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# Smart Gas Booking and Safety System Using IoT

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## Abstract

*The integration of IoT enables real-time communication between the system and end users, ensuring prompt action in emergencies. With increasing incidents related to LPG leaks, this project aims to minimize casualties and property damage through timely alerts. The system's real-time monitoring and automation streamline gas booking and enhance household safety, making it a vital contribution to smart home technology.Fire accidents due to LPG leakage claim numerous lives annually in India. According to statistics, around 17% of domestic fire incidents are caused by gas leaks. This system not only aims to provide timely alerts to users but also alerts nearby authorities to prevent damage escalation. By leveraging the Internet of Things, the framework ensures data is communicated* effectively, reducing response time significantly.

*This paper presents an integrated IoT-based system for smart LPG cylinder booking and real-time gas leakage detection. The system automates cylinder refill requests based on weight sensing and alerts users of potential gas leaks using the MQ5 sensor. Additionally, it provides instant notifications via SMS and mobile applications while triggering alarms to ensure household safety. A prototype built using ESP32 and Raspberry Pi demonstrates a low-cost, scalable approach with effective results in real-time alerting and safety automation.*

Keywords: IoT, LPG, ESP32, MQ5, Gas Safety, Load Cell, Automated Booking, Gas Leakage Detection

## I. Introduction

Other related works primarily focused on standalone leakage detection or manual booking systems. GSM-based solutions, while functional, lacked the efficiency of integrated, network-based systems. Our research bridges this gap by combining automated booking and real-time leakage detection with cloud and app support for effective monitoring.

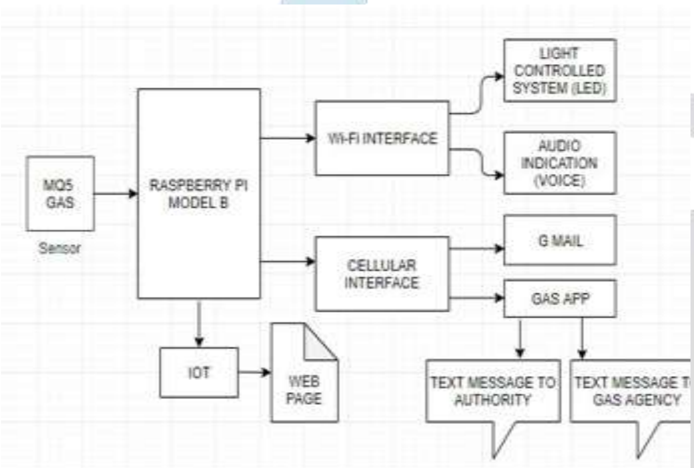
Liquefied Petroleum Gas (LPG) is widely used in residential kitchens across India. However, many households still face challenges with timely gas booking and undetected leaks, often resulting in accidents and even fatalities. The integration of IoT with gas cylinders aims to automate monitoring, enhance safety, and reduce user intervention in emergencies. This paper proposes a Smart Gas Booking and Safety System (SGBSS) leveraging sensors and embedded systems for intelligent detection and response.

## II. Literature Review

Recent advancements in gas safety systems have focused on integrating IoT technologies with cloud-based platforms to enable smarter and more responsive solutions. Several studies have explored hybrid systems that combine gas leakage detection with automated ventilation or fire suppression mechanisms, contributing to the development of comprehensive smart home safety frameworks. Researchers like Patel et al. (2021) have demonstrated the use of cloud platforms such as Firebase and AWS IoT Core for real-time data logging and remote monitoring, allowing users to track gas usage and system status from anywhere. Furthermore, machine learning approaches have been introduced in recent literature to analyze usage patterns and detect anomalies, paving the way for predictive maintenance and intelligent alert systems. Compared to traditional GSM-based models, these IoT-enabled systems offer faster response times, remote accessibility, and better scalability. Additionally, low-power embedded systems like the ESP32 have become popular in such applications due to their energy efficiency and integrated Wi-Fi/Bluetooth capabilities, making them ideal for continuous safety monitoring in residential settings.

## III. System Design & Working

An additional future enhancement includes integrating AI algorithms for anomaly detection based on historical data. A mobile robotic platform could be deployed in large facilities or pipelines for leak detection and repair tasks. Cloud dashboards could be expanded to include predictive analytics and usage trend graphs to help users track and optimize gas consumption.




When gas levels drop (as measured by the load cell via HX711), the ESP32 triggers a booking request and sends notifications. The MQ5 sensor continuously scans for gas in the air. Upon detection, it activates the buzzer, flashes LEDs, and sends alerts through SMS or app notifications. A Python script running on the Raspberry Pi controls sensor input, interfaces with a web dashboard, and logs data. Future upgrades can include automated valve shut-off, cloud integration (Firebase), and voice assistant compatibility.

## IV. Results & Discussion

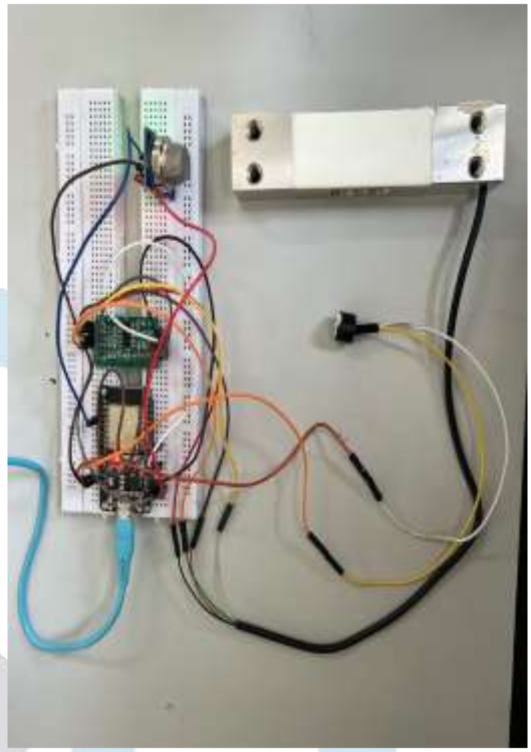
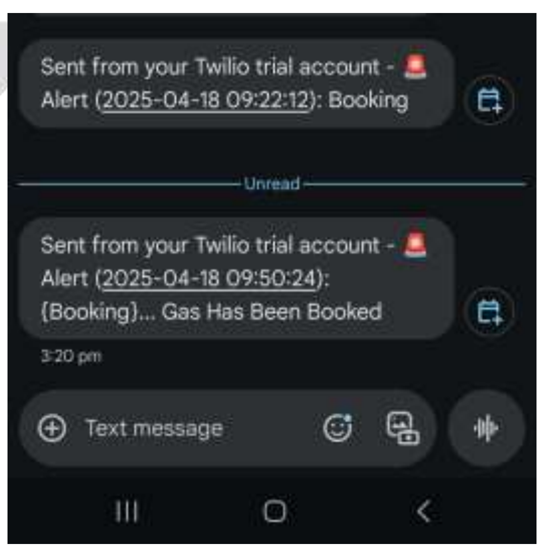


Figure: System Setup Output (Prototype Working)

**Sensor Response Time**: During testing, the MQ5 gas sensor demonstrated a swift response to the presence of LPG in the surrounding environment. When exposed to gas concentrations exceeding the 700 ppm threshold, the sensor triggered the alert mechanism within an average of 5 to 7 seconds. This included activation of the buzzer, LED indicators, and the transmission of alerts via SMS and the mobile application. The low latency in detection and notification ensures timely response, which is critical in preventing fire hazards. The system's efficiency in real-time detection confirms its suitability for household use where rapid action is essential.



## V. Conclusion

The proposed Smart Gas Booking and Safety System provides a dual advantage of safety and convenience. By leveraging IoT and embedded systems, it ensures proactive gas leak detection and hassle-free booking automation. The system's modular design makes it adaptable for domestic as well as small commercial settings. Test results confirm the system's real-time performance and reliability."

## VI. Future Scope

1. AI-Powered Leak Prediction: Incorporate machine learning to predict potential leaks before they occur, using historical sensor data patterns.

2. Voice Assistant Integration: Enable booking and system status checks through Google Assistant or Alexa (e.g., "Check gas level" or "Book a new cylinder").

3. Smart Shutoff Mechanism: Design an automated valve that cuts off gas supply if a leak is detected — connected to ESP32 for instant control.

4. Energy Harvesting Module: Use small solar panels or thermal energy from the kitchen to power the device — make it energy independent.

6. Scalability to Industrial Use: Adapt the system for use in restaurants, factories, or pipeline facilities with larger, multi-point gas monitoring.

## VII. References

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