Universitas Bina Sarana Informatika

Air Quality Analysis
Manual Book

Monitoring CO2 Concentration in Rooftop Building Areas

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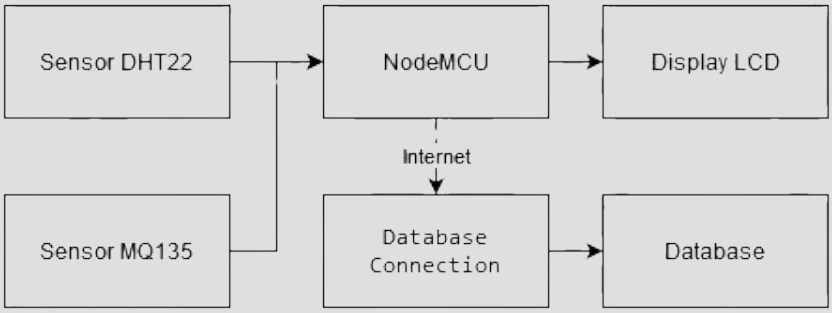
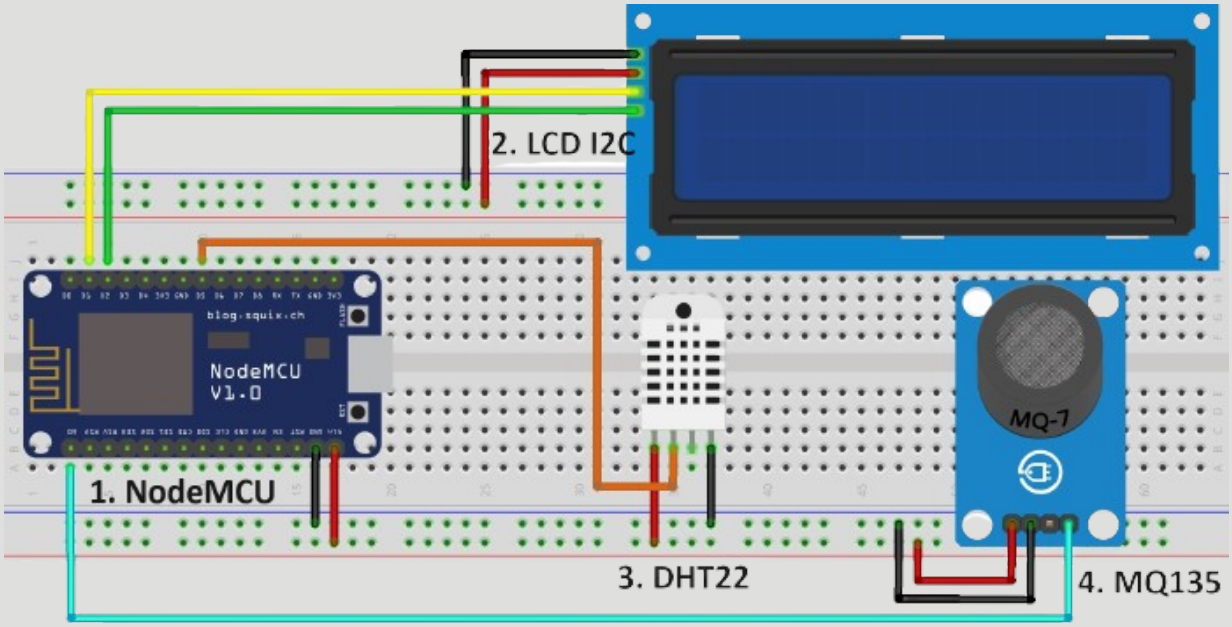
Simulation





Fritzing is open-source hardware design software that allows users to create schematics, Printed Circuit Board (PCB) layouts, and even visualize physical prototypes in 3D. In this project, Fritzing is utilized to create the schematic design of an IoT device for air quality analysis.

Coding Arduino IDE

Script Code

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <Adafruit_Sensor.h>
#include <DHT.h>
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>

#define DHT_PIN 14  // Pin data DHT22 terhubung ke pin D4 pada NodeMCU
#define DHT_TYPE DHT22
#define MQ_PIN A0  // Pin analog sensor MQ-135 terhubung ke pin A0 pada NodeMCU

#define ssid  "ssid"
#define password "pass"
String  app_id = "nodemcudevice02";

// Konstanta kalibrasi
float slope = 0.2;  // Nilai yang sesuai dari kalibrasi
float intercept = 100;  // Nilai yang sesuai dari kalibrasi

// Fungsi untuk menghitung konsentrasi CO2 dalam ppm
float hitungCO2(float nilaiSensor) {
  return (nilaiSensor * slope) + intercept;
}

LiquidCrystal_I2C lcd(0x27, 16, 2);  // Alamat I2C LCD 16x2
DHT dht(DHT_PIN, DHT_TYPE);

void setup() {
  Serial.begin(9600);
  dht.begin();
  lcd.begin(16, 2);
  lcd.init();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print("Sensor");
  lcd.setCursor(0, 1);
  lcd.print("MQ-135 & DHT22");
  delay(2000);
```

Coding Arduino IDE

Script Code

```
  // Koneksi WiFi
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting to WiFi..");
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Connecting to");
    lcd.setCursor(0, 1);
    lcd.print("WiFi.....");
    delay(2000);
  }
  Serial.println("Connected to WiFi");
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Connected to");
    lcd.setCursor(0, 1);
    lcd.print("WiFi: "+ String(ssid));
    delay(2000);
}

void loop() {
  float temperature = dht.readTemperature();
  float humidity = dht.readHumidity();
  int nilaiSensor = analogRead(MQ_PIN);
  float konsentrasiCO2 = hitungCO2(nilaiSensor);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Temp: " + String(temperature) + " C");
  lcd.setCursor(0, 1);
  lcd.print("Co2: " + String(konsentrasiCO2) + " PPM");
```

Coding Arduino IDE

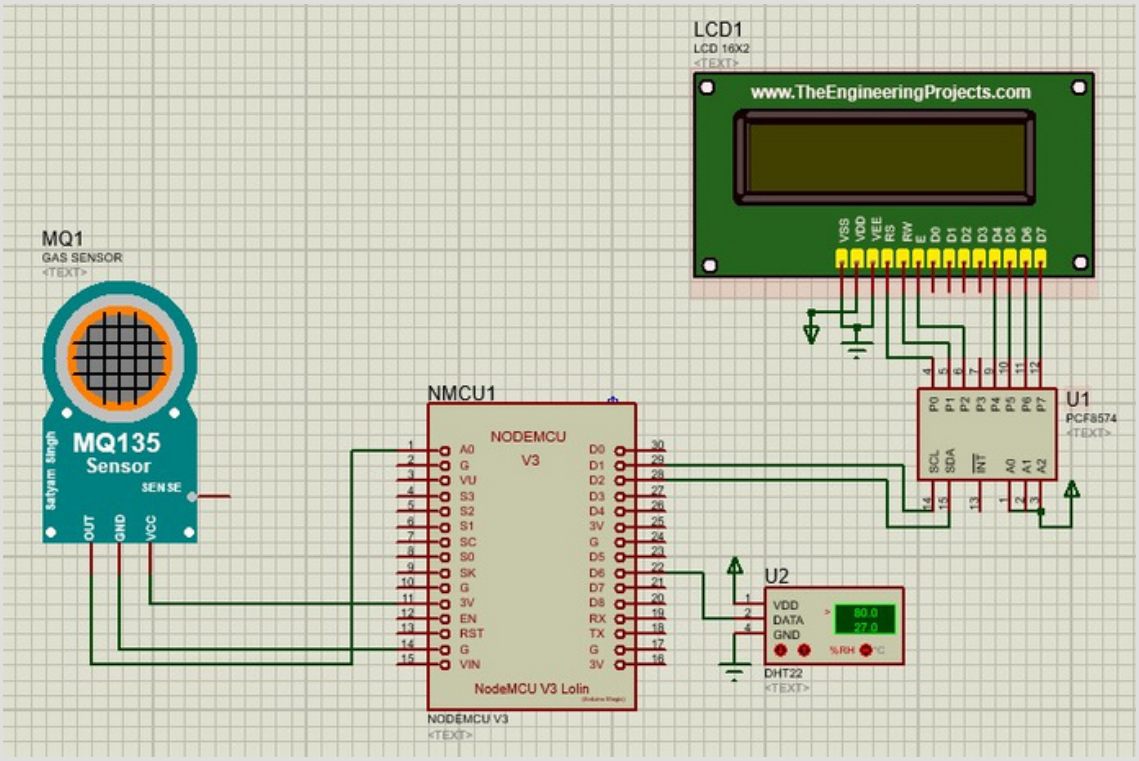
Script Code

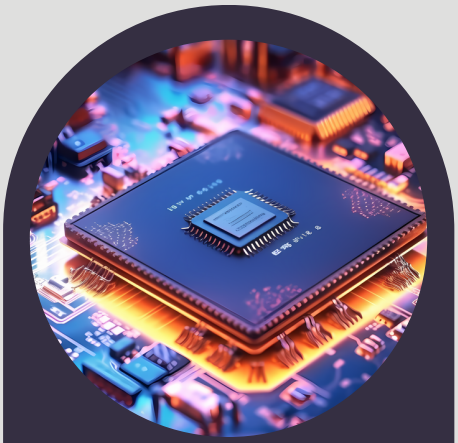
```
Serial.print("Temperature: ");
 Serial.print(temperature);
 Serial.print(" °C, Humidity: ");
 Serial.print(humidity);
 Serial.print("%, MQ-135 Value: ");
 Serial.println(konsentrasiCO2);
 HTTPClient http;
 http.begin("http://quakewarn.cloud/co2/index.php");
 http.addHeader("Content-Type", "application/x-www-form-urlencoded");
 String postData = "temp=" + String(temperature) +
                   "&hum=" + String(humidity) +
                   "&co2=" + String(konsentrasiCO2) +
                   "&app_id=" + app_id;
 Serial.println("POST Data: " + postData);
 int httpResponseCode = http.POST(postData);

 if (httpResponseCode > 0) {
   Serial.println("Data terkirim ke server");
   String response = http.getString();
   Serial.println("Server Response: " + response);
 } else {
   Serial.println("Gagal mengirim data ke server");
 }

 http.end();
 delay(30000);
}
```

Pin Configuration
Proteus





1. MQ-135 (CO2 Gas Sensor):
   - Analog Pin (A0) → NodeMCU to read CO2 concentration values.
2. DHT-22 (Temperature and Humidity Sensor):
   - Data Pin → NodeMCU to transfer temperature and humidity data.
3. NodeMCU ESP8266 (WiFi Microcontroller):
   - Analog Pin (A0) → MQ-135.
   - Digital Pin (D6) → DHT-22.
   - Digital Pins (D1, D2) → LCD I2C.
4. LCD I2C:
   - RS Pin → P0 I2C.
   - E Pin → P2 I2C.
   - DB4 to DB7 Pins → I2C P4 to P7.
5. Interconnection of Devices:
   - NodeMCU to MQ-135 (A0).
   - NodeMCU to DHT-22 (D6).
   - NodeMCU to LCD I2C (D1, D2).
6. Additional Pin Functions:
   - Power Supply (VCC and GND) for each component.
   - Pull-up Resistor on DHT-22 data pin.

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Cloud Database

IOT Connection

```
<?php
if (isset($_POST['app_id'])) {
    $temperature = $_POST['temp'];
    $humidity = $_POST['hum'];
    $co2Value = $_POST['co2'];
    $app_id = $_POST['app_id'];
    $host = "localhost";
    $username = "userdatabase";
    $password = "passdatabase";
    $database = "namedatabase";
        $koneksi = new mysqli($host, $username, $password, $database);
     if ($koneksi->connect_error) {die("Koneksi gagal: " . $koneksi->connect_error);}
        $sql = "INSERT INTO sensor_data (app_id, temperature, humidity, co2)
   VALUES ('$app_id','$temperature', '$humidity', '$co2Value')";
    if ($koneksi->query($sql) === TRUE) {
       echo "Data berhasil disimpan ke dalam database";
    } else {echo "Error: " . $sql . "<br>" . $koneksi->error;}
    $koneksi->close();
} else {echo "Akses ditolak. app_id tidak ditemukan.";}
?>
```

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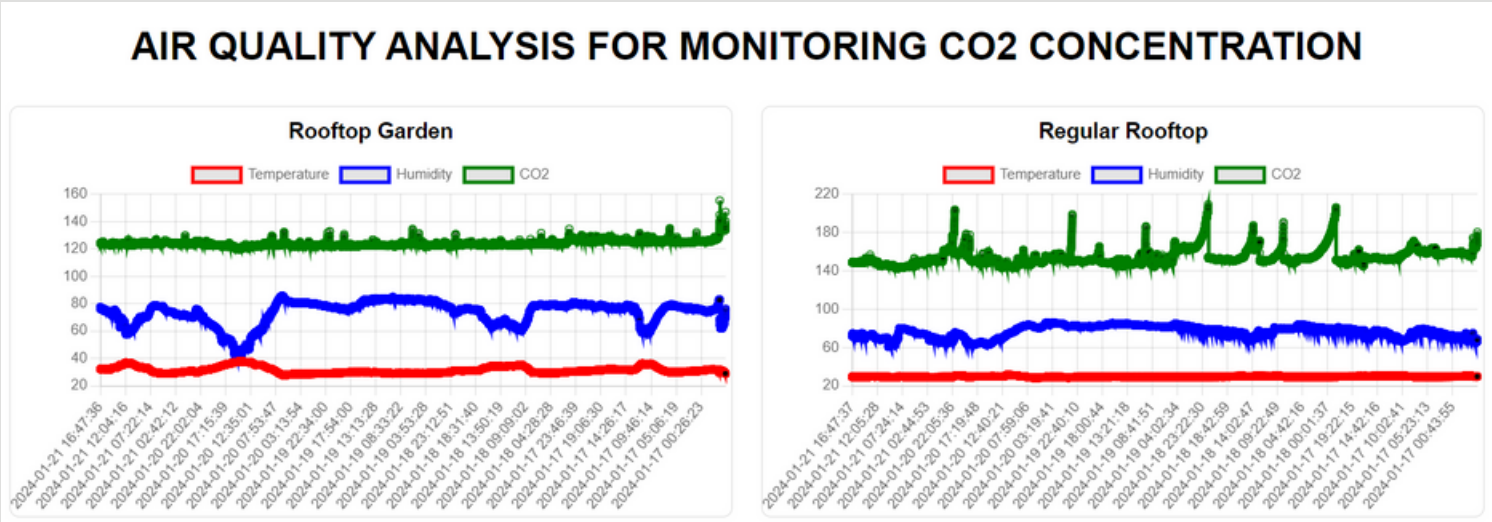
Analysis
Result

https://quakewarn.cloud/co2/grafik/



Quantitative Method

The concentration of CO2, temperature, and humidity is measured using MQ-135 and DHT22 sensors at four different periods throughout the day. The collected data is statistically analyzed to identify the average and trends in CO2 concentration.

Qualitative Method

Visual observation and interpretation are conducted on the Rooftop Garden and Normal Rooftop environments. The research focuses on the environmental characteristics and the impact of rooftop gardens on air quality in the specified area.

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Thank You

This research focuses on understanding the air quality in rooftop areas in DKI Jakarta using Internet of Things (IoT) technology and CO2 sensors. Two locations, namely Rooftop Garden and Normal Rooftop, were compared over four different periods in a day. The results showed that Rooftop Gardens had lower average CO2 levels (295 PPM) compared to Normal Roooftops (360 PPM), indicating the potential of garden roof designs to reduce CO2 concentrations.

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