

**Faculty of Computing & IT**

**University of Sialkot**

Securing Environment from LPG Gas Disasters

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# Statement of submission

This is certified that **Adil Saleem** and **Ali Yousaf** Roll No. **21201011-002 & 21201011-006** have successfully completed the final year project named as Securing Environment from LPG Gas Disasters at the Department of Information Technology, University of Sialkot, to fulfill the requirement of the degree of ADP in Information Technology.

Project Supervisor Project Management Office

Faculty of C&IT -USKT

Head of the Department

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Date:

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# Abstract

Gas leakage is a serious issue in commercial and residential buildings as well as with gas-powered vehicles. If the leak is not discovered, it could explode and seriously harm both people and the environment. Local alarms provide warning in the traditional leakage detection system. We suggest a leakage detection technique in which the first response team is also given wireless media access to the leakage information. As a result, even when no one is present, preventive measures are taken right away. The leakage is discovered by the detection system, which then automatically places a GSM warning call. The gas leakage detection system has undergone development and LPG testing on a prototype. The experimental findings indicate that the system can find the leak in less than a minute. In addition to this the authorize person will receive the message informing about leakage.

# CHAPTER-1 INTRODUCTION & HISTORICAL BACKGROUND

## 1.1 INTRODUCTION

This project can be used to prevent accidents due to gas leakage. This project is mainly based on internet of things. One person can get remotely alert message the gas is leakage. It includes the simple component, when they are connected in proper way, it becomes a very useful system. This project has wide range of application. Gas Leakage Detector using GSM & Arduino UNO with SMS Alert.

In this project we are going to learn how to design Gas Leakage Detector Using GSM & Arduino with SMS Alert. We will interface Sim800l GSM Module as well as MQ5 Gas Sensor with Arduino. The gas level value will be displayed on the 16\*2 LCD display. Whenever the excess gas is detected, SMS will be sent to a particular phone number.

Gas leakage detector are very useful in detecting Gas in building, and so are the important safety parameters in order to prevent disasters. Bursting cylinders and accidental fires have caused lots of harm to the economies in the past. This circuit triggers the alerts system when gas leakage is detected. The circuit mainly uses the MQ5 Gas sensor. This MQ5 gas sensor is sensible to LPG and Methane etc. it detects the presence of a dangerous LPG leak in your car or in a service station, storage tank environment.

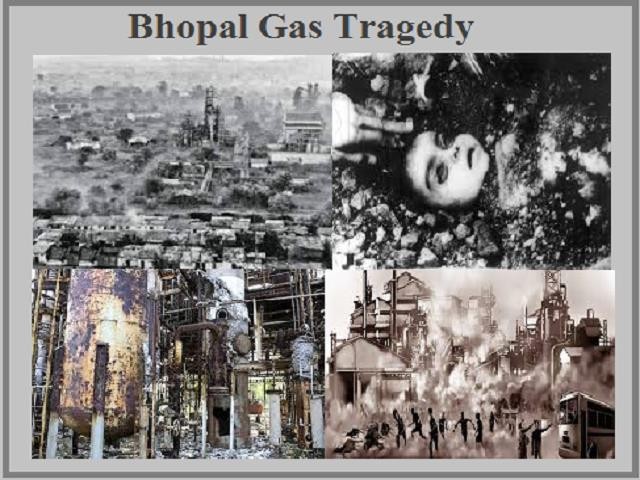
The sensor has excellent sensitivity combined with the quick response time. If the LPG sensor senses any gas leakage from storage the output of this sensor goes low. This low single is monitored by the microcontroller and sends the signal to GSM module to send messages as “GASLEAKAGE” to a mobile number written in code. You can also useSIM900 or any other GSM Module instead of SIM800l.Similarly you can use MQ2/MQ3/MQ6 or any other Gas/Smoke Sensor instead of MQ5.

## 1.2 HISTORICAL BACKGROUND

Case study for Bhopal Gas Tragedy

### 1.2.1 CASE 1

Bhopal disaster, chemical leak in 1984 in the city of Bhopal, Madhya Pradesh state, India. At the time, it was called the worst industrial accident in history. On December 3, 1984, about 45 tons of the dangerous gas methyl isocyanate escaped from an insecticide plant that was owned by the Indian subsidiary of the American firm Union Carbide Corporation. The gas drifted over the densely populated neighborhoods around the plant, killing thousands of people immediately and creating a panic as tens of thousands of others attempted to flee Bhopal. The final death toll was estimated to be between 15,000 and 20,000. Some half a million survivors suffered respiratory problems, eye irritation or blindness, and other maladies resulting from exposure to the toxic gas; many were awarded compensation of a few hundred dollars. Investigations later established that substandard operating and safety procedures at the understaffed plant had led to the catastrophe. In 1998 the former factory site was turned over to the Madhya Pradesh.



*Figure 1.1 BHOPAL GAS TRAGEDY*

### 1.2.2 CAUSES FOR DISASTER:

There are two main lines of argument involving the disaster:

1) Corporate Negligence

2) Worker Sabotage

* The "Corporate Negligence" point of view argues that the disaster was caused by a potent combination of under-maintained and decaying facilities, a weak attitude towards safety, and an undertrained workforce, culminating in worker actions that inadvertently enabled water to penetrate the MIC (Methyl isocyanate) tanks in the absence of properly working safeguards. (Wikipedia)
* This point of view also argues that management (and to some extent, local government) underinvested in safety, which allowed for a dangerous working environment to develop.
* Factors cited include the filling of the MIC tanks beyond recommended levels, poor maintenance after the plant ceased MIC production at the end of 1984, allowing several safety systems to be inoperable due to poor maintenance, and
* Switching off safety systems to save money— including the MIC tank refrigeration system which could have mitigated the disaster severity, and non-existent catastrophe management plans.
* Other factors identified by government inquiries included undersized safety devices and the dependence on manual operations. Specific plant management deficiencies that were identified include the lack of skilled operators, reduction of safety management, insufficient maintenance, and inadequate emergency action plans.
* The "Worker Sabotage" point of view argues that it was not physically possible for the water to enter the tank without concerted human effort, and that extensive testimony and engineering analysis leads to a conclusion that water entered the tank when a rogue individual employee hooked a water hose directly to an empty valve on the side of the tank. This point of view further argues that the Indian government took extensive actions to hide this possibility in order to attach blame to UCC (union carbide). (Wikipedia)
* Theories differ as to how the water entered the tank. At the time, workers were cleaning out a clogged pipe with water about 400 feet from the tank. They claimed that they were not told to isolate the tank with a pipe slip-blind plate. The operators assumed that owing to bad maintenance and leaking valves, it was possible for the water to leak into the tank

### 1.2.3 Short Term Effects:

* Severe eye irritation
* A feeling of suffocation,
* Burning in the respiratory tract,
* Blepharospasm, breathlessness,
* Stomach pains and vomiting.
* People awakened by these symptoms fled away from the plant. Those who ran inhaled more than those who had a vehicle to ride. Owing to their height, children and other residents of shorter stature inhaled higher concentrations, as methyl isocyanate gas is approximately twice as dense as air and, therefore, in an open environment has a tendency to fall toward the ground.

### 1.2.4 Long-term Effects:

* Eyes: Chronic conjunctivitis, scars on cornea, corneal opacity, early cataracts, Blindness
* Respiratory tracts: Obstructive and/or restrictive disease, pulmonary fibrosis, aggravation of TB and chronic bronchitis
* Neurological system: Impairment of memory, finer motor skills, numbness etc.
* Psychological problems: Post traumatic stress disorder (PTSD)
* Children's health: Peri- and neonatal death rates increased. Failure to grow, intellectual impairment, etc.
* Cancer
* Immune deficiency
* Soil and water contamination in the area was blamed for chronic health problems and high instances of birth defects in the area’s inhabitants

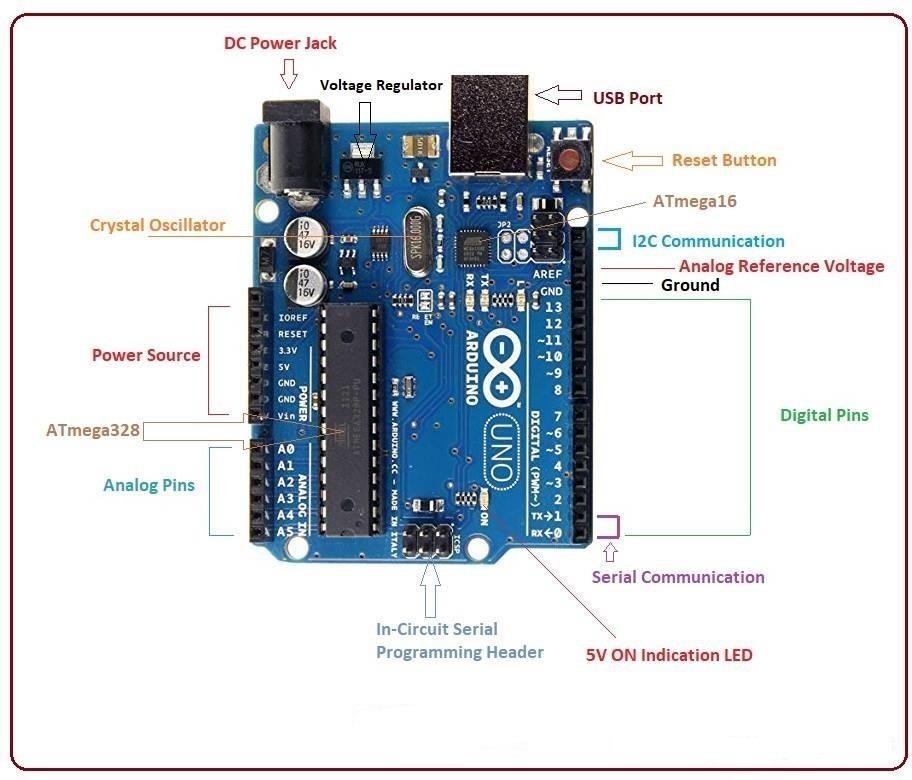
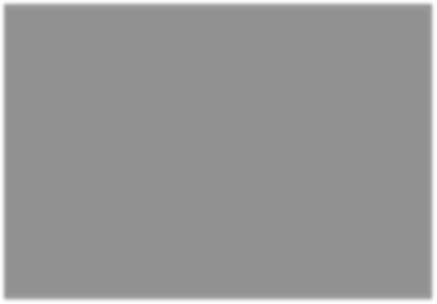
# CHAPTER-2 COMPLTE HARDWARE DETAIL

## 2.1 PLANNING OF COMPONENTS

* MQ5 to sense LPG (use digital out to detect level status).
* Arduino is use to read signal from MQ5 sensor.
* To read MQ5 output and detect gas leak and sound alarm and SMS alert.
* To send AT command to GSM module.
* To send a status message commands to LCD module.
* To turn ON and OFF sound alarm.
* GSM module for GSM communication and to send SMS to mobile number.
* LCD module to produce alarm sound.

### 2.1.1 ARDUINO UNO

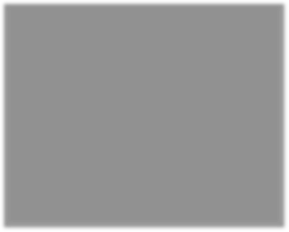
* Arduino uno is an electronic prototype platform/board based on ATmega AVR.
* Microcontroller has ATmega 328 (8 bit,6Mhz).
* It operates on +5 volts.
* 14 digital I/O pins (of which 6 are PWM) (pulse width modulation)
* The voltage regulator converts the input to 5v. Subsequently, this signal powers up the Arduino Uno board.
* There is a reset button on Arduino which does pretty much same as unplugging the board and plugging it back. It restarts your program from beginning.
* We also use crystal oscillator to executed I synchronization with clock and provide timing for different operation into microcontroller.



*Figure 2.1.1 ARDUINO UNO*

### 2.1.2 MQ5 SENSOR MODULE

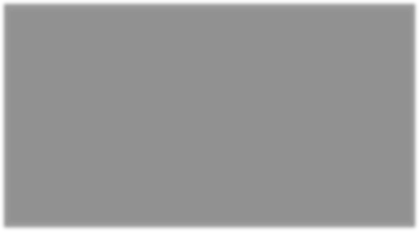
* MQ5 sensor is a generic sensor used to detect LPG presence.
* The sensor has a sensitive filament made of tin oxide. (Sno2)
* The module has both analog and digital output.
* MQ5 sensor can give analog signal and digital signal as per the requirements.
* The detection rang of MQ5 sensor is between 300-10000 ppm (parts per million).
* It operates on +5 volts.
* It can also detect other gas like methane and alcohol as well.
* The digital out give only two possible output- high & low (hence its more suited for detection of gas leak than to measure volume of gas presence).



*Figure 2.1.2 MQ5 SENSOR*

### 2.1.3 LCD DISPLAY (16X2)

There are two sections pins on the whole (16×2) LCD module. Some of them are data pins and some are command pin. Somehow, every pin has a role in controlling a single pixel on the display. Additionally, all the input/output pins of this module are shown in the pin out diagram.



*Figure 2.1.3 LCD DISPLAY (16X2)*

### 2.1.4 GSM MODULE

GSM is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM user a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies. TDMA, GSM and code division multiple access. GSM digitizer and compresses data, then send sit down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 megahertz or 1800 MHZ frequency band.

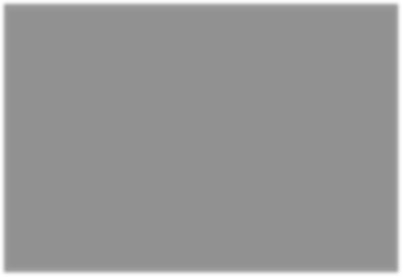
GSM together with other technologies is the part of the evolution of wireless mobile telecommunication that includes High-Speed circuit switched data, General packet radio service Enhanced data GSM environment and universal mobile telecommunication.



*Figure 2.1.4 GSM MODULE*

### 2.1.5 JUMPER WIRE

These female-female premium jumper wire are handy for making harness or between headers on PCB's. They're 3" (75mm) long and come in a 'strip' of 20 (2pieces of each of ten rainbow colors). They have 0.1" female header contacts on either end and fit cleanly next to each other on standard-pitch 0.1" (2.54mm) header. The best part is they come in a 20-pin ribbon cable. You can always pull the ribbon wires off to make individual jumpers, or keep them together to make neatly organized wire harnesses. We have tons of different Jumper Wires available, in all shapes and sizes! Note: The length of the jumper wires is sometimes a bit longer than what is listed. For best results, when plugging these into a male header, have the sides with the 'silver latch bit' sticking out since that side is a tiny bit wider than 0.



*Figure 2.1.5 JUMPER WIRE*

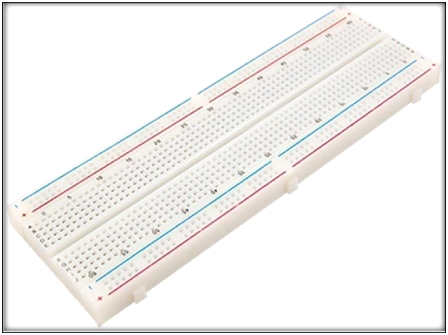
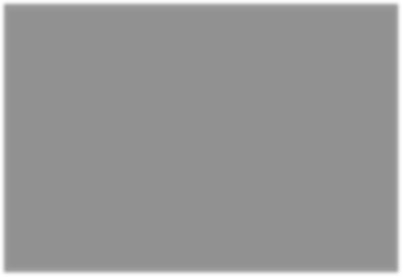
### 2.1.6 BREAD BOARD

A breadboard is a circuit board that is used to make temporary circuits. It is a device having electronics and test circuit designs. The electronic elements inside the electronic circuits can be interchanged by inserting the terminals and leads into holes and later connecting it with the help of appropriate wires. The device has stripes of metal below the board that connects the holes placed on the top of the board.

The connections of the breadboard are mostly temporary and the elements can further be reassembled and reused without any damage. Breadboards are generally used in electrical engineering. Engineers make use of breadboards in order to test different products made by them.

Using breadboard is the most efficient way of testing and also, they are cost effective. They can be reused again and again for the purpose of testing. Today, starting from tiny analog, digital circuits to complicated.

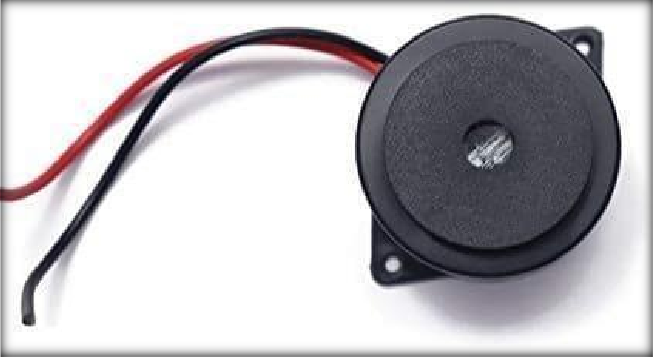
Breadboards earlier were made of copper wires or terminal strips. These days it is made up of white plastic and is a breadboard that can be plugged. Breadboards are solder less and they are made of two kinds of strips i.e., terminal and bus strips. Terminal strips help in holding the electronic elements while the bus strip is used to power electric power to all the electronic components. You can find manufacturers selling solder less breadboards very easily, some manufactures sell the bust and terminal strips separately and some sell it together.



*Figure 2.1.6 BREAD BOARD*

### 2.1.7 BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

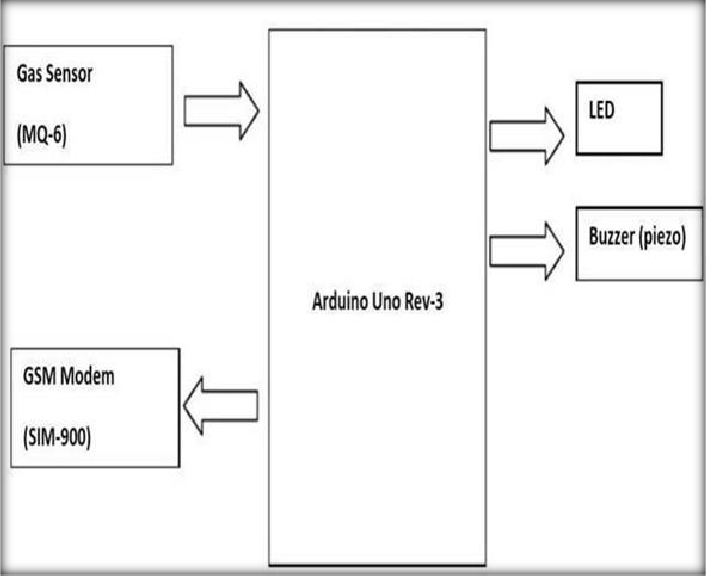


*Figure 2.1.7 BUZZER*

# CHAPTER-3 DIAGRAMS & WORKING OF PROJECT

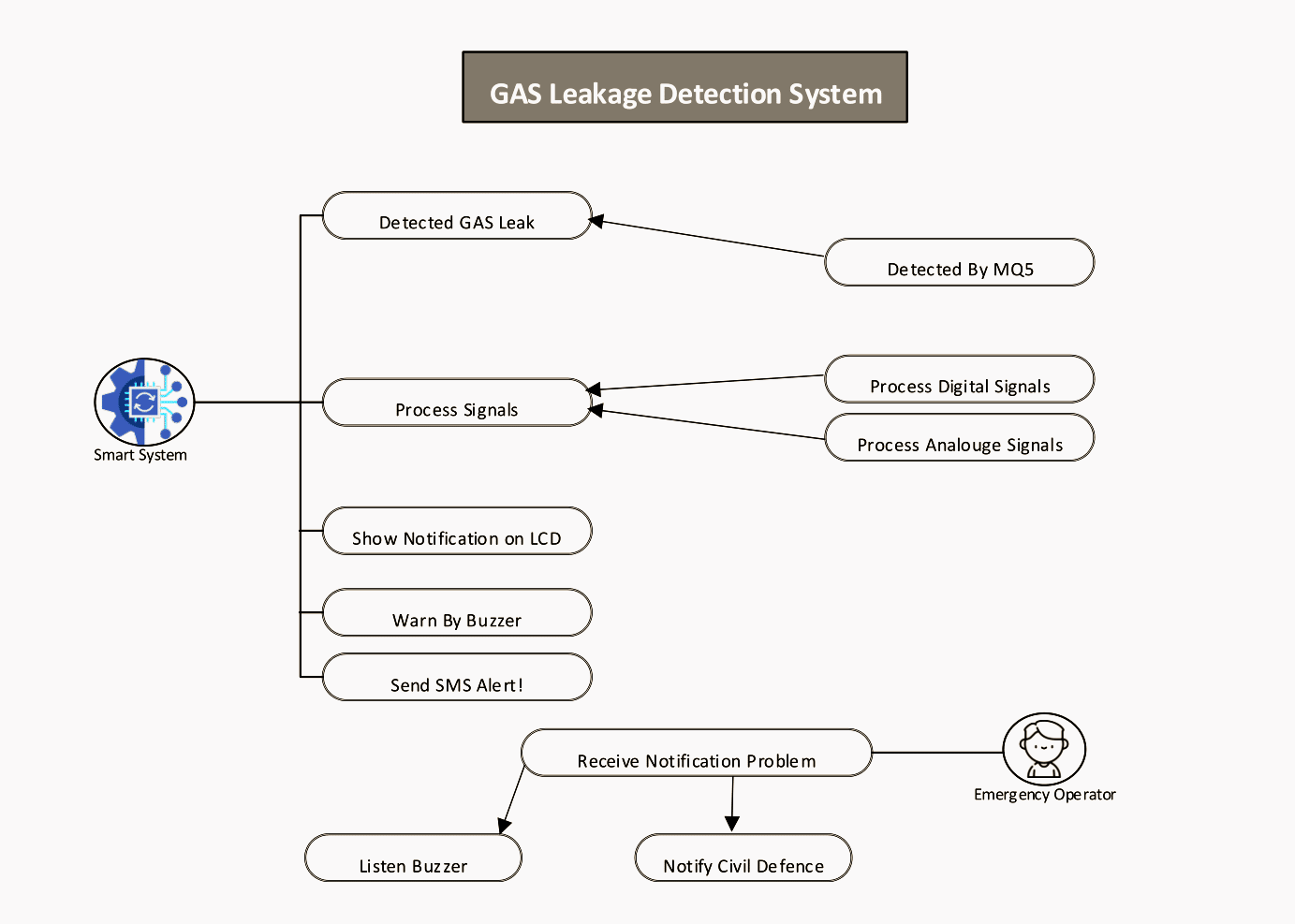
## 3.1. Diagrams

### 3.1.1 BLOCK DIAGRAM



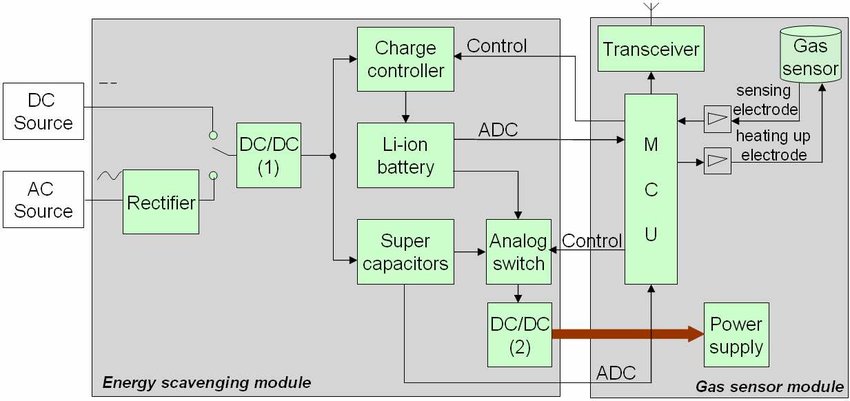
*Figure 3.1.1 BLOCK DIAGRAM*

### 3.1.2 USE CASE DIAGRAM



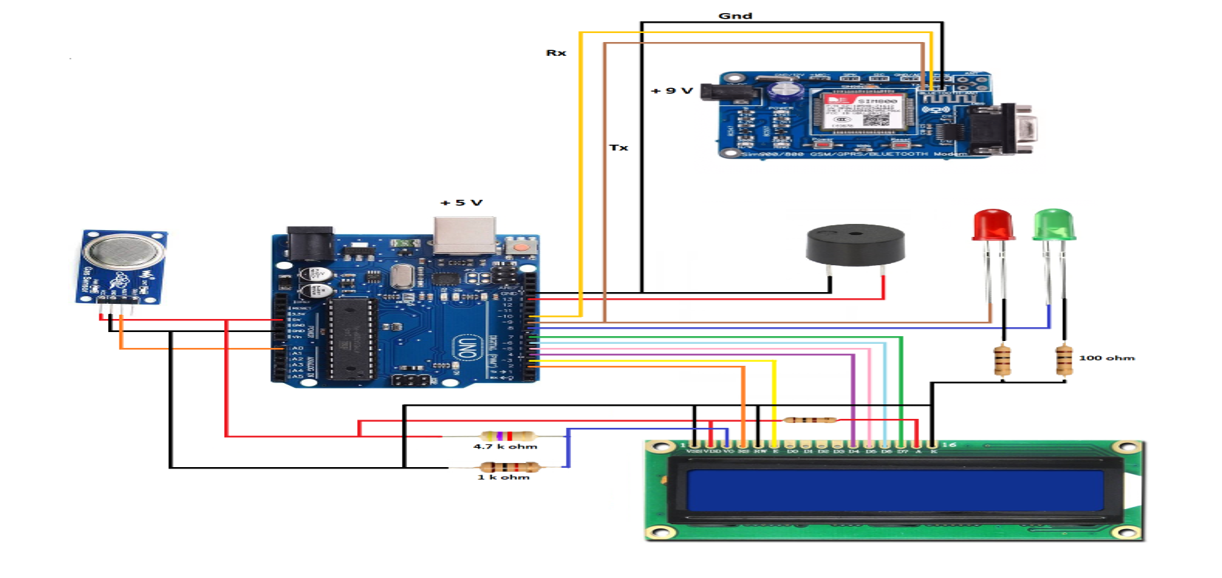
*Figure 3.1.2 USECASE DIAGRAM*

### 3.1.3 ARCHITECTURE DIAGRAM



*Figure 3.1.3 ARCHITECHTURE DIAGRAM*

### 3.1.4 CIRCUIT DIAGRAM



*Figure 3.1.4 CIRCUIT DIAGRAM*

## 3.2 WORKING OF SETUP

### 3.2.1 ARDUINO:

* Pin number 1 to 13 are digital pin.
* Pin number from Vin to IOPFEF is power pin.
* Pin number A0 to A5 are analog input pins.

### 3.2.2 LCD DISPLAY:

* Function of pin Vss as a ground.
* Function of pin Vcc is to give +5v supply.
* Function of pin Vee is use as contrast control (0v: High contrast)
* Function of pin RS is register select (0: command reg. 1: datareg.)
* Function of pin RW is read/write (0: write,1: read)
* Function of pin E is enabled H-L pulse.
* Function of pin D0-D7 is data pin.
* Function of pin LED+ is give +5v.
* Function of pin LED- is ground

### 3.2.3 MQ5 SENSOR:

* Function of pin A0 is the analog out can be used to detect gas leakage and to measure volume of gas leakage in specific units.
* Function of pin D0 is digital out can be used to detect gas leakage and hence trigger an alert system.
* Function of pin Vcc is used to give supply to MQ5 sensor.
* Function of pin GND is a ground of MQ5 sensor.

### 3.2.4 GSM MODULE:

* Function of pin RXD is to receive the data.
* Function of pin GND is a ground of GSM module.

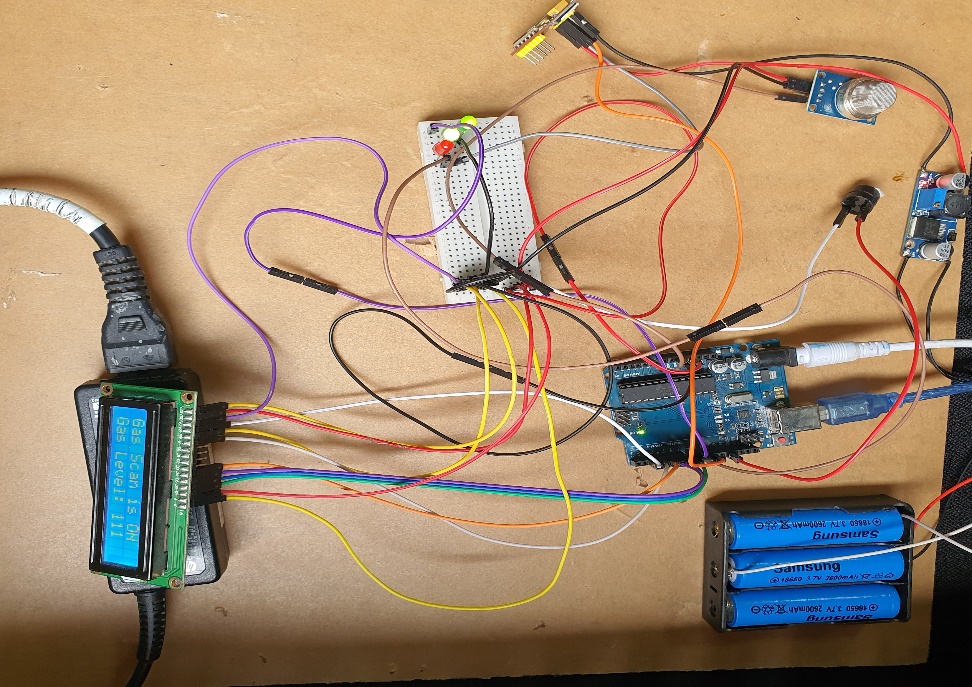
### 3.2.5 WORKING OF COMPONENTS

* At firsts MQ5 sensor sense the gas leak, which sends an analog signal to Arduino uno with is form pin A0 of sensor to pin A0 of Arduino.
* MQ5 sensor got power from Arduino uno which is +5 volt form the power pin of 5 volt on the Arduino.
* Analog signals are converts into digital signals in Arduino uno with the help of analog to digital converter.
* Arduino uno sends the signal to display with show that how much percentage gas are leak.
* Arduino uno sends data from the digital pin no.2,3,4,5 to the display pin no DB4, DB5, DB6, DB7 which is data pins of display.
* If leakage of gas is more than that of permissible limit buzzer start ringing which get power from the arduino from the power pin of 5 volt and GSM module sends a SMS to the register mobile number.
* GSM module connect to arduino though the pin no.1 of arduino which is TX pin of arduino to the RX pin of GSM module & GND pin of GSM module are connect to the GND pin of the Arduino.
* Interfacing MQ5 Sensor to Arduino
* Connecting Digital Out of MQ5 to 7
* Interfacing GSM Module to Arduino
* Connect to PWM pins 9 and 10 of Arduino (using software serial)
* To of GSM Module to 9 and GSM Module to 10
* Interfacing Speaker to Arduino
* Connect to Pin 8 of Arduino
* Interfacing LCD Module to Arduino
* 16.2 LCD Module is used
* Data Lines (DB4, DB5, DB7 connected to 5,4,3,2 pins of Arduino in order)
* Enable Pin connected to 11 and RS (Register Select) Connected to 12
* Backlit LED is connected to Become (+5v) through a 560 ohms current limiting resistor
* Connect - is adjusted by connecting VEE to a 10k Pat and +5v.

## 3.3 WORKING OF PROJECT

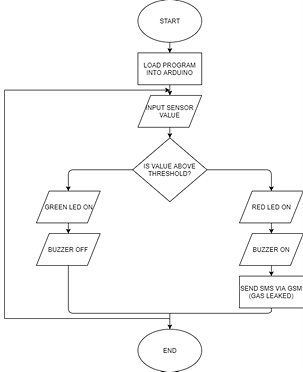
When the circuit is powered on after uploading code, the LCD displays the Gas Level in some analog numbers. It will display the status of whether the gas level is normal or excessive. When the gas level exceeds it will display SMS Sent status.

This circuit triggers the alert system when smoke or gas leakage is detected. The circuit mainly uses the MQ5 Gas sensor and Arduino to detect gas leak. The sensor has excellent sensitivity combined with the quick response time. This low signal is monitored by the microcontroller and sends the signal to the GSM module Sim800l to send messages as "Excess Gas Detected. Open Windows" to a mobile number written in code.



*Figure 3.3 PROJECT PHOTO*

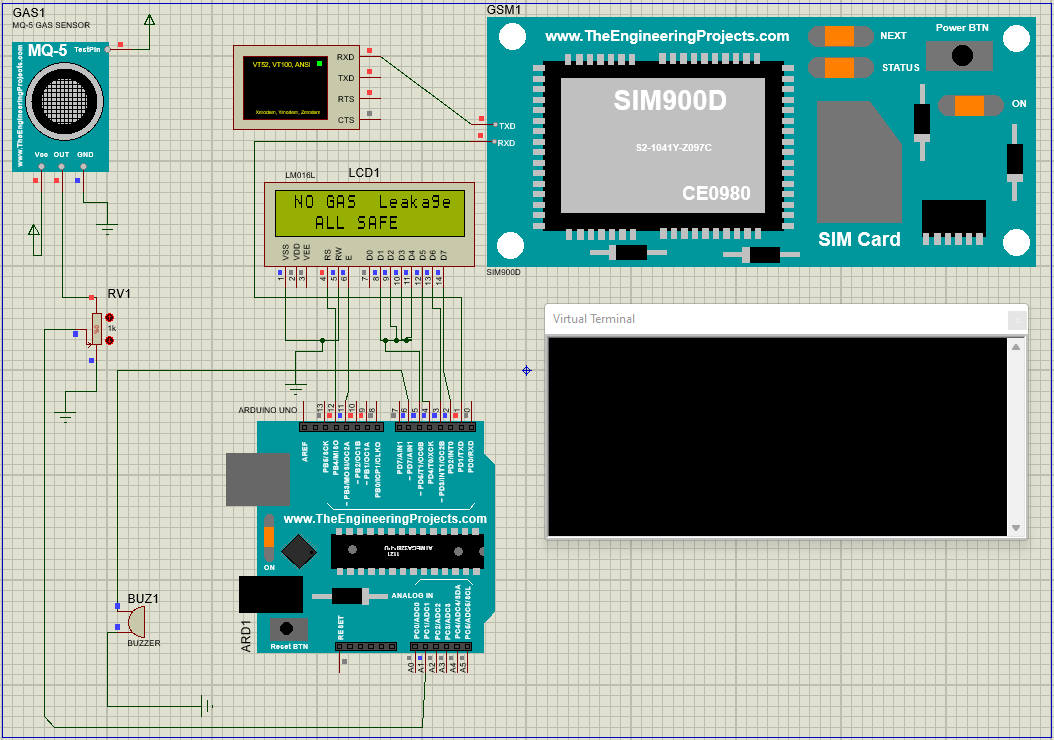
## 3.4 FLOW CHART



*Figure 3.4 FLOW CHART*

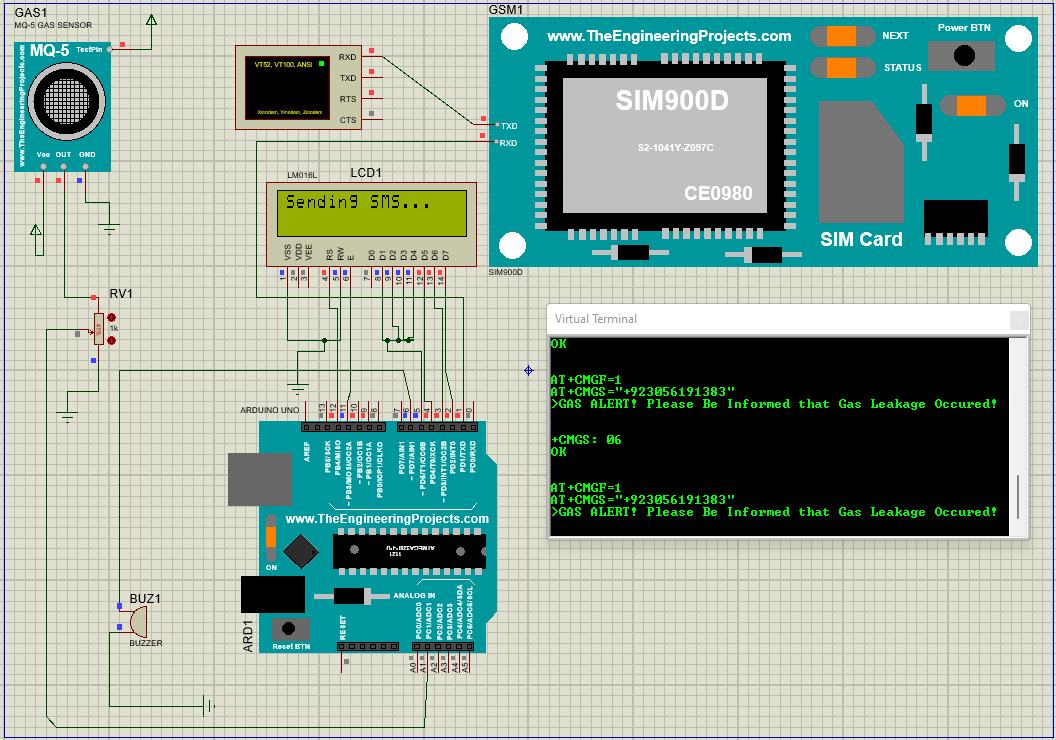
## 3.5 PROTEUS DIAGRAMS

### 3.5.1. NO GAS DETECTED



*Figure 3.5.1 No Gas detected*

### 3.5.2 GAS DETECTED



*Figure 3.5.2 Gas detected*

## 3.6 CODING OF PROJECT

#include <LiquidCrystal.h>

LiquidCrystal lcd(2,3,4,5,6,7);

#include <SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

int gasValue = A0; // smoke / gas sensor connected with analog pin A1 of the arduino / mega.

int data = 0;

int buzzer = 13;

int G\_led = 8; // choose the pin for the Green LED

int R\_led = 9; // choose the pin for the Red Led

void setup()

{

pinMode(buzzer,OUTPUT);

pinMode(R\_led,OUTPUT); // declare Red LED as output

pinMode(G\_led,OUTPUT); // declare Green LED as output

randomSeed(analogRead(0));

mySerial.begin(9600); // Setting the baud rate of GSM Module

Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)

lcd.begin(16,2);

pinMode(gasValue, INPUT);

lcd.print (" Gas Leakage ");

lcd.setCursor(0,1);

lcd.print (" Detector Alarm ");

delay(3000);

lcd.clear();

}

void loop()

{

data = analogRead(gasValue);

Serial.print("Gas Level: ");

Serial.println(data);

lcd.print ("Gas Scan is ON");

lcd.setCursor(0,1);

lcd.print("Gas Level: ");

lcd.print(data);

delay(1000);

if ( data > 200) //

{

digitalWrite(buzzer, HIGH);

digitalWrite(R\_led, HIGH); // Turn LED on.

digitalWrite(G\_led, LOW); // Turn LED off.

SendMessage();

Serial.print("Gas detect alarm");

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Gas Level Exceed");

lcd.setCursor(0,1);

lcd.print("SMS Sent");

delay(1000);

}

else

{

digitalWrite(buzzer, LOW);

digitalWrite(R\_led, LOW); // Turn LED off.

digitalWrite(G\_led, HIGH); // Turn LED on.

Serial.print("Gas Level Low");

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Gas Level Normal");

delay(1000);

}

lcd.clear();

}

void SendMessage()

{

Serial.println("I am in send");

mySerial.println("AT+CMGF=1"); //Sets the GSM Module in Text Mode

delay(1000); // Delay of 1000 milli seconds or 1 second

mySerial.println("AT+CMGS=\"+923056191383\"\r");

delay(1000);

mySerial.println("Alert! Gas Leakage Detected.");

mySerial.println(data);

delay(100);

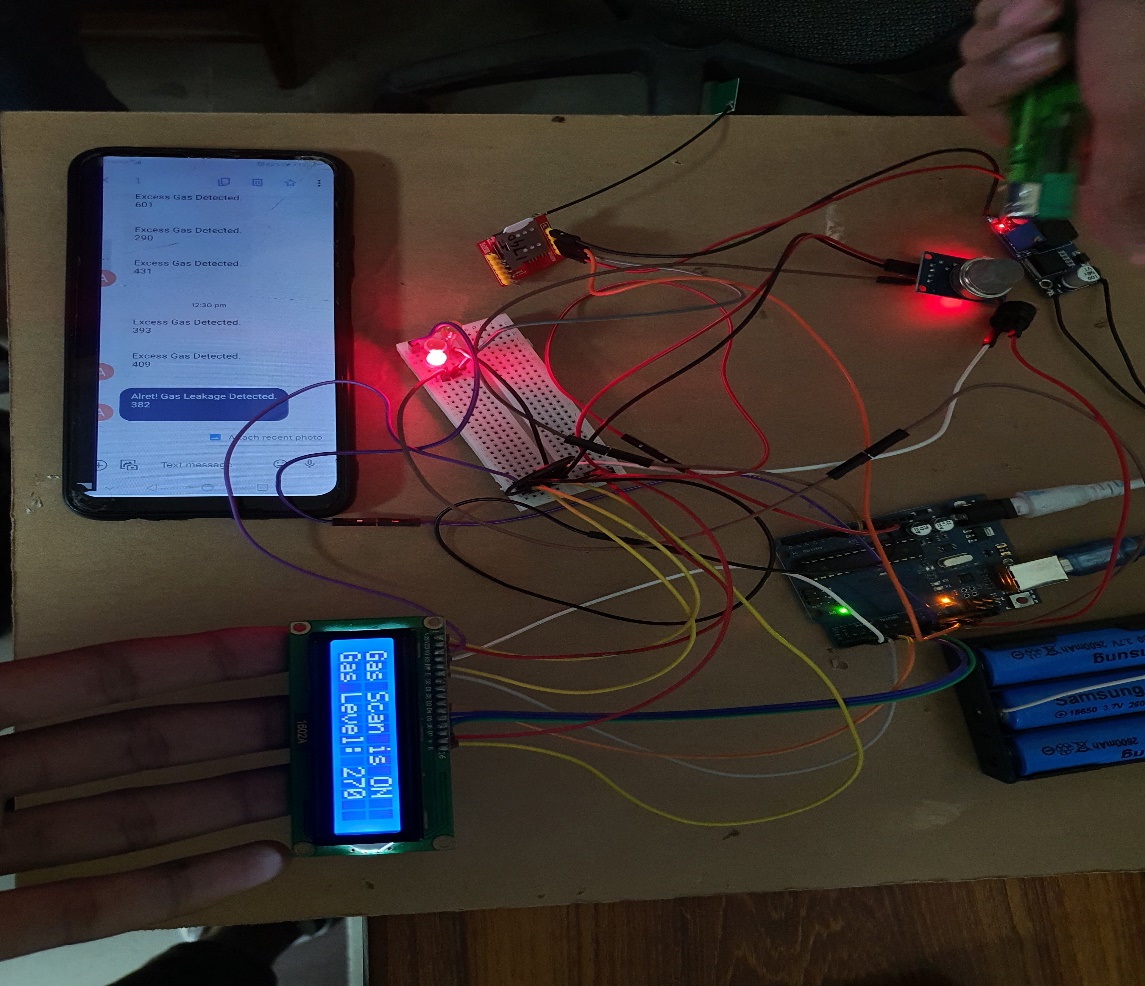
mySerial.println((char)26);// ASCII code of CTRL+Z

delay(1000);

}

# CHAPTER-4 RESULTS

### 4.1 RESULT



*Figure 4.1 Result*

# CHAPTER-5 CONCLUSION AND FUTURE WORK

### 5.1 CONCLUSION

The project is extremely helpful in preventing accidents caused by gas leaks. This works incredibly well when it is widely implemented. Remote communication can be done quickly. Because this detection system is inexpensive, anyone can use it.

### 5.2 FUTURE WORK

This gas leak detector can be enhanced and made more complicated in a variety of ways by adding advance features. The GSM module makes it possible to notify the appropriate parties about a gas leak, which improves the effectiveness of the system. The GSM module's use in this detector stops accidents from going in a dangerous direction.

Another modification that can be made to this gas leak detector is the addition of a tripper circuit that, when activated by a gas leak, cuts off the main power supply. Switching any appliances during a gas leak is risky because they might spark. This tripper circuit helps to reduce the electrical risks that may arise as a result of a gas leak. In order to prevent further gas leaks, it is compulsory to turn off the gas regulator in addition to tripping the main supply.

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