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AIR QUALITY MONITORING SYSTEM USING NODEMCU

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Abstract:

The amount of pollution has risen through time due to a variety of causes, including population growth, increasing vehicle usage, industrialisation, and urbanisation. These variables have a negative impact on human well-being by adversely impacting the health of those who are exposed to the pollution. The goal of the Air Quality Monitoring System (AQM) is to inform the public about the risks posed by pollution. The recommended system's tilt towards IoT and ability to issue alerts when a sensor's value exceeds a threshold value are two important features. To show the current level of pollution, this gadget has an LCD monitor.

A novel framework based on data collecting and transmission called a Wireless sensor network (WSN) is suggested to monitor air quality. Temperature, humidity, CO and CO2 volumes, as well as the detection of any gas, smoke, alcohol or LPG leaks, are selected as the environmental monitoring parameters. Because temperature and humidity are important to everyone, the values are also relayed over the internet so that anybody within the system's range may check them on their cellphones and laptops. A harmful parameter, CO, is carefully monitored.

Key Words: *ESP8266, DHT11, MQ135, I2c, LCD.*

I. Introduction

We're intending to create an IoT-based LCD alert system for our air pollution monitoring system. When the level of dangerous gases in the air, such as CO2, smoking, alcohol, benzene, and NH3, exceeds a specific threshold, which occurs when the air quality deteriorates. On the LCD, the air quality will be shown in PPM for easy monitoring. However, in this study, a MQ135 sensor is utilised as the air quality sensor, which is the best option for monitoring Air Quality since it can detect most dangerous substances and can measure their level correctly. Smoke detectors and LPG detectors both employ MQ2 sensors and Air Quality Analyzers.Using a computer or mobile device, you may check the pollution level from anywhere in this job. When pollution levels exceed a certain threshold, this system, which can be deployed anywhere, can also activate some gadgets.

A study found that air pollution causes 50,000 to 100,000 premature deaths annually in the United States alone. In contrast, there are over 3,000,000 people globally and 300,000 in the EU. IoT-based air pollution monitoring systems use the Internet to monitor air quality over a web server. When the air quality drops below a predetermined threshold, which occurs when dangerous gases like CO2, smoke, alcohol, benzene, NH3, LPG, and NOx are present in sufficient quantities, an alarm is set off. It will display the air quality in PPM on the LCD and on the website so that it can be readily monitored.

LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where gases are mostly to be found and give an alert message when the system crosses the threshold limit.

The atmospheric dispersion modeling of a pollutant gas is, as a final act, the mathematical simulation of how pollutants from an emitted gas disperse in the ambient atmosphere. Currently, the simulation is performed with computer programs/specialized software that use mathematical equations and algorithms to simulate how pollutants disperse in the air and, in some cases, how they react in the atmosphere. The concentration of air pollutants downwind from sources like industrial facilities, moving automobiles in traffic, or unintentional chemical discharges is estimated or predicted using dispersion models.

Software models for air pollution serve a significant role in science because they can evaluate the significance of pertinent processes. The sole technique that quantifies the deterministic link between emissions and concentrations/depositions, including the effects of past and future scenarios, and assesses the efficacy of pollution prevention measures is air pollution dispersion modelling. This makes the air pollution models essential for forensic applications as well as regulatory studies.

II. Air Quality Monitoring System

A. Product Design

Researchers strive to create tools to facilitate monitoring and can perform more complex simulations, where simulation serves as a learning medium in the field of experimental circuit analysis. Product designs include Block Diagrams, product designs, Application Designs, and Connections. The following is an illustration of the block diagram of the tool that will be made in this study in Figure 1.

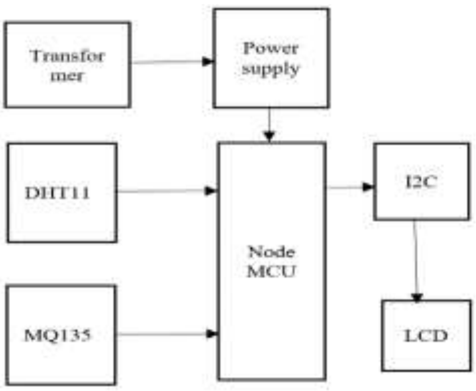

Figure1: Block diagram of the designed system

In Figure 1, the power supply is used to operate the system through the NodeMCU ESP826 module, so that all components are able to work and function properly. The DHT11 sensor is used to measure temperature, which is used to detect temperature and humidity. The MQ135 sensor is used to detect harmful gases like CO CO2, LPG gas, NH3, etc., and then sends the data to ESP8266. All the modules are connected to each other, and the output is displayed in LCD and also in the Blynk IoT application. The ESP8266 MCU node will use the DHT11 sensor to detect temperature and humidity while using the MQ-135 sensor to calculate the value of gas leakage. It will then send the data to the Blynk Server.

B. Product Design

The product design was designed by researchers to facilitate the simulation of learning activities

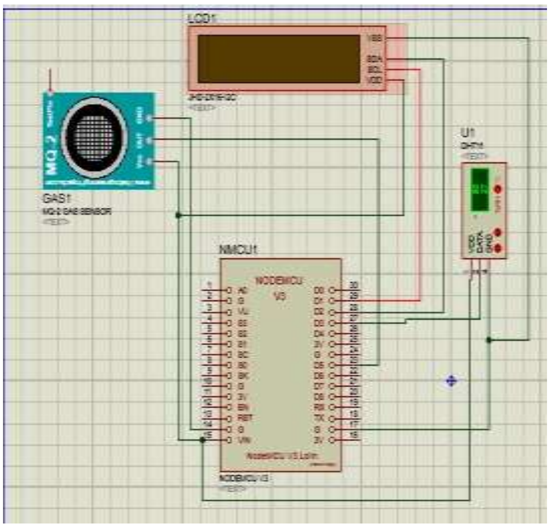

Figure 2: NodeMCU ESP8266 Pin Diagram

The built-in Wi-Fi on the Node MCU controller makes it possible to connect to the internet and access IoT devices. The Blynk programme will be used to connect a laptop or mobile device to the Internet of Things. According to Figure 2, every component is interconnected. We'll keep an eye on weather variables like humidity and temperature in this system. We utilised the DHT11 (digital humidity and temperature) sensor for this purpose. This sensor determines the environment's temperature and humidity values and outputs them digitally to the controller, a NodeMCU with built-in Wi-Fi.

The MQ135 sensor, a dust sensor that can detect the presence of airborne dust particles, is used to measure air quality.The controller receives this number and often compares it to the reference air quality index parameter. When the sensor's value is higher than the standard level, air pollution is shown. The Node MCU controller, which can receive sensor data and transmit it to the LCD-interfaced module, will connect to all of these sensors over its network. This software-based system is programmed using embedded C.

C. Connections

1) ESP8266

Each Component will be connected to the ESP8266 through pins of the ESP8266 Board. This setup is started by pressing the ON/OFF button on the blynk smart application As NodeMUC is Connected to the blynk application through WIFI. The data gathered from other components are forwarded to Node MCU, Next data from ESP8266 to Blynk IOT Application, according to the code we inserted Output will be displayed in LCD and Blynk IoT Application as shown in figure 3 app design

Table1. NodeMCU Connections with DHT11 Senser

Microcontroller	DHT11 Sensor
D3	Data
3V	VCC
GND	GND

2) DHT11 Sensor

DHT11 Sensor is used to detect the temperature and humidity, so there are 2 possibilities cold and hot. We are taking cold from ice cubes and heat from matches. The DHT11 will calculate the amount of heat or cold and display it on an LCD screen with the help of the Blynk Application. If the temperature is above the min level, then it will indicate in blynk Application and also in LCD (danger level)

Table 2. ESP8266 with DHT11 sensor

Microcontroller	DHT11 Sensor
D3	Data
3V	VCC
GND	GND

3) MQ135 Sensor

MQ135 is one of the popular gas sensors from the MQ series of sensors that are commonly used in air quality control equipment. It operates from 2.5V to 5.0V and can provide both digital and analog output.

MQ135 is a gas detector connected to ESP8266. If the device detects any harmful gases, it collects the data and sends it to Node MCU, as it can measure CO, CO2, NH3, LPG, etc.MQ135 has 3 pins and it acts as an input device.

Table 3. ESP8266 connected to MQ135 Sensor

Microcontroller	MQ-135 Sensor
A0	A0
3V	VCC
GND	GND

4) I2C

I2C will acts as an integrated circuit that integrates LCD and ESP8266. It has 3 pins

Table 4. Connection with I2C

Microcontroller	I2C
D1	SCL
D2	SDL

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Total connections in detail:

- The code written in Arduino ide using Embedded C is successfully compiled with zero errors and uploaded to NODE MCU (Esp-12E) module using a micro cable.
- This NODE MCU is connected to sensors such as DHT11 and MQ135.
- The DHT11 has 3 pins where, pin 1 is connected 5v power supply, pin 2 is connected data pin D3
- The MQ135 sensor has four-pin configurations. Pin 1 and pin 2 are analog and digital outputs respectively.
- This work takes analog output, therefor pin 1 is connected to the A0 pin of NODE MCU.
- Avoid using pin 2 (digital output), because any one output is sufficient.
- Pin 4 is connected to a 5V power supply, pin 3 is connected to the ground, and pin 4 is also connected to the power supply.
- This DHT 11 sensor sends data only in digital format to NODE MCU. Hence, it is connected to data pin D3.
- The liquid crystal display(16 * 2) is interfaced through i2c module.
- The 16 pins of LCD are given as input for the I2C module and it gives four pins as output.
- • The serial clock line (SCL), which is attached to D1 of the NODE MCU, is pin 1 of I2C.
- The serial data line (SDL), which is attached to D2 of the NODE MCU, is pin 2 of the I2C protocol.
- pin 3 and pin 4 are connected to the 5V power supply and ground respectively.

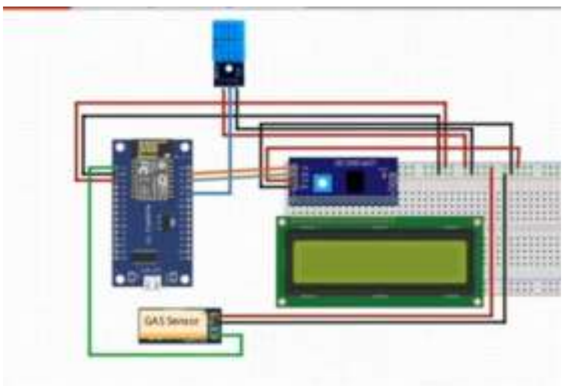


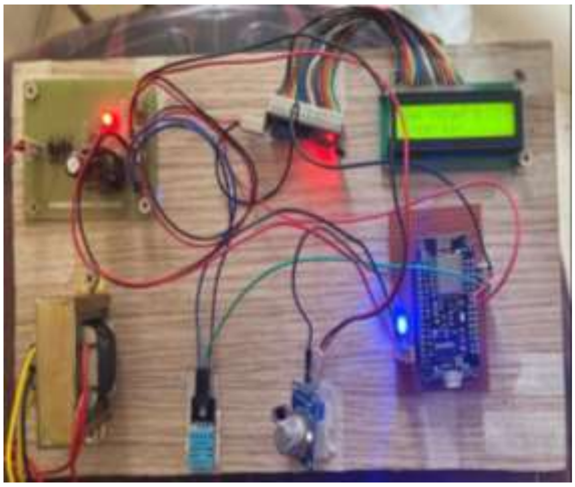
Figure 3. Connections

D. App Design

Figure 3: App Design

Blynk IoT Application is used for this Work. Through Blynk IoT can design the themes and ON/OFF buttons and percentage bars. First, we have to create a file in app after that we should give it a name and after that select the components, and versions which are used in your project.

According to that, it will generate a code that you have to copy into Arduino IDE.



E. Results

Various gases in the atmosphere are monitored in this project. Generally, in this project we use Node MCU, MQ135, DHT11 Sensor, and 16x2 LCD, IC2.these are the hardware requirements of this project, and software requirements are ARDUINO IDE

Figure 4. Hardware Output

III. Conclusions

In this project, the DHT11 sensor measures temperature and humidity, while the MQ135 sensor monitors air quality. The output of the sensors, which includes the air quality index, humidity, and temperature, is in perfect working order.

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