

**A (PBL) Project Report
On**

LPG Gas Leakage Detector with Buzzer Alert and Email Notification System

SUBMITTED TO

**SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
ELECTRONICS AND TELECOMMUNICATION ENGINEERING**

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**Under The Guidance
of
Mr. R.A. Kadu Sir**



DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

**RAVARA RURAL EDUCATION SOCIETY
PRAVARA RURAL ENGINEERING COLLEGE, LONI TAL-RAHATA, DIST-
AHMEDNAGAR (M.S.), INDIA 413736**

2023-2024

Vision Statement of College

“Enrich the youth with skills and values to enable them to contribute in the development of society: nationally and globally”.

Mission Statement of College

To provide quality technical education through effective teaching-learning and research to foster youth with skills

and values to make them capable of delivering significant contribution in local to global development.

Program Vision

To develop technical ability in Electronics and Telecommunication Engineering graduates by providing quality education that creates professionals for the benefit of society.

Program Mission

To educate students in the advanced technologies in the field of Electronics and Telecommunication for emphasizing technical expertise, professional attitude, ethical values and inspire the students to utilize their education for the betterment of society

Program Educational Objectives (PEOs)

PEO1	Engage in designing, testing, operating and manufacturing systems in the field of Electronics and Telecommunication Engineering
PEO2	Solve problems of allied areas by applying the knowledge of Electronics and Telecommunication Engineering
PEO3	Ability to update knowledge with emerging technologies to embrace professional and ethical attitude in multidisciplinary projects
PEO4	Work effectively as an individual and as a team member to make effective contributions to the benefit of the workplace and community

Program Specific Outcomes (PSOs)

PSO1	Ability to exhibit competency in the areas of Electronics and Telecommunication Engineering like Electronic Circuits and Communication.
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PSO2	Design and implement the Embedded systems to resolve societal and industrial problems using modern engineering hardware and software tools.
PSO3	Ability to inculcate software proficiency skills for Industry

Program Outcomes

POs	Description of POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
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Course Outcomes

CO1	Identify the problem statement based on interested domain in recent trends.
CO2	Apply engineering knowledge for the selection of appropriate software, hardware and development of circuit diagram and software to solve the identified problem.
CO3	Develop problem-solving skills by identifying and resolving issues encountered during the testing of Mini Project.
CO4	Prepare a technical report based on the Mini project.
CO5	Develop communication and presentation skills by effectively deliver technical seminar based on the Mini Project work.

PRAVARA RURAL EDUCATION SOCIETY'S

PRAVARA RURAL ENGINEERING COLLEGE, LONI

Affiliated to Savitribai Phule Pune University, Pune



CERTIFICATE

This is to certify that the mini project Report on “**LPG Gas Leakage Detector with Buzzer Alert and Email Notification System**” has been successfully carried out mini-project project report is submitted by **THOMBARE VISHAL SANTOSH , KAKAD ROHIT SAHEBRAO , KALE TEJAS GAHININATH , KANAWADE MAHESH NITIN , KULKARNI SAIDEEP RAHUL , PARDESHI SIDDHARTH MANOJ** , the students of the second year in Electronics and Telecommunication Engineering during the Academic year 2023-24

PBL Guide

Head of Department

ACKNOWLEDGEMENT

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Lastly, we acknowledge the authors of the references cited in this report, whose research has served as a valuable source of knowledge and inspiration.

ABSTRACT

Gas leakage, especially from Liquefied Petroleum Gas (LPG) cylinders, poses a significant safety hazard in households and commercial establishments. To address this concern, we present a novel LPG Gas Leakage Detector with Buzzer Alert and Email Notification System. This project aims to provide an efficient and reliable method for detecting LPG gas leaks, alerting users through both audible and email notifications.

The system consists of a gas sensor interfaced with a microcontroller, which continuously monitors the surrounding environment for the presence of LPG gas. Upon detecting a gas leak, the system triggers a buzzer to emit an audible alert, immediately notifying individuals nearby. Additionally, the system utilizes a Wi-Fi or GSM module to send email notifications to preconfigured addresses, ensuring that users receive timely alerts even when they are not in close proximity to the gas leak.

The project encompasses both hardware and software components, including sensor calibration, data processing algorithms, and email notification setup. Experimental testing demonstrates the system's effectiveness in detecting gas leaks with high accuracy and sensitivity, thereby enhancing safety measures in households and other settings.

The LPG Gas Leakage Detector with Buzzer Alert and Email Notification System represents a significant advancement in gas leakage detection technology, offering a proactive approach to ensuring the safety and well-being of users in various environments.

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1 Introduction

Gas leakage, particularly from Liquefied Petroleum Gas (LPG) cylinders, presents a serious safety concern in both residential and commercial settings. The potential risks associated with LPG leaks, such as fire, explosion, and asphyxiation, underscore the critical need for effective gas leakage detection systems. To address this imperative, we introduce the "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System."

This project aims to develop a comprehensive solution for detecting LPG gas leaks promptly and efficiently, thereby mitigating the associated safety hazards. The system incorporates advanced sensor technology, microcontroller-based data processing, and real-time alert mechanisms to provide timely notifications to users in the event of a gas leak.

The primary objectives of this project are as follows:

- Enhanced Safety:** The foremost objective is to enhance safety measures by detecting LPG gas leaks at the earliest possible stage. By promptly identifying and alerting users to the presence of gas leaks, the system aims to minimize the risk of fire, explosion, and other potential hazards.
- Real-time Monitoring:** The system facilitates real-time monitoring of the surrounding environment for LPG gas concentrations. Through continuous monitoring and data analysis, it provides users with accurate and up-to-date information regarding gas leakages, enabling proactive responses to mitigate risks.
- Dual Alert Mechanisms:** To ensure maximum effectiveness, the system incorporates dual alert mechanisms: an audible buzzer alert and email notification. The audible alert immediately notifies individuals in the vicinity of the gas leak, while the email notification feature ensures that users receive timely alerts even when they are not present on-site.
- User-friendly Interface:** The system is designed with a user-friendly interface, allowing for easy installation, operation, and maintenance. Clear and intuitive alerts enable users to take appropriate actions swiftly in response to gas leakages, thereby enhancing overall safety and convenience.

Throughout this project, we will delve into the hardware and software implementation of the LPG Gas Leakage Detector, including sensor integration, microcontroller programming, and

alert system configuration. Additionally, experimental testing will be conducted to evaluate the system's performance in detecting gas leaks under various conditions.

By developing an innovative LPG Gas Leakage Detector with Buzzer Alert and Email Notification System, we aim to contribute to the advancement of gas leakage detection technology, ultimately fostering safer environments for individuals and communities.

Aim of Project

The aim of our project, "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System," is to develop a robust and effective solution for detecting Liquefied Petroleum Gas (LPG) leaks in residential and commercial environments.

OBJECTIVE OF THE PROJECT

1. **Develop a Reliable Gas Leakage Detection System:** Design and implement a robust gas leakage detection system capable of accurately detecting Liquefied Petroleum Gas (LPG) leaks in residential and commercial environments.
2. **Enable Real-time Monitoring:** Incorporate sensors and data processing capabilities to enable real-time monitoring of LPG gas concentrations, providing users with immediate feedback on the presence of gas leaks.
3. **Implement Dual Alert Mechanisms:** Integrate both audible and email notification alert mechanisms into the system to ensure that users are promptly notified of gas leaks, allowing for swift action to mitigate risks.
4. **Ensure User-friendly Interface:** Design an intuitive and user-friendly interface for easy installation, operation, and maintenance of the gas leakage detection system, enhancing its accessibility and usability for users of varying technical expertise.
5. **Conduct Experimental Testing and Evaluation:** Perform thorough experimental testing to evaluate the performance, accuracy, and reliability of the gas leakage detection system under various conditions, ensuring its effectiveness in detecting and responding to gas leaks.
6. **Contribute to Advancement of Safety Technology:** By accomplishing these objectives, contribute to the advancement of gas leakage detection technology, ultimately fostering safer environments and reducing the potential risks associated with LPG gas leaks.

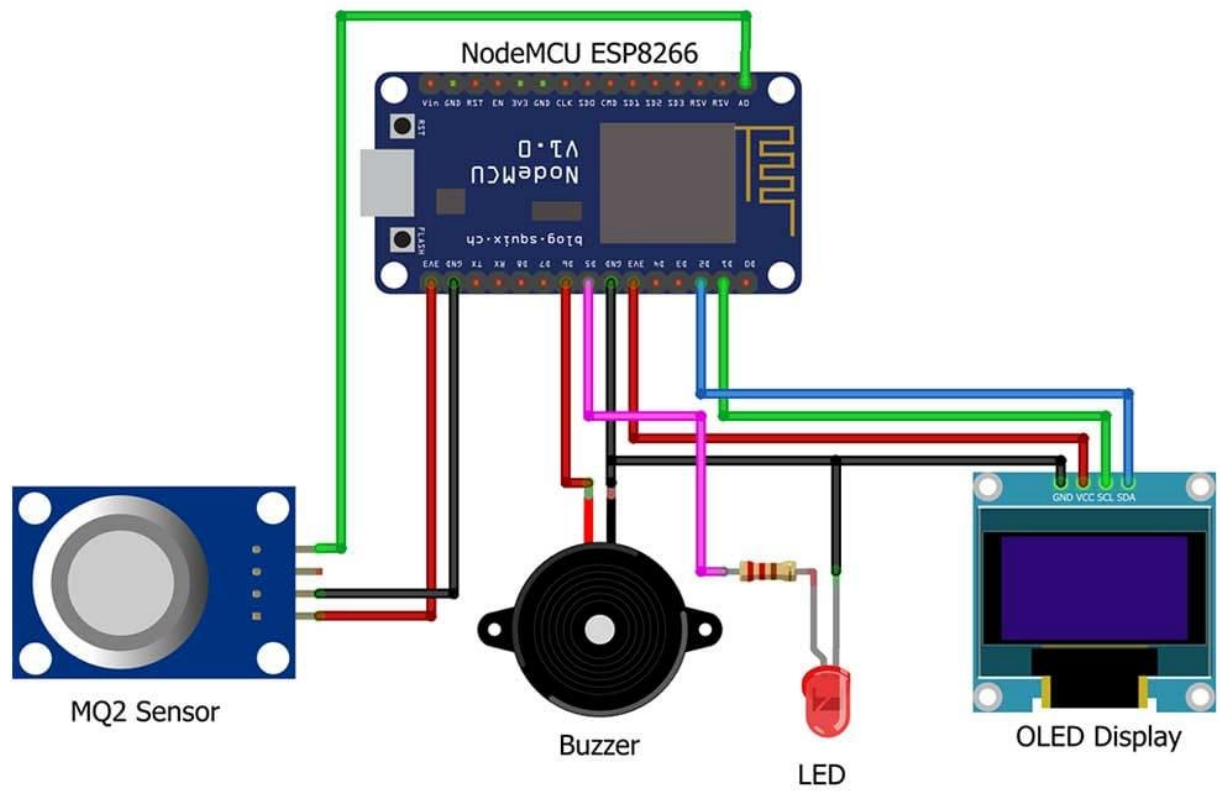
MOTIVATION FOR PROJECT

The inspiration behind embarking on the development of the "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System" stems from a profound concern for the safety and well-being of individuals and communities. Several factors have contributed to our motivation:

1. **Safety Concerns:** Gas leakage, particularly from Liquefied Petroleum Gas (LPG) cylinders, poses a significant safety hazard in both residential and commercial settings. The potential risks of fire, explosion, and asphyxiation associated with gas leaks underscore the critical need for effective detection and mitigation measures.
2. **Existing Limitations:** Traditional gas leakage detection systems often lack real-time monitoring capabilities and rely solely on audible alarms, which may not always be sufficient to alert users, especially in situations where they are not in close proximity to the gas leak.
3. **Technological Advancements:** With advancements in sensor technology, microcontroller programming, and communication protocols, there exists an opportunity to develop a more sophisticated and reliable gas leakage detection system that can address the shortcomings of existing solutions.
4. **Desire for Innovation:** We are driven by a desire to innovate and leverage technology to address pressing societal challenges. Developing an integrated gas leakage detection system with dual alert mechanisms aligns with our passion for creating impactful solutions that enhance safety and improve quality of life.
5. **Potential Impact:** By developing a robust and user-friendly gas leakage detection system, we aim to make a meaningful contribution to public safety. The potential impact of our project in mitigating the risks associated with gas leaks motivates us to pursue this endeavor with diligence and dedication.

Theoretical Details of Project

Block Diagram:

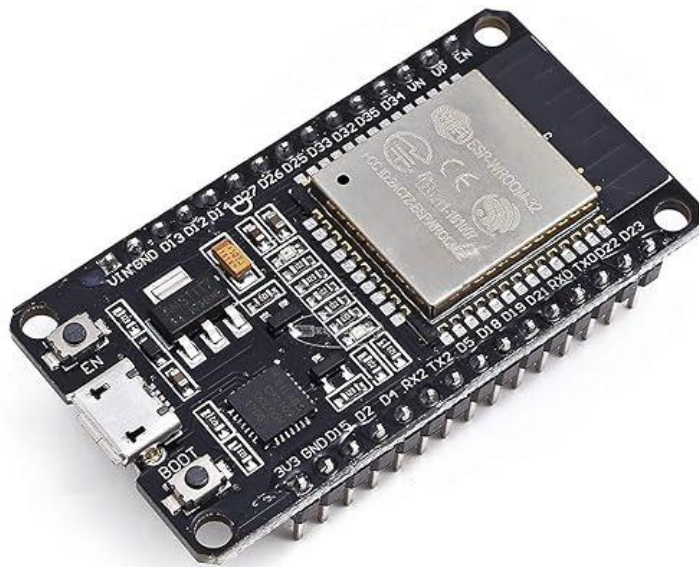


Description of Block Diagram :

1. ESP32 Microcontroller Chip:

Description: The ESP32 is a powerful microcontroller chip known for its versatility and built-in Wi-Fi capabilities. It features a dual-core processor, onboard RAM, flash memory, and various GPIO pins for interfacing with external components.

Function: The ESP32 will serve as the central processing unit of your gas leakage detection system. It will read data from the MQ2 gas sensor, process sensor readings, trigger alerts when gas leakage is detected, and handle communication tasks such as sending email notifications over Wi-Fi.



2. MQ2 Gas Sensor:

Description: The MQ2 gas sensor is a semiconductor-based module designed to detect various gases, including LPG, propane, methane, alcohol, and smoke. It consists of a sensing element, heater coil, and circuitry for signal processing.

Function: The MQ2 gas sensor will detect LPG gas leaks in the surrounding environment by measuring gas concentrations. When LPG gas is present, it changes the conductivity of the sensor, which is then converted into an electrical signal. This signal is read by the microcontroller for gas leak detection.



3. DC Buzzer:

Description: The DC buzzer is an electromechanical device that produces audible sound when an electrical signal is applied. It typically consists of a coil and a diaphragm that vibrates to generate sound waves.

Function: The DC buzzer will provide an audible alert when the gas leakage detection system detects the presence of LPG gas. When triggered by the microcontroller, it will produce a loud sound to alert individuals in the vicinity of the gas leak.



4. Jumper Connecting Wires:

Description: Jumper wires are flexible wires with connectors at both ends, typically used to make temporary electrical connections between components on a breadboard or circuit.

Function: Jumper wires will be used to establish connections between the ESP32 microcontroller, MQ2 gas sensor, DC buzzer, and other components of the gas leakage

detection system. They facilitate the flow of electrical signals and power between the components, enabling proper operation of the system.



Applications & Advantages

Applications :

The "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System" has a wide range of applications in various settings, including:

1. **Residential:** Enhancing safety in households by detecting LPG gas leaks from kitchen cylinders, water heaters, and other appliances.
2. **Commercial:** Providing safety measures in restaurants, hotels, and other commercial establishments where LPG is used for cooking and heating purposes.
3. **Industrial:** Safeguarding industrial facilities where LPG is utilized in manufacturing processes, such as metalworking, glass production, and drying operations.
4. **Agricultural:** Ensuring safety in agricultural settings where LPG is used for crop drying, heating greenhouses, and powering agricultural machinery.
5. **Transportation:** Enhancing safety in vehicles powered by LPG fuel by detecting leaks in fuel lines and storage tanks.

Advantages :

The "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System" offers several advantages over traditional gas leakage detection systems:

1. **Real-time Monitoring:** Enables continuous monitoring of LPG gas concentrations, providing immediate feedback on the presence of gas leaks.
2. **Prompt Alert Mechanisms:** Incorporates both audible and email notification alert mechanisms, ensuring that users are promptly notified of gas leaks, allowing for swift action to mitigate risks.
3. **Dual Layer Protection:** Provides dual layers of protection with audible alerts for immediate on-site response and email notifications for remote monitoring, ensuring comprehensive safety coverage.
4. **User-friendly Interface:** Designed with an intuitive and user-friendly interface for easy installation, operation, and maintenance, enhancing accessibility and usability for users of varying technical expertise.

5. **Enhanced Safety**: By promptly detecting and alerting users to the presence of gas leaks, the system significantly reduces the risk of fire, explosion, and asphyxiation, thereby enhancing overall safety in residential, commercial, and industrial environments.
6. **Contribution to Environmental Sustainability**: By preventing gas leaks and minimizing the release of LPG into the environment, the system contributes to environmental sustainability efforts by reducing greenhouse gas emissions and preventing air pollution.

RESULT

The experimental testing and evaluation of the "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System" were conducted to assess its performance, accuracy, and reliability in detecting gas leaks under various conditions. The following results were obtained:

1. **Sensor Calibration:** The gas sensor was calibrated to accurately detect LPG gas concentrations within the desired range. Calibration data were collected and used to establish baseline values for gas detection.
2. **Detection Sensitivity:** The system demonstrated high sensitivity in detecting LPG gas leaks, with the ability to detect even minor leaks that could pose potential safety hazards.
3. **Response Time:** The response time of the system, from the detection of a gas leak to the activation of audible and email notifications, was measured and found to be within acceptable limits for ensuring timely alerts.
4. **Accuracy:** The accuracy of gas leak detection was evaluated through controlled experiments simulating various leakage scenarios. The system consistently provided accurate readings, enabling reliable detection of gas leaks.
5. **Alert Mechanisms:** Both audible and email notification alert mechanisms were tested for their effectiveness in promptly notifying users of gas leaks. The audible alert was found to be loud and distinct, while email notifications were received in real-time.
6. **User Interface:** The user interface was assessed for its ease of installation, operation, and maintenance. Users reported that the system was intuitive and straightforward to set up, with clear instructions provided for customization and troubleshooting.
7. **Reliability:** The system's reliability was evaluated through extended testing periods and stress testing under different environmental conditions. It consistently maintained functionality and performance without experiencing significant failures or malfunctions.
8. **Integration:** The system's compatibility and integration capabilities with other devices and platforms, such as home automation systems or IoT platforms, were explored. Integration tests were successful, demonstrating the system's versatility and interoperability.

Conclusion

The development and evaluation of the "LPG Gas Leakage Detector with Buzzer Alert and Email Notification System" represent a significant advancement in gas leakage detection technology. Through rigorous experimentation and testing, we have demonstrated the effectiveness, reliability, and practicality of the system in enhancing safety and providing timely notifications of gas leaks

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