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Gas Leakage Detection and Alert System by Using Arduino and GSM Module

Course Title: Microprocessor and Interfacing

Course Code: CSE2006

Under the Guidance of

Prof: Anuradha G

Team Members:

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2) **Penchal Reddy – 17BCE0927**

Declaration

We hereby declare that the project work entitled **"Gas Leakage Detection and Alert System by Using Arduino and GSM Module"** submitted to the VIT Vellore, is a record of an original work done by **Rathnam Sasidhar Achari** and **Penchal Reddy** under the guidance of **Prof.Anuradha G** and this project work is submitted in the partial fulfilment of the requirements for the award of the degree of B.Tech in Computer Science& Engineering. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

Abstract:

Gas leaks is a major issue in residential premises, industrial sector, homes and many other public places, but is often ignored. One of the reasons for this is that it is very difficult for one to detect it. Even a small leak may gradually build up an explosive concentration of gas, hence making it all the more dangerous. In addition to the immense harm gas leaks may cause to humanity, it may also affect vegetation and animals adversely. The most obvious tell-tale sign of a gas leak is the smell but if one is unable to detect it or ignores it, the gas might even cause fatal fires and immense damage to both life and property. One should host regular gas check-ups and ensure that all the devices and appliances are not leaking. To avoid accidents due to leakage one can also install a gas detection kit.

The main purpose of this project is to detect gas leakage and send alert message to the owner and also the buzzer rings automatically after the detection of LPG leakage. The sensor after detecting abnormal amounts of gas content in the atmosphere will ring an alarm and simultaneously send SMS to the listed number of concerned friends, family and neighbours. An LCD will display that there is LPG leakage according to the concentration of the gas limit. For detection of LPG leakage, the MQ-2 gas sensor has been used which is highly sensitive to gas like LPG, smoke and butane.

Objectives of the Project

- Detect Gas Leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance that can be detected using MQ2 Sensor.
- Produce a sound alarm using Buzzer upon gas leak and stop the alarm once gas leak is under control (gas presence in atmosphere is under normal range)
- Display status in an LCD using a 16×2 LCD module.
- Send a Alert Message to the Mobile number of friend or owner or family member.

Requirements:

Hardware Requirements:

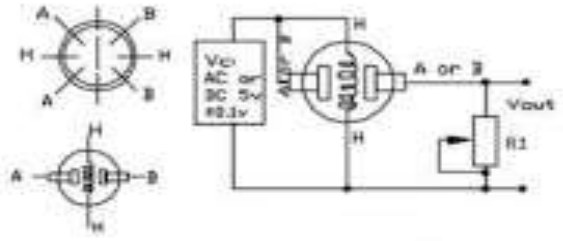
1) Bread Board – Rs.150/-
2) MQ2 Gas Sensor – Rs.220/-
3) Arduino UNO – Rs.450/-
4) 16×2 LCD Module – Rs.200/-
5) I2C Module – Rs.200/-
6) GSM 800A Module –Rs.1500/-
7) Adapter –Rs.120/-
8) USB Cable – Rs.170/-
9) Wires – Rs.40/- (20 Wires)

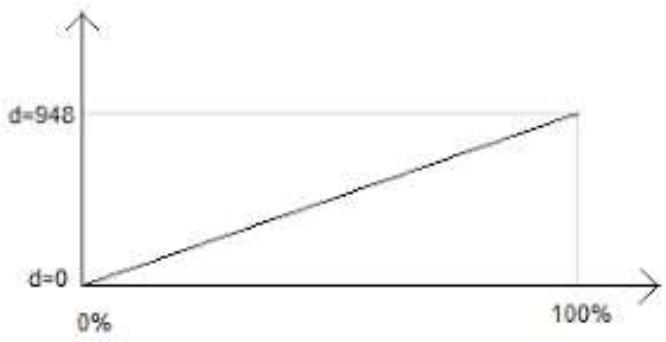
Software Requirements:

1) Arduino IDE
2) Windows OS
3) 64 bit OS
4) Laptop / PC

Working of MQ2 sensor:

The MQ2 has an electrochemical sensor, which changes its resistance for different concentrations of varied gasses. The sensor is connected in series with a variable resistor to form a voltage divider circuit (Fig 1), and the variable resistor is used to change sensitivity. MQ2 is an SnO2 based gas sensor which can sense gases like methane, propane, butane, alcohol, smoke, hydrogen etc. Since LPG primarily contains propane and butane, MQ2 sensor can be used for sensing LPG. The figure below shows the schematic arrangement of an MQ2 gas sensor.





LPG gas sensor using arduino (MQ2 sensor)

MQ2 sensor senses the flammable gases by the increase in temperature when they are oxidized by the heating element. Consider the figure given above. If there is any flammable gas present in the sample , the oxidization of the same gas results in increased temperature and the resistance of the sensor resistor will drop. That means more current will flow through the load resistor and so the voltage across it will shoot up. At normal conditions(no LPG in the air), the sensor resistor will be very high around 850K . So the voltage drop Vout across the load resistor will be around zero. When the sensor is fully exposed to LPG the sensor resistance drops to around 800 ohms and the voltage drop across the load resistance will be around 4.62 volts. After conversion by the ADC, the digital equivalent of 4.62 volt will be 948 and it is stored in the variable "d" (refer the program). The change in the resistance changes the voltage across the sensor, and this voltage can be read by a microcontroller. The voltage value can be used to find the resistance of the sensor by knowing the reference voltage and the other resistor's resistance.

Finding the Concentration of a Gas:

The concentration of a gas can be calculated by measuring the sensor's Ro and Rs values and using the following formula Concentration = Xo (Y/ Yo) Φ Where Φ is the slope, which can be found using the Sensitivity Characteristic curve and the following formula Φ = Log (Y2/Y1) / Log(X2/X1) Where (X2, Y2) and (X1, Y1) are any two points on a section (lines between indicated points on the curve) of the curve. Since the curve has different slopes at different concentrations the (X2, Y2) and (X1, Y1) values should be taken from the corresponding sections The Xo and Yo values are Initial Concentration and Rs/Ro ratio on a section of the curve (lines between marked points), these values are the starting points of each section (each line between marked points has different slopes) Y is the Rs/Ro Ratio for the current concentration of the gas For the graph shown above, the concentration percentage for a given digital output of the ADC can be determined using the following equation. p=d/9.48 where d is the digital output

of the ADC and p is the percentage. The equation is obtained by finding the equation of the above graph in the general form y=mx+c. Where m is the slope and c is the y intercept.

Information related to why we have selected the project. What you have actually done in the project and where do we find the application related to it:

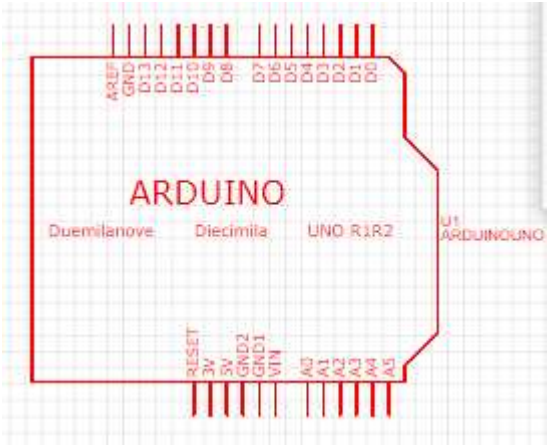
As we already discussed in Abstract, Project is just an idea initiative to many accidents occurring because of Gas leakage. Our project mainly focussed on this part and it is developed with Arduino and GSM and MQ2 gas sensor. It sends an alert message to phone and buzzer rings and LCD displays the status when gas is detected.

Apart from Arduino what type of interface used:

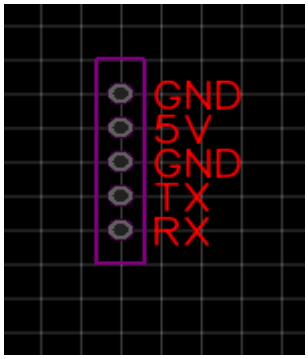
Apart from Arduino, we also used GSM Module to send the alert messages to phones and it worked successfully. We also used Arduino IDE to run the code and execute the project.

Pin Diagrams:

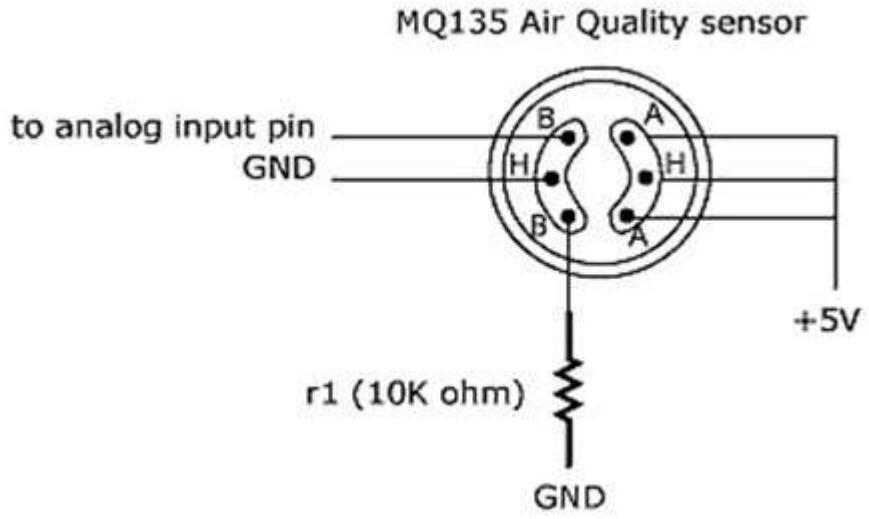
Arduino UNO:



GSM:



MQ2 Gas Sensor:



GSM Module:

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires aSIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice calls

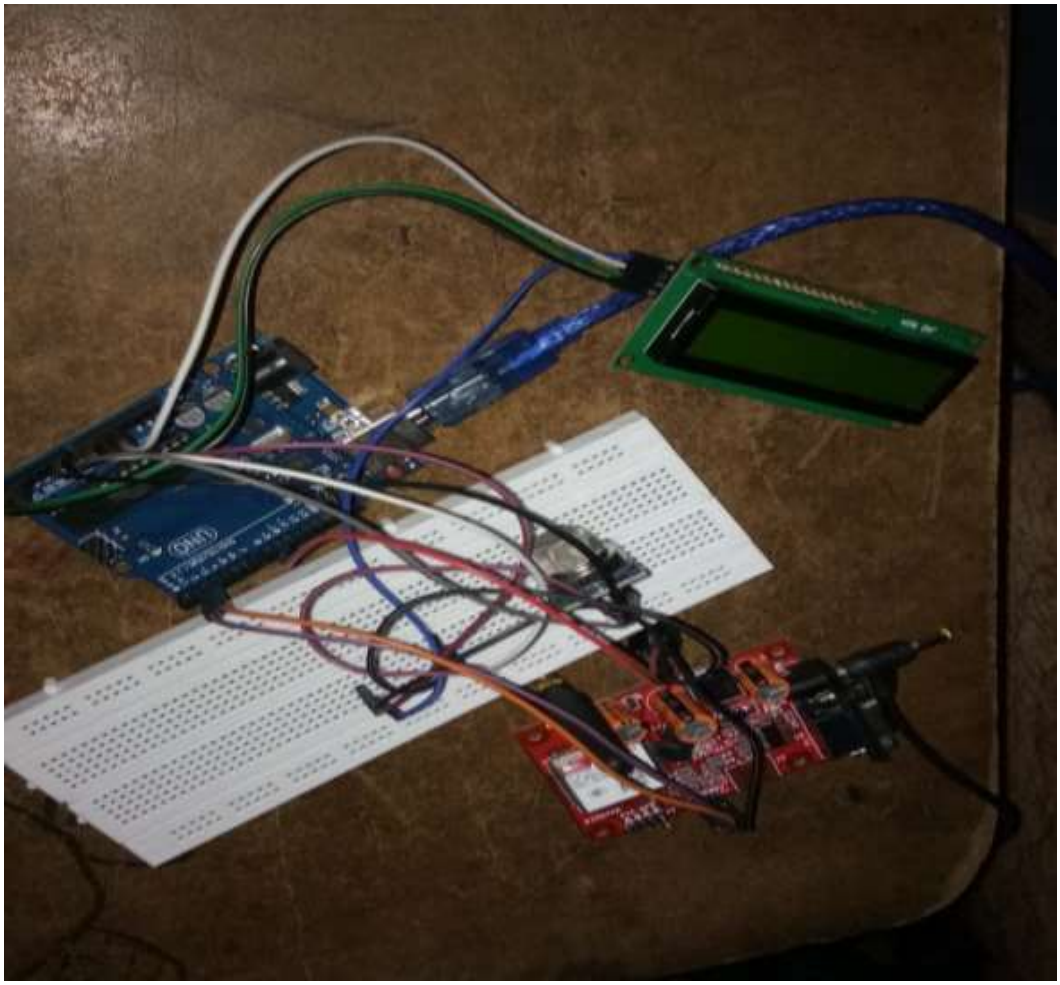
The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

How communication getting established between the hardware and software to how the functioning of:

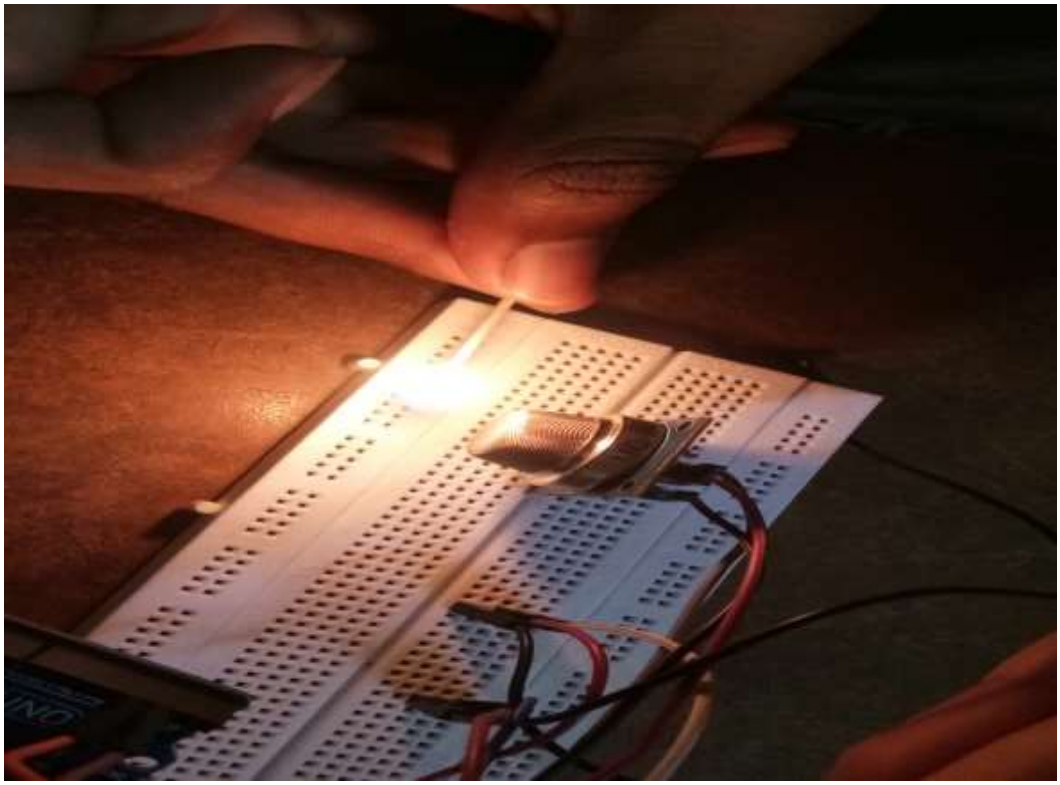
System is connected to Arduino using USB cable and when the code is run in Arduino IDE, through the USB cable, the code gets loaded to Arduino board and project starts working.

Screenshots:

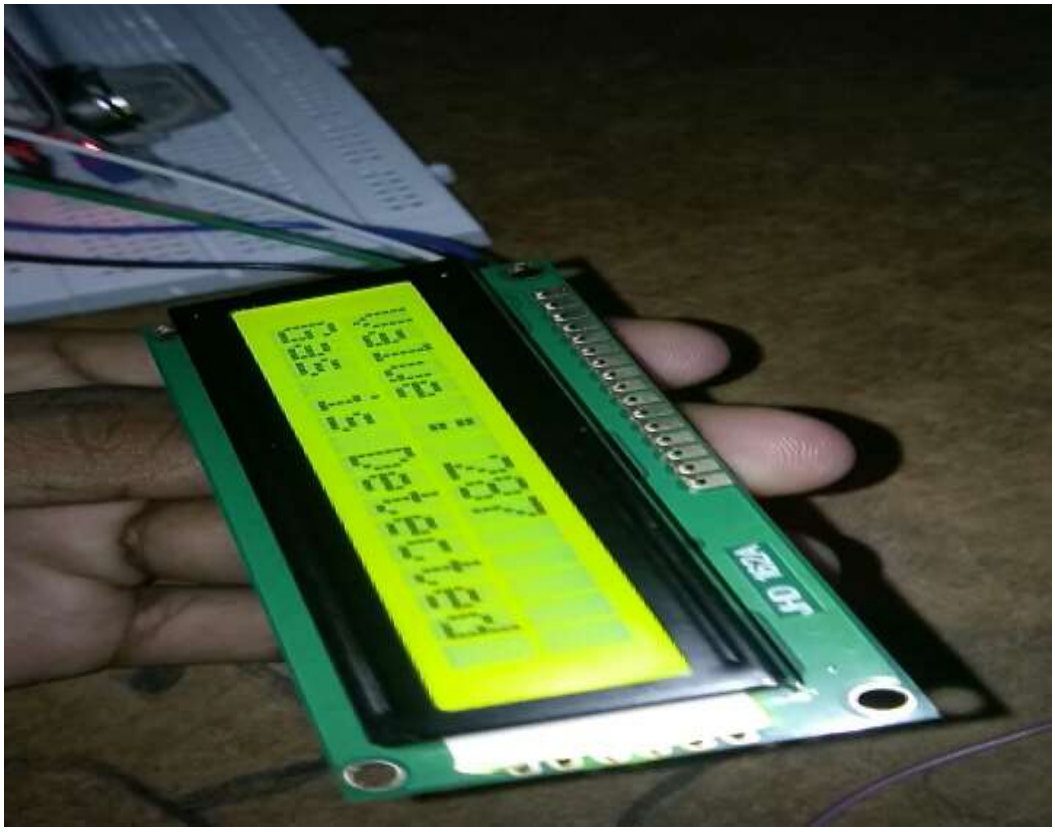
Total Components connected to each other.



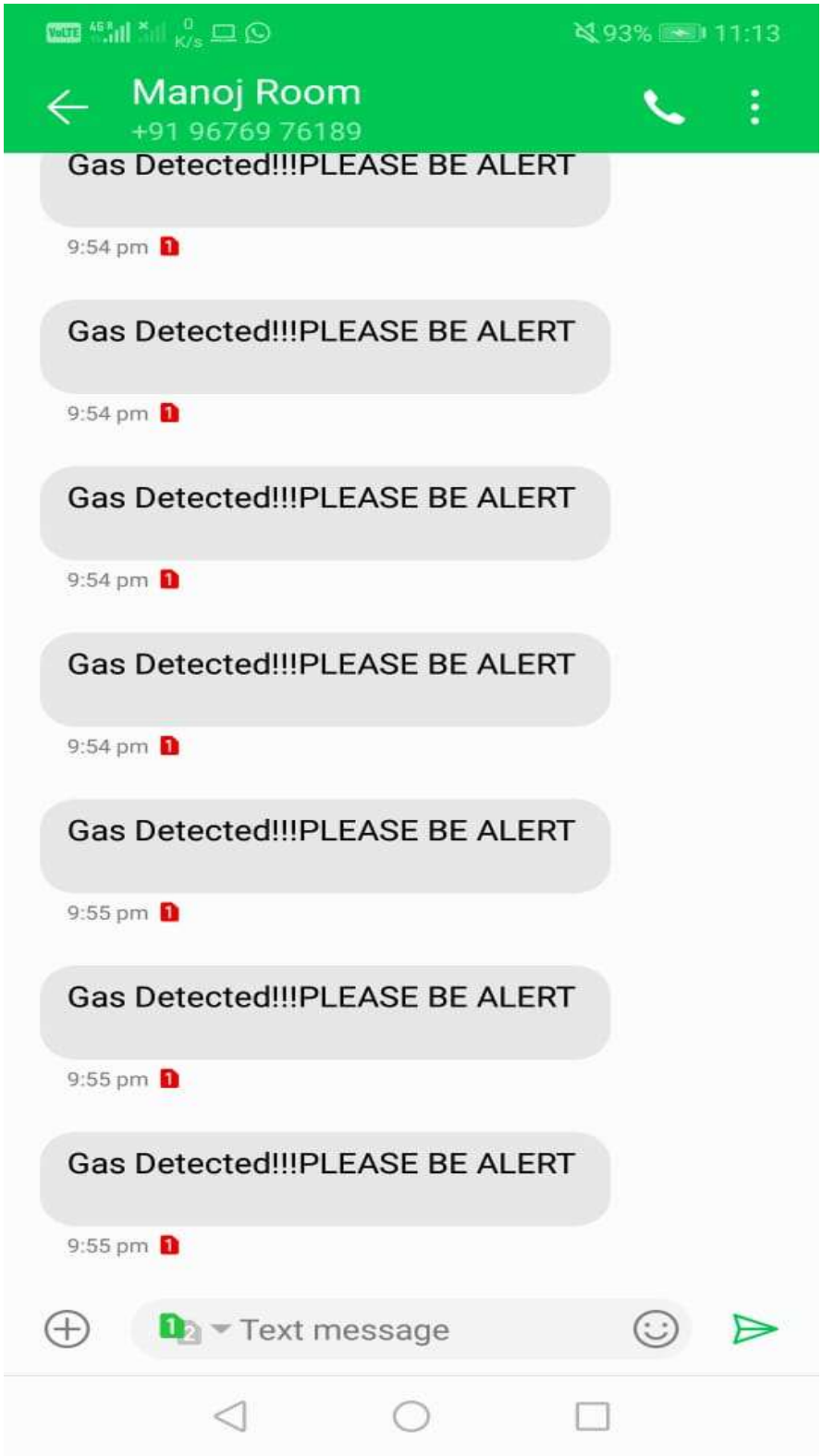
Testing the MQ2 with Matchstick



Value of the gas gets displayed in LCD:



Message came to Phone:



Code:

```
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>
#include<Wire.h>
#include<MQ2.h>

LiquidCrystal_I2C lcd(0x27, 16,2);
SoftwareSerial gsm(2,3);
SoftwareSerial mySerial(2, 3);

#define buzzerPin 10
#define gasPin A0

int Analog_Input = A0;
MQ2 mq2(Analog_Input);

void setup()
{
mySerial.begin(2400);
Serial.begin(200);
lcd.begin();
pinMode(buzzerPin,OUTPUT);
lcd.backlight();
mq2.begin();
lcd.setCursor(0, 0);
lcd.print("Calibrating");
```

```
for(int i = 0; i <10; i++)
{
if (i==4) {
lcd.setCursor(0, 1);
lcd.print("."); }
else lcd.print(".");
delay(500);
}
lcd.setCursor(5, 1);
lcd.print("done"); delay(1000);
lcd.clear();
lcd.setCursor(1, 0);
lcd.print("SENSOR ACTIVE");
delay(1500);
lcd.clear();
}

void loop()
{
int gasSensor = analogRead(gasPin);
if (gasSensor > 405)
{
sendmessage();
digitalWrite(buzzerPin,HIGH);
lcd.setCursor(0, 0);
lcd.print("Value : ");
lcd.print(gasSensor);
```

```
Serial.print(gasSensor);
Serial.print("\t");
lcd.setCursor(0, 1);
Serial.println("Gas is Detected");
lcd.print("Gas is Detected");
delay(300);
lcd.clear();
}
else if (gasSensor < 405)
{
digitalWrite(buzzerPin,LOW);
lcd.setCursor(0, 0);
lcd.print("Value : ");
lcd.print(gasSensor);
Serial.print(gasSensor);
Serial.print("\t");
lcd.setCursor(0,1);
Serial.println("No Gas");
lcd.print("No Gas");
delay(300);
}
}

void sendmessage()
{
  delay(10000);
  Serial.begin(9600);
```

```
  gsm.begin(9600);
  gsm.println("AT+CMGF=1");
  delay(1000);
  gsm.println("AT+CMGS=\"+91XXXXXXXXXX\"\r"); //replace x by your number
  delay(1000);
  gsm.println("Gas Detected!!!PLEASE BE ALERT");
  delay(100);
  gsm.println((char)26);
  delay(1000);
}
```

Conclusion:

The LPG Gas Detection System is quite an essential part of every household, organisation, and building in order to keep ourselves and our loved ones safe. Gas leakage leads to severe accidents resulting in material losses and human injuries. Gas leakage occurs mainly due to poor maintenance of equipment and inadequate awareness of the people. Gas leakage detection is essential to prevent accidents and to save human lives. This paper presented Gas leakage detection and alert system. This system triggers LED and buzzer to alert people and sends a message to the owner when Gas leakage is detected. This system is very simple yet reliable. We have successfully used a MQ2 sensor to detect LPG Gas. When LPG gas leakage occurs, it gives analog output to A0 pin and Arduino continuously reads the pin. When Arduino gets a HIGH pulse from LPG Gas module it shows “Gas is detected” message on 16x2 LCD and activates buzzer which beeps again and again until the gas detector module doesn't sense the gas in environment. And We used GSM Module to send message to the Owner. When Arduino gets a HIGH Pulse from gas module, automatically GSM Module gets activated and message is sent. When LPG gas detector module gives LOW pulse to Arduino, then LCD shows “No Gas” message.

Future Development of the Project:

We can add GPS modem to this system and send the location of gas leak to fire stations along with buzzer and GSM Module when Gas is leaked. It could help many people and save many lives.

References:

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