# DEVELOPING A SMART AIR-QUALITY MONITORING SYSTEM BASED ON NODEMCU FOR CLOUD BASED ANALYTICS USING WSN

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## ABSTRACT

*Air pollution has received much attention today and eventually emerged as a major threat to society. This paper focuses primarily on a device that can monitor air quality, ground vibration levels, and a fire safety alert system for industrial workers, given the difficulty and magnitude of air pollution. A WIFI-enabled ESP8266 NodeMCU microcontroller is used to implement this. It interfaces with air quality monitoring sensors MQ135, a DHT11 (Humidity and Temperature) sensor, a Geophone sensor to measure industrial vibration levels, and a flame sensor to keep workers from getting burned. As an alert module, the buzzer is utilized. By connecting the app to the NodeMCU, the sensor data are stored in the cloud platform, analysed, and monitored on the BLYNK (an IoT platform).*

## I. INTRODUCTION

The world has been blindfolded by the development of technology and industries, and the consequences of this blindfolding have impacted the common people and their healthy lifestyles. For industrial workers to maintain a healthy lifestyle, monitoring air quality has become increasingly important. As a result, we have proposed an air quality monitor. Other than that, it identifies the vibration level estimation in the modern region and keeps the labourers from fire mishaps.

The ESP8266 NodeMCU, which is connected to MQ135 air quality monitoring sensors via an internet access point, is the primary component of the air quality monitoring system. Temperature and humidity are measured with a DHT11 sensor. If the levels are higher than usual, it measures the gas level in the air. In industries, a Geophone sensor detects the vibrating level, and a flame sensor is used to keep workers safe from fires. The buzzer alerts people to potentially hazardous circumstances. The NodeMCU stores all the data, which is further analysed, stored on a cloud platform, and monitored by the mobile app BLYNK.
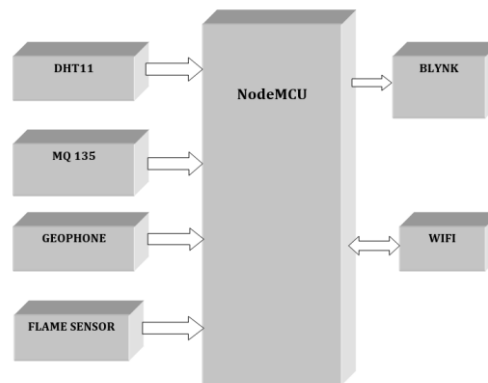
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# PROPOSED METHODOLOGY
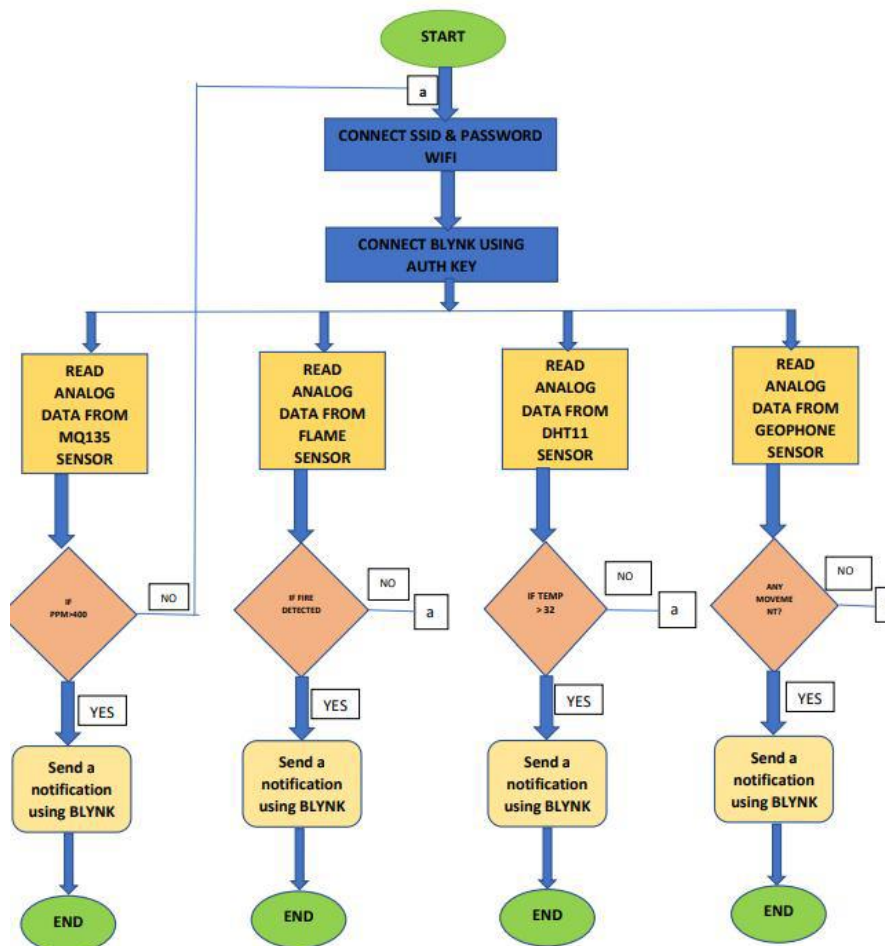


Fig. 1. Block Diagram of the proposed Device



Fig.2. Flowchart

We propose a cloud-based air quality monitoring system that would assist in checking and monitoring the environment in the industrial area through a highly efficient wireless sensor

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network in response to the growing need to protect the health of workers in the industrial area. A microcontroller, and several sensors, make up this system. This microcontroller is a NodeMCU based on the ESP8266 Wi-Fi. It has an inbuilt Wi-Fi module, making it more exceptional than other microcontrollers.

The NodeMCU is connected to the DHT11 sensor. This sensor displays the industry's temperature and humidity levels. It has two pins for the ground and the VCC terminal, as well as data pins. The buzzer will notify everyone in the vicinity of the Temperature higher than normal. Through the Blynk app, the information will be sent as a message alert to workers' mobile phones.

The MQ-135 sensor, connected to the NodeMCU, monitors air quality. It has two additional VCC pins and ground terminals and four digital and analogue pins. It measures the concentration of various gases, including harmful gases like carbon dioxide and ammonia. The Blynk app will alert workers' mobile devices if the concentration of those gases exceeds the normal level.

NodeMCU serves as the interface for the geophone sensor. It detects the movement of the earth. Will send a message with a blank app to the employees if the geophone sensor detects an earthquake automatically.

Industries have a very high risk of fire accidents. We use a fire sensor that works on the IR (infrared) waves phenomenon to notify workers of a fire. It has digital, analogue, and two additional pins for the ground and VCC terminals. Utilize the Blynk app to send a pop-up notification via SMS in the event of a fire.

**Specification**

1) DHT11: The system uses the DHT11 humidity and temperature sensor, which has a range of 20 to 90 per cents C with 5% accuracy and a range of 0 to 51 degrees C with 2 degrees C accuracy at a sampling rate of no more than 1 Hz. It has three pins, one of which is a data pin, and the other two are connected to the ground and Vcc. It is a low-cost digital sensor that calculates the air around it without interfering with analogue input pins by employing a capacitive and thermistor humidity sensor.

2) MQ135: MQ135, a gas sensor, is connected to the analogue pin of the NodeMCU to monitor the concentration of various gases in the air. It measures the amount of $CO_2$, Benzene, $NH_3$, alcohol, and $NO_x$ in the air. It can output digital and analogue signals from 2.5V to 5.0V. The sensitivity is good, and the power consumption is around 150 mA.

3) GPS Sensor: Earthquakes can be detected with this sensor. It converts the voltage into ground movement (velocity). The seismic response, or deviation of this measured voltage from the baseline, is analyzed for the earth's structure. It is a simple mechanical high-recurrence vibration sensor. 4) Flame Sensor: It operates from -40C to +100C. A fire source with a wavelength in the range of 765 nm to 111 nm can be detected by this sensor. It is an infrared radiation-touchy sensor. It is compact and small, with an Adjustable threshold value and power consumption of 3 volts. The digital pin, VCC, and GND are its three pins.

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## RESULTS

The Blynk app (IoT Platform used) displayed the readings from the MQ135 (PPM Value) sensor as a pop-up notification. Used the BLYNK app's gauge widget to measure the output. A threshold value has already been predetermined. The BLYNK app will notify you if the value exceeds. Fig. 3. displays the MQ135 gas sensor's results. Maximum safest values for Temperature and humidity have been set. The BLYNK app displays a notification on the user's screen if the values are exceeded. DHT11 to display humidity results. Temperature utilizing the DHT11 sensor. To test the fire sensor, a burning flame is brought within 100 centimetres of the device. The BLYNK app sends an alert notification to the user, and a buzzer serves as an alert sound.
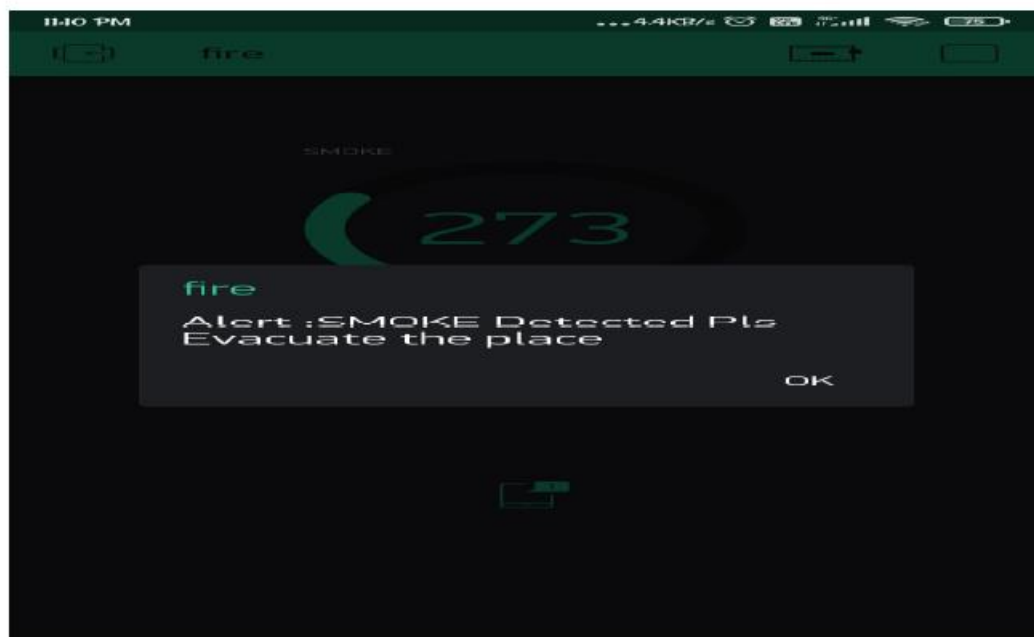


Fig. 3. Results of the MQ135 on Blynk App

## CONCLUSION

The wireless air pollution monitoring system alerts users in the event of a significant change in air quality and provides up-to-date demographic data. Authorities can then take action based on this information. These days, it is normal for the Temperature to rise, so no one takes care of them when the Temperature is high, but the damage to people is significant. Therefore, this paper sends an alert notification to the user's mobile device so that they can take care of themselves even when temperatures and humidity rise significantly. Carbon monoxide, carbon dioxide, smoke, and dust concentrations in the atmosphere were precisely measured by the developed air quality monitoring and visualization system. Since the sensor is a part of the Internet of Things framework, it can effectively measure and track pollutants in real-time. Pollution monitoring, health monitoring, livelihood measurement, sustainability assessments, and measurement-related fields are all solved by this system. The database stores the data automatically; the authorities can use this information to take immediate action. Knowing how

many pollutants are in their area and taking steps to control them is also helpful to the average person. Due to the rising level of pollution brought on by the expansion of industries, this robust system is extremely useful. The product is reasonably priced, and the system is simple to use. This system monitors five parameters and can be expanded to consider additional parameters contributing to pollution, particularly by industries.

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