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Cloud-based Air Quality Monitoring through Wireless Sensor Network using NodeMCU

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Abstract: ***In the present-day world, air pollution has gained huge attention and eventually become a major threat to society. Considering the exigency and magnitude of air pollution, this paper focus mainly on the device which is capable of monitoring the air quality, vibration levels of the ground, and a type of fire safety alert system for the employees working in the industrial environment. This is implemented using a WIFI-enabled ESP8266 NodeMCU microcontroller which is interfaced with air quality monitoring sensors MQ135, DHT11 (Humidity and Temperature) sensor, Geophone sensor to detect measurements of vibration levels in industries, and a flame sensor to prevent the workers from fire accidents. The buzzer is used as an alert module. 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

The advancement in technology and industries has blindfolded the world and so is its consequences, which eventually affected the common people and their healthy lifestyles. Monitoring the quality of air has become an essential need for the workers in the industrial areas to lead a healthy lifestyle. So, we have proposed a device which monitors the quality of air and besides that, it detects the measurement of vibration level in the industrial area and also prevents the workers from fire accidents.

In the air quality monitoring system, the main building block is WIFI enabled ESP8266 NodeMCU which is interfaced with an internet access point to air quality monitoring sensors MQ135, it measures the gas level in the air if the levels exceed the usual. A DHT11 sensor is used to measure the temperature and humidity.

A flame sensor is used to prevent the workers from fire accidents and also a Geophone sensor, which detects the vibrating level in the industries.

The buzzer is used to make people aware of hazardous situations. And all the data gets stored in the NodeMCU and later the data is further analyzed and stored on cloud platform and monitored on the mobile app called BLYNK.

II. OVERVIEW OF PROBLEM STATEMENT

Everyone wants to live a happy and healthy lifestyle but the advancement in the field of industries and technologies has adversely affected the healthy lifestyles of people all over the world. The fact is, as an individual it is highly impossible to control the pollution. So, proposing a model which will help individuals to have control over themselves and protect their smartphones with the help of an application called BLYNK.

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 paper's main objective is to monitor the quality of air, measurement of vibration levels on the ground and alerts the workers about fire accidents. Even though many researchers have implemented the device. But only a few have concentrated on almost all the problems faced by industrial workers in the industries.

So, with the thought of solving the difficulties faced by workers in the industries, we have proposed a cost-effective single device that considers all the issues which a worker usually faces in the industry.

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IV. PROPOSED METHODOLOGY

A. Explanation

With the growing need for the protection of the health of industrial area workers, we propose a cloud-based 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 quality of air is monitored by the MQ-135 sensor which is interfaced with the NodeMCU. it has 4 pins i.e., digital pins, analog pins, and two other pins for VCC and ground terminals. It measures the concentration of various gases like ammonia, co2, and other harmful gases. If the concentration level of those gases exceeds the normal level the message pop up will be sent to workers' mobile in form of a message alert through the Blynk app.

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.

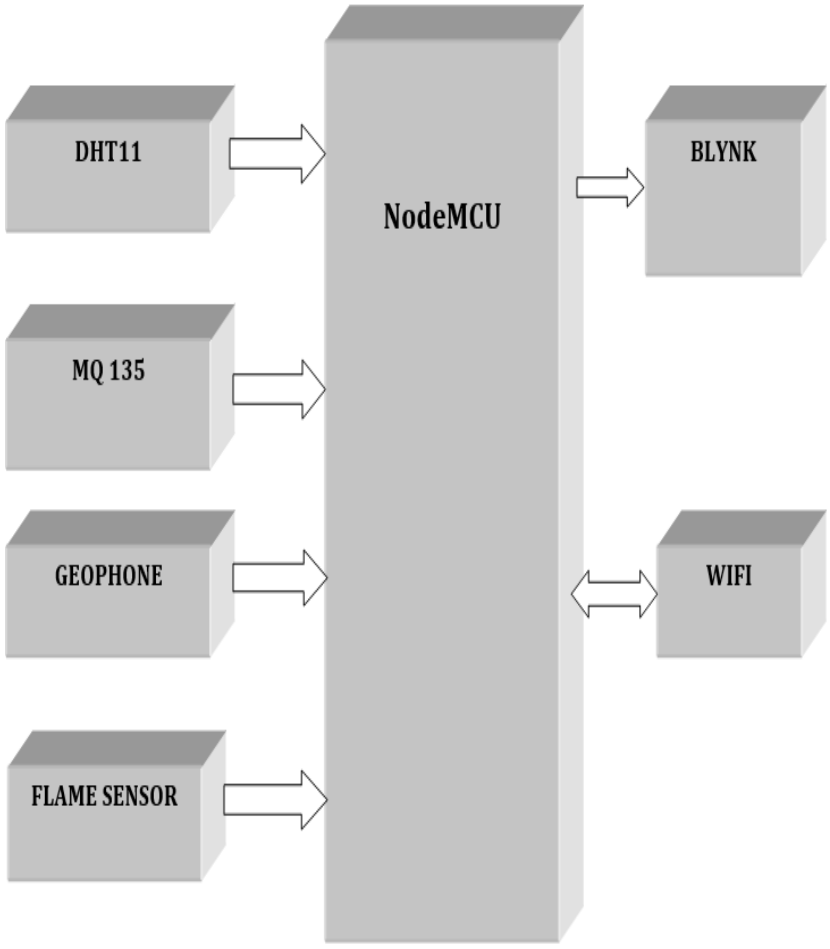


Fig. 1. Block Diagram of the proposed Device

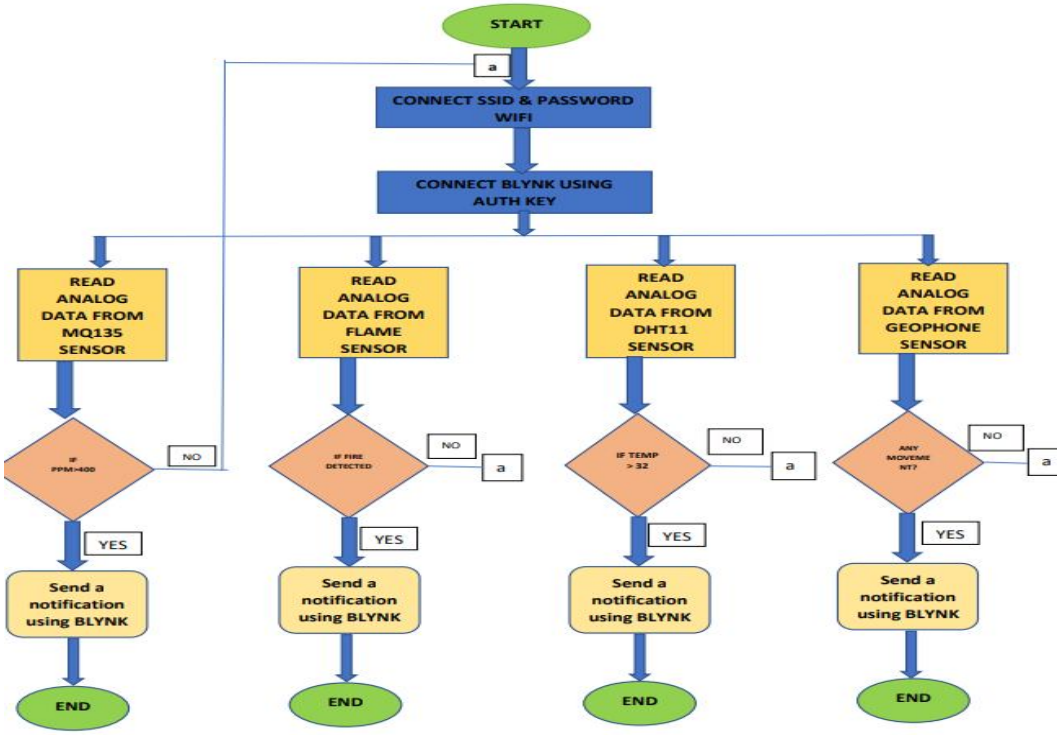


Fig.2. Flowchart

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.

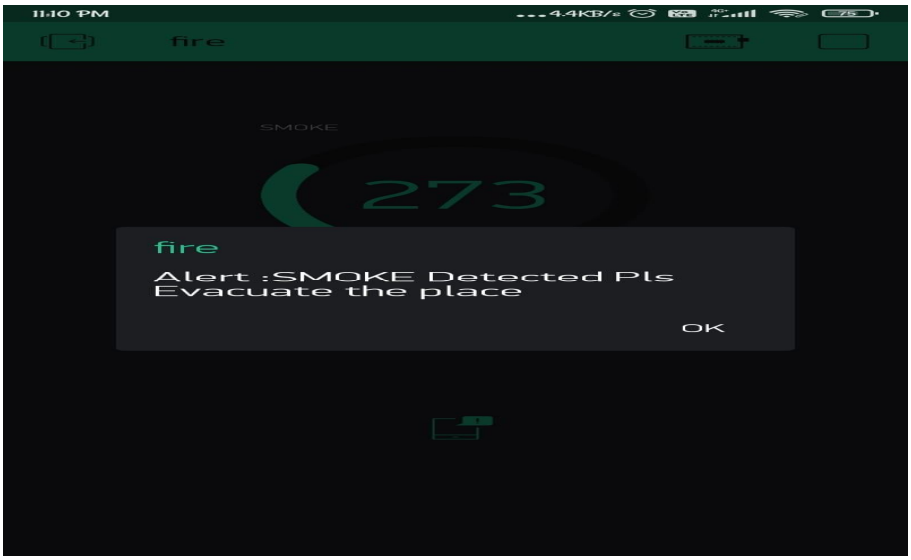


Fig. 3. Results of the MQ135 on Blynk App

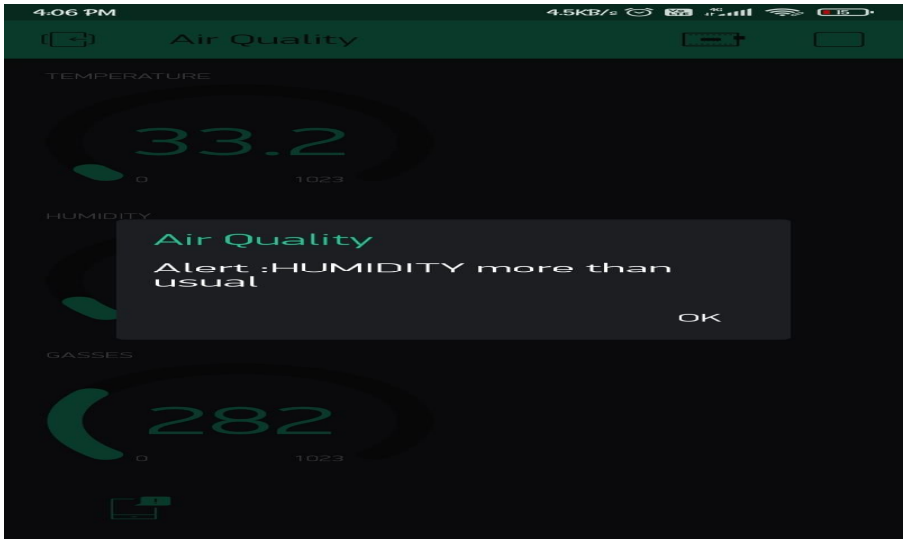


Fig. 4. Results of the DHT11 on Blynk App

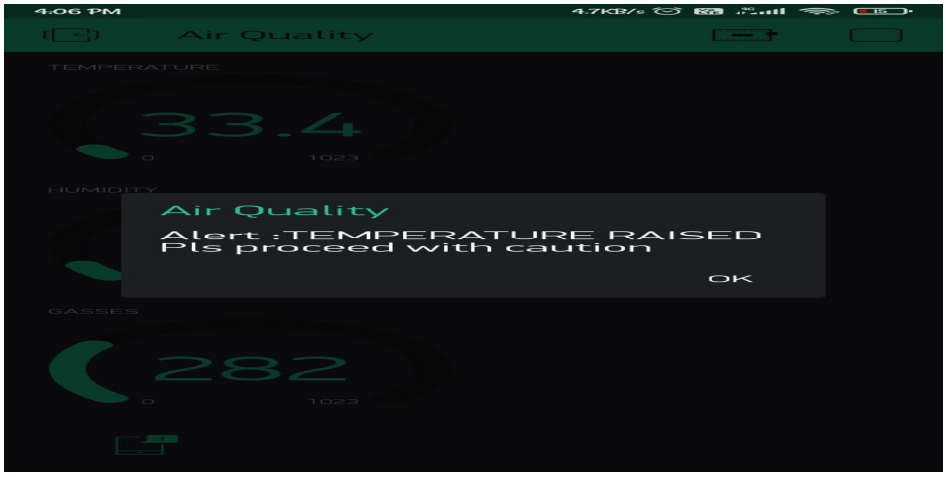


Fig. 5. Results of the DHT11 on Blynk App

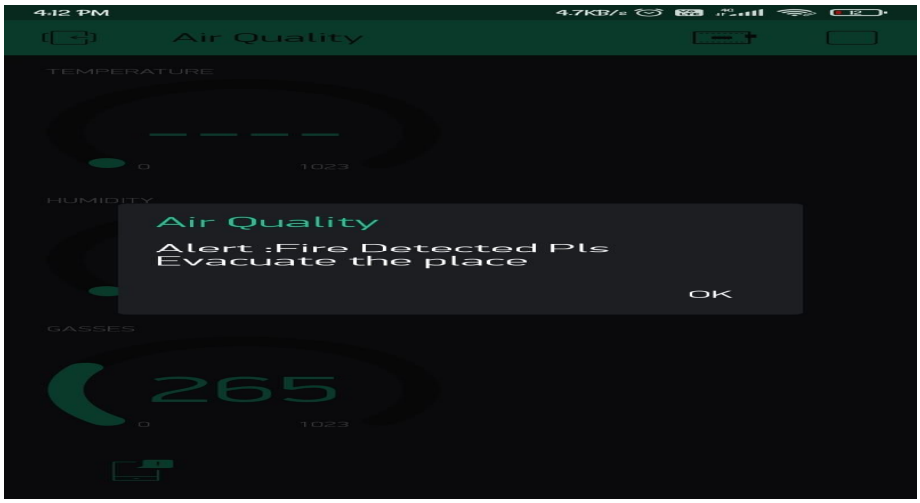


Fig.6. Results of the Flame sensor in Blynk App

VI. CONCLUSION

The wireless air pollution monitoring system provides the up to date information about the level of population, as well 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 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. 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, sustainability 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.

REFERENCES

[1] H. P. L. d. Medeiros and G. Girão, "An IoT-based Air Quality Monitoring Platform," *2020 IEEE International Smart Cities Conference (ISC2)*, 2020, pp. 1-6, doi:10.1109/ISC251055.2020.923907

[2] S. McGrath, C. Flanagan, L. Zeng and C. O'Leary, "IoT Personal Air Quality Monitor," 2020 31st Irish Signals and Systems Conference (ISSC), 2020, pp. 1-4, doi: 10.1109/ISSC49989.2020.9180199.

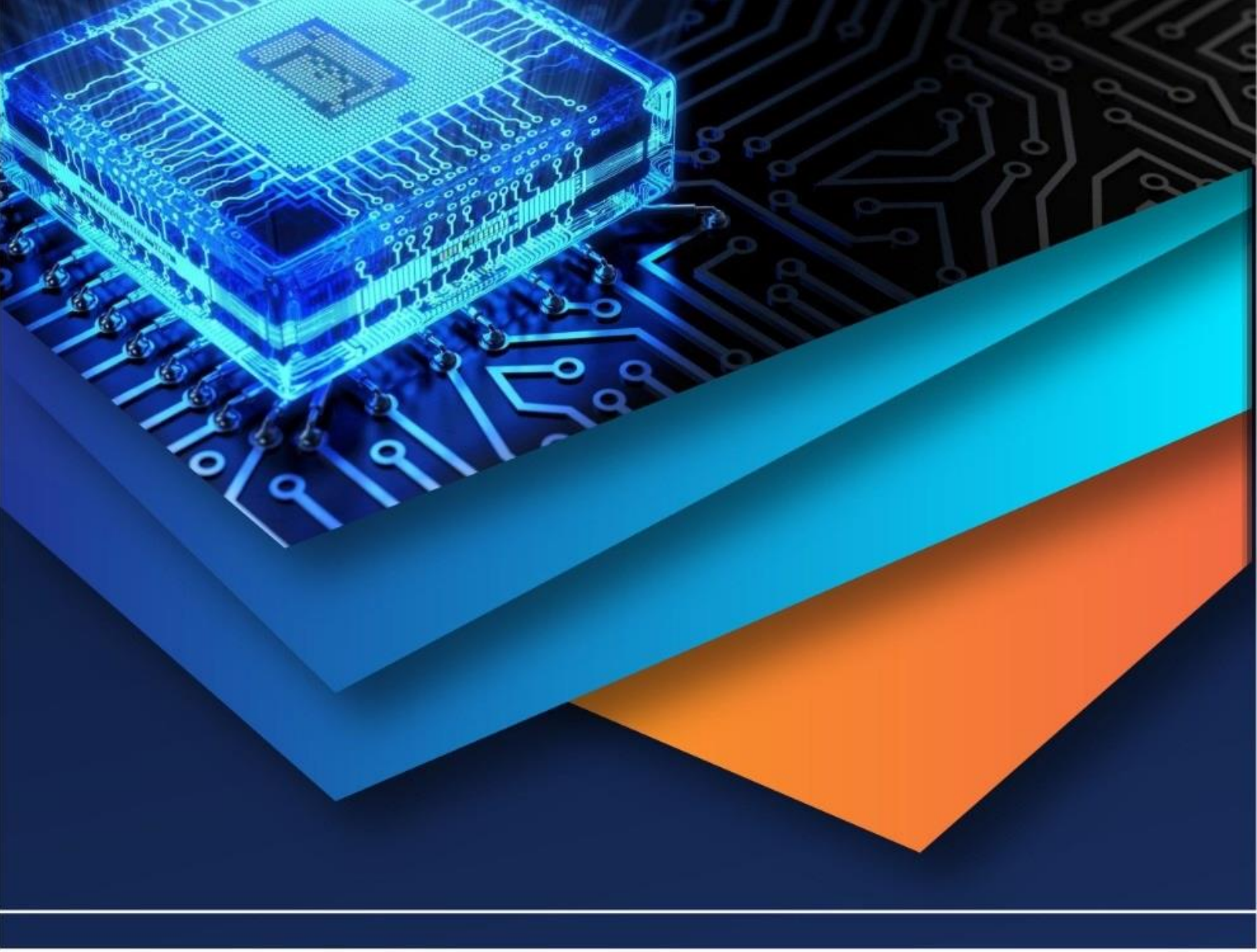
[3] M. Kharade, S. Katangle, G. M. Kale, S. B. Deosarkar and S. L. Nalbalwar, "A NodeMCU based Fire Safety and Air Quality Monitoring Device," *2020 International Conference for Emerging Technology (INCET)*, 2020, pp. 1-4, doi: 10.1109/INCET49848.2020.9153983.

[4] R. K. Kodali, S. Pathuri and S. C. Rajnarayanan, "Smart Indoor Air Pollution Monitoring Station," 2020 International Conference on Computer Communication and Informatics (ICCCI), 2020, pp. 1-5, doi: 10.1109/ICCCI48352.2020.9104080.

[5] G. Verma, P. Mittal and S. Farheen, "Real Time Weather Prediction System Using IOT and Machine Learning," 2020 6th International Conference on Signal Processing and Communication (ICSC), 2020, pp. 322-324, doi: 10.1109/ICSC48311.2020.9182766.

[6] B. K. Moharana, P. Anand, S. Kumar and P. Kodali, "Development of an IoT-based Real-Time Air Quality Monitoring Device," 2020 International Conference on Communication and Signal Processing (ICCSP), 2020, pp. 191-194, doi: 10.1109/ICCSP48568.2020.9182330.

[7] V. N. Deekshit, M. V. Ramesh, P. K. Indukala and G. J. Nair, "Smart geophone sensor network for effective detection of landslide induced geophone signals," 2016 International Conference on Communication and Signal Processing (ICCSP), 2016, pp. 1565-1569, doi: 10.1109/ICCSP.2016.7754422.



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