PROJECT ABSTRACT

IoT Gas Cylinder Weight Monitor using Load Cell

A 50 kg load cell with HX711 amplifier and ESP32 weighs an LPG cylinder continuously, tracking net gas, daily consumption and refill events with a kitchen LCD and web dashboard. Delivered built-to-order with firmware, platform guide, calibration procedure, report, PPT and viva kit.

01. Title

IoT Gas Cylinder Weight Monitor using Load Cell

02. Introduction / Background

The honest way to know how much LPG remains in a cylinder is to weigh it: the tare weight is stamped on the cylinder body, so gross weight minus tare equals gas remaining. Households instead shake the cylinder or guess — and discover it is empty mid-cooking. A load cell makes weight a continuous, logged measurement. A strain-gauge bar cell under a steel platform flexes microscopically under the cylinder; the HX711 24-bit amplifier digitizes that signal for a microcontroller that applies calibration and tare, tracks consumption, detects refills and raises reorder reminders. This project builds the complete appliance: platform, electronics, kitchen LCD and dashboard.

03. Problem Statement

LPG users have no convenient, trustworthy indication of remaining gas, leading to surprise empty cylinders and emergency refill logistics. Manual weighing is impractical as a habit. The project addresses this with a permanent under-cylinder weighing platform that reports live weight locally and net-gas analytics remotely — calibrated with a real known-weight procedure rather than assumed accuracy, and explicit about what it cannot do (it is not a certified leak detector).

04. Objectives

- Build a steel weighing platform with a 50 kg bar load cell that lives permanently under the cylinder.
- Interface the load cell via HX711 to an ESP32 with averaging, tare and calibration-factor handling.
- Show live weight on a local 16×2 LCD and publish readings to a dashboard over MQTT.

- Compute net gas, daily consumption, days-left estimates, refill detection and reorder reminders.
- Document the known-weight calibration procedure and the resulting accuracy honestly.

05. Proposed Methodology

The cylinder stands on the platform; the bar load cell's Wheatstone bridge output is digitized by the HX711 at 24-bit resolution and read by the ESP32 over a two-wire serial interface. Firmware averages multiple samples to reject vibration, applies the buyer's calibration factor (set with a known 5 kg weight) and subtracts the configured tare to yield gross and net weights. The LCD shows live weight; MQTT publishes to the dashboard's gauge, 30-day trend chart and daily consumption bars. A gross-weight jump above 10 kg is logged as a refill; net gas below 20% of a full fill raises the reorder reminder with a days-left estimate from the recent burn rate; abnormally fast drops are flagged for leak checking.

06. System Architecture / Working

- Sensing: 50 kg bar load cell → HX711 24-bit ADC → ESP32 (averaging, calibration, tare).
- Local UI: 16×2 I2C LCD showing live gross/net weight.
- Cloud: MQTT over Wi-Fi to dashboard (gauge, trend, consumption bars, refill history, alert log).
- Logic: refill auto-detection (>10 kg jump), reorder reminder (<20% net), sudden-drop flag.
- Data flow: Weigh → average → calibrate → tare → display + publish → analytics → alerts.

07. Hardware / Software Requirements

- Hardware: 50 kg bar load cell, HX711 module, ESP32, 16×2 I2C LCD, steel plate + hardware for the platform, 5 V USB adapter, known 5 kg reference weight for calibration.
- Software: Arduino IDE / ESP32 core, MQTT broker, web dashboard (HTML/CSS/JS).
- Tools: drill, spanners, soldering station; a hard, level floor for installation.

08. Expected Outcomes

- Working platform reporting gross weight within approximately ±50 g after the documented calibration.
- Local LCD plus dashboard showing net gas, consumption trends and days-left estimates.

- Automatic refill detection and reorder reminders validated in the student's own kitchen trial.
- Report covering strain-gauge theory, HX711 interfacing, calibration math and evaluation results.
- Complete PPT and viva Q&A on load cells, precision ADCs, calibration and tare handling.

09. Applications

- Household LPG monitoring with refill planning.
- Small restaurants and hostels managing multiple cylinders (one unit per cylinder).
- Teaching platform for strain gauges, instrumentation amplifiers and calibration metrology.
- Extension base for weight-based inventory of any containerized consumable.

10. Future Scope

- MQ-series gas sensor fusion for genuine leak detection alongside weight analytics.
- Multi-cylinder management with per-cylinder dashboards and automatic distributor booking API.
- Battery-backed operation with low-power modes for areas with unreliable mains.
- Load-cell temperature compensation for outdoor installations.