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E Gas Rescuer and Notifier

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ABSTRACT

Liquefied Petroleum Gas (LPG) is extensively used for domestic activities such as cooking and heating, but its leakage can result in dangerous consequences like fires or explosions. This paper presents the design and implementation of an LPG gas detection and alert system aimed at enhancing user safety. The system utilizes the MQ2 gas sensor to detect the presence of LPG in the environment. Upon identifying a gas leak, the system initiates a series of safety measures, including shutting off electrical appliances to prevent ignition, activating a buzzer to alert nearby individuals, illuminating an LED for visual indication, and sending an emergency alert to the Fire Brigade Department for prompt response. This integrated solution enhances the reliability of domestic safety by providing early detection and real-time alerts, thereby minimizing the risk associated with LPG leakage. The system is designed to be cost-effective, easy to deploy, and capable of ensuring quick intervention in hazardous situations.

KEYWORDS: *LPG (Liquefied Petroleum Gas), gas leak detection, fire prevention, emergency alert, electrical appliance shutdown, LED indicator, Fire Brigade alert, domestic safety*

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1. INTRODUCTION

Liquefied Petroleum Gas (LPG) is a commonly used fuel for cooking, heating, and other household applications due to its efficiency and availability. However, the inherent risks associated with LPG, such as leaks that can lead to fires, explosions, and potential loss of life, make it essential to implement effective safety measures. Gas leaks are often undetectable by human senses, and if left unnoticed, they can lead to catastrophic consequences. Therefore, the development of a reliable LPG gas detection and alert system is critical to ensuring the safety of users and mitigating these hazards.

This research focuses on the design and implementation of a smart LPG leak detection system that integrates gas sensors, alert mechanisms, and emergency response protocols. The MQ2 gas sensor, known for its sensitivity to various gases including LPG, serves as the core detection component of the system. Upon detecting a leak, the system automatically triggers a series of protective actions, such as shutting off electrical appliances to prevent potential ignition, activating a buzzer for audible alert, lighting up an LED for visual indication, and sending an emergency message to the Fire Brigade Department for timely intervention.

This paper presents a detailed description of the system's architecture, functionality, and potential impact on improving domestic safety. The integration of real-time gas detection and instant alerts can significantly reduce the risks associated with LPG leaks, offering a cost-effective solution to ensure the well-being of users in households and other LPG-utilizing environments.

2. LITERATURE REVIEW

In 2018, Patel et al [1] found that implementing automatic shutdown and emergency alert systems alongside gas leak detection sensors can effectively prevent catastrophic accidents, ensuring prompt action from emergency responders.

In the later year 2019, Rohit A. et al [2] concluded that the MQ2 sensor is an affordable and efficient solution for detecting LPG gas leaks in household environments, with high sensitivity and reliable performance.

In the year 2020, Bansal A. et al [2] demonstrated that integrating LPG leak detection systems with

automatic gas shut-off mechanisms and alarm systems significantly enhances the safety and prevention of potential hazards in domestic settings.

It was concluded Singh and Kaur 2020[5] that integrating machine learning algorithms with gas detection systems could significantly improve the accuracy of leak detection and reduce false alarms, thereby enhancing system reliability.

Furthermore, Sharma and Gupta 2021[3] highlighted that IoT-based LPG gas detection systems, coupled with real-time alerts, offer an improved safety measure by notifying users of leaks remotely, even when they are not present at home.

In this paper, we focus on designing an LPG gas detection and alert system to improve domestic safety by detecting leaks, shutting off appliances, sounding alarms, and notifying emergency services, minimizing the risk of fires or explosions through early detection and real-time alerts.

3. PROBLEM STATEMENT

LPG is widely used for its convenience and cost-effectiveness, but its flammability poses significant risks to human life, property, and the environment. Leakage, if not detected and controlled quickly, can result in deadly accidents such as fires and explosions. Despite safety regulations and technologies, incidents continue to occur.

A recent LPG explosion at the home of Nepali Congress lawmaker Chandra Bhandari in February 2023, resulting in the tragic death of his mother and severe burns to both. The incident was reportedly triggered when Chandra entered the kitchen and switched on the light, igniting the accumulated gas from a suspected leak. This incident highlights the critical need for advanced, real-time safety solutions to prevent LPG-related accidents and protect lives.

4. OBJECTIVES

A. **Design a reliable LPG gas detection system** using the MQ2 sensor for early leak detection.

B. **Implement automated safety measures** such as shutting off appliances, triggering alarms, and visual indicators when a leak is detected.

C. **Send real-time emergency alerts** to local fire departments for quick response to gas leaks.

D. **Evaluate system effectiveness** in terms of accuracy, reliability, and prompt hazard prevention.

E. **Ensure ease of use and cost-effectiveness** for widespread deployment in residential and commercial settings.

5. METHODOLOGY

I. Block Diagram

The following block diagram shown in fig.1 illustrates the key components and their interactions within E Gas Rescuer and Notifier.

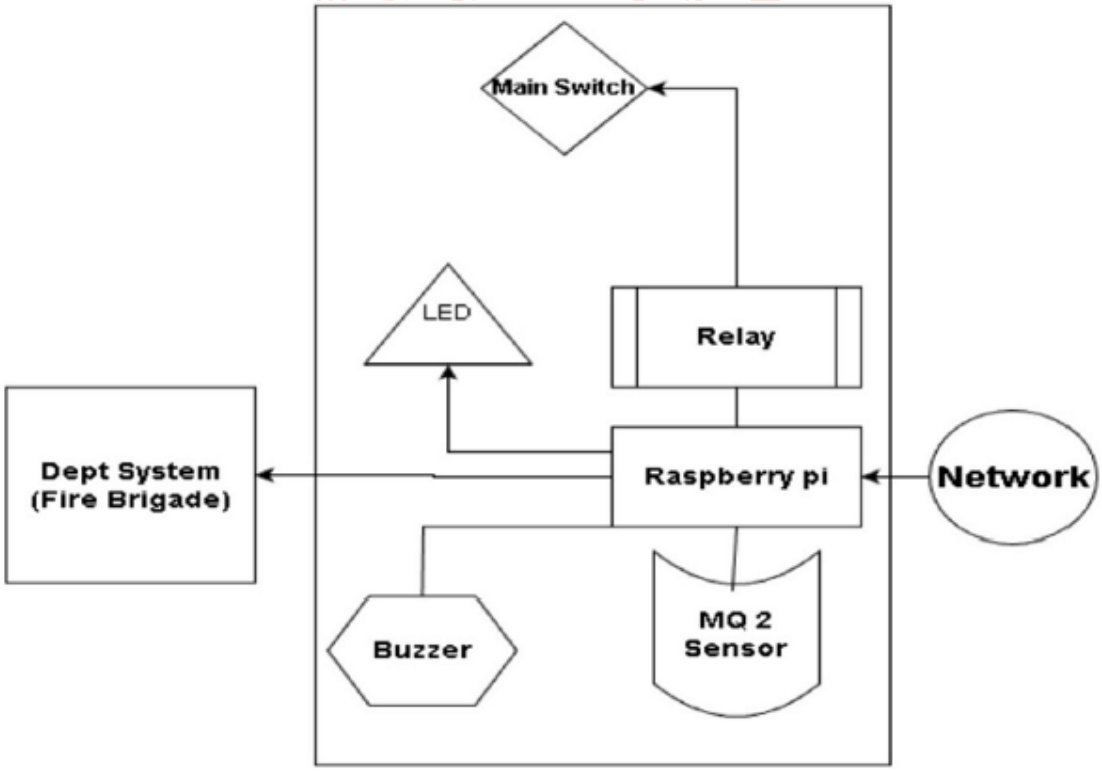

Figure 1: Block Diagram of the E Gas Rescuer and Notifier

In this system, When the MQ-2 sensor detects smoke or harmful gases, the Raspberry Pi processes the data and triggers a **buzzer and LED** as an alert. Additionally, it controls a **relay** to turn off the **main switch** and sends a notification to the **fire brigade department** through a network connection. The main component used in E Gas Rescuer and Notifier are as follows:

Raspberry Pi- Acts as the central processing unit, receiving signals from the sensor and controlling other components.

MQ-2 Sensor - Detects smoke, LPG, propane, methane, and other combustible gases.

Relay - An electrically operated switch that controls high-power devices, like turning off the main switch.

Buzzer - Produces a sound alarm when gas or smoke is detected.

II. Flowchart

The following flowchart shown in fig.2 outlines the sequential steps involved in detecting an LPG leak and initiating the corresponding safety actions and alerts.

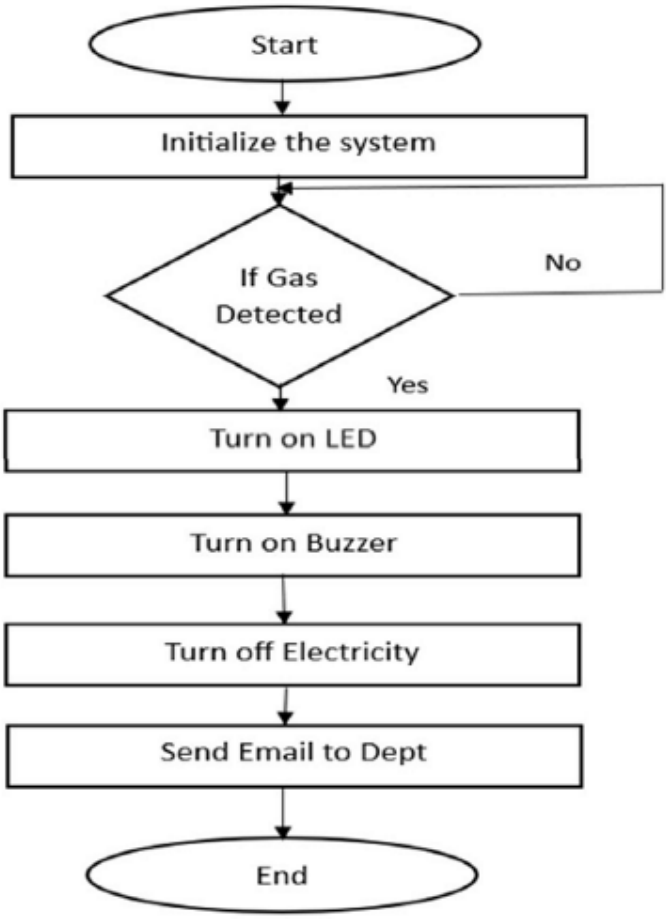

Figure 2: Flowchart of the E Gas Rescuer and Notifier

E Gas Rescuer and Notifier

working Start - The system begins operation.

Initialize the system - The system starts up and gets ready to monitor gas levels.

If Gas Detected? - A decision point:

- No: If no gas is detected, the system keeps monitoring.
- Yes: If gas is detected, the system takes the following safety measures:
  1. Turn on LED - A visual alert is activated.
  2. Turn on Buzzer - An audible alert is triggered.
  3. Turn off Electricity - To prevent fire or explosion, the electricity supply is cut off.
  4. Send Email to Dept - A notification email is sent to the concerned department for further action.

End - The process is complete.

III. Prototype

As follows, the prototype of the LPG gas detection and alert system integrates the MQ2 sensor with safety measures, providing a functional demonstration of leak detection and real-time alerts.

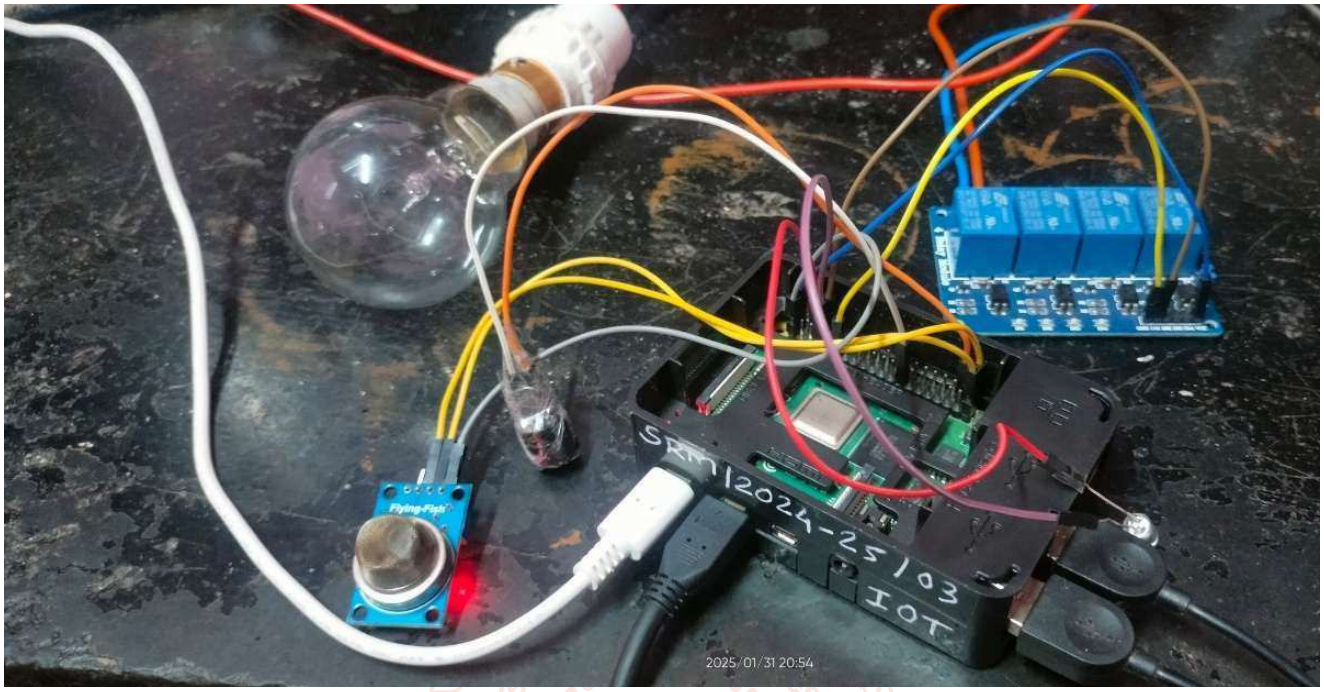

Figure 3: Prototype of the E Gas Rescuer and Notifier

6. RESULTS AND DISCUSSION

Firstly, as shown in fig.4 The system is initialized to detect gas by continuously monitoring the environment with the MQ2 sensor, ensuring prompt identification of any LPG leakage.

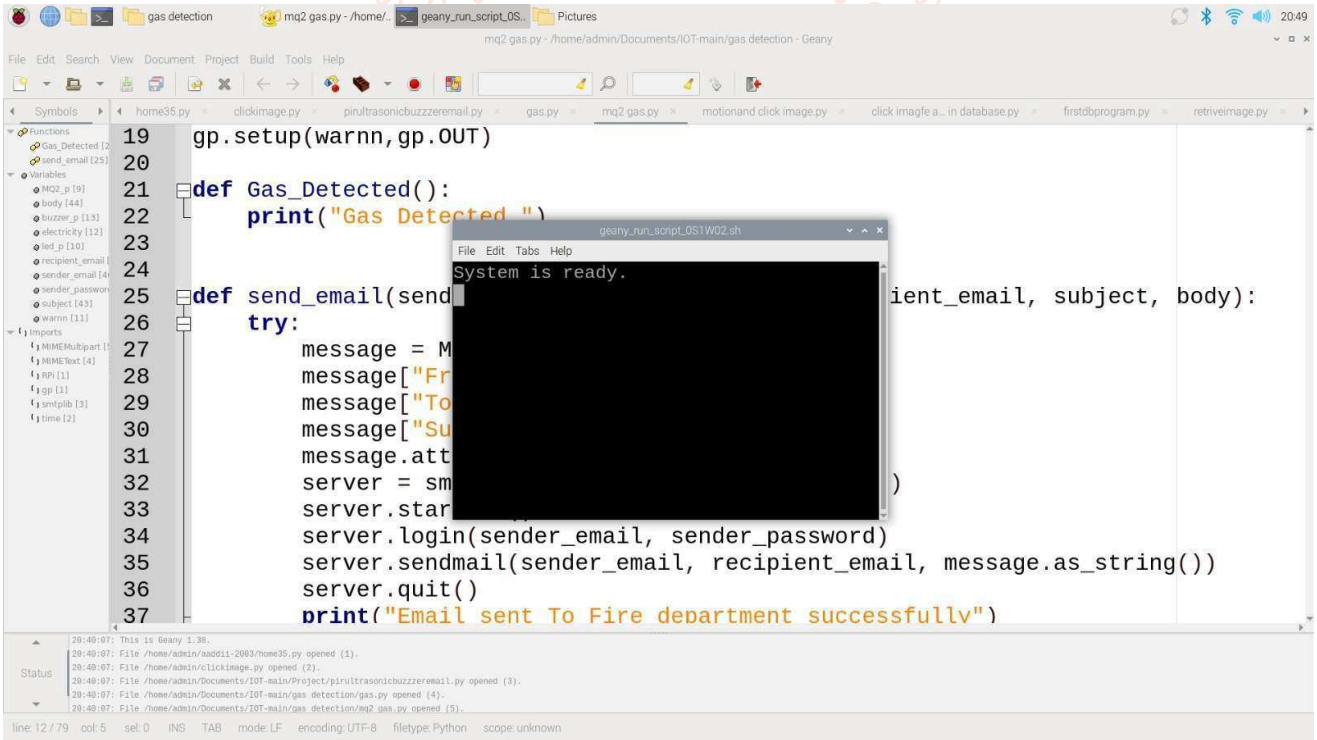

Figure 4: System is initialized to detect gas

Once gas is detected, the system activates safety measures such as triggering an alarm, shutting off appliances, sending mail and notifying emergency services.

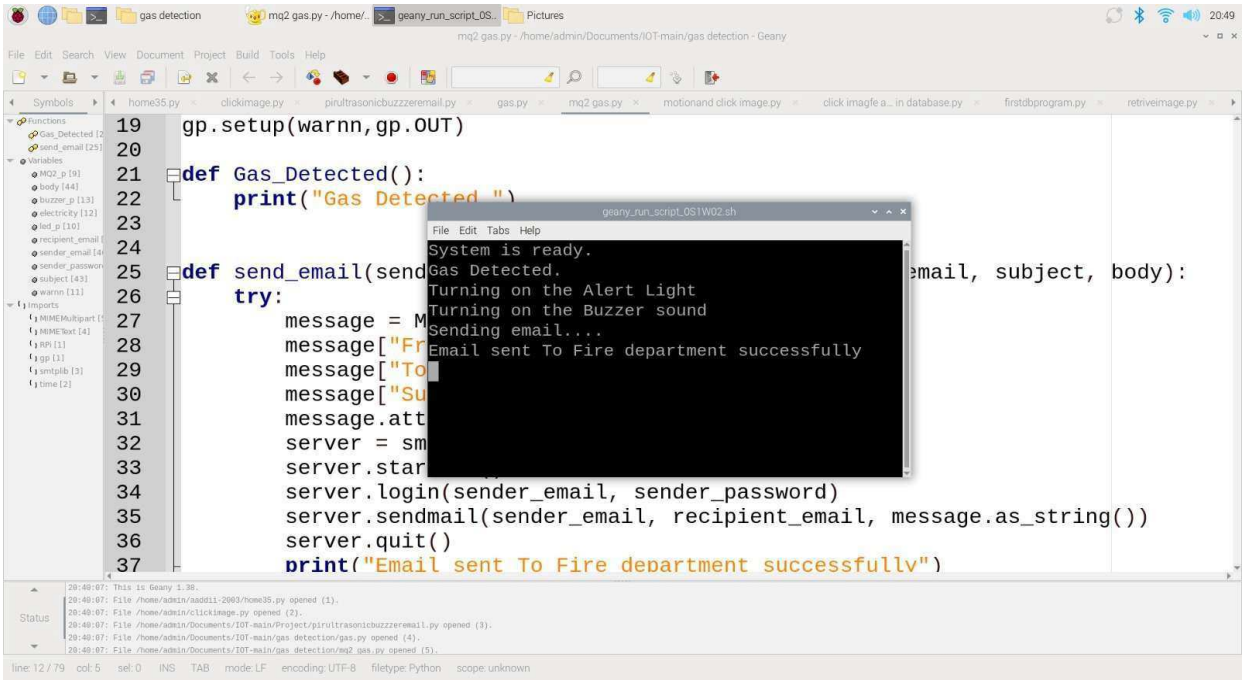

Figure 5: Result after gas is detected

A real-time email is sent to the Fire Brigade Department immediately after gas detection, ensuring prompt emergency response.

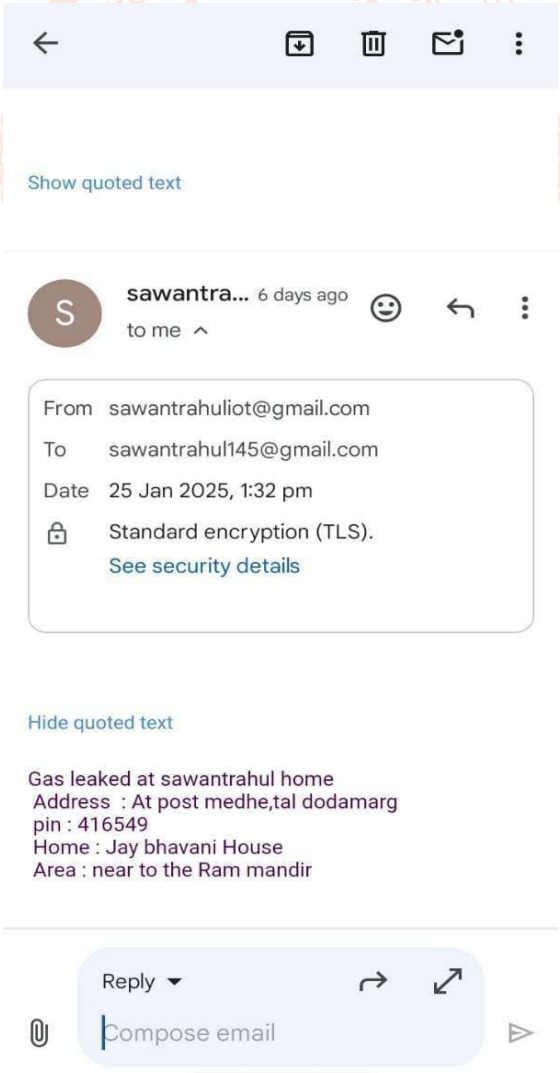

Figure 6: Real Time email received after gas is detected

7. CONCLUSION

The LPG gas detection and alert system presented in this paper offers a reliable and cost-effective solution to enhance domestic safety. By leveraging the MQ2 gas sensor, the system promptly detects gas leaks and activates multiple safety measures, such as appliance shutdown, auditory and visual alerts, and emergency notifications to the Fire Brigade Department. These features ensure timely intervention, reducing the risk of fire or explosion due to LPG leakage. The simplicity of its design and ease of deployment makes this system a practical addition to homes, providing a significant step toward improved safety and quick hazard management in domestic environments.

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