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ANDROID BASED GAS BOOKING SYSTEM AND LEAKAGE DETECTION USING IOT

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ABSTRACT

Liquefied Petroleum Gas (LPG) is widely used in households and industries, but gas leakage and the unavailability of gas cylinders pose significant safety and convenience challenges. This project presents an IoT-based Gas Leakage Detection and Automatic Gas Booking System that enhances safety and automation. The system integrates Arduino Uno and ESP32 microcontrollers to monitor gas levels and detect leakage in real-time.

A Load Cell is employed to measure the weight of the gas cylinder, ensuring continuous monitoring of gas consumption. When the weight of the cylinder drops below a predefined threshold, the system utilizes the GSM module to automatically book a new gas cylinder by sending an SMS notification to the authorized distributor. For safety measures, an MQ-05 Gas Sensor is incorporated to detect any gas leakage. Upon detecting leakage, the system promptly sends an SMS alert to an authorized mobile number, allowing immediate action to prevent hazards.

The proposed system enhances safety, reduces manual intervention, and ensures the timely availability of gas cylinders. It also provides a cost-effective and scalable solution for households and industries. By leveraging IoT-based automation, the system significantly improves efficiency in gas booking and safety management, contributing to smart home and industrial applications.

KEYWORDS-

MQ-05 gas sensor, GSM module, Gas weight monitoring module, SMS alert, Load Cell, IOT

I.INTRODUCTION

In recent years, the integration of the Internet of Things (IoT) in household and industrial safety systems has gained significant attention. One of the critical concerns in residential and commercial sectors is gas booking automation and leakage detection. Conventional methods of detecting gas leaks and manually booking gas cylinders often result in safety hazards and inconvenience. Address these challenges, this project present Android Based Gas Booking System and Leakage Detection using IOT.

The system utilizes Arduino Uno and ESP32 microcontrollers to efficiently monitor gas levels and detect leakage in real-time. The MQ-05 gas sensor is employed to sense any gas leakage, and upon detection, an automated SMS alert is sent to an authorized mobile user via the GSM module, ensuring timely intervention. Additionally, a load cell is incorporated to continuously measure the weight of the gas cylinder. When the cylinder weight falls below a predefined threshold, the system automatically initiates a gas cylinder booking request through GSM communication.

This smart gas management system enhances safety by preventing potential gas-related accidents and improves convenience by automating the gas booking process.

The use of IoT technology ensures real-time monitoring, early detection of leaks, and seamless gas booking, making it a reliable solution for both residential and industrial applications.

II. PROBLEM STATEMENT

LPG (Liquefied Petroleum Gas) is widely used in households and industries for cooking and heating purposes. However, managing gas cylinder bookings efficiently and detecting gas leaks in real time are major concerns for users and suppliers. Traditional gas booking methods are time-consuming, and undetected gas leaks can lead to hazardous situations, including explosions and health risks.

The existing gas booking process often requires manual intervention, leading to delays and inconvenience for users. Additionally, gas leakage incidents frequently go unnoticed until significant damage occurs. There is a need for an intelligent system that integrates gas booking with real-time leakage detection to ensure safety and convenience.

An Android-based gas booking system integrated with an IoT-enabled gas leakage detection mechanism can address these challenges effectively. The proposed system will include the following features:

Gas Booking System: Users can book gas cylinders through a mobile application. The app will provide real-time stock availability and estimated delivery time. Automatic booking reminders based on usage patterns. Payment integration for seamless transactions.

Gas Leakage Detection: Sensors will monitor gas levels and detect leaks in real time. Alerts will be sent via mobile notifications, SMS, and email in case of a leak. Automatic shut-off mechanism to prevent accidents. Integration with emergency services for quick response.

Enhanced User Convenience: A simple and efficient way to book gas cylinders via a mobile app. Improved Safety: Real-time gas leak detection minimizes risks of fire hazards. Automation & Efficiency: Reduced human intervention in the booking process and faster emergency response. This system can be beneficial for households, restaurants, and industries where LPG is commonly used, ensuring both convenience and safety through technology integration.

III. METHODOLOGY

The methodology for this system is designed to enhance user convenience and safety by integrating mobile technology with real-time gas monitoring. The system consists of an Android application for seamless gas booking, an IoT-based gas leakage detection unit, and a cloud-based server for data storage and processing.

For safety, the system employs gas sensors (MQ-5) connected to a microcontroller (Arduino and ESP8266) to continuously monitor LPG leakage. When a leak is detected, the sensor transmits data to the microcontroller, which then sends alerts to users via push notifications, SMS, and email. Additionally, the system can trigger automatic shut-off mechanisms and notify emergency services to prevent accidents. The cloud server manages real-time data, enabling remote monitoring and predictive analysis of gas usage patterns.

By leveraging IoT, cloud computing, and Android development, this system provides an efficient and automated approach to gas booking while ensuring household and industrial safety through early leakage detection and emergency response mechanisms. This innovation reduces human intervention, enhances safety measures, and improves the overall user experience in gas management.

IV. BLOCK DIAGRAM

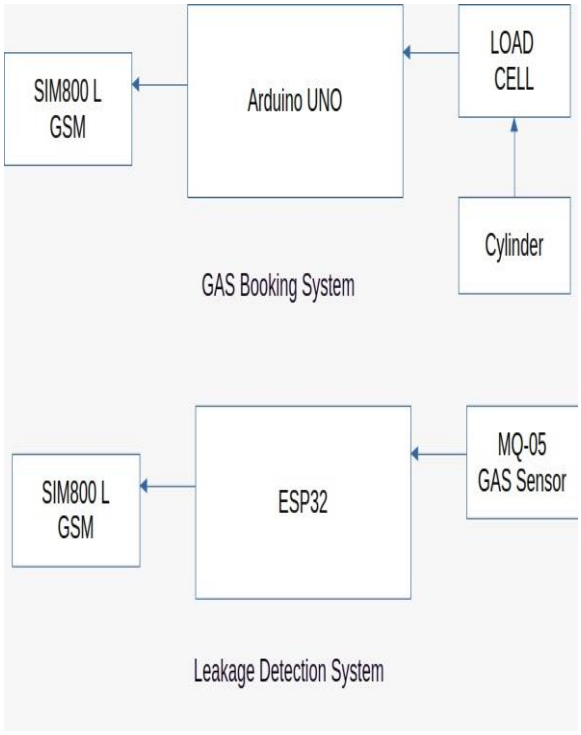


Fig: Block Diagram of Android Based Gas Booking System and Leakage Detection using IOT

V. COMPONENTS USED

1. ARDUINO UNO

The Arduino UNO is a widely used open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0 The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

It is widely used in IOT based health monitoring systems due to its high processing power, multiple input/output (I/O) pins, and enhanced memory capacity. The Arduino Mega 2560 is an advanced micro controller board based on the ATmega2560 processor.

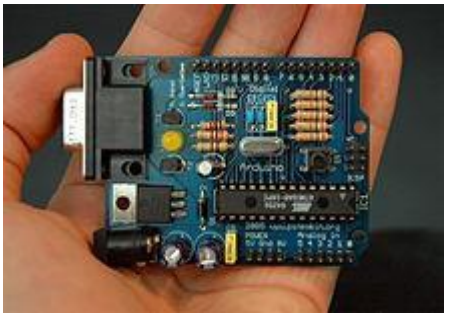
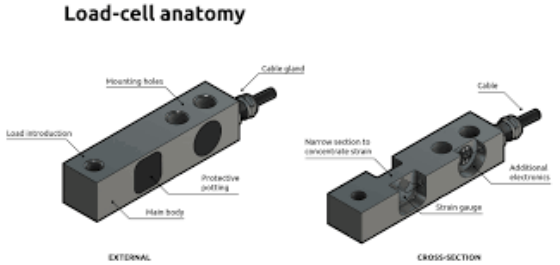


Fig: **ARDUINO UNO**

Microcontroller: Microchip ATmega328P, Operating Voltage: 5 Volt, Input Voltage: 7 to 20 Volts, Digital I/O Pins: 14 (of which 6 provide PWM output), Analog Input Pins: 6, DC Current per I/O Pin: 20 mA, DC Current for 3.3V Pin: 50 mA, Flash Memory: 32 KB of which 0.5 KB used by bootloader, SRAM: 2 KB, EEPROM: 1 KB, Clock Speed: 16 MH, Length:68.6mm, Weidth:53.4mm, Weight:25g

2. LOAD CELL

A load cell is a transducer that converts a force or weight into an electrical signal, making it an essential component for weight measurement applications. In this project, a strain gauge-based load cell is used to measure the weight of the gas cylinder and monitor its usage in real-time.



The load cell operates on the principle of Wheatstone bridge circuitry, where the deformation of the strain gauges results in a change in resistance,

which is then converted into an electrical output. Accurate weight measurement for precise gas level monitoring.

Real-time tracking of gas consumption. Automatic gas booking when the weight falls below a threshold, reducing manual intervention.

3.MQ-05 Gas Sensor

The MQ-05 gas sensor is a metal oxide semiconductor (MOS) sensor designed to detect the presence of LPG (Liquefied Petroleum Gas), natural gas, and town gas in the environment. It operates on the principle of chemoresistance, where the sensor's resistance changes when exposed to target gases, enabling accurate gas concentration measurement.

Fig:MQ05 Gas Senor

Technical Specifications of MQ-05 Sensor, Operating Voltage: 5V DC, Sensing Range: 200 ppm – 10000 ppm (parts per million), Response Time: ≤ 10 seconds, Preheat Time: ≥ 24 hours for optimal performance, Output Type: Analog and Digital.

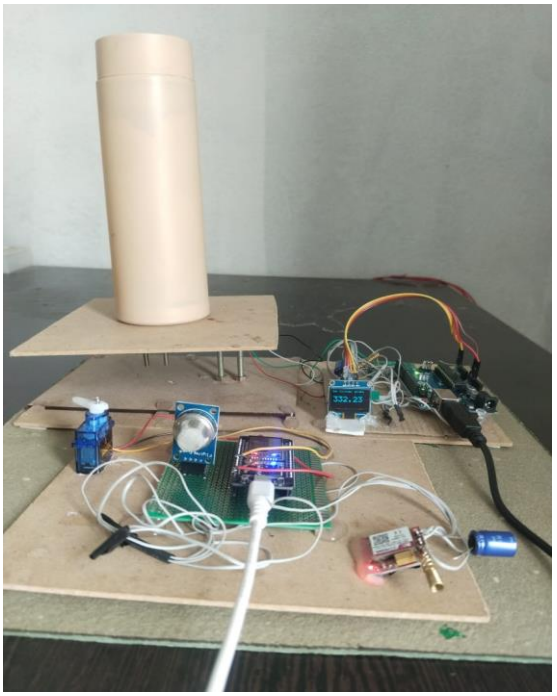
5. GSM MODULE

The Global System for Mobile Communications (GSM) is a family of standards to describe the protocols for second-generation (2G) digital cellular networks as used by mobile devices such as mobile phones and mobile broadband modems. GSM is also a used in GSM. 2G networks developed as a replacement for first generation (1G) analog cellular networks. The original GSM standard, which was delivered by the European Telecommunications Standards Institute (ETSI), originally described a digital, circuit-switched network optimized for full duplex voice telephony, employing time division multiple access (TDMA) between stations.

Fig: **GSM MODULE**

RESULT:

The IoT-Based Gas Leakage Detection and Automatic Gas Booking System successfully implemented and tested under various conditions. The results validate the system's ability to detect gas leakage, monitor gas levels, and automatically book a new gas cylinder when required.



CONCLUSION: -

The IoT-Based Gas Leakage Detection and Automatic Gas Booking System is an innovative and reliable solution designed to enhance safety, efficiency, and automation in gas management. The system successfully integrates gas leakage detection, weight monitoring, automated gas booking, and IoT-based real-time alerts, ensuring a proactive approach to hazard prevention. Experimental results confirm that the system can accurately detect LPG leakage within 2–5 seconds, measure gas cylinder weight with high precision, and automatically book a refill when the weight reaches a critical threshold. The GSM module ensures instant SMS alerts, while the ESP32-based IoT integration enables real-time remote monitoring.

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