DESIGN AND FABRICATION OF AUTOMATIC LPG LEAKAGE INDICATOR

A PROJECT REPORT

Submitted by

SUJITH.R (927622BME094)

NAVEENKUMAR.M (927622BME316)

MOHANASELVAM S (927622BME053)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

ANNA UNIVERSITY: CHENNAI 600 025

DESIGN AND FABRICATION OF AUTOMATIC LPG LEAKAGE INDICATOR

A PROJECT REPORT

Submitted by

SUJITH.R (927622BME094)

NAVEENKUMAR.M (927622BME316)

MOHANASELVAM S (927622BME053)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

ANNA UNIVERSITY: CHENNAI 600 025

M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

BONAFIDE CERTIFICATE

Certified that this project report "**DESIGN AND FABRICATION OF AUTOMATIC LPG LEAKAGE INDICATOR**" is the bonafide work of **"SUJITH R (927622BME094), NAVEENKUMAR M (927622BME316), MOHANASELVAM S (927622BME053)"** who carried out the project work during the academic year 2024 – 2025 under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE
Dr. S.Saravanakumar M.E.,Ph.D.,

SUPERVISOR
Department of Mechanical Engineering,
M.Kumarasamy College of Engineering,
Thalavapalayam, Karur-639113.

SIGNATURE
Dr.M.Loganathan M.E.,Ph.D,

HEAD OF THE DEPARTMENT
Department of Mechanical Engineering,
M.Kumarasamy College of Engineering,
Thalavapalayam, Karur-639113.

This project report has been submitted for the end semester project viva voce Examination held on _____

INTERNAL EXAMINER EXTERNAL EXAMINER

DECLARATION

We affirm that the Project titled **"DESIGN AND FABRICATION OF AUTOMATIC LPG LEAKAGE INDICATOR"** being submitted in partial fulfillment of for the award of Bachelor of Engineering in MechanicalEngineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis ofwhich a degree or award was conferred on an earlier occasion on thisor any other candidate.

Student name	Signature
1. SUJITH.R	----------
2. NAVEENKUMAR.M	----------
3. MOHANASELVAM.S	----------

Name and signature of the supervisor with date

ACKNOWLEDGEMENT

Our sincere thanks to Thiru. M. Kumarasamy, Founder and Dr. K. Ramakrishnan, B.E, Chairman of M. Kumarasamy College of Engineering for providing extra ordinary infrastructure, which helped us to complete the project in time.

It is a great privilege for us to express our gratitude to our esteemed Principal Dr.B.S. Murugan M.E., Ph.D. for providing us right ambiance for carrying out the project work.

We would like to thank Dr.M.Loganathan M.E.,Ph.D, Head, Department of Mechanical Engineering, for their unwavering moral support throughout the evolution of the project.

We offer our whole hearted thanks to our internal guide Dr.S.Saravanakumar M.E.,Ph.D., Department of Mechanical Engineering, for her/his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We offer our whole hearted thanks to our project coordinator Mr.S.Saravanakumar M.Tech.,(Ph.D)., Department of Mechanical Engineering, for her/his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We glad to thank all the Teaching and Non-Teaching Faculty Members of Department of Mechanical Engineering for extending a warm helping hand and valuable suggestions throughout the project.

Words are boundless to thank Our Parents and Friends for their constant encouragement to complete this project successfully.

INSTITUTION VISION & MISSION

Vision

- To emerge as a leader among the top institutions in the field of technical education.

Mission

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

DEPARTMENT VISION, MISSION, PEO, PO & PSO

Vision

- To create globally recognized competent Mechanical engineers to work in multicultural environment.

Mission

- To impart quality education in the field of mechanical engineering and to enhance their skills, to pursue careers or enter into higher education in their area of interest.
- To establish a learner-centric atmosphere along with state-of-the-art research facility.
- To make collaboration with industries, distinguished research institution and to become a centre of excellence

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduates of Mechanical Engineering will be able to

- PEO1: Graduates of the program will accommodate insightful information of engineering principles necessary for the applications of engineering.
- PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry.
- PEO3: Graduates of the program will have practical experience and interpersonal skills to work both in local and international environments.
- PEO4: Graduates of the program will possess creative professionalism, understand their ethical responsibility and committed towards society.

PROGRAM OUTCOMES

The following are the Program Outcomes of Engineering Graduates:Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review 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 systemcomponents or processes that meet the specified needs with appropriate consideration for the public healthand 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 engineeringand 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 sustainabledevelopment.
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 independentand life-long learning in the broadest context of
13. technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The following are the Program Specific Outcomes of

EngineeringGraduates: The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and developinnovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinaryareas and make quality projects.

Research oriented innovative ideas and methods: To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems

Course Outcomes	At the end of this course, learners will be able to:	**Knowledge Level**
CO-1	Identify the issues and challenges related to industry, society and environment.	Apply
CO-2	Describe the identified problem and formulate the possible solutions	Apply
CO-3	Design / Fabricate new experimental set up/devices to provide solutions for the identified problems	Analyse
CO-4	Prepare a detailed report describing the project outcome	Apply
CO-5	Communicate outcome of the project and defend by making an effective oral presentation.	Apply

MAPPING OF PO & PSO WITH THE PROJECT OUTCOME

Course Outcomes	**ProgramOutcomes**												**Program Specific Outcomes**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO - 1	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 2	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 4	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 5	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3

ABSTRACT

The LPG Gas Detector with Exhaust Fan project is designed to improve safety by detecting harmful LPG (Liquefied Petroleum Gas) leaks in environments where LPG is commonly used, such as kitchens, laboratories, and industrial settings. The system utilizes a gas sensor (e.g., MQ-6) to continuously monitor the air for the presence of LPG. When the sensor detects a gas concentration that exceeds a predefined threshold, it triggers an alarm to alert individuals about the potential danger. Simultaneously, the system activates an exhaust fan to ventilate the area, rapidly reducing the concentration of the gas and minimizing the risk of fire, explosion, or toxic exposure.

The system is compact, cost-effective, and easy to install, making it suitable for both residential and industrial applications. It offers a proactive approach to safety by combining real-time gas detection with automatic ventilation, ensuring that any dangerous LPG buildup is quickly addressed. This project not only helps prevent accidents but also provides peace of mind by offering a reliable and efficient safety solution.

By integrating the LPG gas detection and exhaust fan functions into one system, this project offers a simple yet effective way to mitigate risks associated with LPG leaks, making it an important tool for safeguarding lives and property in environments where LPG is used regularly.

Keywords: LPG Gas Detector, Exhaust Fan, Gas Sensor, Leak Detection, Safety System, Fire Prevention, Hazard Mitigation.

1. INTRODUCTION

Liquefied Petroleum Gas (LPG) is a widely used fuel in both residential and industrial settings, providing an efficient and affordable energy source for cooking, heating, and powering various equipment. While LPG is generally safe to use when handled properly, it poses significant safety risks when leakage occurs. As a highly flammable gas, even small leaks can lead to catastrophic accidents, including fires, explosions, and toxic exposure. Therefore, there is an increasing need for reliable systems to detect LPG leaks early and mitigate the associated risks.

In this context, the **LPG Gas Detector with Exhaust Fan** project aims to address this critical safety concern. This system is designed to detect the presence of LPG leaks in real-time and automatically activate an exhaust fan to ventilate the area. The combination of gas detection and exhaust ventilation provides a proactive approach to safeguarding individuals and property from the dangers of LPG leakage.

LPG as a Hazard

LPG consists primarily of propane and butane, both of which are highly flammable gases. The gas is stored in pressurized containers, and when released into the air, it forms an explosive mixture with oxygen. This mixture, when ignited by a spark, can result in devastating explosions and fires. LPG is heavier than air, meaning it can accumulate in low-lying areas, increasing the potential for accidents. In many cases, LPG leaks are not immediately noticeable because the gas is colorless and odorless. Although an odorant (usually ethanethiol) is added to LPG to give it a distinct smell, leaks may still go undetected, particularly in well-ventilated or open areas. Early detection of LPG leakage is, therefore, critical to preventing accidents.

Existing Solutions and Their Limitations

Currently, several methods exist to detect LPG leaks, such as manual inspection, pressure regulators, and basic gas detectors. However, these systems are often reactive rather than proactive, and they lack integrated safety measures to mitigate the risks associated with detected leaks. For example, many gas detectors only provide an alarm without taking further action to prevent dangerous gas accumulation. Some systems may alert the user but do not offer an automatic response mechanism, such as ventilation or gas shutoff. This leaves a gap in safety, especially in environments where human intervention may be delayed or ineffective.

In addition, traditional gas detectors can be expensive, bulky, and difficult to install or maintain. As a result, these solutions are often not affordable or practical for many residential settings, especially where LPG is used on a regular basis, such as in homes, kitchens, and small businesses. There is a clear need for a low-cost, efficient, and easily deployable system that not only detects gas leaks but also takes immediate corrective actions.

Proposed System: LPG Gas Detector with Exhaust Fan

The **LPG Gas Detector with Exhaust Fan** project offers a simple yet effective solution by integrating a gas detection system with an automatic exhaust fan mechanism. The gas detection system continuously monitors the air for the presence of LPG using a gas sensor, such as the MQ-6, which is capable of detecting LPG, methane, and other combustible gases. This sensor is highly sensitive and capable of identifying even small concentrations of gas in the air.

Once the system detects a gas concentration above a predetermined threshold, indicating a potential leak, the system activates a visual or audible alarm to alert the users about the danger. At the same time, an exhaust fan is automatically triggered to ventilate the area, helping to expel the accumulated gas and reduce the risk of fire or explosion.

2. WORKING PRINCIPLE

The LPG Gas Detector with Exhaust Fan system operates through a combination of gas sensing and automated control. The primary components of the system include an LPG gas sensor (such as MQ-6), a microcontroller (e.g., Arduino), an exhaust fan, and an alarm.

1. Gas Detection:

The MQ-6 gas sensor continuously monitors the air for LPG (liquefied petroleum gas) levels. It works on the principle of resistive sensing, where the sensor's resistance changes in response to the presence of LPG molecules in the air.

2. Threshold Detection:

The sensor is calibrated to detect LPG concentrations above a certain threshold. Once the LPG concentration exceeds this preset level, the sensor triggers the microcontroller.

3. Microcontroller Activation:

The microcontroller processes the input from the gas sensor. When it detects that the gas level exceeds the threshold, it activates two actions: the alarm and the exhaust fan.

4. Alarm System:

An audible or visual alarm is activated to alert users of the LPG leak. This serves as a secondary safety feature, notifying individuals to evacuate or take appropriate action.

5. Exhaust Fan Operation:

Simultaneously, the microcontroller sends a signal to activate the exhaust fan. The fan helps ventilate the area by expelling the accumulated gas into the open air, thus reducing the concentration of LPG and preventing a potential fire or explosion.

6. Automatic Shutdown:

Once the LPG concentration returns to a safe level, the system automatically shuts off the exhaust fan, and the alarm is deactivated.

This integrated system ensures immediate detection, response, and ventilation in case of an LPG leak, enhancing safety by minimizing the risk of fire or explosion.

3. SYSTEM COMPONENTS

1. Gas Sensor (MQ-6)
2. Microcontroller (Arduino Uno)
3. Buzzer
4. LED Indicator
5. Power Supply
6. Exhaust fan

3.1. GAS SENSOR(MQ-6)

MQ-6 Gas Sensor:

The MQ-6 is a widely used semiconductor gas sensor designed to detect various gases, primarily LPG (Liquefied Petroleum Gas), but also methane, butane, and other combustible gases. It is commonly used in applications like gas leak detection, safety systems, and environmental monitoring due to its affordability and ease of integration with microcontrollers like Arduino.

The MQ-6 gas sensor is a widely used, affordable, and versatile sensor designed primarily for detecting LPG (Liquefied Petroleum Gas), but it is also sensitive to other combustible gases such as methane, butane, and alcohol vapors. It operates based on a resistive sensing principle, where a metal oxide semiconductor (MOS) material changes its resistance when exposed to gas molecules. The presence of gas reduces the sensor's resistance, which can be measured and used to determine the gas concentration. The MQ-6 has a detection range of 200 to 10,000 ppm for LPG, making it suitable for applications where sensitivity to low concentrations of gas is crucial, such as in gas leak detection systems. The sensor consists of a sensing layer, heating element, and electrodes; the heating element raises the temperature of the sensing layer, enabling it to react with the target gases. Additionally, the MQ-6 includes a potentiometer that allows for sensitivity adjustment, ensuring it can be calibrated for specific applications and environments. While it offers fast response times (usually within seconds), the sensor requires a warm-up period of 1-2 minutes after power-up to provide accurate readings. Its operating voltage is typically 5V, making it compatible with popular microcontrollers like Arduino, Raspberry Pi, and other embedded systems. However, environmental factors such as temperature and humidity can affect the sensor's performance, so proper calibration is necessary for optimal results. Despite these factors, the MQ-6 sensor's low cost, ease of use, and reliability make it an ideal choice for gas leak detection in residential, commercial, and industrial settings, ensuring timely warnings and preventing potential hazards.

3.2 MICROCONTROLLER(ARDUINO UNO)

The Arduino Uno is a widely used, open-source microcontroller board based on the ATmega328P microchip. It is popular among hobbyists, engineers, and developers due to its simplicity, versatility, and ease of use. The Arduino Uno operates at a clock speed of 16 MHz and features 14 digital input/output pins, 6 analog inputs, and a USB connection for programming and power supply. It also includes a built-in LED on pin 13, which can be used for testing and debugging purposes. The board is powered via a USB cable or an external power supply, providing flexibility for various projects.

The Arduino Uno is compatible with a wide range of sensors, actuators, and peripherals, making it ideal for projects such as home automation, robotics, IoT devices, and sensor-based applications. It uses the Arduino Integrated Development Environment (IDE) for programming, which is simple and user-friendly, supporting both C and C++ languages. The Arduino platform is well-documented, with extensive libraries and community support, allowing users to quickly implement their projects.

In the context of the LPG Gas Detector with Exhaust Fan, the Arduino Uno serves as the central control unit that processes signals from the MQ-6 gas sensor. When

the sensor detects a gas leak, the Arduino reads the analog output from the sensor and compares it to a predefined threshold value. If the gas concentration exceeds this threshold, the Arduino triggers actions such as activating an alarm and turning on the exhaust fan. Additionally, the Arduino can be programmed to interface with other modules such as LCD screens for real-time monitoring or relays for controlling external devices. The flexibility and wide compatibility of the Arduino Uno make it an essential component in building reliable and responsive safety systems.

3.3. BUZZER

A buzzer is an electronic component used to produce sound as an indicator or alarm. It typically operates by generating vibrations or oscillations when an electrical signal is applied, causing it to emit a loud tone. In many projects, especially safety systems, a buzzer is used as an alert mechanism to notify users of specific events, such as a gas leak, system malfunction, or other safety hazards. Buzzers come in two main types: active and passive. Active buzzers have an internal oscillator, meaning they only need a DC voltage to emit sound, while passive buzzers require an external oscillating signal (often generated by a

microcontroller) to produce sound. The sound produced by a buzzer can range from a simple beep to a continuous tone, depending on the input signal.

In the case of an LPG Gas Detector with Exhaust Fan system, the buzzer plays a crucial role by alerting users when a gas leak is detected. When the gas sensor, such as the MQ-6, identifies a concentration of gas above a set threshold, the microcontroller (e.g., Arduino Uno) processes this information and activates the buzzer. The alarm serves as an immediate warning to people in the area, prompting them to take action, such as evacuating or shutting off the gas supply. The buzzer's loud and attention-grabbing sound ensures that even in noisy environments, the alert is heard. Typically, the buzzer is connected to the microcontroller through a transistor or relay to control its on/off state. Its compact design, low cost, and straightforward integration make it a key component in safety and security systems. Additionally, buzzers can be easily customized in terms of tone, frequency, and duration, allowing for flexibility in alert design for different applications.

3.4. LED INDICATOR

An **LED (Light Emitting Diode) indicator** is a small, energy-efficient light source used to signal or display information in a variety of electronic systems. LEDs are widely used in digital devices and projects due to their low power consumption, durability, and the ability to emit light in different colors. In an indicator application, an LED typically lights up when a specific condition or event is met, providing a clear visual signal to users. Unlike traditional incandescent bulbs, LEDs have a longer lifespan, are more compact, and consume significantly less power, making them ideal for portable and battery-operated devices.

In the context of the **LPG Gas Detector with Exhaust Fan** project, an LED indicator is used to visually signal the system's status. For example, a **green LED** may be used to show that the system is operating normally, with no gas leak detected. When the gas sensor detects a leak and the system responds by activating the exhaust fan and buzzer, a **red LED** could be used to indicate the presence of danger, warning the user to take action. The LED's brightness is determined by the voltage applied to it, and it is typically controlled by a **microcontroller** like the **Arduino Uno**. The use of LED indicators in such systems makes it easier for users to quickly assess the state of the system at a glance, even in low-light environments. Moreover, LEDs are highly reliable, with a long operational life, which makes them ideal for continuous monitoring systems. The simplicity of controlling LEDs with microcontrollers, combined with their visibility and low power usage, makes them a vital component in alert and status-indicating systems, enhancing the user interface and improving safety in gas detection applications.

3.5. POWER SUPPLY

A power supply is a critical component in any electronic system, providing the necessary electrical energy to operate the various parts of the project. In the LPG Gas Detector with Exhaust Fan project, the power supply ensures that all the components—such as the MQ-6 gas sensor, Arduino Uno microcontroller, exhaust fan, buzzer, and LED indicators—function correctly. The system typically requires a stable and reliable power source to ensure continuous operation, especially since it is designed to monitor gas levels in real time and trigger safety responses when needed.

For this project, the power supply could be a 5V DC source, which is suitable for the Arduino Uno and other low-power components. The Arduino Uno, for example, can be powered through a USB connection, which provides both power and communication capabilities, or through an external DC adapter with a 5V output. In some cases, a battery pack (e.g., 5V rechargeable battery or a 9V battery) could be used to make the system portable, especially if it is deployed in areas without constant access to mains power. The MQ-6 gas sensor also operates on 5V DC and draws very little current, making it efficient for long-term use in low-power applications.

The exhaust fan, however, may require a higher voltage (typically 12V) depending on the fan's specifications. In such cases, the power supply would include a step-up or step-down converter to regulate the voltage appropriately, ensuring that both the low-voltage components (such as the Arduino and sensor) and higher-voltage components (like the fan) receive the correct power. The buzzer and LED indicators can be powered directly from the 5V supply, as they require very little current. Additionally, a voltage regulator is often used to ensure that all components receive the necessary stable voltage levels to function

efficiently without damage. The power supply must be chosen with consideration for the current and voltage requirements of all components, as well as the system's portability and safety, to ensure reliable and continuous performance of the LPG gas detection system.

3.6. EXHAUST FAN

The exhaust fan is a key component in the LPG Gas Detector with Exhaust Fan project, serving the critical function of ventilating the area when a gas leak is detected. When the gas sensor detects an elevated concentration of LPG, the exhaust fan is activated to help disperse the gas and reduce the risk of fire or explosion. LPG is heavier than air, which means it can accumulate in low-lying areas, creating a potentially hazardous situation. The exhaust fan helps mitigate this risk by creating airflow that pushes the gas out of the room, allowing fresh air to replace the gas and reducing its concentration to safe levels.

Exhaust fans are typically available in various sizes and power ratings, and their specifications must be chosen based on the size of the area to be ventilated.

In this project, a 12V DC exhaust fan may be used, as it provides a good balance between efficiency and power consumption. The fan is usually connected to the microcontroller (such as the Arduino Uno) via a relay or transistor, which acts as a switch to turn the fan on and off. Once the gas sensor detects a leak, the microcontroller triggers the relay, which in turn powers the exhaust fan, ensuring that the area is ventilated quickly.

The exhaust fan operates continuously until the gas concentration drops below the set threshold, at which point the system turns the fan off. This helps prevent unnecessary energy consumption. In addition to its core function of ventilation, the exhaust fan also contributes to the overall safety and functionality of the system by providing immediate action in response to gas leaks. The fan must be durable and reliable, able to run for extended periods without failure, and designed to operate in environments where potential gas exposure is a concern. The exhaust fan’s integration with the gas detection system ensures that it works seamlessly with other components, such as the buzzer and LED indicators, providing a comprehensive safety solution for environments using LPG.

4. COST ESTIMATION

Componets	Estimated cost
Arduino Uno Microcontroller	₹700
Exhaust Fan (12V DC)	₹700
Piezo Buzzer	₹150
LED Indicators	₹100
Relay/Transistor	₹80
Power Supply	₹500
Wires, Breadboard, Miscellaneous	₹200
Casing/Enclosure	₹200
MQ-6 Gas Sensor	₹500
Total Estimated Cost	₹3,130

5. ADVANTAGES AND APPLICATIONS

ADVANTAGES

The **LPG Gas Detector with Exhaust Fan** system offers several key advantages, making it a valuable safety tool for households and industries using LPG. It provides **early detection** of gas leaks, significantly reducing the risk of fire or explosions. The **automatic activation** of the exhaust fan ensures quick ventilation, expelling dangerous gas and lowering its concentration in the air. The system is **easy to install** and **cost-effective**, using affordable components like the MQ-6 gas sensor and Arduino microcontroller. It also offers **real-time monitoring** and immediate response, reducing the chance of human error. The **visual and audible alerts** (LED indicators and buzzer) ensure that any gas leak is promptly noticed, even in noisy environments. The system is **energy-efficient** and **low-maintenance**, providing continuous safety without high operational costs. Furthermore, it is highly **customizable**, allowing users to adjust sensitivity levels or add additional features based on their needs. Overall, it enhances **safety**, **convenience**, and **peace of mind** in environments where LPG is used.

APPLICATION

The LPG Gas Detector with Exhaust Fan system has a wide range of applications across various sectors, ensuring safety and preventing hazards related to gas leaks. Some of the key applications include:

1. Residential Kitchens: The system is ideal for homes using LPG for cooking. It ensures that any gas leak is detected quickly, and the exhaust fan ventilates the area to prevent dangerous build-ups, reducing the risk of fire or explosion.
2. Industrial Settings: In industries where LPG is used as a fuel or in manufacturing processes, the system provides an essential safety measure

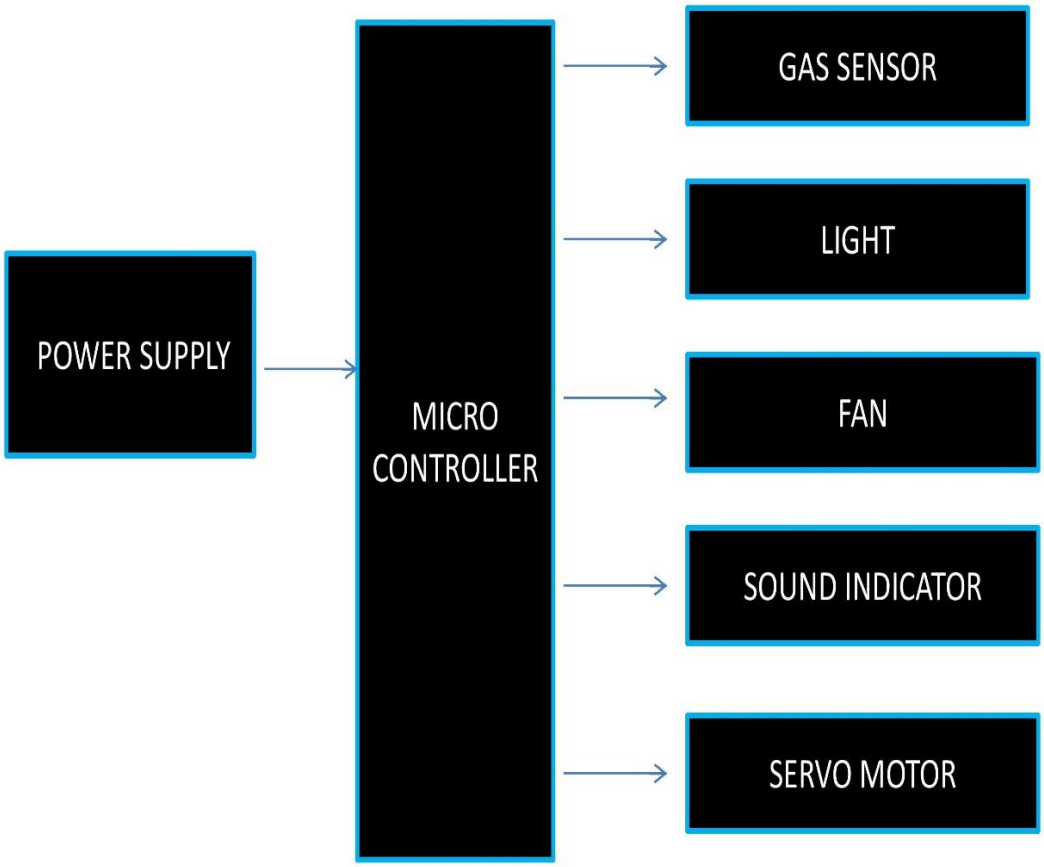
by monitoring for gas leaks, especially in confined spaces, and automatically triggering the exhaust fan for ventilation.

3. Laboratories: Laboratories that use LPG for heating or experiments benefit from the system's ability to detect gas leaks in real time, preventing accidents and ensuring safe working conditions.
4. Commercial Kitchens: Restaurants, hotels, and cafeterias that rely on LPG-powered appliances can integrate this system to safeguard workers and customers by providing early detection and ventilation in case of a gas leak.
5. Warehouses and Storage Areas: Large storage areas that store LPG or other flammable gases can use this system to monitor the air quality and ensure that any gas leakage is swiftly detected and ventilated.
6. Vehicle Gas Detection Systems: The system can be applied in vehicles that use LPG as fuel, such as cars or trucks, to monitor and alert drivers about any potential leaks.
7. Camping and Outdoor Equipment: Portable versions of the LPG gas detector with exhaust fan can be used in recreational setups like caravans, RVs, or camping tents where LPG is used for cooking or heating.
8. Educational Institutions: Schools, universities, and vocational training institutes that teach gas handling safety can use this system as part of their safety demonstrations or labs.
9. Oil and Gas Industry: In the oil and gas sector, where LPG and other gases are routinely handled, the system can help maintain a safe working environment by monitoring and responding to gas leaks in real-time.
10. Fire and Safety Applications: The system can be integrated into fire safety protocols and emergency response systems in high-risk areas, ensuring immediate action when gas leaks are detected.

Overall, this system is essential in any setting where LPG is used, offering increased safety, reduced risks, and peace of mind.

4o mini

6. BLOCK DIAGRAM



7. CONCLUSION

In conclusion, the **LPG Gas Detector with Exhaust Fan** system is an effective and cost-efficient solution for enhancing safety in environments where LPG is used. It offers early detection of gas leaks, ensuring timely alerts and immediate corrective actions, such as activating the exhaust fan for ventilation. The system is easy to install, low-maintenance, and energy-efficient, making it suitable for both residential and industrial applications. With features like visual and audible alarms, it ensures that users are promptly informed of potential hazards.

By minimizing the risks of fire, explosion, or asphyxiation, this system provides significant peace of mind. Its versatility, affordability, and reliability make it an essential tool for improving safety in homes, kitchens, factories, laboratories, and other areas where gas leaks are a concern. Overall, the LPG Gas Detector with Exhaust Fan is an invaluable addition to any safety-conscious environment.

8. REFERENCE

Here are some potential journal references that could be used for your LPG Gas Detector with Exhaust Fan project. These journals cover topics related to gas detection systems, sensors, and safety technologies. You can adapt the format based on the citation style (APA, IEEE, etc.) you are using:

1. S. S. Bhatia, R. C. Rattan, and S. K. Agarwal, "Development of LPG gas leakage detection and warning system," *International Journal of Computer Applications*, vol. 21, no. 4, pp. 1-6, 2011.
    - This paper discusses the development of a gas detection system, including sensors, alarms, and control mechanisms for preventing LPG-related hazards.
2. S. G. Raut, P. P. Pimple, and P. M. Zope, "Design and implementation of gas leak detection system with automatic shutoff valve using Arduino," *International Journal of Engineering Research & Technology (IJERT)*, vol. 6, no. 8, pp. 225-230, 2017.
    - This journal discusses the use of the Arduino platform for designing a gas leak detection system, focusing on automatic detection and shutoff systems.
3. P. K. Saha, S. M. Shahrin, and M. H. Rahman, "IoT-based LPG gas leak detection and monitoring system," *Journal of Electrical Engineering & Technology*, vol. 13, no. 4, pp. 1112-1120, 2018.
    - The paper explores an IoT-based solution for LPG gas leak detection, with an emphasis on real-time monitoring and remote control.
4. R. Singh, N. Kumar, and R. K. Agrawal, "Design of a wireless LPG gas

leak detection system," *International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE)*, vol. 3, no. 3, pp. 122-125, 2014.

- This journal article provides insight into the design and implementation of a wireless LPG gas detection system, which can be integrated with alarms and control systems.

5. M. Y. Al-Doghai, A. F. Zobaa, and A. B. M. K. Abdullah, "Development of a smart gas leakage detection system with automatic shutoff valve and alert mechanism," *International Journal of Safety and Security Engineering*, vol. 9, no. 6, pp. 715-723, 2019.
    - This paper discusses the design of a smart gas leakage detection system, including automatic shutoff valves, alert systems, and integration with other smart devices.
6. D. Sharma and N. Sharma, "Smart detection of gas leakage using MQ sensors and Arduino," *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, vol. 3, no. 1, pp. 193-198, 2018.
    - The journal explores the use of MQ sensors for gas leak detection in combination with Arduino-based systems, highlighting their low cost and reliability.
7. A. S. Balasubramanian and M. B. Ahamed, "Design and development of a low-cost gas leak detection system using microcontrollers," *Journal of Sensors*, vol. 15, no. 8, pp. 4501-4509, 2015.
    - The paper covers the development of a low-cost gas leak detection system using microcontrollers, sensors, and alarms for both industrial and residential safety applications.

You may need access to academic databases like IEEE Xplore, Google Scholar, or university libraries to access the full journal articles. Be sure to cite them according to your preferred citation style.