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# Gas Leakage Management System

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**ABSTRACT:** Gas leaks pose a significant risk in residential settings, often leading to accidents and hazardous situations. To address this issue, the **Gas Leakage Management System using Arduino** has been developed, offering a cost-effective and efficient solution for LPG gas leak detection and prevention. This system integrates real-time monitoring with automated safety responses and user notification features to ensure comprehensive protection. At the core of the system, an **MQ-6 gas sensor** continuously detects LPG concentrations, triggering an alarm when gas levels exceed predefined thresholds. Upon detection, an **automatic shut-off valve** immediately halts gas flow, while a **ventilation fan** disperses the leaked gas to prevent hazardous accumulation. Additionally, a **load cell** monitors the cylinder's weight to provide real-time updates on gas levels, ensuring users are informed about refills. To enhance safety further, a **GSM module** sends immediate SMS alerts and calls to notify users of detected leaks, ensuring prompt action even when they are away. Designed using affordable components like Arduino, relays, and sensors, this system is accessible for household deployment while being scalable for various residential environments. The Gas Leakage Management System not only mitigates the risks associated with LPG leaks but also automates critical safety measures, delivering real-time alerts and ensuring a safer living environment. This paper discusses the system's design, implementation, and potential impact on enhancing residential safety, making it a valuable contribution to smart home innovations.

**KEYWORDS:** LPG Gas Detection, Automated Shut-off Valve, Smart Ventilation Fan, Gas Level Monitoring, GSM Module for Alerts, Disaster prevention, Mq6 gas sensor , Gsm 900 A.

## I. INTRODUCTION

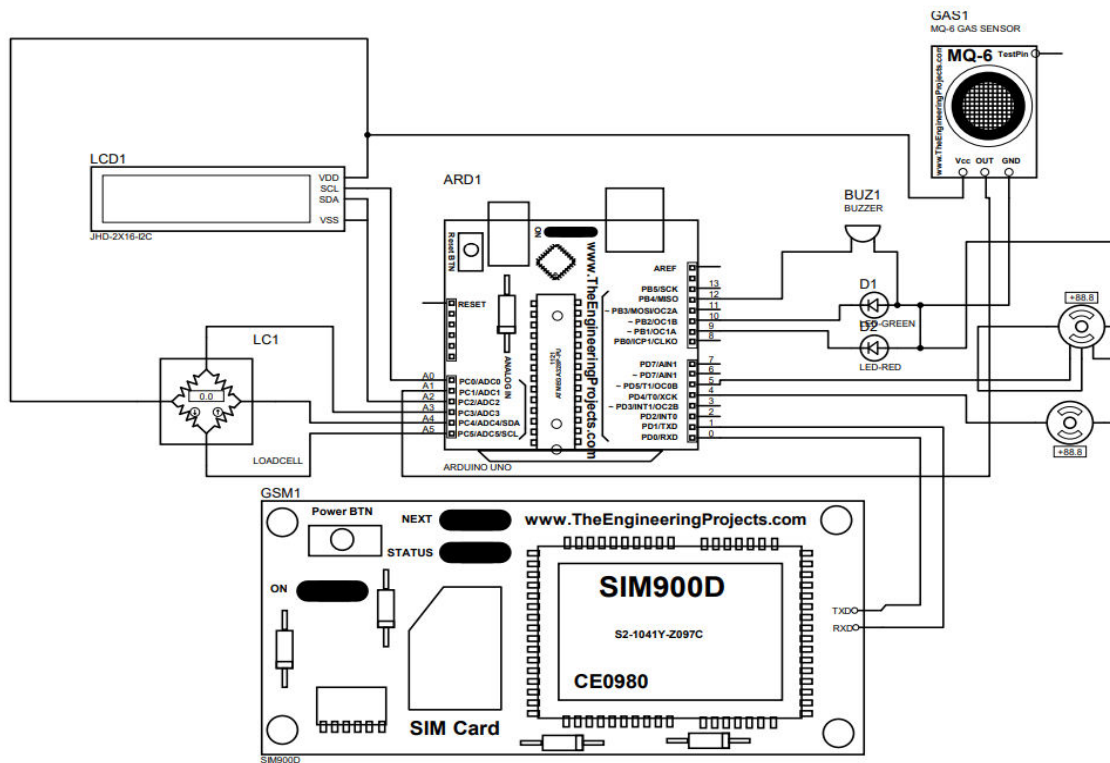
Gas leaks, particularly from liquefied petroleum gas (LPG) cylinders, represent a significant safety concern in residential and commercial environments. These leaks can lead to catastrophic consequences, including fires, explosions, and health issues arising from the inhalation of toxic gases. Given the widespread use of LPG for cooking and heating, the need for reliable, automated gas safety systems has become increasingly urgent. Traditional safety measures, such as manual shut-off valves or odor-based detection, often fail to address leaks effectively, especially when occupants are not present to take immediate action.

The Gas Leakage Management System using Arduino is designed to provide a comprehensive solution to this problem. This system automates the detection of gas leaks, initiates critical safety measures to prevent escalation, and ensures that users are notified promptly, even when they are not at home. At the heart of the system is the MQ-6 gas sensor, which is highly sensitive to LPG and capable of detecting even small increases in gas concentration. When the gas level exceeds a predefined safety threshold, the system activates multiple safety protocols. These include closing an automatic shut-off valve to stop the gas supply and starting a ventilation fan to disperse the leaked gas, reducing the risk of hazardous accumulation.

To further enhance functionality, the system includes a load cell-based gas level indicator, which monitors the LPG cylinder's weight and alerts the user when a refill is needed. Additionally, a GSM module ensures remote communication by sending SMS alerts and making calls to notify users of detected leaks. By employing a microcontroller-based automation approach and using cost-effective components, this system provides an affordable, scalable, and practical solution for enhancing gas safety in homes and businesses.

This project aims to demonstrate the design, implementation, and effectiveness of the Gas Leakage Management System, highlighting its potential to significantly reduce the risks associated with LPG usage and provide a safer living environment for residents.

## II. CIRCUIT DIAGRAM OF GAS MANAGEMENT SYSTEM



(Gas Leakage Management System)

This system leverages a gas sensor, microcontroller, GSM module, and alert mechanisms to ensure gas leakage detection and prompt user notification. When powered on, the Arduino Uno initializes all components, including the gas sensor, LCD, buzzer, load cell, and GSM module. The MQ-6 sensor continuously monitors gas concentration and sends an analog signal to the Arduino, which processes it to determine if the gas level exceeds a predefined safe threshold. If the concentration is within safe limits, the green LED remains ON, indicating normal operation. When gas concentration surpasses the threshold, the Arduino triggers the red LED, activates the buzzer for an audible alert, and displays "Gas Leakage Detected" on the LCD. Simultaneously, it sends an SMS alert via the GSM module to notify users remotely. Additionally, if a load cell is integrated, the system monitors the gas cylinder's weight and alerts the user if the cylinder is running low. Optional features include automatic activation of an exhaust fan to disperse leaked gas, further enhancing safety. Once the gas level returns to normal, the system resets, turning off the red LED and buzzer, reverting to safe mode, and continuing monitoring.

## III. PROBLEM STATEMENT

LPG gas leaks in residential and commercial settings pose serious risks, including fires, explosions, and health hazards. Traditional safety measures, such as odor-based detection and manual shut-off valves, are inadequate, particularly when occupants are absent or unaware of the leak. This project aims to develop an automated Gas Leakage Management System using Arduino, which detects gas leaks in real time, shuts off the gas supply, activates ventilation, and sends immediate alerts to users, ensuring a proactive and reliable response to gas leak hazards.

**Volume 14, Issue 2, February 2025****|DOI: 10.15680/IJRSET.2025.1402060|****IV. OBJECTIVE OF PROJECT**

The objective of the Gas Leakage Management System project is to design and develop an automated, cost-effective safety solution for detecting and managing LPG gas leaks in residential environments. This system aims to provide real-time detection, immediate corrective actions, and remote user notifications to ensure a safer living space. The project seeks to address the critical aspects of gas leak management, including early detection, automatic shut-off, ventilation, and timely alerts.

Key objectives include:

1. **Real-Time Detection of Gas Leaks:** Utilizing the MQ-6 gas sensor to monitor LPG concentrations continuously and provide immediate alerts when gas levels exceed safe thresholds.
2. **Automated Safety Responses:** Implementing automatic shut-off mechanisms and activating a ventilation fan to minimize the risk of fire, explosion, and toxic gas exposure.
3. **Remote User Notifications:** Integrating a GSM module to send SMS and call alerts, ensuring users are notified of gas leaks even when away from home.
4. **Efficient Gas Level Monitoring:** Providing real-time monitoring of gas cylinder levels using a load cell, alerting users when a refill is necessary.
5. **Cost-Effective and Scalable Design:** Developing an affordable solution using widely available components, making the system accessible and scalable for a variety of households.

The project aims to enhance safety and provide peace of mind by offering an efficient, scalable solution to prevent gas-related accidents and ensure timely response to potential hazards.

**V. SCOPE OF PROJECT**

This project focuses on developing an automated Gas Leakage Management System for residential use, designed to enhance safety by detecting LPG gas leaks and responding to potential hazards. Key features include:

1. **Real-Time Leak Detection:** The system will use an MQ-6 gas sensor to monitor LPG gas levels and detect leaks promptly, triggering an automatic shut-off of the gas supply and activation of a ventilation fan.
2. **User Alerts:** A GSM module will send SMS and make phone calls to alert users about gas leaks, ensuring immediate action even when they are away.
3. **Gas Level Monitoring:** A load cell-based indicator will monitor the LPG cylinder's weight, notifying users when a refill is needed.
4. **Scalable and Cost-Effective Solution:** The system will be built using affordable components like Arduino and sensors, making it accessible for a wide range of households.

The scope is limited to residential applications, aiming to provide a reliable, user-friendly, and cost-effective solution to prevent gas-related accidents.

**VI. EXISTING SYSTEM**

Existing gas leakage detection systems rely on manual detection, odor-based methods, or basic automatic shut-off valves. These systems are often unreliable, requiring human intervention or failing to provide remote notifications. They lack automated responses like shutting off the gas or activating ventilation and do not integrate with smart home systems. Additionally, most systems do not offer predictive maintenance or alerts for low gas levels. The proposed system addresses these limitations with real-time detection, automated responses, remote notifications, and smart home integration for better safety and convenience.

**VII. LIMITATIONS**

1. **Power Supply Dependency:** The system requires a constant power source, which makes it vulnerable to power outages. In the event of an electrical failure, the system may not function properly, compromising its reliability.
2. **Network Coverage:** The GSM module relies on network connectivity to send notifications. In areas with poor or no GSM network coverage, the system may fail to send alerts, limiting its effectiveness in remote locations.
3. **Sensor Calibration:** The MQ-6 gas sensor requires regular maintenance and calibration to maintain accuracy. Without proper calibration, the sensor's detection capability may degrade over time, affecting system performance.

4. **Installation Complexity:** The initial setup and installation of the system might require technical knowledge, especially in terms of wiring and component integration, which could be a barrier for users without technical expertise.
5. **Limited Scalability:** The system may not be ideal for large-scale industrial applications without additional sensors and networked infrastructure.
6. **Slow Response Time:** Depending on environmental conditions, the sensor may take time to detect gas leaks and trigger responses, delaying critical safety measures

These limitations need to be considered when implementing the system, as they may impact the system's functionality and accessibility in certain conditions.

### VIII. PROPOSED SYSTEM

The proposed Gas Leakage Management System offers an automated solution for detecting and managing LPG gas leaks in residential environments. Key features include:

1. **Real-Time Gas Detection:** The MQ-6 gas sensor monitors LPG levels and triggers alerts if concentrations exceed safe thresholds.
2. **Automated Safety Responses:** The system automatically shuts off the gas supply and activates a ventilation fan when a leak is detected, reducing risks like fire or explosion.
3. **Gas Level Monitoring:** A load cell tracks gas cylinder weight, notifying users when a refill is needed.
4. **Remote Notifications:** The GSM module sends SMS and makes calls to alert users of leaks, even when they are away from home.
5. **Cost-Effective and Scalable:** Built with affordable components like Arduino and sensors, the system is accessible and easily scalable.

### IX. FUTURE SCOPE

1. **Smart Home Integration:** Connect with IoT platforms like Google Home and Alexa for seamless monitoring and control.
2. **AI-Powered Detection:** Implement machine learning to reduce false alarms and improve gas leak detection accuracy.
3. **Cloud-Based Monitoring:** Store gas level data on the cloud for real-time tracking and predictive maintenance.
4. **Industrial Application:** Expand the system for large-scale industrial safety with multiple sensor networks.
5. **Mobile App Enhancement:** Improve user experience with detailed analytics, remote control, and customizable alerts.

### X. CONCLUSION

The Gas Leakage Management System using Arduino offers an effective and affordable solution to LPG gas leak safety in residential environments. By integrating real-time detection, automatic shut-off, ventilation, and remote notifications, the system ensures timely alerts and actions to prevent accidents. The use of the MQ-6 sensor and GSM module enhances safety by enabling prompt responses, even when users are away from home.

This system demonstrates the potential of microcontroller-based automation in household safety, providing an efficient, cost-effective solution for gas leak detection and management. Future enhancements, such as backup power, IoT integration, and additional sensors, can further improve its functionality. Overall, the system enhances safety, reduces risks, and offers peace of mind to users.

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