PROJECT ABSTRACT

IoT LPG Cylinder Level Monitor with Refill Booking Alerts

A weight-based IoT monitor for domestic LPG cylinders: a 50 kg load cell under a steel platform, read by an ESP32 through an HX711 24-bit ADC, tracks gas level by weight, estimates days remaining from average consumption, and fires low-level alerts with a one-tap refill-booking reminder on a companion web dashboard. Includes the prototype, ESP32 firmware, dashboard and full viva kit.

Project type: Hybrid (hardware + software)

Availability: Built to order

Suitable branches: Electronics / E&TC, Electrical, IoT & Embedded

Technologies: ESP32, 50 kg load cell, HX711 ADC, strain-gauge weighing, 16x2 LCD, HTML/CSS/JS dashboard, deep-sleep power design, Wi-Fi

Price: Request a quotation

Prepared by Projectech · projectech.in — for academic project reference.

1. Abstract

This project presents an IoT-based LPG cylinder level monitor that tracks gas remaining by weight instead of guesswork. A 50 kg single-point load cell mounted under a steel weighing platform supports the cylinder; an HX711 24-bit ADC digitises the strain-gauge signal; an ESP32 converts weight into a gas-level percentage by subtracting the stored tare and dividing by the refill size, and estimates days remaining from the household's rolling average consumption. When the level crosses the alert threshold (20% default, 10% option), the companion web dashboard fires a low-level alert and a one-tap button sets a refill-booking reminder. A 16x2 LCD shows live weight and status on the rig itself. The system is a monitor only — it never actuates the cylinder valve and is not a gas-leak detector.

2. Problem Statement

Households discover an empty cylinder at the worst possible moment — mid-cooking — because there is no reliable way to see how much gas is left. Lifting the cylinder to judge its weight is the common workaround, but a 14.2 kg domestic cylinder's steel body weighs roughly 15 kg on its own, so a human estimate is nearly meaningless. Late or emergency refills are the result. This project replaces the guess with a measurement: continuous weighing of the cylinder, converted into a gas percentage and a days-remaining estimate, with alerts that arrive while there is still time to book a refill.

3. Objectives

- Measure total cylinder weight continuously using a 50 kg load cell and HX711 ADC.
- Compute gas level (%) from weight minus tare, for 14.2 / 5 / 19 kg cylinder sizes.
- Estimate days remaining from a rolling average of daily consumption.
- Fire low-level alerts at a configurable threshold and log them until refill.
- Provide a one-tap refill-booking reminder on the companion web dashboard.
- Show live weight and status on a local 16x2 LCD.
- Keep the rig passive and safe: no valve actuation, no mains near the cylinder.

4. System Architecture

The system is organized in three layers. The **sensing layer** is the steel weighing platform on a 50 kg single-point load cell, wired to an HX711 24-bit ADC module. The **edge layer** is the ESP32 running Arduino firmware: it reads the HX711 at gain 128 with moving-average filtering, applies the two-point calibration factor, stores the tare in flash, computes gas level and days-remaining, updates the 16x2 LCD, and deep-sleeps between 15-minute reading cycles. The **application layer** is the GasWatch companion web dashboard (single-file HTML/CSS/JS) served by the ESP32 over Wi-Fi, showing the fill graphic, gas remaining in kg, days-left counter, 30-day usage chart with threshold line, node status and the refill-booking button.

5. Technologies Used

- ESP32 (Arduino framework)
- 50 kg single-point load cell
- HX711 24-bit ADC module
- Strain-gauge weighing
- 16x2 LCD (I2C)
- HTML/CSS/JS companion dashboard
- Deep-sleep power design
- Wi-Fi IoT node

6. Working Principle

- The cylinder stands on the steel platform supported by the load cell; the load cell wires feed the HX711 amplifier.
- The ESP32 reads the HX711 at gain 128 (channel A), filters the samples, and converts counts to kilograms with the calibration factor.
- On first use the buyer stores the tare (empty cylinder weight) in flash; gas remaining = total weight – tare.
- Gas percentage = gas remaining ÷ refill size; days remaining = gas remaining ÷ rolling average daily use.
- The ESP32 deep-sleeps between readings, waking every 15 minutes to sample, update the LCD and serve the dashboard.
- Crossing the alert threshold fires the dashboard alert banner and latches the event in the refill-alert log.
- The "Book refill" button sets a booking reminder; a weight jump back near full marks the refill completed.

7. Key Features

- Weight-based gas level from a 50 kg load cell: firmware subtracts tare and divides by refill size.
- Days-remaining estimate with predicted refill date from rolling average consumption.
- Configurable low-level alerts (20% default, 10% option) with a latched alert history.
- One-tap refill-booking reminder that logs the booking event.
- Live web dashboard: fill graphic, gas kg, days-left, 30-day chart, node status.
- 16x2 LCD on the rig showing live weight and STABLE/ALERT status.
- Buyer-run two-point calibration procedure included for honest accuracy.

8. Applications

- Domestic kitchens using 14.2 kg or 5 kg LPG cylinders.
- Hostels, canteens and small restaurants on 19 kg commercial cylinders.
- Elderly or remote households where a surprise empty cylinder is a real hardship.
- Dormitories and paying-guest accommodations managing multiple cylinders.

9. Prerequisites

- Basic knowledge of embedded systems and sensor interfacing.
- Understanding of strain gauges, ADC resolution and calibration.
- Basic Arduino/C++ programming.
- A known reference weight (e.g. a weighed water bottle) for the two-point calibration.

- Stable Wi-Fi where the cylinder stands, for dashboard access.

10. Limitations

- Monitor only: it never actuates the cylinder valve and cannot shut off gas.
- Not a gas-leak detector: it measures weight, not gas concentration in air.
- The ~10 g resolution is a design target reached after filtering and the buyer's own calibration — not a measured claim until calibrated on the built unit.
- The cylinder must stand undisturbed on the platform; moving it during a reading skews that sample.
- Days-remaining assumes consumption near the recent average; sudden usage changes drift the estimate until the average relearns.
- Dashboard reach is limited by Wi-Fi range; no GSM/SMS fallback in the standard build.
- Readings are 15 minutes apart by design — this is not a real-time safety system.

11. Future Scope

- GSM/SMS alert module for homes without reliable Wi-Fi.
- Direct gas-agency booking API integration instead of a reminder.
- Multi-cylinder management view for hostels and restaurants.
- Optional MQ-series gas-leak sensor as a companion safety layer.
- Solar trickle-charging for the node battery.

12. Conclusion

The IoT LPG Cylinder Level Monitor replaces cylinder-shaking guesswork with a continuous, honest measurement. A load cell, an HX711 and an ESP32 turn the oldest trick in the book — weighing the cylinder — into a modern IoT system with gas percentage, days-remaining estimates and timely refill alerts, all demonstrable on the rig's LCD and the GasWatch dashboard. The project is explicit about its boundaries: a passive monitor, never a valve controller or a leak detector, with accuracy claims tied to the buyer's own calibration run.