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Faculty of

Electronics & Telecommunications

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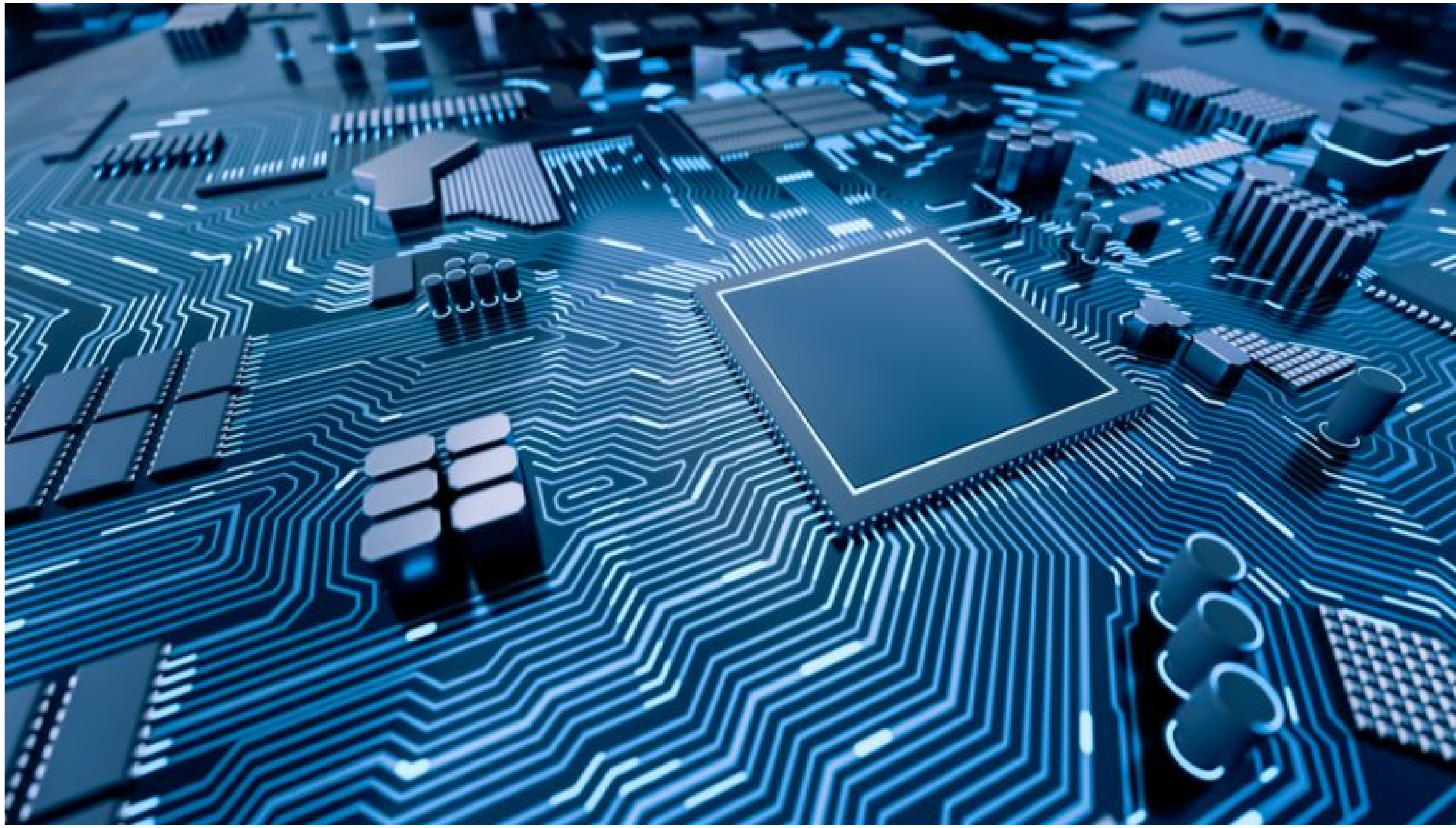

Internet of Things:

Practice

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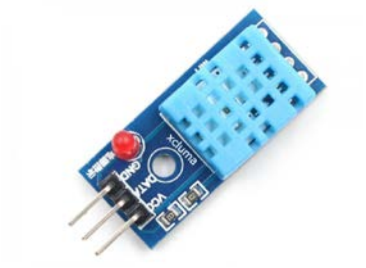
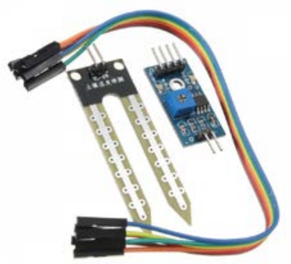
- Email: nguyen.tan17089@gmail.com

GETTING SENSING DATA

- Temperature/Humidity Sensor
- GAS Sensor (MQ2)
- Soil Moisture Sensor





First Rules!

❖ You might actually damage hardware

- Double check when you do wiring
- Do not connect any unintended GPIO pins, or you will short circuit the ESP8266
- During wiring, Power off the ESP8266 (or unplugged microUSB connection)
- Do not touch with wet fingers

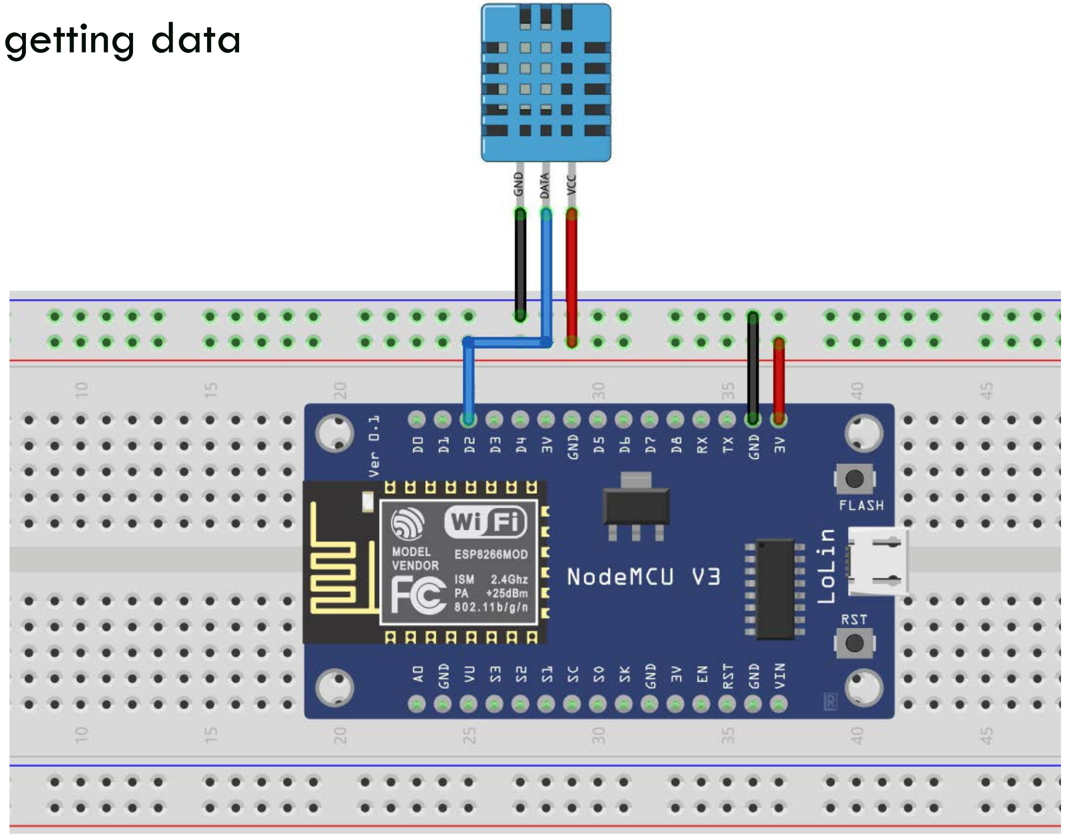
❖ Think "why", and consult hardware reference for better understanding

- Reading hardware references is a must-have skill
- You don't have to read a reference thoroughly at the beginning (Later, you will)

Temperature/Humidity Sensor

❖ Circuit diagram

- Connect a DHT11 module to ESP8266 as the following circuit diagram
- Measure the temperature/humidity and heat index by getting data from D2 pin of ESP8266



DHT11 Specs.

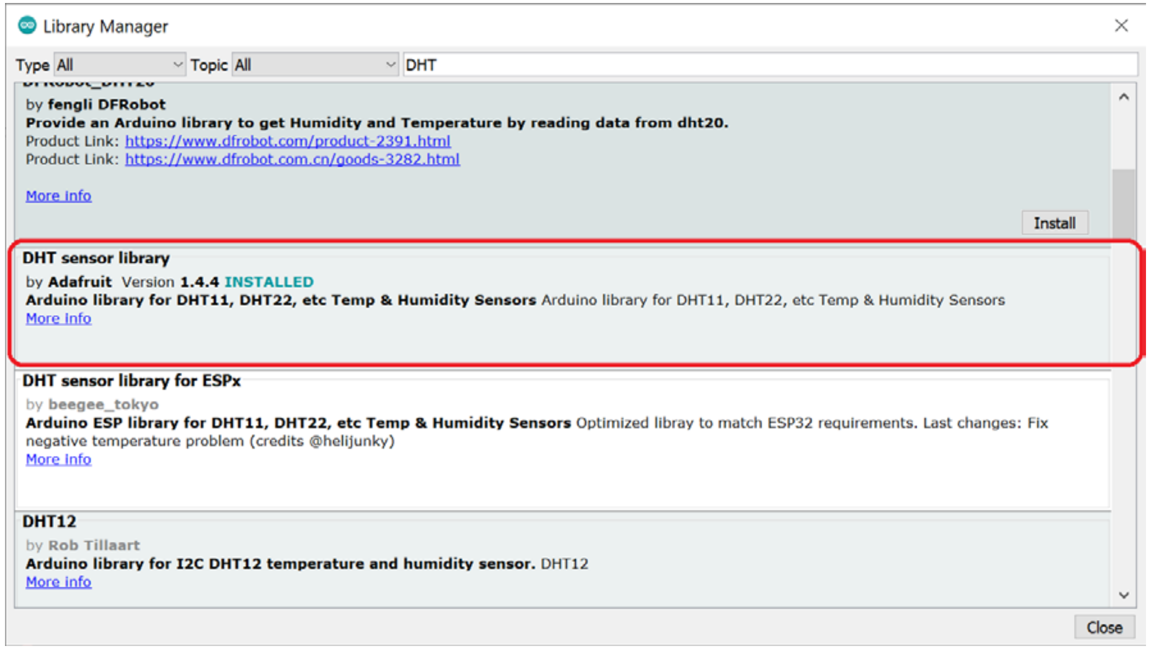
- Operating Voltage: 3.5V to 5.5V.
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data.
- Temperature Range: 0°C to 50°C.
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit.
- Accuracy: ±1°C and ±1%

Temperature/Humidity Sensor

❖ Demo Code

- Install a DHT sensor library

(Tools → Manage libraries → Search "DHT")

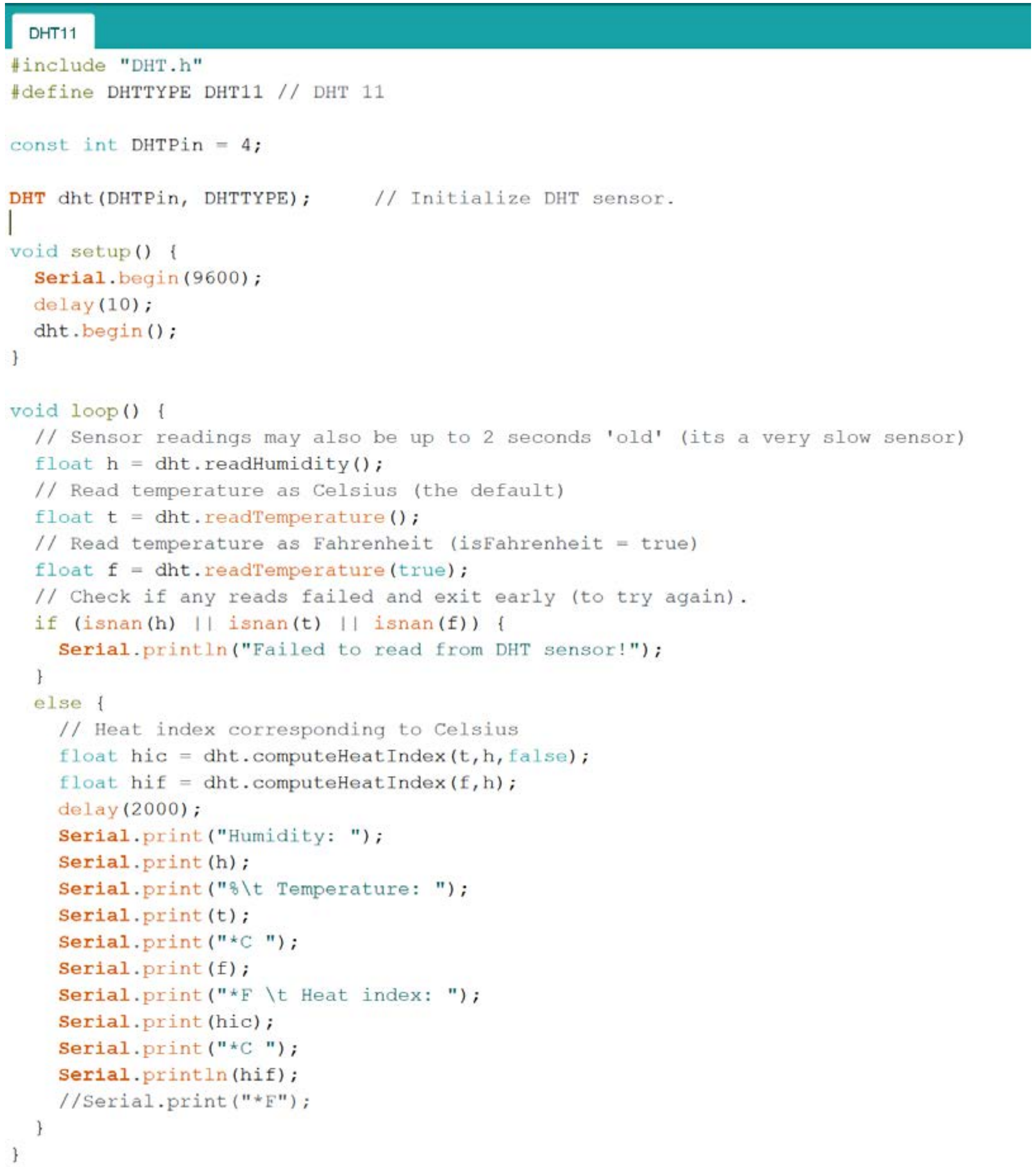


by fengli DFRobot
Provide an Arduino library to get Humidity and Temperature by reading data from dht20.
Product Link: https://www.dfrobot.com/product-2391.html
Product Link: https://www.dfrobot.com.cn/goods-3282.html
More info

DHT sensor library
by **Adafruit** Version **1.4.4** **INSTALLED**
Arduino library for DHT11, DHT22, etc Temp & Humidity Sensors Arduino library for DHT11, DHT22, etc Temp & Humidity Sensors
More info

DHT sensor library for ESPx
by beegee_tokyo
Arduino ESP library for DHT11, DHT22, etc Temp & Humidity Sensors Optimized libray to match ESP32 requirements. Last changes: Fix negative temperature problem (credits @helijunky)
More info

DHT12
by Rob Tillaart
Arduino library for I2C DHT12 temperature and humidity sensor. DHT12
More info



```
#include "DHT.h"
#define DHTTYPE DHT11 // DHT 11

const int DHTPin = 4;

DHT dht(DHTPin, DHTTYPE);     // Initialize DHT sensor.

void setup() {
  Serial.begin(9600);
  delay(10);
  dht.begin();
}

void loop() {
  // Sensor readings may also be up to 2 seconds 'old' (its a very slow sensor)
  float h = dht.readHumidity();
  // Read temperature as Celsius (the default)
  float t = dht.readTemperature();
  // Read temperature as Fahrenheit (isFahrenheit = true)
  float f = dht.readTemperature(true);
  // Check if any reads failed and exit early (to try again).
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println("Failed to read from DHT sensor!");
  }
  else {
    // Heat index corresponding to Celsius
    float hic = dht.computeHeatIndex(t,h,false);
    float hif = dht.computeHeatIndex(f,h);
    delay(2000);
    Serial.print("Humidity: ");
    Serial.print(h);
    Serial.print("%\t Temperature: ");
    Serial.print(t);
    Serial.print("*C ");
    Serial.print(f);
    Serial.print("*F \t Heat index: ");
    Serial.print(hic);
    Serial.print("*C ");
    Serial.println(hif);
    //Serial.print("*F");
  }
}
```

Temperature/Humidity Sensor

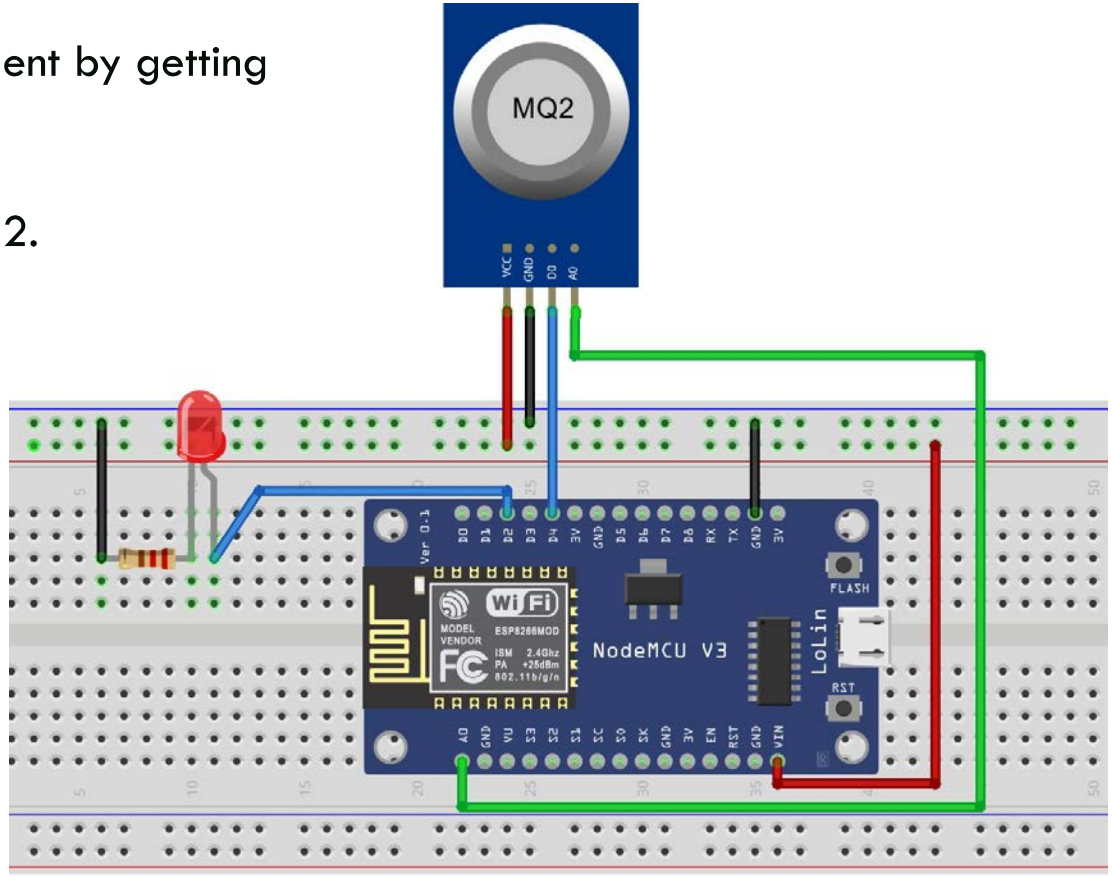
❖ Explore more

- Build an application that automatically alerts the user via a LED when the temperature is too high or too low.

GAS Sensor

❖ Circuit diagram

- Connect a MQ2 module to ESP8266 as the following circuit diagram,
- Measure the level of Gas in the surrounding environment by getting information from A0 pin,
- Turn on the red LED when Gas is detected by the MQ2.


MQ2
VCC
GND
D0
A0
NodeMCU V3
LoLin
FLASH
RST
Wi Fi
ESP8266MOD
D0 D1 D2 D3 D4 3V GND D5 D6 D7 D8 RX TX GND 3V
A0 GND VU S3 S2 S1 SC S0 SK GND 3V EN RST GND VIN

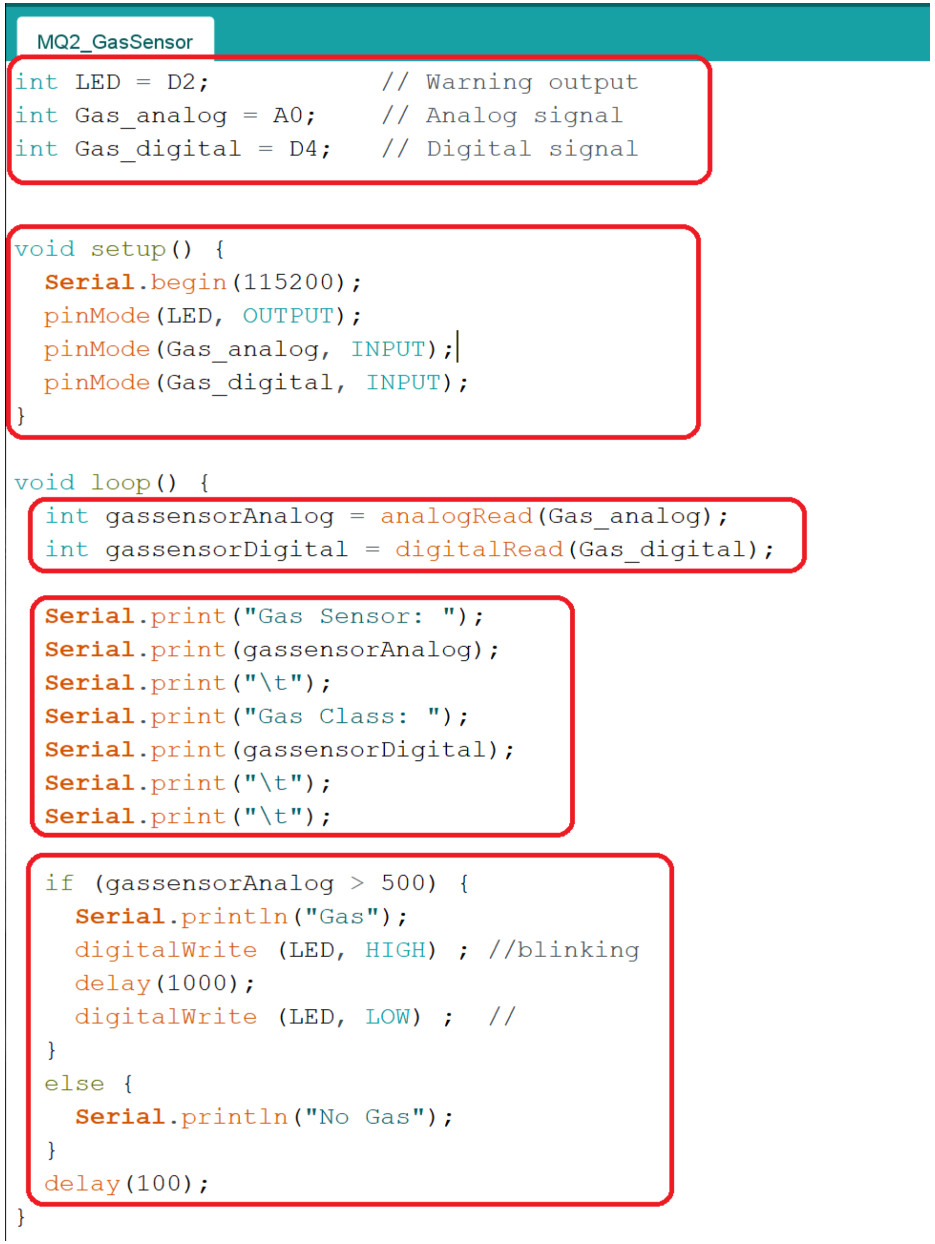
MQ2 Specs.

- Input voltage: 5V
- Output signal: Digital/Analog
- Type of detected gas: H2, LPG, CH4, CO, Alcohol, Smoke and Propane

GAS Sensor

❖ Demo Code

- Implement the demo code
- Analyse the pieces of the demo code
- Use Digital signal to trigger the LED



```
int LED = D2;               // Warning output
int Gas_analog = A0;        // Analog signal
int Gas_digital = D4;       // Digital signal

void setup() {
  Serial.begin(115200);
  pinMode(LED, OUTPUT);
  pinMode(Gas_analog, INPUT);
  pinMode(Gas_digital, INPUT);
}

void loop() {
  int gassensorAnalog = analogRead(Gas_analog);
  int gassensorDigital = digitalRead(Gas_digital);

  Serial.print("Gas Sensor: ");
  Serial.print(gassensorAnalog);
  Serial.print("\t");
  Serial.print("Gas Class: ");
  Serial.print(gassensorDigital);
  Serial.print("\t");
  Serial.print("\t");

  if (gassensorAnalog > 500) {
    Serial.println("Gas");
    digitalWrite (LED, HIGH) ; //blinking
    delay(1000);
    digitalWrite (LED, LOW) ;  //
  }
  else {
    Serial.println("No Gas");
  }
  delay(100);
}
```

GAS Sensor

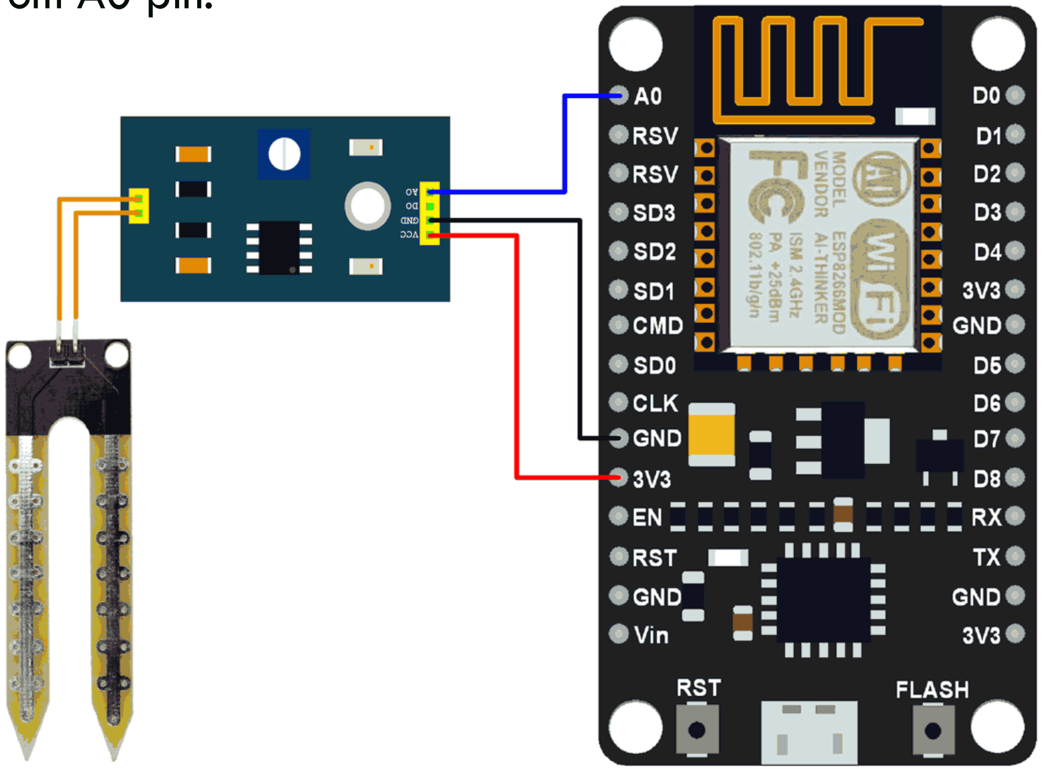
Explore more

- Build an application that automatically alerts the user about the levels of GAS in the surrounding environment by using different color LEDs.

Soil Moisture Sensor

❖ Circuit diagram

- Connect a soil moisture module to ESP8266 as the following circuit diagram,
- Measure the level of moisture by getting information from A0 pin.



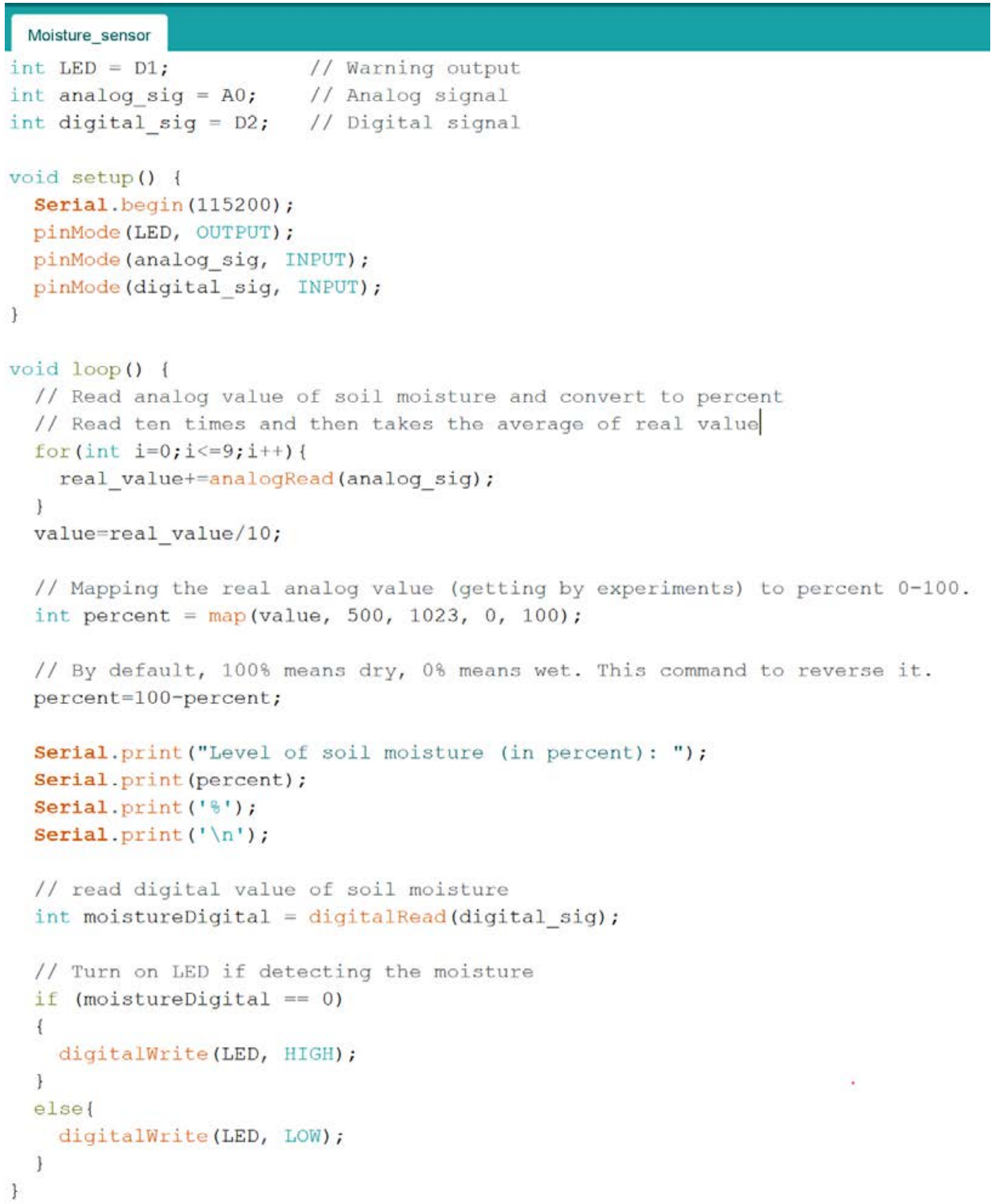
Soil Moisture sensor Specs.

- Input voltage: 3.3V - 5V
- Output signal: Digital/Analog

Soil Moisture Sensor

❖ Demo Code

- Implement the demo code
- Analyse the pieces of the demo code



```
int LED = D1;            // Warning output
int analog_sig = A0;     // Analog signal
int digital_sig = D2;    // Digital signal

void setup() {
  Serial.begin(115200);
  pinMode(LED, OUTPUT);
  pinMode(analog_sig, INPUT);
  pinMode(digital_sig, INPUT);
}

void loop() {
  // Read analog value of soil moisture and convert to percent
  // Read ten times and then takes the average of real value
  for(int i=0;i<=9;i++){
    real_value+=analogRead(analog_sig);
  }
  value=real_value/10;

  // Mapping the real analog value (getting by experiments) to percent 0-100.
  int percent = map(value, 500, 1023, 0, 100);

  // By default, 100% means dry, 0% means wet. This command to reverse it.
  percent=100-percent;

  Serial.print("Level of soil moisture (in percent): ");
  Serial.print(percent);
  Serial.print('%');
  Serial.print('\n');

  // read digital value of soil moisture
  int moistureDigital = digitalRead(digital_sig);

  // Turn on LED if detecting the moisture
  if (moistureDigital == 0)
  {
    digitalWrite(LED, HIGH);
  }
  else{
    digitalWrite(LED, LOW);
  }
}
```

System Integratation

❖ Explore more

- Build an embedded application that uses at least two sensors and one actuator.

THANK YOU!