GAS LEAKAGE DETECTOR WITH CALL ALERT SESTEM

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DECLARATION

We hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of **Chowdhury Sadeeya Naimah, Lecturer,Department of Electrical and Electronics Engineering ,Uttara University(UU).** We also declare that no part of this project and thereof has been or is being submitted elsewhere for the award of any degree.

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Approval

This is to certify that the project on ***"Gas Leakage Detector With CALL Alert System "*** by (Md. Samsul Islam Sumon, ID- 2213171015, MD.Sazzad Ali, ID-2213171039, Md. Abdul Aziz, ID- 2213171034),has been carried out under our supervisor. The project has been carried out in partial fulfillment of the requirement for the degree of Bachelor of Science (BSc) in Electrical and Electronics Engineering of the year 2024 and has been approved as to its style and contents.

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"The Authors".

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ABSTRACT

This project proposes designing and implementing an LPG gas leakage detection and alert system for households and industries. The increase in deaths caused by LPG explosions has highlighted the need for a gas leak detection system to identify potential hazards. Various gas sensors are used in this process, including wireless and GSM technology. The gas sensor detects the presence of LPG gas in the environment, and the microcontroller processes the sensor data to trigger an alarm or shut off the gas supply. The system can also send an Call alert to a designated phone number in case of gas leakage. The proposed system is intended to prevent accidents, fires, and explosions by providing an early warning and taking necessary actions to minimize the damage caused by gas leakage. The proposed LPG Gas Leak Detection Smart Tool effectively addresses the growing concern about LPG explosions and their catastrophic consequences.

Keywords: Arduino, MQ-9 Sensor, Buzzer, GSM Module, 16*2 LCD Display,12*C LCD display module,12 Volt DC power supply,1 SIM card

CHAPTER-1

1.1 INTRODUCTION

The use of liquefied petroleum gas (LPG) as a fuel source has become increasingly popular in households and industries due to its affordability and efficiency. However, the risk associated with LPG gas leakage cannot be overstated. LPG is highly flammable and explosive, and its leakage can lead to accidents, fires, and explosions that can cause fatalities and significant damage to property. Therefore, there is a growing need for an effective gas leak detection system that can identify potential hazards and provide early warning to prevent catastrophic consequences. To address this concern, this project proposes designing and implementing an LPG gas leakage detection and alert system for households and industries. The system is designed to detect the presence of LPG gas using various gas sensors, including wireless and GSM technology. These sensors can detect the concentration of LPG gas in the environment and send the data to a microcontroller for processing. The microcontroller processes the sensor data and triggers an alarm or shuts off the gas supply in case of a gas leak. Additionally, the system is designed to send an SMS alert to a designated phone number in case of gas leakage, providing an early warning to prevent accidents, fires, and explosions. The proposed LPG Gas Leak Detection Smart Tool offers a reliable and effective solution to address the growing concern about LPG explosions and their catastrophic consequences. By incorporating gas sensors, wireless and GSM technology, microcontrollers, and an alarm system, the system provides enhanced house safety and industrial safety, preventing potential hazards and minimizing the damage caused by gas leakage. Overall, this project aims to develop a gas leak detection system that offers an effective solution to the increasing concerns of LPG gas leakage, providing an early warning to prevent accidents, fires, and explosions, and enhancing the safety of households and industries.

1.2 OBJECTIVE OF THE PROJECT

A. Aim To design and implement an LPG gas leakage detection and alert system that enhances the safety of households and industries by detecting potential gas hazards and providing an early warning to prevent accidents, fires, and explosions.

1) To research and identify the appropriate gas sensors, wireless and GSM technology, and microcontrollers needed to detect LPG gas leakage.

2) To design and develop a gas leak detection system that can detect the presence of LPG gas and trigger an alarm or shut off the gas supply in case of a gas leak.

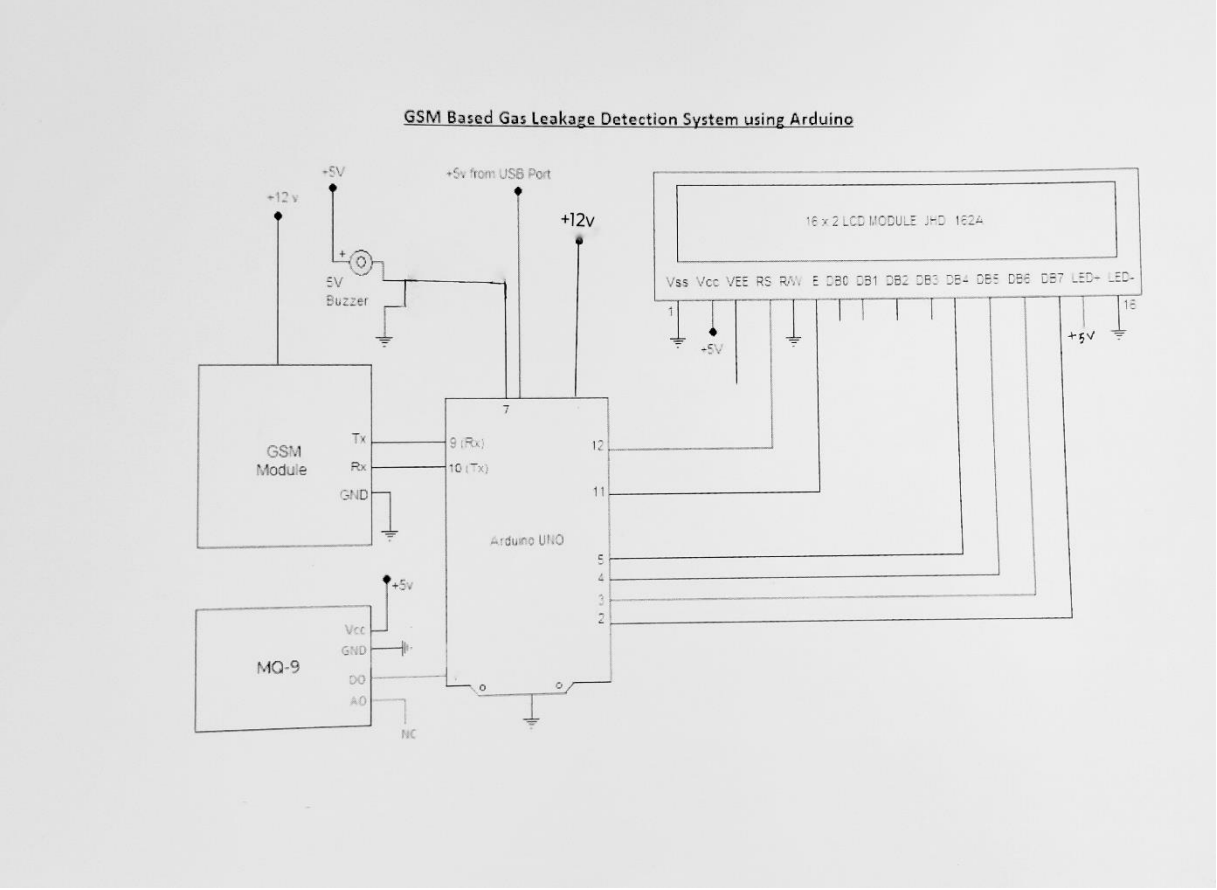
3) To integrate the gas leak detection system with wireless and GSM technology to send Call alert to a designated phone number in case of gas leakage.

4) To provide an effective solution to address the growing concerns of LPG explosions and their catastrophic consequences, enhancing the safety of households and industries

CHAPTER-2

2.1 EXISTING METHODOLOGY

There are generally over 80% LPG customers in the country in which 35% has the gas related Accidents occur because of gas leakage. So, the real concern is spillage of LPG. Whenever the spillage of LPG has occurred, the gas sensor is used to detect the leakage of gas. The Arduino will alert the buzzer, triggering the sound alarm and the LCD display is turned on. It sends Call alert through GSM module. The above Guidelines are also executed for the gas spillage identification system.



2.2 PROPOSED METHODOLOGY

In this study it can be described how the tool can work to capture the gas received by the sensor, then the sensor is processed in an Arduino program that can display data in the LCD, emit sound, and send a short message to the registered mobile number. The scheme can be seen in the block diagram

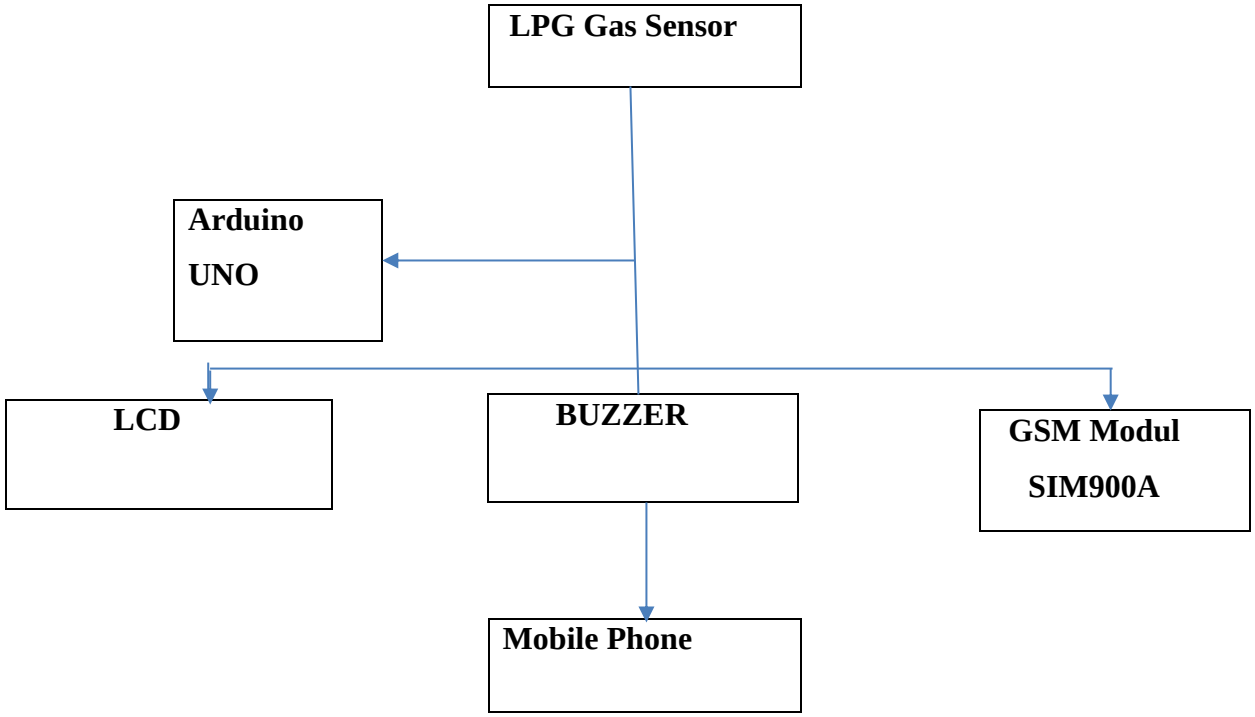


Fig: block diagram

1) Selection of Components: The first step is to identify and select the required components for the system. This includes an LPG gas sensor, Arduino Uno microcontroller, LCD screen, buzzer, GSM module, and a mobile phone.

2) Circuit Design: The next step involves designing the circuit for the system. The gas sensor is connected to the Arduino Uno microcontroller, which processes the sensor data and triggers an alarm through the buzzer and LCD screen in case of gas leakage. The GSM module is also connected to the microcontroller to send an SMS alert to a designated phone number. Fig. Circuit Design

3) Programming: The third step involves programming the microcontroller. The code is written in the Arduino IDE, which controls the gas sensor, LCD screen, buzzer, and GSM module. The code also includes the SMS alert system, which sends a text message to the designated phone number in case of gas leakage.

4) System Integration: The fourth step involves integrating all the components of the system. The gas sensor, microcontroller, LCD screen, buzzer, and GSM module are connected according to the circuit design. The mobile phone is also configured to receive SMS alerts.

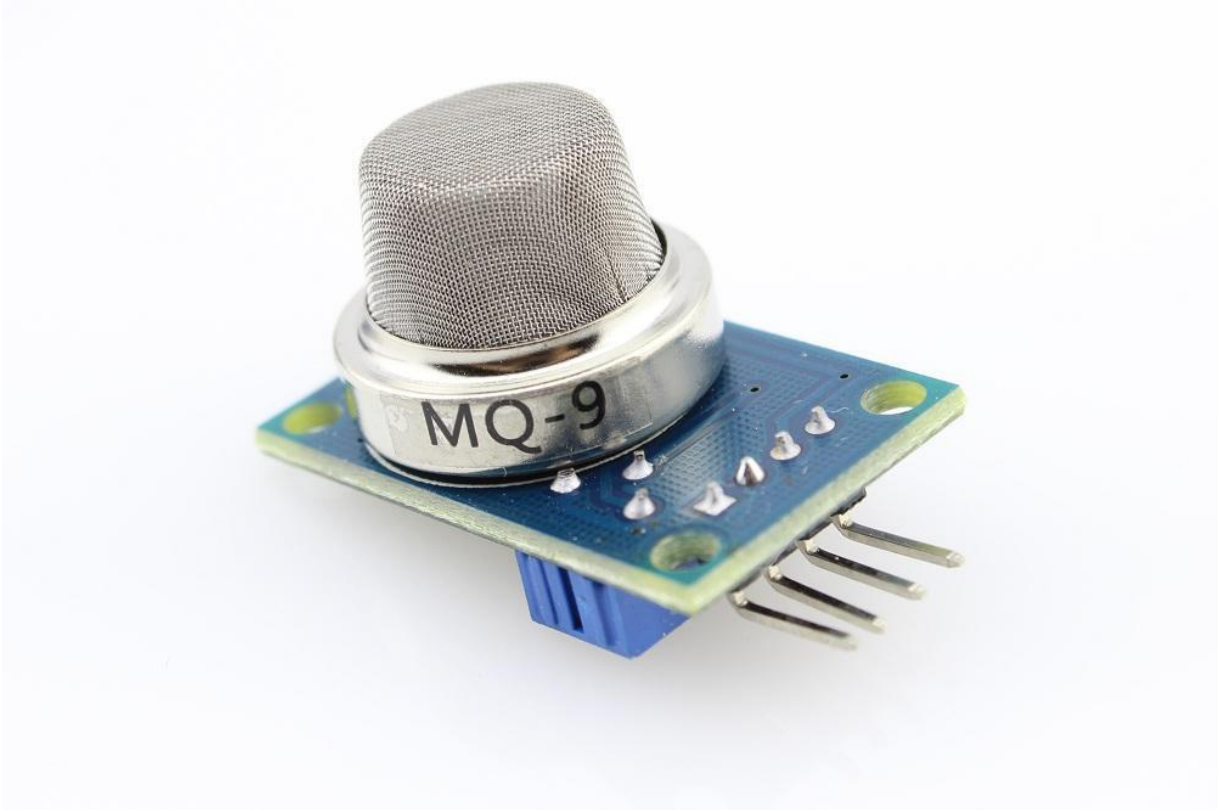
5) Testing: The final step involves testing the system to ensure that it is accurate and reliable. The system is tested in a controlled environment using LPG gas to simulate real-world conditions. The system's performance is evaluated, and any necessary modifications are made to ensure that it meets the specified requirements and objectives

Overall, the methodology for designing and implementing an LPG gas leakage detection and alert system involves a systematic approach that involves component selection, circuit design, programming, system integration, and testing to ensure that the system is accurate, reliable, and effective in detecting LPG gas leakage.

CHAPTER-3

3.1 HARDWARE AND ITS DETAILS

The MQ9 is a methane, carbon monoxide gas detection sensor. The sensor includes tin dioxide as its sensing element. The SnO2 (tin dioxide) has lower conductivity in pure air. When the air has carbon Monoxide, Coal, Liquefied, flammable gases, the conductivity of the sensor gets higher. A simple device makes measuring this change in conductivity and turning it into obvious data. However, the sensor requires some calibration.



 as you can see the 4 male header pins are labelled with

 A0

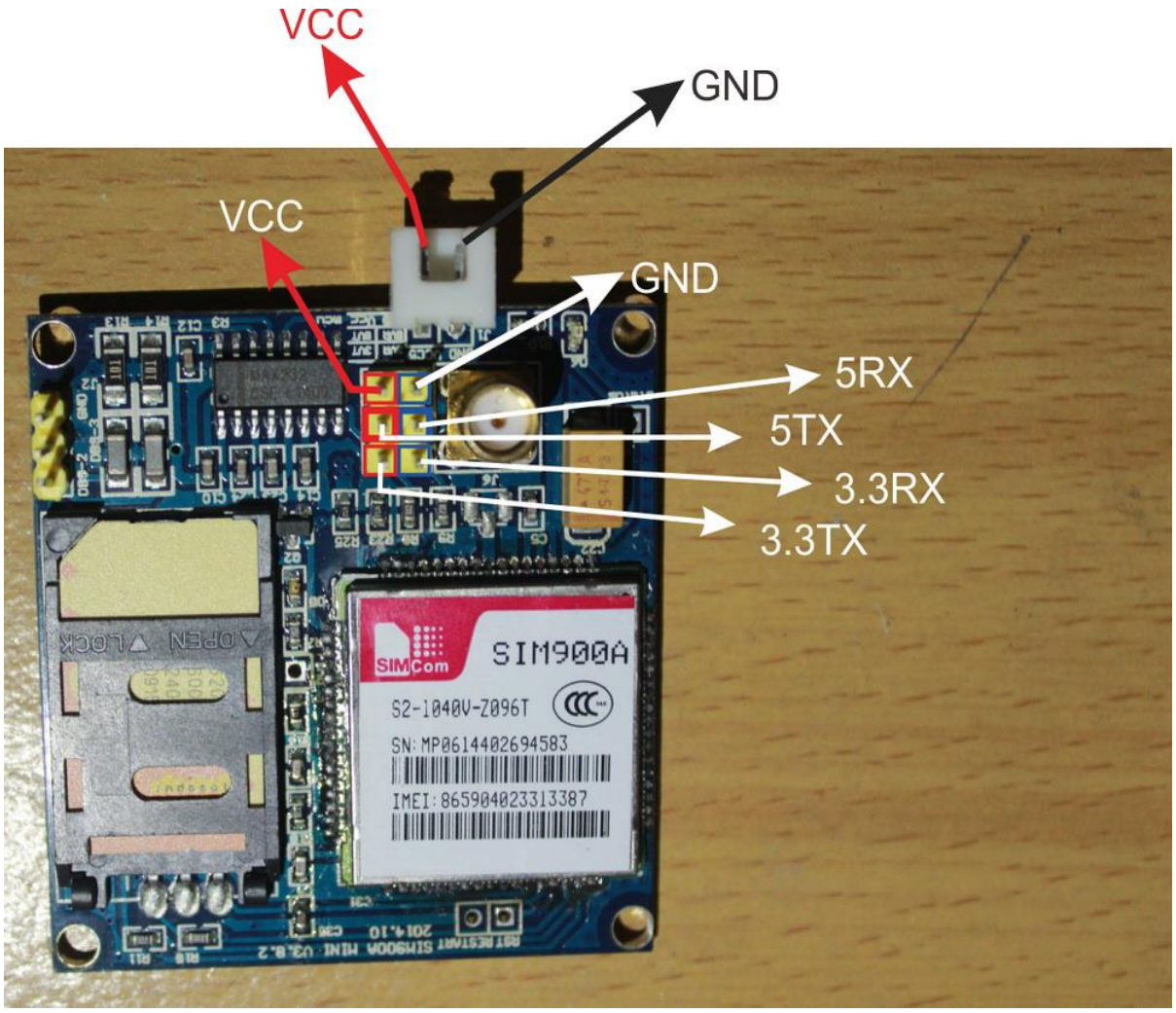
 D0

 GND

 VCC

3.2 SIM900A GSM MODULE:

GSM is a mobile communication modem; it is stands for global system for mobile communication.(GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.



3.3 16×2 LCD MODULE:

LCD (Liquid Crystal Display) is the innovation utilized in scratch pad shows and other littler PCs. Like innovation for light-producing diode (LED) and gas-plasma, LCDs permit presentations tobe a lot slenderer than innovation for cathode beam tube (CRT). LCDs expend considerably less power than LED shows and gas shows since they work as opposed to emanating it on the guideline of blocking light. LCD is either made with an uninvolved lattice or a showcase network for dynamic framework show.Likewise alluded to as a meagre film transistor (TFT) show is the dynamic framework LCD. The uninvolved LCD lattice has a matrix of conductors at every crossing point of the network with pixels. Two conductors on the lattice send a current to

control the light for any pixel. A functioning framework has a transistor situated at every pixel crossing point, requiring less current to control the luminance of a pixel.

3.4 BUZZER

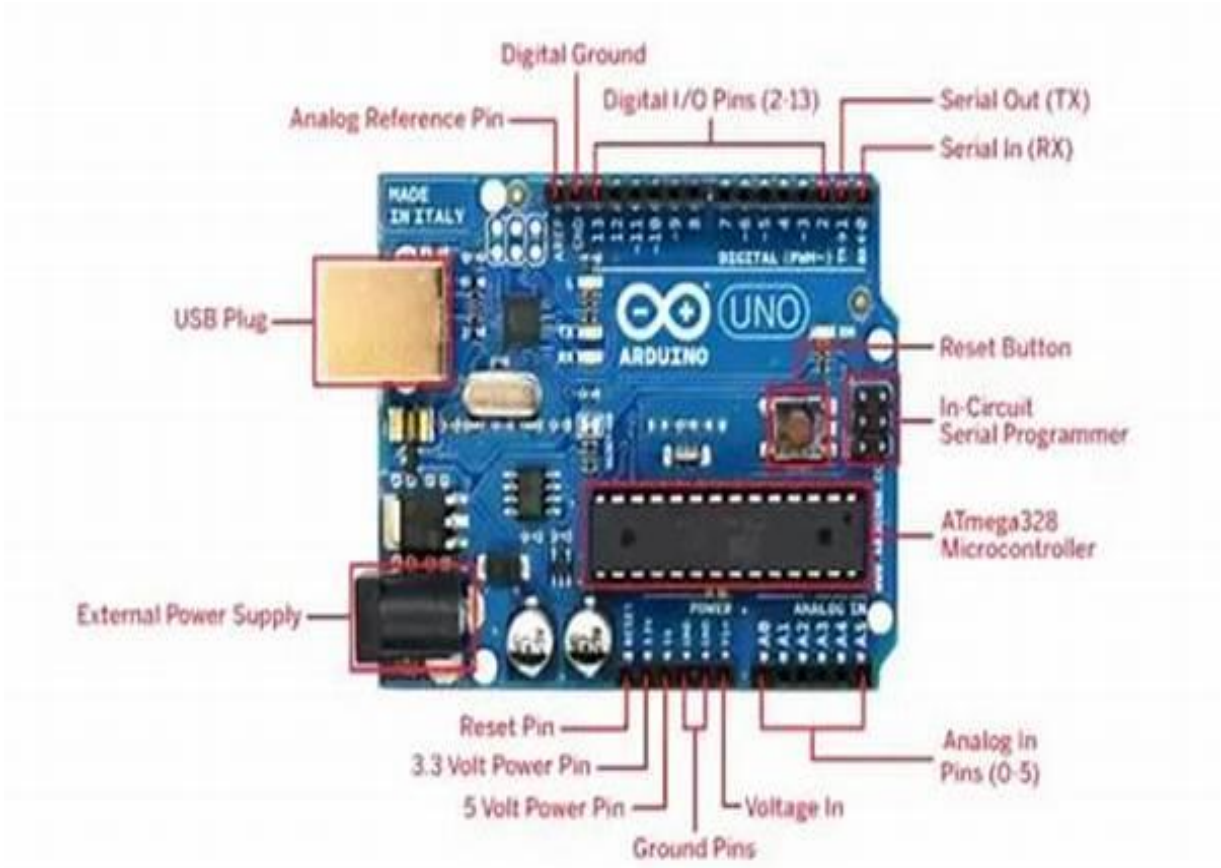
The buzzer will be used to emit sounds to alert users during leakage. A buzzer or beeper is a signaling device usually electronics, that is most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a pre-set timehas lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong.

Active Passive Buzzer

Active Passive Buzzer Pinout

3.5 ARDUINO UNO:

The Uno with Cable is a micro-controller board base on the ATmega328. 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 need to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. “Uno” means one in Italian and is the name to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards and the reference model for the Arduino platform; for a comparison with previous versions, see the index ofArduino boards. Note: The Uno R3 reference design can use an Atmega8, 168, or 328, Current models use an Atmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.



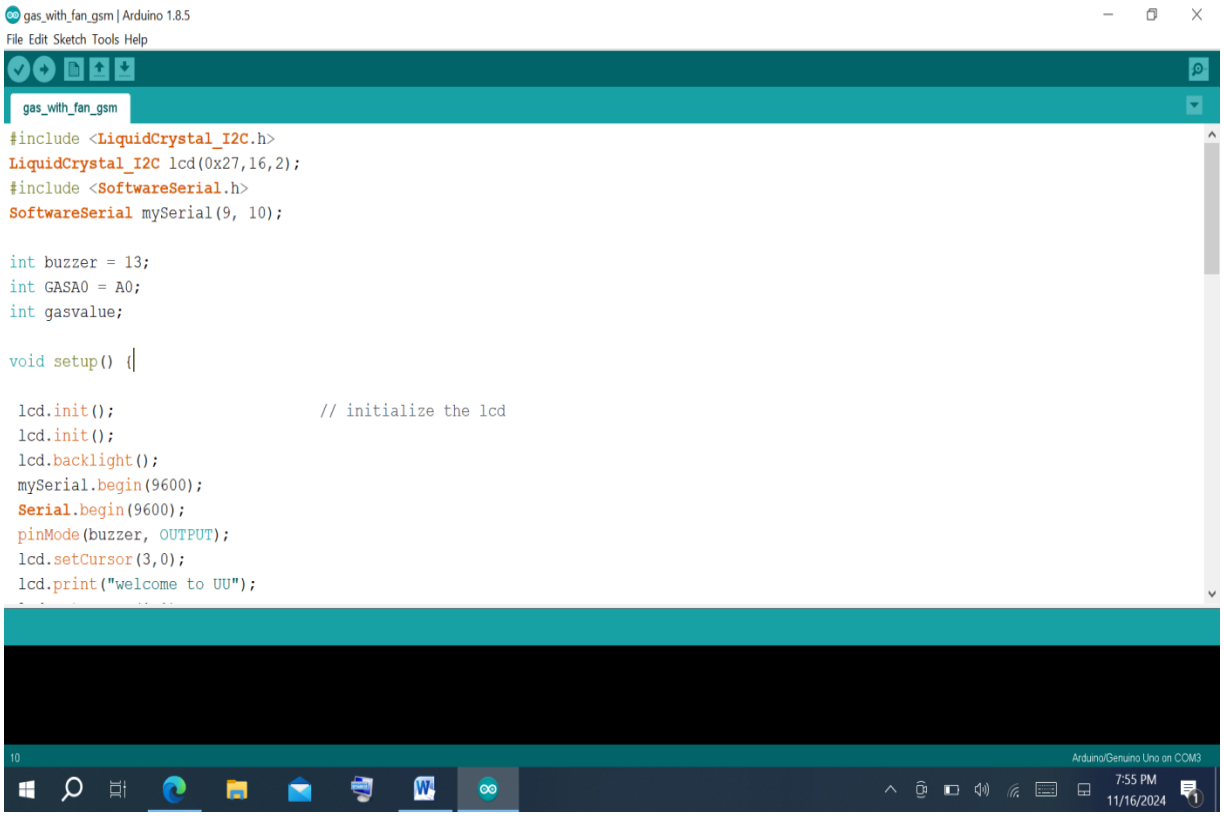
SOFTWARE AND ITS DETAILS

3.6 ARDUINO IDE 1.8.5

Arduino IDE where IDE stands for Integrated Development Environment – An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go. Arduino IDE is an open-source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, and Linux and runs on

the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.

The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages. How to install Arduino IDE: You can download the Software from Arduino main website.



Program

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);

int buzzer = 7;
int GASA0 = A0;
int gasvalue;
int i = 0; // Variable to ensure only one call request

void setup() {
  lcd.init();                      // Initialize the LCD
  lcd.backlight();                 // Turn on the backlight
  mySerial.begin(115200);          // Initialize SoftwareSerial
  Serial.begin(115200);            // Initialize Serial Monitor
  pinMode(buzzer, OUTPUT);         // Set buzzer as output

  lcd.setCursor(3, 0);             // Display welcome message
  lcd.print("Welcome UU ");
  lcd.setCursor(1, 1);
  lcd.print("Gas Leakage");
  delay(2000);                     // Reduced delay for welcome screen
}
```

```
void loop() {
  int analogSensor = analogRead(GASA0);    // Read the gas sensor
  gasvalue = (analogSensor - 50) / 10;            // Scale the gas value

  lcd.setCursor(0, 0);
  lcd.print("GAS Level: ");
  lcd.setCursor(10, 0);
  lcd.print(gasvalue);
  lcd.print("% ");

  if (gasvalue >= 10) {               // If gas level exceeds 10%

     CallFunction();                  // Make the call
    lcd.setCursor(0, 1);
    lcd.print("DANGER  ");
    tone(buzzer, 1000, 200);        // Buzzer alarm
  } else {
    lcd.setCursor(0, 1);
    lcd.print("NORMAL ");
    noTone(buzzer);                  // Turn off the buzzer
  }

  delay(500);                         // Consider non-blocking alternative
}

void CallFunction() {
  if (i == 0) { // Ensure only one call request is sent
    mySerial.println("ATD+8801853459114;");        // Dial the phone number (replace with actual)
    delay(1000);
    Serial.println("Calling +8801853459114...");
    i++; // Increment to prevent multiple calls
  } else {
    Serial.println("Call request already sent. Wait for the current call to complete.");
  }
}
```

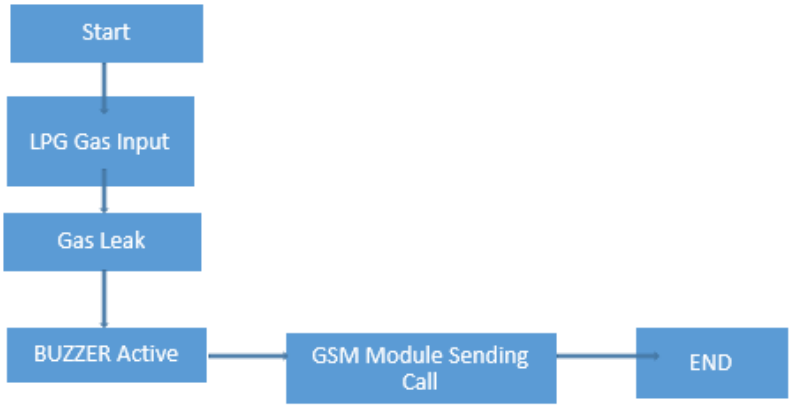


Fig: Flow chart

The flowchart represents the working of an LPG gas leakage detection and alert system.

At the starting point of the system. The gas sensor detects the presence of LPG gas in the environment. If there is no gas leak, the system does not take any action. However, a yellow light blinks on the LCD to indicate that the system is functioning correctly. This is the end of the system's working when no gas leak is detected. If the gas sensor detects a gas leak, the system takes necessary actions to prevent accidents, fires, and explosions. The buzzer is activated to provide an audible warning to the people in the vicinity. The system sends an CALL alert to a designated phone number to inform about the gas leak. This is the end of the system's working when a gas leak is detected, and necessary actions are taken to minimize the damage caused by gas leakage. Overall, the flowchart represents the simple and effective working of the LPG gas leakage detection and alert system

3.7 REQUIREMENT

A. Hardware Used

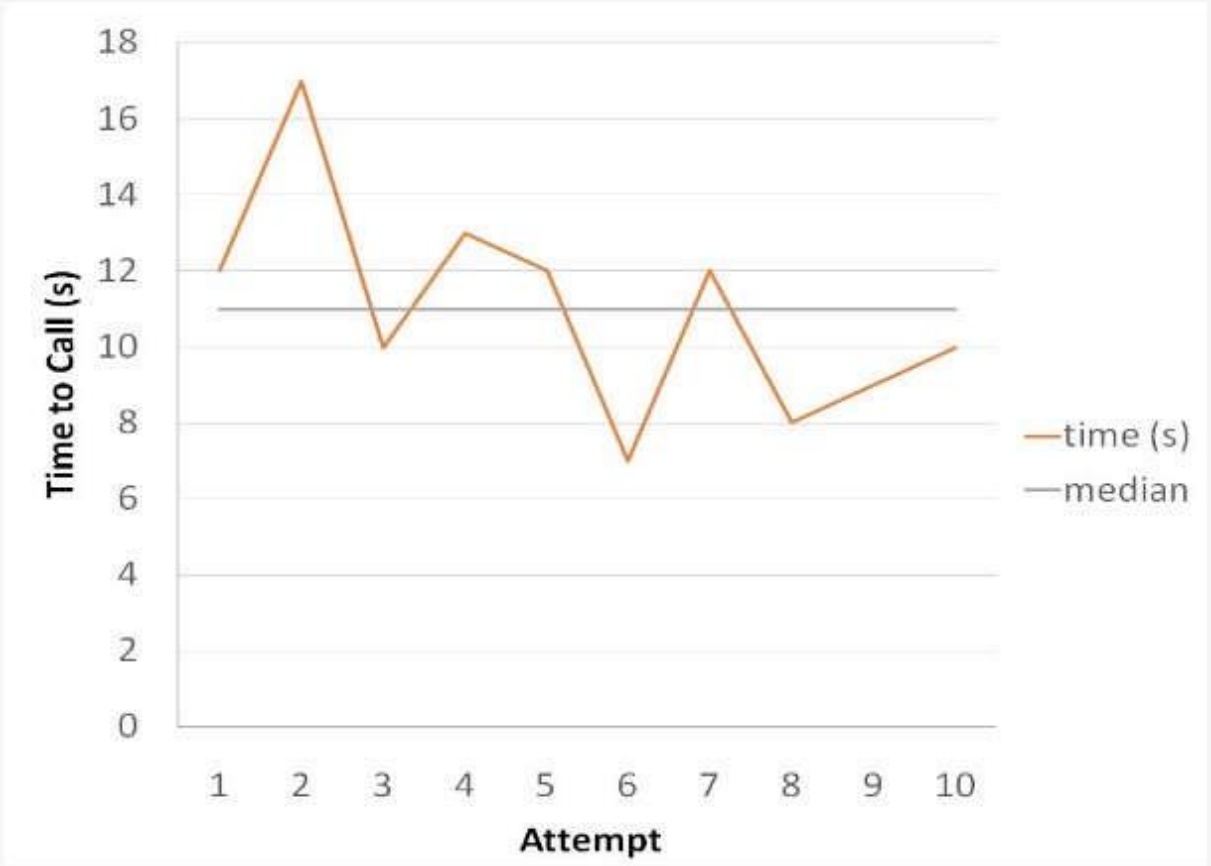
1) Arduino Uno Microcontroller
2) MQ9 sensor
3) GSM Module SIM900A
4) 16*2 LCD module
5) Power supply
6) Buzzer
7) SIM Card
8) Mobile phone

B. Software Used

1) Arduino Compiler IDE
2) Coding language- JAVA
3) WINDOWS

4.1 RESULTSAND DISCUSSION

Initially, to simulate the operation of the sensor was used a lighter simulating the gas leak in the open environment, obtaining the real time reading, the answers were very accurate, however, the module only made a connection, since the gas was it dissipated into the air quickly. The source code has been changed several times to define the level of gas that would be checked before the alert. We initially tested with very high values, triggering the alert with 180ppm (parts per million), performed 10 tests and got the following results:



In the tests performed we obtained an average time of 11 seconds between gas detection by the sensor with the gas level configured to perform the call when it reached 180 ppm, then we made another 10 tests where we set the source code to 20 ppm and we got so the same result as graph 1. The reduction in the reading of the analog values in the program did not affect the alert trigger, coinciding in the same result, since what was sought was the efficiency of the GSM shield as an alert, with the average time continuing. In 11 seconds, we can infer that there is an efficient response to the proposed problem.

5.1 CONCLUSION

This article describes an alert system using phone calls, we could achieve the desired result, with a fast, cheap and robust prototype. It can tackle a problem that similar systems have. A sound alarm works with people nearby the alarm but when they are away from an issue appears, that is the late discovery of a leak, leading to accidents. SMS messages can be ignored and may not be delivered in proper time. With a proper call, people can react more quickly, using the proper measures to avoid a bigger problem. In further works, we expect to have it not only calling but making it an Internet-connected device. We already have the hardware, but we must circumvent the limitations imposed due to the lack of connectivity before mentioned

5.2 FUTURE SCOPE

The LPG gas leakage detection and the alert system have a significant future in improving safety and preventing accidents in households and industries. With advancements in technology, the system can be further enhanced to provide more accurate and efficient detection of gas leakage. The integration of artificial intelligence and machine learning algorithms can improve the system's ability to identify potential hazards and trigger appropriate responses. Additionally, the system can be connected to a central monitoring system, enabling remote monitoring and management of gas leakage in real time. Overall, the future scope of the LPG gas leakage detection and alert system is promising, and continuous research and development can further enhance its capabilities.

5.3 Cost Table

Sl No	Description	Qty	Prices
01	1) Arduino Uno Microcontroller	**01**	**900.00**
	2) MQ9 sensor		**800.00**
	3) GSM Module SIM900A		**120.00**
	4) 16*2 LCD module		**200.00**
	5)icd display module		**250.00**
	5) Power supply		**120.00**
	6) Buzzer		**55.00**
	7) Wires		**40.00**
Total			**2485.00**

5.3REFERENCES

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