

LPG GAS LEVEL AND LEAKAGE INDICATOR WITH AUTOMATIC BOOKING SYSTEM USING ESP32

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Abstract- The use of LPG in homes and Commercial places is increasing, the safety gas and continuous gas availability are very important, this paper presents an IOT – based gas level and leakage monitoring system using an ESP32 microcontroller, MQ-2, and load sensor. The system continuously checks for gas leakage and monitors the level of gas in the cylinder. When a gas leak is detected, it immediately alerts the user through a buzzer, LED indicators, notifications to. The load sensor measures the weight of the cylinder, and when the gas level drops below a predefined threshold, the system automatically sends a refill booking request through a cloud-based services. This reduces manual effort and prevents unexpected gas shortages. The system uses WI-FI connectivity to provide real time data access through a mobile application, allowing users to monitor the system from anywhere. Testing results show that the system provides accurate readings, responds quickly to leakage, and works reliably over time. This solution improves safety, automation, and user convenience, making it suitable for homes, restaurants and small-scale industries.

Key Words: Smart LPG System, IoT Gas Safety, Real-Time Leakage Detection, ESP32 Automatic, Load Sensor, Automatic Gas Booking.



1. INTRODUCTION

Liquefied Petroleum Gas (LPG) is widely used in domestic and industrial applications due to its high efficiency, clean combustion, and ease of handling. However, the use of LPG cylinder involves significant risks such as gas leakage and unexpected depletion of gas. Gas leakage can lead to serious hazards including fire accidents. Therefore, continuous monitoring of LPG cylinders is essential to ensure safety and uninterrupted usage.

Several systems have been developed to address these challenges. Traditional gas monitoring methods rely on manual checking, in accurate and unreliable. With the advancement of Internet of Things (IoT) technology, smart systems have been introduced to provide real-time monitoring and remote access to gas-related data [1], [4]. Gas sensors such as MQ-series sensors are widely used for detecting LPG leakage due to their sensitivity and reliability [3], [7].

In addition to leakage detection, monitoring the gas level is equally important. Load sensor -based systems are commonly used to measure the weight of LPG cylinders and estimate the remaining gas level accurately [6]. Some existing systems also integrate automatic booking features using GSM or IoT technologies to ensure timely cylinder replacement [2], [5].

In this paper, an IoT- based Gas Level and Leakage Indicator with Automatic Booking System is proposed. The system uses a load sensor to measure the gas level and anMQ-6gas sensor to detect leakage. An ESP32microcontrollerisused for data processing and wireless communication. The system provides real-time updates through a mobile application and generates alerts using a buzzer and notifications in case of leakage. Additionally, when the gas level falls below a predefined threshold, the system automatically initiates a gas refill booking request using a cloud-based service or API.

The proposed system enhances safety, reduces manual effort, and improves user convenience. It provides an efficient and reliable solution for LPG monitoring in both residential and industrial environments.

1.1 System Features and Benefits

The system offers several important features that improve safety, efficiency, and user convenience. It provides continuous monitoring of LPG cylinders, ensuring that users are always aware of the gas level and leakage status. The use of a load sensor improves accuracy in measuring the remaining gas compared to traditional methods.

Another key feature is automatic gas booking, which eliminates the need for manual checking and booking. This ensures that the cylinder is replaced on time without any delay. The integration of IoT technology allows remote monitoring through a mobile application, making the system user-friendly and efficient.

Overall, the system enhances safety, reduces effort, and provides a reliable smart solution for LPG usage in homes and industrial environment to all the LPG users.

2. LITERATURE SURVEY

Liquefied Petroleum Gas (LPG) is commonly used in homes, restaurants, and industries because of its efficiency and ease of use. However, safety issues such as gas leakage and difficulty in knowing the remaining gas level are still major concerns. To solve these problems, many researchers have developed systems using sensors, microcontrollers, and communication technologies.

Earlier works mainly focused on detection gas leakage using MQ-series sensors and providing alerts through buzzers [3],[7]. These systems were useful in identifying leakage but did not provide additional features like gas level monitoring or remote access. Later, researchers introduced IoT-based systems that allow users to monitor gas conditions through mobile applications in real time [1],[4].

To measure the gas level, some studies used weight-based methods with load sensors, which provides better accuracy compared to traditional estimation techniques [6]. Other works also include automatic gas booking features using GSM or internet-based communication to reduce manual effort on getting the gas bookings [2],[5].

Even though these developments improved and monitoring, most systems focused only on individual features and did not provide a complete solution. This creates a need for an integrated system that combines gas level, monitoring leakage detection real-time alerts and automatic booking for (LPG) cylinders.

2.1. Existing System

In most homes and commercial places, LPG cylinders are still used without any smart monitoring system. Users depend on manual methods to check gas levels and detect leakage, which has several drawbacks.

Gas level is usually estimated by lifting the cylinder, observing flame quality, or guessing based on usage. These methods are not accurate and often lead to sudden gas depletion. Leakage detection is also done manually using smell or soap solution tests, which are unsafe and unreliable.

Some basic gas detectors are available, but they only produce a local alarm and do not provide mobile alerts or remote monitoring. They also do not measure gas levels or perform any automated actions.

Another major limitation is that gas booking is done manually. Users must remember to book a refill through phone calls or mobile apps, which can be inconvenient and may lead to delays.

2.2. Proposed System

To overcome these limitations, this project proposes an IoT-based LPG monitoring system that integrates multiple features into a single platform. The system uses a load sensor to measure the weight of cylinder and estimate the gas level, while an MQ-6 gas sensor is used to detect leakage.

An ESP32 microcontroller processes the sensor data and sends to a mobile applications using Wi-Fi. Users can monitor gas, leakage status, and system update in real time. When leakage is detected, the system provides immediate alerts through a buzzer and sends notifications to the mobiles.

When the gas level falls below a predefined threshold, the system automatically sends a booking request only through cloud based. This ensures that the cylinder is replaced on time without user intervention.

The proposed system improves safety, provides real time monitoring and introduces automation, to make it more efficient and user friendly compared to existing methods.

3. METHODOLOGY

This section describes the implementation of the proposed system by combining sensing, processing and communication components in to a single working model. The system is designed to monitor LPG cylinder conditions continuously and respond automatically when required. A load sensor is used to determine the cylinder weight, which helps in identifying the available gas level, which an MQ-6 gas sensor is used to sense any leakage in the surrounding environment. Both sensors are

connected to the ESP32 microcontroller, which acts as sending it to a cloud platform using Wi-Fi. A mobile application is used to display the information to the user in real time. The system is tested under different conditions to ensure proper function, accuracy and reliability.

3.1. Working Approach

The operation of the system is based on continuous sensing and intelligent decision making. The load sensor measures the cylinder weight at regular intervals and this value issued to calculated the remaining gas level. At the same time, The MQ-6 sensor monitors the surroundings air to detect any presence of LPG gas The ESP32 receives both inputs and analyses them using predefined conditions. When the gas level falls below a certain limit, the system identifies it as a low-level condition and sends a notification to the user. If gas leakage is detected, the system immediately activates a buzzer and sends message for the mobiles to ensure quick response.

The mobile application retrieves this data and presents it in a simple format, allowing users to check gas level and leakage it displays in the mobile, and alerts at any time. When the gas level reaches through a critical point, the system automatically initiates a booking request through an online service, reducing the need for manual action. The overall system ensures smooth communication between hardware and software components, providing real-time monitoring, fast alert response, and automated gas management in a efficient and reliable manner.

4. IMPLEMENTATION

The implementation phase focuses on developing a working model of the system by integrating hardware components and programming the microcontroller. In this project, a load sensor and MQ-6sensor are used along with the ESP32 to monitor the LPG cylinder. The sensor is connected to the ESP32, which collects and processes the data continuously. The system is programmed using Arduino IDE, where the sensor values are read and sends the information to mobile. When the level and leakage is low it will display and the system generates alerts and performs automatic gas booking through predefined communication methods are included to improve safety and usability. Paper calibration and carried out to ensure the system works accurately and reliably.

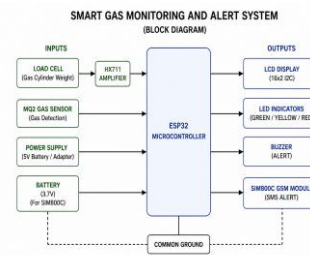


Fig-1 Block Diagram

4.1 Block Diagram Explanation

The ESP32 processes the data received from the sensors and compares it with predefined limits to decide the required action. When a gas leakage is detected, the system immediately activates the buzzer and LED indicators to provide a local warning. At the same time, notifications present through Wi-Fi for remote monitoring. For additional safety, an optional relay with a solenoid valve can be used to automatically stop the gas supply during emergency conditions. A stable power supply ensures smooth operation of all components. When the gas level falls below the set limit, the system automatically initiates a booking request. Overall, the system shows effective coordination between sensing, processing, alerting, and automation to ensure safe and reliable LPG monitoring.

4.2. Hardware Implementation

The hardware setup includes the ESP32 microcontroller, load sensor with HX711 module, MQ-6 gas sensor, buzzer, LED indicators and a regulated power supply. The load sensor is placed below the LPG cylinder to measure the weight of the gas cylinder and displays on mobile. The MQ- 2 sensor is positioned near the cylinder valve to detect any leakage effectively. Both sensors are connected to the ESP32, which acts as the central controller of the system. The buzzer and LED provide immediate alerts when leakage or low gas level is detected.

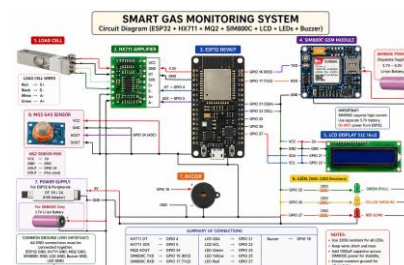


Fig2: Circuit Diagram

4.3. Software Implementation

The software is developed using Arduino IDE and written in embedded c/c+. The ESP32 continuously reads data from the sensor and processes it to determine the gas level and leakage condition. The program compares sensor values with predefined limits to identify abnormal situation. If leakage is detected, the system activates the buzzer and LED to alert the user. When the gas level becomes slow, a warning is generated, and the system initiates an automatic booking action using predefined logic. The software is designed to run continuously and provide stable performance.

4.4. System Integration

System integration ensures that all components work together smoothly. The sensors provide input to the ESP32, which processes the data and makes decisions based on sets conditions. When abnormal conditions occur, the system generates alert through the buzzer and Led indicator. The automatic booking function is also triggered when the gas level becomes low. This coordination between sensing, processing and alert mechanisms ensures that the system operates efficiently and more safety.

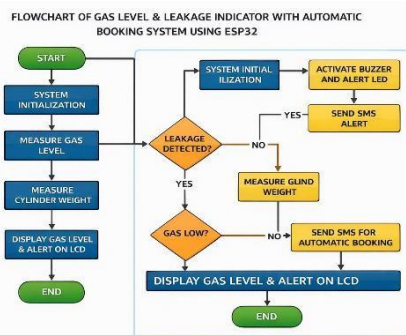


Fig-3: Flow Chart

5. RESULT

The developed system was tested under different conditions to evaluate its performance in gas level monitoring, leakage detection and alert generation. The load sensor was able to measure the weight of the gas cylinder accurately and the successfully converted the data in to an estimated gas level. During testing the reading changed in according to the weight of the gas cylinder when the weight of the gas cylinder goes down it automatically books the cylinder.

The system is tested under different conditions to verify its accuracy and performance. The MQ-6 sensor is tested by exposing it to gas to confirm quick leakage detection. The load sensor is tested with different weight to ensure correct gas level estimation ESP32 is

checked for proper data processing and stable operation. The alert system is tested to ensure the buzzer and LED respond correctly during leakage and low gas condition. The result show that the system works effectively, providing reliable monitoring and timely alerts, making it suitable for real-world use.

The alert system worked properly in both situations, including low gas level and gas leakage. When the gas level dropped below the predefined limit, the system generated a warning to inform the user. Similarly, during leakage conductions, the system provided instant alerts through the buzzer and LED. These features ensure that the user is always aware of cylinder conduction.

The system performance was stable during continuous operations. ESP32 microcontroller processed sensor data efficiently and handled all the operations without any errors and works smoothly, providing accurate monitoring and quick response.

The developed system effectively monitors LPG cylinder conditions with high reliability. The load sensor accurately estimates the gas level, while the MQ-6 sensor quickly detects leakage and triggers immediate alerts. The system responds without delay, ensuring timely warning to the user. Therefore, it enhances safety and reduces the risk of accidents as well as unexpected gas depletion. Overall, the system proves to be a practical and efficient solution for real-time LPG monitoring.

The overall the system performance of the developed system shows that it effectively monitors the gas level and reliably detects leakage conduction. Therefore, it reduces the need of manual checking and helps users take timely action to avoid hazardous situations and unexpected gas shortage. Hence, the project provides a practical and efficient solution suitable for real-life applications such as homes and all industries workings.

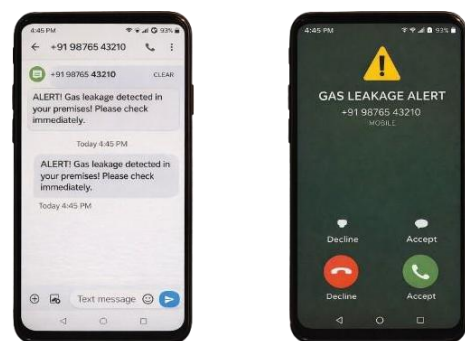


Fig-4: Mobile Notifications.

6. CONCLUSION

The developed LPG Gas Level and Leakage Indicator with Automatic Booking System successfully demonstrates a practical and efficient solution for improving safety and convenience in LPG usage. The system is capable of continuously monitoring the gas level using a load sensor and detecting leakage of gas using MQ-6 sensor. The ESP32 microcontroller effectively processes the data and generates timely alerts through a buzzer and LED indicators of the booking status in mobile and sends notification to mobile.

Therefore, the system reduces the need of manual checking and helps in preventing dangerous situations caused by gas leakage or sudden gas depletion. The automatic booking when the gas cylinder is completed. The overall performance of the system is reliable, stable and suitable for real time applications.

Hence, the proposed system provides a smart and cost-effective solution that can be used in households and commercial environments to improve safety, efficiency and ease to use.

7. FUTURESCOPE

The proposed system can be further enhanced by incorporating additional features to improve its performance, safety and user experience. In the future, an automatic gas shut-off mechanism using a solenoid valve can be integrated to stop the gas supply. The system can also be extended to support multiple LPG cylinder, making it suitable for large applications such as apartments, restaurants and commercial setups where continuous monitoring is required.

Further improvements can include the development of a dedicated mobile applications that provides details information such as gas usage in all, alert logs and system status in more user-friendly manner. Advantage data processing techniques can also be applied to predict the remaining gas usage time more accurately, helping users plan refills in advance.

In addition, the system can be integrated with smart home technologies to enable remote control and automation. Voice-based control and notifications can also be added to enhance user convenience. Therefore, with these improvements, the system can evolve in to a more advance, intelligent and fully automated LPG monitoring solution for modern smart environments.

6. REFERENCES

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