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Smart LPG Gas Monitoring and Automatic Booking with Alert System

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Abstract: *In recent years, rapid advancements in IoT and embedded systems have enabled automation in various sectors, including home utilities. One major challenge in households using LPG is determining the level of gas in the cylinder and timely booking of replacements. This paper proposes a smart LPG monitoring system with automatic booking and alert mechanisms. The system continuously monitors the gas level using a load cell and ESP32 microcontroller, processes data via HX711, and sends SMS alerts through a GSM module. A web-based interface allows users to choose between manual or automatic booking modes. The system ensures real-time status updates, making LPG usage more convenient and efficient.*

Keywords: ESP32S, Internet of Things (IoT), GSM Module, Load Cell, Booking Configuration, Web Interface

I. INTRODUCTION

LPG is a crucial utility in households and industries. Traditionally, users rely on guesswork or delayed indications to reorder gas cylinders, leading to interruptions in daily tasks. Internet of Things (IoT) provides a platform to automate monitoring and alert services. The objective of this paper is to design an intelligent, cost-effective system for constant monitoring of LPG levels and facilitating automated or manual booking based on user preference, thus eliminating the need for manual intervention.

II. SYSTEM OVERVIEW

The proposed system continuously measures the weight of the LPG cylinder using a load cell. If the weight falls below a threshold, the system alerts the user via SMS and initiates a booking based on selected mode (manual/auto). A user-friendly web interface displays real-time data and booking history.

2.1 System Architecture

The architecture includes: Load Cell Sensor for weight measurement, HX711 module for analog-to-digital conversion, ESP32S Microcontroller for processing and control, GSM Module for communication, Power supply and voltage regulator, Web-based user interface for configuration and monitoring.

2.2 Presentation Layer (User Interface)

The interface is a dynamic web portal accessible via browsers. It shows: Real-time gas level, Alerts and notifications, Manual/Auto booking mode selection, Booking history and user authentication.

2.3 Application Layer (Backend Logic)

This layer includes: Configuration settings, Weight-to-status logic, Alert triggers, GSM-based message dispatch, Booking control based on threshold evaluation.

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2.4 Data Layer (Database and Storage)

Data is stored securely in cloud/server storage and includes: User profiles, Booking logs, Cylinder status logs, Threshold values and system calibration data.

2.5 AI & Analytics Layer

While the current model uses rule-based decision logic, future versions may incorporate AI to: Predict consumption patterns, Optimize threshold levels dynamically, Enable predictive maintenance alerts.

2.6 Integration Layer

Connects microcontroller data to cloud servers, Pushes alerts to mobile devices using GSM, Interfaces with external services (e.g., distributor APIs for booking).

2.7 Security Layer

User authentication on the web interface, Data encryption for communication, Secure GSM messaging, Safe handling of user preferences and booking data.

III. HARDWARE COMPONENTS

The system uses scalable hardware for real-time analytics and AI processing.

Table 1. Hardware Components Used

S.No	Component	Specification
1	Load Sensor	40kg capacity load cell for weight measurement
2	ESP32S Microcontroller	Dual-core Wi-Fi + Bluetooth-enabled controller
3	GSM Module	SMS sending and communication functionality
4	HX711 Module	Load cell signal amplification and conversion
5	Power Supply Board	12V to 5V regulated DC conversion

IV. SYSTEM OPERATION

The system starts by continuously monitoring the LPG cylinder's weight. Analog values from the load sensor are converted to digital using HX711 and processed by ESP32. Based on the pre-defined threshold and the user's selected booking mode: In manual mode, SMS alerts notify the user, who must log in and confirm booking. In auto mode, booking is placed automatically, and confirmation is sent via SMS.

V. RESULTS

The prototype system was successfully implemented and tested. Key outcomes: Real-time gas monitoring via webpage, Accurate detection of gas threshold, SMS alerts to registered mobile numbers, Seamless manual and auto booking options, Reduced need for manual checking or dealer calls.

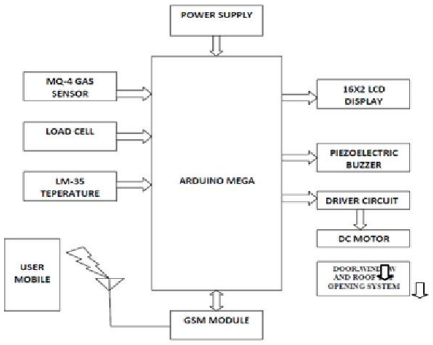

Fig 1: Block Diagram of Proposed System

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VI. CONCLUSION

The smart LPG monitoring system enhances user convenience by automating gas level detection and booking. The system supports real-time alerts, booking configuration, and a user-friendly interface. Future developments may integrate AI for predictive analytics and support for gas leakage detection, making it more comprehensive and secure.

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