# ทดลองปฏิบัติ

# Outline

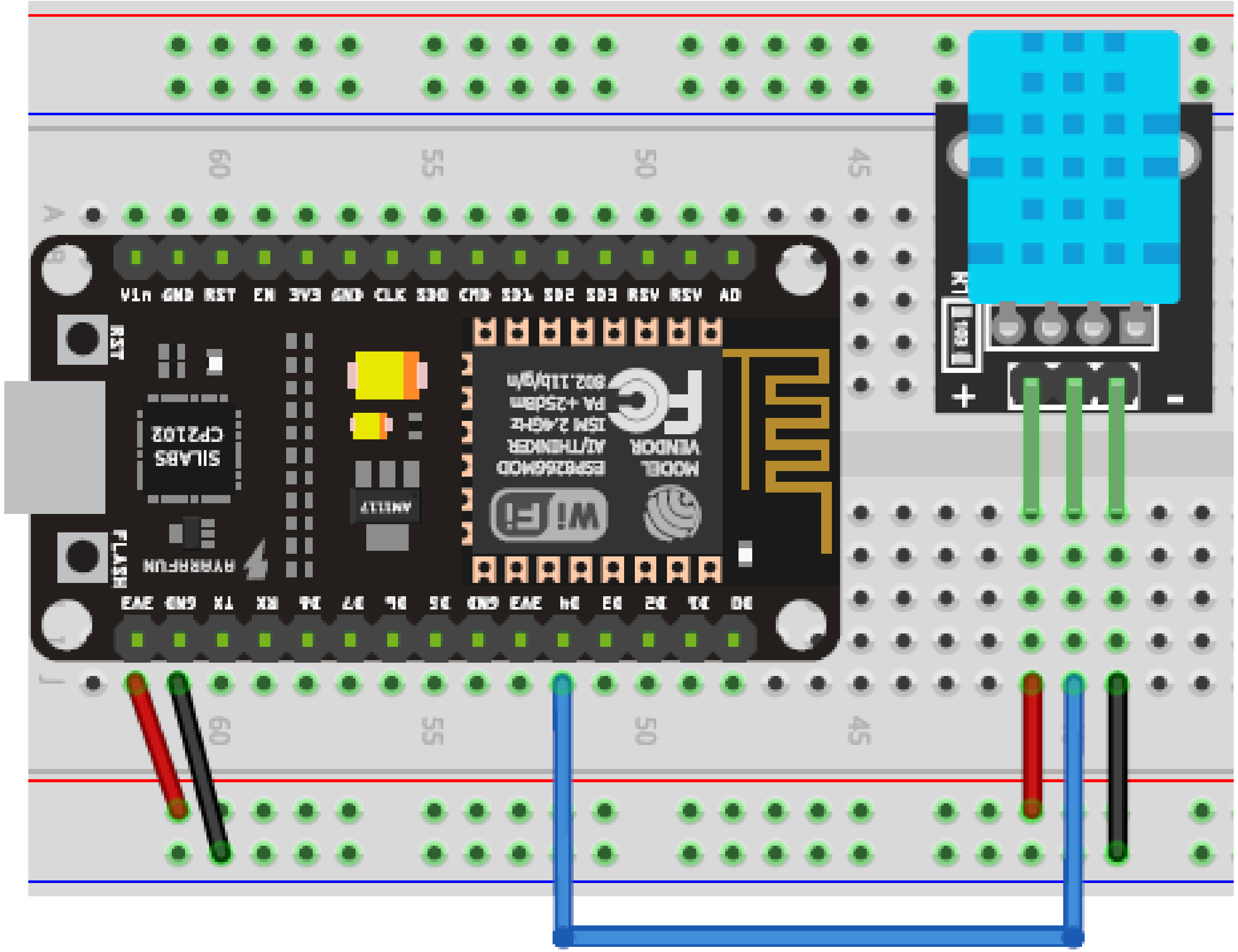
- ทดลองใช้งาน DHT 11 Module
- ทดลองใช้งาน BH1750 Module
- ทดลองใช้งาน Ultra Sonic Module HC-SR04+
- ทดลองใช้งาน LCD 16x2 i2c Display Module
- ประยุกต์การใช้งานลักษณะ IoT

# DHT 11 Module

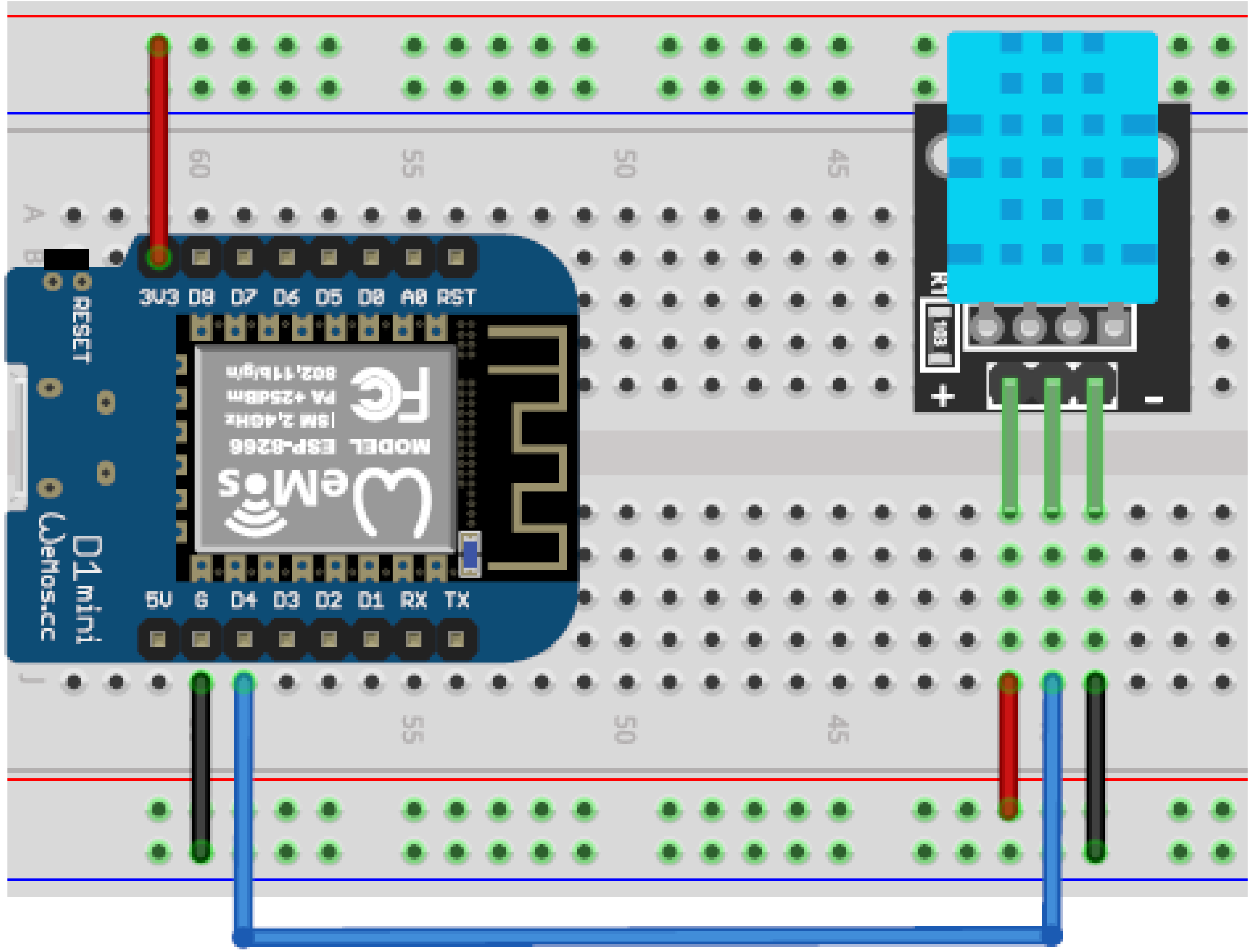
- โมดูลวัดอุณหภูมิ และ ความชื้น
- 3 to 5V power and I/O
- วัดความชื้นระดับ  20-80% โดยมีความผิดพลาดในการวัดไม่เกิน 5%
- วัดอุณหภูมิ  0-50°C  โดยมีความผิดพลาดในการวัดไม่เกิน ±2°C
- วามถี่ในการวัด 1 Hz  (อ่านค่าได้วินาทีละครั้ง)

ที่มา : https://goo.gl/E2XeRu

# NodeMCU DHT11 Wiring Diagram



# WeMos DHT11 Wiring Diagram



# esp8266_dht11_lib_demo-1

```
#include "DHT.h" // -> https://github.com/adafruit/DHT-sensor-library

// define the DHT sensor type to be used (tested: DHT11 and DHT22)
#define DHT_TYPE   DHT11
//#define DHT_TYPE   DHT22

#define DHT_PIN    (2)       // use the D4 pin (GPIO-2)

// note: use Vcc=3.3V for the DHTxx sensor

DHT dht( DHT_PIN, DHT_TYPE );

// global variable used for sprintf()
char sbuf[32];
```

# esp8266_dht11_lib_demo-1

```
void setup() {
  Serial.begin( 115200 );
  Serial.println( F("\n\n\n\n") );
  delay(1000);
  Serial.println( F("ESP8266 DHTxx Demo...") );
  dht.begin();
}
```

# esp8266_dht11_lib_demo-1

```
void loop() {
  float humid = dht.readHumidity();  // read the humidity
  float temp = dht.readTemperature(); // read temperature as Celsius

  // Check if any reads failed and exit early (to try again).
  if ( isnan(humid) || isnan(temp) ) {
     Serial.println( F("Failed to read from DHT sensor!") );
     delay(1000);
     return;
  }
  Serial.print( F("Humidity: ") );
  dtostrf( humid, 3, 1, sbuf );
  Serial.print( sbuf );
  Serial.print( F(" %RH, ") );
  Serial.print( F("Temperature: ") );
  dtostrf( temp, 3, 1, sbuf );
  Serial.print( sbuf );
  Serial.println( F(" deg.C") );
  // wait a few seconds between measurements.
  delay(2000);
}
```

# esp8266_dht11_lib_demo-2

```
#include <ESP8266WiFi.h>
#include "PubSubClient.h"
#include "DHT.h"

#define DHTPIN D4     // what pin we're connected to

// Uncomment whatever type you're using!
#define DHTTYPE DHT11   // DHT 11
//#define DHTTYPE DHT22   // DHT 22  (AM2302)
//#define DHTTYPE DHT21   // DHT 21 (AM2301)

DHT dht(DHTPIN, DHTTYPE);
```

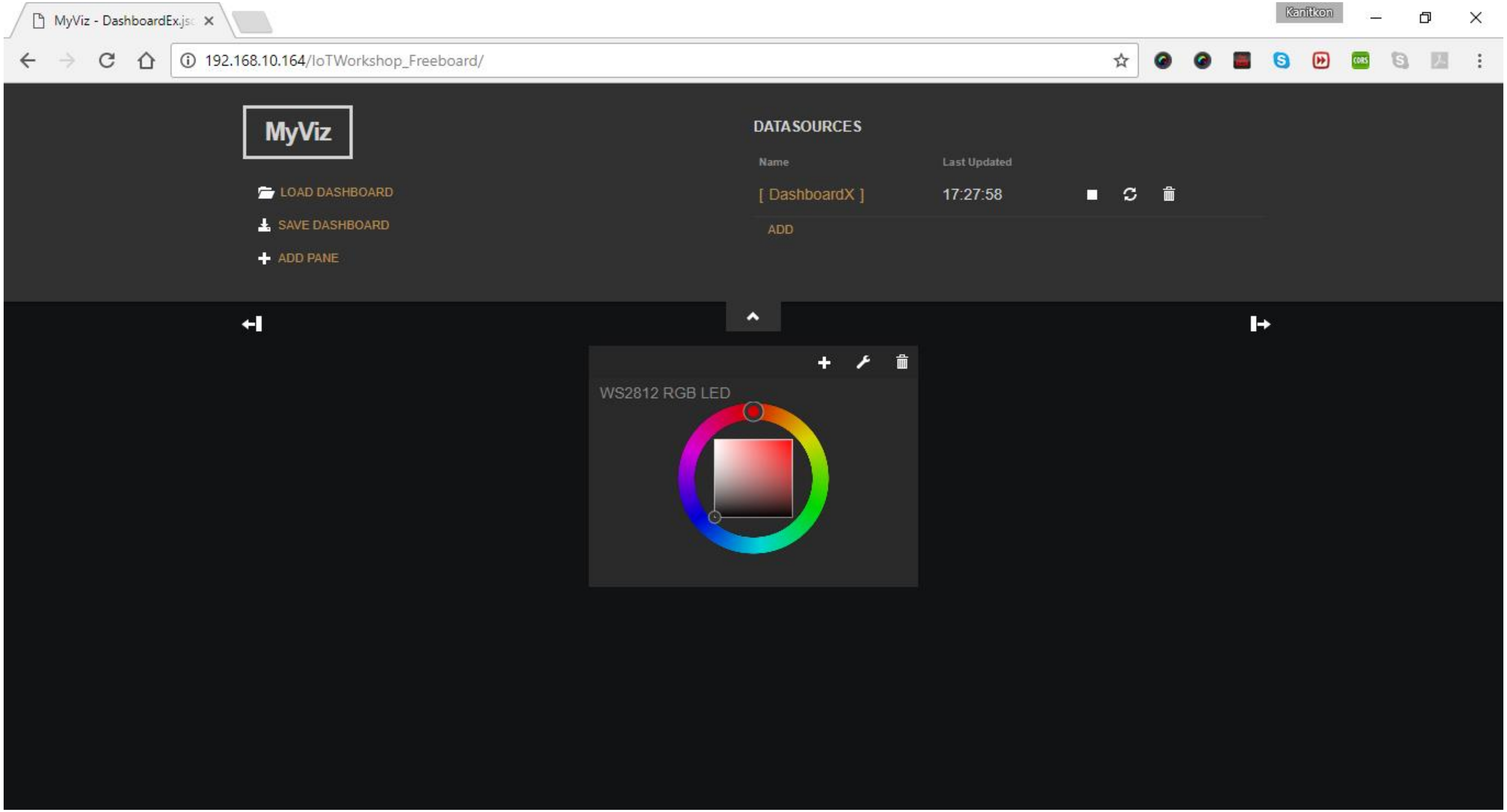
# esp8266_dht11_lib_demo-2

```
void setup() {
  Serial.begin(115200);
  Serial.println("DHTxx test!");
  setup_wifi();
  client.setServer(mqtt_server, mqtt_port);
  dht.begin();
  sprintf(temperature_topic, "/esp8266/%d/temperature", esp_id);
  sprintf(humidity_topic, "/esp8266/%d/humidity", esp_id);
}
```

# esp8266_dht11_lib_demo-2

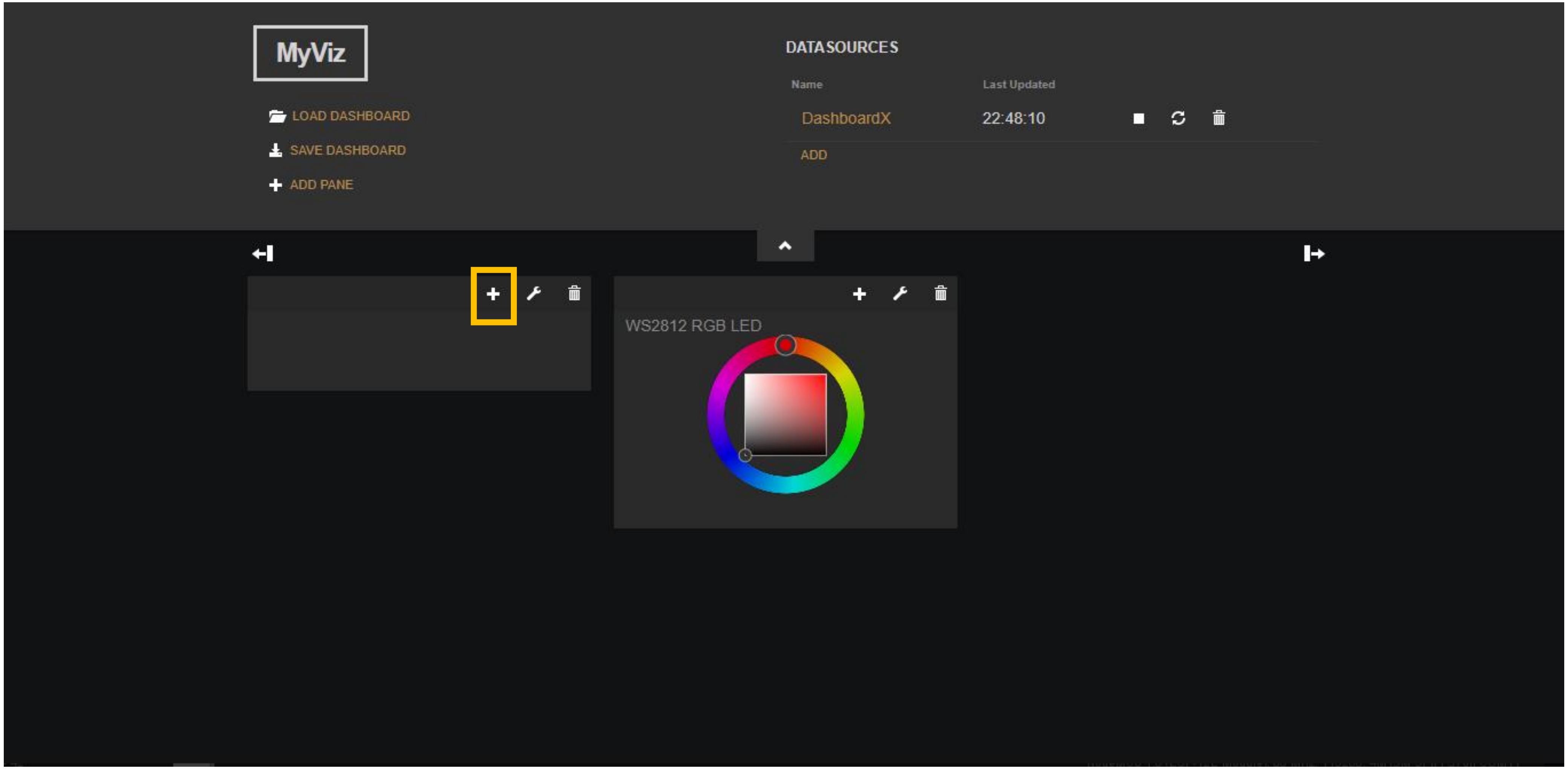
```
void loop() {
  if (!client.connected()) {
    reconnect();
  }
  client.loop();
  long now = millis();
  if (now - lastMsg > 5000) {
    lastMsg = now;
  // Reading temperature or humidity takes about 250 milliseconds!
  // Sensor readings may also be up to 2 seconds 'old' (its a very slow sensor)
    float newHum = dht.readHumidity();
    float newTemp = dht.readTemperature();
    Serial.print("New temperature:");     Serial.println(String(newTemp).c_str());
    client.publish(temperature_topic, String(newTemp).c_str(), true);
    Serial.print("New humidity:");     Serial.println(String(newHum).c_str());
    client.publish(humidity_topic, String(newHum).c_str(), true);
 }
}
```

# ใช้งาน Freeboard เรียกดูค่า DHT11



| Name | Last Updated |
|---|---|
| [ DashboardX ] | 17:27:58 |

# ใช้งาน Freeboard เรียกดูค่า DHT11



MyViz

LOAD DASHBOARD
SAVE DASHBOARD
ADD PANE

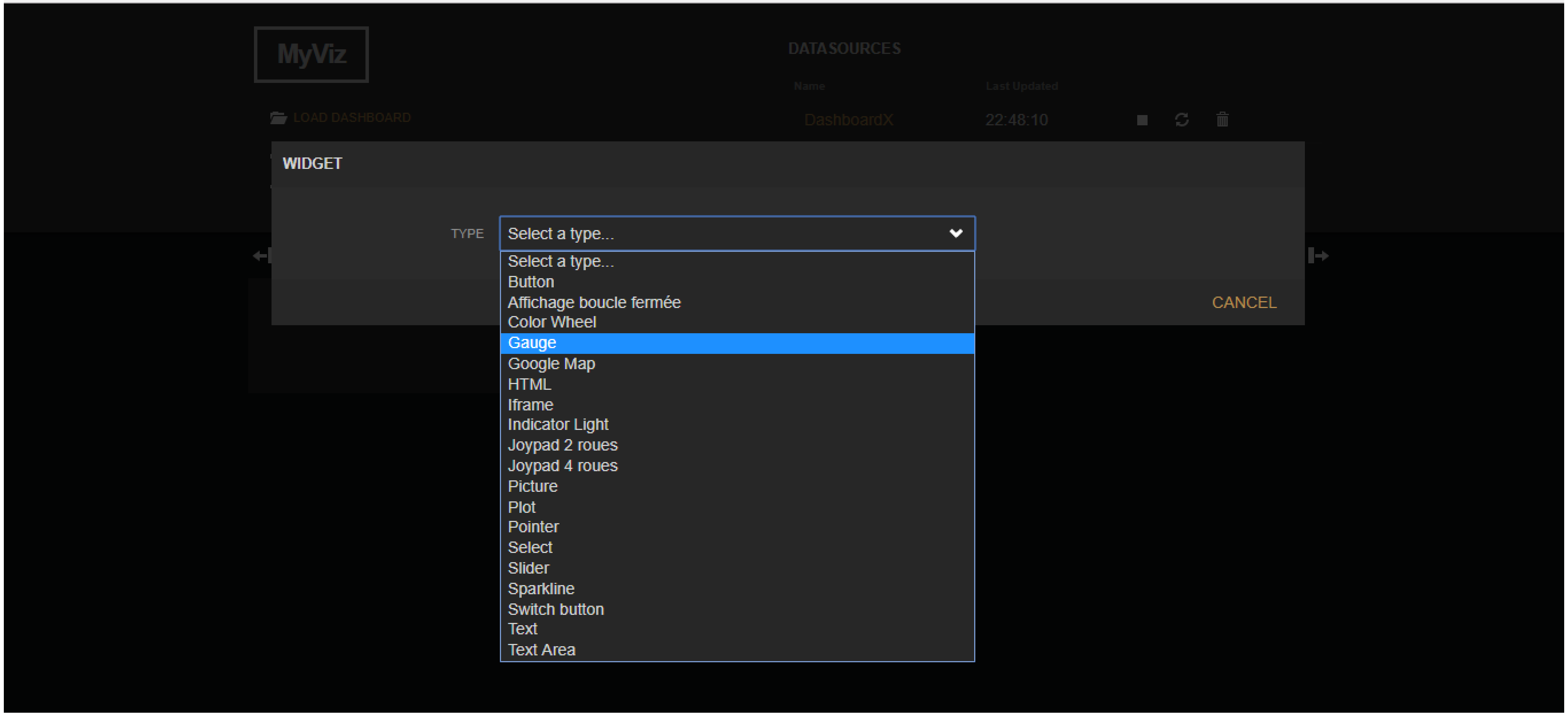
DATASOURCES

| Name | Last Updated |
|---|---|
| DashboardX | 22:48:10 |

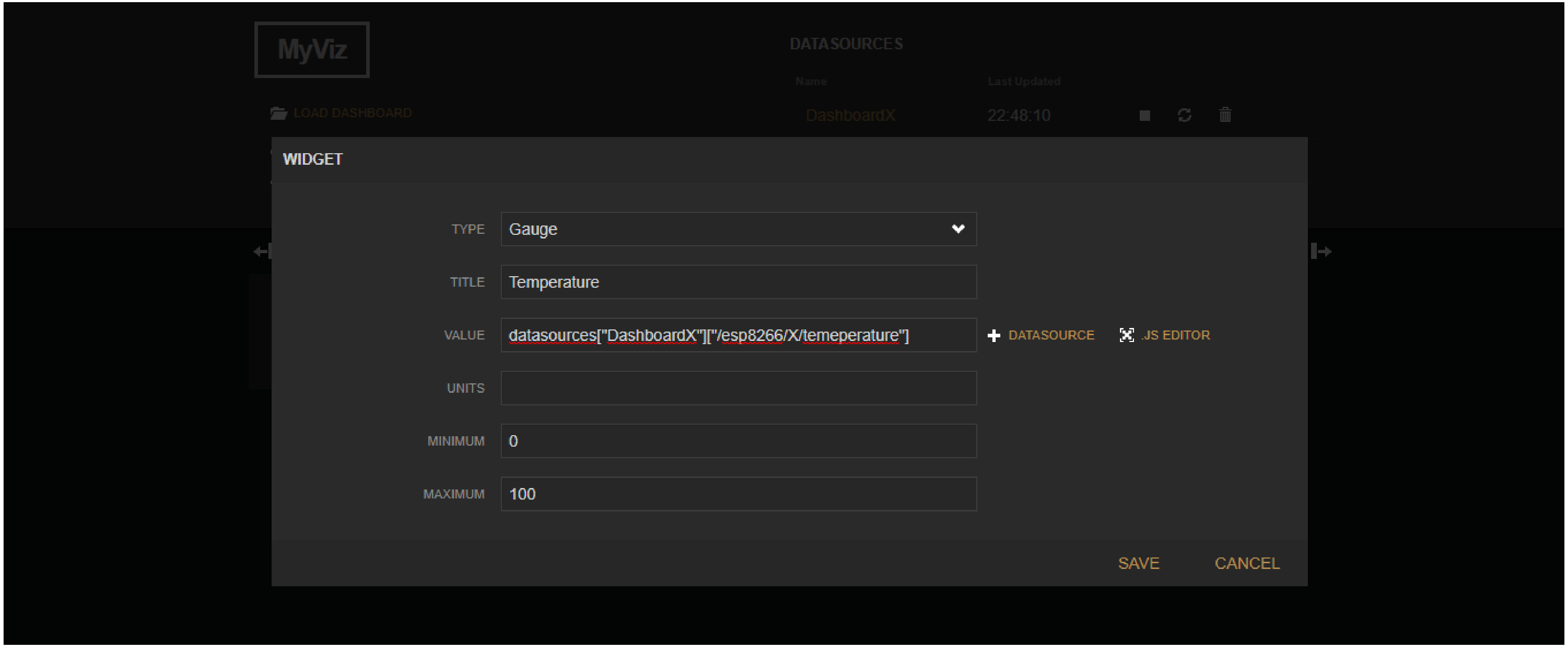
ADD

WS2812 RGB LED

# ใช้งาน Freeboard เรียกดูค่า DHT11



# ใช้งาน Freeboard เรียกดูค่า DHT11



WIDGET

TYPE Gauge

TITLE Temperature

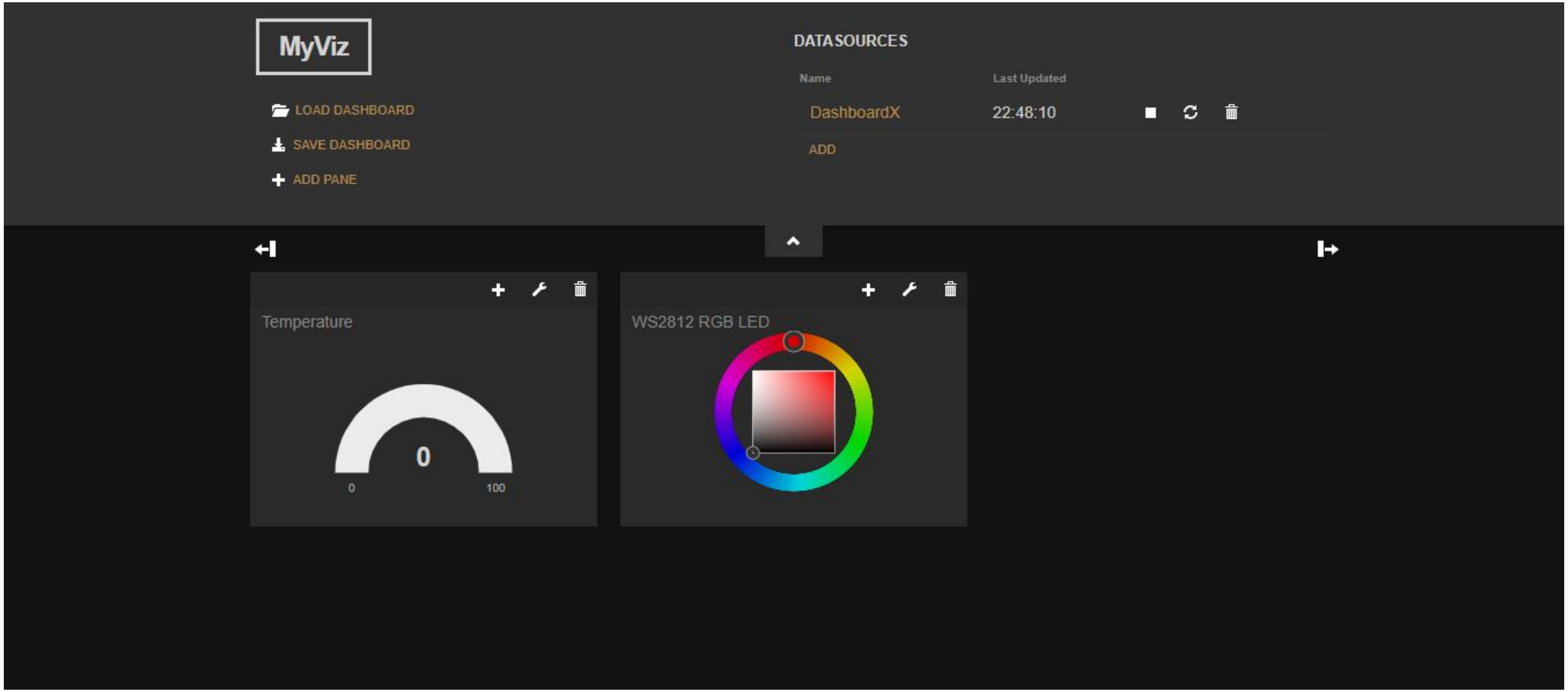
VALUE datasources["DashboardX"]["/esp8266/X/temeperature"]

UNITS

MINIMUM 0

MAXIMUM 100

# ใช้งาน Freeboard เรียกดูค่า DHT11

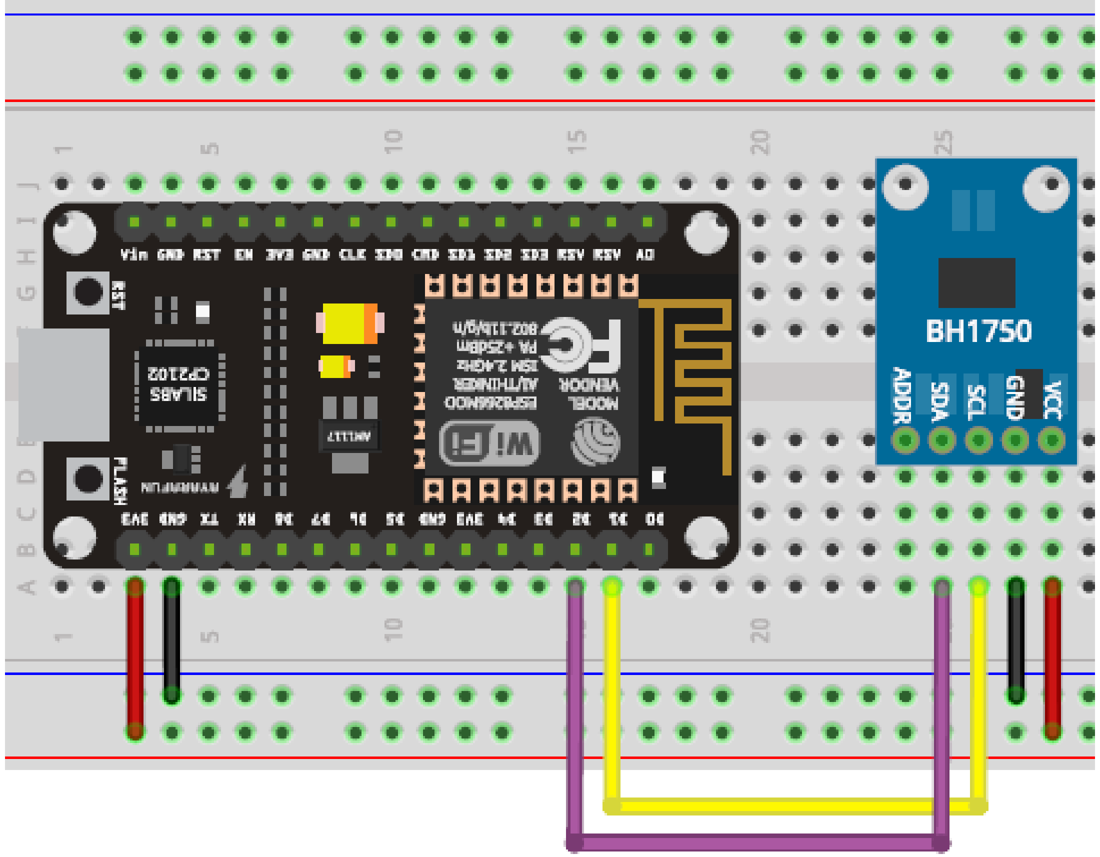


# BH1750 Module

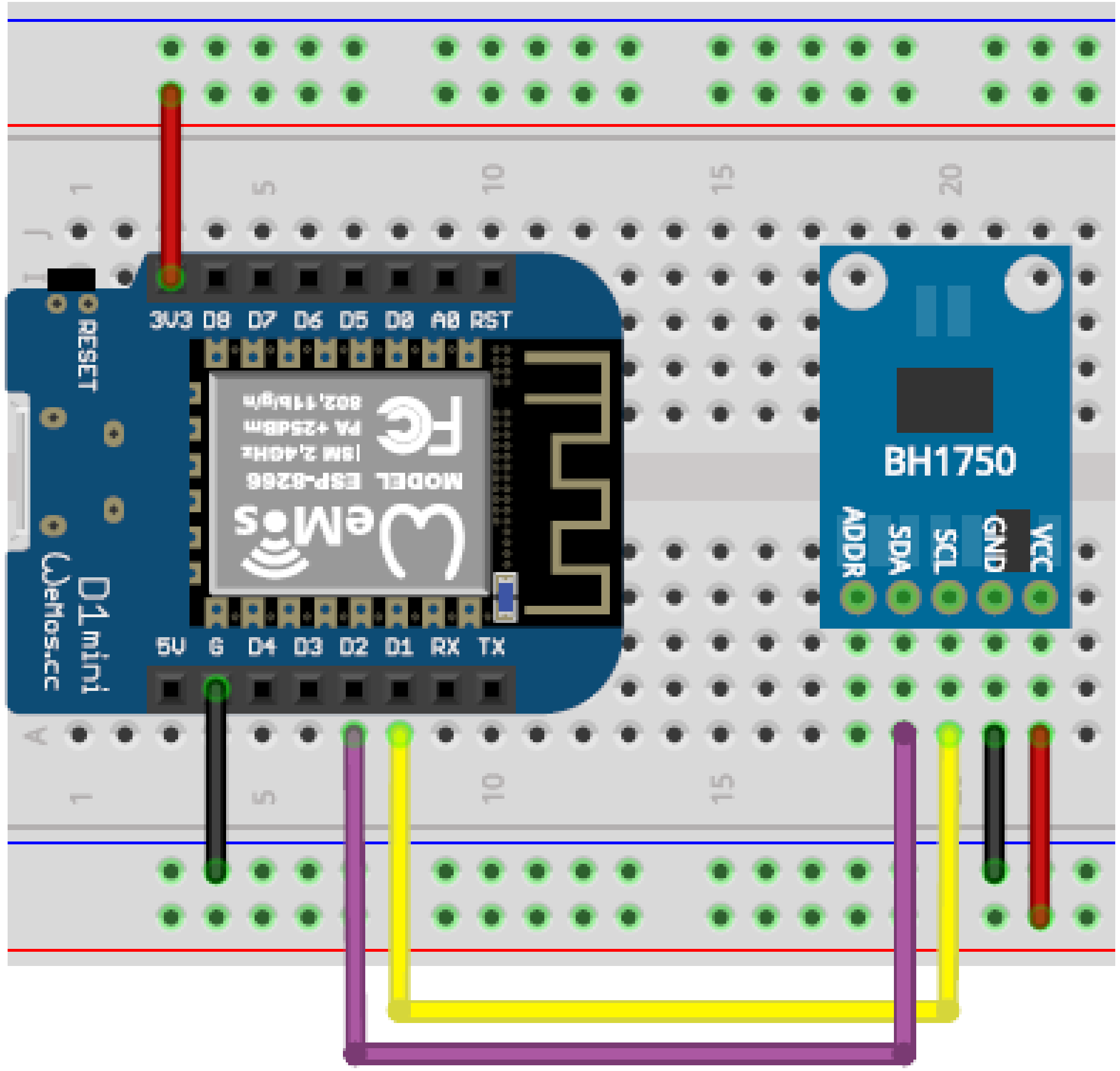
ที่มา : https://goo.gl/G74yWP

- โมดูลวัดความเข้มแสง
- เชื่อมต่อแบบ I2C
- แรงดันไฟเลี้ยงในช่วง 2.4V - 3.6V
- ความละเอียด: 16 บิต ได้ค่า 1-65536 หน่วยเป็น Lux (step: 0.5 Lux, 1 Lux, หรือ 4 Lux ขึ้นอยู่กับโหมดการวัดที่เลือก)
- ระยะเวลาในการวัดแต่ละครั้ง: ประมาณ 120 msec (สำหรับ 0.5 Lux หรือ 1 Lux), 16 msec (สำหรับ 4 Lux) ขึ้นอยู่กับโหมดการวัดที่เลือก

# NodeMCU BH1750 Wiring Diagram



# WeMos BH1750 Wiring Diagram



# esp8266_bh1750_lib_demo-1

```
#include <Wire.h>
#include "BH1750.h"            // -> https://github.com/claws/BH1750

#define LED_PIN        (D4)    // D4 pin (GPIO-2)
#define SDA_PIN        (D2)    // D2 pin (GPIO-4)
#define SCL_PIN        (D1)    // D1 pin (GPIO-5)

#define DEV_ADDR       (0x23)  // set the I2C device address (BH1750)

#define INTERVAL_MSEC  (1000)  // update interval: 1 sec

BH1750 bh( DEV_ADDR );         // create BH1750 object

// global variables
char sbuf[64];                 // char buffer for sprintf()
uint32_t ts;                   // used to save timestamp
```

# esp8266_bh1750_lib_demo-1

```
void setup() {
  pinMode( LED_PIN, OUTPUT );
  digitalWrite( LED_PIN, LOW );
  Serial.begin( 115200 );

  for ( int i=0; i < 10; i++ ) {
    delay(100);
    Serial.println();
  }
  Serial.flush();

  Serial.println( F("BH1750 Sensor Reading...") );
  bh.begin( BH1750_CONTINUOUS_HIGH_RES_MODE,
            SDA_PIN, SCL_PIN, 400000 /* set I2C frequency */ );
  ts = millis();
}
```

# esp8266_bh1750_lib_demo-1

```
void process() {
  uint16_t lux = bh.readLightLevel();  // read the sensor value

  String str;
  str += "Light: ";
  dtostrf( lux, 6, 1, sbuf );
  str += sbuf;
  str += " Lux";

  Serial.println( str.c_str() );
}

void loop() {
  if ( millis() - ts >= INTERVAL_MSEC ) {
     ts += INTERVAL_MSEC;
     digitalWrite( LED_PIN, HIGH );
     process();
     digitalWrite( LED_PIN, LOW );
  }
  delay(1); // delay for 1 msec
}
```

# esp8266_bh1750_lib_demo-2

```
#include <Wire.h> // use the Wire library
#include "BH1750.h"            // https://github.com/claws/BH1750
#include <ESP8266WiFi.h>
#include "PubSubClient.h"

#define I2C_SCL_PIN        (D1)    // D1 pin (GPIO-5
#define I2C_SDA_PIN        (D2)    // D2 pin (GPIO-4
#define I2C_BH1750_ADDR       (0x23)

BH1750 bh( I2C_BH1750_ADDR );

char sbuf[64];
uint32_t ts;
```

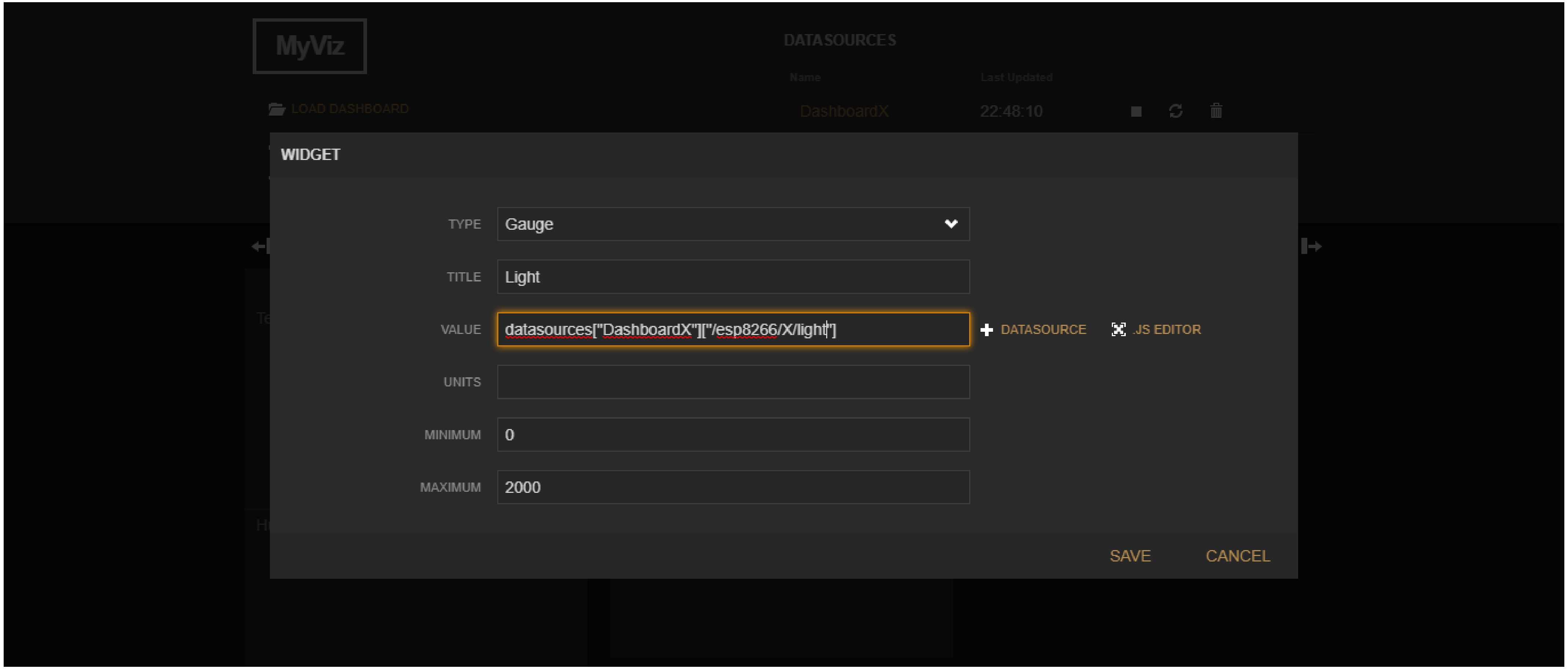
# esp8266_bh1750_lib_demo-2

```
void setup() {
  // put your setup code here, to run once:
  Serial.begin( 115200 );
  Serial.println( "\n\n\n" );

  setup_wifi();
  client.setServer(mqtt_server, mqtt_port);

  Wire.begin( I2C_SDA_PIN, I2C_SCL_PIN );
  delay(1000);
  i2c_scan();
  delay(1000);

  bh.begin( BH1750_CONTINUOUS_HIGH_RES_MODE, I2C_SDA_PIN, I2C_SCL_PIN, 400000 );

  Serial.print( "Light Intensity" );
  ts = millis();
}
```

# esp8266_bh1750_lib_demo-2

```
void loop() {
  // put your main code here, to run repeatedly:
  if (!client.connected()) {
    reconnect();
  }
  client.loop();

  if ( millis() - ts >= INTERVAL_MSEC ) {
     char val_str[8];
     ts += INTERVAL_MSEC;

     uint16_t lux = bh.readLightLevel();
     dtostrf( lux, 6, 1, val_str );

     char light_topic[64];
     sprintf(light_topic, "/esp8266/%d/light", esp_id);
     sprintf( sbuf, "     %s Lux", val_str );      Serial.println( sbuf );
     client.publish(light_topic, val_str, true);
  }
  delay(1);
}
```

# ใช้งาน Freeboard เรียกดูค่า BH1750



TYPE: Gauge

TITLE: Light

VALUE: datasources["DashboardX"]["/esp8266/X/light"]

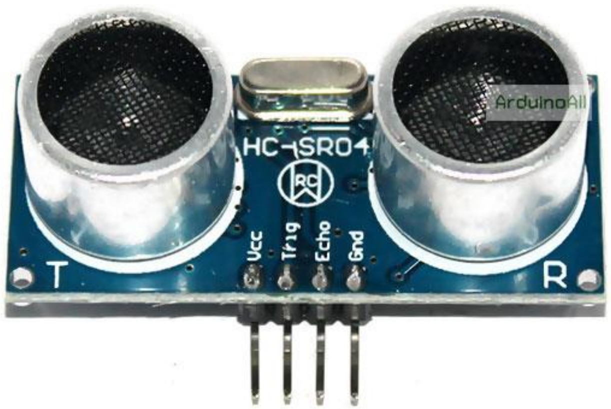
UNITS:

MINIMUM: 0

MAXIMUM: 2000

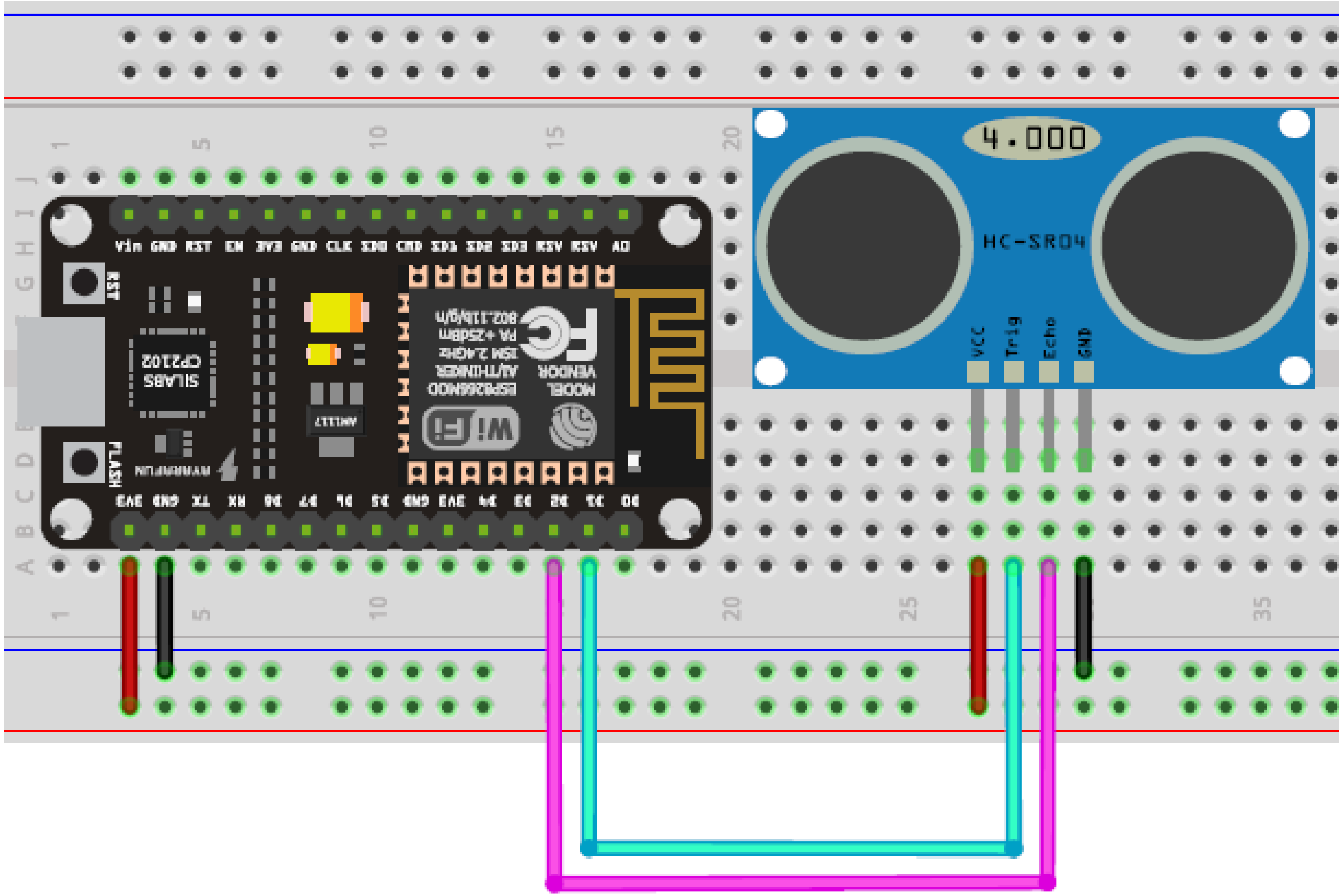
# Ultrasonic Module HC-SR04+

- โมดูลวัดระยะห่างโดยใช้คลื่นเสียง
- 3.3V power and I/O
- ช่วงในการวัดที่ 2-400 cm

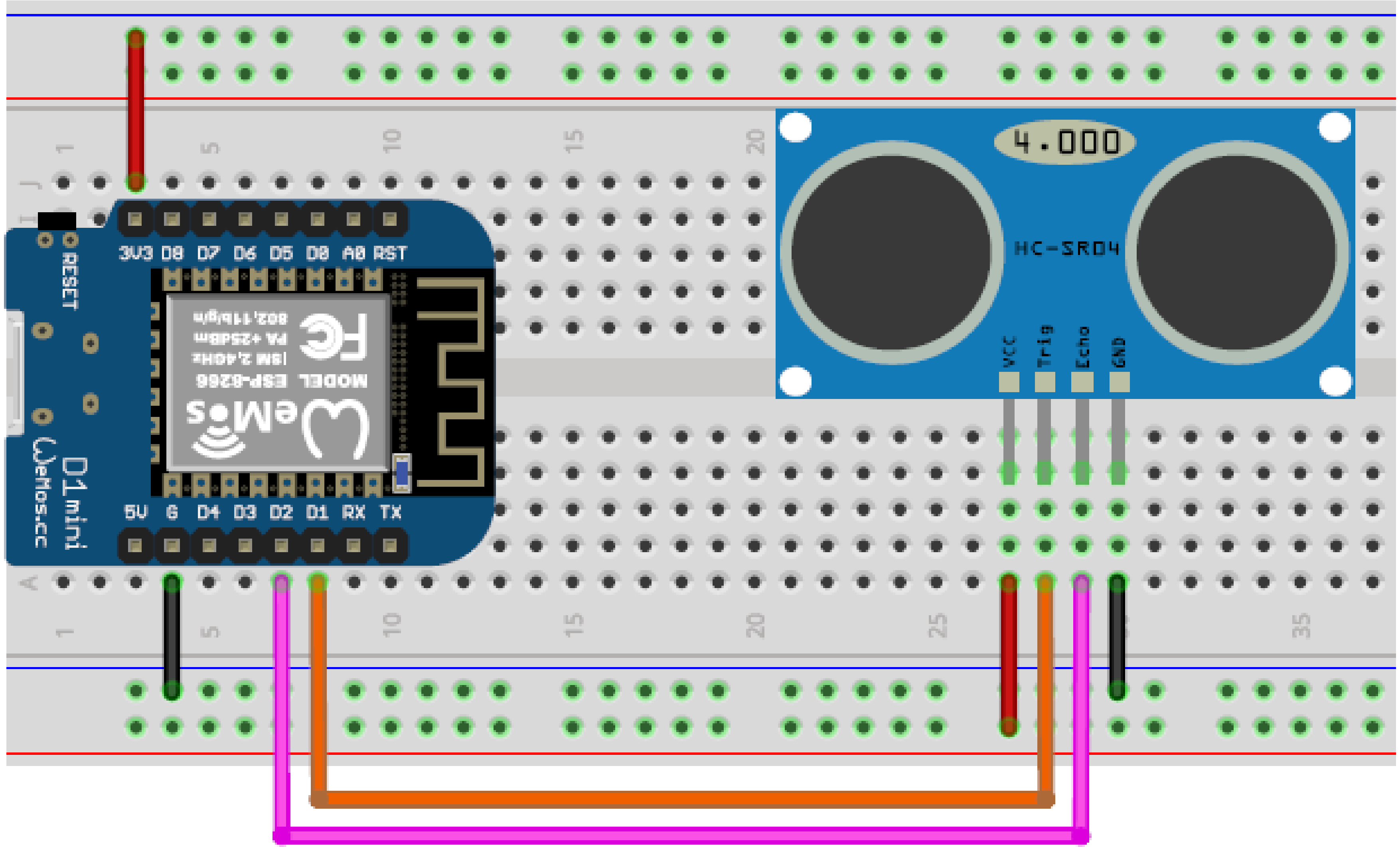


ที่มา : https://goo.gl/5tUDuq

# NodeMCU Ultrasonic Wiring Diagram



# WeMos Ultrasonic Wiring Diagram



# esp8266_ultrasonic_sr04p_demo-1

```
#define TRIG_PIN    5     // GPIO-5 / D1 pin
#define ECHO_PIN    4     // GPIO-4 / D2 pin

const uint32_t timeout_usec = 40000;      // timeout in microseconds
const uint32_t sound_speed  = 34300;      // in centimeters/second

String str;

void setup() {
   Serial.begin( 115200 );
   Serial.println( F("\n\n\n") );
   delay(100);
   Serial.println( F("ESP8266 Ultrasonic SR04+ Demo...") );
   pinMode( ECHO_PIN, INPUT  );
   pinMode( TRIG_PIN, OUTPUT );
}
```

# esp8266_ultrasonic_sr04p_demo-1

```
void loop() {
   // send a PING signal (a short-pulse signal on TRIG pin)
   digitalWrite( TRIG_PIN, HIGH );
   delayMicroseconds( 20 );
   digitalWrite( TRIG_PIN, LOW );

   // see: https://www.arduino.cc/en/Reference/pulseIn
   uint32_t duration = pulseIn( ECHO_PIN, HIGH, timeout_usec );
   str = F("Duration: ");
   str += duration;
   str += F(" usec, ");
   str += F("Distance: ");
   str += (sound_speed * duration / 1000000) / 2;
   str += F(" cm");
   Serial.println( str );

   delay(500);
}
```

# esp8266_ultrasonic_sr04p_demo-2

```
void setup() {
  Serial.begin(115200);
  pinMode( ECHO_PIN,  INPUT  );
  pinMode( TRIG_PIN,  OUTPUT );
  setup_wifi();
  client.setServer(mqtt_server, mqtt_port);
}

uint32_t read_distance() {
   // send a PING signal (a short-pulse signal on TRIG pin)
   digitalWrite( TRIG_PIN, HIGH );
   delayMicroseconds( 20 );
   digitalWrite( TRIG_PIN, LOW );
   // see: https://www.arduino.cc/en/Reference/pulseIn
   // measure pulse width of the ECHO signal
   uint32_t duration = pulseIn( ECHO_PIN, HIGH, timeout_usec );
   uint32_t distance_cm = (sound_speed * duration / 1000000) / 2;
   return distance_cm;
}
```

# esp8266_ultrasonic_sr04p_demo-2

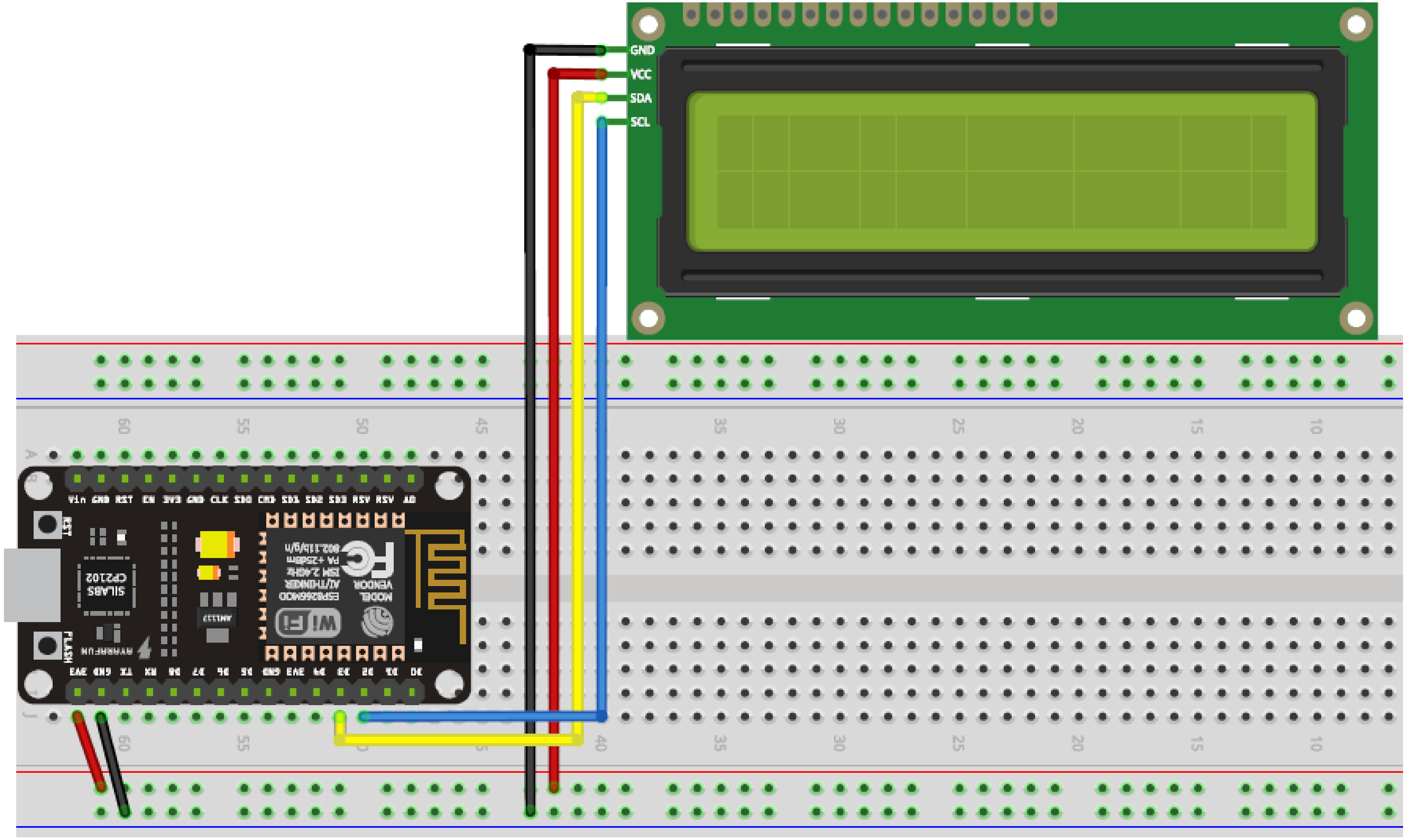
```
void loop() {
  if (!client.connected()) {
    reconnect();
  }
  client.loop();

  long now = millis();
  if (now - lastMsg > 500) {
    lastMsg = now;

    char distance[64];
    sprintf(distance, "/esp8266/%d/distance", esp_id);

    uint32_t newDistance = read_distance();
    Serial.print("New distance:");     Serial.println(String(newDistance).c_str());
    client.publish(distance, String(newDistance).c_str(), true);
 }
}
```

# LCD 16x2 i2c Display Module

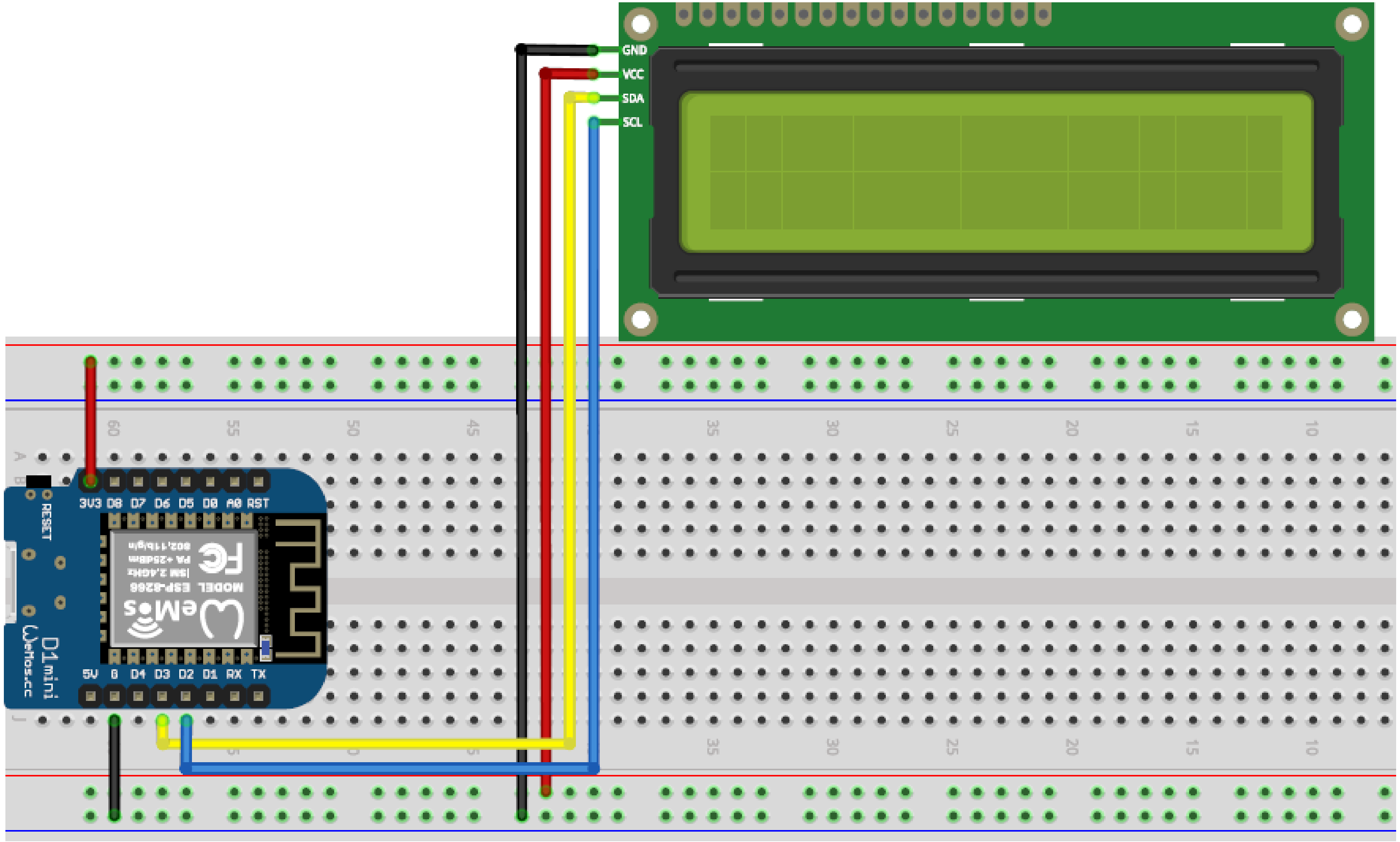
- โมดูลแสดงข้อความขนาด 16 ตัวอักษร 2 แถว
- มีการเชื่อมต่อแบบ i2c โดยใช้โมดูลที่ใช้ไอซี PCF8574

ที่มา : https://goo.gl/EcD6p2

# NodeMCU LCD Wiring Diagram


GND
VCC
SDA
SCL
Vin GND RST EN 3V3 GND CLK SDO CMD SD1 SD2 SD3 RSV RSV A0
3V3 GND TX RX D8 D7 D6 D5 GND 3V3 D4 D3 D2 D1 D0
RST
FLASH
CP2102
SILABS
Wi Fi
60
55
50
45
40
35
30
25
20
15
10

# WeMos LCD Wiring Diagram



# esp8266_pcf8574a_lcd_lib_demo-2

```
#include <Wire.h> // use the Wire library
#include "LiquidCrystal_I2C.h" // -> https://github.com/fdebrabander/Arduino-LiquidCrystal-I2C-library

#define I2C_SCL_PIN       (4)       // D2 pin (SCL / GPIO-4)
#define I2C_SDA_PIN       (0)       // D3 pin (SDA / GPIO-0)
#define I2C_ADDR          (0x3F)    // set the I2C address for PCF8574 LCD adapter (0x27 or 0x3F)

LiquidCrystal_I2C lcd( I2C_ADDR, 16, 2 ); // 16x2 LCD display, set I2C address

// global variables
char sbuf[64];   // used for sprintf()
uint32_t ts;     // used to save timestamp value

#define INTERVAL_MSEC  (1000)
```

# esp8266_pcf8574a_lcd_lib_demo-1

```
void setup() {
  Serial.begin( 115200 );

  Wire.begin( I2C_SDA_PIN, I2C_SCL_PIN );
  delay(1000);
  i2c_scan();
  delay(1000);

  lcd.begin( I2C_SDA_PIN, I2C_SCL_PIN, 400000 );
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(0,0); // set cursor at top-level position on the first row
  lcd.print( F("ESP8266 Demo") );
  lcd.setCursor(0,1); // set cursor at the start position on the second row
  lcd.print( F("ESL KMUTNB") );
  lcd.clear();
  lcd.setCursor(0,0); // set cursor at top-level position on the first row
  lcd.print( F("16x2 LCD Adapter") );
  delay(1000);
  ts = millis();
}
```

# esp8266_pcf8574a_lcd_lib_demo-1

```
uint16_t count = 0;

void loop() {
  if ( millis() - ts >= INTERVAL_MSEC ) {
     ts += INTERVAL_MSEC;
     sprintf_P( sbuf, PSTR("Count: %04u"), count );
     count = (count+1) % 10000;
     lcd.setCursor(0 /*col*/, 1 /*row*/);
     lcd.print( sbuf );
     Serial.println( sbuf );
  }
  delay(1);
}
```

# esp8266_pcf8574a_lcd_lib_demo-2

```
#include <ESP8266WiFi.h>
#include "PubSubClient.h"
#include <Wire.h> // use the Wire library
#include "LiquidCrystal_I2C.h" // -> https://github.com/fdebrabander/Arduino-LiquidCrystal-I2C-library

#define I2C_SCL_PIN      (4)      // D2 pin (SCL / GPIO-4)
#define I2C_SDA_PIN      (0)      // D3 pin (SDA / GPIO-0)
#define I2C_ADDR         (0x3F)   // set the I2C address for PCF8574 LCD adapter (0x27 or 0x3F)

LiquidCrystal_I2C lcd( I2C_ADDR, 16, 2 ); // 16x2 LCD display, set I2C address

// global variables
char sbuf[64];   // used for sprintf()
uint32_t ts;     // used to save timestamp value

#define INTERVAL_MSEC  (1000)
```

# esp8266_pcf8574a_lcd_lib_demo-2

```
void setup() {
  Serial.begin( 115200 );

  setup_wifi();
  client.setServer(mqtt_server, mqtt_port);
  client.setCallback(callback);

  Wire.begin( I2C_SDA_PIN, I2C_SCL_PIN );
  delay(1000);
  i2c_scan();
  delay(1000);

  lcd.begin( I2C_SDA_PIN, I2C_SCL_PIN, 400000 );
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(0,0); // set cursor at top-level position on the first row
  lcd.print( F("IoT Workshop") );
  delay(1000);
  ts = millis();
}
```

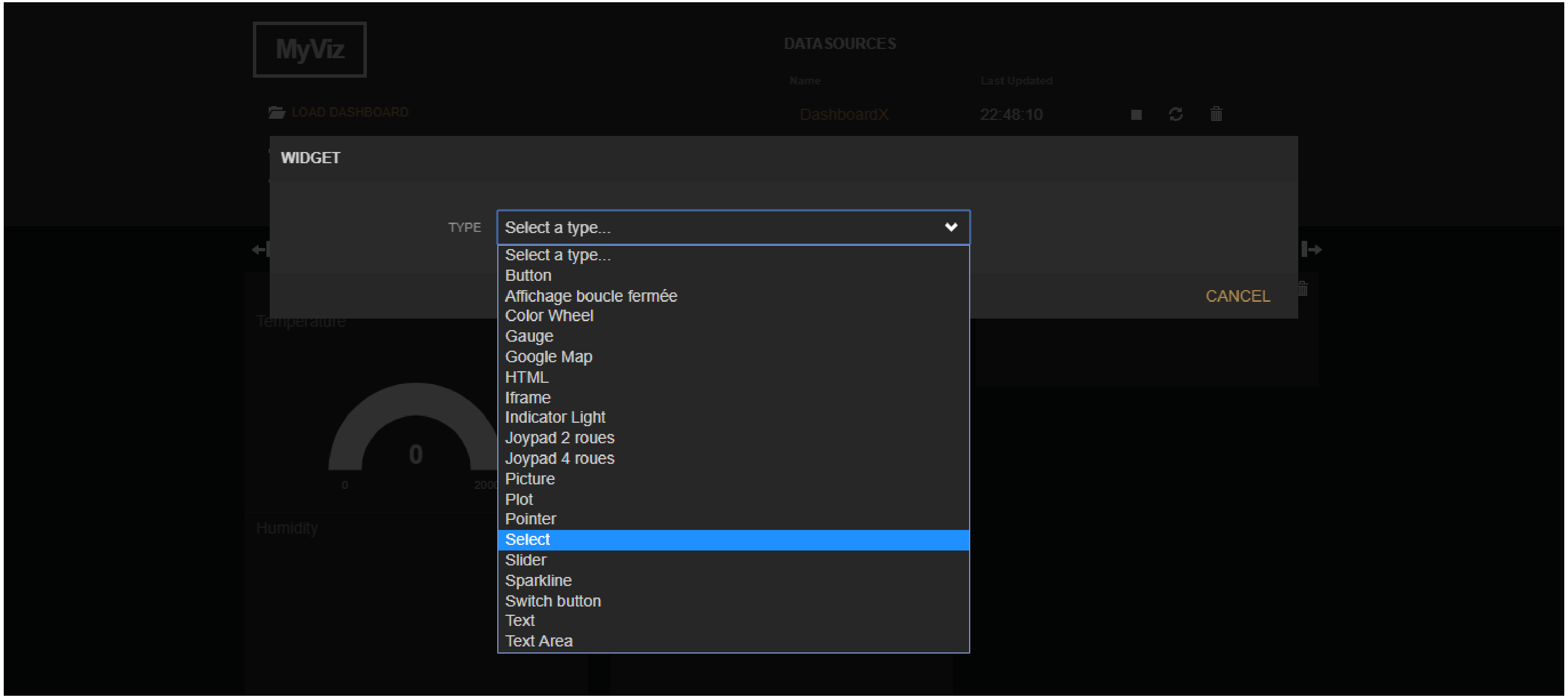
# esp8266_pcf8574a_lcd_lib_demo-2

```
void loop() {
  connectCloudMQTT();
  if( millis() - ts >= INTERVAL_MSEC){
    ts += INTERVAL_MSEC;
    if (count_scroll%(text.length()+16) == 0){
      lcd.clear();
      lcd.setCursor(16,0); // set cursor at top-level position on the first row
      lcd.print(text);
    }else{
      lcd.scrollDisplayLeft();
    }
    count_scroll++;
  }
}
```

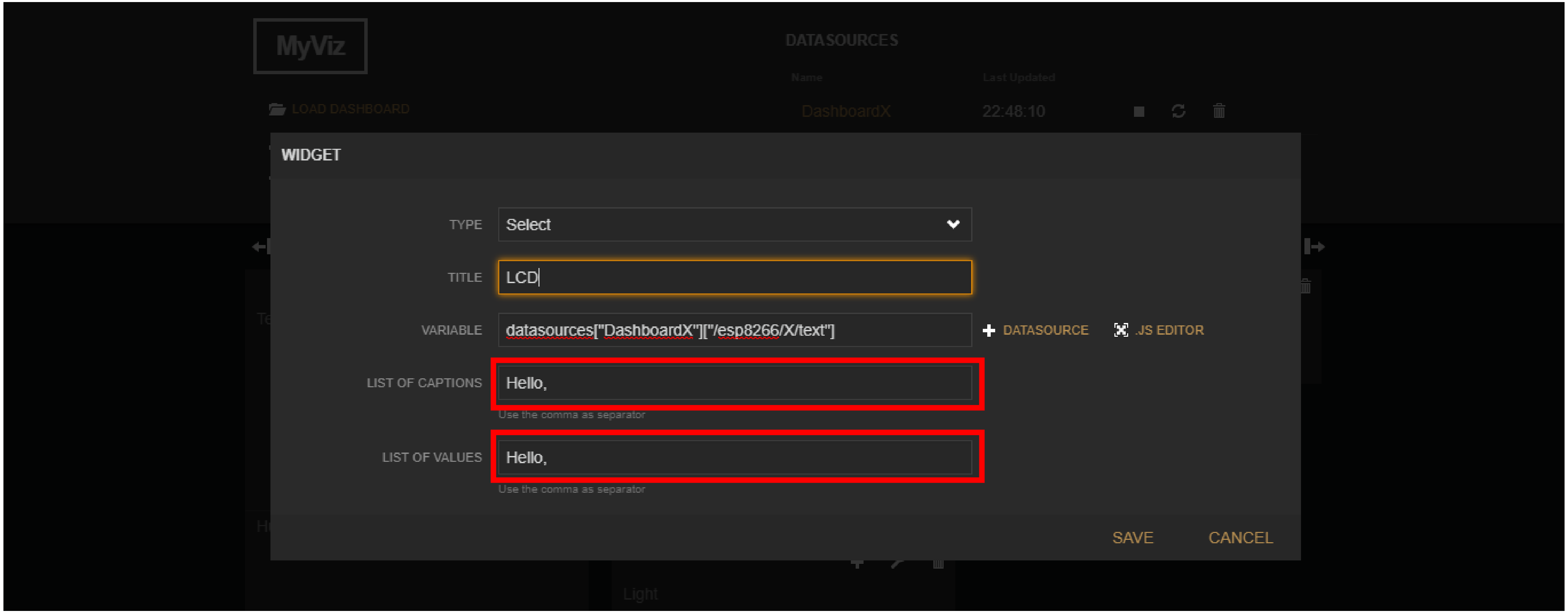
# esp8266_pcf8574a_lcd_lib_demo-2

```
void callback(char* topic, byte* payload, unsigned int length) {
  const char s[2] = "/";
  char *token;
  token = strtok(topic, s);
  token = strtok(NULL, s);
  token = strtok(NULL, s);
  if(!strcmp(token, "text")){
    payload[length] = '\0';
    text = String((char*)payload);
    Serial.println(text);
  }
}
```

# ใช้งาน Freeboard ส่งข้อความแสดงที่ LCD



# ใช้งาน Freeboard ส่งข้อความแสดงที่ LCD



WIDGET

TYPE: Select

TITLE: LCD

VARIABLE: datasources["DashboardX"]["/esp8266/X/text"]

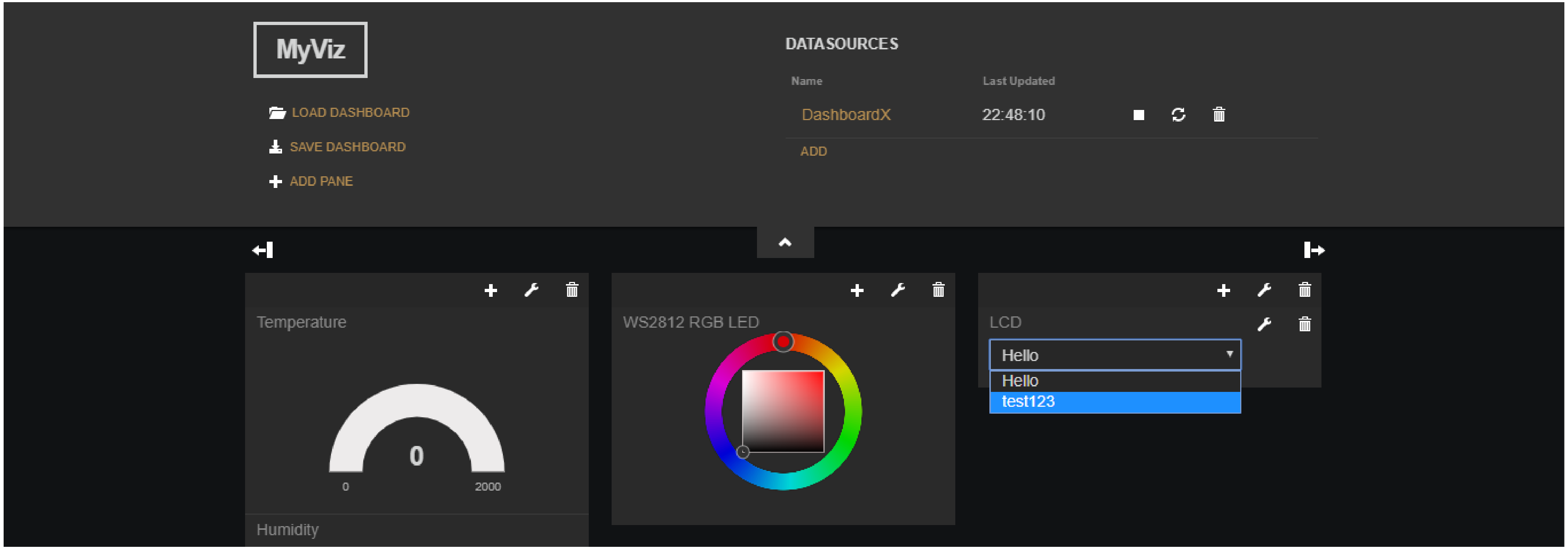
LIST OF CAPTIONS: Hello,

Use the comma as separator

LIST OF VALUES: Hello,

Use the comma as separator

# ใช้งาน Freeboard ส่งข้อความแสดงที่ LCD



| Name | Last Updated |
|---|---|
| DashboardX | 22:48:10 |

LCD: Hello