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A Real-Time Gas Leak Detection System with Messaging Capabilities

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Abstract - The system consists of an MQ2 gas sensor connected to an ESP8266 (NodeMCU) microcontroller, which detects gas leakages by sending alerts to users through the Blynk IoT platform. The ESP8266 performs Wi-Fi connection after start-up, then proceeds to read gas levels through its analog input. The sensor value is read by the system once every 2 seconds before it sends the data to the Blynk application. When gas concentration surpasses the set limit, the system creates an alert that switches off the LED light and activates the relay or motor equivalent to an exhaust fan or buzzer and sends immediate notifications to users through Blynk. When the gas measurement shows safety, the system activates the LED light while keeping the motor powered down. Remote monitoring occurs indefinitely because this configuration allows instant notification of gas leaks.

***Key Words*:** MQ2 gas sensor, ESP8266, gas leakage detection, Blynk IoT platform, user notifications, remote monitoring.

1. INTRODUCTION

The system uses an ESP8266 (NodeMCU) microcontroller with an MQ2 gas sensor and connects to the Blynk platform for remote monitoring, which sends alerts to users. The main purpose of this system is gas detection in environmental spaces to create instant warnings that protect users from dangerous situations. The system keeps monitoring gas concentrations by connecting to Wi-Fi. The system will initiate a visual alert along with mechanical signaling that prompts the user to receive real-time alerts through the Blynk app when the gas level crosses its predefined set point. The proposed project develops a budget-friendly and user-friendly device for immediate hazardous gas detection, which can serve residential and industrial safety needs.

2. SYSTEM CONTENT

2.1 ESP8266 Microcontroller

The ESP8266 NodeMCU microcontroller is the key component for this gas leakage detection system because it obtains sensor data and processes it while connecting to the Blynk IoT platform. The NodeMCU ESP8266 microcontroller uses its A0 pin to permanently detect analog signals from the MQ2 gas sensor to determine the environmental gas concentrations. Sensor data analysis allows the ESP8266 to decide if gas concentrations exceed specified safety parameters. A detected leak triggers the alert system by activating both the LED indicator together with the relay, which enables a motor or alarm, while the user receives immediate notification on their Blynk app. The Wi-Fi connectivity provided by ESP8266 delivers strong performance combined with smooth data transfer capabilities, so the device operates efficiently as an effective controller for real-time safety systems.

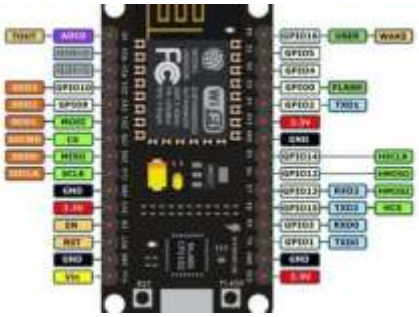

Fig-1: ESP8266 MICROCONTROLLER

2.2 MQ-2 Gas Sensor

The gas leakage detection system operates through the MQ-2 gas sensor, which functions as its primary sensing element. The sensor can track multiple gas substances, which include LPG alongside methane, along with smoke and other combustible gases. The ESP8266 analog pin (A0) functions as the measurement point for the sensor to detect air gas concentrations. The device produces an analogue voltage output dependent on gas concentrations, and the ESP8266 performs the reading and evaluation process. The Blynk app sends notifications together with visual and mechanical alerts when the gas concentration reaches or exceeds 250 program program-defined threshold. Through its continuous gas concentration measurements, the MQ-2 detects gases in real time, thus triggering immediate notifications for safety response.

Fig-2: MQ-2 Gas Sensor

2.3 DC Motor

The automated response control of the DC motor (or relay-connected device) gets activated through the ESP8266 microcontroller after detecting gas levels exceeding security thresholds. The motor connected to digital pin D6 operates only under abnormal conditions. The ESP8266 activates the motor through a HIGH value on the pin, which sends power to either a motor or safety equipment like ventilation systems or alarms. The system responds mechanically right away to prevent gas buildup and complement the information sent to users through the Blynk app.

***Fig-3**: DC Motor*

2.4 Buzzer

When a buzzer functions as an alert component in this gas leakage detection system, it provides immediate audible warnings to people around the area regarding possible gas leaks. When connected to the ESP8266 digital output pin, for example, D6, like motors or relays, the buzzer stays inactive during regular operations. A HIGH signal from the ESP8266 to the buzzer initialization pin through the defined pin activates it and generates an audible notification for attention purposes when gas levels exceed the set threshold. The device employs a local alarm in combination with LED indicators and Blynk app remote alerts to notify users near and far so they can act quickly in emergencies. The incorporated buzzer system enables real-time hazard detection to be more effective through the safety system.

Fig-4: Buzzer

2.5 BLYNK Application

The system employs an ESP8266 microcontroller together with the Blynk platform to provide real-time monitoring and notification capabilities for gas leakage detection through IoT technology. The MQ2 gas sensor continuously measures LPG, methane, and smoke concentrations through its connection to analog pin A0. The device connects to WiFi through the provided SSID and password to exchange information with the Blynk app through its preconfigured template authentication. The system triggers several safety components once gas levels reach 250: the buzzer and motor activate through the relay, and the LED connected to D5 switches off because it operates on LOW activation. The system activates logEvent () within the Blynk app to notify users about potential gas leak situations through a message. When the gas level meets normal conditions, the system executes a reset operation that stops all activated outputs, including the buzzer and motor, while it turns on the LED. Real-time gas level monitoring is possible through the Blynk app because sensor data is transmitted to virtual pin V0 every two seconds. The system provides a reliable real-time warning and surveillance capability that works in both residential and industrial applications.

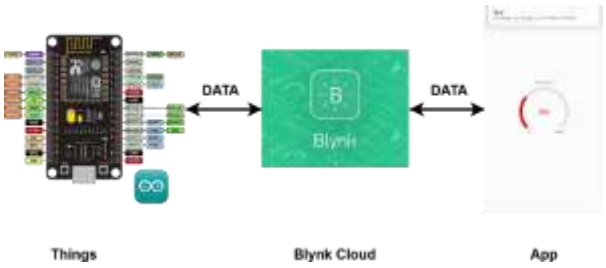

Fig-5: Blynk App Interfacing

3. METHODOLOGY

A gas leakage detection system operates with an ESP8266 microcontroller-controlled MQ2 gas sensor that sends data through the Blynk IoT platform to support distant monitoring and generate alerts. The MQ2 sensor runs continuous air quality monitoring that generates analog gas concentration values, which connect to analog pin A0 of the ESP8266. The Wi-Fi connection of the microcontroller operates through entering previously defined SSID authentication and password information. The system operates with a predefined value of 250 that functions as the detection boundary for possible gas leaks. The system scans gas values through its virtual pin V0 two times in second before transferring the results to the Blynk cloud storage. When gas concentration reaches above the defined threshold, the system conducts simultaneous safety actions by disabling the LED (because it works on an active low function) and turning on either the motor or relay component, and producing a Blynk app notification that indicates a gas leakage. The system maintains the LED in an ON state, alongside keeping the motor off when the gas values stay below the established threshold. The Blynk Timer library controls the regular execution of sensor readings and safety condition tests. The main loop constantly executes both Blynk connection and timer operations for maintaining immediate monitoring and user response capabilities. Users can benefit from an economic approach to early gas leak identification through IoT-based mobile notifications because the system enables secure hardware sensor integration with cloud capabilities to enhance both residential and industrial safety.

3.1 Block Diagram

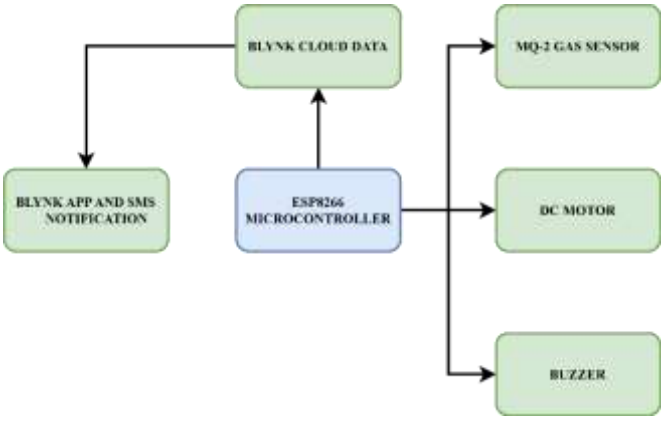

Fig-6: Block Diagram

4. RESULT AND DISCUSSION

The system employs an ESP8266 microcontroller together with the Blynk platform to provide real-time monitoring and notification capabilities for gas leakage detection through IoT technology. The MQ2 gas sensor continuously measures LPG, methane, and smoke concentrations through its connection to analog pin A0. The device connects to WiFi through the provided SSID and password to exchange information with the Blynk app through its preconfigured template authentication.

Fig-7: EXPREMENTAL SETUP

The system triggers several safety components once gas levels reach 250: the buzzer and motor activate through the relay, and the LED connected to D5 switches off because it operates on LOW activation.

Fig-8: Blynk App Indication Setup

The system activates logEvent () within the Blynk app to notify users about potential gas leak situations through a message. When the gas level meets normal conditions, the system executes a reset operation that stops all activated outputs, including the buzzer and motor, while it turns on the LED. Real-time gas level monitoring is possible through the Blynk app because sensor data is transmitted to virtual pin V0 every two seconds. The system provides a reliable real-time warning and surveillance capability that works in both residential and industrial applications.

5. CONCLUSION

The project shows the successful implementation of a real-time gas system.

A leakage detection system that utilizes an ESP8266 microcontroller together with an MQ2 gas sensor and the Blynk IoT platform. The system tracks gas concentrations while activating buzzer alerts, motor operation, LED indicators, and Blynk app notifications for dangerous gas readings. Real-time data monitoring with cloud-based alerts creates a safer environment and quick response capabilities, which enable this system to work effectively in homes and small industrial settings. The system demonstrates practical value for gas safety improvement in everyday settings because it combines affordable costs with easy installation and dependable functionality.

REFERENCES

1. **ENHANCING GAS LEAK DETECTION WITH IOT TECHNOLOGY** Rekha R. Nair, Kishore S, Vineeth 2024.
2. **LPG GAS LEVEL MONITORING AND LEAKAGE DETECTION SYSTEM,** V.M. Umale, Sanket Yende, Kalyani Bhagwat, *Journal of Science and Engineering 2023.*
3. **TOXIC GAS LEAK MONITORING ALARM SYSTEM BASED ON WIRELESS SENSOR NETWORK** Jianyun Ni, Zihao Li, Shuzhi Xie, Chao Jia 2018.
4. **DESIGN AND IMPLEMENTATION OF A SMART GAS LEAK DETECTION SYSTEM** Suboth Gajbhiye, Savita Sarode, Pallavi Bansod 2020.
5. **REAL TIME GAS LEAKAGE DETECTION AND MONITORING SYSTEM USING IOT",** Sayali Joshi, Shital Munjal, Uma Karanje, 2019.
6. **DESIGN OF LOW-COST GAS LEAKAGE MONITORING SYSTEMS USING ESP8266,** Benjamin kommey, Daniel opoko, International Journal of Informatics Systems and Computer Engineering 2022.
7. **LIQUIFIED PETROLEUM GAS MONITORING AND LEAKAGE DETECTION SYSTEM USING NODEMCU ESP8266 AND WIFI TECHNOLOGY**, suzi seroja binti sarnin, Fadzlina Naim, Divine Senanu Ametefe, January, Indonesian Journal of Electrical Engineering and Computer Science 2020.
8. **SMART HOME GAS LEAKAGE MONITORING WITH REAL-TIME SMS ALERTS USING IOT TECHNOLOGY** Asmita Varma, Prabhakar S, Kayalvizhi Jayavel 2017.
9. **IoT-BASED REAL-TIME GAS LEAKAGE DETECTION AND NOTIFICATION SYSTEM FOR INDUSTRIAL SAFETY**, Ravi, R.N.V. Greeshma,2018.
10. **IOT BASED REAL TIME INDUSTRIAL HAZARDOUS GAS LEAKAGE DETECTION AND ALERTING SYSTEM**, P Kundu, V Mishra, GM Kumar, International Research Journal of Engineering and Technology 2020.