LPG Gas Leakage Detection System with Auto Cut-Off Regulator

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Abstract— This paper presents an effective IoT-enabled gas leakage monitoring and controlling system that ensures safety for both home and industrial environments. This project combines hardware and software tools such as; NodeMCU, MQ5 gas sensor, relay operated exhaust fan, buzzer and servo motor to enable automated action in case of any detected gas leak. In case of gas emission detection, the system not only notifies people within the vicinity by sounding alarms but also, activates the exhaust fan towards clearing that area which issues alerts to the users via Blynk app to keep watch on the situation even when they are far away.

Index Terms— Buzzer, Exhaust fan, Node MCU, Servo motor.

I. INTRODUCTION

Gas leakage detection and smart management systems are very important for safekeeping offices, factories, and homes. Gas leakage is a source of fires and explosions, especially that of Liquefied Petroleum Gas (LPG), and can cause very severe health issues [1]. Using IoT devices gives a modern approach to detect and manage gas leaks in real-time [2]. These systems employ sensors located in critical points that, through continuous monitoring of gas levels, give an immediate response in the event of any leakage.

Node MCU, MQ5 gas sensor, relay, buzzer, exhaust fan, and a servo motor are used in this project to implement a complete gas safety management system. The MQ5 sensor detects dangerous gas concentrations, which trigger automated responses to mitigate potential hazards.

Whenever there is leakage of gases, it turns ON its buzzer, and via relay, exhaust fan becomes ON for better ventilation. Also, it informs the user in real time using the smartphone about the incidence with the help of application named Blynk. The system also includes a servo motor connected to the gas regulator. In case of a gas leak, the servo motor automatically cuts off the gas supply to prevent further leakage. This integration of automatic actions, such as alerting nearby personnel, improving air circulation, and cutting off the gas supply, ensures an effective and quick response to minimize risks. This system integrates IoT technologies to provide an advanced and reliable solution for managing gas leakage in industrial and domestic settings.

Paper [3] presents the system which identifies gas leaks, activating warnings and sending SMS notifications. Paper [4-5] presents an Arduino UNO, MQ5 sensor, and GSM module to detect gas leaks, issuing warnings and sending SMS alerts. In paper [6], the system identifies gas leaks, activating warnings and sending SMS notifications. Paper [7] describes gas leaks, cuts off power and alerts users for enhanced safety.

This project aims to create an effective IoT-enabled gas leakage monitoring and controlling system that ensures safety for both home and industrial environments. The aim of this system is to reduce potential dangers brought about by gases such as Liquefied Petroleum Gas (LPG) which can be caused by gas level monitoring and alarming devices assessing no leaks and timely carrying out of measures to avert any potential risks.

II. COMPONENT DESCRIPTION

A. Node MCU

Fig. 1: Node MCU

Node MCU is an open-source development board that is highly regarded for IoT projects. The ESP8266 Wi-Fi chip complements the advantage by providing

internet connectivity. It has a number of GPIO pins that are used to attach sensors and actuators.
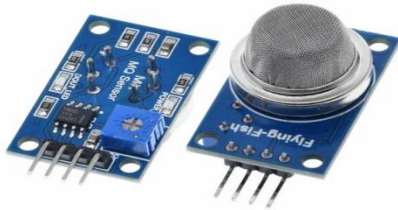
B. MQ5 SENSOR

Fig.2: MQ5 Sensor

The gas sensing material used in the MQ-5 gas sensor, which has a low conductivity in clean air. When there is flammable gas like LPG in the environment where the sensor is located, the conductivity of the sensor increases with the increase of the flammable gas like LPG concentration in the air. The MQ-5 gas sensor has high sensitivity to butane, propane and methane, and can take into account both methane and propane, etc.

C. Servo motor

Fig.3: Servo motor

A servo motor is an electromechanical device that produces torque and velocity based on the supplied current and 5-volt voltage. A servo motor works as part of a closed loop system providing torque and velocity as commanded from a servo controller utilizing a feedback device to close the loop (0°-180°).

D. Buzzer

Fig.4: Buzzer

A buzzer is an audio signaling device to alerting. It have 2 pins. Mostly buzzers and beepers are used for alarm devices, timers. Piezo buzzer is an electronic device commonly used to produce sound and alerting to user.
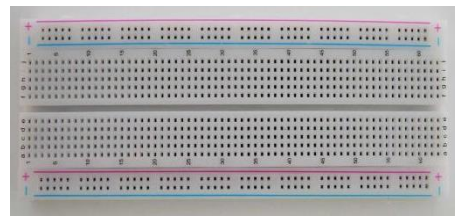
E. BREADBOARD

Fig.4: Breadboard

Bread Board is a development base for prototyping of electronics. It is most reusable. It is very easy to use for designing a temporary project. It is not good tool when designing circuits with high voltages. Similarly the boards will have difficulty in keeping up high current applications so here we are using this bread board for our temporary testing purpose.

F. Jumper Wires

Fig.5: Jumper wires

A connecting jumper wires is an electrical wire, or a bunch of cables with a leads or pin named as male-male and male-female pins is normally used to interconnect the components with bread board without soldering.

G. 9V DC Battery

Fig.6: Battery

This is General purpose 9V Original HW marked Non-Rechargeable Battery for all your project and application needs. Its Universal 9V battery size and connecting points; it is useful in many DIY projects as well as household applications and they can easily be replaced and installed.

H. Relay

Fig.7: Relay

A relay is an electrically operated switch used to control high-power devices with low-power signals. It consists of an electromagnet (coil), movable armature, and fixed contacts. When current flows through the coil, it creates a magnetic field that moves the armature, opening or closing the circuit to control the connected device. Relays are essential for isolating low-power control circuits from high-voltage loads, making them ideal for switching motors, lights and appliances.
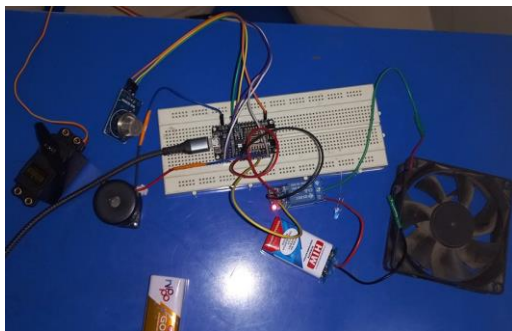
IV. RESULT & DISCUSSION

Fig.9: LPG Gas Leakage Detection System

The gas leakage detection system has been successfully designed and built using NodeMCU, an MQ5 gas sensor, a buzzer, exhaust fan, servo motor, relay and Blynk app for alerts as shown in the fig.9

During the test, the MQ5 gas sensor successfully identified the presence of LPG gas in various proportions. In case the gas concentration level was above the set limits, the system activated the buzzer and caused the relay to switch on the exhaust fan and rotating the servo motor to shut off the gas regulator. At the same time, the user received a pushed notification via the Blynk app about the ongoing process, which facilitated external monitoring and rapid action.

The system performed well in detecting gas leaks and triggering the countermeasures on its own. Communication through Blynk was effective as the system kept the users properly informed and updated. The users were also satisfied with the functioning of the exhaust fan and shut off valves, which acted immediately to control the levels of gas. Thus overall, the system worked smoothly without any significant waiting periods, thereby proving that the functioning of an inexpensive and effective gas leak detection system suitable for home and industrial purposes was achievable.

V. CONCLUSION

This paper presented an Iot-based gas leakage detection system utilising Node MCU, MQ5 sensor, buzzer, exhaust fan and the Blink app. The system effectively detects gas leaks and provides real time alerts through both local alarms and remote notification, ensuring a quick response to hazardous situations. It combines hardware and software tools such as; NodeMCU, MQ5 gas sensor, relay operated exhaust fan, buzzer and servo motor to enable automated action in case of any detected gas leak. If gas emission detected, the system not only notifies people within the vicinity by sounding alarms but also, activates the exhaust fan towards clearing that area which issues alerts to the users via Blynk app to keep watch on the situation even when they are far away. In addition a servo motor is used for closing off the gas valve which prevents excessive gas from escaping and turning into a dangerous incident.

VI. FUTURE SCOPE

This proposed work can be advanced by including sensors for other gases, like methane and carbon monoxide and environmental factors such as temperature and humidity. Machine learning can be applied to enhance the accuracy of detection, lower false alarms, and predict leakage trends. Adding a GPS will enable location-based alerts and make it better suited for large installations.

Apart from that, voice assistant integration using Google Assistant or Alexa would enable more interactive operations while a GSM module would give alert for SMS and call features for areas with connectivity problems with the internet. This system can be scaled to the real-time monitoring of multiple locations and would work in industrial applications. Renewable sources of energy, like solar power, for enhanced sustainability, especially for remote applications can be used.

VII. REFFERENCE

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