช้การสื่อสารระหว่างเครื่องจักรกับเครื่องจักร M2M - Intelligence Machine Control
ชื่อ-สกุล : วราสิริ ลิ้มประเสริฐ B6214005

6/6 -- คำถามท้ายบทเพื่อทดสอบความเข้าใจ

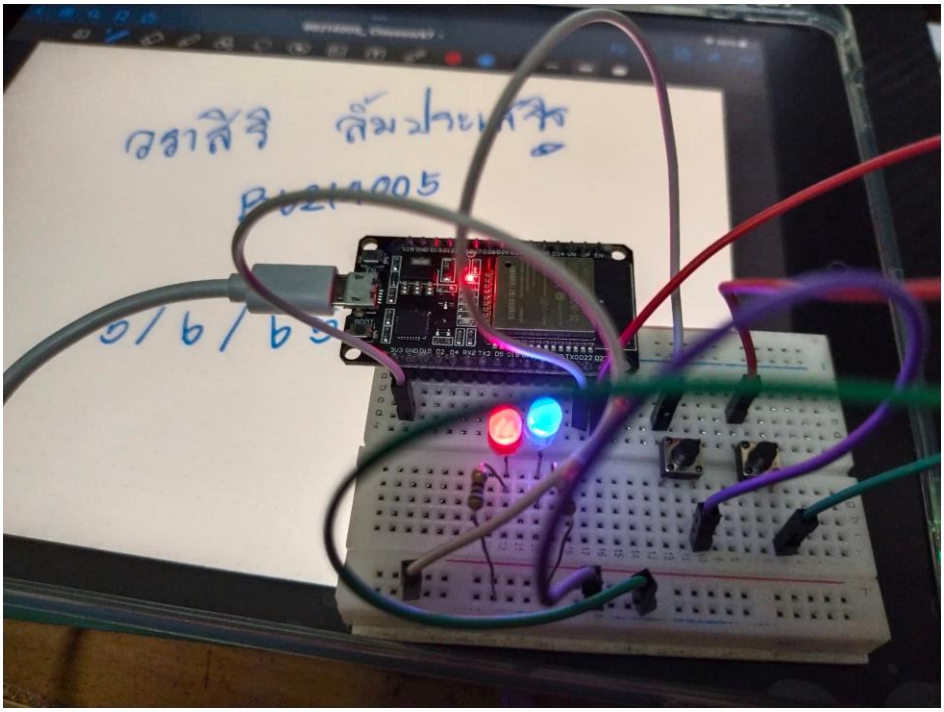
Quiz_101 – กดติด กดดับ 2 ชุด

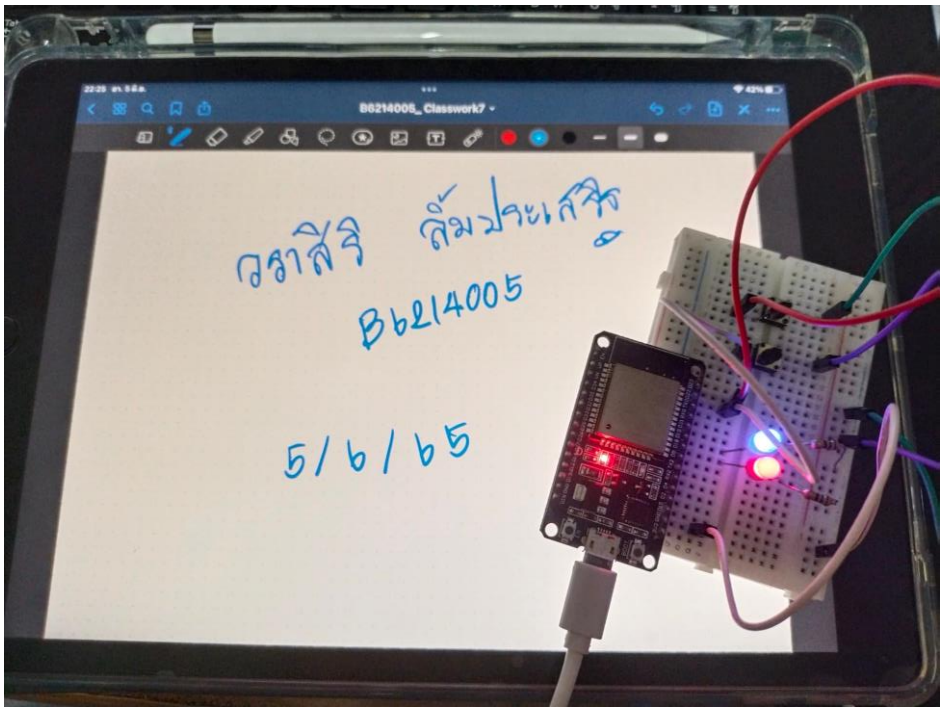
- หากต้องการให้ใช้ 1 สวิตซ์ ควบคุม 1 LED แบบกดติด-กดดับ จำนวน 2 วงจรจะต่อวงจรและเขียนโปรแกรมอย่างไร {SW-D22 -- LED-D19, SW-D23 -- LED-D18}




```
#define pushButton1 22
#define pushButton2 23
#define LEDPin1 18
#define LEDPin2 19

int buttonState1 = 0;
int buttonState2 = 0;

void setup() {
  Serial.begin(115200);
  pinMode(pushButton1, INPUT_PULLUP);
  pinMode(pushButton2, INPUT_PULLUP);
  pinMode(LEDPin1, OUTPUT);
  pinMode(LEDPin2, OUTPUT);
}
void loop() {
  if (digitalRead(pushButton1) == LOW) {
    delay(20);
    buttonState1 = 1 - buttonState1;
    digitalWrite(LEDPin1, buttonState1);
    while (digitalRead(pushButton1) == LOW);
    delay(20);
  }

  if (digitalRead(pushButton2) == LOW) {
    delay(20);
    buttonState2 = 1 - buttonState2;
```

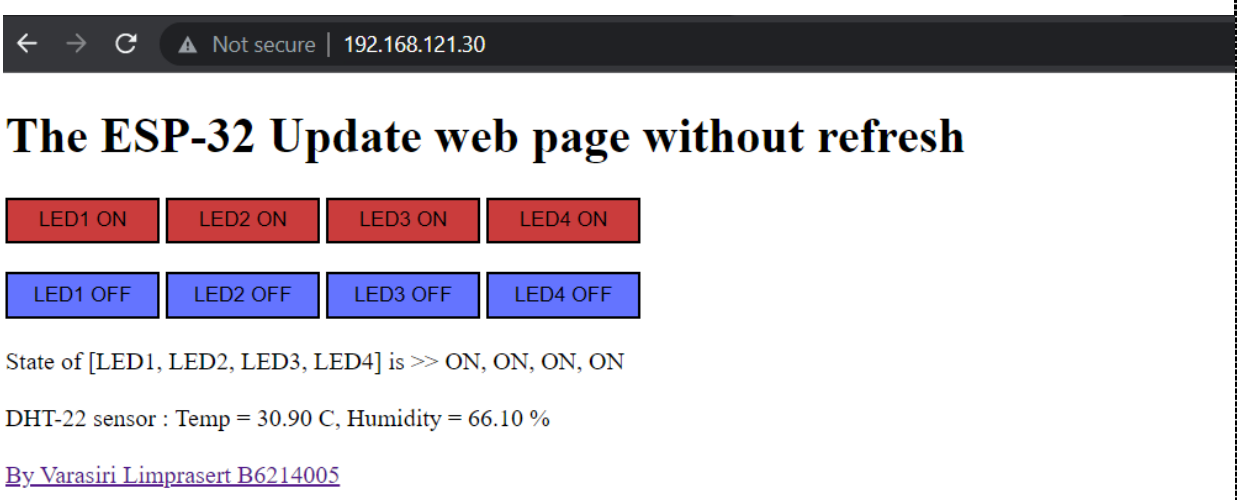
```
    digitalWrite(LEDPin2, buttonState2);
    while (digitalRead(pushButton2) == LOW);
    delay(20);
  }
}
```





Quiz_102 – Web Control 4 LED and Monitor Humid/Temperature

- เพิ่มเติมจาก Q202 อยากได้ปุ่มสำหรับคุมปิด-เปิด หลอดไฟ LED 4 ดวง
- อยากมีกด Link ไปที่หน้า FB ของตัวเอง
- https://www.colorhexa.com/008cba?fbclid=IwAR3dIZ_gRgDWmREmnzuknLbMxV3pOHy4YIPuLEz8-ZzTOX2VhWxcH2QjLGk



SourceCode

```
#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 = "V2036";
const char* password = "fnafchica";
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
//==============================================================
```

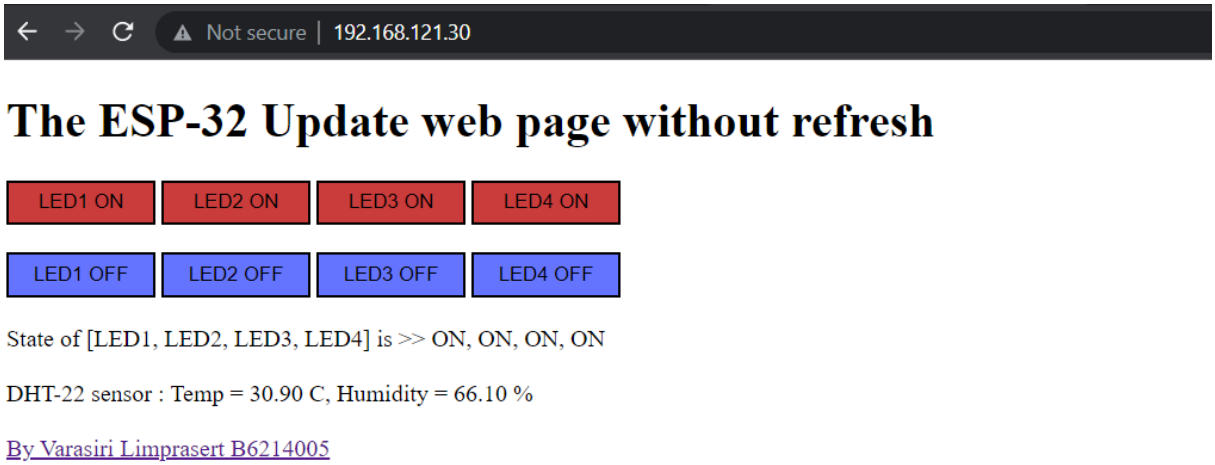
```
void handleRoot() {
  String s = MAIN_page; //Read HTML contents
  server.send(200, "text/html", s); //Send web page
}
void handleADC() {
  float h = dht.getHumidity();
  float t = dht.getTemperature();
  String tmpValue = "Temp = ";
  tmpValue += String(t) + " C, Humidity = ";
  tmpValue += String(h) + " %";
  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);
```

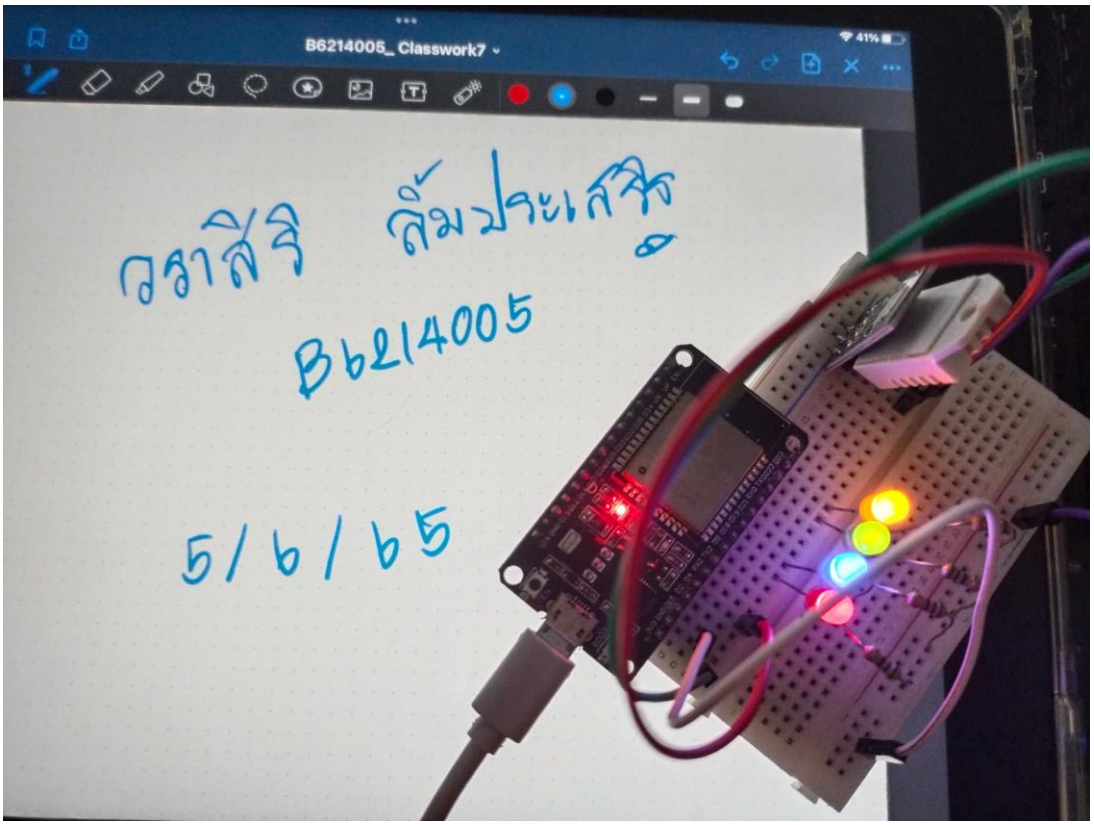
```
  pinMode(testLED2, OUTPUT);
  pinMode(testLED3, OUTPUT);
  pinMode(testLED4, OUTPUT);
  Serial.print("\n\nConnect to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500); Serial.print(".");
  }
  Serial.print("\nConnected "); Serial.println(ssid);
  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
}
```

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/chi.sweethome.50/">By Varasiri Limprasert
B6214005</a>
</body>
</html>
)=====";
```

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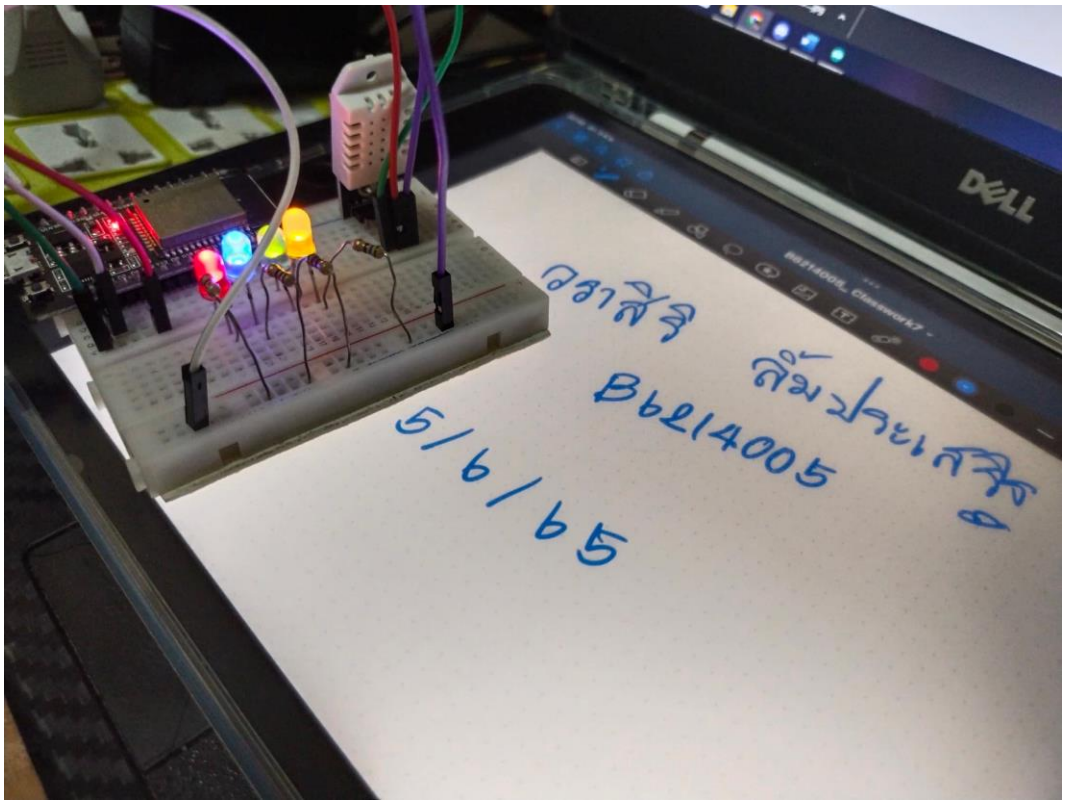
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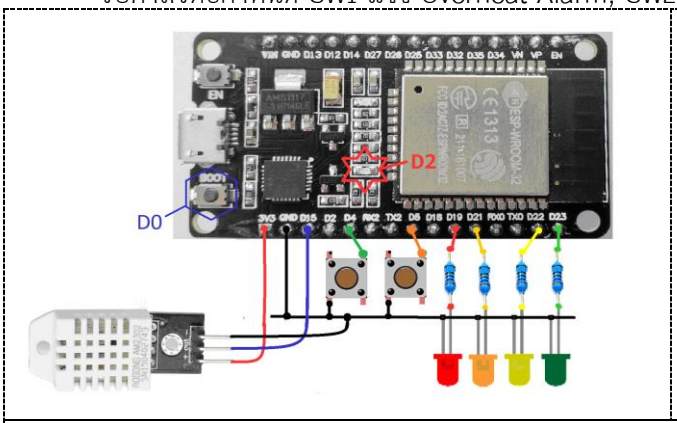
Quiz_103 – Pub/Sub Data from (DHT22 + 4 LED + 2 Switch)

- อ่านค่า DHT-22 แล้วส่งไปยัง MQTT Broker ทุกๆ 5 วินาที
- กำหนดให้ใช้ mqtt.eclipse.org เป็น Broker
- ควบคุมการปิดเปิด 4 LED
- รับค่าสวิตซ์กำหนด SW1 แจ้ง Overheat Alarm, SW2 แจ้ง Intruders Alarm




```
#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 = "V2036";
const char* password = "fnafchica";
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);
```

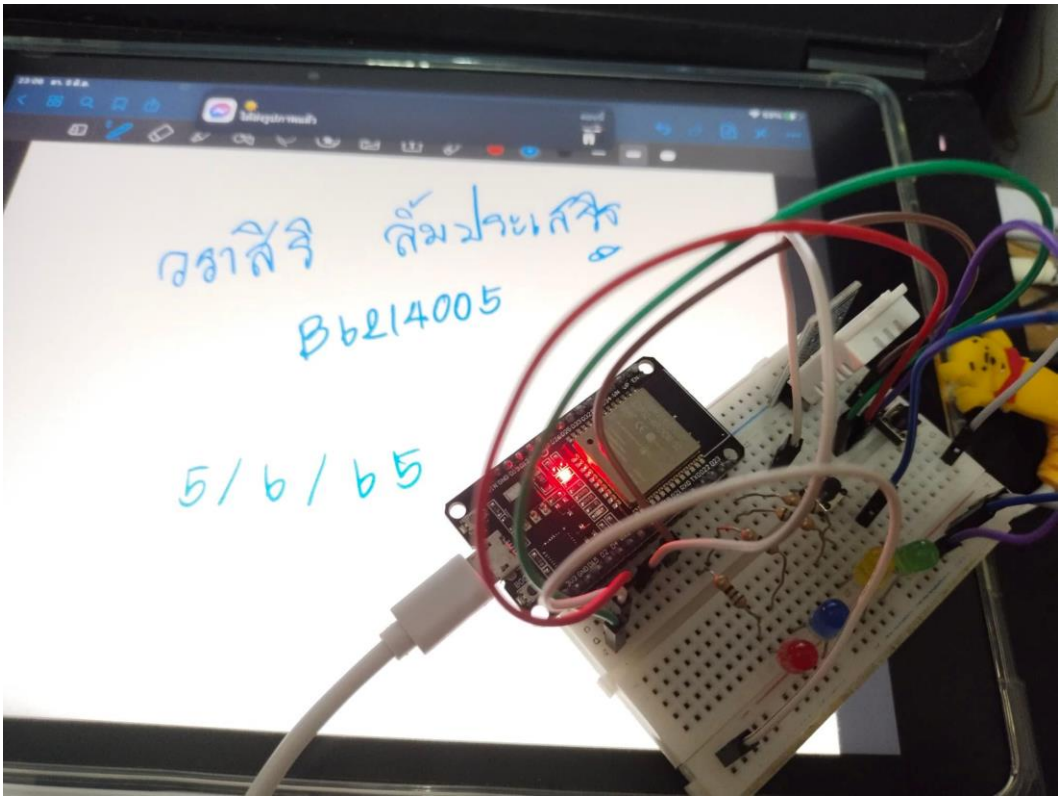
```
  setup_wifi();
  dht.setup(DHT22_Pin, DHTesp::DHT22);
  pinMode(pushButton1, INPUT_PULLUP);
  pinMode(pushButton2, INPUT_PULLUP);
  client.setServer(mqtt_server, 1883);
  client.setCallback(callback);
  pinMode(testLED1, OUTPUT);
  pinMode(testLED2, OUTPUT);
  pinMode(testLED3, OUTPUT);
  pinMode(testLED4, 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);
  }
}
```

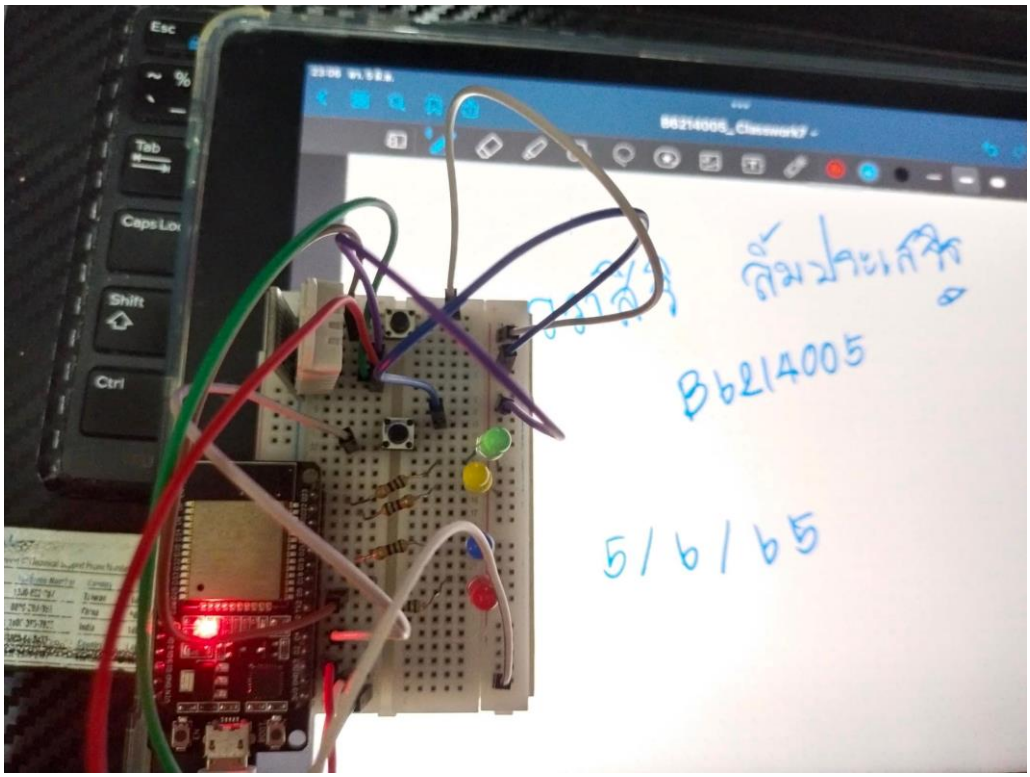
Subscriptions

Topic: "bearish" Showing the last 5 messages — +

Messages: 0/6

#	Time	Topic	QoS	Message
1	11:01:24	bearish	0	TempC: 31.10 C, Humidity: 65.80 %
2	11:01:29	bearish	0	TempC: 31.20 C, Humidity: 65.70 %
3	11:01:31	bearish	0	Intruders Alarm
4	11:01:34	bearish	0	TempC: 31.20 C, Humidity: 65.40 %
5	11:01:34	bearish	0	Overheat Alarm

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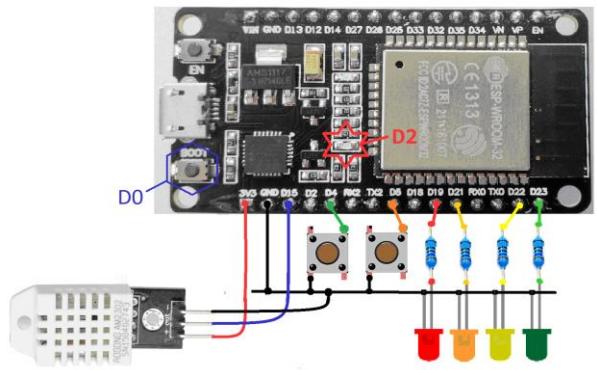
Quiz_104 – Blynk and LINE from (DHT22 + 4 LED + 2 Switch)

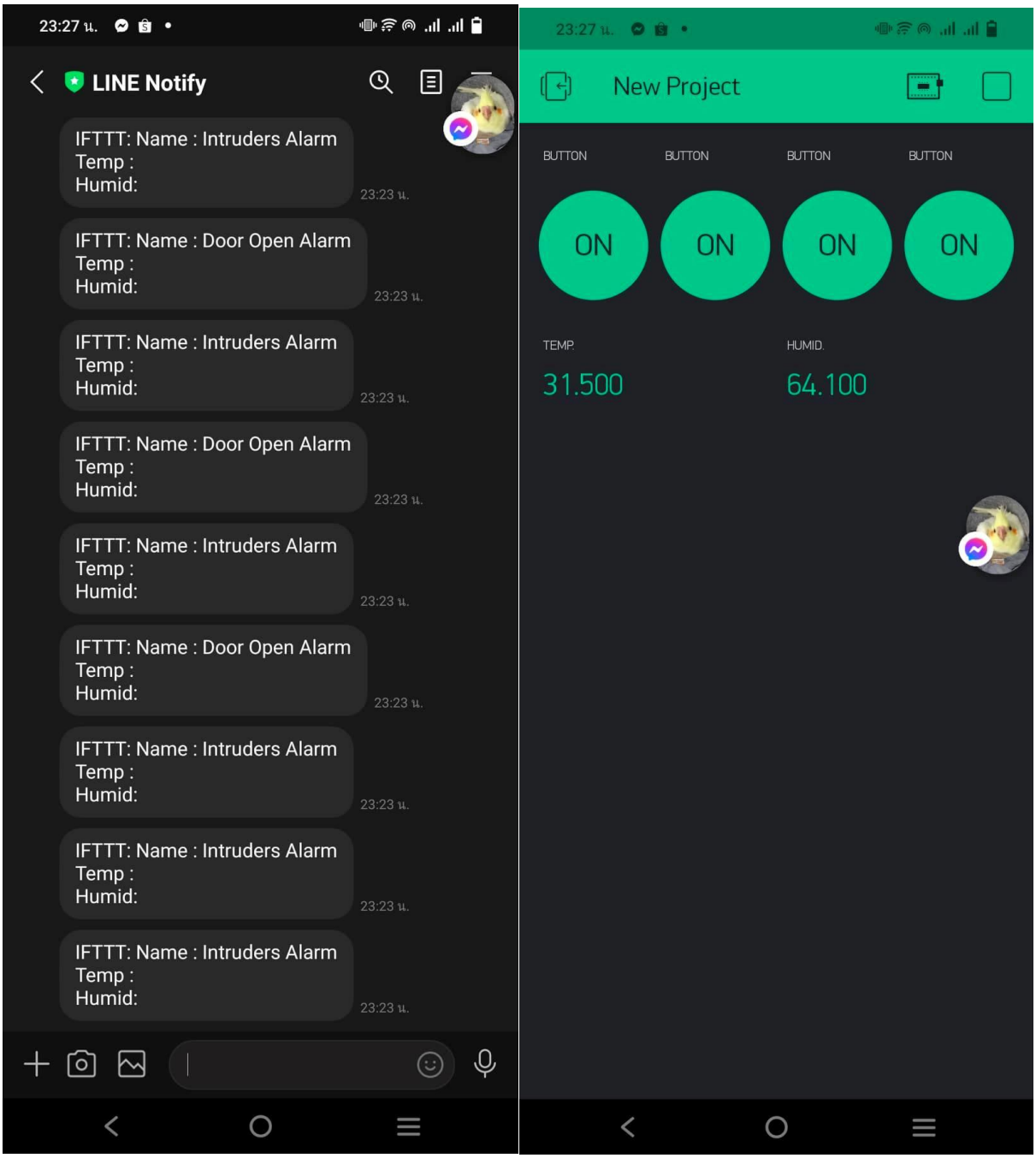
- ควบคุมการปิดเปิด 4 LED
- อ่านค่า DHT-22 แล้วส่งไปยัง Blynk ทุกๆ 5 วินาที
- บันทึกค่าไปยัง Google Sheet
- หากอุณหภูมิเกิน 28'C ให้แจ้งไปยัง LINE
- รับค่าสวิตซ์กำหนด SW1 แจ้ง Overheat Alarm, SW2 แจ้ง Intruders Alarm ไปยัง LINE




```
#define BLYNK_PRINT Serial
#include <WiFi.h>
#include <HTTPClient.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include "DHTesp.h"
#define DHT22_Pin 15
#define sw1 2
#define sw2 4

#define WebHooksKey "oXSQX-hS7mc2o1blAA3UlubXBXN2WIrMlIheoCkvYQI"
#define WebHooksEventName "Test_Key"
char auth[] = "Y1ccpnuLjmwpjmQ1n_ZqSVxraOe88oHp";
char ssid[] = "V2036";
char pass[] = "fnafchica";

DHTesp dht;
WidgetLED LED1(V2);
WidgetLED LED2(V3);
BlynkTimer timer;

void setup() {
  Serial.begin(115200);
  dht.setup(DHT22_Pin, DHTesp::DHT22); // Connect DHT sensor to GPIO 15
  pinMode(sw1, INPUT_PULLDOWN);
  pinMode(sw2, INPUT_PULLDOWN);
  Blynk.begin(auth, ssid, pass);
```

```
  timer.setInterval(1000L, myTimerEvent);
}
void myTimerEvent() {
  float humidity = dht.getHumidity();
  float temperature = dht.getTemperature();
  Blynk.virtualWrite(V0, temperature);
  Blynk.virtualWrite(V1, humidity);
  if (digitalRead(sw1)) LED1.on();
  else LED1.off();
  if (digitalRead(sw2)) LED2.on();
  else LED2.off();
  Serial.print(" Temp('C) >> "); Serial.print(temperature, 1);
  Serial.print(", Humidity(%) >> "); Serial.println(humidity, 1);
}

void loop()
{
  Blynk.run();
  if (digitalRead(sw1) == LOW) {
    String serverName = "http://maker.ifttt.com/trigger/" +
                        String(WebHooksEventName) + "/with/key/" + String(WebHooksKey);
    String httpRequestData = "value1=" + String("Door Open Alarm");
    Serial.println("Server Name :" + serverName);
    Serial.println("json httpRequestData :" + httpRequestData);
    if (WiFi.status() == WL_CONNECTED) {
      HTTPClient http;
      http.begin(serverName);
      http.addHeader("Content-Type", "application/x-www-form-urlencoded");
      int httpResponseCode = http.POST(httpRequestData);
      Serial.print("HTTP Response code: ");
      Serial.println(httpResponseCode);
      http.end();
      if (httpResponseCode == 200)
        Serial.println("Successfully sent");
      else
        Serial.println("Failed!");
    }
    else {
      Serial.println("WiFi Disconnected");
    }
  }
  if (digitalRead(sw2) == LOW) {
    String serverName = "http://maker.ifttt.com/trigger/" +
                        String(WebHooksEventName) + "/with/key/" + String(WebHooksKey);
    String httpRequestData = "value1=" + String("Intruders Alarm");
```

```
    Serial.println("Server Name :" + serverName);
    Serial.println("json httpRequestData :" + httpRequestData);
    if (WiFi.status() == WL_CONNECTED) {
      HTTPClient http;
      http.begin(serverName);
      http.addHeader("Content-Type", "application/x-www-form-urlencoded");
      int httpResponseCode = http.POST(httpRequestData);
      Serial.print("HTTP Response code: ");
      Serial.println(httpResponseCode);
      http.end();
      if (httpResponseCode == 200)
        Serial.println("Successfully sent");
      else
        Serial.println("Failed!");
    }
    else {
      Serial.println("WiFi Disconnected");
    }
    timer.run(); // running timer every 250ms
  }
}
```


23:27 น.
LINE Notify
IFTTT: Name : Intruders Alarm
Temp :
Humid:
23:23 น.
IFTTT: Name : Door Open Alarm
Temp :
Humid:
23:23 น.
IFTTT: Name : Intruders Alarm
Temp :
Humid:
23:23 น.
IFTTT: Name : Door Open Alarm
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IFTTT: Name : Intruders Alarm
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IFTTT: Name : Door Open Alarm
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IFTTT: Name : Intruders Alarm
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IFTTT: Name : Intruders Alarm
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IFTTT: Name : Intruders Alarm
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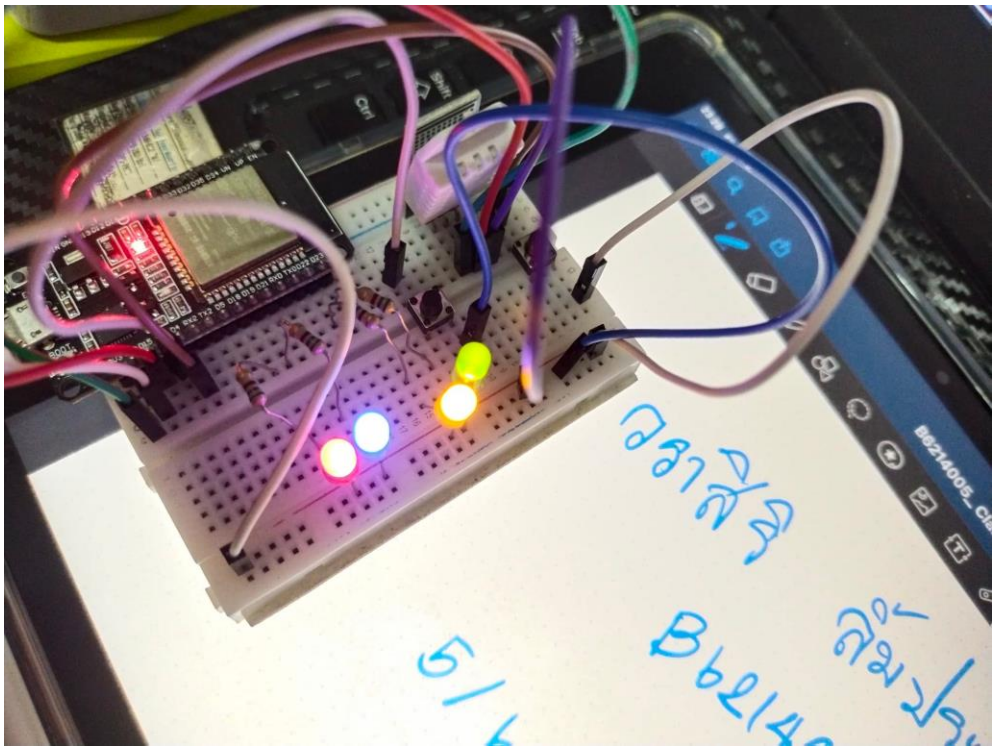
New Project
BUTTON
BUTTON
BUTTON
BUTTON
ON
ON
ON
ON
TEMP.
31.500
HUMID.
64.100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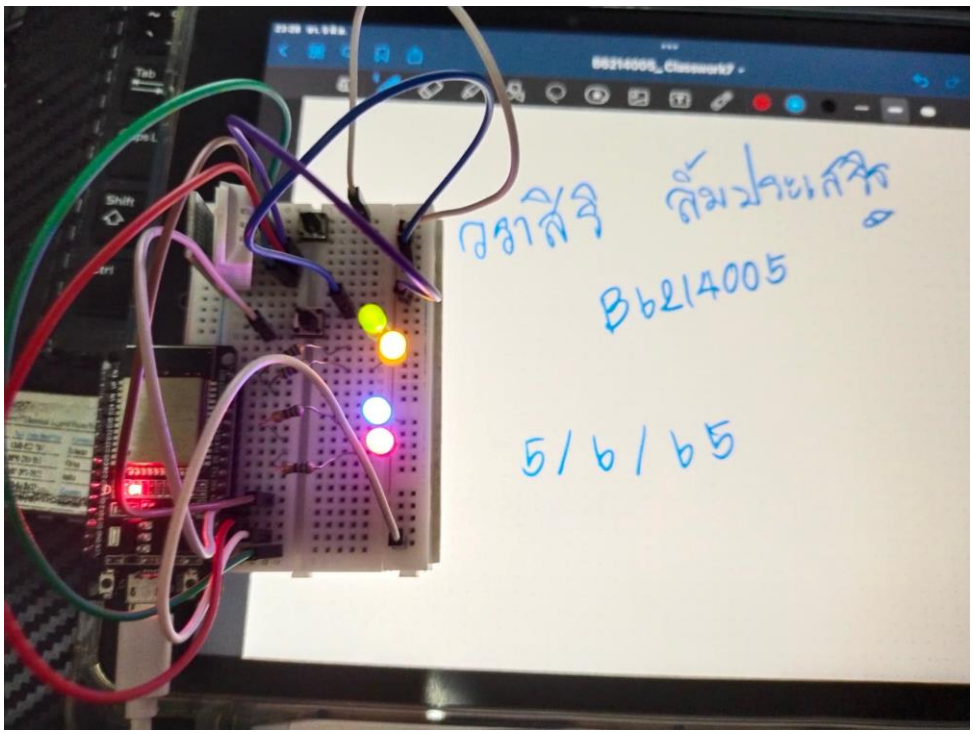
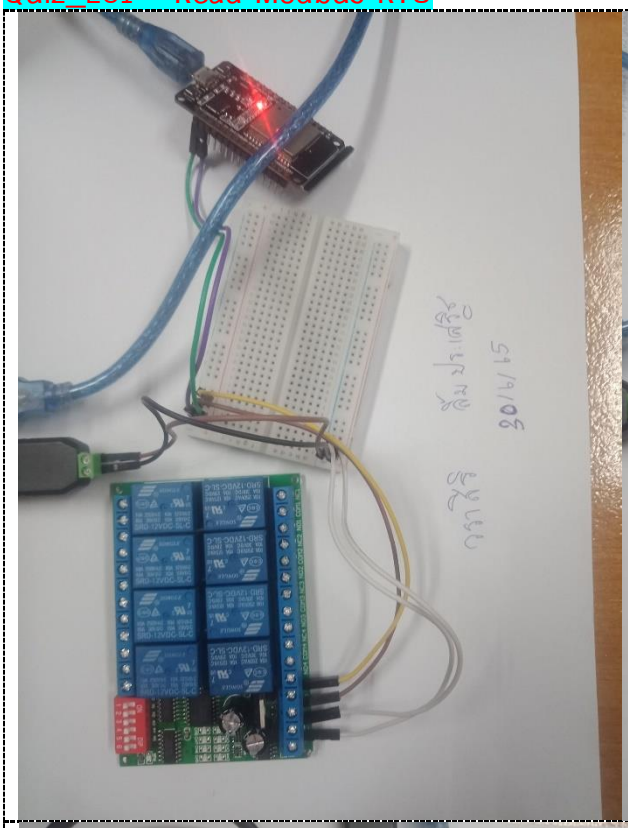
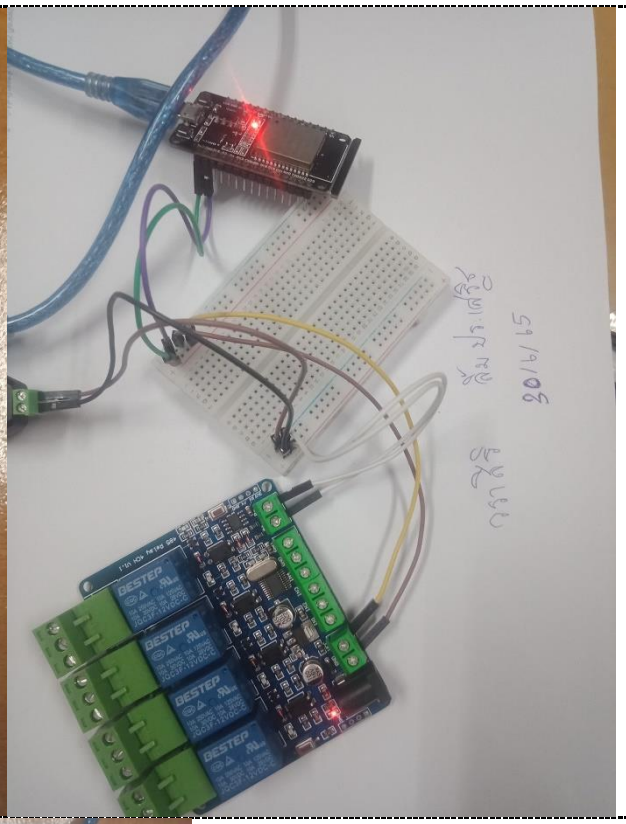

วราสิริ ลิ้มปราะเสริฐ
B6214005
5/6/65

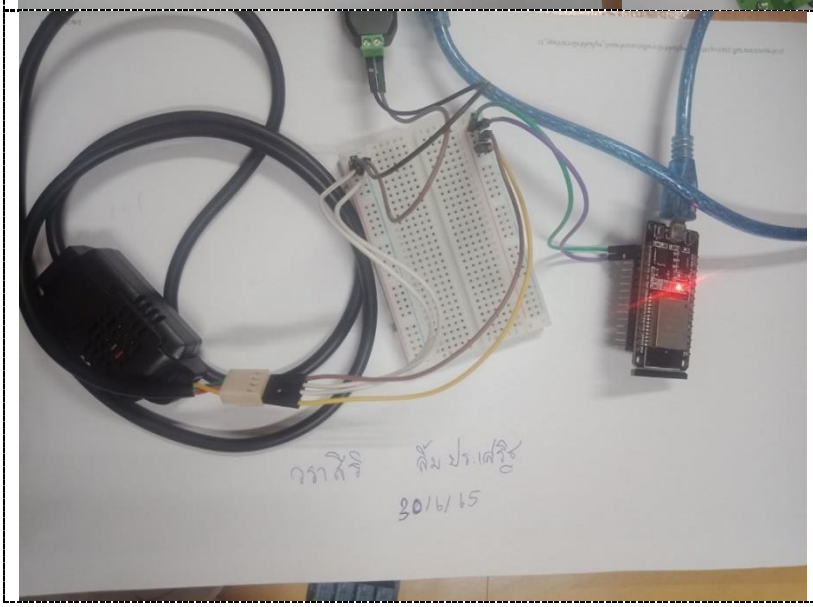
การควบคุมเครื่องจักรอัจฉริยะโดยใช้การสื่อสารระหว่างเครื่องจักรกับเครื่องจักร M2M - Intelligence Machine Control
ชื่อ-สกุล : วราสิริ ลิ้มประเสริฐ B6214005

4/4: -- คำถามท้ายบทเพื่อทดสอบความเข้าใจ

Quiz_201 – Read Modbus RTU







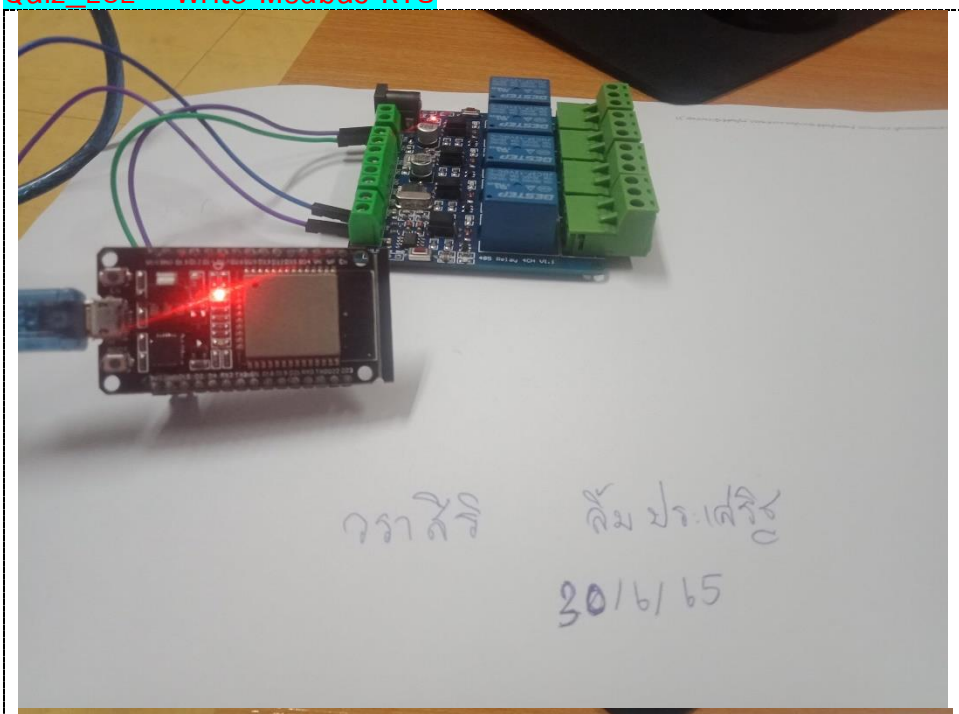
```
#include "ModbusMaster.h" //https://github.com/4-20ma/ModbusMaster
#define Slave_ID 1
#define MAX485_RE_NEG 4
#define RX_PIN 16
#define TX_PIN 17
ModbusMaster modbus;
void preTransmission() {
  digitalWrite(MAX485_RE_NEG, HIGH); //Switch to transmit data
}
void postTransmission() {
  digitalWrite(MAX485_RE_NEG, LOW); //Switch to receive data
}
void setup() {
  pinMode(MAX485_RE_NEG, OUTPUT);
  digitalWrite(MAX485_RE_NEG, LOW);
  Serial.begin(115200, SERIAL_8N1);
  Serial2.begin(9600, SERIAL_8N1, RX_PIN, TX_PIN);
  modbus.begin(Slave_ID, Serial2);
  modbus.preTransmission(preTransmission);
  modbus.postTransmission(postTransmission);
}
long lastMillis = 0;
void loop() {
  long currentMillis = millis();
  if (currentMillis - lastMillis > 1000) {
    uint8_t result = modbus.readHoldingRegisters(0, 2);
    if (getResultMsg(&modbus, result)) {
      Serial.println();
      double res_dbl = modbus.getResponseBuffer(0) / 10;
      String res = "Temperature: " + String(res_dbl) + " C\r\n";
      res_dbl = modbus.getResponseBuffer(1) / 10;
      res += "Humidity: " + String(res_dbl) + " %";
      Serial.println(res);
    }
    lastMillis = currentMillis;
  }
}
bool getResultMsg(ModbusMaster *node, uint8_t result) {
  String tmpstr2 = "\r\n";
  switch (result) {
    case node->ku8MBSuccess:
      return true;
      break;
    case node->ku8MBIllegalFunction:
      tmpstr2 += "Illegal Function";
      break;
    case node->ku8MBIllegalDataAddress:
      tmpstr2 += "Illegal Data Address";
      break;
    case node->ku8MBIllegalDataValue:
      tmpstr2 += "Illegal Data Value";
      break;
    case node->ku8MBSlaveDeviceFailure:
      tmpstr2 += "Slave Device Failure";
      break;
    case node->ku8MBInvalidSlaveID:
      tmpstr2 += "Invalid Slave ID";
```

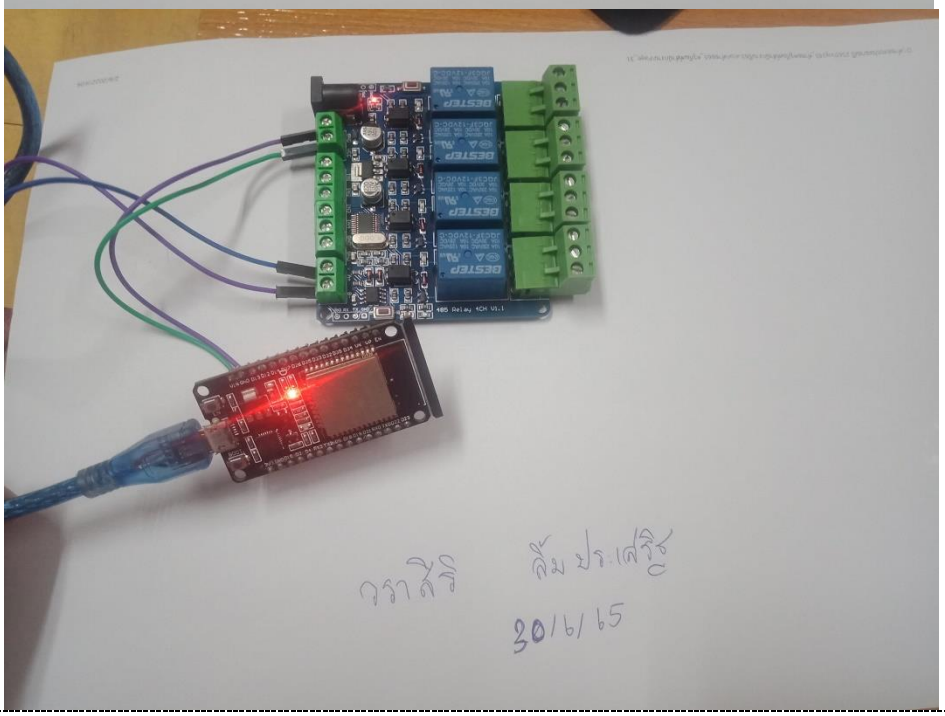
```
      break;
    case node->ku8MBInvalidFunction:
      tmpstr2 += "Invalid Function";
      break;
    case node->ku8MBResponseTimedOut:
      tmpstr2 += "Response Timed Out";
      break;
    case node->ku8MBInvalidCRC:
      tmpstr2 += "Invalid CRC";
      break;
    default:
      tmpstr2 += "Unknown error: " + String(result);
      break;
  }
  Serial.println(tmpstr2);
  return false;
}
```

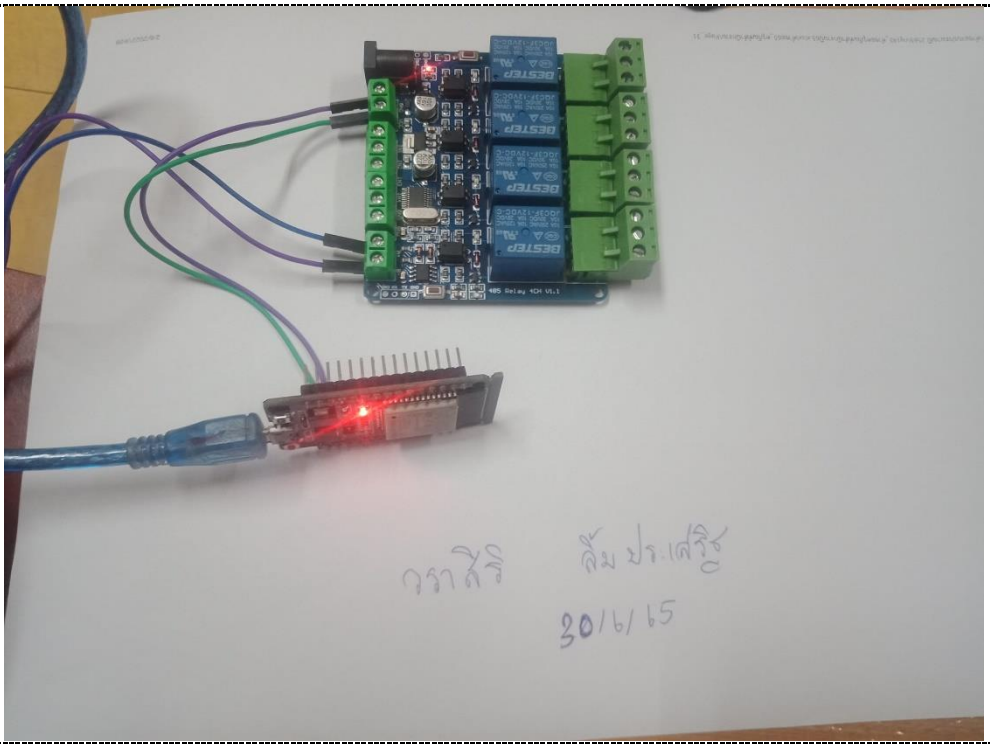
< ผลการทดสอบ >

```
Temperature: 30.00 C
Humidity: 78.00 %

Temperature: 30.00 C
Humidity: 78.00 %

Temperature: 30.00 C
Humidity: 78.00 %

Temperature: 30.00 C
Humidity: 78.00 %
```

Quiz_202 – Write Modbus RTU







< Source Code >

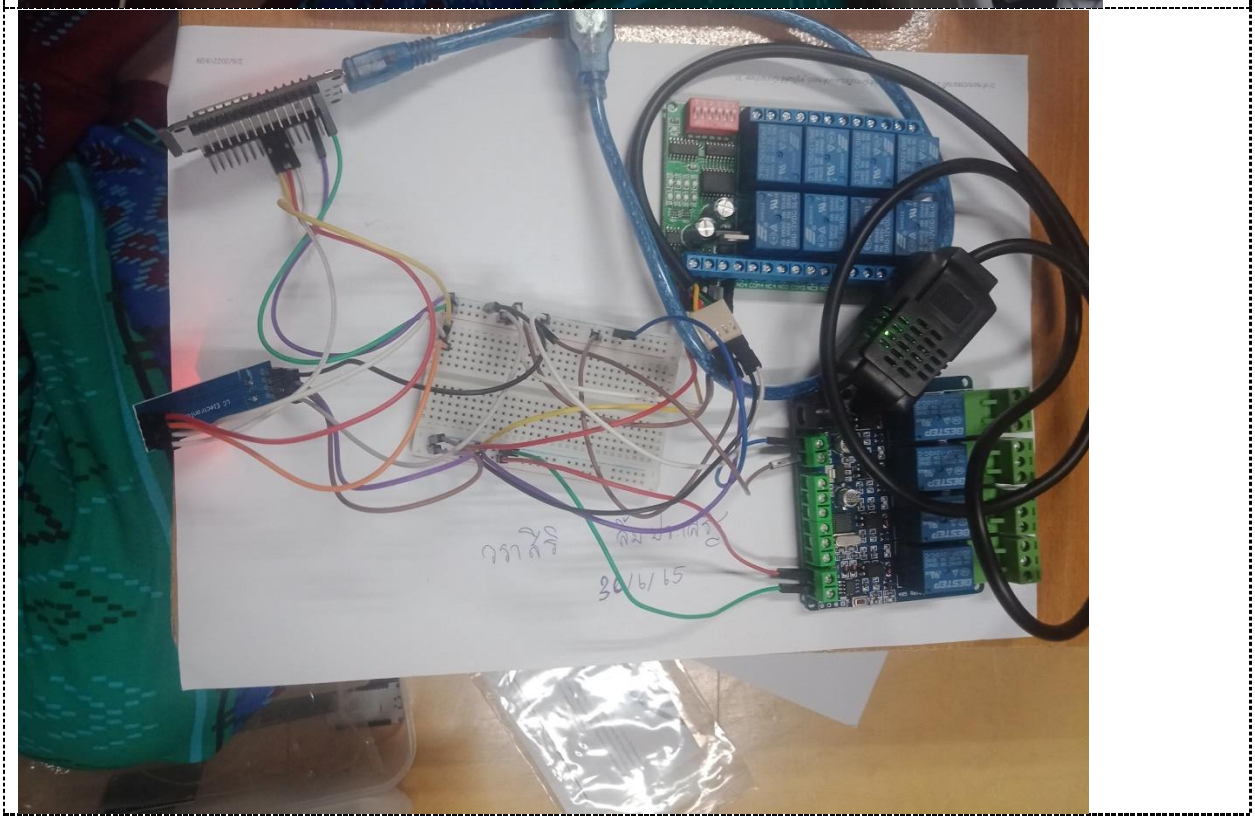
```
#define RS485Transmit HIGH
#define RS485Receive LOW
#define RS485Control 4 //RS485 Direction control
#define Pin_LEDMonitor 2
byte Board_ID = 0x05; // ID = 5
byte Mdbs_Cmd = 0x05; // Command 05
byte H_RelayID = 0x00;
byte L_RelayID = 0x00;
byte Relay_On = 0x01; // On = 0100
byte Relay_Off = 0x00; // Off = 0000
byte OnOff_Dly = 0x00;
byte HByte_CRC = 00;
byte LByte_CRC = 00;
int StepConut = 0;
byte Echo[20];
void setup() {
  pinMode(Pin_LEDMonitor, OUTPUT);
  pinMode(RS485Control, OUTPUT);
  Serial.begin(115200);
  Serial2.begin(9600);
  digitalWrite(RS485Control, RS485Receive);
  Serial.println("Start Test MODBUS RTU");
}
uint16_t CRC16_Update(uint16_t tempCRC, uint8_t inData) {
  tempCRC ^= inData;
  for (int i = 0; i < 8; ++i)
    if (tempCRC & 1) tempCRC = (tempCRC >> 1) ^ 0xA001;
    else tempCRC = (tempCRC >> 1);
  return tempCRC;
}
uint16_t SendByte_CRCUpdate(uint16_t tempCRC, uint8_t inData) {
```

```
  Serial2.write(inData);
  if (inData < 0x10) Serial.print("0");
  Serial.print(inData, HEX);
  Serial.print(" ");
  tempCRC = CRC16_Update(tempCRC, inData);
  return tempCRC;
}
void RTU_RelayCtrl(int rly_ID, byte rly_Cmd) {
  uint16_t Calc_CRC = 0xffff; // the initial value
  H_RelayID = highByte(rly_ID);
  L_RelayID = lowByte(rly_ID);
  digitalWrite(Pin_LEDMonitor, HIGH);
  digitalWrite(RS485Control, RS485Transmit); delay(10);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, Board_ID);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, Mdbs_Cmd);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, H_RelayID);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, L_RelayID);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, rly_Cmd);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, OnOff_Dly);
  HByte_CRC = highByte(Calc_CRC);
  LByte_CRC = lowByte(Calc_CRC);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, LByte_CRC);
  Calc_CRC = SendByte_CRCUpdate(Calc_CRC, HByte_CRC);
  delay(10);
  digitalWrite(RS485Control, RS485Receive);
  digitalWrite(Pin_LEDMonitor, LOW);
  Serial.println();
}
void loop() {
  RTU_RelayCtrl(0, Relay_On); delay(3000);
  RTU_RelayCtrl(1, Relay_On); delay(3000);
  RTU_RelayCtrl(2, Relay_On); delay(3000);
  RTU_RelayCtrl(3, Relay_On); delay(3000);
  RTU_RelayCtrl(0, Relay_Off); delay(3000);
  RTU_RelayCtrl(1, Relay_Off); delay(3000);
  RTU_RelayCtrl(2, Relay_Off); delay(3000);
  RTU_RelayCtrl(
}
```

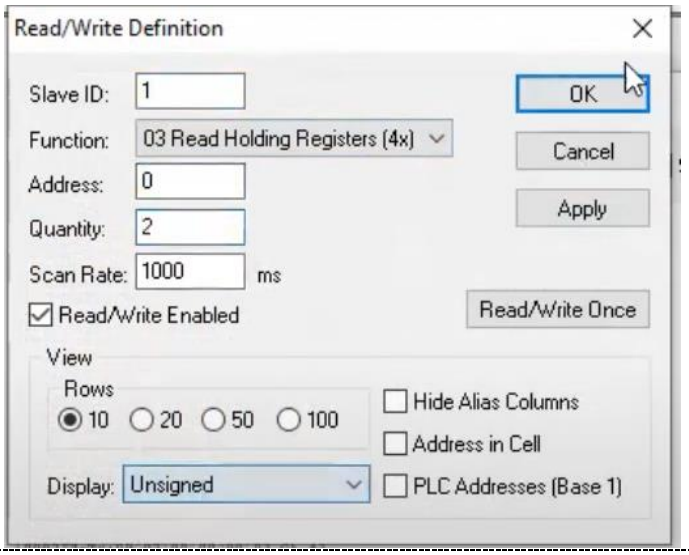
< ผลการทดสอบ >

```
01 02 00 00 00 04 79 C9  >> 01 02 01 00 A1 88 FF 00 00 00
01 05 00 00 00 00 CD CA
01 02 00 00 00 04 79 C9  >> 01 02 01 02 20 49 FF 00 00 00
01 05 00 01 00 00 9C 0A
01 02 00 00 00 04 79 C9  >> 01 02 01 02 A0 4E FF 00 00 00
01 05 00 02 00 00 6C 0A
```

Quiz_203 – Read/Write Modbus RTU



เซ็ตค่าใน Read/Write Definition



<Source Code>

```
#include <ModbusMaster.h>
#define RS485Transmit HIGH
#define RS485Receive LOW
#define RS485Control 4 //RS485 Direction control
#define Pin_LEDMonitor 2
#define Slave_Sensor_ID 1
#define Slave_Relay8_ID 3
#define Slave_Ry4In4_ID 5
int state = 0;
float CTempp, Hudmid;
bool DgInput0, DgInput1, DgInput2, DgInput3;
ModbusMaster node_Sensor;
ModbusMaster node_Relay8;
ModbusMaster node_Ry4In4;
void preTransmission() {
  digitalWrite(RS485Control, RS485Transmit);
}
void postTransmission() {
  digitalWrite(RS485Control, RS485Receive);
}
void setup() {
  pinMode(RS485Control, OUTPUT);
  pinMode(Pin_LEDMonitor, OUTPUT);
  Serial.begin(115200);
  Serial2.begin(9600);
  postTransmission();
  node_Sensor.begin(Slave_Sensor_ID, Serial2); // Modbus slave ID=1
  node_Sensor.preTransmission(preTransmission);
  node_Sensor.postTransmission(postTransmission);
  node_Relay8.begin(Slave_Relay8_ID, Serial2); // Modbus slave ID=3
  node_Relay8.preTransmission(preTransmission);
  node_Relay8.postTransmission(postTransmission);
  node_Ry4In4.begin(Slave_Ry4In4_ID, Serial2); // Modbus slave ID=5
  node_Ry4In4.preTransmission(preTransmission);
  node_Ry4In4.postTransmission(postTransmission);
}
```

```
void ReadTemperature(void) {
  uint8_t result;
  // Toggle the coil at address (Manual Load Control)
  result = node_Sensor.writeSingleCoil(Slave_Sensor_ID, state);
  state = !state;
  // Read 2 registers starting at 0x0000)
  result = node_Sensor.readInputRegisters(0x0000, 2); // From=0, nByte=2
  if (result == node_Sensor.ku8MBSuccess) {
    CTempp = node_Sensor.getResponseBuffer(0x00) / 10.0f;
    Hudmid = node_Sensor.getResponseBuffer(0x01) / 10.0f;
  }
}
void ReadDigitalInput(void) {
  uint8_t result;
  // Toggle the coil at address (Manual Load Control)
  result = node_Ry4In4.writeSingleCoil(Slave_Sensor_ID, state);
  state = !state;
  // Read 4 registers starting at 0x0000)
  result = node_Ry4In4.readDiscreteInputs(0, 4); // Start=0, nByte=4
  if (result == node_Ry4In4.ku8MBSuccess) {
    int DgTemp = node_Ry4In4.getResponseBuffer(0x00);
    DgInput3 = (DgTemp >> 3) & 1;
    DgInput2 = (DgTemp >> 2) & 1;
    DgInput1 = (DgTemp >> 1) & 1;
    DgInput0 = (DgTemp >> 0) & 1;
  }
}
void RelayControl(int inputCase) {
  int rnMode = inputCase / 10;
  int nRelay = inputCase % 10;
  if (rnMode == 81) node_Relay8.writeSingleRegister(nRelay, 0x0100); // On RelayX
  if (rnMode == 80) node_Relay8.writeSingleRegister(nRelay, 0x0200); // Off RelayX
  if (rnMode == 41) node_Ry4In4.writeSingleRegister(nRelay, 0x0100); // On RelayX
  if (rnMode == 40) node_Ry4In4.writeSingleRegister(nRelay, 0x0000); // Off RelayX
}
void loop() {
  ReadTemperature();
  ReadDigitalInput();
  Serial.print("\n Tempp('C): "); Serial.print(CTempp, 2);
  Serial.print(", Humid(%): "); Serial.print(Hudmid, 2);
  Serial.print(", Sensor[0:3]: "); Serial.print(DgInput3);
  Serial.print("-"); Serial.print(DgInput2);
  Serial.print("-"); Serial.print(DgInput1);
  Serial.print("-"); Serial.print(DgInput0);
  if (Serial.available() > 0) {
    int DataInput = Serial.parseInt();
    Serial.print("\n >> XYZ > X={8,4}Board Name, Y={1,0}On,Off, Z={0-8}RlyID >> ");
    Serial.println(DataInput);
    RelayControl(DataInput);
  }
  delay(2000);
}
```

< ผลการทดสอบ >

```
COM7
Send
Tempp('C): 26.60, Humid(%): 80.80, Sensor[0:3]: 0-1-1-1
>> XYZ > X={8,4}Board Name, Y={1,0}On,Off, Z={0-8}RlyID >> 410

Tempp('C): 26.60, Humid(%): 80.80, Sensor[0:3]: 0-1-1-1
>> XYZ > X={8,4}Board Name, Y={1,0}On,Off, Z={0-8}RlyID >> 801

Tempp('C): 26.60, Humid(%): 80.70, Sensor[0:3]: 0-1-1-1
>> XYZ > X={8,4}Board Name, Y={1,0}On,Off, Z={0-8}RlyID >> 400

Tempp('C): 26.60, Humid(%): 80.60, Sensor[0:3]: 0-1-1-1
>> XYZ > X={8,4}Board Name, Y={1,0}On,Off, Z={0-8}RlyID >> 0

Tempp('C): 26.60, Humid(%): 80.50, Sensor[0:3]: 0-1-1-1
Tempp('C): 26.60, Humid(%): 80.50, Sensor[0:3]: 0-1-1-1
Tempp('C): 26.60, Humid(%): 80.50, Sensor[0:3]: 0-1-1-1
Tempp('C): 26.60, Humid(%): 80.50, Sensor[0:3]: 0-1-1-1
Autoscroll  Show timestamp  Carriage return  9600 baud  Clear output
```

Quiz_204 – PLC Test

ไม่มีอุปกรณ์ที่ใช้ในการทดลอง จึงไม่สามารถเอามาลงให้ได้