GAS LEAKAGE MONITORING AND ALERTING SYSTEM

PROJECT REPORT

Submitted by

RAVI TEJA K.

SAHITHI REDDY K.

MELIKIS SAM S.

DINESH KUMAR M.

In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

TABLE OF CONTENTS

ABSTRACT

Gas leakage has been a significant issue over the past three decades in homes, hotels, retail stores, workplaces, flats, etc. In recent years, there have been more fatalities caused by gas cylinder explosions. The primary goal of this research is to compare several publications that focus on gas detection in order to prevent fire accidents and preserve lives and property. Installing a gas leak detection system, which can automatically detect the gas and assist in stopping the leak, is one way to prevent accidents caused by gas leaks. Using gas sensors and temperature monitoring at several locations, this gas detection system finds LPG. This gas detection system is constructed with an Arduino Uno, a Gas Sensor, and a few output devices. The potential of fire exposures from this gas leak will affect homes, apartments, businesses, and large buildings. This gas detection system is primarily used to deliver SMS notifications to the user or authorized person so they may respond immediately when a fire is present by shutting off the gas valve from the cylinder. The buzzer emits a beeping sound when gas is leaking, signaling the presence of a fire. When gas leaks, this system automatically opens the windows and doors. Next, GSM notifies the customers by text message that gas is leaking. The poor-quality rubber tubing in gas cylinders is primarily to blame for fire mishaps. Due to obstructions in the burner or leaks in the gas pipelines, the gas supply from the regulator to the burner may be on even while the regulator is off. When there is a significant gas leak, a buzzer and LED are turned ON to signal the situation. In order to solve this issue, this system also utilized a 16x2 LCD display. Whether there is a gas leak or not is shown on an LCD. This essay covered the evolution of gas leakage as well as potential future issues caused by gas leakage.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GSM	Global System for Mobile Communication
LED	Light-Emitting Diode
IOT	Internet Of Things

CHAPTER 1

INTRODUCTION

1.1 OBJECTIVE

Since the 1910 discovery of liquefied petroleum gas (LPG), a blend of industrial-grade gases that are normally stored in liquid form in pressurized cylinders and vaporize at normal temperatures, fire accidents are now a common occurrence in industries, residences, and markets in any country. However, when LPG leaks and both material damage and human injury or death occur, which are increasing day by day for so many causes, it could result in significant fire events.

LPG gas leaks have increased from 0.72% to 10.74% of all cooking incidents. The most serious safety issue is hence the identification of gas leaks. In order to avoid fires and provide home safety, this project represents the detection and alarm system for LPG leakage. It is based on the Global System for Mobile (GSM) network and serves as an alert warning system. It can be used to detect the presence of gases. " When there is a gas leak, the sensors in the circuit will detect it and switch on the LED. At this point, the GSM modem will send an SMS alert to the mobile user to let them know! "Please check," which offers immediate notification. This device can be mounted anywhere that is thought to be appropriate, including factories, LPG storage rooms, and kitchens.

The Arduino Board can be used to create a variety of inventions utilizing a variety of tools. Arduino is an emulation board that may be used to test various projects and run applications. It includes an ATmega328 microcontroller. When compared to other microcontroller platforms, Arduino boards are less expensive, and the software is compatible with Windows, Linux, and Mac OS X. Microcontroller systems are often only compatible with Windows. We employ the Arduino Uno in this study, which deals with the integration of IOT and embedded

systems (hardware and software). The 14 digital input pins and 6 analogue pins of the Arduino Uno are used to connect various sorts of sensors and to interface with various devices.

These pins, which are coupled to various sensors, allow for the reading of inputs. It keeps 3.3v and 5v output power supplies and 3 ground pins for connecting to various sensors. The microcontroller on the Arduino board allows the program to be saved and do the tasks specified in the program. Once the code has been uploaded to the microcontroller, multiple uploads to a computer or laptop are not required. We need to use software called Arduino IDE to upload the code to the Arduino board. There are several boards than Arduino that can connect to sensors and have built-in WIFI, Bluetooth, etc. LPG is a combination of the highly combustible chemical butane and propane. Because the gas is odorless, a strong odorant called ethanethiol is added to make leaks easier to detect. The most widely utilized odorants on the international scale include tetrahydrothiophene, amyl mercaptan, and EN589. One of the alternative fuels used nowadays is LPG. Liquefied petroleum gas is also referred to as LPG, LP gas, auto gas, etc. This gas is frequently employed for cooking, heating appliances, and a few other uses. Due to the rising costs of gasoline and diesel, LPG is also employed as a substitute fuel in vehicles.

Not only is finding gas leaks critical, but also stopping them is crucial. In this work, a system that not only detects gas leaks but also alerts (beeps), shuts off the main power and gas supplies, and sends an SMS is presented. The GSM module is utilized to send an SMS to the user as an alert. MQ-6 has been utilized as a high accuracy gas sensor.

CHAPTER 2

LITERATUR SURVEY

2.1 EXISTING METHOD

Several studies showing the advantages of home security in our home have appeared in the literature survey.

2.2 GAS LEAKAGE DETECTION BASED

Ramya R Shekar et al. proposed MQ-5 gas sensor is used to detect the leakage of gas and when the gas is going to be empty it will send the notification to the gas agency to book a cylinder automatically through WIFI using IOT. Suppose if the gas leakage is sensed an SMS will be send to the authorized person. For making this system a microcontroller ATMEGA328 is used to interface with the GSM module, LPG sensor and with some output devices like Buzzer, LCD display, Relay etc., The sensor used in this model can be sensed and it detects gas leakage and the authorized person will get the notification for remaining percentage of gas in the cylinder and also some actions will be occurred to pre-book a new cylinder. It helps to their safety and to prevent the major accidents and also protects their life and property from the accidents due to the gas leaking. The major purpose of this work is to a safe and easy way for booking a gas and to detect the gas leakage for avoiding the accidents.

2.3 ONLINE MONITORING OF GEOLOGICAL CO2 STORAGE AND LEAKAGE BASED ON WIRELESS SENSOR NETWORKS

Hui Yang et al. proposed a real-time monitoring system for CO2 gas leakage had been developed successfully that which can able to realize the storage automatically and show in LCD display through a wireless medium. This is

expensive system and used in wireless, many sensors have been implemented in different location along with the GPS module to collect the data of location and time information. The monitoring equipment consists of CPU, air environment sensors, GPS receiver module and secure digital memory card for storage of data along with liquid crystal display (LCD) module and GPRS wireless transmission module. The CPU automatically stores the data in storage module and displays it in LCD display. The GPRS module continuously transmits the collected information to data center server. The online monitoring Webs' clients are developed using the PHP language which connects a local server and runs on Apache web server. Where MYSQL is used for the database because of its speed and browser web maps has been created, optimized with Open Layers JavaScript web-mapping libraries.

2.4 IOT BASED INDUSTRIAL PLANT SAFETY GAS LEAKAGE DETECTION SYSTEM

Ravi Kishore Kodali et al. proposes that these days there are so many fire-accidents in industries due to the gas leaks. These causes a very big damage to the industry equipment's and human life also. With this gas leaks human deaths are becoming more and more now-a-days. So, this project proposes a leakage detector to detect the gas leakage and sends a warning message to the people through the mobile SMS. This project includes low cost MQ4, MQ6, MQ135 gas sensors to detect LPG, Methane, and Benzene gas leaks and used ESP-32 as a WIFI module. The above-mentioned gases are uploaded in the UBIDOTS cloud and then the login details are included in the warning message so that the user can check the message, and stop the gas leaking. They used a sound alert using Buzzer for detecting a gas leaking and send an SMS to the concerned person using IFTTT web service, where SMS will be sent to the mobile number with very less delay.

They also used different colors of LEDs to specify the gas leaked like RED LED indicates as presence of LPG whereas GREEN LED indicates as no presence of LPG.

2.5 GAS LEAKAGE AND FIRE DETECTION USING RASPBERRY PI

Sourabh Jamadagni et al. proposed Raspberry Pi Model 3 is interfaced with GSM module to work as a Gas Leakage and Fire Detection Monitoring System. Here MQ-2 gas sensor is used to detect the gas leakage. This paper has the growth in the industrial monitoring system using IOT. Raspberry Pi plays an important role where all components interfaced with it. Gas leakage and Fire detection is the process of identifying potentially hazardous gas leaks and fire by sensors. These sensors alert the people by sending the SMS through the GSM. Whenever the gas and fire are detected by sensor, a voltage is generated in it and it gives as input to raspberry pi. The SMS is sent by the GSM when the gas and fire is detected. This will detect the gas leakage and fire and it will be informed to the user through SMS. This system is cost effective and more effective than the existing system, solves the problem in an effective way.

2.6 SMART GAS LEAKAGE DETECTION WITH MONITORING AND AUTOMATIC SAFETY SYSTEM

Mahmudul Hasan et al. proposed gas leakage detection with monitoring and automatic safety system. This project designed a system which notify the user through Internet of Things from the mobile app. They designed a safety system because LPG is a highly hazardous and inflammable gas with the help of IOT through the mobile app. Here they used MQ-2 gas sensor to detect the LPG gas where elements like propane and butane is used. And, in this system they used Wi-Fi module for communication medium for sending the results and

notifications through the mobile app. Node-MCU ESP-8266 used for communication purpose and they used the software named “BLYNK” for mobile app. Mainly this system is to avoid accidents by gas leakage and to monitor the gas level of LPG cylinder for household purpose.

2.7 PROBLEM STATEMENT

Gas leaks are a frequent issue in both homes and businesses. It can result in the loss of life and property if it is not identified and fixed in a timely manner. Carbon monoxide, which may be fatal, is also extremely hazardous to life. Natural gas leaks can be hazardous since they raise the possibility of a fire or explosion. In the event of a gas leak, local gas suppliers "try hard to provide enough warning." The gas firm adds a warning "rotten-egg" scent (mercaptan or a similar sulfur-based substance) that most people can easily identify because methane, and consequently natural gas, has no smell. People with impaired senses of smell, however, might not be able to rely on this safety measure.

Because gas leaks from pipelines inside of homes, gas cylinders are starting to become the main problem. These gas leaks can occur when pipes are damaged or because of ageing pipes, which can cause gas leaks. Both the lives of people and the environment are seriously endangered by gas leaks. Because of human error, gas leaks can occur anytime, anywhere, if you have gas appliances. Most people use their LPG cylinders for cooking and other facilities in their homes.

When the gas leaks and mixes with other butane from the cylinders, it becomes extremely combustible. This LPG uses propane. In most cases, when gas leaks from a pipeline, it spreads to any area where there is a higher concentration of gas despite the fact that there should not be any gas there. The environment and

human health are both at risk when gas is being released and inhaled. Even though gas leaks are caused by little cracks in the pipelines, they can grow to the point of exposure if they spread over a room as well as the entire house, building, or other area.

Due to global warming, it is particularly bad for the ecosystem if natural gas seeps into the atmosphere. Equipment deterioration is the primary cause of gas leaks in residential buildings. When there are numerous gas appliances in a home, the gas is burned while cooking or for other purposes, and if a leak occurs, it can be dangerous for both the home and the environment.

CHAPTER 3

PROPOSED SOLUTION

3.1 OVERVIEW

The objective of the research is to recognize gas leaks as a part of the safety system. It is capable of detecting a variety of compounds, including alcohol, smoke, H2, CH4, CO, and butane. An SMS alert will also be sent to the specified person in addition to the sound alarm. The gas supply will be shut off by the fire safety department's valve when the percentage exceeds the threshold. Human life and property are protected under this system. Risk in the workplace, at home, in business, etc. is alerted to by the detection findings, which are displayed on LCD. Gas leaks in this system have been checked for using the gas sensor, which sends signals to the Arduino board. The Arduino is connected to the LCD, GSM, and buzzer to deliver signals. The GSM module delivers an SMS to the requested mobile number as a result. Whether a gas leak is present in the sensor's field of detection determines whether an SMS should be issued. And an exhaust fan is implemented to reduce the concentration of gas leaks.

The Arduino UNO R3 and the MQ-6 gas sensor serve as the system's foundation. The sensor will provide a digital output of 1 when it detects gas in the atmosphere and a digital output of 0 if no gas is detected. The sensor output will be used as digital input by Arduino. The buzzer will start to tune and the LCD will display "----DANGER----" if the sensor output is high. The bell won't tune and the LCD will display "---NORMAL LEVEL---" if the sensor output is low. How much percentage of gas is leaking can be visible in the LCD display. When the gas is leaking above the danger level

then exhaust fan will turn on to reduce the gas concentration during this process with help of servo motor gas valve will be turned off automatically.

Table 3.1 Comparison of existing method and proposed method

EXISTING METHOD	PROPOSED METOD
Gas Flow monitoring not available.	Continuous Gas Flow monitoring available.
It does not have a led indicator.	It has a Led indicator.
The buzzer not works like alarm.	It has a Led indicator.
IOT is used to send SMS to user.	With help of GSM user can get the SMS to the know gas leaking status.
Automatic turn off gas valve is not implemented.	Automatic turn off gas valve is implemented.
Exhaust fan is not available in these methods.	Exhaust fan is available in this method to reduce the gas concentration.

3.2 CIRCUITDIAGRAM

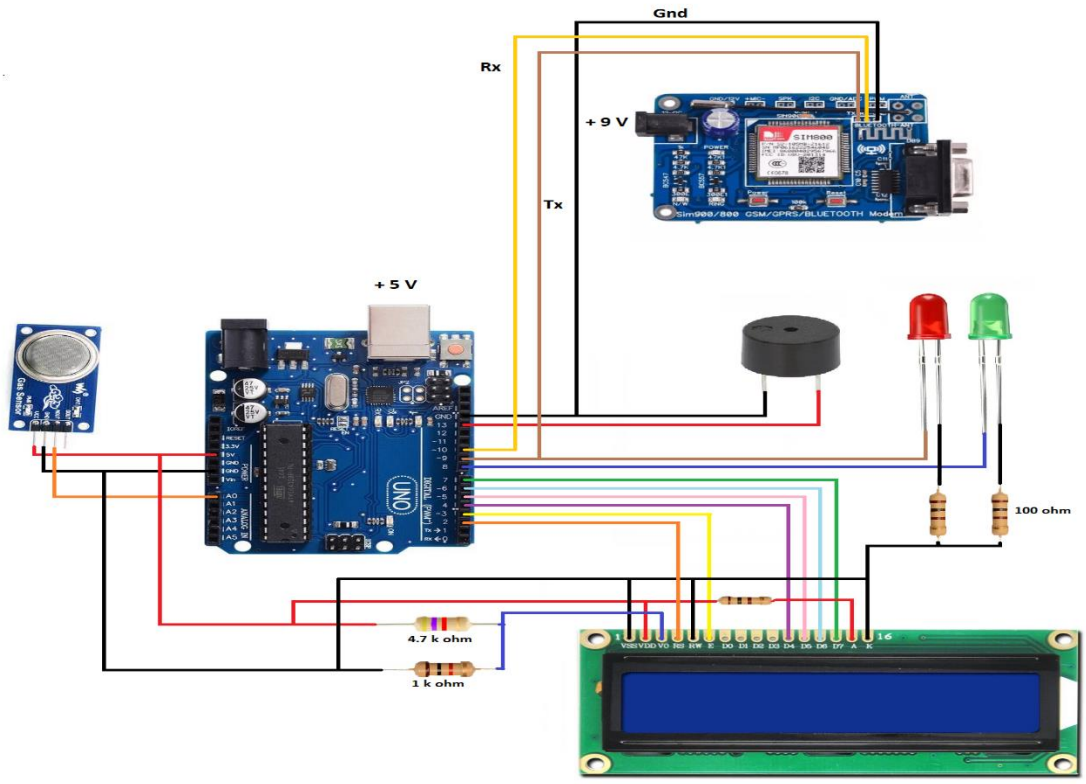

Figure 3.1 Circuit diagram of proposed system

The figure 3.1 shows circuit connections used to build the gas leakage monitoring and alerting system.

CHAPTER 4

HARDWARE DISCRIPTION

4.1 OVERVIEW

Table 4.1 In this project we are using the components are listed below.

Component Name :	Quantity required :
Jumper wires	25
Arduino	1
GAS sensor	1
Bread board	1
LED’s	2
GSM SIM800a module	1
LCD Display	1
I2c module	1
5v DC motor	1
Servo motor	1
Resistors	3
Buzzer	1
9v battery	1

Here table 4.1 shows the list components used in project

Jumper wires

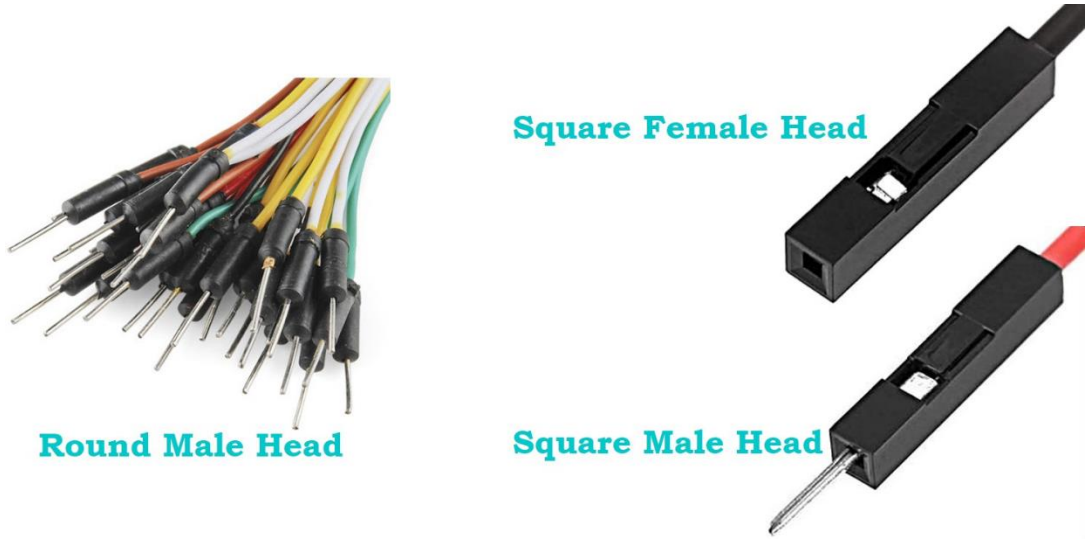

Figure 4.1 Jumper wires

AS shown in figure 4.1 jumpers are tiny metal connectors used to close or open a circuit part. They have two or more connection points, which regulate an electrical circuit board. Their function is to configure the settings for computer peripherals, like the motherboard. Suppose your motherboard supported intrusion detection. A jumper can be set to enable or disable it. Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. You can use jumper wires to modify a circuit or diagnose problems in a circuit. Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad. This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire.

Types of Jumper Wires

Jumper wires come in three versions:

- Male-to-male jumper
- Male-to-female jumper
- Female-to-female jumper

And two types of head shapes: square head and round head. The difference between each is in the endpoint of the wire. Male ends have a pin protruding and can plug into things, while female ends do not but are also used for plugging. Moreover, a male connector is referred to as a plug and has a solid pin for Centre conduction. Meanwhile, a female connector is referred to as a jack and has a Centre conductor with a hole in it to accept the male pin. Male-to-male jumper wires are the most common and what you will likely use most often. For instance, when connecting two ports on a breadboard, a male-to-male wire is what you will need.

Arduino

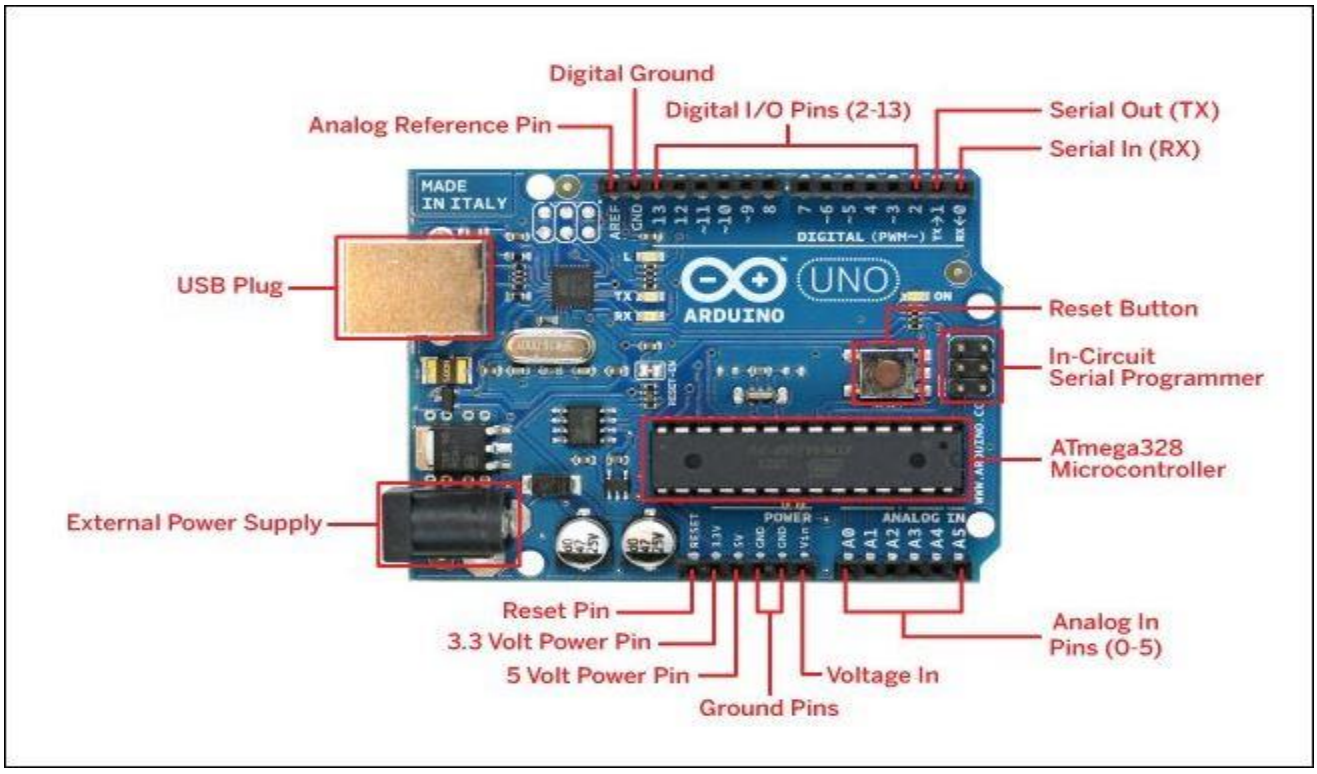

Figure 4.2 Arduino

As shown in figure 4.2 the Arduino is an open-source electronics platform based on easy-to-use hardware and software used to build electronics projects.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it.

The Arduino has a large support community and an extensive set of support libraries and hardware add-on “shields” (e.g. you can easily make your Arduino wireless with our Weixel shield), making it a great introductory platform for embedded electronics. Note that we also offer a Spark Fun Inventor’s Kit, which includes an Arduino Uno along with an assortment of components (e.g., breadboard, sensors, jumper wires, and LEDs) that make it possible to create a number of fun introductory projects.

GAS sensor

Figure 4.3 GAS sensor

As shown in figure 4.3 the MQ-6 module is used in gas leakage detecting equipment in family and industry, this module has high sensitivity to LPG, iso-butane, propane and LNG. It can also be used to detect the presence of alcohol, cooking fumes, and cigarette smoke. The module gives out the concentration of the gases as a analog voltage equivalent to the concentration of the gases. The module also has an onboard comparator for comparing against an adjustable preset value and giving out a digital high or low. It can be easily interfaced with your Arduino or Raspberry Pi. This is a simple-to-use MQ-6 Liquefied Petroleum, iso-butane, propane gas Sensor module, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air.

The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is

power the heater coil with 5V, add a load resistance, and connect the output to an ADC. Sensitive material of MQ-6 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exists, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electro circuit, convert change of conductivity to correspond output signal of gas concentration.MQ-6 gas sensor has high sensitity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

FEATURES

- Voltage: 5V
- Detecting concentration
- 200-10000 ppm LPG
- iso-butane
- propane
- LNG
- Analog and Digital Output
- Digital Out is High or Low based on a adjustable preset threshold.

APPLICATIONS

- Domestic gas leakage detector
- Industrial Combustible gas detector
- Portable gas detector

Bread board

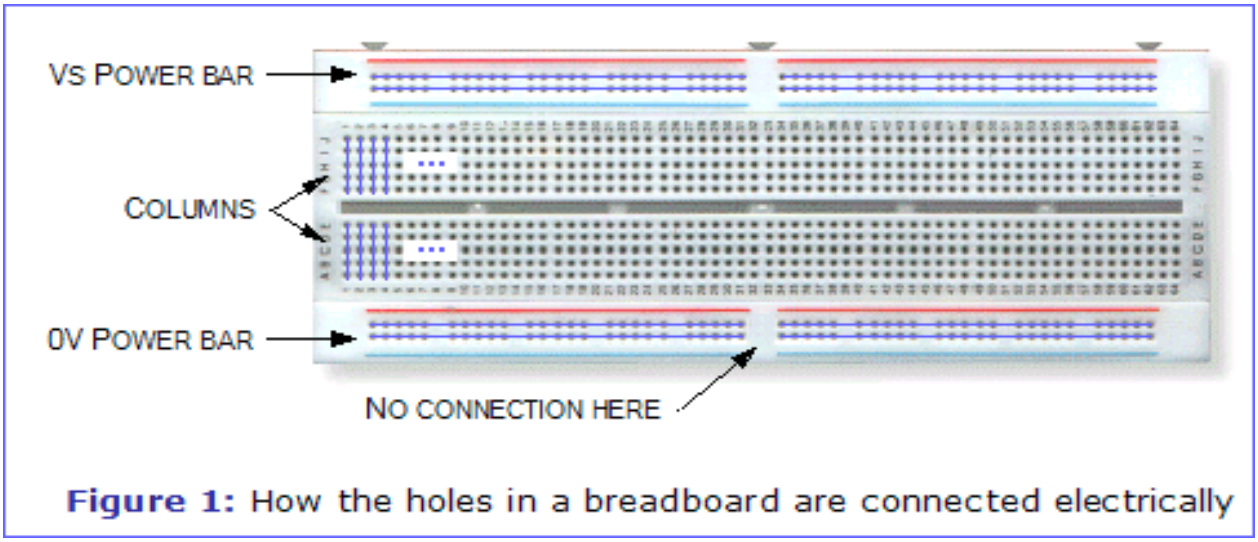

Figure 4.4 Bread board

Breadboards are designed to work with through-hole electronic components as shown in the figure 4.4. These components have long metal leads that are designed to be inserted through holes in a printed circuit board (PCB) that are plated with a thin copper coating, which allows the components leads to be soldered to the board. A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.

LED’s

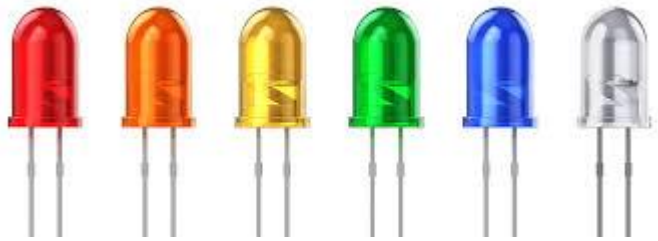

Figure 4.5 Led

As shown in figure 4.6 light releasing diode is an electric component that emits light when the electric current flows through it. It is a light source based on semiconductors. When current passes through the LED, the electrons recombine with holes emitting light in the process. It is a specific type of diode having similar characteristics as the p-n junction diode. This means that an LED allows the flow of current in its forward direction while it blocks the flow in the reverse direction. Light-emitting diodes are built using a weak layer of heavily doped semiconductor material. Based on the semiconductor material used and the amount of doping, an LED will emit a colored light at a particular spectral wavelength when forward biased.

GSM SIM800a module

Figure 4.6 GSM SIM800a module

As shown in figure 4.6 the SIM800A Quad-Band GSM/GPRS Module with RS232 Interface is a complete Quad-band GSM/GPRS solution in an LGA(Land grid array) type which can be embedded in the customer applications. SIM800A support Quad-band 850/900/1800/1900 MHz, it can transmit Voice, SMS, and data information with low power consumption. With tiny size of 100 x 53 x 15 mm, it can fit into slim and compact demands of custom design. Featuring and Embedded AT, it allows total cost savings and fast time-to-market for customer applications.

The SIM800A modem has a SIM800A GSM chip and RS232 interface while enables easy connection with the computer or laptop using the USB to the Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800A modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manager of the USB to Serial Adapter.

Then you can open Putty or any other terminal software and open a connection to that COM port at 9600 baud rates, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example "ATr" you should receive back a reply from the SIM800A modem saying "OK" or other response depending on the command sent.

Application :

1. Remote Data Monitor and Control.
2. Water, gas, and oil flow metering.
3. AMR (automatic meter reading).
4. Power station monitoring and control.
5. Remote POS (point of sale) terminals.
6. Traffic signals monitor and control.
7. Power distribution network supervision.

8. Central heating system supervision.
9. The weather station data transmission.
10. Vending machine.
11. Traffic info guidance.
12. Parking meter and Taxi Monitor.
13. Telecom equipment supervision (Mobile base station, microwave or optical relay station).

Features :

1. Quad-band 850/900/1800/1900MHz.
2. GPRS class 2/10.
3. Control via AT commands (3GPP TS 27.007, 27.005 and SIMCOM enhanced AT command set).
4. High-Quality Product (Not hobby grade).
5. 5V interface for direct communication with MCU kit.
6. Configurable baud rate.
7. Built-in SIM Cardholder.
8. Built-in Network Status LED.
9. Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
10. Low power.

LCD Display

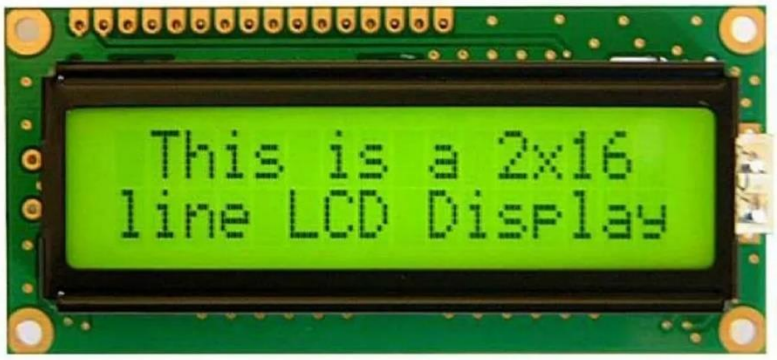

Figure 4.7 LCD Display

A liquid-crystal display (LCD) as shown in figure 4.7 is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the

same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

I2c module

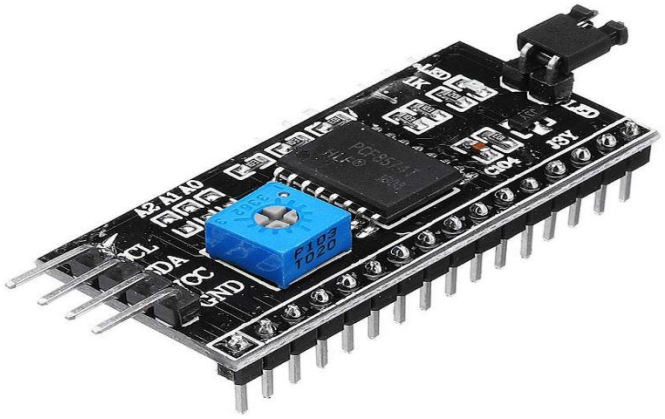

Figure 4.8 I2c Module

As shown in the above figure 4.8 I2C is a synchronous, multi slave, multi master packet switched, single-ended serial bus. i.e., multiple chips can be connected to the same bus. I2C uses only two bidirectional open collector or open drain lines, Serial Data Line (SDA) and Serial Clock Line (SCL), pulled up with resistors. Typical voltages used are +5 V or +3.3 V, although systems with other voltages are permitted. 16 pins are faced to rear side and 4 pins faced towards front side. The 16 pins for connect to 16x2 LCD and the 2 pins out of 4 pins are SDA and SCL. SDA is the serial data pin and SCL is the clock pin. The rest 2 pins for power supply (Vcc and ground).There is a POT on the I2C Module. We can control the contrast of the LCD display by rotating this POT. And there is a jumber fixed on the module. When we remove the jumber, the backlight of the LCD display will go OFF.

5v DC motor

Figure 4.9 5v DC motor

As shown in figure 4.9 a DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and

hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Servo Motor

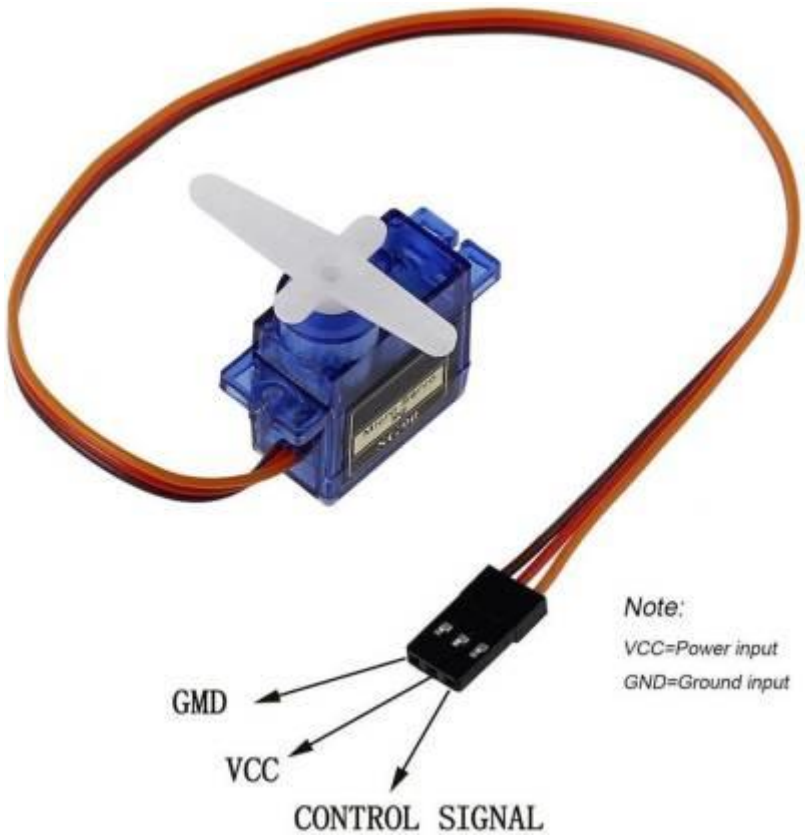

Figure 4.10 5v Servo Motor

As shown in figure 4.10 a servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a **servo mechanism**. If motor is powered by a DC power supply, then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about

the **DC servo motor working**. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Resistors

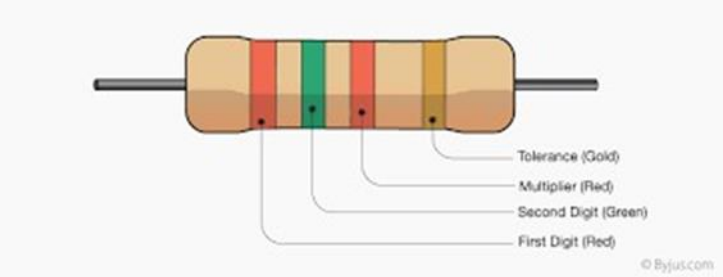

Figure 4.11 Resistor

A resistor is a passive two-terminal electrical component as shown in the figure 4.11 that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

Buzzer

Figure 4.12 Buzzer

As shown in figure 4.12 a **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.

9 V Battery

Figure 4.13 9 v Battery

Batteries are collection of one or more cells whose chemical reactions create a flow of electrons in a circuit. All batteries are made up of three basic components: an anode (the '-' side), a cathode (the '+' side) as shown in the figure 4.13 and some kind of electrolyte (a substance that chemically reacts with the anode and cathode).

CHAPTER 5

SOFTWARE DESCRIPTION

5.1 PROCEDURE TO CREATE A PROJECT USING ARDUINO IDE

Figure 5.1 procedure to start Arduino IDE

As shown in figure 5.1 code will be developed by the developers and it can be compiled by using ctrl + R.

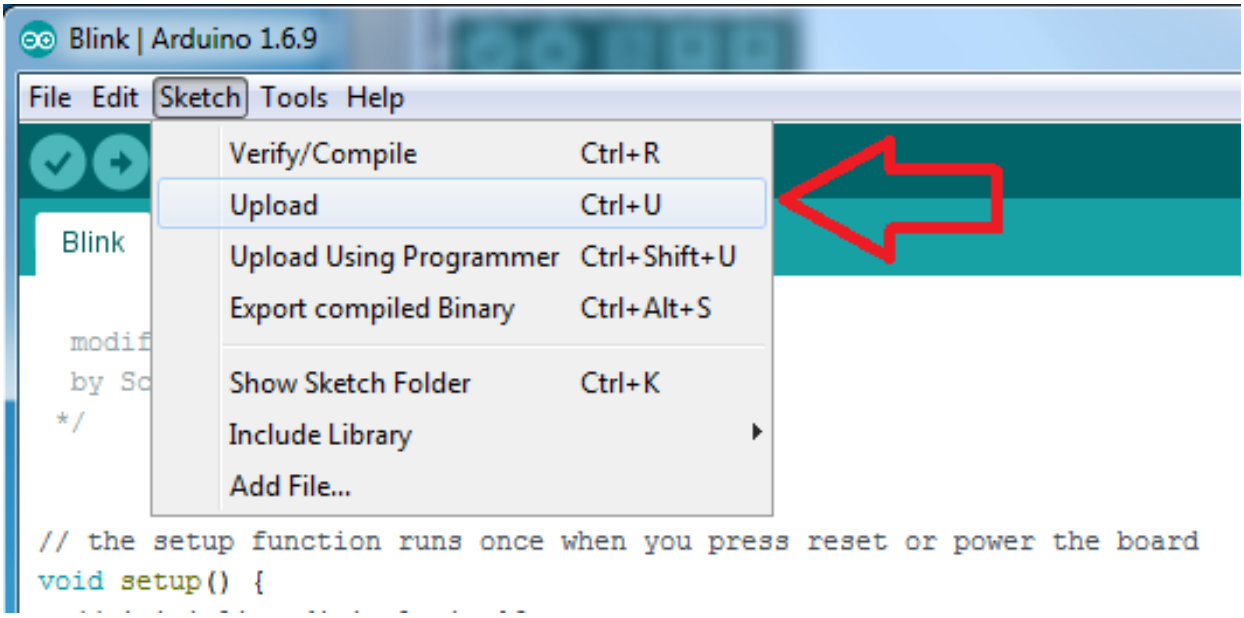

Figure 5.2 uploading code

After code compiled successfully the next step is to upload the code from Arduino IDE to Arduino board through a cable.

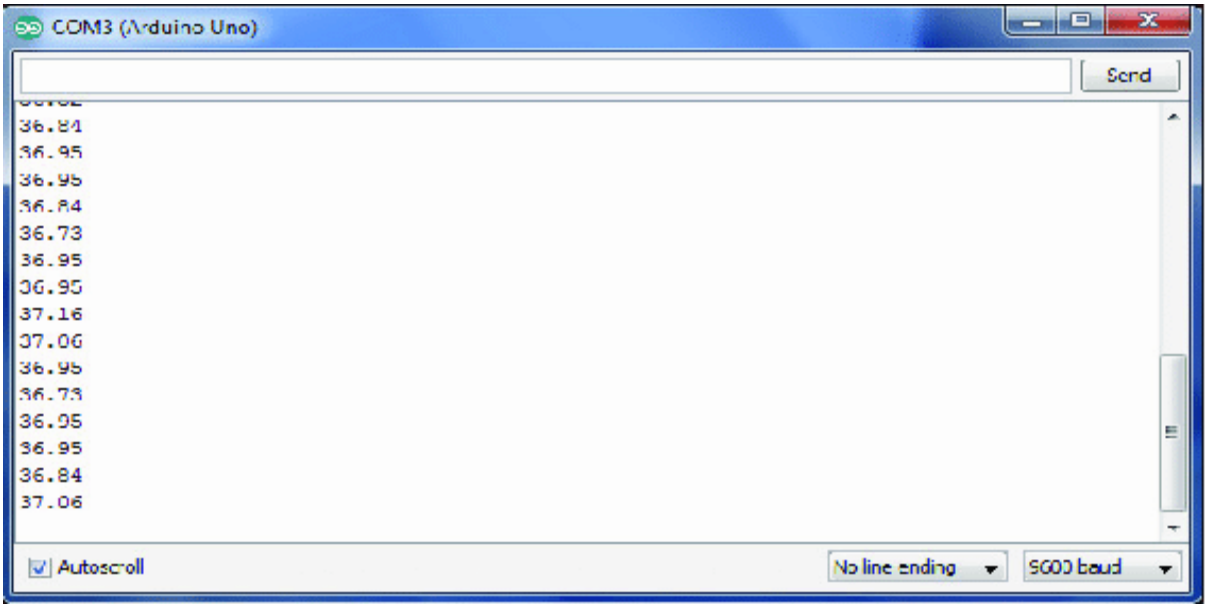

Figure 5.3 serial monitor

Amount of gas leakage can be shown in Serial monitor as above

5.2CODING STRUCTURE

```
#include <LiquidCrystal_I2C.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x3F,16,2);
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
#include<Servo.h>
Servo s1;
char msg;
int a=0;
int buzzer = 12;
int green = 7;
int red = 6;
int fan = 2;
int GASA0 = A0;
int gasvalue;

void setup() {
                                        // initialize the lcd//SDA =BROWN A4
 lcd.init();
 lcd.init();
 lcd.backlight();
 mySerial.begin(9600);
 Serial.begin(9600);
 lcd.setCursor(3,0);
 lcd.print("welcome to");
 lcd.setCursor(6,1);
```

```
 lcd.print("ECE");
 delay(3000);
 lcd.clear();
 pinMode(buzzer, OUTPUT);
 pinMode(green, OUTPUT);
 pinMode(red, OUTPUT);
 pinMode(fan, OUTPUT);
 s1.attach(8);                  // servo motor


}

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("%");
  if (gasvalue >= 40)
  {
    SendTextMessage();
    lcd.setCursor(0,1);
    lcd.print("!!!!!DANGER!!!!!");        // functions when gas exceeds
```

```
  digitalWrite(7,LOW);//green
  digitalWrite(2,HIGH);//fan
  s1.write(220);
  do
  {
    analogSensor = analogRead(GASA0);
    gasvalue=(analogSensor-50)/10;
    digitalWrite(6,HIGH);//red
    delay (200);
    digitalWrite(6,LOW);//red
    delay (200);
    digitalWrite(12,HIGH);//buzzer
    delay (200);
    digitalWrite(12,LOW);//buzzer
    delay (200);
    Serial.println("DANGER LEVEL");
    Serial.println(gasvalue);
  }while(gasvalue >= 40);
 }
else
{
  lcd.setCursor(0,1);
  lcd.print("--NORMAL level--");      // gas in normal level
  digitalWrite(2,LOW);//fan
  digitalWrite(6,LOW);//red
  digitalWrite(12,LOW);//buzzer
  digitalWrite(7,HIGH); //white
```

```
    s1.write(0);
    Serial.println("Normal LEVEL");
    Serial.println(gasvalue);
    delay(1000);
  }
}


void SendTextMessage()
{
  mySerial.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  mySerial.println("AT+CMGS=\"+916301638529\"\r");
  delay(1000);
  mySerial.println("Gas Leaking!! in Home house num:123 ");//the content of the message
  delay(200);
  mySerial.println((char)26);//the stopping character
  delay(1000);
  lcd.setCursor(0,0);
  lcd.print("SMS  Sent");
}

void ReceiveMessage()  // to receive msgs
{
  mySerial.println("AT+CNMI=2,2,0,0,0");//AT command to receive live messages
```

```
  delay(1000);
  if(mySerial.available()>0)
  {
    msg=mySerial.read();
    Serial.print(msg);
    delay(1000);
    lcd.setCursor(0,0);
    lcd.print(msg);
  }
 }
 void MakeCall()  // to make calls
 {
  mySerial.println("ATD+916301638529");
  Serial.println("Calling....");
  delay(1000);
  lcd.setCursor(0,0);
    lcd.print("calling....");
    delay(1000);
}
```

CHAPTER 6

RESULTS AND IMPLEMENTATIONS

As seen in fig. 6.2, the gas leakage security system prototype. By placing a tiny amount of LPG gas close to the sensor, this system has been put to the test. A signal is sent to the microcontroller by the MQ-6 gas sensor after it detects LPG gas. An active signal is then sent to other devices connected to the external world via the microcontroller. As a result, an LCD screen displays a message and a buzzer sounds with LED blinking. With the aid of a servo motor, GSM module, and an SMS, the main power and gas supply are turned off simultaneously.

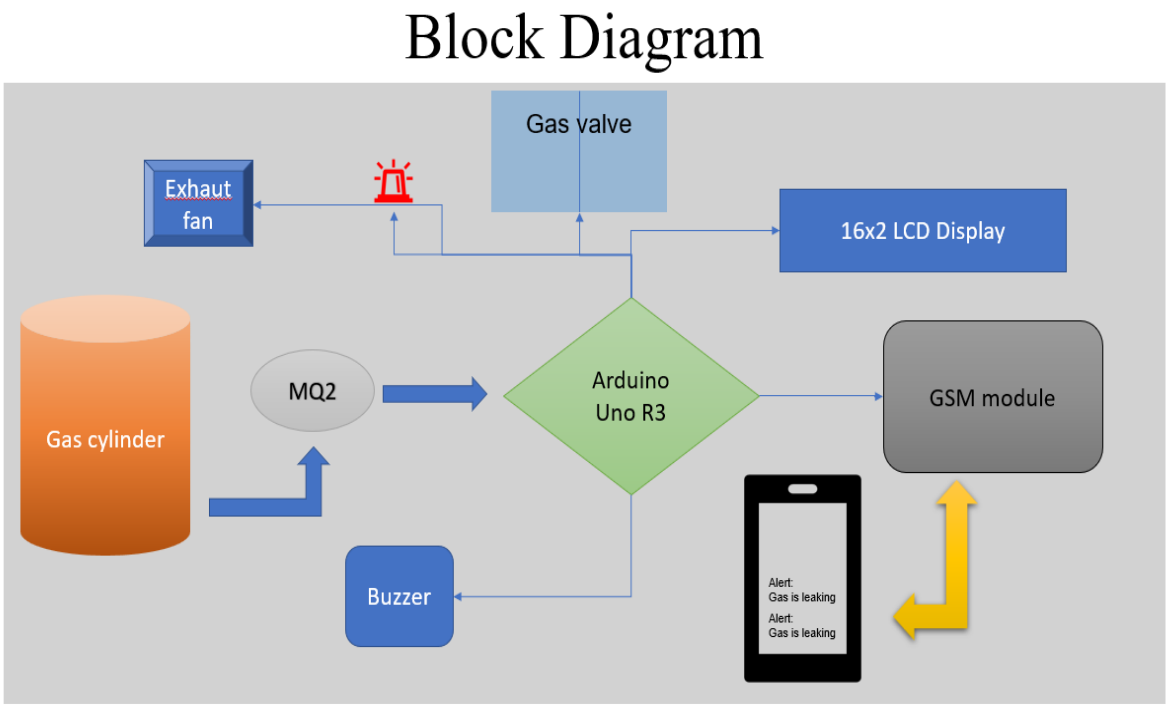

Figure 6.1 Block diagram of gas leakage monitoring and alerting system

We can see that our end-to-end WSN system is capable of delivering precise gas leak detection and quick, real-time monitoring of gas concentration. In

both the no-leak and leak scenarios, the delivered LPG levels at the sink position. No LPG leak is visible on the display because no reported alarm packets have been found. These findings show that our method provides a reliable, accurate, and effective early detection technique. investigates the packet loss rate in relation to the size of the packet and the number of nodes in a region. Our experimental results on the dependability of communication demonstrate that even when leakage is minimal, dependable and reliable data transfer between nodes is still feasible.

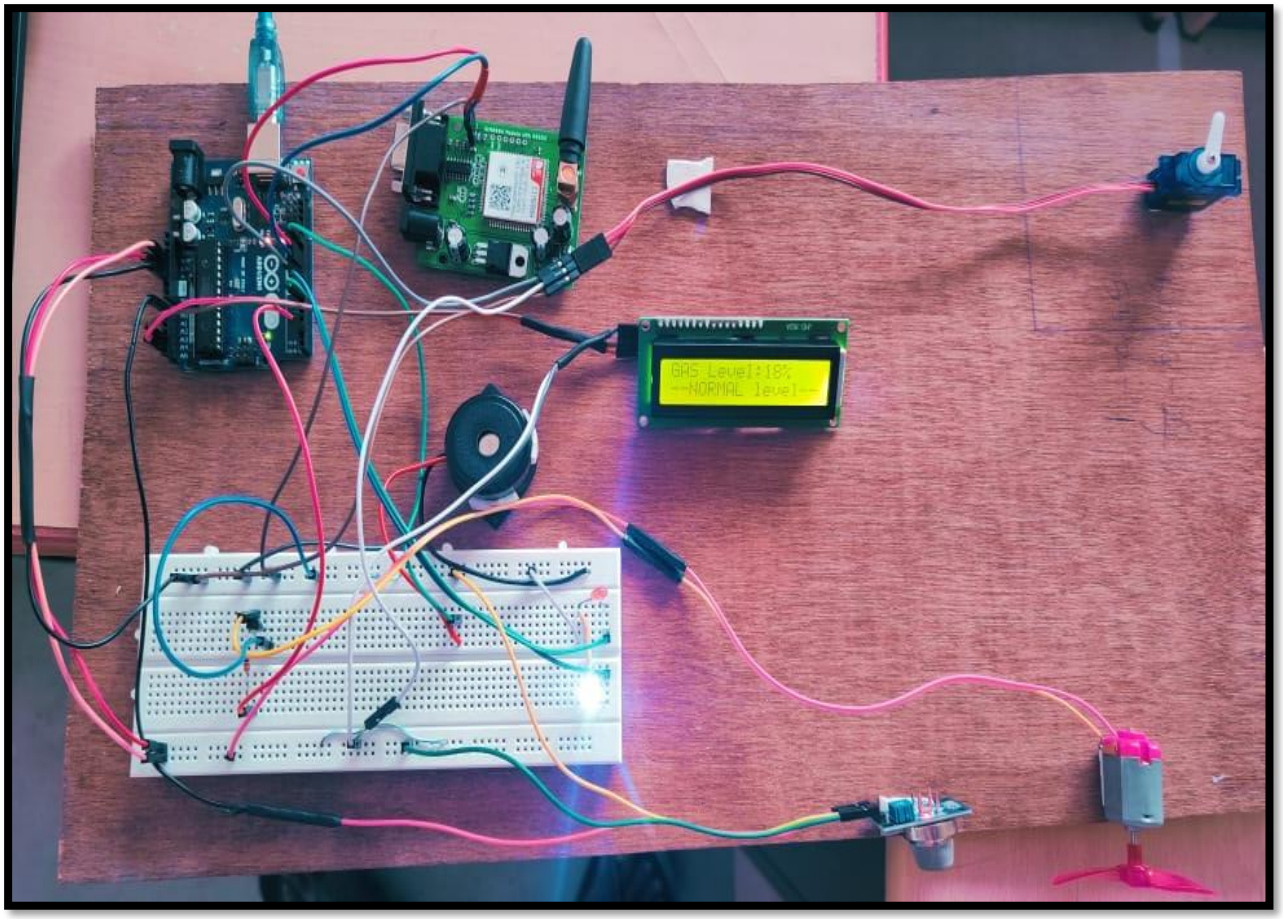

Figure 6.2 overall circuit connection

CHAPTER 7

CONCLUSION AND FUTURE WORK

CONCLUSION

One of the main issues in urban and rural families, as well as the oil and gas businesses, is gas leakage. The implementation of the gas leakage detection system with a MQ6 sensor and alerting the user is done after doing a literature review in order to improve community support and provide an effective method of disaster prevention. Effective techniques are also discovered, including the usage of the Intel Edison Board, the Arm Cortex Family, and a number of sensors for detecting techniques. This study presented a straightforward yet effective method for employing GSM to deliver notifications to the receiving user in order to address the issue of gas detection and notification.

Different nodes in the end-to-end WSN system have been produced and put together, and their performance has been assessed under realistic conditions. To show the viability of the suggested hardware and software design components in a practical setting, experimental testing of WSN prototypes is specifically conducted.

FUTURE WORK

The suggested end-to-end system displayed robust and reliable communication. It is important to note that the suggested system can be used in other applications to monitor and report various physical conditions (such as temperature, humidity, and intrusion detection) by swapping out the gas sensor with the proper sensing unit that can measure the relevant physical conditions.

REFERENCE

1. [https://www.elprocus.com/what-is-arduino-uno-r3-pin-diagram-specification-and-applications/]
2. [https://www.geeksforgeeks.org/how-gsm-works/#:~:text=Working%20%3A,75%20MHz%20band%20were%20added.]
3. [https://docs.arduino.cc/learn/starting-guide/the-arduino-software-ide]
4. [F. Sheppard, Jr., and A. Guiseppi-Elie, ‘‘pH measurement,’’ in Measurement, Instrumentation, and Sensors Handbook: Electromagnetic, Optical, Radiation, Chemical, and Biomedical Measurement, J. G. Webster and H. Eren, Eds., 2nd ed. Boca Raton, FL, USA: CRC Press, 2017, ch. 59, p. 6.]
5. [https://www.kollmorgen.com/en-us/blogs/how-servo-motors-work/#:~:text=How%20does%20a%20servo%20motor,device%20to%20close%20the%20loop.]
6. [https://www.tutorialspoint.com/arduino/arduino_dc_motor.htm]
7. [https://www.makerguides.com/character-i2c-lcd-arduino-tutorial/]
8. [N. Vikram, K. Harish, M. Nihaal, R. Umesh, A. Shetty, and A. Kumar, “A low cost home automation system using wi-fi based wireless sensor network incorporating internet of things (iot),” 2017 IEEE 7th International Advance Computing Conference (IACC), 2017.]
9. [P. Datta and B. Sharma, “A survey on iot architectures, protocols,

security and smart city-based applications," in 2017 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT). IEEE, 2017, pp. 1–5.]

10. [.-Y. Chan, Y. Ren, Y.-C. Tseng, and J.-C. Chen, "eHint: An efficient protocol for uploading small-size IoT data," in Proc. IEEE Wireless Commun. Netw. Conf., 2017, pp. 1–6.]

11. [C. Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development. Englewood Cliffs, NJ, USA: Prentice-Hall, 2004]

12. [https://www.sparkfun.com/products/9405#:~:text=The%20MQ%2D6%20can%20detect,the%20output%20to%20an%20ADC.]

13. [E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software. New York, NY, USA: Addison Wesley, 1994.]

14. [P. Chmelar and M. Dobrovolny, "The fusion of ultrasonic and optical measurement devices for autonomous mapping," in Proc. 23rd Int. Conf. Radioelektronika (RADIOELEKTRONIKA), Apr. 2013, pp. 292–296.]

15. [Yang Cai, Hongyun Gao, Bing Tong, Min Li, N Arsad, Yulin Li, "Measurement of trace ethane using a mid-IR LED", in proc. 2016 IEEE 6th International Conference on Photonics (ICP), Kuching, Malaysia, 2016, DOI: 10.1109/ICP.2016.7510055.]

16. [D. A. Bravo and C. F. Rengifo, "Comparación entre el aprendizaje

presencial y remoto para la enseñanza de sistemas de control automático," Academia y Virtualidad, vol. 15, no. 1, pp. 1–15, Apr. 2022. [Online]. Available: https://doi.org/10.18359/issn.2011-0731]

17. [C. F. Rengifo and D. A. Bravo, "A project-based learning approach to teach identification and control systems," IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, vol. 15, no. 1, pp. 10–16, Feb. 2020.]

18. [E. F. Fuchs and M. A. Masoum, Power Conversion of Renewable Energy Systems. Boston, MA, USA: Springer, 2011. [Online]. Available: https://link.springer.com/book/10.1007/978-1-4419-7979-7#about, doi: 10.1007/978-1-4419-7979-7.]

19. [https://www.instructables.com/Arduino-Buzzer-With-LDR-and-LED/#:~:text=The%20wire%20attach%20to%20LED,attach%20to%20buzzer%20long%20leg.]

20. [D. Miorandi, S. Sicari, F. De Pellegrini, I. Chlamtac, "Internet of Things: Vision, Applications and Research Challenges", Ad Hoc Networks, vol. 10, no. 7, pp. 1497-1516, Sept. 2012, 1497-1516. DOI: 10.1016/j.adhoc.2012.02.016.]

21. [B. Kerkez, S.D. Glaser, R.C. Bales, M.W. Meadows, "Design and performance of a wireless sensor network for catchment-scale snow and soil moisture measurements" Water resour. Res, vol 48, no. 9, Sept. 2012, DOI: 10.1029/2011WR011214.]

22. [C. S. Hussain, M.-S. Park, A. K. Bashir, S. C. Shah, and J. Lee, "A collaborative scheme for boundary detection and tracking of continuous

objects in WSNs," Intelligent Automation & Soft Computing, vol. 19, no. 3, pp. 439–456, 2013]

23. [V. J. Hodge, S. O'Keefe, M. Weeks, and A. Moulds, "Wireless sensor networks for condition monitoring in the railway industry: A survey," IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 3, pp. 1088–1106, 2015.]

24. [S. Greś, M. Döhler, P. Andersen, and L. Mevel, ''Kalman filter-based subspace identification for operational modal analysis under unmeasured periodic excitation,'' Mech. Syst. Signal Process., vol. 146, pp. 1–24, Jan. 2021.]

25. [M. S. Jadin and K. H. Ghazali, ''Gas leakage detection using thermal imaging technique,'' in Proc. UKSim-AMSS 16th Int. Conf. Comput. Modelling Simulation, Cambridge, U.K., Mar. 2014, pp. 302–306]

26. [https://create.arduino.cc/projecthub/MisterBotBreak/how-to-use-a-gas-sensor-mq-2-1027f2]

27. [https://www.circuitstoday.com/interface-gsm-module-with-arduino]

28. [H. Yong, D. Meng, W. Zuo, and L. Zhang, "Robust online matrix factorization for dynamic background subtraction," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 40, no. 7, pp. 1726–1740, Jul. 2018.]

29. [M. Yang, J. Crenshaw, B. Augustine, R. Mareachen, and Y. Wu, "AdaBoost-based face detection for embedded systems," Computer

Vision and Image Understanding, vol. 114, no. 11, pp. 1116–1125, Nov. 2010.]

30. [https://www.google.com/search?q=arduino+interface+with+servo+motor&rlz=1C1CHBD_enIN916IN916&oq=arduino+interface+with+servo+motor&aqs=chrome.69i57j35i39l2j0i67i131i433j0i67l6.19933j0j4&sourceid=chrome&ie=UTF-8]