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Gas Level Detection and Automatic Gas Booking System

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Abstract*: In general, LPG gas is used in our homes most of the time, and using it has become a basic need for everyone. It is dangerous to breathe in areas where there is a chance of losing our lives because gas leaks have been observed in the past and continue to this day, causing multiple accidents. If the gas leak's level rises, it may explode. Gas leaks must be found and prevented, if necessary, in order to prevent such losses. The only way to detect gas leaks is to continuously monitor the atmosphere, which is only possible artificially. How In an effort to reduce the conditions that lead to gas leaks, our It's also critical to keep an eye on the pressure inside the large gas containers holding dangerous gasses to prevent them from bursting and causing an unexpected gas leak. The system is an Internet of Things application running in the cloud that processes sensor data and makes appropriate decisions. This problem has a number of suggested remedies, but none of them have shown to be effective. The goal of this IOT project is to detect leaks and notify individuals, hence reducing the number of gas leak events. The gas sensor MQ2 finds the gas leak coming from the cylinder. The MQ-2 can detect alcohol, smoke, propane, H2, LPG, CH4, and CO. It is connected to the Node MCU (ESP8266), which is configured to deliver the message straight to the user's smartphone via the cloud. For short work suggests a system for detecting leaks in buildings and homes*

Keywords: Arduino uno, Internet of Things(IoT), Load Cell, Gas Sensor, Buzzer

I. INTRODUCTION

Despite the fact that gas has become a vital component of our everyday lives, we frequently observe the widespread usage of gas cylinders in huge, complex companies. Therefore, we have created a mechanism to handle issues that arise from their untimely death or damage brought on by mishaps. The gas level will be continually monitored in this, and the status of any gas leaks will also be checked. If the gas level is dropping, the percentage of gas remaining will be display Additionally, at the same time, any gas leaks will also be reported to The purpose of this project is to detect gas leaks using Internet of Things approaches. The primary goal of this research is to continuously monitor the weight of the cooking gas cylinder while also determining how much gas is used in a given week or month and storing this data to an IoT platform over time. When the weight hits the minimal level, it will appear on a smartphone connected to a wifi network, alerting the housewife to chain and other family members to examine the entire information or refuel the LPG gas cylinder for routine cooking. In order to prevent mishaps in the kitchen, this system is also intended to detect and sense for liquid petroleum gas (LPG) leaks. If the amount of gas concentration exceeds the usual threshold, the alarm unit will activate immediately.

Safety at Industrial places like CNG and LPG should be always a priority. As we all know that Gas leakage always been a major problem with industrial sector, residential areas and gas driven vehicles such as CNG (Compressed Natural Gas) buses, cars etc. Security is the level of protection against dangers and losses. The help of this technology is needed to provide an early warning alert in order to ensure that enough time is available to prevent many potential dangers. There is always a risk of leakage whenever and wherever combustible gas is used, threatening human lives and properties. Therefore, designing a low-cost gas leakage detector helps in minimizing this risk over a span of few years. There have been several accidents caused by combustible gases

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(LPG or methane) leakages in homes and industries (mainly oil and gas)These leakages had led to the loss of several lives and properties through fire outbreaks and explosions. One such prevention methods to stop these kind of accidents related with the gas leakage is to install a gas leakage detecting device at permeable places. The ultimate goal of this project is to design and develop such kind of a device which is capable to automatically detect and simultaneously stops the gas leakage in those permeable areas. The combustible gases can be detected by this system which has a gas sensor and it uses iot to remotely monitoring about the leakage and level of gas through iot cloud.

II. OVERVIEW OF Proposed system, block, circuit diagram

A. Proposed System

The existing system only detects the gas and gas level and give alert to about the gas leakage and such system send alert only one or the person whos mobile number is registered, There for the goal of this IOT project is to detect leaks and notify individuals, hence reducing the number of gas leak events. The gas sensor MQ2 finds the gas leak coming from hecylinder. The MQ2 can detect alcohol, smoke, propane, H2, LPG In an effort to reduce the conditions that lead to gas leaks, our work suggests a system for detecting leaks in homes and businesses. It's also critical to keep an eye on the pressure inside the large gas containers holding dangerous gasses to prevent them from bursting and causing an unexpected gas leak. The system is an Internet of Things application running in the cloud that processes sensor data and makes appropriate decisions. This problem has a number of suggested remedies, but none of them have shown to be effective. The goal of this IOT project is to detect leaks and notify individuals, hence reducing the number of gas leak events. The gas sensor MQ2 finds the gas leak coming from the cylinder. The MQ-2 can detect alcohol, smoke, propane, H2, LPG, CH4.The MQ2,can detect alcohol, smoke, propane, H2, LPG It is connected to the Node MCU (ESP8266), which is configured to deliver the message straight to the user's smartphone via the cloud. There is also a buzzer connected to the circuit for instant feedback. alarm to the home's occupants, enabling us to switch off the cylinder and prevent an explosion.

B. Block Diagram

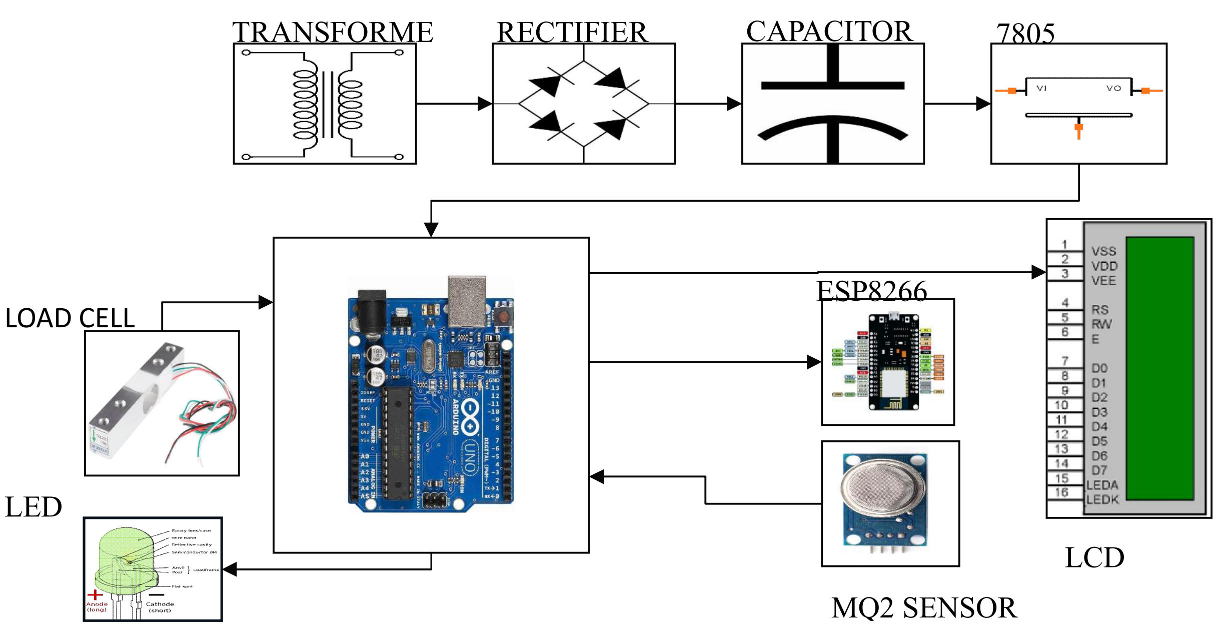

Fig 1-Block diagram of gas level detection and gas leakage detection

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In above circuit diagram shows the connections of sensors with Arduino uno controller to gas lavel detection and leakage dection. Two sensors are used in the system for the purpose of detect gas and gas level. Load cell of 6kg used for measure the weight of gas tank which is mounted on gas trolly and MQ6 sensor used for gas leakage detection. Load cell SDA, SCL, VCC and GND terminal are connected with 6, 7 Digital i/o pins and VCC and GND pin of Arduino uno R3 and MQ6 has 3 terminals Vcc, Gndand Do which are connected with Vcc, Gnd and digital i/o pin 2 of Arduino uno. And Buzzer connected with the digital i/o pin 2 of Arduino. Rs, en, d4, d5, d6, d7 pins of lcd 16x2 are connected 13, 12, 11, 10, 9, 8 digital i/o pins of Arduino respectively. And digital output of MQ6 sensor is also connected to the esp8266 to detect the gas leakage condition and show it on thingspeak server.

C. Circuit Diagram:

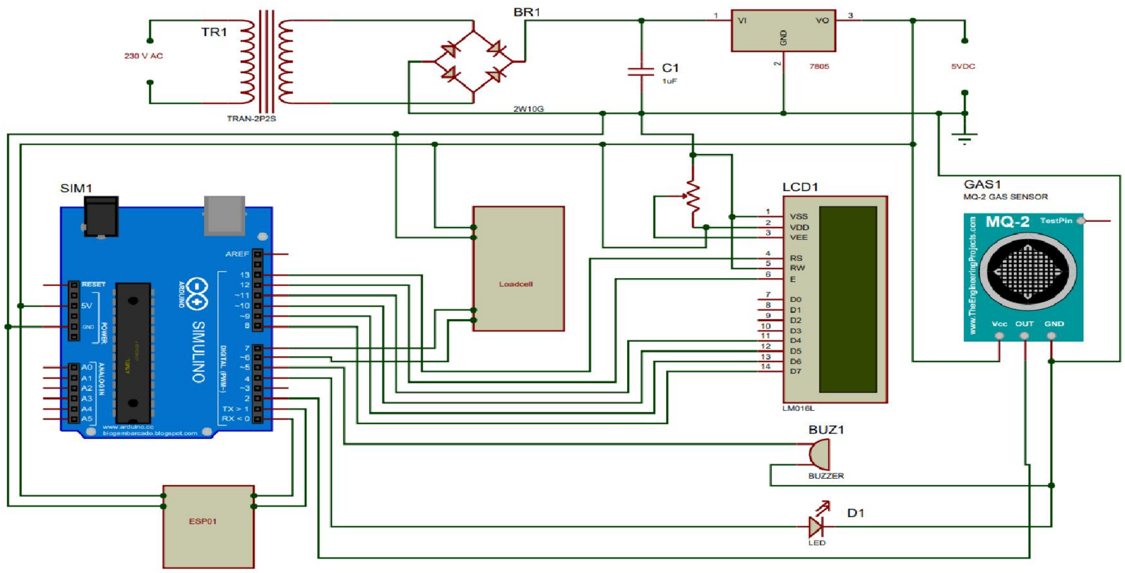

Fig 2-Circuit diagram of gas level detection and gas leakage detection

III. DESIGN AND ARCHITECTURE

A. Working:

1. The objective of this project is to detect any leakage of LPG. It will detect the leakage and will alert to stop the gas supply.
2. This system is based on the Arduino UNO R3 and MQ-6 gas sensor. When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas in not detected the sensor will give digital output 0. Arduino and esp8266 will receive the sensor output as digital input. If the sensor output is high, then the buzzer will start tuning along with the LCD that will show that "Gas detected: Yes". If the sensor output is low then buzzer will not be tuning, and the LCD will show that "Gas detected: No". both conditions are show on the thingspeak server to remotely monitor.
3. In this project we gas level also detect by weight sensor and show on the display. When gas level is below the 10% alert to booking gas.

B. Methodology

This is the methodology we used in our model:

1. First the system is turned on and the gas sensor start reading the gas concentration And load cell measure the weight of gas tank.
2. System then determine if the gas leakage is there or not and also read the gas level.
3. If the gas is not leaking and gas level is sufficient then it continues to read the data and upload on cloud .

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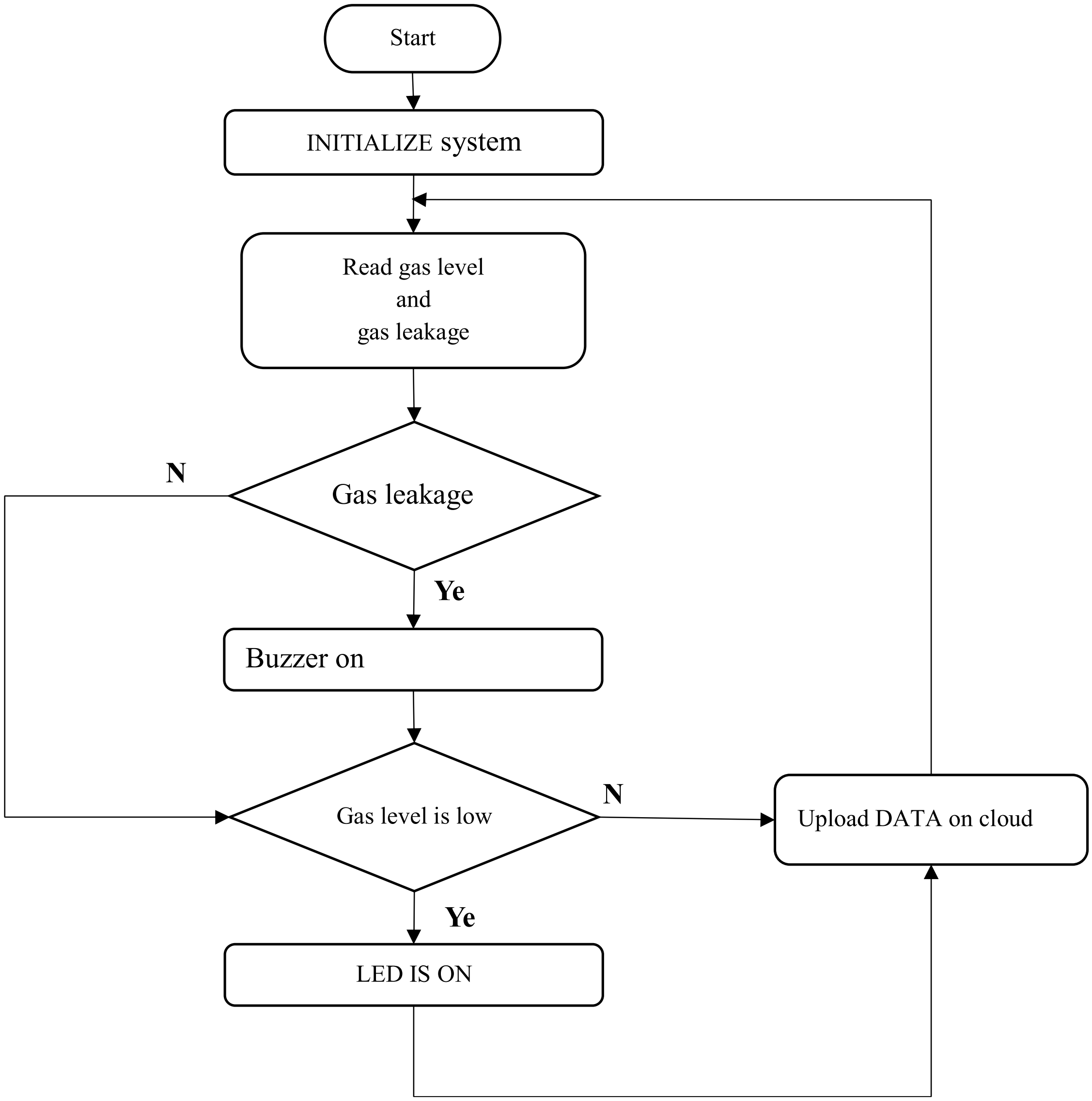
4. If the gas is leaking then system will start the buzzer and alert the concerned person and start the preventive operation and gas level is low it will turn on indicator.
5. It will keep on reading the data using gas sensor and load cell.



C. Power Require

Power require for Arduino uno 5V *0.5 Amp = 5 x 0.5 = 2.5
Power require for LCD 5V *0.5 Amp = 5 x 0.5 = 2.5
Power require for MQ2 Sensor 5V *0.2 Amp = 5 x 0.2 = 1
Power require for Esp8266 5V *0.2 Amp = 5 x 0.2 = 1
Power require for Load cell 5V *0.5 Amp = 5 x 0.5 = 2.5
Power require for Buzzer 5V *0.2 Amp = 5 x 0.2 = 1
Power require for LED 5V *0.2 Amp = 5 x 0.2 = 1
Total power require for model = 2.5 + 2.5 + 1 + 1 + 2.5 +1 +1 = 11.5 w.

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IV. IMPLEMENTATION AND ALGORITHMS

A. LCD (Liquid Crystal Display)

1. Purpose:Displays gas level in real-time, status of the gas booking process, and notifications like "Gas Low," "Booking Done," or "Error."
2. Specifications: Typically, a 16x2 LCD (16 characters per line, 2 lines) is used.Interfaces with the microcontroller via I2C or direct GPIO pins.
3. Integration: Connected to the microcontroller (e.g., Arduino or ESP8266).Controlled using libraries like LiquidCrystal for Arduino or equivalent for ESP8266.
4. Power Requirements: Operates at 5V, derived from the system's power supply.
5. Design Tip: Use an I2C adapter for easy wiring and to reduce the number of pins used on the microcontroller.

B. Microcontroller Unit (MCU)

1. Purpose: Acts as the brain of the system, processing input from sensors, controlling output devices (LCD, buzzer), and handling communication (via ESP8266).
2. Options: Arduino Uno: Suitable for basic prototypes.ESP8266/NodeMCU: Offers Wi-Fi capabilities for IoT integration.ESP32: For advanced functionality and additional processing power.
3. Key Functions: Reads sensor data from the load cell, strain gauges, and gas sensor. Processes the data to determine gas level and leakage status. Sends gas level data to the cloud via ESP8266 for booking automation. Triggers the buzzer in case of gas leakage or critical alerts.
4. Coding Environment: Programmed using Arduino IDE or ESP-IDF (for ESP8266/ESP32).

C. Power Supply Design

1. Purpose: Provides stable and regulated power to all components, ensuring smooth operation.
2. Design Components: Transformer: Steps down AC mains voltage (230V) to 12V.Bridge Rectifier: Converts AC to DC.
3. Voltage Regulators:7805 for 5V supply (LCD, sensors, microcontroller).AMS1117 for 3.3V supply (ESP8266). Capacitors: For filtering and noise reduction.
4. Battery Backup: Optionally include a Li-ion or lead-acid battery for power failure scenarios.
5. Output Voltage: 5V and 3.3V as required by different modules.

D. Gas Sensor

1. Purpose: Detects gas leakage and triggers an alert.
2. Options:MQ-5: Detects LPG, methane, and natural gas.MQ-6 or MQ-135: Alternative sensors with similar functionalities.
3. Integration: Connected to the microcontroller via an analog input pin. Requires a load resistor for proper operation (typically 10kΩ).
4. Power Requirements: Operates on 5V.
5. Response: Outputs voltage proportional to gas concentration in the air.
6. Code Implementation: Use a threshold value to determine leakage. If the sensor reading exceeds the threshold, trigger the buzzer and send alerts.

E. Buzzer

1. Purpose: Provides an audible alert for gas leakage or other critical conditions.
2. Specifications: A 5V piezoelectric buzzer.
3. Integration: Connected to the microcontroller through a GPIO pin.Controlled via simple HIGH/LOW signals in the code.
4. Operation: Activated when gas leakage is detected or during a test alert.

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F. Strain Gauges

1. Purpose: Key components of the load cell that sense deformation caused by weight.
2. Working Principle: As weight is applied, strain gauges experience changes in resistance, which is converted into electrical signals.
3. Configuration: Typically arranged in a Wheatstone Bridge configuration to improve sensitivity and reduce noise.
4. Signal Conditioning: The HX711 amplifier boosts the signal from the strain gauges for processing.

G. Load Cell

1. Purpose: Measures the weight of the LPG cylinder to estimate the remaining gas level.
2. Specifications: Load cell with a capacity of 50kg or 100kg, depending on cylinder weight.Outputs small voltage changes proportional to the weight applied.
3. Integration: Connected to the microcontroller through an HX711 load cell amplifier module, which converts the analog signal to digital data.
4. Calibration: Perform a two-point calibration: one with no weight and one with a known weight.
5. Code Implementation: Libraries like HX711.h (for Arduino) are used to read weight data.

H. ESP8266 (Wi-Fi Module)

1. Purpose: Enables IoT functionality by connecting the system to a cloud server or database.
2. Key Features: Built-in TCP/IP stack. Operates at 3.3V.Supports protocols like HTTP and MQTT.
3. Integration: Communicates with the microcontroller over UART (TX/RX pins).
4. Functions: Sends gas level data to a cloud platform (e.g., Firebase or ThingSpeak).Sends alerts or triggers automatic gas booking via an API.
5. Programming: Can be programmed separately or controlled via AT commands from the main microcontroller.

V. CONCLUSION

In conclusion, the integration of blockchain technology into agriculture supply chains for crops presents both opportunities and challenges. While the benefits of enhanced transparency, traceability, and data security are promising, several significant challenges must be addressed for successful implementation. Data accuracy, quality, and integration are foundational to building trust within the supply chain. Overcoming these challenges requires standardized data formats and accurate data collection methods. The high costs associated with blockchain implementation and the need for funding, particularly for small-scale farmers, underscore the importance of finding sustainable financing models. Interoperability and scalability challenges call for the development of industry-wide standards and systems that can adapt to the growth of the agriculture supply chain. Regulatory compliance, particularly regarding food safety and data privacy, necessitates a careful balance between transparency and compliance. Education and adoption hurdles must be addressed through training and awareness programs to ensure that all stakeholders can use the technology effectively and securely. The complexity of supply chains and the need for real-time data entry make connectivity and infrastructure crucial considerations.

Privacy concerns, cyber security, and the environmental impact of energy-intensive blockchain networks all require vigilant attention and innovative solutions. Furthermore, gaining the trust of participants in the supply chain, who may be resistant to change, is an ongoing challenge. In light of these challenges, it is essential to approach blockchain adoption in agriculture supply chains with a thoughtful and holistic strategy. Collaborative efforts among stakeholders, the development of tailored solutions, and a commitment to addressing these challenges will be key to unlocking the full potential of blockchain technology in enhancing the efficiency, transparency, and sustainability of agriculture supply chains. Overcoming these challenges will lead to a more resilient and reliable supply chain that benefits everyone involved, from farmers to consumers.

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