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IoT BASED GAS MONITORING SYSTEM

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ABSTRACT—

The fact that fuels and gases are used in everything from homes to businesses highlights both their significance and the risks that could arise from improper handling of them. The urgent necessity for proactive gas leak detection and prevention methods has been brought to light by previous instances. This project uses an actuator and sensor combination to solve this necessity. The main detection mechanism is the MQ2 gas sensor, which is capable of detecting a variety of gases, such as LPG, i-butane, hydrogen, methane, smoke, and alcohol. It lacks exact readings but offers a broad indication of gas concentration within an allowable error range. An ultrasonic sensor also improves the precision of detection. When the system detects gas, it starts taking preventative action. It does this by turning on a servo motor to cut off the gas supply and sounding a buzzer alarm to alert users to the problem. In addition, an LCD monitor offers real-time gas level feedback. Additionally, the addition of a WiFi module allows the system to instantly notify the owner through alert messages, guaranteeing prompt action and reducing the likelihood of mishaps. This all-encompassing method combines sensor technology and actuation mechanisms to produce a reliable system for preventing and detecting gas leaks that can be used in both industrial and residential contexts.

Keywords— Gas leak detection, MQ2 sensor, ultrasonic sensor, servo motor, buzzer alarm, LCD display, WiFi module, precautionary measures, accident prevention.

INTRODUCTION :

The most common gas used in homes for cooking, LPG, carries a number of concerns if handled improperly or leaks, which could cause irreversible damage to people's lives and property. Its limited diffusion due to its propensity to settle as a heavy gas makes inhalation a suffocating concern.

Furthermore, leaking LPG can catch fire and cause explosions, which have been linked to an alarming increase in fatalities in recent years. Due to their increasingly hectic schedules, customers can forget to repurchase petrol or find it difficult to do so, which would result in waste.

Furthermore, neglect-related mishaps like leaving burners on continue to be a worry. In order to tackle these problems, our suggested remedy centres on creating a smart gas infrastructure. By quickly identifying LPG leaks and notifying customers via an android app powered by Internet of Things (IoT) technology, this solution improves home safety. Remotely operating the gas valve allows users to reduce risks from any location in the world. Additionally, load sensors are used by the system to continuously monitor the LPG levels in the cylinder.

Users receive timely reminders to replace the cylinder, immediately contacting the gas agency, should the gas level fall below a predefined threshold. Our system's integration of these features not only improves safety but also fosters effective gas management, which lowers waste and lowers the hazards related to gas utilisation.

LITERATURE REVIEW

In the past, There are lots of authors came up with ideas to prevent and detect gas leakage such as, [1] The authors

Somashekhar Malipatil, Shilpa, Jayasudha proposed LPG Gas Measurement Detection using GPS. They used components like Arduino, LPG, GPS, MQ6 sensor, Load cell,Signal amplifier. This system monitors the level of gas cylinder. If threshold level comes below 2kgs the alert SMS will be sent to the user and also it detects the leakage level. [2] Siddharth, Rameswari, Keerthana Gayathri, Kavin Sanjaya proposed Smart gas assistant for a perfect kitchen. In this paper they used Arudino, Wi-Fi, GSM Module, Internet of Things, Online Tool, Mobile Application. The proposed system aims to enhance the safety and efficiency of gas stations by integrating several key components: gas level monitoring, leak detection, automatic shutoff mechanisms, and notification systems.

Firstly, gas level monitoring is crucial for ensuring that gas tanks are adequately stocked to meet customer demand. This is achieved through the installation of sensors within the tanks, which continuously measure the gas level. We have used load cell to accurately gauge the gas level. The sensor data is then transmitted to a central control unit.

Simultaneously, the system incorporates gas leak detection mechanisms to safeguard against potential hazards. Gas leak sensors are strategically positioned throughout the gas station, including areas around the storage tanks and dispensers. These sensors continuously monitor the air for the presence of gas at levels higher than the safe threshold. If a gas leak is detected, the control unit initiates an automatic shutoff mechanism.

The automatic shutoff mechanism is designed to swiftly respond to gas leaks by halting the flow of gas from the storage tanks. This prevents further leakage and mitigates the risk of fires or explosions. The shutoff mechanism may involve electronically controlling gas flow valves or cutting off power to gas pumps, effectively isolating the source of the leak.

Continuous monitoring of the system's components is essential to identify any malfunctions or abnormalities promptly.

METHODOLOGY

ARDUINO UNO:The Arduino UNO is a widely used microcontroller board that is well-known for its adaptability and simplicity of use in projects involving electronics prototyping. It has several digital and analog input/output connections and is powered by the Atmega328P microcontroller, which makes it appropriate for a variety of uses. The Arduino UNO provides a solid platform for professionals, students, and hobbyists to investigate, experiment, and invent in the field of embedded systems and the Internet of Things. Its user-friendly programming environment and large online community support further contribute to this.

Fig.1 Arduino UNO

ULTRASONIC SENSOR: The purpose of an ultrasonic sensor is to identify whether or not items are in its immediate proximity by using sound waves with frequencies higher than those that are audible to humans. The sensor, which usually consists of a transmitter and a receiver, sends out ultrasonic pulses and timed how long it takes for the waves to return after striking an item. The sensor calculates the time it takes for the waves to return in order to accurately identify how far away the item is. Ultrasonic sensors find extensive usage in a multitude of applications, such as obstacle avoidance systems, object detection, and distance measuring. Their benefits include being suitable for both indoor and outdoor use, operating without contact, and being immune to environmental elements like dust and light. Furthermore, due to their low cost, ultrasonic sensors are a preferred option for smart home, automotive, robotics, and industrial automation applications.

Fig2. Ultrasonic Sensor

MQ2 SENSOR: The MQ-2 sensor operates on the principle of chemisorptions, where gas molecules react with the sensor's metal oxide sensing layer. Here's a step-bystep explanation. The MQ-2 sensor operates like a tiny bloodhound sniffing out combustible gases. It has a metal oxide layer heated up by a built-in element. When gas molecules like methane or propane float by and contact this hot layer, a chemical reaction occurs. This reaction throws a wrench in the metal oxide's conductivity - its ability to conduct electricity. As more gas gets detected, the conductivity increases. By measuring this change in conductivity (often via resistance or voltage), the MQ-2 sensor essentially tells us there's a gas leak somewhere, although it can't pinpoint the exact culprit. It's important to remember that this sensor has its limitations. It can't tell the difference between various combustible gases and can be sensitive to environmental factors like humidity. Additionally, its baseline reading can drift over time, requiring recalibration. But for its affordability and ease of use, the MQ-2 sensor remains a reliable workhorse for detecting a broad spectrum of combustible gases in various applications.

Fig3. MQ2 Sensor

BUZZER : Buzzers are electrical signalling devices that sound off when they are triggered. It operates by vibrating a diaphragm or similar resonating element with the help of an electromechanical component to produce sound waves. For a multitude of purposes, buzzer devices are commonly used to generate alerts, cautions, or auditory signals. A museum's Internet of Things (IoT)-based anti-theft monitoring system can use a buzzer as an audible alert mechanism to deter potential theft attempts and unauthorized entry. By raising the alarm and warning anybody nearby when it notices questionable activity, such as illegal movement or tampering with exhibits, the buzzer helps to bolster security measures in the museum environment.

Fig4. Buzzer

SERVO MOTOR:A servo motor stands as a specialized type of rotary actuator renowned for its ability to precisely control angular position, velocity, and acceleration. Engineered to transform electrical signals into mechanical movement, it facilitates accurate positioning of the motor shaft, making it an indispensable component in numerous industries and applications. Servo motors are characterized by their capability to offer controlled motion with exceptional precision and reliability. They accomplish this through a combination of key components and sophisticated control mechanisms. These motors are widely utilized in diverse applications across industries due to their unparalleled performance and versatility.

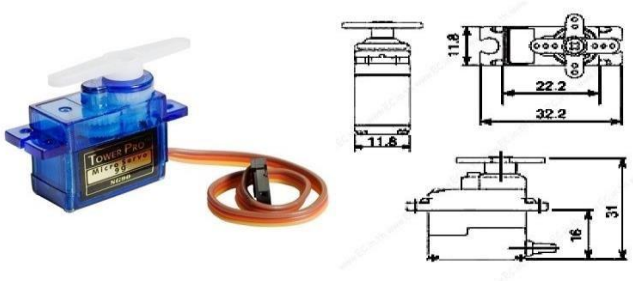

Fig5 .ServoMotor

RESULT AND DISCUSSION

The IoT-based gas monitoring system effectively detects gas leakage and provides real-time gas level feedback. If the gas level surpasses a predefined threshold, indicating a potential leakage, an alert is triggered via an IoT-based display. Additionally, the integration of an MQ2 gas sensor further fortifies the system by preemptively detecting gas leakage and signaling a motor to shut off the power supply by closing the valve. This proactive approach minimizes the risk of accidents, ensuring user safety and environmental protection. The IoT-based display facilitates remote monitoring, enabling users to track gas levels and take necessary actions remotely. While the system demonstrates effectiveness, further optimization may be warranted to refine performance, responsiveness, and integration with existing infrastructure. Considerations such as data security, system reliability, and user interface design should also be addressed for enhanced user satisfaction and adoption. Through continued innovation, IoT-based gas monitoring systems have the potential to revolutionize gas safety practices, mitigating risks associated with gas leakage comprehensively.

CONCLUSION

The integration of advanced sensor technologies and precise actuation mechanisms in this project presents a comprehensive solution for gas leak detection and prevention, addressing the critical need for safety in both residential and industrial environments. By leveraging the capabilities of the MQ2 gas sensor and ultrasonic sensor, the system offers broad coverage for detecting various gases with enhanced precision, ranging from combustible gases like LPG and methane to smoke and alcohol vapors. Upon detecting gas concentrations, the system swiftly initiates preventive measures, such as activating a servo motor to halt gas supply and sounding a loud buzzer alarm, ensuring immediate alerts to occupants. The inclusion of an LCD monitor provides real-time feedback on gas levels, enhancing user awareness and facilitating informed decision-making.Designed for versatility, scalability, and future development, this system underscores its significance in safeguarding lives and property while paving the way for further advancements in gas leak detection technology.

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