SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"LIQUEFIED PETROLEUM GAS LEAKAGE DETECTION AND MONITORING SYSTEM"

submitted in partial fulfillment of the requirement for the completion of V semester of

BACHELOR OF ENGINEERING

in

ELECTRONICS & INSTRUMENTATION ENGINEERING

Submitted by

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DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

2024-25

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DEPARTMENT OF ELECTRONICS & INSTRUMENATION ENGINEERING

CERTIFICATE

Certified that the miniproject work entitled "LIQUEFIED PETROLEUM GAS LEAKAGE DETECTION AND MONITORING SYSTEM" is a bonafide work carried out by Jashwanth Kumar V (1SI22EI041), Hemanth S (1SI22EI043), Sujay U Kattimani (1SI23EI424), Vikas N P (1SI23EI426) in partial fulfillment for the completion of V Semester of Bachelor of Engineering in Electronics and Instrumentation Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2024-25. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The mini project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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Course Outcomes

CO1: To identify a problem through literature survey and knowledge of contemporary engineering technology.
CO2: To consolidate the literature search to identify issues/gaps and formulate the engineering problem.

CO3: To prepare project schedule for the identified design methodology and engage in budget analysis, and share responsibility for every member in the team.

CO4: To provide sustainable engineering solution considering health, safety, legal, cultural issues and also demonstrate concern for environment.

CO5: To identify and apply the mathematical concepts, science concepts, engineering and management concepts necessary to implement the identified engineering problem.

CO6: To select the engineering tools/components required to implement the proposed solution for the identified engineering problem.

CO7: To analyze, design, and implement optimal design solution, interpret results of experiments and draw valid conclusion.

CO8: To demonstrate effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE/Springer/ paper format of the work.

CO9: To engage in effective oral communication through power point presentation and demonstration of the project work.

CO10:To demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics.

CO11: To perform in the team, contribute to the team and mentor/lead the team.

Program Outcomes

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Program Specific Objectives

Student will be able to

PSO1: Apply the technical knowledge of measurement techniques, instrumentation, control, communications and the state - of - the art technologies in process, healthcare and related domains.

PSO2: Apply the knowledge of Signal Processing, Electronic Circuits and Programming Skills to design embedded systems for real time applications.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO-1											3		
CO-2		3											
CO-3										3			
CO-4						3							
CO-5	3	3											
CO-6					3						3		
CO-7			3	3									
CO-8										3			
CO-9										3			
CO-10								3					
CO-11									3				
Average	3	3	3	3	3	3	3	3	3	3	3		

Attainment level: - 1: Slight (low) 2: Moderate (medium) 3: Substantial (high)

Contents

Abstract

Liquefied Petroleum Gas (LPG) is a widely used energy source, but its flammable nature makes undetected leaks a significant safety hazard, potentially leading to fire, explosions, and environmental harm. This project focuses on the development of an LPG Leakage Detection and Monitoring System to address these risks effectively. The system uses the advanced gas sensors to monitor LPG concentrations in real-time, detect leaks early, and trigger immediate safety measures such as activating alarms, shutting off the gas supply. It also sends notifications via mobile devices for prompt action . Designed for residential and commercial use, the system ensures safety and promotes the compliance with safety regulations. By providing a scalable, affordable, and efficient solution, this system contributes to protecting lives, safeguarding property, and minimizing environmental risks associated with LPG usage

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Chapter 1

Introduction

Liquefied Petroleum Gas (LPG) is a commonly used energy source in homes, businesses, and industries due to its convenience and efficiency. Ensuring safety during its use is essential. This LPG Leakage Detection and Notification System is designed to detect gas leaks and take immediate action. When a leak is detected, the system shuts off the gas supply to prevent further leakage and notifies the user.The system focuses on simplicity, reliability, and quick response, ensuring safety in homes and other settings where LPG is used. It provides an effective solution for maintaining safety.

1.1 Motivation

The LPG Leakage Detection and Notification System is designed to ensure safety by detecting gas leaks and taking immediate action. LPG is widely used in homes, businesses, and industries due to its convenience and efficiency, and this system provides a dependable solution to enhance its safe use. The system uses modern sensor technology to monitor gas levels in real-time. When a leak is detected, it automatically shuts off the gas supply and notifies the user, allowing for quick responses.This simple and reliable solution is suitable for various settings and promotes efficient use of resources while enhancing safety. By focusing on preventive measures, the system highlights the importance of technology in making daily life safer and more secure.

1.2 Objective of the project

To develop an LPG leakage detection system that ensures safety by providing real-time alerts and automated responses to prevent hazards.

1.3 Scope of the project

The “Liquefied Petroleum Gas (LPG) Leakage Detection and Notification System” focuses on providing a practical solution for detecting LPG leaks and ensuring safety in various environments. The main functions of the system are to detect leaks using sensors, automatically shut off the gas supply when a leak is found, and send notifications to the user to alert them. The scope of the project includes creating a reliable, easy-to-use system that can be installed in any setting where LPG is in use. It will be scalable, making it suitable for different environments, from small households to larger commercial or industrial spaces. This project will ensure the system works automatically without needing any manual help, providing an easy way to keep people and property safe. The solution will be simple, affordable, and easy to take care of, meeting basic safety needs.

Chapter 2

Literature Survey

1. Samiha et al. (2019): GSM-Based Gas Leakage Detection and Ventilation System Samiha et al. proposed a GSM-based system that not only detects LPG leaks,but also triggers a ventilation system to disperse leaked gas. The system uses an MQ2 sensor for gas detection, while a servomotor activates the ventilation process. An LCD and buzzer provide immediate alerts, and a GSM module sends text alerts to users' phones. This design is particularly useful for small spaces where ventilation may be limited, and the ventilation feature adds an additional safety layer by quickly reducing gasconcentration.

2. Debnath et al. (2020): Low-cost IoT-Based Gas, Fire, and Temperature Detection System Debnath et al. developed a low-cost IoT system that detects gas leaks, fires, and sudden temperature rises. The system features an MQ2 gas sensor, IR flame sensor, and DHT11 temperature sensor, all of which work together to send real-time data to users' smartphones. A GSM module is used to place calls and send alerts during emergencies. This low-cost approach provides users with a comprehensive monitoring system that covers multiple hazards, making it practical for homes and small industries where budget constraints exist.

3. Malbog et al. (2020): LPG Leakage and Flame Detection with SMS Notification Malbog et al. designed a rule-based system to detect LPG leakage and flames by utilizing sensors that send SMS notifications and trigger an alarm system. Their system achieved 100% accuracy in functionality tests, making it highly reliable for domestic safety. The main components of the system include an MQ6 gas sensor and a flame detector, which together identify hazardous conditions and alert users. This rule-based approach simplifies the detection mechanism and improves the safety of LPG household users, providing timely alerts to prevent potential accidents and deaths. The system's 100% precision underscores its efficiency, positioning it as a reliable solution for immediate threat detection and response in home environments.

4. Yaya et al. (2021): LPG Gas Use and Leakage Detection Using IoT Yaya et al. developed an IoT-based system that not only detects gas leaks, but also monitors LPG usage and automatically places orders when gas levels are low. This design incorporates sensors and an automated knob closure function to reduce leakage risks. Users receive notifications via a mobile application, allowing enhanced user experience and control over LPG management. This system is advantageous for places where LPG supply consistency and safety are essential, as it proactively monitors gas usage patterns and prevents accidental leaks through automated shutdown functions.

5. Tasnim et al. (2022): Sensor-Based Automated Gas Leakage Detection and Prevention System Tasnim et al. introduced a modular system that detects LPG leaks, tracks location and sends alerts to both users and emergency services. Their system includes a Gas Detection Module, Location Detection Module, and Alarm Module, all integrated for comprehensive response. When a leak is detected, the system activates an alarm and provides location tracking to ensure faster emergency response. The modular nature of this system enables versatile applications in homes, industries, and other environments where LPG safety is paramount.

6.S.Saranya et al. (2023): Arduino-Based Gas Leakage Detection System Saranya et al. developed a gas detection system utilizing an Arduino Uno and an MQ6 sensor, designed for general-purpose use in homes and small businesses. This system monitors environmental gases like methane and propane, activating an LED and buzzer for immediate alerts. The Arduino platform's simplicity makes it accessible for those with basic technical skills, and the system's affordability is well-suited for budget-conscious users. The gas detection mechanism is straightforward, offering a practical solution to detect hazardous gases effectively.

7.Shinde et al. (2023): GSM-Based LPG Leakage Detection with Alert Indication Shinde et al. developed a lightweight, compact LPG leakage detection system based on Arduino. This system uses an MQ6 sensor to detect gas leaks and activates an LED and buzzer for immediate visual and auditory alerts. Additionally, a GSM module sends SMS or calls to users in case of leakage, which is especially useful when the house is unoccupied. The system's simplicity and cost-effectiveness make it suitable for residential use, providing a reliable method for notifying users of potential LPG leaks without complex hardware.

8.Sai et al. (2023): Smart LPG Gas Leakage Detection and Monitoring System Sai et al. introduced a cloud-based IoT system that detects LPG leaks and monitors pressure in gas containers, suitable for both residential and industrial settings. Their design connects MQ2 gas sensors to the NodeMCU, which transmits real-time data to users' smartphones. The system also features a buzzer alarm to provide immediate feedback to residents in case of a leak, enabling quick actions to prevent escalation. With its integration into cloud networks, the system offers an efficient solution for widespread monitoring, promising to enhance safety through real-time alerts and rapid response capabilities.

9.Saleh et al. (2024): Smart Gas Leakage Detection System for Home Safety

Saleh et al. presented an LPG leak detection system that assesses risk at multiple levels, informing users, their contacts, and emergency services as the risk level escalates. The system uses an Arduino controller and an MQ6 sensor, complemented by a fan motor to reduce gas concentration when a leak is detected. This solution is suitable for domestic environments where occupants need varying alert levels for different degrees of risk. The multiple alert levels (low, medium, high) add flexibility to the system, enabling tailored responses based on the severity of the gas leak.

Chapter 3

System Overview

The overall block diagram and it's each block functions are discussed in this chapter

3.1 Block diagram

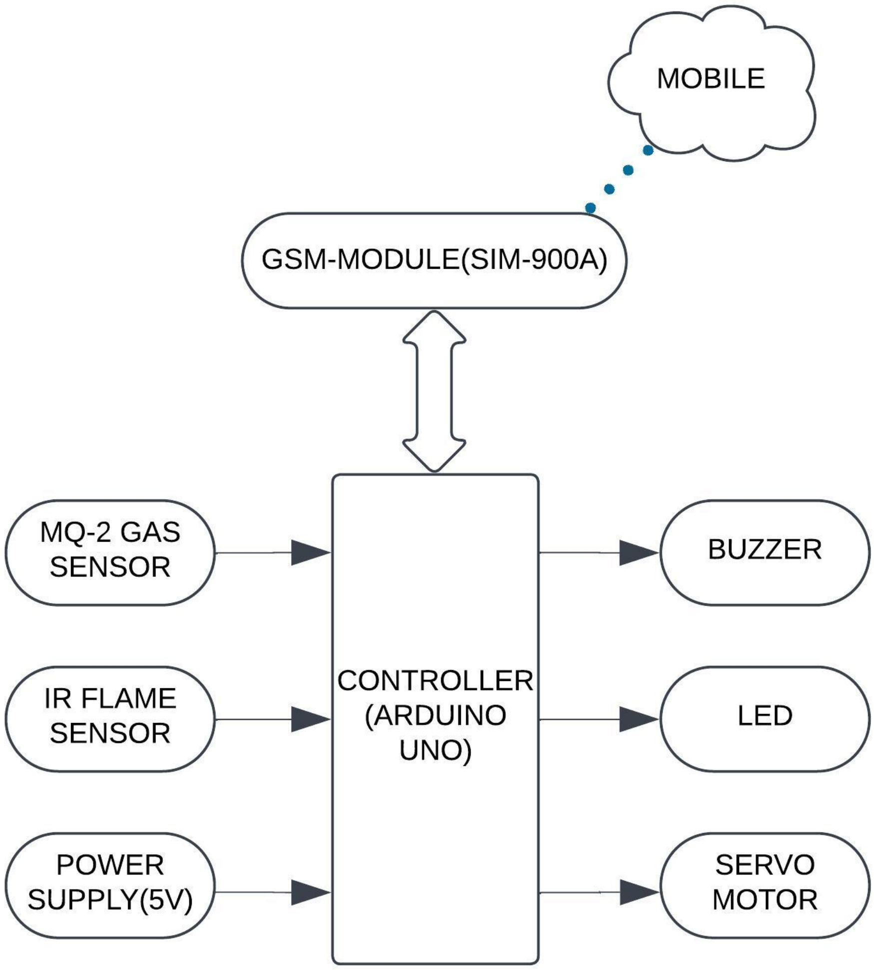

Figure 3.1: Block Diagram of LPG gas leakage detection and monitoring system

3.2 Methodology

Gas Detection: The MQ2 sensor is used to detect gases like LPG in the air. It constantly checks for any gas leaks and sends this information to the Arduino for processing.

Immediate Notification: When the system detects a gas leak, the GSM module sends a text message to user phone. This ensures you are alerted immediately, even if you are not nearby.

Local Alarm:A loud buzzer sounds to warn people who are close to the area of the gas leak. At the same time, a light turns on to visually show that there is a danger.

Automated Controls: The system uses a motor to automatically shut off the gas supply when a leak is detected. This helps stop the leak and reduces the chance of accidents.

Fire Detection and Emergency Alert: In case of an fire accident, the fire sensor detects the flames. It sends a message to the nearby fire station with the exact location using longitude and latitude. This ensures quick response and help.

Chapter 4

System Hardware

4.1 Arduino UNO

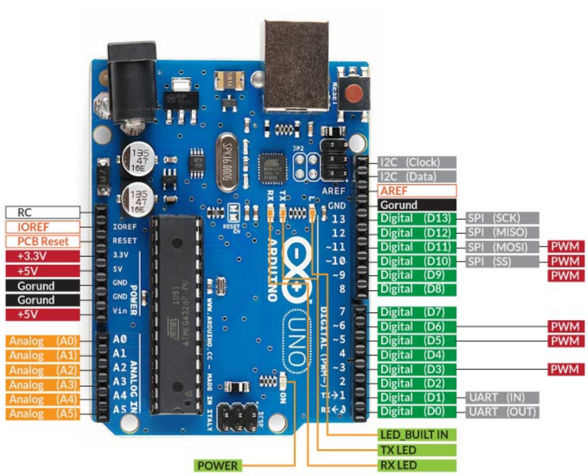

Figure 4.1: Arduino UNO

The Arduino Uno is chosen for this project because it is simple to use, cost-effective, and has plenty of input/output pins to connect the gas sensor and other components like relays or alarms. It ensures the system operates automatically without manual intervention, improving safety in environments where LPG is used.

4.2 GSM Module

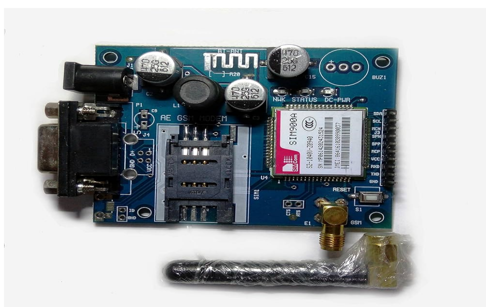

Figure 4.2: GSM Module

GSM (Global System for Mobile Communications) is a widely used standard for mobile networks, enabling voice calls, SMS, and data services. It operates on various frequency bands and uses digital transmission techniques for reliable communication. GSM is used to send alerts when a gas leak is detected. This enables remote monitoring, allowing the user to be informed even if they are away from the system. GSM provides reliable communication, enhancing safety and ensuring that users can take action in case of a leak.

4.3 Servo Motor

A servo motor is used in the LPG Leakage Detection and Monitoring System to control the gas valve. When a gas leak is detected by the sensor, the system sends a signal to the servo motor to rotate and close the gas valve, stopping the flow of gas.Servo motors are preferred because they offer precise control over movement, allowing for accurate positioning of the valve. They can rotate to a specific angle, ensuring the valve is either fully open or fully closed.

Figure 4.3: Servo Motor

4.4 MQ-2 Sensor

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses. The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Propane, Hydrogen, Methane and Carbon Monoxide concentrations ranging from 200 to 10000 ppm. In the system, the MQ-2 sensor continuously monitors

Figure 4.4: MQ-2 Sensor

the surrounding air for any gas leakage. When the concentration of LPG in the air exceeds a certain threshold, the sensor sends a signal to the microcontroller. The microcontroller then processes this signal and triggers the servo motor to close the gas valve, shutting off the gas supply.

4.5 IR Flame Sensor

A Flame Sensor is a device that can be used to detect presence of a fire source . There are several ways to implement a Flame Sensor but the module used in this project is an Infrared Radiation Sensitive Sensor.n case of a fire caused by an LPG leak, the IR flame sensor detects the infrared radiation emitted by the flames. Once the sensor identifies the radiation, it sends a signal to the microcontroller (such as Arduino), which then triggers the necessary safety measures, such as shutting off the gas supply and activating alarms and notify the nearby firestation with location co-ordinates.

Figure 4.5: IR Flame Sensor

4.6 LED

LED, or Light-Emitting Diode, is a semiconductor device that emits light when an electric current flows through it. In the LPG Leakage Detection and Shut-Off System, a single LED is used as a visual indicator to show the system's status. The LED provides a simple and clear signal to the user about the condition of the system.

Figure 4.6: LED

4.7 Buzzer

A buzzer is a simple audio signaling device commonly used in electronic projects to produce sound, indicating an alert, warning, or notification. It works by generating sound through an oscillating frequency, typically using an internal piezoelectric element or an electromagnetic coil. A buzzer is used as an auditory alert to notify users of critical situations, such as gas leaks or fire accidents caused by the leak.

Figure 4.7: Buzzer

4.8 Interfacing Diagram

This diagram shows how the Arduino Uno connects to various components for a safety system. Two MQ-2 gas sensors are linked to the Arduino's analog pins (A0 and A1) to detect gas leaks. They are powered by the Arduino's 5V and GND pins. An IR flame sensor is connected to analog pin A5 to detect fire and also uses the Arduino for power. A GSM module (SIM-900A) is connected to the TX and RX pins (8 and 7) to send alerts via messages. It is powered by a 12V external supply and uses the Arduino's GND.A servo motor (MG996R) is connected to digital pin 11 to shut off the gas supply, while a buzzer on pin 3 sounds an alarm in case of danger. An LED on pin 12 shows the system's status. The Arduino Uno coordinates all components, ensuring automatic detection, alerts, and safety actions.

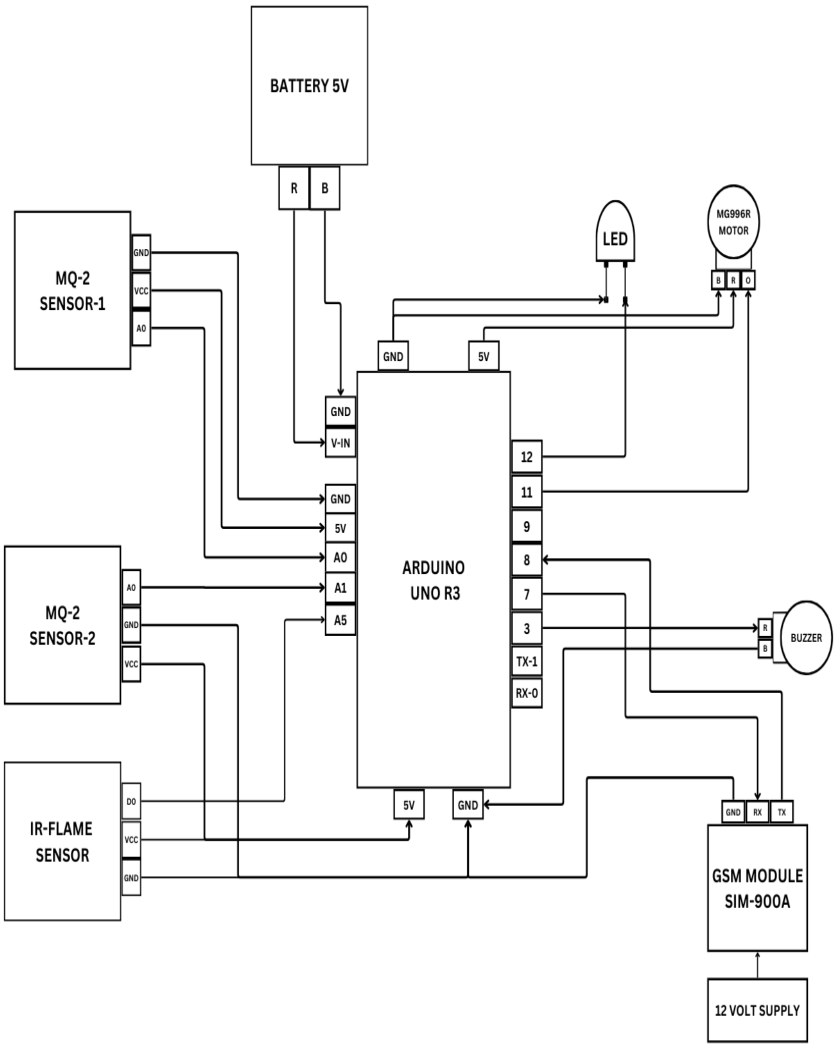

Figure 4.8: Arduino uno

Chapter 5

System Software

5.1 Arduino IDE

Figure 5.1: Servo Motor

The Arduino IDE (Integrated Development Environment) is used to program and control the microcontroller (such as Arduino Uno) in the LPG Detection and Shut-Off System. It provides a user-friendly platform to write, compile, and upload code to the Arduino board, enabling it to process inputs from the gas sensor, IR flame sensor, and other components, and take necessary actions like shutting off the gas supply and triggering alerts.

In this system, the Arduino IDE is used to:

1.Write Code: The IDE allows users to write the program that defines the behavior of the system, such as detecting gas leaks, triggering the servo motor to shut off the gas valve, and activating the buzzer or LED for alerts.

2.Compile Code: Once the program is written, the IDE compiles the code to ensure there are no errors and that it can run on the microcontroller.

3.Upload Code: The compiled code is then uploaded to the Arduino board via USB, enabling it to interact with the connected sensors and components.

The Arduino IDE is simple to use, even for beginners, and offers various libraries and tools to support the integration of sensors, relays, and other hardware in the LPG detection system. It provides a flexible and accessible way to develop, test, and deploy the code needed to ensure the system operates effectively.

5.2 Flowchart

The functional **Flowchart** of the project.

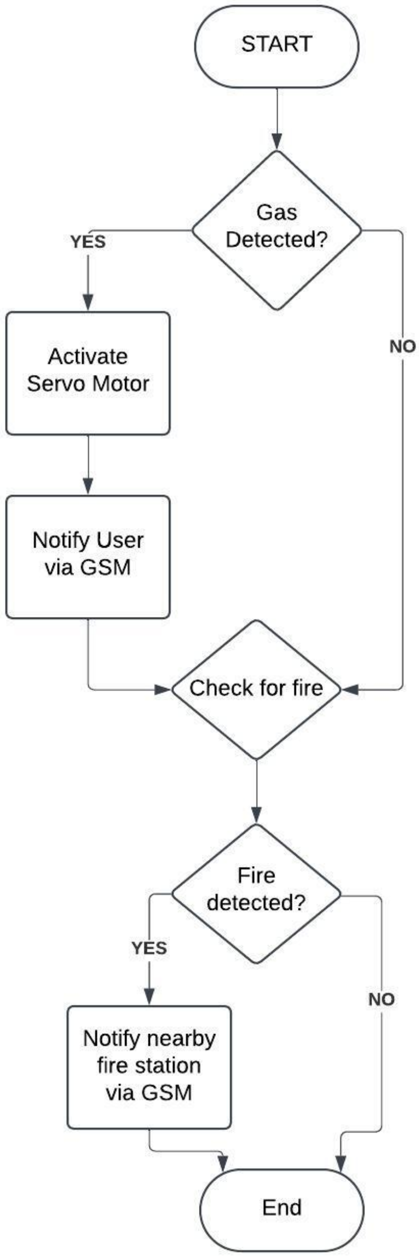

Figure 5.2: Functional Flow chart

Chapter 6

Test and Results

The **LPG Leakage Detection and Monitoring System** was tested under various conditions to ensure its functionality. In the first test, the gas sensor was exposed to LPG gas to simulate a leak. The system responded as expected, detecting the gas leak and triggering the servo motor to shut off the gas supply. The LED lit up, and the buzzer sounded, alerting the user about the leak. The system also notified the user through an SMS. In the second test, a small flame was placed near the IR flame sensor to simulate a fire. The system successfully detected the fire, triggered the servo motor to close the gas valve, and activated the LED and buzzer to notify the user of the danger. The system sent the location coordinates to the nearby fire station, ensuring a quick response.

These tests confirmed that the system can accurately detect LPG leaks and fire hazards, respond appropriately by shutting off the gas supply, and notify users effectively using visual and auditory alerts, while also ensuring that emergency services are alerted with location details in case of fire.

Table 6.1: MQ-2 sensor output tabular column

Gas Value(ppm)	Analog Output Voltage(V)	Digital Output	Gas Detected
0	0.1 – 0.2	LOW(0)	No gas detected
100	0.5	LOW(0)	Weak gas detected
200	1.0	LOW(0)	Detectable gas level
500	2.0	HIGH(1)	High gas level
1000	3.5	HIGH(1)	Dangerous gas level
>1000	4.5 – 5.0	HIGH(1)	Critical gas level

Table 6.2: IR Flame sensor output tabular column

Distance to Fire Source(in CMs)	Analog Output Voltage(V)	Digital Output	Fire Detected
<10	4.5 – 5.0	HIGH(1)	Yes
10-20	3.5 – 4.5	HIGH(1)	Yes
20-30	2.0 – 3.5	HIGH(1)	Yes
30-50	1.0 – 2.0	LOW(0)	No
>50	<1.0	LOW(0)	No

6.1 Snapshots of Result

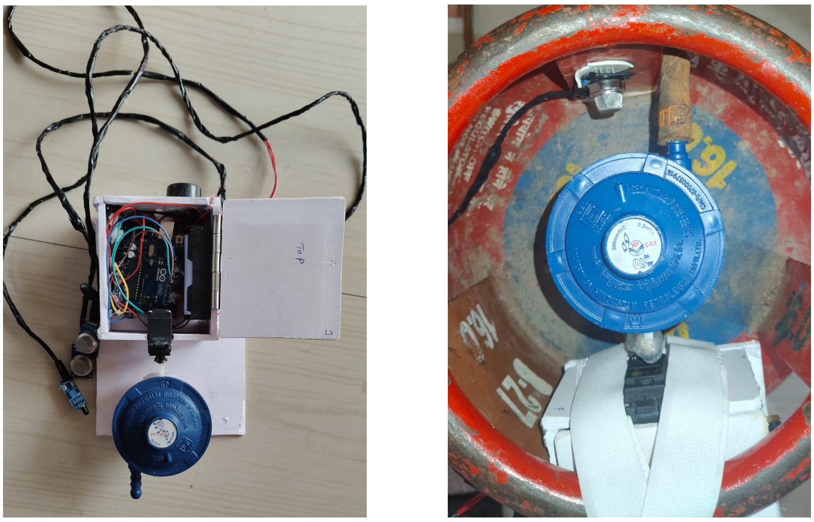

Figure 6.1: Top view of the device

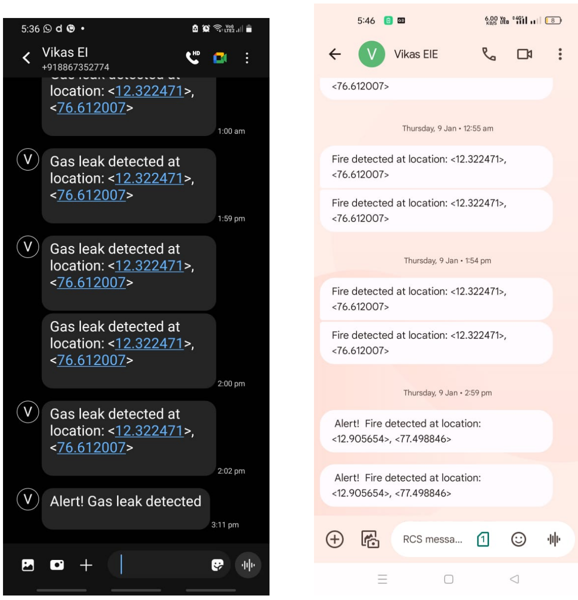

Figure 6.2: Notification sent to user and fire station

Chapter 7

Conclusion

The Project titled “LPG leakage detection and monitoring system”,is successfully implemented and tested under various conditions.

The Liquefied Petroleum Gas (LPG) Leakage Detection and Monitoring System offers a vital solution to address the growing safety concerns associated with LPG use in homes, businesses, and industries. By integrating modern technologies like advanced gas sensors this system enables real-time detection, immediate alerts, and timely responses to potential gas leaks. Not only does it improve safety by preventing accidents such as fires and explosions, but it also contributes to environmental protection and cost savings through efficient resource management. With its scalability and ease of integration, this system has the potential to make a significant impact on global safety standards, ensuring a safer and more secure environment for all.

This Liquefied Petroleum Gas (LPG) Leakage Detection and Monitoring System successfully meets its core objectives of enhancing safety, preventing potential accidents, and reducing environmental impact in areas where LPG is used. The system provides real-time leak detection, immediate alerts, and proactive response mechanisms, ensuring a safer living and working environment. With its cost-effectiveness, scalability, and ease of integration, the system offers a reliable solution for both residential and industrial settings, making it an essential tool for modern gas safety management and resource conservation.

7.1 Scope for future work

The future scope of the Liquefied Petroleum Gas (LPG) Leakage Detection and Monitoring System holds significant potential for further advancements and wider applications. Some key areas for future development include:

1. **Integration with Smart Home Systems**: The system can be integrated with smart home platforms like Google Home, Amazon Alexa, or Apple HomeKit, allowing users to control and monitor gas safety through voice commands or mobile apps.

2. **Advanced AI and Machine Learning**: The use of AI and machine learning algorithms can be incorporated to predict potential leak occurrences based on environmental factors and historical data, enhancing the system's predictive capabilities and reducing false alarms.

3. **Multi-Gas Detection**: Future versions of the system could include multi-gas sensors, expanding its capability to detect a variety of harmful gases beyond LPG, such as methane, carbon monoxide, and other hazardous emissions.

4. **Enhanced Automation**: The system could evolve to automate the gas shutoff process with more advanced control mechanisms, such as remote-operated valves or automatic isolation of affected areas, improving safety response times.

5. **Cloud-based Data Analytics**: Incorporating cloud-based data storage and analytics would allow users to access detailed reports, maintenance logs, and historical data, providing insights into system performance and leak trends.

7.2 Budget Estimation

Table 7.1: Component List with Quantities and Costs

COMPONENTS	**QUANTITY**	**COST**
Arduino uno	1	250
MQ-2 sensor	2	240
IR Flame sensor	1	60
Servo motor	1	300
LED	1	5
Power supply (12V)	1	120
GSM module	1	1000
Buzzer	1	20
total	**9**	**1995**

7.3 Project Schedule

Table 7.2: Plan of Action

Events	**Oct 2024**	**Nov 2024**	**Dec 2024**	**Jan 2025**
Problem identification	✓			
Literature survey for possible methods to address the problem	✓			
Design solution		✓		
Identification of platforms/tools/controllers		✓		
Implementation of hardware setup		✓		
Execution of software			✓	
Analyse and interpret the results			✓	
Demonstration				✓
Preparation of submission of the report				✓
Presentation of the work carried on symposium/Exhibition				✓

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Appendices

Appendix A

Data Sheet of Arduino UNO

A.1 Arduino UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software, designed for creating interactive projects. It features microcontroller boards programmable via the Arduino IDE using a simplified coding language.

A.2 Specifications

- ATMega328P Processor
- AVR CPU at up to 16 MHz
- 32KB Flash
- 2KB SRAM
- 1KB EEPROM The Arduino is shown in the Figure A.1 .The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Appendix B

Data Sheet of GSM900A

B.1 GSM900A

GSM (Global System for Mobile Communications) is a standard for mobile networks enabling voice calls, SMS, and basic data services. It operates on various frequency bands and supports worldwide interoperability for mobile communication.

B.2 Specifications

• Frequency Bands: 900/1800 MHz

• GPRS: Multi-slot class 10

• Control Interface: Standard AT commands (GSM 07.07, 07.05, and SIMCOM enhanced commands)

• Supply Voltage: 5V

• Power Consumption: Approximately 1.5mA in sleep mode

• Operating Temperature: -40°C to +85°C

• Dimensions: 24mm x 24mm x 3mm

• Weight: 3.4g

Appendix C

Data Sheet of MQ-2 sensor

C.1 MQ-2 sensor

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses

C.2 Specifications

• Operating Voltage :5V DC.

• Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane.

• Analog output voltage: 0V to 5V

•Digital Output Voltage: 0V or 5V

• Can be used as a Digital or analog sensor

Appendix D

Data Sheet of IR Flame sensor

D.1 IR Flame sensor

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses

D.2 Specifications

- Operating Voltage :5v DC.
- Can detect fire or wavelength in 760 1100 nm nano within the scope of the light source.
- Signal detection sensitivity can be adjusted.

Appendix E

Data Sheet of Servo Motor

E.1 Servo Motor

The MG996 servo motor is a powerful motor often used in robotics and automation projects. It works with a voltage between 4.8V and 7.2V and can provide a torque of up to 9.4 kg-cm at 6V. The motor rotates between 0° and 180° and is controlled by PWM signals. It moves at a speed of 0.17 seconds per 60° at 6V and has strong metal gears for better durability. This motor is perfect for tasks that need accurate movement and high power.

E.2 Specifications

- Operating Voltage :4.8V – 7.2V
- Rotation 180°.

Self Assessment of Project

Self Assessment of Project			
	PO PSO	Contribution from the project	Level
1	Engineering Knowledge: Knowledge of mathematics, engineering fundamentals engineering specialization to form of complex engineering problems		2
2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.		2
3	Design/development of solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required		3
4	Conduct investigations of complex problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis interpretation of data to provide valid conclusions.		

5	Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.		
6	The Engineer and the world: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.		2
7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws.		
8	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.		3
9	Communicate clearly and inclusively in engineering and society. Write effective reports and design documents. Deliver presentations considering cultural, language, and learning differences.		4

10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments..		4
11	Life-long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.		4
12	PSO1: Apply the concepts of electronic circuits and systems to analyses and design systems related to Microelectronics, Communication, Signal processing and Embedded systems for solving real world problems		4
13	PSO2: To identify problems in the area of communication and embedded systems and provide efficient solutions using modern tools/algorithms working in a team		4

Level	Grade
poor	1
average	2
good	3
vgood	4
excellent	5