IoT BASED LPG GAS LEAKAGE AND FIRE DETECTOR SYSTEM



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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Certification

This is to certify that this project entitled "**IoT Based LPG Gas Leakage and Fire Detector system**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ABSTRACT

The idea behind our project is to give a solution by power cut the gas provision as soon as a gas leakage is perceived apart from activating the sounding alarm. It is very life threatening if you will not distinguish and modified right away. Arduino is used as the main controller. The final output of the project is used to detect leakage if gas from cylinders and also notify the user by connecting via IoT.

Gas leakage is a major problem in the industrial sector, in residential locations etc. One of the preventive methods to stop the incident related to the gas leak is to install a gas leak detection kit at vulnerable locations. The goal of this paper is to propose a system that can detect, alert and automatically control gas leaks. In particular, a gas sensor has been used which has a high sensitivity to gases such as propane and butane together with LPG.

Safety apparatus for the use of LPG gas connections in common households and industries against hazardous conditions such as gas leak, fire and explosion of compressed gas cylinders should be provided. Our aim of this research is to give security to all the people around the world from LPG gas leakage by equipping them with an economical and effective alarming system which not only can detect this menace threat but also can automatically control it by its safety line of action.

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LIST OF ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
LCD	Liquid Crystal Display
ADC	Analog-to-Digital Converter
IR	Infrared Receiver
IC	Integrated Circuit
LED	Light Emitting Diode
UNO	Means “One” in Italian
LPG	Liquefied petroleum gas
MQ	Methane Natural Combustible

CHAPTER I

INTRODUCTION

1.1 Introduction

Now a days the home safety detection system plays the important role for the security of people. Since all the people from the home goes to work on daily bases, it makes impossible to check on the appliances available at home specially LPG gas cylinder, wired circuits, Etc. Since last few years there is a tremendous hike in the demands of liquefied petroleum gas (LPG) and natural gas. These gases are mostly used on large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includes gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

1.2 Background Study

We did research over the possible sources that we could access. In our exploration, we did find the authors: Luay Friwan, Khaldon Lweesy, Aya Bani-Salma and Nour Mani, who presented a paper titled "A Wireless Home Safety Gas Leakage Detection System" in the year 2011, November. They proposed to detect gas with the use of a sensor. This gas sensor senses the changes in gas. Upon detection of a change, it activates the alarm and sends a signal to the receiver. In addition to it, another paper titled "Development of multipurpose gas leakage and fire alarm system" was proposed in the year 2013, by the authors Nivedita S and Padmavathy A. The ideology of this paper was to give indications of gas or smoke leakage with the help of LED, gas sensors and relay.

Many Systems similar have been proposed earlier by different authors and researchers and that has helped us to improve the gas safety issue in our every day to day lives. But there were no steps taken to prevent the accident in case of leakage. A lot of people would prefer to go with quote 'prevention is better than cure'. Our system uses MQ5 gas sensor to detect inflammable gas leakage and LM35 temperature sensor which will sense the sudden rise in temperature than above the room temperature. When gas leakage is detected, our device could inform the user, alert them, provide solution from suffocation in that area, and ultimately prevent the leak from further effects. This makes easy for both the commercial as well as

domestic sector to keep track on the problems faced on daily basis. Hence, we have a cure and a curb to treat gas leakage.

1.3 Objectives

- General Objective To layout and acquire a project "LPG Leakage Detector using Arduino."
- Acquire project that will perceive gas outflow like Methane leak and LPG leak
- Acquire a project that will fabricate a sound alarm during gas outflow and rest the alarm once gas outflow is regulated
- Acquire a project that will fabricate fan during gas outflow and rest the alarm once gas outflow is regulated.

1.4 Methodology

Our device consists of these parts:

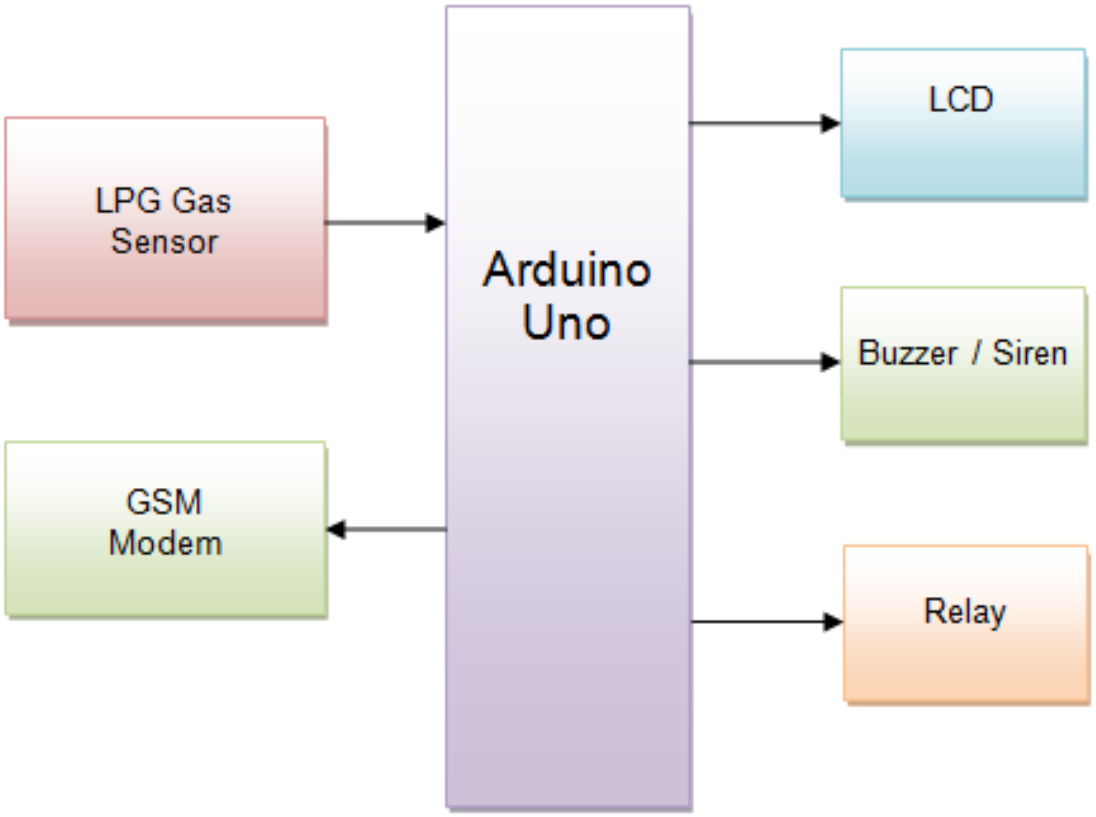
a) Detection System

- This part consists of a gas sensor MQ5 and this will continuously monitor the gas concentration.

b) Prevention System

- This part consists of a special type of Gas valve that we will be designing that will be similar to present regular valves but a servo motor will be attached to its control knob to allow automatic. A connection to the exhaust fan and window is made, in which the sensor would make it run in case of gas detection. All these parts will be interfaced with Arduino Uno which will be controlling the whole device.

1.5 Flowchart



1.6 Problem Formulation

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or a pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, home, workplace, industry and the environment.

Vizag Gas leak was a resultant of the escape of styrene that were unattended for a long period. This colorless oily liquid can spread in fumes. So, a detector must be made in such a way that could detect any kind of gas, fume, leak, smoke etc. However harmful and dangerous it can be, the detector could be attached with certain parameters that could help to prevent the issue.

CHAPTER II

THEORY OF THE PROJECT

2.1 Introduction

It is a flammable mixture of hydrocarbon gases which is used in cooking, vehicles, etc. LPG cannot be dispersed easily and it is heavier than air. It leads to suffocation when inhaled. When leakage occurs, suddenly ignites which may lead to explosion.

2.2 Theory

They detect the acoustic emission created when a pressured gas expands in a low pressure area through a small orifice (the leak). They use acoustic sensors to detect changes in the background noise of its environment.

2.2.1 Arduino Uno

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

The UNO is the most used and documented board of the whole Arduino family. Arduino UNO is a microcontroller board based on the ATmega328P.

It is a microcontroller developed by Arduino.cc which is equipped with pins of both analog and digital type. This board can be encoded using the Arduino IDE software. It comes in various types, in which here we have used Arduino Uno. It would receive the signal upon detection of gas and performs the command to turn the knob off,

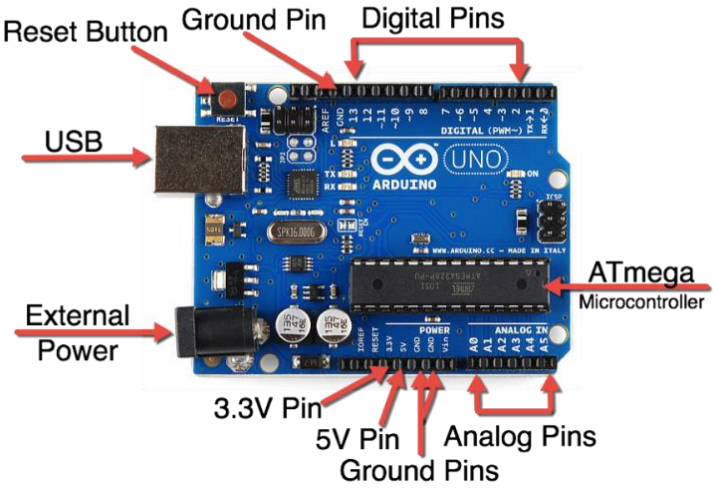


Fig: 2.2.1 Arduino UNO Pin Diagram

2.2.2 MQ-5 LPG Sensor

The Grove - Gas Sensor(MQ5) module is useful for gas leakage detection (in home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible.

Working Principles of MQ-5 LPG Sensor:

The working principle behind the MQ-5 gas sensor is as follows: The sensor has a sensitive filament made of SnO2. ... When a combustible gas such as LPG is introduced, the filament's conductivity rises, and the amount of change in it's conductance/resistance can be used to indicate the equivalent gas concentration. The MQ5 (MQ-5) is used in gas leakage detecting equipment in consumer and industry applications, this sensor is suitable for detecting LPG, natural gas, coal gas.

MQ5 can sense methane(CH4) only upto 10000 ppm. The most basic connection for an MQ5 is between a digital pin on theArduino Unoand its power supply. You'll need to connect a +5V line from the Arduino to pin 4 (the “VCC” connector) for power. And another GND line from the Arduino to pin 6 (the “GND” connector) for grounding.



Fig: 2.2.2 MQ-5 LPG Sensor

2.2.3 Potentiometer

A potentiometer is a simple mechanical device that comes in many different forms. It provides a variable amount of resistance that changes as you manipulate it. The examples in this article uses a potentiometer with a twisting shaft, one of the more common versions of a potentiometer you will find.
By passing voltage through a potentiometer into an analog input on your Arduino, it is possible to measure the amount of resistance of the potentiometer as an analog value. This article will showcase use cases of potentiometers, as well as teach you how to connect and read data from them. One shows how you can use a potentiometer as an input for a color mixer, and the other shows how to accurately choose colors and how to smoothly fade between them.

The typical potentiometer will have 3 pins, two power supply pins (+5V and GND), and one pin that connects to an analog input pin on your Arduino to read the value output.

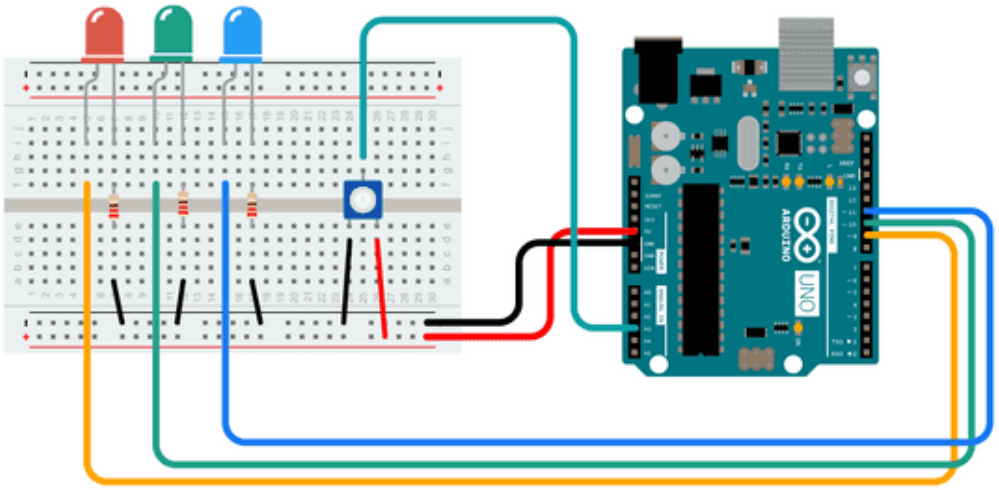


Fig: 2.2.3 Potentiometer

2.2.4 Breadboard

A breadboard is a solderless construction base used for developing an electronic circuit and wiring for projects with microcontroller boards like Arduino. As common as it seems, it may be daunting when first getting started with using one.

A breadboard (sometimes called a plugblock) is used for building temporary circuits. It is useful to designers because it allows components to be removed and replaced easily. It is useful to the person who wants to build a circuit to demonstrate its action, then to reuse the components in another circuit.

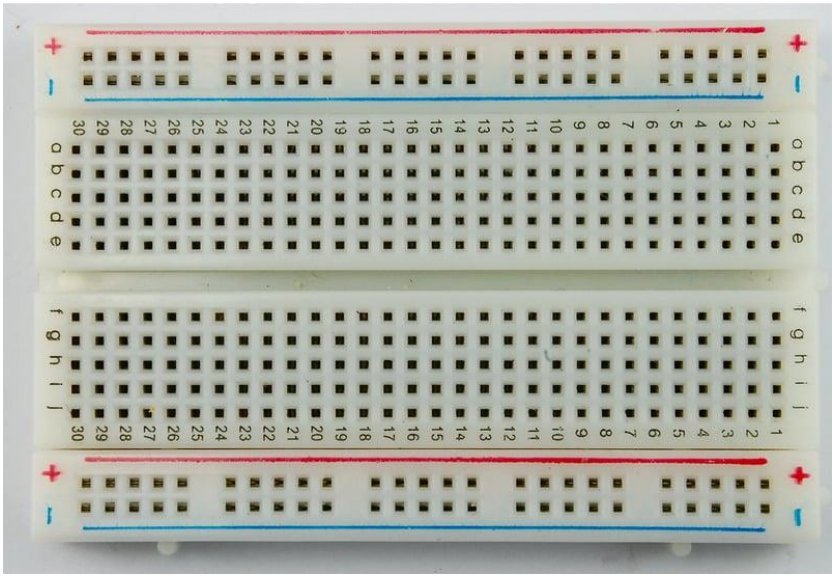


Fig: 2.2.4 Breadboard

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.

So, where did the name come from? In earlier times, electronics relied on circuits derived from screws and nails hit on wooden boards, otherwise used for cutting bread, and thus the name breadboard. Functionality. The earlier versions of breadboard circuits relied on circuits created on the wooden board.

The advantages of breadboard include the following.

- It is used to make a temporary prototype for the electronics projects.
- This is reusable because it doesn't need any soldering.
- These boards are less weight because the material used to make this board is a lightweight plastic material.
- Testing can be done very easily.

The vertical rails on the breadboard, called bus strips, are also connected by a conductive metal; they supply power to the circuit. When the circuit is complete, current will flow from positive terminal (also called power) to a negative one (ground). In this circuit, batteries are the power source.

2.2.5 Relay

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as controlling any other output as we'll see later on.

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized.



Fig: 2.2.5 Relay

Relay works on the principle of electromagnetic induction. When the electromagnet is applied with some current, it induces a magnetic field around it. Relays can reduce the need for high-amperage wiring and switches, which are expensive and take up space. Therefore, switching to relays in your electronic systems can reduce the size or weight of a casing, for instance, or allow manufacturers to fit more functionality into a space of the same size.

Relay Applications:

- When galvanic isolation is desired, relays are employed whenever it is necessary to control a high-power or high-voltage circuit with a low-power circuit. ...
- Lighting control systems.
- Industrial process controllers.
- Traffic control.
- Motor drives control.
- Protection systems of electrical power system.

2.2.6 Arduino Power Supply

Arduino boards can operate satisfactorily on power that is available from the USB port. It provides 5V DC voltage and can be sourced from the port from a PC, wall socket adapter or portable power bank. We can use any 12V AC-DC adapter with proper out voltage and proper connector to power our Arduino board. It is more convenient when deploying our project where it's not constantly monitored. We can also use a 9V battery to power the Arduino Uno, with the help of a snap-in connector with a DC Barrel Jack.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.



Fig: 2.2.6 Arduino Power Supply

Well 5V is right in the range the microcontrollers on the Arduino board need in order to operate. The 5V regulator requires a min input voltage of 6.2 volts and can take a maximum input voltage of 20V – so the power supply you hook up to your DC jack needs to be in that range for voltage. The maximum current that an Arduino pin can supply depends on the model of Arduino you are using. Generally, most Arduino models have a limit of 40 mA (milliamps) per pin. As for the total current that an Arduino can supply, it depends on the model. Most Arduinos can provide around 200 mA in total.

The boards mentioned before have an **onboard integrated battery charge management circuit**. This circuit integrates the most common battery and power management functions, like a battery charger, a voltage regulator, and a load switch, all in one.

All Arduino boards need electric power to function. A power supply is what is used to provide electric power to the boards and typically can be a battery, USB cable, AC adapter or a regulated power source device.

2.2.7 Arduino UNO Cable

USB 2.0 Cable Type A/B

Use it to connect Arduino Uno, Arduino Mega 2560, Arduino 101 or any board with the USB female A port of your computer. Cable length is approximately 100cm. Cable color and shape may vary slightly from image as our stock rotates. The Cable for Arduino Nano (USB 2.0 A to USB 2.0 Mini B) 30cm Connects speed-critical devices, such as smartphones and peripherals that require a Mini-B connection to your computer. Use this cable to connect your Arduino Board which features a Mini-B USB port to the Laptop/PC.

Most important thing to remember is you must use solid-core wire, ideally 22 American Wire Gauge (AWG). Make sure you don't nick or cut the wire, because that could weaken it. Grab a red wire and plug one end into the pin marked 5V on the Arduino board. Plug the other end of the red wire into the breadboard rail marked with a red line— this will be your power bus. Similarly, grab a blue wire and plug it into one of the pins marked GND, right next to the red wire



Fig: 2.2.7 Arduino UNO Cable

When you upload a program to Arduino, it gets saved in its memory and starts to run as soon as you power on the board. So you can use Arduino without a USB connection to computer if you could provide an alternative power source of 5V, 1A. You can provide the power through the Vin pin or through an adapter.

The term USB stands for "Universal Serial Bus". USB cable assemblies are some of the most popular cable types available, used mostly to connect computers to peripheral devices such as cameras, camcorders, printers, scanners, and more.

2.2.8 Jumper Wires

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit. Most important thing to remember is you must use solid-core wire, ideally 22 American Wire Gauge (AWG). Make sure you don't nick or cut the wire, because that could weaken it. Cut the other side to length, remember you'll need a little extra so that you can strip the other end too!



Fig: 2.2.8 Jumper Wires

For instance, you are connecting an Arduino Uno pin with a breadboard. A male-to-male jumper is recommended. But if you are connecting it directly to an Ultrasonic Sensor, go for a male-to-female

jumper. How many different types of jumper wires are there? Male-to-male, male-to-female, and female-to-female connector wires are the most common.

In electronics and particularly computing, a jumper is a short length of conductor used to close, open or bypass part of an electronic circuit. They are typically used to set up or configure printed circuit boards, such as the motherboards of computers. The process of setting a jumper is often called strapping.

Red is positive and black is negative. Here's the correct order for your jumper cables: RED to DEAD: Connect the red clip to the positive terminal on your dead battery. RED to DONOR: Connect the red clip to the positive terminal on the donor vehicle's working battery. Each jumper has one input and one output. The jumper input must be connected to one pin output, the jumper output can be connected to multiple pin inputs. The jumper can be used to connect microcontroller pins or make connection between spare parts pins.

Attach the red jumper cables first. Start by clamping one red cable to the positive side of the battery that won't start. Then attach the other red clamp to the positive side of the working battery. Next, clamp one black cable to the negative side of the working battery. The two most normal conventions are: Black (or sometimes Blue): This denotes a wire running directly to Ground (GND) Red: This is connected to a source of power. Normally running from the 3.3V on your Particle board. Battery jumper cables are usually used on 12V batteries but they could just as easily handle 24V or 48V. You should not use them on 120V.

2.2.9 Exhaust Fan

Programming the Arduino for AC fan speed control. After the hardware connection, we need to write up the code for Arduino, which will generate a PWM signal to control the AC signal ON/OFF timing using a potentiometer input. We previously used PWM techniques in many projects.
The exhaust fan gets operated when the gas sensor detects the gas. It is used to send the leaked gas of some part out of the room. Hence, it is helpful in preventing from further explosion.



Fig: 2.2.9 Exhaust Fan

2.2.10 Light

This project includes household lights such as LED, Energy saving, Tube light, UV light and other lighting system, which will automatically shut down by leakage sensor and stop from highly destructive situation and fire situation also.

2.2.11 Buzzer

The piezo, also known as the buzzer, is a component that is used for generating sound. It is a digital component that can be connected to digital outputs, and emits a tone when the output is HIGH. The buzzer will be used to emit sounds to alert users during leakage. A buzzer or beeper is a signalling 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.

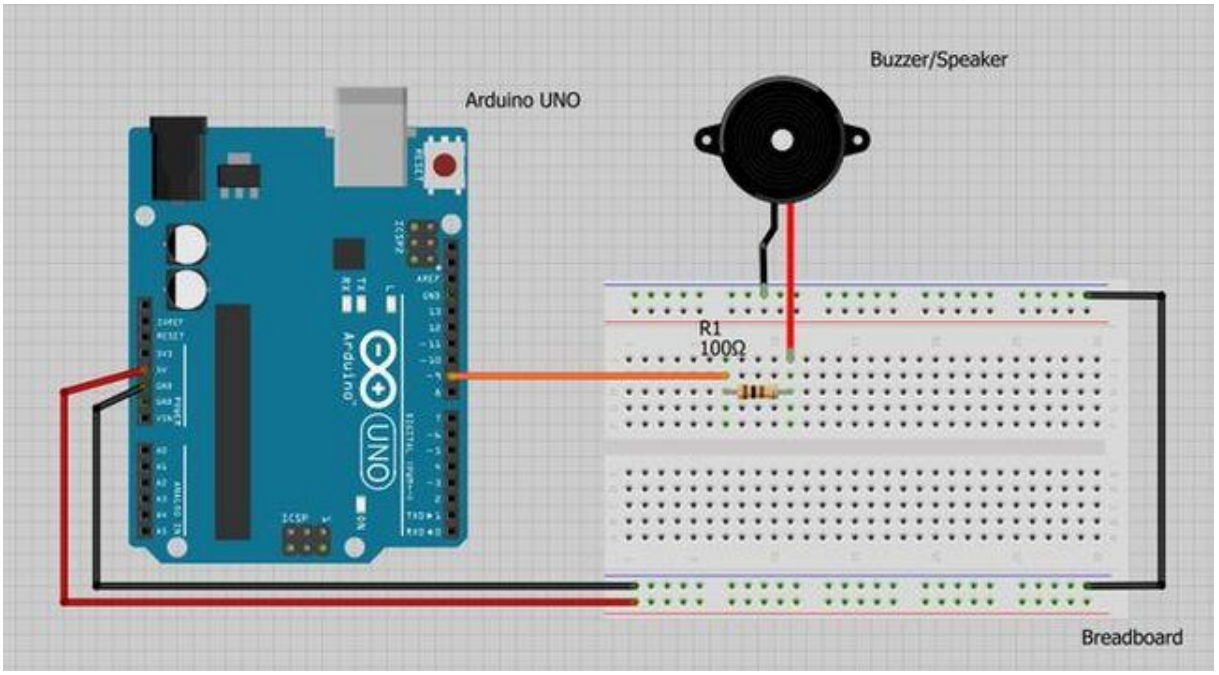


Fig: 2.2.11 Buzzer and Diagram

Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong.

The Connections are pretty simple:

1. Connect Supply wire (positive) of the buzzer to the Digital Pin of the Arduino.
2. Connect Ground wire (negative) of the buzzer to Ground Pin on the Arduino, through a 100-ohm resistor.

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. The term buzzers is thought to derive from the old street slang term for a pickpocket who targeted women - a moll buzzer. Obviously batsmen steal an extra run or two while the opposition are distracted, hence the name buzzers.

2.2.12 Knob

The automatic knob is considered as the prevention for gas leakage. After the Arduino board sends the signal to the software, the command is passed to turn off the knob with the help of a servo motor.

2.2.13 Window

The window automatically opens to avoid suffocation and to allow outside air to fill the space. The mechanism over here is similar to the knob, where the command is passed from the software and it opens upon detection.

CHAPTER III

DESIGN & FEBRICATION

3.1 Introduction

In this chapter fully cover with discuss design and fabrication of this project. Here we will discuss about developed block diagram and briefly describe about the circuit description and also learn about working principle. Total project flow chart is also available in this chapter.

3.2 Block Diagram

In the proposed system of „LPG Gas Leakage Detection using Arduino‟ will be great help in preventing explosions and blasts. Apart from sound alarm and SMS alert it will also turn on exhaust fan and automatic opening of window by the mechanical force using servo motor. This helps to remove the leaked gas in room, which is used in case of nobody is present when the leakage occurs and to prevent accidents and property.

The way this tool works is when gas is sensed by gas sensor according to the LPG gas level it detects. The higher the LPG gas is detected, the higher the voltage released. When the sensor output is moved the presence of gas, then Arduino will activate, and activate the buzzer and display the writing on the LCD stating the gas is high, which means there has been a gas leak, then the GSM SIM800L module will send anotification message to the handphone number specified in theprogram.

However, if the sensor does not detect a leak, the sensor will not remove the output, and the sensor will continue to work until it is proven that there is an LPG gas leak. When the program is run the system will immediately detect LPG gas detected by the sensor.

Then the Arduino microcontroller will read LPG gas through an LPG gas sensor. If it detects a gas leak, the red LED will light up, the buzzer will activate, the window will open automatically by utilization of servo motor, and also running of exhaust fan to neutralize the leakage, then the system will send a notification message stating that there has been an LPG gas leak. After solving the problem of detection, the green LED will glow, which indicates there is no further trouble. If no LPG gas leak is detected, the system will continue to detect the gas level through the LPG gas sensor until it detects an LPG gas leak.

3.3 Circuit Description

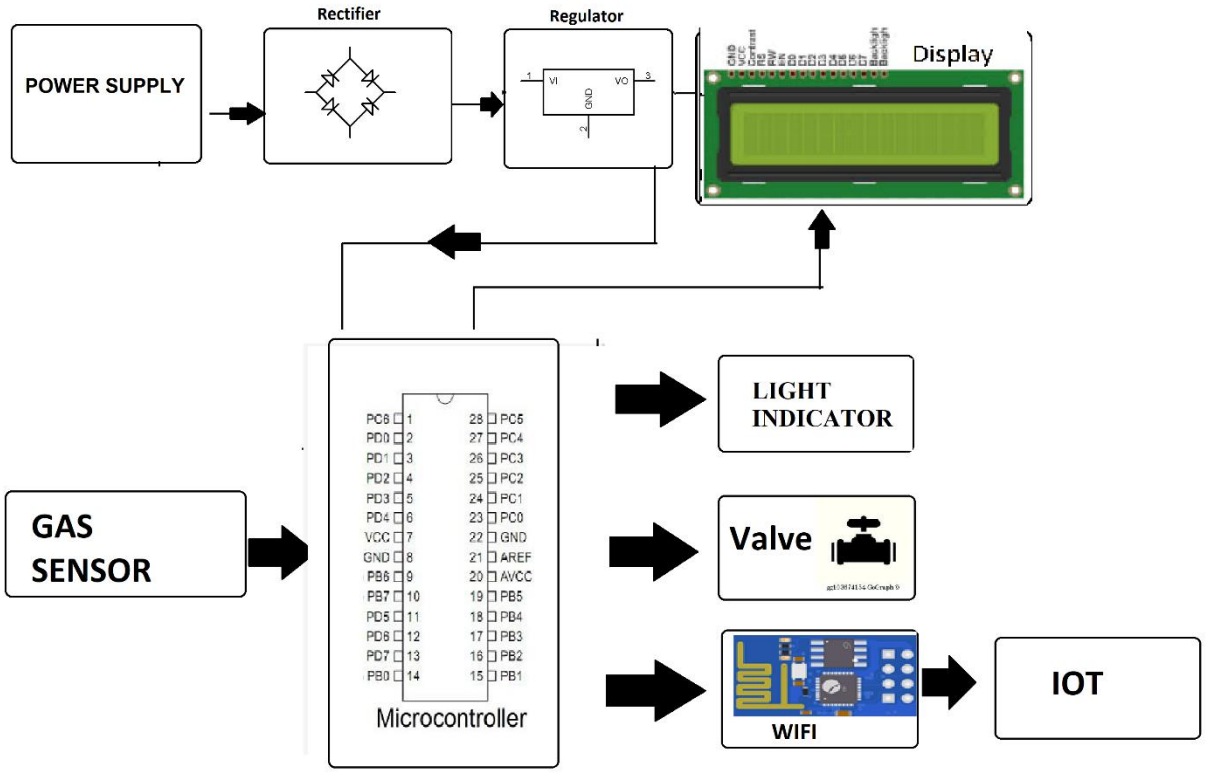


Fig: 3.3 Circuit diagram of the Project

When we will turn on the circuit power supply between 5v to 12v, then the 7805 voltage regulator IC converts the input voltage into 5v output. Because MQ5 Gas Sensor Module operates on 5v input voltage. The MQ5 gas sensor module can sense LPG. Here the 555 timer IC configured in monostable mode, so when it gets a LOW (Ground) trigger pulse at its trigger pin, then the IC OUTPUT becomes High**.**

After turn on the power supply MQ5 gas sensor start sensing LPG gas is present in the air or not. If LPG gas leaks from a cylinder then the MQ5 gas sensor detects it and provides LOW (Ground/0v) output voltage from the "D0" pin. This output voltage goes to the Base terminal of the BC557 Transistor and the transistor becomes active. Now it starts conducting and the 555 timer ic trigger pin (IC pin 2) connects to the ground. Then the IC produces High out from Pin 3. This output voltage goes to the LED and Buzzer. Then the LED starts glowing and the buzzer generates Sound.

.

3.4 Overview of LPG Leakage Detector Sensor

This device will continuously monitor the level of LPG gas present in the air. While monitoring, if the value of LPG gas in air is within the set limit then the RGB LED on the circuit will glow green giving a safe sign.

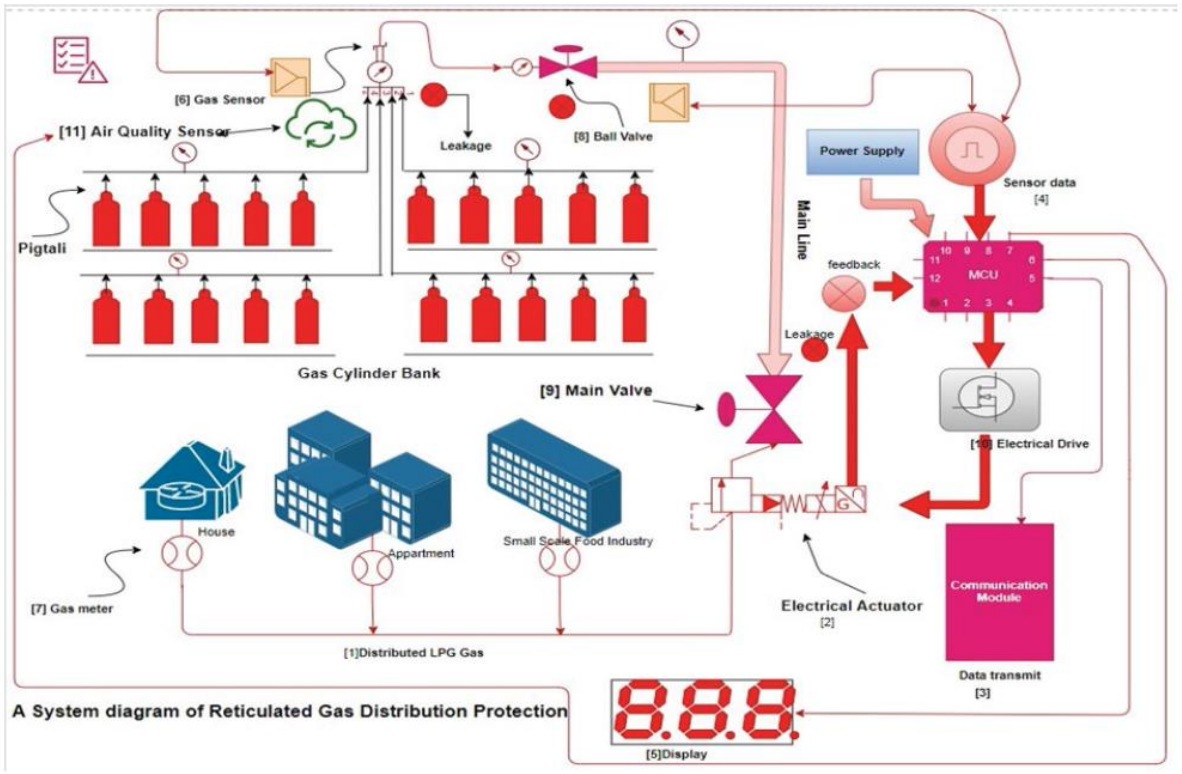


Fig: 3.4: Overview of LPG Leakage Detector Sensor

3.5 Working Principle

The LPG Leak Detector is a wall-mounted device fitted close to the floor level with an alarm setting at 20% of the Lower Explosive Limit. Whenever there is a leak, the in-built sensor detects and alerts the user in less than 5 minutes, much before it can cause any accidents.
In this IOT gas leakage detector, device will get connected to WIFI, the minimum and maximum parameter can be set accordingly. Such IOT as well as Arduino based gas leakage detector systems can be installed in homes, hotels LPG gas storage areas. In this LPG gas detector system sense the LPG gas using MQ5 gas sensor.

There have been many incidents like explosions and fires due to LPG gas leakage. Such incidents can cause dangerous effects if the leakage is not detected at an early stage. IOT LPG leakage detector project using Arduino is a project which will help in determining gas leakage in the surroundings and send data to an IOT module.
Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity. These systems do not require any human interaction and the same is the case with iot based gas detection system. It does not require human attention. This method uses two or more gas sensors to detect leakage in two or more locations around the gas tube and its distribution line. WSN system works based on gas sensor MQ-6 and wireless module Bluetooth HC-05. Explosion prevention system works based on alarm/buzzer, exhaust fan, and automatic gas regulator.

After the stabilization, the pressure change in the test piece is compared to the pressure change in the reference volume, using the Transducer. The difference in volume is measured and if a leak is detected the difference will increase. An alarm limit may be set for a pass/fail decision. Burner work on the principle called the venturi- effect. It says that as a gas passes through a pipe that narrows or widens, the velocity and pressure of the gas vary. When pipe is narrows, the flow of gas is more rapidly. When the gas flows faster through the narrow sections the pressure decreases.

3.6 Image of the Project

The device was tested placing the LPG device at leaked area . We obtained the results as expected since the system was built as expected according to plan. After gas is sensed the red LED glows, buzzer sounds, LCD displays message, GSM sends notification to users then exhaust fan runs and opens the window to neutralize. After there is no gas leak, every components stops a triggering and green LED glows indicating no threat.

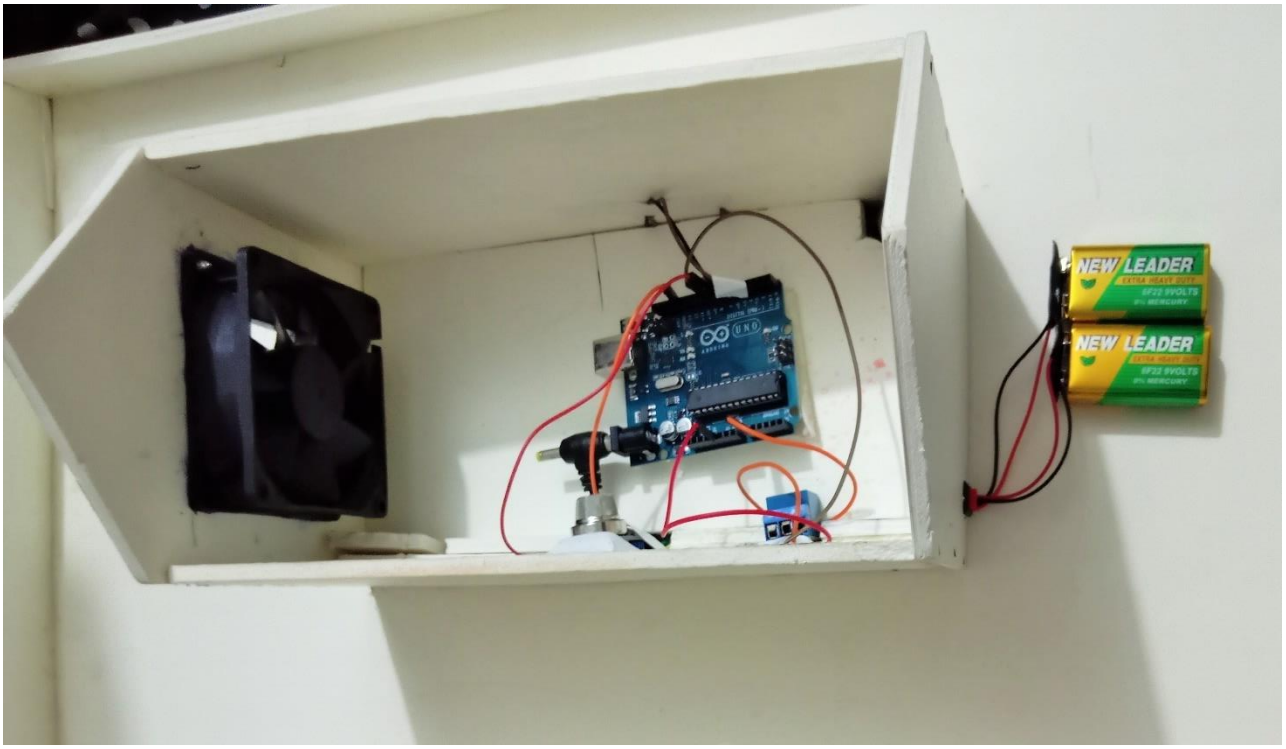


Fig: 3.6.1: Real image of the project-1



Fig: 3.6.2: Real image of the project-2

After going through this project survey, it can conclude that detection of the LPG gas leakage is incredible in the project system. And it is necessary to provide the gas leakage protection system for various applications like industrial and domestic users in daily life. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

Chapter IV

Result

4.1 Introduction

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages current version of the protection system.

4.2 Result

As intended, the MQ5 sensor does detect the gas and lets the Arduino know. The Arduino board efficiently sends the signal to the software. As we have programmed in the software, it does run the program and hence the output is seen as the buzzer sound is heard, the window opens via the servo motor. Hence, the harmful gas, smoke and fumes can be distinguished by this detector, alerted to the user, prevented from danger and achieve an environment-friendly surrounding.

The device was tested placing the LPG device at leaked area . We obtained the results as expected since the system was built as expected according to plan. After gas is sensed the red LED glows, buzzer sounds, LCD displays message, GSM sends notification to users then exhaust fan runs and opens the window to neutralize. After there is no gas leak, every components stops a triggering and green LED glows indicating no threat.

4.3 Advantags

- Gas sensors not only help detect gasses but also avoid ‘the aftermath' like fire breakouts.
- This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas.
- The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.
- Low maintenance and low operating costs.
- Reliable technology

4.4 Disadvantages

- Only one gas can be measured with each instrument.
- When heavy dust, steam or fog blocks the laser beam, the system will not be able to take measurements. This is also the case when a person or vehicle blocks the path.
- Its sensitivity depends on Humidity and Temperature.
- Could not detect natural gas, alcohol.

Chapter V

CONCLUSION

5.1 Conclusion

Thus, we would like to conclude that our system mainly focuses on home and industrial safety. By this, provides us with significance in the health department. Also, it leads to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage of gases will hurt our economy. Moreover, when the workers get affected, the job in the industry or factory cannot be continued, hence, affecting the economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years. Therefore, this detector solely can prevent and ensure safety.

Additionally we also plan on making it portable, so that the users can carry it anywhere and employ this device. By using an advanced GSM technology or Raspberry PI, we plan to embed the nearby location of the fire service automatically into the system through the Internet wherever it is taken by the user. So that the device upon detecting the new location can automatically sync the details of the local authorities into it which may be overall more effective; hopefully, accidents anywhere can easily be stopped through this device now. Considering all the prospects, we can introduce this device furthermore into the poultry farms as our device is designed to combat gas leakage in mostly closed places.

This system provides a control action during gas leakage by closing the solenoid valve. And it activates the alarm and also sends alert messages to the users within a short time. It is an economical system which can be installed in apartments, hotels and wherever it is needed. The cost ofthe proposed system is lesser than the commercially available detectors in the market. It can help us to prevent from accidents in all directions. There are some products available which are similar to this gas leakage detector but those are not cost efficient and doesn't have any safety mechanisms. If this product becomes commercial, it will overcome all demerits of other similar products.

5.2 Future Work

Over the years, we have been marching towards various developments and advancements. This includes smart houses artificial intelligence etc. Smart houses can make our in-room living simple as much as it can. The control of fans and lights is now within our hands. Wi-Fi and software programming has put forth the initial steps towards the future to make control over the safety and other applications in the house. Another innovation that could push it a little further would be this gas detection sensor. As it ensures safety in our house from the gaseous hazards. Also, in industries and factories, we can avoid the disaster and ensure the safety of the workers.

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Appendix

```
#include <LiquidCrystal.h> LiquidCrystal
lcd(5,6,8,9,10,11);


int redled = 2;
int greenled =
3;int buzzer =
4; int sensor =
A0;
int sensorThresh = 400;


void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
lcd.begin(16,2);
}


void loop()
{
  int analogValue = analogRead(sensor);
Serial.print(analogValue);
if(analogValue>sensorThresh)
  {
digitalWrite(redled,HIGH);
```

```
digitalWrite(greenl
    ed,LOW);
    tone(buzzer,100
    0,10000);
lcd.clea
r();
lcd.set
Cursor(
0,1);
lcd.prin
t("ALE
RT");
    delay(100
0);
lcd.clear();
lcd.setCursor(
0,1);
lcd.print("EV
ACUATE");
    delay(1000);
  }
  else
  {
digitalWrite(greenl
ed,HIGH);
digitalWrite(redled,
LOW);
noTone(buzzer);
lcd.cle
ar();
lcd.set
Cursor
```

```
(0,0);
lcd.pri
nt("SA
FE");
    delay(100
0);
lcd.clear();
lcd.setCursor
(0,1);
lcd.print("AL
L CLEAR");
    delay(1000);
  }

}
```