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Monitoring of Cloud-based Air Quality using NodeMCU

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Abstract: ***Air pollution has received a lot of attention in the modern world and has subsequently grown to pose a serious hazard to society. This research focuses on a device that can monitor air quality, ground vibration levels, and a form of fire safety alarm system for employees working in an industrial environment due to the urgency and quantity of air pollution. A WIFI-enabled ESP8266 NodeMCU microcontroller is used to implement this, and it is connected to air quality monitoring sensors MQ135 and DHT11 (Humidity and Temperature), as well as a geophone sensor to measure vibration levels in industrial settings and a flame sensor to protect workers from fire accidents. An alarm module is used with the buzzer. The sensor data is stored in NodeMCU and the data is analyzed and stored in the cloud platform and monitored on the BLYNK (an IoT platform) by interfacing the app with NodeMCU.***

Keywords: WIFI (wireless fidelity), ESP (Espressif Modules), MCU (Microcontroller Unit), DHT11 (Digital humidity and temperature sensor), IoT (Internet of things)

I. INTRODUCTION

In The globe has been blindfolded by the development of industries and technology, and this has led to consequences that finally had an impact on the general populace and their healthy lifestyles. For industrial area workers to maintain a healthy lifestyle, air quality monitoring has become crucial.

Therefore, we have suggested a gadget that keeps an eye on the air's quality while also detecting the level of vibration in industrial areas and protecting workers from fire hazards. The main component of the air quality monitoring system is a WIFI-enabled ESP8266 NodeMCU, which is connected to an internet access point and air quality monitoring sensors MQ135 to measure gas levels in the air if they rise over normal levels.

Both the temperature and the humidity are measured using a DHT11 sensor. Both a Geophone sensor, which measures the vibratory level in the businesses, and a flame sensor are used to protect workers from fire-related mishaps. The buzzer is used to alert people to potentially dangerous circumstances. And all of the data is saved in the NodeMCU before being further examined, saved, and accessed via a mobile application called BLYNK.

II. OVERVIEW OF PROBLEM STATEMENT

Everyone wants to have a happy and healthy lifestyle, yet global advancements in industries and technologies have had a negative impact on people's ability to lead healthy lives. The truth is that a single person has little chance of reducing pollution. In order to help people gain control over themselves and secure their cellphones, a model is being proposed that uses the BLYNK app.

High environmental temperature is dangerous to our bodies and can lead to heat cramps and exhaustion. So, when the temperature exceeds a certain level, a notification is sent to the user. Similarly, when the air in the surroundings crosses the gas levels the user will get notified and the user can take respective precautions like evacuating the place. For fire safety purposes, a flame sensor is connected to the NodeMCU which functions on infrared waves phenomenon and when fire gets the buzzer gets activated and the employees in the industries can take the necessary action. This is the whole working of the system.

III. NOVELTY OF THE PAPER

The primary goals of the paper are to record ground vibration levels, keep track of air quality, and notify staff when fires occur. Despite the fact that the apparatus has been used by many studies. However, only few of them have focused on practically all of the issues faced by industrial workers. Therefore, in an effort to address the challenges faced by workers in the workplace, we have suggested a practical, affordable solution that takes into account every problem that a worker typically encounters.

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IV. PROPOSED METHODOLOGY

A. Explanation

We suggest a cloud-based system to address the growing requirement for industrial area employees' health protection. The paper's main objectives are to maintain track of air quality, monitor ground vibration levels, and alert employees when there are fires. Despite the fact that many studies have employed the device. a worker typically encountered air quality monitoring system that would help to check and monitor the environment in the industrial area through a wireless sensor network with high efficiency. This system consists of several sensors and a microcontroller. The Microcontroller used here is ESP8266 Wi-Fi-based NodeMCU. It has an inbuilt Wi-Fi module which makes it more peculiar than other microcontrollers the DHT11 sensor is interfaced with the NodeMCU. this sensor gives the temperature and humidity level within the industry. It has data pins and two other pins for the VCC terminal and ground. If the temperature is greater than normal temperature automatically the buzzer will alert the surrounding people at the same time the information will be sent to workers' mobiles in form of a message alert through the Blynk app.

The MQ-135 sensor, which is connected to the NodeMCU, keeps track of the air quality. It features four pins, including two for the VCC and ground terminals, two analogue pins, and two digital pins. It determines the concentration of several gases, including hazardous gases like co2 and ammonia. The Blynk app will send a message alert to employees' mobile phones in the form of a pop-up message if the concentration level of those gases exceeds the normal limit.

The geophone sensor is interfaced with NodeMCU it senses the earth's movement...if there is any earthquake detection by the geophone sensor automatically the workers will be alerted through a message with a blank app.

The fire accidents chances are very high in industries, to alert the workers of fire we use a fire sensor that works on the IR (Infrared) waves phenomenon. It has digital pins, analog pins and two other pins for VCC and ground terminals. if any fire accident happens SMS pop up will be sent through the Blynk app.

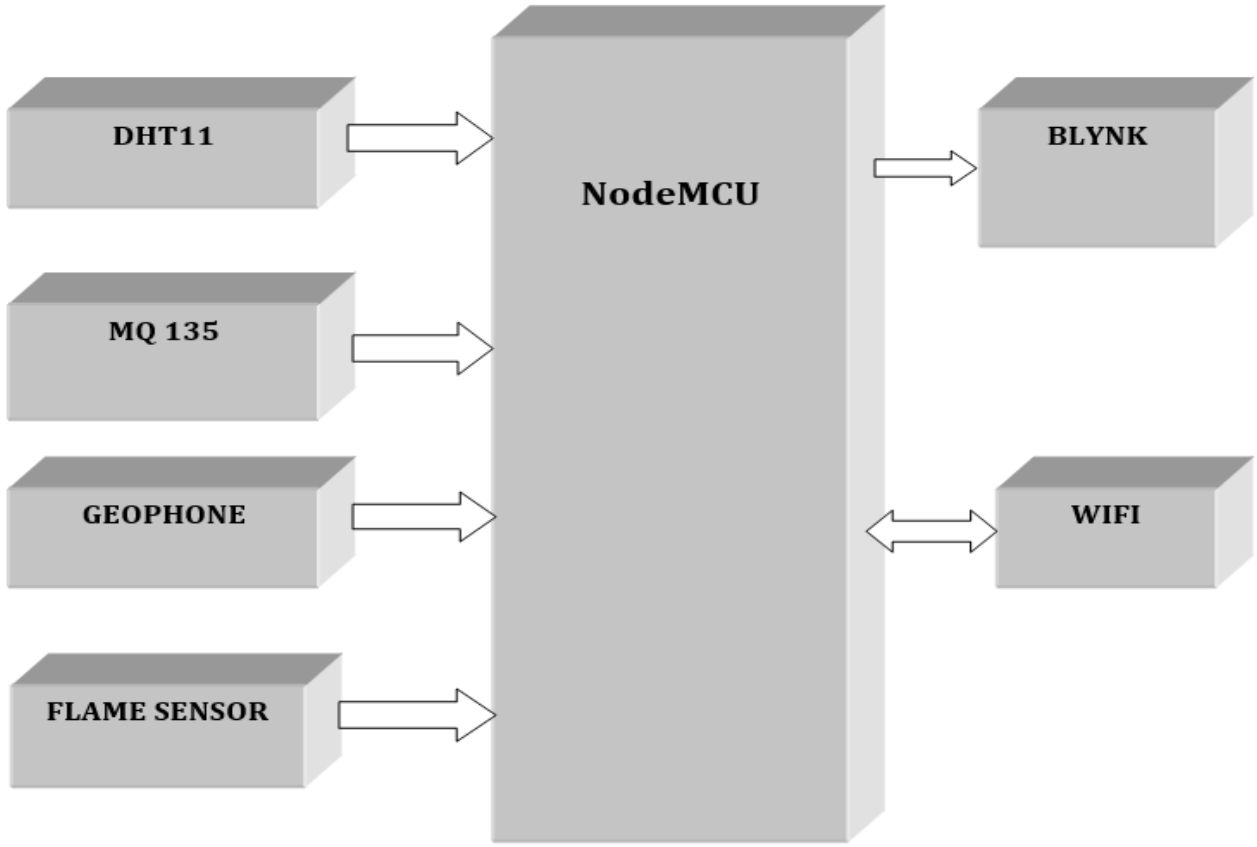


Fig. 1. Block Diagram of the proposed Device

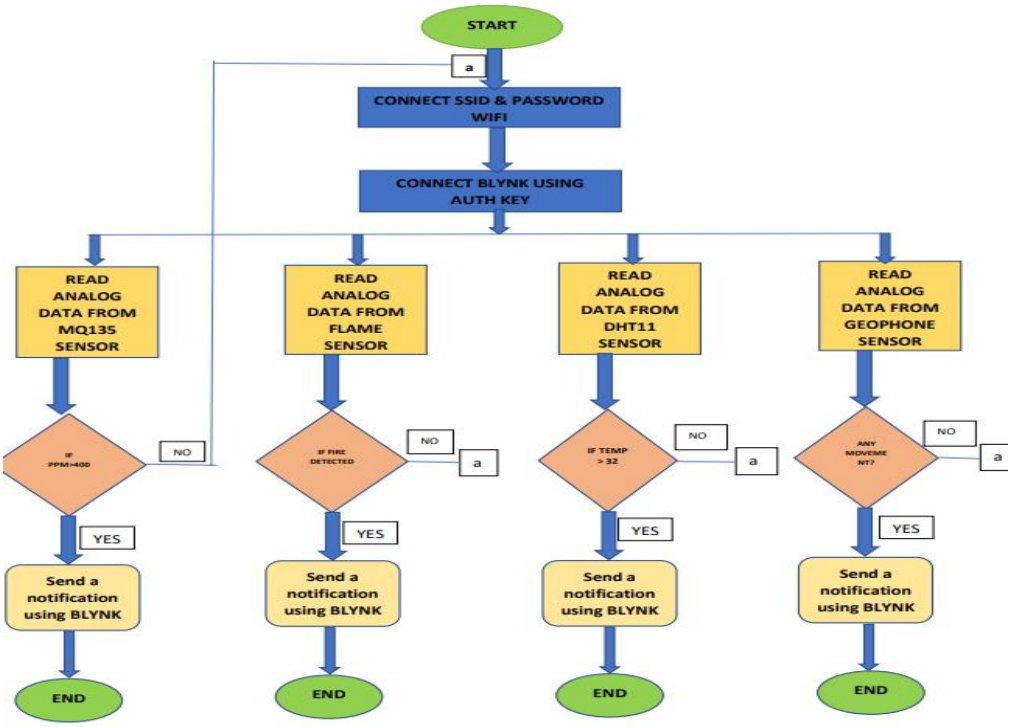


Fig. 2. Flowchart

B. Specifications

1) *DHT11:* The humidity and temperature sensor used in the system is DHT11 with a humidity range from 20-90%C with 5% accuracy and a temperature range sensing 0-51°C with ±2°C accuracy with No more than 1 Hz sampling rate. It has 3 pins ie one is a data pin and the other two are connected to Vcc and ground It is an low-cost digital sensor that uses a capacitive and thermistor humidity sensor to calculate the surrounding air with no analog input pins interference.
2) *MQ135:* To monitor the concentration of different gases in the air we use MQ135.MQ135 a gas sensor is connected with the analog pin of the NodeMCU. It operates between the range of 2.5V to 5.0V and can give both analog and digital output. It measures the level of NH3, alcohol, Benzene, NOx and CO2 in the air. Power consumption is around 150mA with good sensitivity.
3) *Geophone Sensor:* This sensor is used to detect earthquakes. it converts ground movement (velocity) into voltage the deviation of this measured voltage from the baseline is called the seismic response and is analyzed for the structure of the earth. it is a purely mechanical type of high-frequency vibration sensor.it works with operating temperatures of -40C to +100C.
4) *Flame Sensor:* This sensor is used to detect the existance of a fire source of a wavelength in the range of 765 nm to 111 nm can be found out . it is an infrared radiation-sensitive sensor. it is small and compact with an Adjustable threshold value with a power consumption of 3v It has three pins ie VCC, GND and digital pin.

V. RESULTS AND DISCUSSIONS

The readings obtained from the MQ135 (PPM Value) sensor were observed in the form of a pop-up notification through the BLYNK app (IoT Platform used). The output was measured on the gauge widget in the BLYNK app. A Threshold value is already set in advance. If the value exceeds then it would be poped up in the BLYNK app. Fig. 3. Shows the results for the MQ135 gas sensor. Temperature and Humidity maximum safest values are set. If the values get exceeded then a notification is flashed on the user screen through the BLYNK app. Fig. 4. Shows results for the Humidity using DHT11. Fig.5. shows results for Temperature using the DHT11 sensor. For testing the fire sensor, a burning flame is brought near the sensor up to a maximum range of 100 cm to detect the fire and an alert notification is sent to the user using the BLYNK app and a buzzer is used as an alert sound. Fig. 6. Shows the results for the Flame sensor.

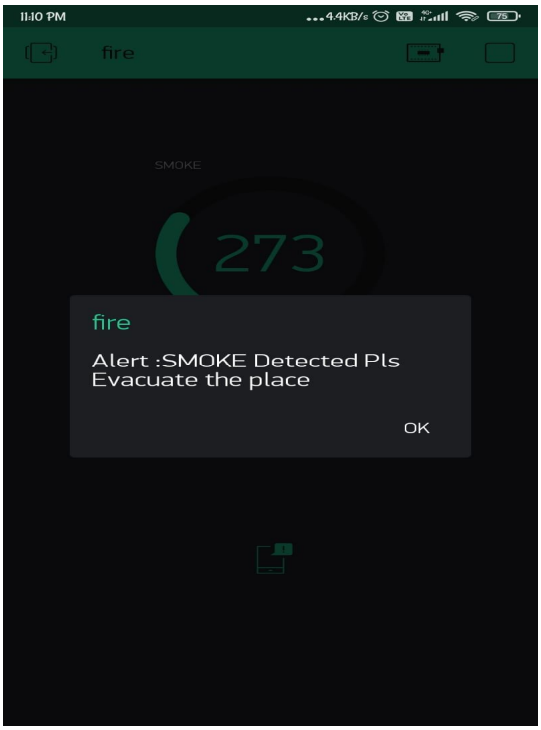


Fig. 3. Results of the MQ135 on Blynk App

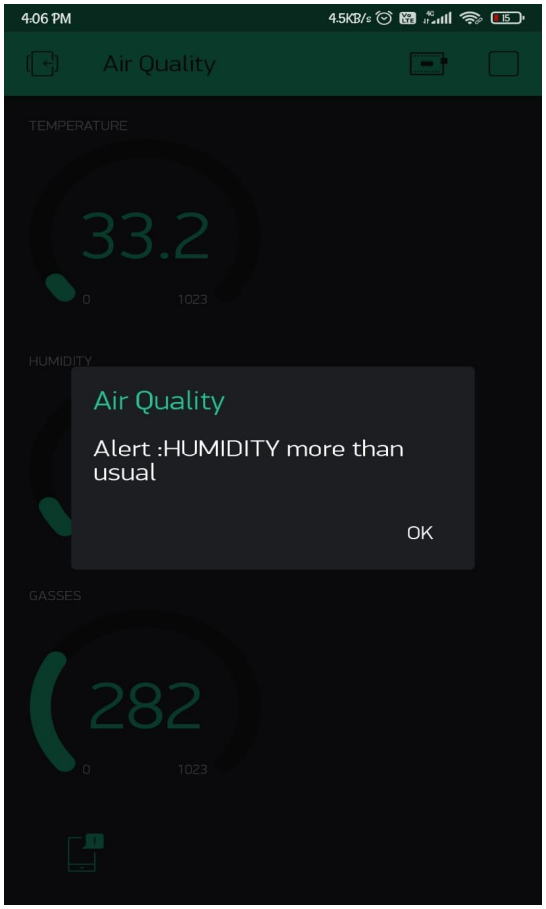


Fig. 4. Results of the DHT11 on Blynk App

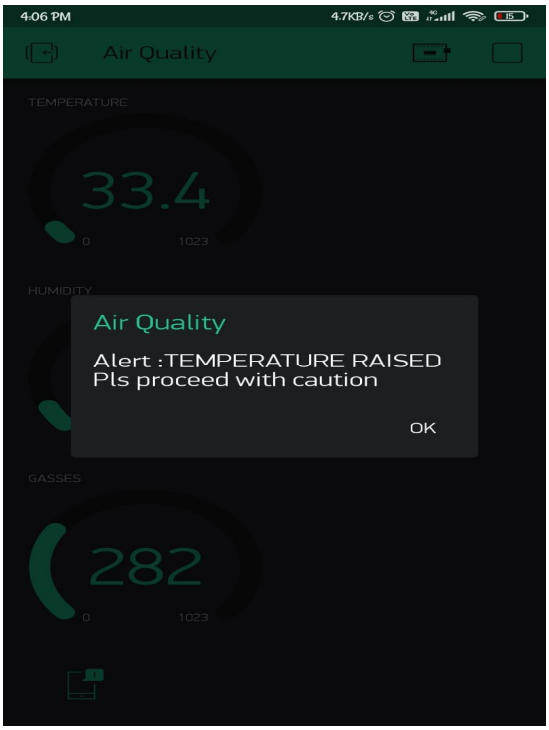


Fig. 5. Results of the DHT11 on Blynk App

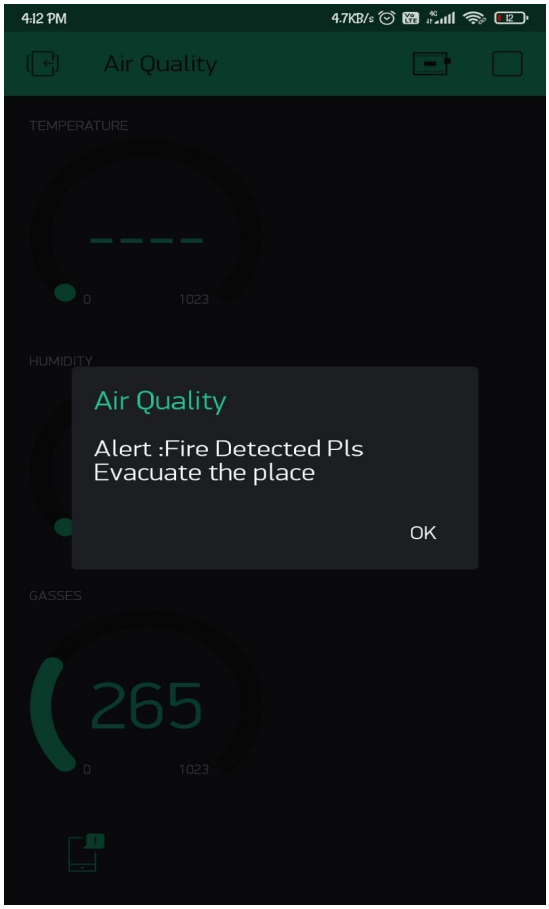


Fig. 6. Results of the Flame sensor in Blynk App

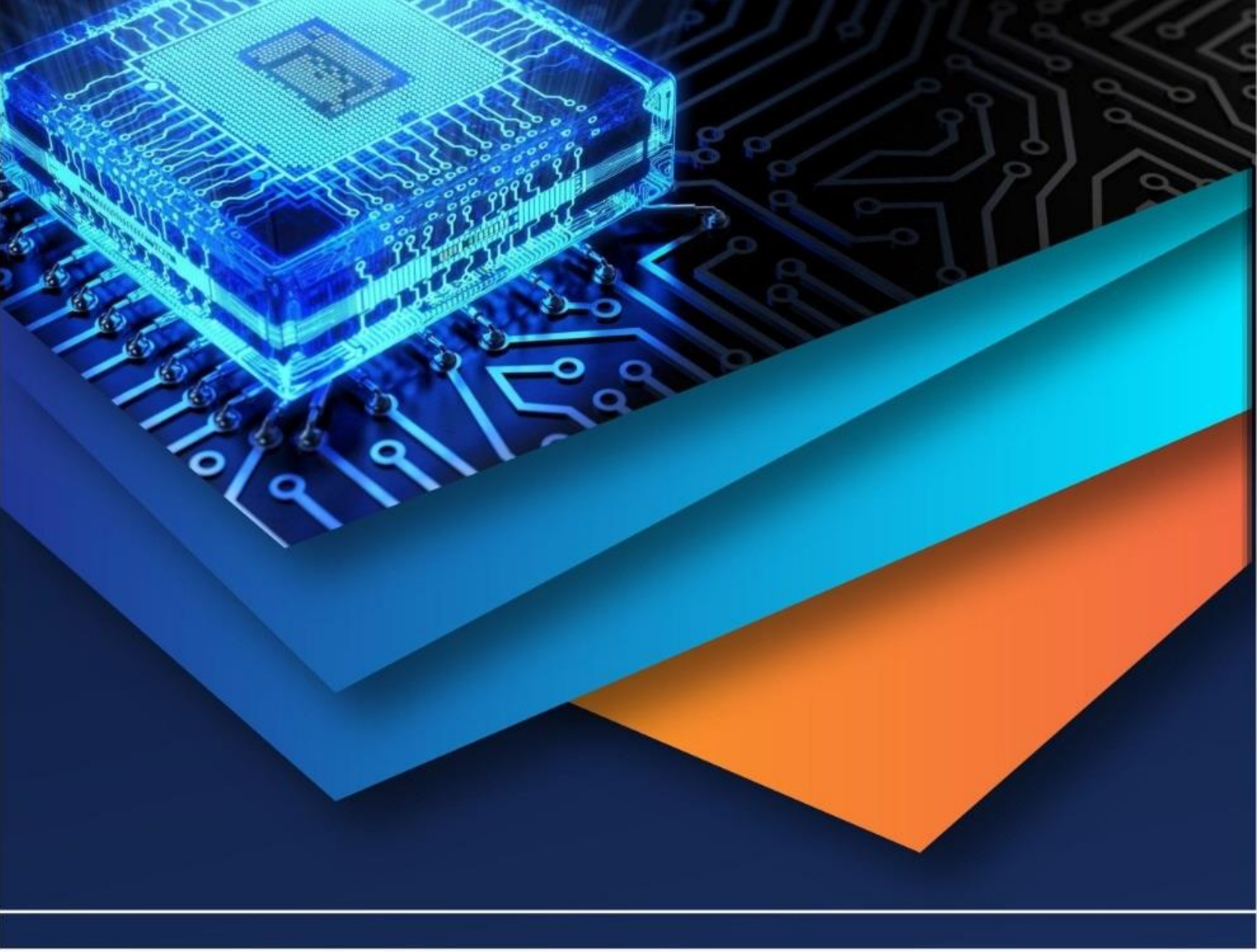
VI. CONCLUSION

The wireless air pollution monitoring system provides the up to date information about the level of population, as well sent to the user's mobile through that they can take care of themselves. The developed air quality monitoring and visualization system accurately measured the concentration of pollutants carbon monoxide, carbon dioxide, smoke, and dust in the atmosphere. as provides an alert in case of huge change in the quality of air. This information can then be used by authorities to take action. An increase in temperature is normal these days so, no one actually takes care of them during a high rise in temperature but the damage that causes people is high. So, in this paper, even high rise in temperature and humidity, an alert notification is The sensor has been integrated with the IoT framework which has efficiently been used to measure and monitor the pollutants in real-time. This system overcomes the problem of pollution monitoring, health monitoring, livelihood measurement, ssustainability assessments, and measurement-related fields. The data are automatically stored in the database; this information can be used by the authorities to take prompt actions. It also helps the normal people to know about the number of pollutants in their area and to take control measures. This is a robust system that is very useful in industries because of the increasing pollution due to the increase in industries. This system is user-friendly the and cost of the product is affordable. This system is monitoring five parameters and hence can be expanded by considering more parameters that cause the pollution, especially by the industries.

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