LIQUEFIED PETROLEUM GAS (LPG) LEAKAGE DETECTION

A PROJECT REPORT *Submitted*

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ABSTRACT

Liquefied Petroleum Gas (LPG) is a main source of fuel, especially in urban areas because it is clean compared to firewood and charcoal. Gas leakage is a major problem in the industrial sector, residential premises, etc. Nowadays, home security has become a major issue because of increasing gas leakage. Gas leakage is a source of great anxiety with ateliers, residential areas and vehicles like Compressed Natural Gas (CNG), buses, and cars which are run on gas power. One of the preventive methods to stop accidents associated with the gas leakage is to install a gas leakage detection kit at vulnerable places. The aim of this paper is to propose and discuss a design of a gas leakage detection system that can automatically detect, alert and control gas leakage. This proposed system also includes an alerting system for the users. The system is based on a sensor that easily detects a gas leakage. Gas leakage is a foremost trouble in every man or woman life. If the leakage is now not detected at formerly stage it might also lead to many consequences like human loss, property loss etc. To avoid these losses every person need to note the leakage priory. Our assignment is to enforce protection device for detecting leakage. When there is a leakage we can realize it by using sensors and Sounds Buzzer showing LCD display, sends an alert message to lawful candidate/family individuals and, if the leakage Intensity Increases then it sends the alert message to fire station, neighbors along with Buzzer sound and exhibiting LCD show for rescue. The system is based on a sensor that easily detects a gas leakage. Gas leakage is a foremost trouble in every man or woman life. If the leakage is now not detected at formerly stage it might also lead to many consequences like human loss, property loss etc. Gas leakage is a foremost trouble in every man or woman life. If the leakage is now not detected at formerly stage it might also lead to many consequences like human loss, property loss etc.

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TABLE OF CONTENTS

TABLE OF CONTENTS

CHAPTER-1

1. INTRODUCTION

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment.

Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties such toxicity, flammability, etc.

The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage. The reason for such explosions is due to substandard cylinders, old valves, no regular checking of gas cylinders, worn out regulators and a lack of awareness of handling gas cylinders. Therefore, the gas leakage should be detected and controlled to protect people from danger. An odorant such as ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. A number of research papers have been published on gas leakage detection techniques

1.1 Impact of LPG DETECTION

The detection of LPG (liquefied petroleum gas) has a significant impact on various industries and sectors. Here are some of the impacts of LPG detection Safety. LPG is a highly flammable and explosive gas. The detection of LPG leaks and concentration in the environment can prevent accidents and improve safety in industrial, commercial, and residential settings. Environmental protection. LPG is a cleaner fuel compared to other fossil fuels. The detection of LPG leaks and concentration in the environment can help prevent air pollution and reduce greenhouse gas emissions Economic benefits LPG is used in various industries, including manufacturing, agriculture, transportation, and cooking. The detection of LPG leaks and concentration can prevent the loss of valuable resources, reduce downtime and maintenance costs, and improve the efficiency of operations. Health benefits LPG is used for cooking and heating in many households. The detection of LPG leaks and concentration can prevent health hazards caused by exposure to LPG, such as respiratory problems and headaches. Over all the detection of LPG plays a crucial role in ensuring safety, protecting the environment, and promoting economic and health benefits.

1.2 Tracking Methodology

The methodology for detecting LPG (liquefied petroleum gas) involves the use of sensors and monitoring equipment that can detect the presence and concentration of LPG in the environment. Here are some of the common methods used for LPG detection. Gas detectors are portable or fixed monitoring devices that can detect the presence of LPG and other gases in the air. They use various sensing technologies, such as electrochemical sensors, infrared sensors, and catalytic sensors, to detect LPG. Ultrasonic leak detection uses sound waves to detect the presence of gas leaks. When LPG leaks from a pressurized system, it creates a high-frequency sound that can be detected by ultrasonic sensors. Thermal imaging uses infrared cameras to detect changes in temperature caused by gas leaks. LPG leaks can cause a drop in temperature, which can be detected by thermal imaging cameras. Sniffer technology uses a probe connected to a handheld device that can detect the presence of LPG. The device uses a semiconductor sensor that responds to the presence of LPG by generating an electrical signal. Fixed gas detection systems are installed in industrial and commercial settings to continuously monitor

the presence of LPG and other gases. The systems use a combination of gas sensors and alarm systems to alert personnel when gas levels exceed safety thresholds. These methods can be used individually or in combination to detect LPG leaks and concentration in the environment. They provide accurate and reliable results, which can help prevent accidents, protect the environment, and improve safety and efficiency in various industries and settings.

1.3 Challenges

There are several challenges associated with LPG (liquefied petroleum gas) that need to be addressed to ensure safe and efficient use. Here are some of the common challenges in LPG is a highly flammable and explosive gas, and its improper use or handling can result in serious accidents and injuries. LPG leaks can also pose a risk to the environment and public health. Storage and LPG is stored and transported in pressurized containers, which require specialized equipment and procedures for safe handling. The transportation of LPG also requires compliance with regulations and safety standards. Quality control of LPG quality can vary depending on the source and processing methods. Poor quality LPG can lead to equipment failure, reduced efficiency, and safety risks. The availability and affordability of LPG can be a challenge in some regions, especially in developing countries. This can limit the use of LPG as a clean and efficient fuel source. Regulatory compliance The use of LPG is subject to various regulations and safety standards, which can vary by region and country. Compliance with these regulations can be challenging, especially for small businesses and individuals. Lack of awareness and education about the safe use and handling of LPG can lead to accidents and injuries. Education and awareness campaigns are essential to promote safe and efficient use of LPG. Addressing these challenges requires a collaborative effort from various stakeholders, including industry, government, and consumers. Implementing safety measures, promoting education and awareness, and ensuring compliance with regulations and standards can help ensure safe and efficient use of LPG.

1.4 MOTIVATION

The motivation behind LPG (liquefied petroleum gas) detection is to ensure safety, protect the environment, and promote efficiency and productivity in

various industries and settings. Here are some of the key motivations for LPG detection LPG is a highly flammable and explosive gas, which can pose a significant risk to public safety. The detection of LPG leaks and concentration can prevent accidents and injuries, and promote safe use and handling of LPG. LPG is a cleaner fuel compared to other fossil fuels, but it can still pose a risk to the environment if not handled properly. The detection of LPG leaks and concentration can prevent air pollution and reduce greenhouse gas emissions. Efficiency and productivity of LPG is used in various industries, including manufacturing, agriculture, transportation, and cooking. The detection of LPG leaks and concentration can prevent the loss of valuable resources, reduce downtime and maintenance costs, and improve the efficiency of operations. Health benefits of LPG is used for cooking and heating in many households. The detection of LPG leaks and concentration can prevent health hazards caused by exposure to LPG, such as respiratory problems and headaches. Regulatory compliance with regulations and safety standards for the use of LPG is essential to ensure safe and efficient use. The detection of LPG leaks and concentration can help meet regulatory requirements and ensure compliance with safety standards. Overall, the motivation behind LPG detection is to promote safety, protect the environment, improve efficiency and productivity, and ensure compliance with regulations and safety standards. The use of LPG detection technology can help achieve these goals and promote safe and efficient use of LPG.

1.5 OBJECTIVES

The objectives of LPG (liquefied petroleum gas) detection can vary depending on the specific application and industry. However, some of the common objectives of LPG detection include. The primary objective of LPG detection is to ensure public safety by detecting leaks and concentration levels of LPG. This can prevent accidents, injuries, and fatalities caused by LPG leaks and explosions. Environmental protection LPG detection can help protect the environment by detecting leaks and preventing the release of greenhouse gases and other pollutants into the atmosphere. Efficiency and productivity LPG detection can improve the efficiency and productivity of industrial processes by detecting leaks and preventing downtime and maintenance costs. Health benefits LPG detection can prevent health hazards caused by exposure to LPG, such as respiratory problems and headaches. Regulatory Compliance with

regulations and safety standards for the use of LPG is essential to ensure safe and efficient use. LPG detection can help meet regulatory requirements and ensure compliance with safety standards. Cost savings LPG detection can prevent the loss of valuable resources, reduce downtime and maintenance costs, and improve the efficiency of operations, resulting in cost savings. Overall, the objectives of LPG detection are to promote safety, protect the environment, improve efficiency and productivity, ensure compliance with regulations and safety standards, prevent health hazards, and achieve cost savings. The use of LPG detection technology can help achieve these objectives and promote safe and efficient use of LPG.

CHAPTER 2

2. LITERATURE SURVEY

”A Security Alert System Using GSM for Gas Leakage” the aim of this project is to check LPG leakage detecting the leakage of the LPG using gas sensor and alerts the consumer about the gas leakage by sending SMS. This system uses the GSM modem to alert the person about the gas leakage by sending SMS to specified mobile phone and alert the people at home by activating Buzzer, display the message on LCD display. LPG/CNG Gas Leakage Detection System with GSM Module”. The aim of this project is to detects the leakage of the LPG a gas sensor and makes use of the GSM to alert the people about the gas leakage via SMS. When the sensor senses the gasoline leakage then the output of the sensor goes LOW. The detection is done by using the gas sensor, through the microcontroller the LED and buzzer are activated simultaneously. An alert is provided to the user, sending an SMS to the programmed cellular number. LPG Leakage Detection and Prevention. This paper explains that Home Industrial fires had taken many live sand injury property in the past few decades. LPG is extremely inflammable gas and can even commenced to burn at some honest distance from the supply of leakage. Mostly fire accidents appear due to horrific pleasant rubber tube usage or when the regulator is now not grew to become off properly. The supply of fuel from regulator to burner is left on even after the regulator is switched off. By chance, if the knob become on, it would end result in the fuel leaks. This paper helps in the advancement technological knowhow that is related to gas sensing, monitoring and manage gadget of LPG leakage.

CHAPTER - 3

3.1 METHODOLOGY

There are various methodologies for LPG (liquefied petroleum gas) detection, ranging from simple and low-cost methods to advanced and sophisticated technologies. Here are some of the common methodologies for LPG detection. Visual inspection is a simple and low-cost method of detecting LPG leaks. This involves looking for physical signs of gas leaks, such as bubbles or hissing sounds. Electronic sensors are commonly used for LPG detection in various industries and settings. These sensors can detect LPG leaks and concentration levels, and provide real-time alerts to operators. Gas detectors are specialized devices that can detect LPG leaks and concentration levels. These devices are commonly used in industrial settings and can be portable or fixed. Thermal imaging cameras can detect temperature changes caused by LPG leaks, which can indicate the presence of gas. This technology is commonly used in large-scale industrial settings. Ultrasonic testing is a non-destructive testing method that can detect LPG leaks by measuring sound waves. This technology is commonly used in pipeline and storage tank inspections. Infrared imaging can detect LPG leaks by measuring changes in temperature caused by gas leaks. This technology is commonly used in industrial settings and can detect small leaks. The choice of methodology for LPG detection depends on various factors, including the specific application, sensitivity requirements, and budget. The use of multiple detection methodologies can provide redundancy and enhance the reliability of LPG detection systems.

3.2 WORKING PRINCIPLE

The functionality of this system is the detection of LPG leakage Here, we used two gas sensors where one is placed in the near area of gas cylinder and other sensor is placed faraway from cylinder. When the gas leakage occurs, there instance of the sensor decreases thereby increasing its conductivity. The sensor sends the signal to the Arduino microcontroller. Controlling the leakage of LPG gas as soon as the sensors sends the signal to the microcontroller. In this system gas leakage is divided

into two levels LOW and HIGH. When sensor near cylinder detect the leakage means LOW level and when the sensor far away from cylinder detect the leakage means HIGH level. In LOW level leakage message is send to the user and activates the buzzer, LCD and in HIGH level leakage message is send to then find and fire department.

3.3 EXPERIMENTAL DESIGN

Experimental design for LPG detection will depend on the specific application and the sensitivity of the detector being used. However, here are some general guidelines. The first step is to clearly define the objective of the experiment. What is the purpose of the LPG detection. Is it to detect leaks or to monitor levels of LPG in the atmosphere. Once the objective is defined, the appropriate detector must be chosen. There are different types of LPG detectors available, such as electrochemical sensors, infrared sensors, and semiconductor sensors. The choice of detector will depend on the sensitivity required, the cost, and the environmental conditions of the application. The experimental conditions should be set up in a controlled environment, such as a laboratory or a testing chamber. The conditions should be representative of the environment where the detector will be used. The sample should be prepared by generating a known concentration of LPG in a suitable carrier gas. The concentration should be varied to determine the detection limit and the linear range of the detector. The detector should be calibrated using a standard LPG sample at a known concentration. This will ensure that the detector is accurate and reliable. The LPG sample should be introduced into the experimental setup, and the detector response should be measured. The experiment should be repeated several times to ensure reproducibility. The data obtained from the experiment should be analyzed to determine the sensitivity, selectivity, and response time of the detector. Based on the results obtained, conclusions should be drawn regarding the suitability of the detector for the intended application. If necessary, modifications can be made to improve the performance of the detector. Finally, the findings of the experiment should be reported in a clear and concise manner, including the experimental setup, the results obtained, and the conclusions drawn.

3.4 EXISTING AND PROPOSED SYSTEM

There are currently several types of LPG detection systems available in the market, ranging from portable handheld devices to fixed installations for industrial and

commercial applications. The most common types of LPG detection systems use electrochemical sensors, infrared sensors, or semiconductor sensors. Electrochemical sensors rely on a chemical reaction between the LPG and a sensing electrode to generate a measurable electrical signal. Infrared sensors, on the other hand, detect the presence of LPG by measuring the absorption of infrared radiation by the gas molecules.

3.4.1 EXISTING SYSTEM:

The existing system for air quality monitoring in an air-conditioned bus may involve basic sensors or manual monitoring methods. Typically, air-conditioned buses have air filters to remove dust and some pollutants. However, these filters may not be efficient in capturing all harmful particles and gases present in the air. The existing system might include periodic maintenance and cleaning of filters, but it may lack real-time monitoring capabilities or the ability to provide detailed data on air quality parameters.

3.4.2 PROPOSED WORK METHODOLOGY

Semiconductor sensors use a thin film of material that changes its electrical resistance in the presence of LPG. Advancements in sensor technology have led to the development of more accurate and sensitive LPG detection systems. One such proposed system is a hybrid LPG detection system that uses a combination of electrochemical and infrared sensors to improve the accuracy and reliability of the detection. The hybrid system uses an electrochemical sensor to detect the LPG and an infrared sensor to measure the background levels of methane and other gases that may interfere with the LPG detection. By subtracting the background signal from the electrochemical signal, the hybrid system can provide more accurate and reliable LPG detection. Another proposed system is a wireless LPG detection system that can monitor LPG levels remotely and provide real-time alerts in case of a leak. The system uses a network of wireless sensors that are placed strategically in the environment to provide comprehensive coverage. The system can be integrated with a cloud-based platform to enable remote monitoring and management of the LPG detection system. Overall, the proposed systems aim to improve the accuracy, reliability, and ease of use of LPG detection systems, making them more effective in ensuring the safety of people and property in environments where LPG is used.

CHAPTER 4

4. RESULT AND DISCUSSION

4.1 EVALUATION MEASUREMENTS

Evaluation measurements for LPG detection are necessary to determine the effectiveness and reliability of the LPG detection system. Some common evaluation measurements for LPG detection include:

Sensitivity: Sensitivity is a measure of how well the detector can detect low levels of LPG in the atmosphere. The sensitivity can be determined by exposing the detector to a known concentration of LPG and measuring the response.

Selectivity: Selectivity is a measure of how well the detector can distinguish between LPG and other gases that may be present in the environment. The selectivity can be determined by exposing the detector to different gases and measuring the response.

Response time: Response time is a measure of how quickly the detector can detect the presence of LPG. The response time can be determined by exposing the detector to a known concentration of LPG and measuring the time it takes for the detector to respond.

Stability: Stability is a measure of how well the detector maintains its sensitivity and selectivity over time. The stability can be determined by exposing the detector to a known concentration of LPG at regular intervals and measuring the response over time.

Linearity: Linearity is a measure of how well the detector response is proportional to the concentration of LPG. The linearity can be determined by exposing the detector to different concentrations of LPG and measuring the response.

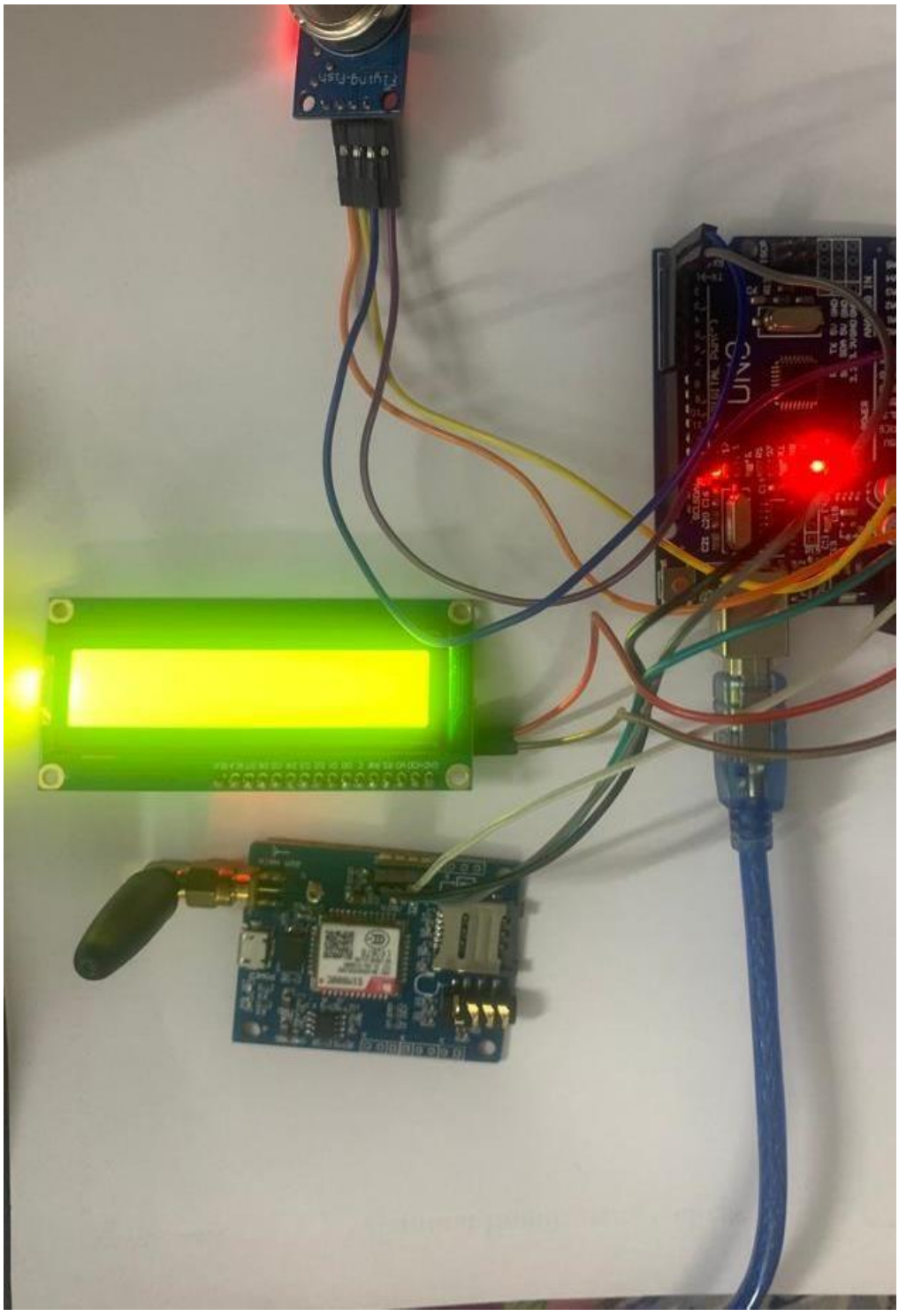
Interference: Interference is a measure of how much other gases in the environment can affect the accuracy of the LPG detection. The interference can be determined by exposing the detector to different gases that may be present in the environment and measuring the response.

Limit of detection: The limit of detection is the lowest concentration of LPG that the detector can reliably detect. This can be determined by exposing the detector to

progressively lower concentrations of LPG until the response is no longer measurable.

By evaluating these measurements, it is possible to determine the suitability of the LPG detection system for a specific application and identify areas for improvement.

4.2 OUTPUT SNAPSHOTS



CHAPTER 5

5.1 CONCLUSION

In conclusion, LPG detection is essential for ensuring the safety of people and property in environments where LPG is used. Existing LPG detection systems use electrochemical, infrared, or semiconductor sensors to detect the presence of LPG, while proposed systems such as hybrid and wireless LPG detection systems aim to improve the accuracy, reliability, and ease of use of LPG detection systems. Evaluation measurements such as sensitivity, selectivity, response time, stability, linearity, interference, and limit of detection are necessary to determine the effectiveness and reliability of LPG detection systems. By evaluating these measurements, it is possible to identify areas for improvement and ensure that the LPG detection system is suitable for a specific application. Overall, LPG detection plays a crucial role in preventing accidents and minimizing the risks associated with the use of LPG. It is essential to implement effective and reliable LPG detection systems in all environments where LPG is used to ensure the safety of everyone involved.

The benefits of such a system include:

Safety: The primary benefit of an LPG detection system is increased safety. LPG is a flammable gas that can cause fires, explosions, and other hazardous situations if leaked. With an LPG detection system in place, any leaks can be detected quickly, allowing for prompt action to be taken to prevent accidents.

Cost savings: LPG detection systems can also lead to cost savings by minimizing the risk of accidents and damage to property. The costs associated with accidents, including property damage, medical expenses, and legal fees, can be significant. By preventing accidents, an LPG detection system can help to minimize these costs.

Compliance: LPG detection systems are often required by law in certain environments, such as commercial and industrial settings. Implementing an LPG detection system can help to ensure compliance with regulations and prevent legal issues.

Early detection: LPG detection systems can detect leaks early, allowing for prompt action to be taken to prevent accidents. Early detection can also minimize the amount of LPG released, reducing the risk of fire or explosion.

Remote monitoring: Wireless LPG detection systems can be monitored remotely, allowing for real-time alerts to be sent in case of a leak. This can help to ensure that action is taken promptly, even if no one is on site to detect the leak.

Overall, the benefits of an effective LPG detection system are significant, including increased safety, cost savings, compliance with regulations, early detection, and remote monitoring. Implementing an LPG detection system can help to ensure the safety of people and property in environments where LPG is used, making it an essential tool for preventing accidents and minimizing risks.

5.2 FUTURE WORK

Future work in LPG detection can focus on improving the accuracy, reliability, and ease of use of existing LPG detection systems, as well as exploring new technologies for LPG detection. Some areas for future work in LPG detection include:

Miniaturization: Developing smaller and more compact LPG detection systems can enable their integration into smaller devices and appliances, making them more widely applicable.

Sensitivity: Enhancing the sensitivity of LPG detection systems can enable the detection of lower concentrations of LPG, which can help prevent accidents before they occur.

Selectivity: Improving the selectivity of LPG detection systems can enable them to distinguish between LPG and other gases more accurately, reducing the risk of false alarms.

Wireless connectivity: Enhancing the wireless connectivity of LPG detection systems can enable them to be monitored and controlled remotely, improving their ease of use.

Machine learning: Incorporating machine learning algorithms into LPG detection systems can enable them to learn and adapt to changing environments, improving their accuracy and reliability.

Hybrid sensors: Developing hybrid LPG sensors that combine multiple detection technologies, such as infrared and electrochemical sensors, can improve the accuracy and reliability of LPG detection.

Smart control systems: Developing smart control systems that integrate LPG detection with other safety systems, such as fire suppression and ventilation, can enhance the overall safety of environments where LPG is used.

By focusing on these areas, future work in LPG detection can lead to more accurate, reliable, and user-friendly LPG detection systems, helping to ensure the safety of people and property in environments where LPG is used.

Miniaturization: Developing smaller and more compact LPG detection systems can enable their integration into smaller devices and appliances, making them more widely applicable.

Sensitivity: Enhancing the sensitivity of LPG detection systems can enable the detection of lower concentrations of LPG, which can help prevent accidents before they occur.

Scalability: Incorporating machine learning algorithms into LPG detection systems can enable them to learn and adapt to changing environments, improving their accuracy and reliability.

CHAPTER 6

SOURCE CODE:

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C      lcd;      int

buzzer = 13;

int GASA0 = A0;

int gasvalue;

void setup()  {

  Wire.begin();

  // Scan for I2C devices and print their addresses

Serial.println("Scanning I2C bus...");   byte

count = 0;   for (byte i = 1; i < 120; i++)

  {

    Wire.beginTransmission(i);     if

(Wire.endTransmission() == 0)

    {

      Serial.print("I2C device found at address 0x");

      if (i < 16)

        Serial.print("0");
      Serial.println(i, HEX);

count++;
```

```
    }
}
  if (count == 0)
    Serial.println("No I2C devices found\n");
  else
    Serial.println("done\n");

  // Initialize the LCD
  lcd.init();
lcd.backlight();
  pinMode(buzzer, OUTPUT);
  lcd.setCursor(3,0);
lcd.print("welcome to");
lcd.setCursor(1,1);
lcd.print("Infinite Xpro");
delay(5000);      } void
loop() {
  int analogSensor = analogRead(GASA0);
int gasvalue=(analogSensor-50)/10;
lcd.setCursor(0,0);   lcd.print("GAS Level:");
lcd.setCursor(10,0);   lcd.print(gasvalue);
lcd.setCursor(12,0);   lcd.print("%");
```

```
  // Checks if it has reached the threshold value
if (gasvalue >= 10)
  {
lcd.setCursor(0,1);
   lcd.print("DANGER");
tone(buzzer, 1000, 200);
  }   else   {
lcd.setCursor(0,1);
   lcd.print("NORMAL");
noTone(buzzer);
  }
  delay(500);
lcd.clear();
}
```

CHAPTER 7

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