

Smart LPG Gas Monitoring and Leakage Detection System Using IoT and Android Application

**Ms.Bhadane Pranjal Prashant¹, Ms.Bhandare Purva Prakash²,
Ms.Ghaydar Sanskruti Kiran³, Ms.Bagul Parita Omprakash⁴,
Mrs.Sonali Sachin Jadhav⁵**

^{1,2,3,4,5}Department of Information Technology

^{1,2,3,4,5}MVP's Rajarshi Shahu Maharaj Polytechnic, Gangapur Road, Nashik, Maharashtra, India

Abstract:

Liquefied Petroleum Gas (LPG) is widely used for domestic cooking and other applications. However, gas leakage and unexpected cylinder exhaustion can create safety risks and inconvenience. Conventional LPG cylinders generally require manual monitoring to identify gas leakage and estimate the remaining gas quantity. This paper presents a Smart LPG Gas Monitoring and Leakage Detection System that integrates sensor-based monitoring, Internet of Things (IoT) technology, and an Android application. The proposed system detects LPG leakage using a gas sensor and provides an alert through the mobile application. Cylinder gas levels are monitored using weight measurements, enabling the estimation of remaining gas quantity and daily consumption. Based on recorded usage patterns, the system predicts the expected cylinder exhaustion date and generates an advance notification approximately two days before the estimated exhaustion. The Android application provides a live monitoring dashboard, consumption history, and analytical reports. The proposed approach aims to improve household safety, support efficient LPG usage monitoring, and reduce inconvenience caused by unexpected cylinder exhaustion.

Keywords: LPG Gas Monitoring, Gas Leakage Detection, Internet of Things, Android Application

1 INTRODUCTION

Liquefied Petroleum Gas (LPG) is commonly used in residential kitchens and commercial environments. Although it is a convenient fuel, leakage can create hazardous conditions. Users may also find it difficult to estimate the remaining gas in a cylinder and may discover that a cylinder is empty only when it is needed. Manual inspection does not normally provide continuous leakage alerts, a structured consumption history, or an estimate of the expected exhaustion date.

The proposed system combines gas sensing, cylinder weight measurement, wireless communication, and an Android application. It is intended to provide leakage alerts, estimate remaining LPG quantity, record daily consumption, and predict cylinder exhaustion from observed usage. The application serves as the interface for live readings, notifications, history, and analytics.

2 PROBLEM STATEMENT

Conventional LPG monitoring methods provide limited support for continuous leakage detection and measured consumption tracking. Users may not receive timely mobile alerts when a leakage condition is detected, and remaining cylinder quantity is often estimated manually. Unexpected exhaustion can interrupt

routine activities. A monitoring system is therefore proposed to combine leakage detection, weight-based quantity estimation, consumption history, exhaustion prediction, and Android notifications.

3 OBJECTIVES

1. To detect potential LPG leakage using a suitable gas sensor.
2. To provide leakage notifications through an Android application.
3. To estimate remaining LPG quantity using cylinder weight measurements.
4. To calculate and record daily LPG consumption.
5. To predict the expected cylinder exhaustion date using historical usage.
6. To generate an advance notification approximately two days before the predicted exhaustion date.
7. To provide a live monitoring dashboard, consumption history, and analytics reports.

4 PROPOSED SYSTEM

The proposed system contains a gas leakage sensing unit, a cylinder weight measurement unit, a microcontroller, a communication mechanism, a backend or data-processing component, and an Android application. The gas sensor monitors the surrounding environment for a response associated with LPG. When a configured threshold is exceeded, the controller identifies a potential leakage condition and initiates the alert process.

A load cell and signal-conditioning module measure cylinder weight. After subtracting the known empty-cylinder weight, the system estimates the remaining LPG quantity. Measurements are transmitted to the data-processing component, where usage history and estimated exhaustion are calculated. The Android application displays the latest readings, leakage status, consumption information, estimated exhaustion date, and reports.

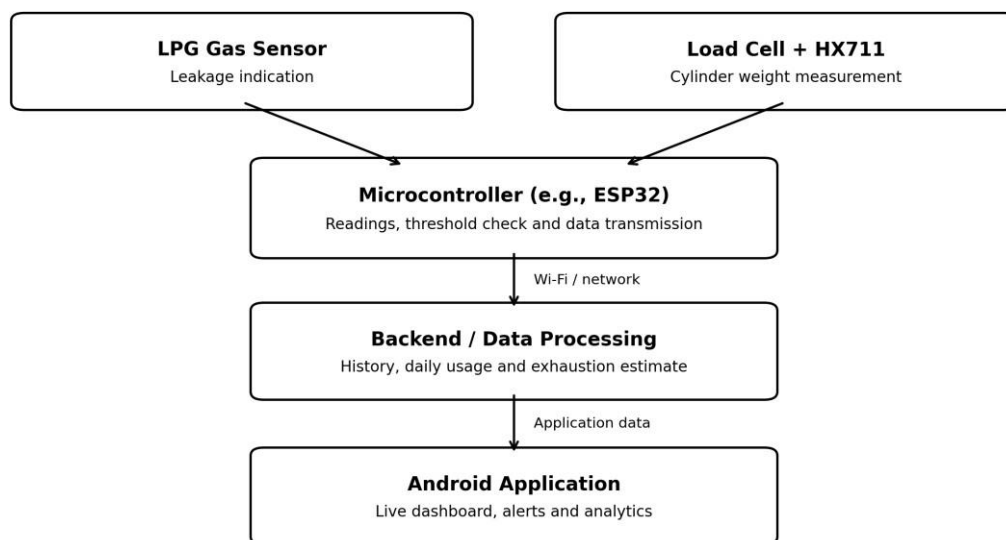


Figure 1. Proposed System Architecture

Figure 1. Proposed System Architecture

5 SYSTEM COMPONENTS

Component	Purpose	Output / Role
LPG gas sensor	Detects a sensor response associated with LPG leakage	Potential leakage indication
Load cell and HX711	Measures cylinder weight	Gross weight reading
Microcontroller	Reads sensors and coordinates data transfer	Processed sensor readings
Backend / data processing	Stores readings and calculates usage estimates	History and exhaustion estimate
Android application	Presents status and notifications	Dashboard, alerts, analytics

Table 1. Proposed System Components and Their Roles

6 METHODOLOGY

6.1 Gas Leakage Detection

The gas sensor reading is compared with a configured threshold. If the threshold condition is met, the system records a potential leakage event and sends an alert through the available communication infrastructure. The threshold must be selected and validated for the chosen sensor and operating environment. A sensor reading should not be treated as a certified gas-concentration measurement unless the sensor has been appropriately calibrated.

6.2 Remaining Gas Level Estimation

The remaining LPG quantity is estimated from the measured gross cylinder weight and the known empty-cylinder weight. The calculation is expressed as follows:

Remaining LPG Quantity = Measured Gross Weight – Empty Cylinder Weight

The remaining percentage can be estimated by dividing the remaining quantity by the nominal LPG capacity and multiplying by 100. The result depends on correct tare-weight information and load-cell calibration.

Remaining Gas Percentage = (Remaining LPG Quantity ÷ Nominal LPG Capacity) × 100

6.3 Daily Consumption Monitoring

Daily consumption is estimated by comparing the measured LPG quantity at two appropriate times. For a daily interval, the previous quantity minus the current quantity gives the estimated amount consumed during that interval.

Daily LPG Consumption = Previous Gas Quantity – Current Gas Quantity

The readings should be stored with timestamps. Filtering and validation may be required to reduce errors caused by unstable measurements or changes in cylinder placement.

6.4 Cylinder Exhaustion Prediction

The estimated exhaustion date is calculated from the remaining LPG quantity and average daily consumption. Average consumption can be calculated over a selected period using recorded usage data.

Average Daily Consumption = Total LPG Consumed During the Selected Period ÷
 Number of Days Estimated Remaining Days = Remaining LPG Quantity ÷ Average
 Daily Consumption

6.5 ANDROID APPLICATION

The Android application is intended to display the latest leakage status, estimated remaining LPG quantity, daily consumption, predicted exhaustion date, and consumption history. It also provides leakage notifications and an advance exhaustion reminder. The actual notification mechanism and dashboard behavior should be validated during implementation testing.

7 FUNCTIONAL REQUIREMENTS

ID	Requirement	Description
FR-1	Leakage detection	Detect a potential leakage condition from gas sensor readings.
FR-2	Mobile alert	Notify the user through the Android application when leakage is detected.
FR-3	Gas level estimation	Estimate remaining LPG quantity from cylinder weight.
FR-4	Daily consumption	Calculate and store usage measurements over time.
FR-5	Exhaustion prediction	Estimate the expected cylinder exhaustion date from usage history.
FR-6	Advance reminder	Provide a reminder approximately two days before predicted exhaustion.
FR-7	Live dashboard	Display current system readings and status.
FR-8	History and analytics	Show recorded consumption and analytical summaries.

Table 2. Functional Requirements

8 PROPOSED TESTING AND EVALUATION

The system should be evaluated using repeatable tests. Results must be recorded from the actual prototype; no numerical performance claims are made in this draft.

Test Area	Evaluation Method	Metric to Record
Leakage detection	Test under controlled and safe conditions using an appropriate procedure	Detection outcome and alert latency
Weight measurement	Compare system readings with a reference weighing scale	Measurement error

Consumption estimate	Compare calculated usage with measured quantity changes	Consumption-estimation error
Exhaustion prediction	Compare predicted exhaustion with observed usage over time	Prediction error in days
Notifications	Check delivery under normal network conditions	Delivery success and latency
Dashboard	Verify that displayed values match stored readings	Data consistency

Table 3. Proposed Testing and Evaluation Plan

9 EXPECTED OUTCOMES

The system is expected to provide a unified view of potential leakage status, remaining LPG quantity, daily consumption, and estimated cylinder exhaustion. The application is intended to make consumption history available and notify users when a leakage condition or an approaching exhaustion date is identified. These outcomes must be confirmed through prototype testing before being reported as achieved results.

10 ADVANTAGES

- Provides a supplementary method for monitoring potential LPG leakage.
- Supports weight-based estimation of remaining cylinder contents.
- Maintains a structured consumption history.
- Estimates the likely cylinder exhaustion date from usage patterns.
- Provides mobile access to readings, alerts, and analytics.

11 LIMITATIONS

Leakage detection depends on sensor characteristics, placement, calibration, and environmental conditions. Remaining gas estimation depends on load-cell accuracy and correct cylinder tare weight. Exhaustion prediction may be inaccurate when usage varies or insufficient history is available. Notifications depend on functioning hardware, communication, backend services, and mobile-device settings. This system must be treated as a supplementary monitor and not as a replacement for certified LPG safety equipment or established emergency procedures.

12 CONCLUSION

The proposed Smart LPG Gas Monitoring and Leakage Detection System integrates sensor-based leakage monitoring, cylinder weight measurement, consumption tracking, exhaustion prediction, and an Android application. The system is designed to provide timely information about potential leakage and the likely remaining operating period of a cylinder. Its practical value must be established through controlled testing of sensor behavior, weight accuracy, notification delivery, and prediction performance.

13 FUTURE SCOPE

Potential extensions include automatic gas supply shut-off, SMS alerts, cylinder booking integration, and an administrative web dashboard. These features are not part of the currently confirmed scope and should be described as implemented only if they are developed and tested.

REFERENCES:

1. Zhengzhou Winsen Electronics Technology Co., Ltd., “MQ-2 Semiconductor Sensor for Flammable Gas,” *MQ-2 Sensor Datasheet*. Available: <https://www.winsen-sensor.com/d/files/manual/mq-2.pdf>
2. Espressif Systems, “ESP32 Series Datasheet.” Available: https://documentation.espressif.com/esp32_datasheet_en.pdf
3. SparkFun Electronics, “Load Cell Amplifier HX711 Breakout Hookup Guide.” Available: <https://learn.sparkfun.com/tutorials/load-cell-amplifier-hx711-breakout-hookup-guide/all/>
4. Google, “Get Started with Firebase Cloud Messaging in Android Apps,” *Firebase Documentation*. Available: <https://firebase.google.com/docs/cloud-messaging/android/get-started>
5. Google, “About Notifications in Views,” *Android Developers Documentation*. Available: <https://developer.android.com/develop/ui/views/notifications>