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PROBLEM STATEMENT : AIR QUALITY MONITORING SYSTEM

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REQUIRED COMPONENTS :

1. DHT11 Sensor :

2. Gas Sensor : MQ135 gas sensor

3. ESP8266 WiFi module

SOURCE CODE:

```
#include <SoftwareSerial.h>
#include <MQ135.h>
#include <DHT.h>
SoftwareSerial softSerial(2, 3);      // RX, TX pin for Arduino
#define DHTPIN A0                     // Analog pin for DHT11
#define DHTTYPE DHT11
MQ135 gasSensor = MQ135(A1);
DHT dht(DHTPIN, DHTTYPE);
#define SSID "sid"                    // SSID - name of wifi (hotspot)
#define PASS "123456789"              // PASS - password required to access wifi (hotspot)
#define IP "184.106.153.149"          // ThingSpeak IP
float t;
float h;
float f;
float hi;
float air_quality;
String result;
```

```
int ledPin = 13;
void setup()
{
  uint32_t baud = 115200;
  Serial.begin(baud);
  dht.begin();
  softSerial.begin(baud);
  pinMode(ledPin, OUTPUT);
  connectWiFi();
}
void loop()
{
 delay(6000);

 Serial.println("DHT11 and MQ135 test!");
 air_quality = gasSensor.getPPM();
 h = dht.readHumidity();
 t = dht.readTemperature();
 f = dht.readTemperature(true);
 if (isnan(h) || isnan(t) || isnan(f)) {
  Serial.println("Failed to read from DHT sensor!");
  return;
 }
 hi = dht.computeHeatIndex(f, h);
 Serial.print("Humidity: ");
 Serial.print(h);
 Serial.print(" %\t");
 Serial.print("Temperature: ");
 Serial.print(t);
 Serial.print(" *C ");
 Serial.print(f);
```

```
 Serial.print(" *F\t");
 Serial.print("Heat index: ");
 Serial.print(hi);
 Serial.println(" *F");
 Serial.print("Gas Level PPM : ");
 Serial.print(air_quality);
 Serial.println(" *PPM");

 if (air_quality<=700)
 {
   digitalWrite(ledPin, HIGH);
   delay(5000);
   digitalWrite(ledPin, LOW);
   result = "0";      //"Pure Air"
 }
 else if(air_quality<=1500 && air_quality>700)
 {
   result = "1";      //"Poor Air"
 }
 else if (air_quality>1500 )
 {
   result = "2";      //"Danger! Move to Fresh Air"
 }
 updateTS();
}
void updateTS()
{
   String cmd = "AT+CIPSTART=\"TCP\",\"";// Setup TCP connection
   cmd += IP;
   cmd += "\",80";
   sendDebug(cmd);
```

```
   delay(6000);
   String url = "GET
/update?key=V8ICHOQB51BYJ8F4&field1="+String(t)+"&field2="+String(h)+"&field3="+String(hi)+"&f
ield4="+String(f)+"&field5="+String(air_quality)+"&field6="+result+"\r\n\r\n\r\n\r\n\r\n\r\n";
   String stringLength="AT+CIPSEND=";
   stringLength +=String(url.length());
   Serial.println(stringLength);
   softSerial.println(stringLength);
  if( softSerial.find( ">" ) )
   {
    Serial.print(">");
    softSerial.print(url);
    Serial.print(url);
    delay(24000);
   }
  else
   {
    Serial.println("AT+CIPCLOSE Executing : ");
    sendDebug( "AT+CIPCLOSE" );    //close TCP connection
   }
}

void sendDebug(String cmd)
{
     Serial.print("SEND: ");
     softSerial.println(cmd);
     Serial.println(cmd);
}

boolean connectWiFi()
{
     softSerial.println("AT+CWMODE=1");     //Single mode of communication
```

```
 delay(6000);
    String cmd="AT+CWJAP=\"";            // Join accespoint (AP) with given SSID and PASS to be able to send data on cloud
    cmd+=SSID;
    cmd+="\",\"";
    cmd+=PASS;
    cmd+="\"";
    sendDebug(cmd);
    delay(6000);
    if(softSerial.find("OK"))
    {
     Serial.println("RECEIVED: OK");
     return true;
    }
    else
    {
     Serial.println("RECEIVED: Error");
     return false;
    }
}
```

WORKING SUMMARY :

1. ESP8266 Connection with Arduino:

- Connect VCC and CH_PD of ESP8266 to the 3.3V pin on Arduino.
- Ensure that the ESP8266 is not supplied with 5V from Arduino to avoid damage.

2. Voltage Divider for ESP8266 RX Pin:

- The RX pin of ESP8266 operates at 3.3V.
- Use a voltage divider with three resistors to convert the Arduino's 5V to 3.3V.
- Connect TX pin of ESP8266 to pin 10 of Arduino and RX pin to pin 9 via the voltage divider.

3. MQ135 Sensor Connection:

- Connect VCC and ground pins of MQ135 sensor to Arduino's 5V and ground, respectively.
- Connect the Analog pin of the sensor to A0 on Arduino.

4. MQ135 Sensor Capabilities:
- MQ135 sensor can detect gases like NH3, NOx, alcohol, Benzene, smoke, CO2, etc.
- It provides gas concentration in parts per million (PPM).

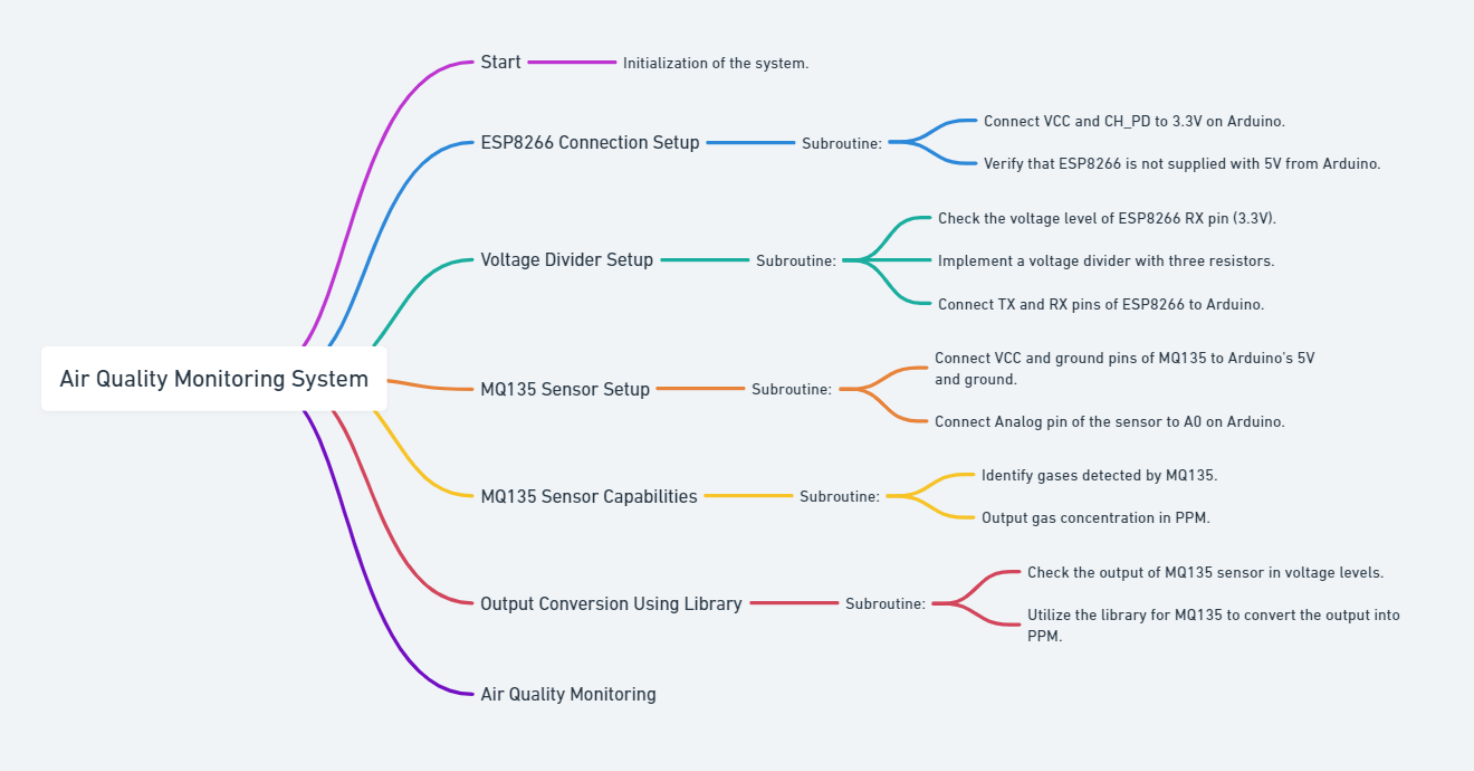
5. Output Conversion Using Library:
- MQ135 sensor outputs voltage levels.
- Use a library for MQ135 to convert the output into PPM.

6. Air Quality Monitoring Thresholds:
- Pollution levels in PPM are monitored.
- Thresholds:
  - Below 1000 PPM: SMS and web-page display "Fresh Air."
  - Exceeding 1000 PPM: LED blinks, web-page displays "Poor Air, Open Windows."
  - Exceeding 2000 PPM: LED continues blinking, web-page shows "Danger! Move to fresh Air."

7. Health Implications:
- Exceeding 1000 PPM may cause headaches, sleepiness, and stagnant air.
- Beyond 2000 PPM can lead to increased heart rate and various diseases.

8. Alert System:
- LED indicates air quality status.
- Web-page provides real-time information on air quality conditions.

9. Safety Measures:
- When pollution exceeds the limit, the system prompts actions like opening windows or moving to fresh air.



Conclusion:

The system offers real-time monitoring and alerts for maintaining a healthy indoor environment.