SMS BASED LPG GAS LEAKAGE DETECTION USING ARDUINO UNO AND GSM

[1]Mr.R.NARENDER,[2]N.SAI SRI DHARANI,[3]N.YASHWANTH,[4]B.BALAJI
[1]Assistant Professor,[234]B.Tech Students
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
ACE Engineering College, Ankushapur (V), Ghatkesar (M), Medchal(Dist.)-5501 301

ABSTRACT:

The system designed with gas leakage detector is quite useful for the kitchens at domestic side and in the industries at commercial side as well. A gas detector is a device, which detects the presence of various gases within an area, usually as part of a system to warn about gases, which might be harmful to humans. Gas detectors can be used to detect combustible, toxic (poisonous) and CO_2 gases. Here MQ-2 is used as a gas sensor that is capable to detect gas leak and an automated alert message is sent to the authorized mobile through the GSM modem. MQ-2 is a general-purpose sensor, which has good sensitivity characteristics to a wide range of gases. This device is designed to operate at 5V-regulated supply. The most suitable application for the gas sensor is the detection of methane, propane and butane, which makes it an excellent sensor for gas leak detectors.

This sensor output is used to trigger the operational amplifier (op-amp); this device is configured as voltage comparator. With the help of a reference voltage generated at one input of comparator, sensor output is compared, whenever the sensor detects any toxic gasses, it generates a potential, which is more than the reference voltage and there by comparator output will become high. This high signal is fed to the controller; on receipt of this high signal the controller sends this information to the authorized person through GSM i.e., SMS to the number defined in the program. The required power supply for the entire module to operate is directly derived from the mains single phase supply.

I. INTRODUCTION

1.1 PROJECT OVERVIEW:

The described system is a gas leakage detection system utilizing an MQ-2 gas sensor and GSM modem. The MQ-2 sensor is sensitive to gases such as methane, propane, and butane. When the sensor detects a gas leak, it triggers an operational amplifier configured as a voltage comparator. If the sensor output surpasses a reference voltage, the comparator sends a signal to the controller. The controller, powered by the mains supply, uses a GSM modem to send an alert SMS to an authorized mobile number. This system is versatile, applicable in both domestic kitchens and industrial environments, enhancing safety by providing timely notifications in the event of a gas leak.
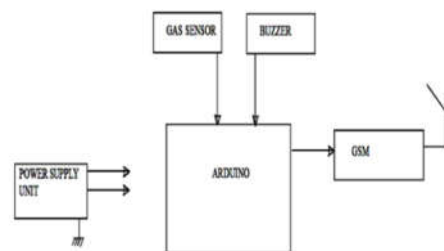
1.2 BLOCK DIAGRAM:

Figure 1: Block Diagram of SMS Based LPG gas leakage detection using Arduino UNO and GSM

BLOCK DIAGRAM DESCRIPTION:

Power Supply Unit:

The power supply unit provides the necessary electrical power to operate the entire system. It is designed to derive power directly from a mains single-phase supply. This unit ensures a stable and continuous power source for the Arduino, gas sensor, buzzer, and GSM module, allowing the system to function reliably and consistently.

In summary, the gas detection system integrates the Arduino as the central controller, a gas sensor for detecting specific gases, a buzzer for audible alerts, a GSM module for remote notifications, and a dedicated power supply unit to ensure uninterrupted operation. Together, these components create a comprehensive solution for detecting and notifying users of potential gas leaks in a given environment.

Figure 2: Step Down Transformer

Arduino:

The Arduino is a microcontroller that serves as the brain of the gas detection system. It processes signals from the gas sensor, activates the buzzer for audible alerts, and interfaces with the GSM module to send notifications. Its programmable nature allows for customization and control of the entire system.

Figure 3:Arduino UNO

Gas Sensor:

The gas sensor, often an MQ series sensor like MQ-2, is a crucial component responsible for detecting the presence of specific gases in its vicinity. In this context, it is sensitive to gases such as methane, propane, and butane. When these gases are detected, the sensor generates electrical signals that trigger actions in the Arduino.

Figure 4: MQ-2 Sensor

GSM Module:

The GSM (Global System for Mobile Communications) module enables communication between the gas detection system and mobile devices. In the event of a gas leak, the Arduino uses the GSM module to send alert messages, typically via SMS, to predefined mobile numbers. This feature ensures that

users receive timely notifications even if they are not in the vicinity of the gas sensor.

Figure 5: GSM Module

Buzzer:

The buzzer serves as an audible alert mechanism in the gas detection system. When the gas sensor detects a hazardous level of gases, the Arduino activates the buzzer to produce a sound, providing a local warning signal. This audible alert is an important feature for situations where visual monitoring may not be immediate or practical.

Figure 6: Buzzer

II. LITERATURE SURVEY
INTRODUCTION

Gas leakage poses significant risks in both domestic and industrial settings, necessitating the development of effective and timely detection systems. This literature survey explores the current state of research and technological advancements in the domain of gas leakage detection, with a specific focus on the integration of Arduino UNO and GSM modules for real-time monitoring and alerting. The project aims to enhance safety measures by leveraging the capabilities of Arduino microcontrollers for gas sensing and GSM technology for immediate communication. Gas detection systems play a crucial role in preventing potential hazards associated with the leakage of LPG (liquefied petroleum gas) and other combustible gases. Understanding the existing technologies and methodologies in this field is essential for designing a robust system that can provide quick and reliable alerts in the event of a gas leak.

This literature survey delves into key areas such as gas detection technologies, the integration of Arduino in gas sensing applications, and the use of GSM

modules for remote communication, forming the groundwork for the proposed "SMS Based LPG Gas Leakage Detection using Arduino UNO and GSM" project.

The survey begins by examining the various gas detection technologies commonly employed, shedding light on the working principles of sensors and their limitations. Subsequently, it delves into the role of Arduino microcontrollers in gas detection systems, exploring how these versatile platforms are utilized for interfacing with gas sensors and optimizing power consumption. The integration of GSM modules is then discussed, focusing on communication protocols and the reliability of SMS notifications in alerting systems.

Through this comprehensive review of existing literature, the aim is to identify gaps, trends, and challenges in the current research landscape. By synthesizing knowledge from diverse sources, this literature survey provides a foundation for the subsequent design and implementation phases of the project, contributing to the development of an innovative and efficient solution for LPG gas leakage detection.

GAS DETECTION TECHNOLOGIES:

Gas detection technologies encompass a variety of sensor types crucial for detecting potential gas leaks. Common technologies include catalytic combustion, infrared, semiconductor, and electrochemical sensors. These sensors operate based on principles such as catalytic oxidation, infrared absorption, semiconductor conductivity changes, and electrochemical reactions. Each technology has its advantages and limitations, influencing factors like sensitivity, selectivity, and response time. Understanding these technologies is vital for designing a robust gas leakage detection system. The subsequent sections will explore the integration of Arduino and GSM technologies to enhance gas detection capabilities.

ARDUINO INTEGRATION IN GAS DETECTION:

Arduino microcontrollers play a crucial role in gas detection systems, facilitating seamless sensor integration and real-time data processing. The utilization of Arduino in gas detection projects involves connecting sensors, processing data, and implementing control logic for automated responses to gas detection events. This section reviews sensor interfacing techniques, including the use of Analog and digital inputs, communication protocols like I2C or UART, and calibration strategies to ensure accurate measurements. The advantages of Arduino, such as its open-source nature and affordability, make it a popular choice for customization and integration with various sensors. However, challenges, such as power consumption optimization and real-time processing limitations, need consideration for effective gas detection solutions. Understanding the role of Arduino sets the stage for exploring its integration with GSM technology in the subsequent section for enhanced remote monitoring and alerting capabilities.

III.   DESCRIPTION

Technical Description

The block diagram of the present project consists of the ARDUINO microcontroller, Gas sensor MQ-2, alarm and GSM modem for communication. The Arduino microcontroller plays major role in receiving the data from the sensor and to take the required action. The gas sensor is used to detect the presence of smoke or hazardous gases and transmits the information. According to the received data the microcontroller sends the information to the authorized person mobile through the GSM in the form of an SMS. The sensor detects the gas leak and feed the signal to the controller and the controller sends information to the authorized person. The following is the description of individual blocks.

Working

- Continuous monitoring of LPG gas concentrations with the MQ-2 sensor.
- Gas concentration compared to a predefined safety threshold.
- If threshold exceeded, Arduino UNO triggers GSM module for immediate SMS alert.
- Alert notifies a predefined recipient about the detected gas leak.
- Rapid response and timely actions for enhanced safety.
- Users can interact by sending SMS queries for real-time gas concentration information.
- System provides reliable and real-time monitoring for quick detection and response.

Procedure

- Apply power to initiate the system.
- Initialize components, including Arduino UNO, GSM module, and MQ-2 gas sensor.
- MQ-2 sensor continuously monitors LPG gas concentrations.
- Compare real-time gas concentration with safety threshold.
- If threshold exceeded, activate GSM module through Arduino UNO.
- Construct SMS alert message indicating the detected gas leak.
- Use GSM module to connect to the cellular network.
- Instruct GSM module to send SMS alert to predefined recipient's phone number.
- Recipient receives SMS alert, providing immediate information about the gas leak.
- Implement rapid response measures for quick detection and timely actions.
- Allow users to interact by sending SMS queries for real-time gas concentration information.
- System provides reliable and real-time monitoring, enhancing safety by alerting users to potential risks.
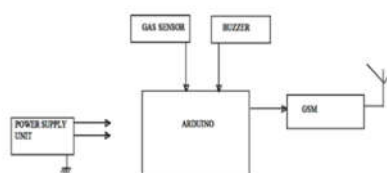
Block Diagram

Figure 7: Block Diagram of SMS Based LPG gas leakage detection using Arduino UNO and GSM

IV.   SYSTEM ANALYSIS
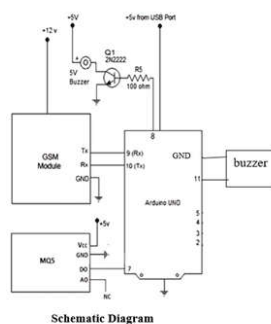
EXISTING MODEL:

Schematic Diagram

Figure 8: Schematic Diagram

The system utilizes an Arduino Uno, MQ-2 gas sensor, buzzer, and GSM module to create an SMS-based LPG gas leakage detection system. The MQ-2 sensor, detecting gas concentrations, interfaces with the Arduino, which processes the data. An operational amplifier, configured as a comparator, helps in decision-making based on gas sensor outputs. Upon detecting a hazardous gas level, the Arduino triggers a buzzer for an audible alert. Simultaneously, it commands the GSM module to send an SMS alert to a predefined number, ensuring remote notification. The power supply, derived from an external source, ensures continuous operation. This integrated solution offers a real-time response to potential gas leaks, enhancing safety in both domestic and industrial settings.

Advantages and Disadvantages

Advantages

- Early Detection of Gas Leaks
- Remote Notification

Disadvantage

- Dependency on Power Supply
- False Alarms

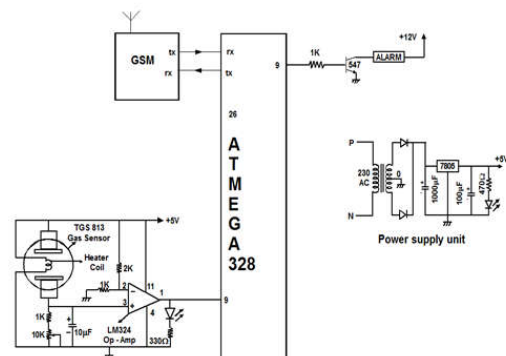**PROPOSED MODEL**

Circuit Diagram

Figure 9: Circuit Diagram

The system utilizes an Arduino Uno, MQ-2 gas sensor, buzzer, and GSM module to create an SMS-based LPG gas leakage detection system. The MQ-2 sensor, detecting gas concentrations, interfaces with the Arduino, which processes the data. An operational amplifier, configured as a comparator, helps in decision-making based on gas sensor outputs. Upon detecting a hazardous gas level, the Arduino triggers a buzzer for an audible alert. Simultaneously, it commands the GSM module to send an SMS alert to a predefined number, ensuring

remote notification. The power supply, derived from an external source, ensures continuous operation. This integrated solution offers a real-time response to potential gas leaks, enhancing safety in both domestic and industrial settings.
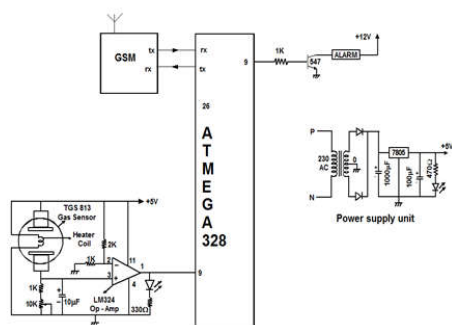
V.   RESULTS

Circuit Diagram:

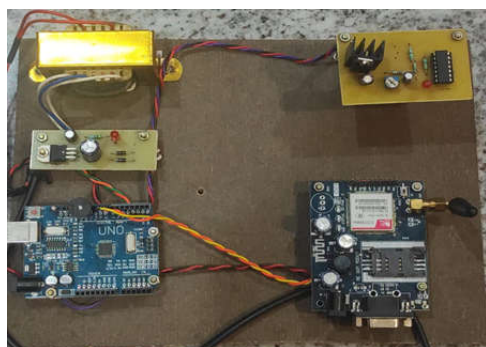Figure 10: Circuit Diagram

Result:

Figure 11: Result

Working

- Continuous monitoring of LPG gas concentrations with the MQ-2 sensor.
- Gas concentration compared to a predefined safety threshold.
- If threshold exceeded, Arduino UNO triggers GSM module for immediate SMS alert.
- Alert notifies a predefined recipient about the detected gas leak.
- Rapid response and timely actions for enhanced safety.
- Users can interact by sending SMS queries for real-time gas concentration information.
- System provides reliable and real-time monitoring for quick detection and response.

ADVANTAGES

1. Timely Alerts via SMS:
2. Remote Monitoring and Notification:
3. Cost-Effective Implementation:
4. Simple and Portable Design:

DISADVANTAGES

1. Dependency on GSM Network
2. Limited Automation

APPLICATIONS

1. Residential Gas Safety
2. Commercial Kitchens
3. Industrial Facilities
4. Educational Institutions
5. Hotels and Hospitality
6. Remote Monitoring Stations

VI.   CONCLUSION & FUTURE SCOPE

CONCLUSION

The SMS-based LPG gas leakage detection system using Arduino UNO and GSM is a valuable solution for enhancing safety in environments where LPG is used. The system effectively detects gas leaks and promptly sends SMS alerts to designated recipients, enabling quick response and mitigation of potential risks. The combination of Arduino's simplicity, gas sensor accuracy, and GSM communication facilitates a cost-effective and accessible solution for a variety of applications, including residential, commercial and industrial settings.

Through the implementation of this system, users can benefit from timely notifications, allowing them to take immediate action in the event of a gas leak. The integration of GSM technology provides a reliable means of communication, ensuring that alerts reach users regardless of their location

FUTURE SCOPE

The SMS-based LPG gas leakage detection system can be further enhanced and expanded in various ways to improve functionality and address specific needs. Some potential areas for future development include.

BIBLIOGRAPHY:

1. https://www.semanticscholar.org/paper/GSM-BASED-GAS-LEAKAGE-DETECTION-SYSTEM-Shrivastava-Prabhaker
2. https://how2electronics.com/gas-leakage-detector-gsm-arduino-sms-alert
3. https://www.researchgate.net/publication/347495607_Gas_leakage_detection_and_alerting_system_using_Arduino_Uno
4. https://en.wikipedia.org/wiki/GSM_modem