Journal of IoT in Social, Mobile, Analytics, and Cloud (ISSN: 2582-1369)
www.irojournals.com/iroismac/

Automated LPG Monitoring and Rebooking System using IoT- A Review

Rajkumar S.[1], Venkatanathan S.[2], Prasanth P.[3]

[1]Assistant Professor, [2,3]Student, Department of Information Technology,Velammal Engineering College, Chennai, India

E-mail: [2]Venkatanathansrinivasan1@gmail.Com, [3]prashanth2862001@gmail.com

Abstract

LPG (Liquified Petroleum Gas) has become an essential requirement in daily life, as many people rely on it for cooking, fueling vehicles, and more LPG offers a portable, clean, and efficient alternative to traditional fossil fuels, making it especially valuable for rural and urban areas in India. By replacing wood, coal, and other traditional fuels, LPG enhances health, air quality, and overall comfort. To simplify the LPG rebooking process for domestic and commercial use, various applications have been developed. This study presents a brief overview of existing research on LPG monitoring systems and proposes a method for automatic rebooking by monitoring LPG consumption in real-time and triggering an automatic refill request when the gas level reaches a predefined threshold. The system also provides users with notifications and updates about the status of the LPG, further enhancing convenience and reliability.

Keywords: Liquified Petroleum Gas, Automatic Rebooking, Internet of Things, Real-time Monitoring.

1. Introduction

LPG, or liquefied petroleum gas, is a common fuel source used for domestic as well as commercial purposes. However, LPG is a highly flammable gas and can be hazardous if not handled properly. Therefore, it is important to have a reliable monitoring system in place to detect any leaks or abnormalities in the LPG supply. There are many existing systems that

DOI: https://doi.org/10.36548/jismac.2024.3.005
Received: 15.06.2024, received in revised form: 08.07.2024, accepted: 20.07.2024, published: 01.08.2024

enables a real time tracking by sending notification or alarm to intimate the gas leakage. For this the LPG monitoring system typically consists of sensors, control units, and alarms. The sensors can be of different types, such as gas sensors, temperature sensors, or load cells. Gas sensors detect the presence of LPG gas in the air and notifies through a SMS or alarm whenever the level of the gas in the atmosphere exceeds the threshold.[1] The control unit processes the data from the sensors and triggers an alarm or automatic shut-off mechanism if it detects any gas leak or abnormality in the LPG supply.

There are also advanced LPG monitoring systems that use IoT (Internet of Things) [1] technology to provide real-time monitoring and alerts. These systems are connected to the internet and can send notifications to the user's mobile phone or email in case of a gas leak or other abnormalities in the LPG supply. The proposed study presents a brief overview of the existing gas leakage monitoring system and the suggests a method to detect the gas leakage, the level of gas usage in real-time. Additionally, the system sends an automatic refill notification on detecting when the gas level reaches a predefined threshold.

1.1 Objective

- To provide a brief overview of the existing LPG gas leakage and alerting system.
- To suggest a model that enables real-time monitoring of gas usage and automatically generates refill alerts.

2. Related Work

The Internet of Things (IoT) connects everyday devices with embedded technology to the internet, enabling remote monitoring and control [1,8]. IoT's development is driven by advances in AI, sensors, and automation. This research utilizes IoT to detect gas leaks and send alerts to the respective persons, addressing significant safety and environmental risks [2].

This study introduces a ZigBee-based wireless network for gas monitoring, utilizing low-cost, low-power sensors to reliably collect gas level data over a 300-meter range. The study evaluates the system's performance, addresses interoperability challenges, and suggests enhancements for improved remote monitoring, benefiting environmental management and industrial automation [3].

Liquefied Petroleum Gas (LPG) is widely used for cooking in developing countries due to its high calorific value, low emissions, and portability. The research proposes an IoT-based system to detect gas leaks and monitor LPG cylinder levels, providing real-time updates and alerts for refills and potential gas leaks, enhancing safety and convenience [4].

The system presents a wireless sensor network for LPG leakage monitoring using an Arduino Nano microcontroller, gas sensor, and XBee. The system continuously monitors gas levels and detects any potential leaks. Microcontrollers are utilized for data processing and controlling sensor operations. The XBee sends data from the gas sensor to the monitoring system, which displays the values on a LabView GUI [5].

LPG gas leakage is monitored by developing a smart electronic system equipped with NodeMCU and ESP8266. The system triggers alarms and sends SMS alerts when leaks or threshold exceedances are detected, displaying data on a web server and an LCD for real-time monitoring [6].

The smart system for monitoring gas leakages is modeled using sensors, microcontrollers, buzzers, and different colored LEDs to indicate the actual situation in the kitchen. The data from the gas sensors is transmitted wirelessly through IoT communication protocols such as Wi-Fi to the users. When a gas leak is detected, the system triggers alerts through various means such as SMS, email, or mobile app notifications to notify users [7].

The gas sensors designed for LPG detection within an IoT architecture continuously monitor the gas level using load sensors and notify the user via SMS and LCD. Additionally, the system forwards an automatic refill request using GSM [9].

The objective of this research is to create a system that can identify gas leaks and notify users through status displays and alarms. Moreover, it immediately closes the gas supply valve as a key safety precaution to reduce the possibility of explosions caused by gas leaks and improve overall safety [10].

The IoT-based system monitors various aspects of LPG cylinders, keeping consumers updated through a mobile application. The system also predicts the average number of days the LPG cylinder will last based on the consumer's consumption pattern [11].

LPG leakage detection has become a necessary requirement to ensure safety at homes and in industries. Additionally, the automatic refill request reduces the need for manual tracking and enhances convenience [12,13]. Therefore, the proposed study aims to develop a system capable of monitoring gas leakage, alerting users, and forwarding an automatic refill request through real-time monitoring of the gas level.

3. Challenges in Existing System

Despite its use, the existing LPG monitoring and alert systems suffer from several challenges, including false alarms, limited coverage, and high costs of design and implementation. To address these issues, sensors need to be properly calibrated, and more affordable LPG monitoring systems using cost-effective components should be considered. Therefore, the proposed study suggests a model that addresses these challenges and includes an automatic refill request initiator through real-time monitoring of the gas level.

4. Proposed System

The proposed method aims to present a cost-effective, energy-efficient, and fault-tolerant LPG monitoring system designed to address the challenges found in existing systems. Additionally, the system utilizes a load cell to track the level of LPG consumption and sends alerts to the concerned person when the level falls below a predefined threshold. The Figure.1 below shows the overall architecture of the proposed.

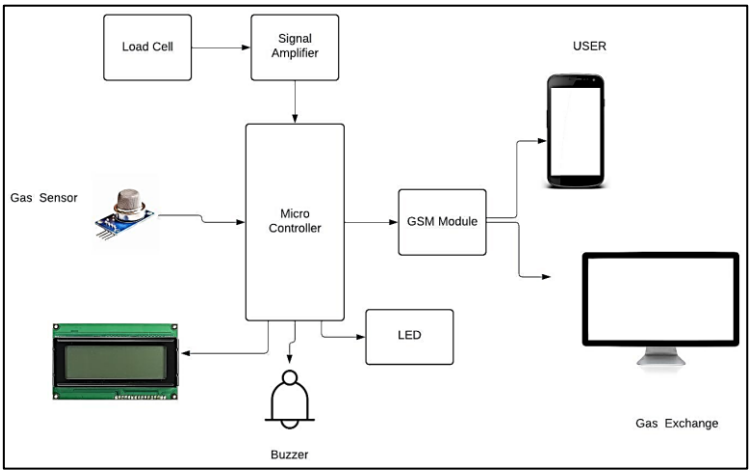

Figure 1. Proposed LPG Rebooking System

The Table 1 shows the hardware components used in the proposed work

Table 1. Hardware Components

S.No	Hardware Components
1	STM32F103 Microcontroller
2	INA125 Instrumentation Amplifier
3	MQ-2 Gas Sensor
4	SIM900 GSM Module
5	Buzzer
6	LED
7	LCD display
8	Power supply
9	TAL220-50kg (Load Cell)

4.1 Working

The proposed system continuously monitors the weight of the LPG cylinder using a load cell and incorporates gas sensors for enhanced detection capabilities. If the load cell detects changes in weight due to gas consumption or a potential leak, the microcontroller processes this data to identify the issue. In the event of a gas leak, the microcontroller triggers a buzzer to provide an audible alarm and sends an SMS alert to a pre-configured phone number of the user and the gas exchange using the GSM module. The GSM module is connected to the microcontroller and handles the SMS notifications. The system operates on a power supply, which can be a battery or mains power, based on the application. To further improve the system's accuracy and reliability, additional sensors, such as temperature sensors and gas sensors, can be integrated.

4.2 Current Progress

The proposed system in its current phase has finalized the components for the LPG monitoring and rebooking system. Future work will focus on developing a hardware prototype and creating an application using ThingSpeak to provide regular updates on the gas level.

5. Conclusion and Future Work

In conclusion, an LPG monitoring and rebooking system is an essential safety feature that helps prevent gas leaks and ensures gas levels are maintained within safe limits while reducing manual tracking and human intervention in rebooking. The system utilizes sensors to monitor gas levels, collects and analyzes data, generates alerts when necessary, and prompts users to take appropriate action. By implementing this system, users can enjoy the benefits of LPG with minimized risks associated with its storage and use. Future work will focus on the implementation and deployment of the proposed system at the prototype level with mobile application. These advancements aim to enhance the safety, efficiency, and convenience of LPG use, benefiting both consumers and the environment

References

[1] Nalayini, C. M., P. Sreemathi, and B. Nanditha. "Deterrence of Accident Using IoT." Journal of Trends in Computer Science and Smart Technology 4, no. 2 (2022): 96-105.

[2] Joshi, Sayali, Shital Munjal, and Uma B. Karanje. "Gas Leakage Detection and Alert System using IoT." International Journal of Scientific Research in Science and Technology (2019). 6(2): 445 -450.

[3] Coboi, Alberto, Minh T. Nguyen, Kien T. La, and Thang C. Vu. "Wireless Sensor Network Based Gas Monitoring System Utilizing ZigBee Technology." Journal of Electronics and Electrical Engineering (2023): 190-207.

[4] Oo, Zaw Lin. "IoT based LPG gas level detection & gas leakage accident prevention with alert system." Balkan Journal of Electrical and Computer Engineering 9, no. 4 (2021): 404-409.

[5] Mujawar, T. H., V. D. Bachuwar, M. S. Kasbe, A. D. Shaligram, and L. P. Deshmukh. "Development of wireless sensor network system for LPG gas leakage detection system." International Journal of Scientific & Engineering Research 6, no. 4 (2015): 558-563.

[6] Mahfuz, Nagib, Shawan Karmokar, and Md Ismail Hossain Rana. "A Smart Approach of LPG Monitoring and Detection System Using IoT." In 2020 11th International

Conference on Computing, Communication and Networking Technologies (ICCCNT), Kharagpur, India IEEE, 2020. 1-4.

[7] Pudugosula, Harika. "Automatic smart and safety monitoring system for kitchen using Internet of Things." In 2019 International Conference on Intelligent Computing and Control Systems (ICCS), Madurai, India. IEEE, 2019.

[8] Satheeskanth, N., S. D. Marasinghe, R. M. L. M. P. Rathnayaka, A. Kunaraj, and J. Joy Mathavan. "IoT-based integrated smart home automation system." In Ubiquitous Intelligent Systems: Proceedings of ICUIS 2021, Springer Singapore, 2022.10. Abdul Rahman, "Integration of Smart LPG Monitoring System with Smart Home Automation“, IEEE Access ,vol.7,no.9,2020. 341-355.

[9] Raj, Arun, Athira Viswanathan, and T. Athul. "LPG gas monitoring system." International Journal of Innovative Technology and Research 3, no. 2 (2015): 1957-1960.

[10] Loshali, Geeta, Rohit Basera, Lalit Darmwal, and Sachin Varma. "Design & Implementation of LPG Gas Detector using GSM Module." International Journal on Emerging Technologies 8, no. 1 (2017): 98-100.

[11] Srivastava, Arpit Kumar, Shivam Thakur, Ashutosh Kumar, and Arpit Raj. "IoT based LPG cylinder monitoring system." In 2019 IEEE International Symposium on Smart Electronic Systems (iSES)(Formerly iNiS), Rourkela, India. IEEE, 2019. 268-271.

[12] Olorunfemi, B. J., D. E. Adenuga, and A. E. Olumilua. "Development and Performance Evaluation of a Household Liquefied Petroleum Gas Monitoring and Leakage Detector." Covenant Journal of Engineering Technology (2020).

[13] Chawla, Sachin, and Hunny Chawla. "A Comparative Study on Monitoring of LPG Gas Cylinders to Prevent Hazards." In 2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), Greater Noida, India. IEEE, 2023. 1479-1484.