

# **LPG Gas Leakage Detector and Safety with Arduino**

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## **Declaration**

This is to certify that the work presented in this project has been carried out by Jannatul Nayeem Shuchi(IT-19010),Md. Tanver Ahammed(IT-19016), Md. Masudur Rahman Sourav(IT-19025), Md. Momin Hossain(IT-19026),Prodip Sarker(IT-19036) in the Department of Information and Communication Technology, Santosh, Tangail-1902, Bangladesh. I evidence that the project work or any part of this project has not submitted anywhere for the award of any degree or diploma. The information has allowed for this document accurate and valid to best of our cognition.

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Introduction . . . . .	1
<b>2</b>	<b>HARDWARE DESCRIPTION</b>	<b>2</b>
2.1	Arduino Mega . . . . .	2
2.2	MQ-5 Smoke Gas Detector Sensor . . . . .	4
2.3	Buzzer . . . . .	6
2.4	Jumper Wire . . . . .	7
2.5	9V Battery . . . . .	8
2.6	LED Bulb . . . . .	9
2.7	1 Channel 5V Relay Board Module . . . . .	10
2.8	Brushed Electric Motor . . . . .	11
2.9	Brushless Motor . . . . .	12
<b>3</b>	<b>SOFTWARE DESCRIPTION</b>	<b>14</b>
3.1	Arduino IDE . . . . .	14
<b>4</b>	<b>Methodology</b>	<b>16</b>
4.1	Block Diagram: . . . . .	17
4.2	Circuit Diagram: . . . . .	18
4.3	How Device in Action: . . . . .	19
<b>5</b>	<b>Source Code</b>	<b>20</b>
<b>6</b>	<b>Advantage and Limitations</b>	<b>22</b>
<b>7</b>	<b>Future work and Conclusion</b>	<b>23</b>

# List of Figures

2.1	Arduino Mega . . . . .	3
2.2	MQ-5 Sensor . . . . .	5
2.3	Buzzer . . . . .	6
2.4	Jumper Wire . . . . .	7
2.5	Battery . . . . .	8
2.6	LED Bulb . . . . .	9
2.7	1 Channel 5V Relay Board Module . . . . .	10
2.8	Brushed Electric Motor . . . . .	11
2.9	Brushless Motor . . . . .	13
3.1	Arduino IDE . . . . .	15
4.1	Circuit Diagram . . . . .	17
4.2	Circuit Diagram . . . . .	18

# Chapter 1

## Introduction

### 1.1 Introduction

LPG cylinder has become an important part of our lives. Not only in an urban household, but also in a rural household, people are using LPG gas cylinders which makes cooking easier. While, the presence of an LPG cylinder has made life easier, it is important to use it properly and safely for it can be harmful and cause life threatening accidents if care is not taken.

LPG cylinder leak can release gases which are combustible and can cause accidents which can lead to burns or even death.

Our device will detect the LPG leakage and activate immediate safety for the accident. LPG leakage can cause a deadly accident and this is increasing day by day in our country Bangladesh. For ensure the safety of the people for the LPG leakage accident we developed the device with Arduino.

# Chapter 2

## HARDWARE DESCRIPTION

### 2.1 Arduino Mega

Arduino is an open source microcontroller board. The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. The microcontroller on the board is programmed using Arduino software. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards and other circuit. The Microcontrollers are typically programmed using a dialect of features from programming language C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the processing language project.

#### Specifications of Arduino Mega

- Microcontroller : ATmega2560
- Operating voltage (logic level) : 5v
- Digital I/O pins : 13
- Analog Input pins : 16
- Clock Speed : 16 MHz
- Flash Memory : 32 KB

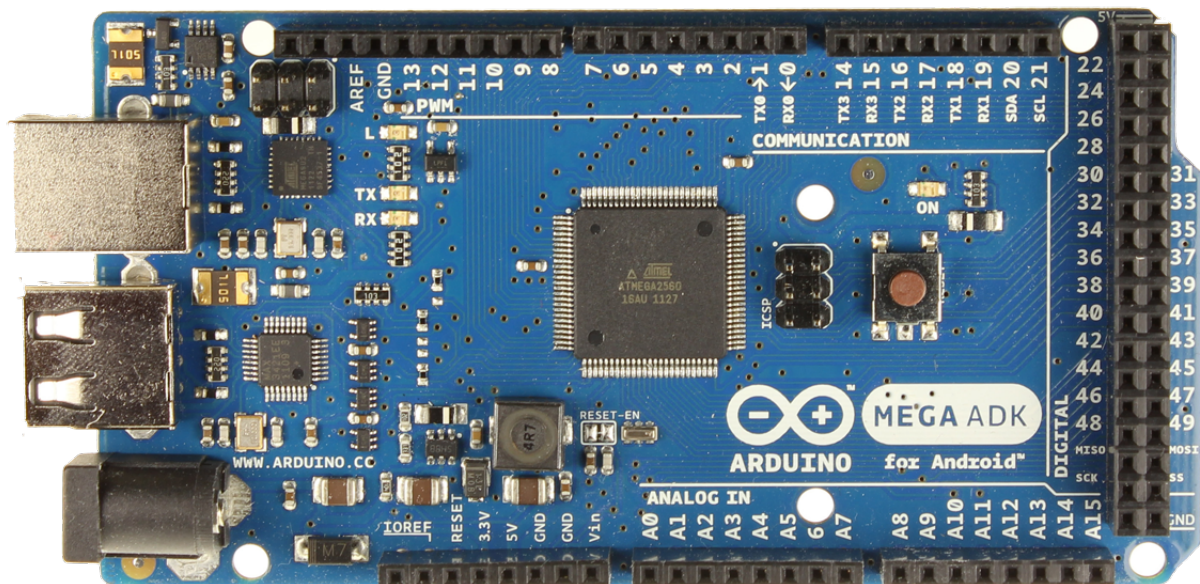


Figure 2.1: Arduino Mega



## 2.2 MQ-5 Smoke Gas Detector Sensor

The Simple MQ-5 Methane LPG Liquid Propane Gas sensor Module is a great way to add basic gas sensing to your project at a reasonable price. The MQ-5 Methane LPG Liquid Propane Gas Sensor Module particulate sensor uses a Buzzer to sense any detected material that is even present in the air!

This MQ-5 Methane LPG Liquid Propane Gas Sensor Module is widely used in gas leakage detecting pieces of equipment in family and industry, are suitable for detecting LPG, natural gas, town gas, avoid the noise of alcohol and cooking fumes and cigarette smoke.

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. Avoid the noise of alcohol, cooking fumes, and cigarette smoke. The sensitivity can be adjusted by the potentiometer.

The sensitive material of the MQ-5 gas sensor is tin Oxide ( $\text{SnO}_2$ ), 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 a simple electro circuit, Convert the change of conductivity to the corresponding output signal of gas concentration.

MQ-5 gas sensor has a high sensitivity to Methane, Propane, and Butane, and could be used to detect both Methane and Propane. The sensor could be used to detect different combustible gas especially Methane, it is with low cost and suitable for different application.

The accuracy of ultrasonic sensor can be affected by temperature and humidity of the air it is being used. It operated in frequency in 40 Hz. This sensors is very popular because multiple purpose application.



**Figure 2.2:** MQ-5 Sensor

## 2.3 Buzzer

A buzzer is a small yet efficient component to add sound features to add sound to our project system. It is very small and compact 2 pin structure. Buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 KHz. This is accomplished by covering an electric, oscillating signal in the audible range, into mechanical energy.



**Figure 2.3:** Buzzer

## 2.4 Jumper Wire

A jumper wire is an electrical wire that has connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wire are typically with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Individual jumper wires are fitted by inserting their end connectors into the slots provided in a breadboard the header connected of a circuit board or piece of test equipment. Jumper wire are in three version:-male to male, male to female and female to male.



**Figure 2.4:** Jumper Wire

## 2.5 9V Battery

The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radios.



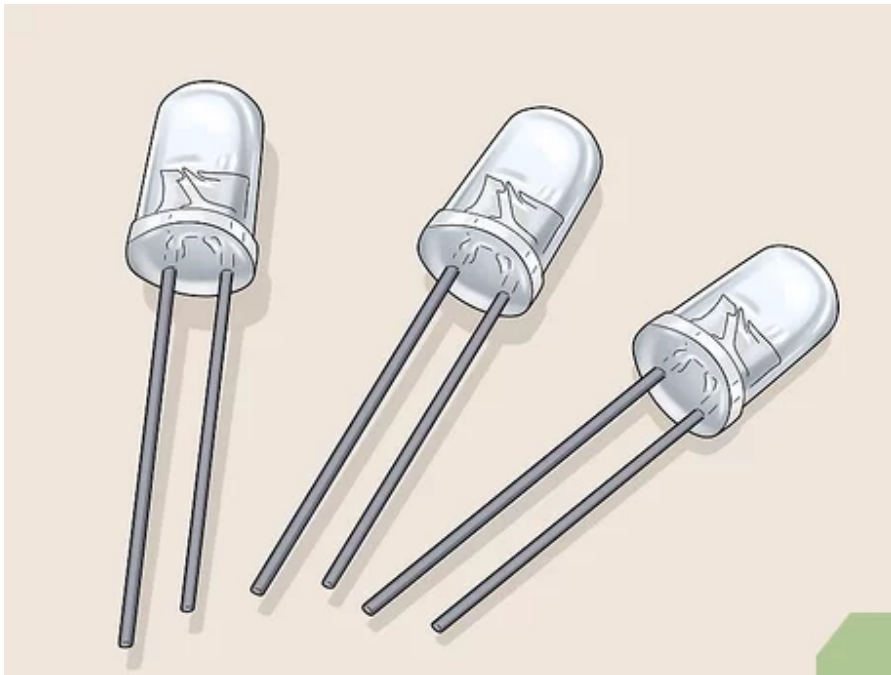
Figure 2.5: Battery

## 2.6 LED Bulb

The high efficiency and directional nature of LEDs makes them ideal for many industrial uses. LEDs are increasingly common in street lights, parking garage lighting, walkway and other outdoor area lighting, refrigerated case lighting, modular lighting, and task lighting.

### Advantages of LED Lighting:

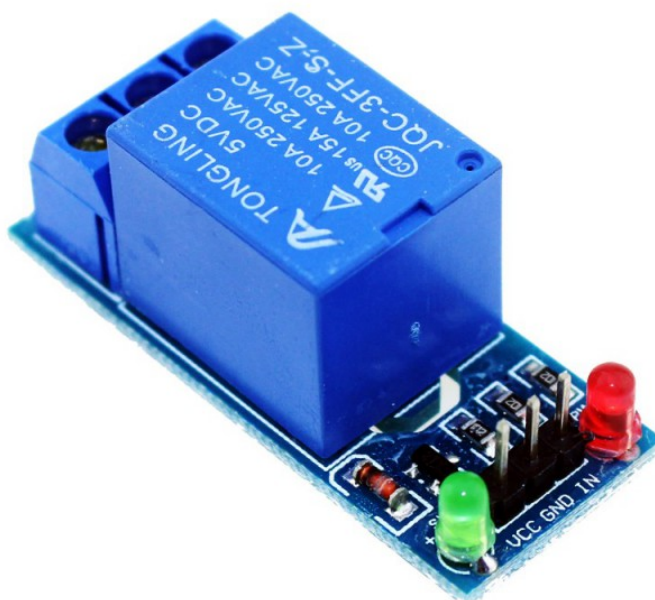
- Long Lifespan.
- Energy Efficiency.
- Improved Environmental Performance.
- No Heat or UV Emissions.
- Design Flexibility.
- Low Voltage Operation.



**Figure 2.6:** LED Bulb

## 2.7 1 Channel 5V Relay Board Module

It is a 1 Channel 5V Relay Board Module. The relay normally open interface maximum load: AC 250V/10A, DC 30V/10A. It has a trigger current of 5mA, and module working voltage of DC 5V. Each channel of the module can be triggered by a jumper to set a high level or a low level. Fault-tolerant design, even if the control line is disconnected, the relay will not move. With status indicator: power (green), 1-channel relay status indicator (red). All module size interfaces can be directly connected through the terminal block, which is convenient and practical.



**Figure 2.7:** 1 Channel 5V Relay Board Module

## 2.8 Brushed Electric Motor

A brushed DC electric motor is an internally commutated electric motor designed to be run from a direct current power source and utilizing an electric brush for contact.

Brushed motors were the first commercially important application of electric power to driving mechanical energy, and DC distribution systems were used for more than 100 years to operate motors in commercial and industrial buildings. Brushed DC motors can be varied in speed by changing the operating voltage or the strength of the magnetic field. Depending on the connections of the field to the power supply, the speed and torque characteristics of a brushed motor can be altered to provide steady speed or speed inversely proportional to the mechanical load. Brushed motors continue to be used for electrical propulsion, cranes, paper machines and steel rolling mills. Since the brushes wear down and require replacement, brushless DC motors using power electronic devices have displaced brushed motors from many applications.



**Figure 2.8:** Brushed Electric Motor

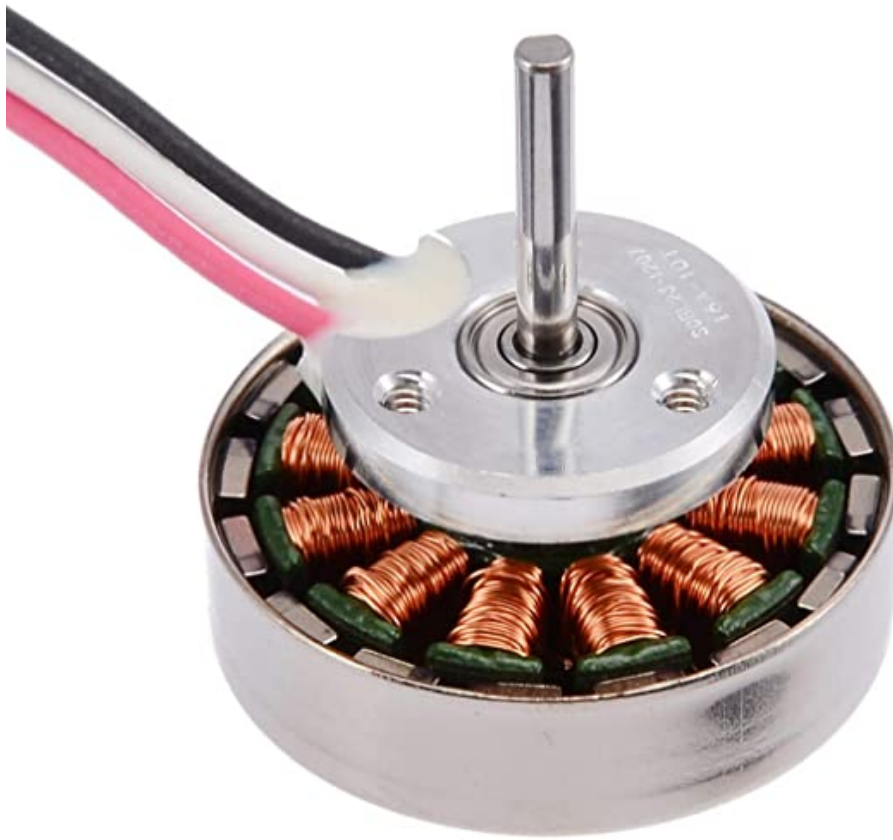


## 2.9 Brushless Motor

Brushless DC electric motor, also known as an electronically commutated motor, is a synchronous motor using a direct current (DC) electric power supply. It uses an electronic controller to switch DC currents to the motor windings producing magnetic fields which effectively rotate in space and which the permanent magnet rotor follows. The controller adjusts the phase and amplitude of the DC current pulses to control the speed and torque of the motor. This control system is an alternative to the mechanical commutator (brushes) used in many conventional electric motors.

The construction of a brushless motor system is typically similar to a permanent magnet synchronous motor (PMSM), but can also be a switched reluctance motor, or an induction (asynchronous) motor. They may also use neodymium magnets and be outrunners (the stator is surrounded by the rotor), inrunners (the rotor is surrounded by the stator), or axial (the rotor and stator are flat and parallel).

The advantages of a brushless motor over brushed motors are high power-to-weight ratio, high speed, nearly instantaneous control of speed (rpm) and torque, high efficiency, and low maintenance. Brushless motors find applications in such places as computer peripherals (disk drives, printers), hand-held power tools, and vehicles ranging from model aircraft to automobiles. In modern washing machines, brushless DC motors have allowed replacement of rubber belts and gearboxes by a direct-drive design.



**Figure 2.9:** Brushless Motor

# Chapter 3

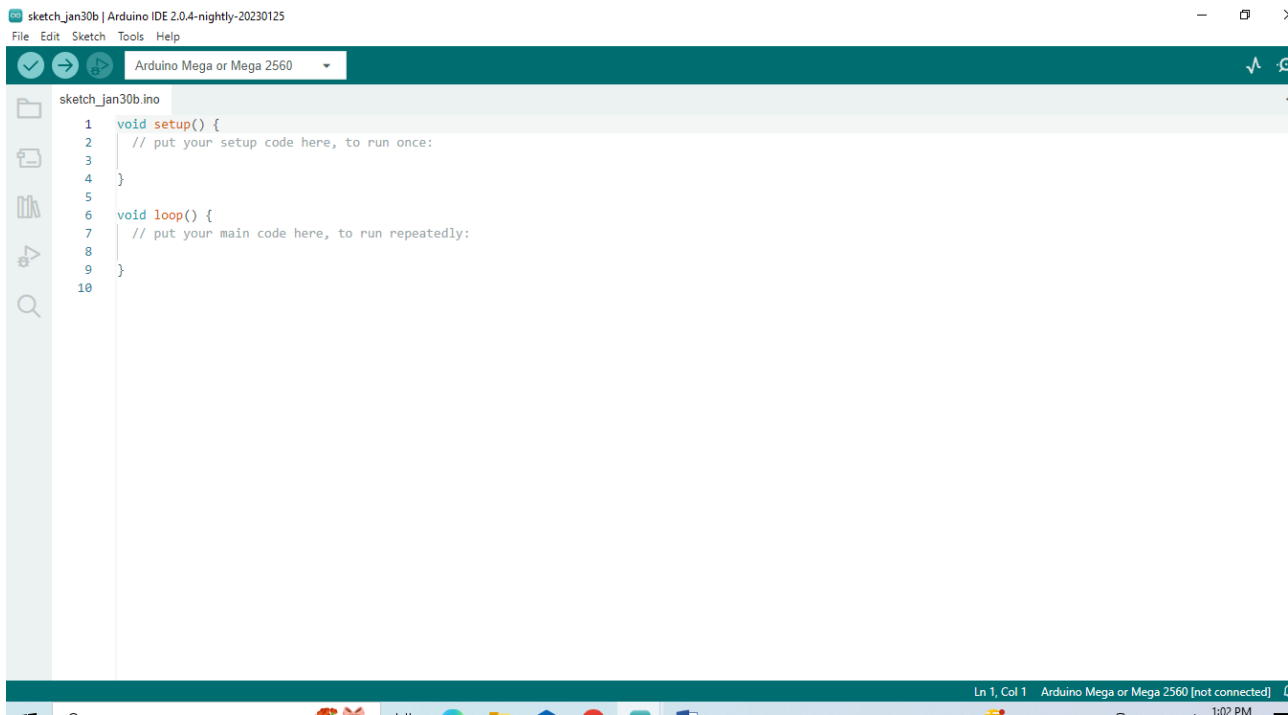
## SOFTWARE DESCRIPTION

### 3.1 Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, Mac OS and Linux) that is written in the programming language java. It is used and uploads programs to Arduino compatible boards.

The Arduino IDE supports the language C and C++ using special rules of codes structuring. The Arduino IDE supplies a software library from the wiring project which provides many common input and output input basic functions, for starting the sketch and the main program loop that are compiled and linked with a program

Arduino IDE is an open source that is mainly used for writing and compiling the code into the Arduino module. It is official software making code compilation too easy that even a common person with no prior technical knowledge can get their feet with the learning process. A different range of Arduino modules available including Arduino Uno, Arduino mega, Arduino Nano, and many more. Each of them consist a microcontroller on the board that is actually programmed and accepts the information in the form of code. The IDE environment mainly contains two basic parts: Editor and compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino module.

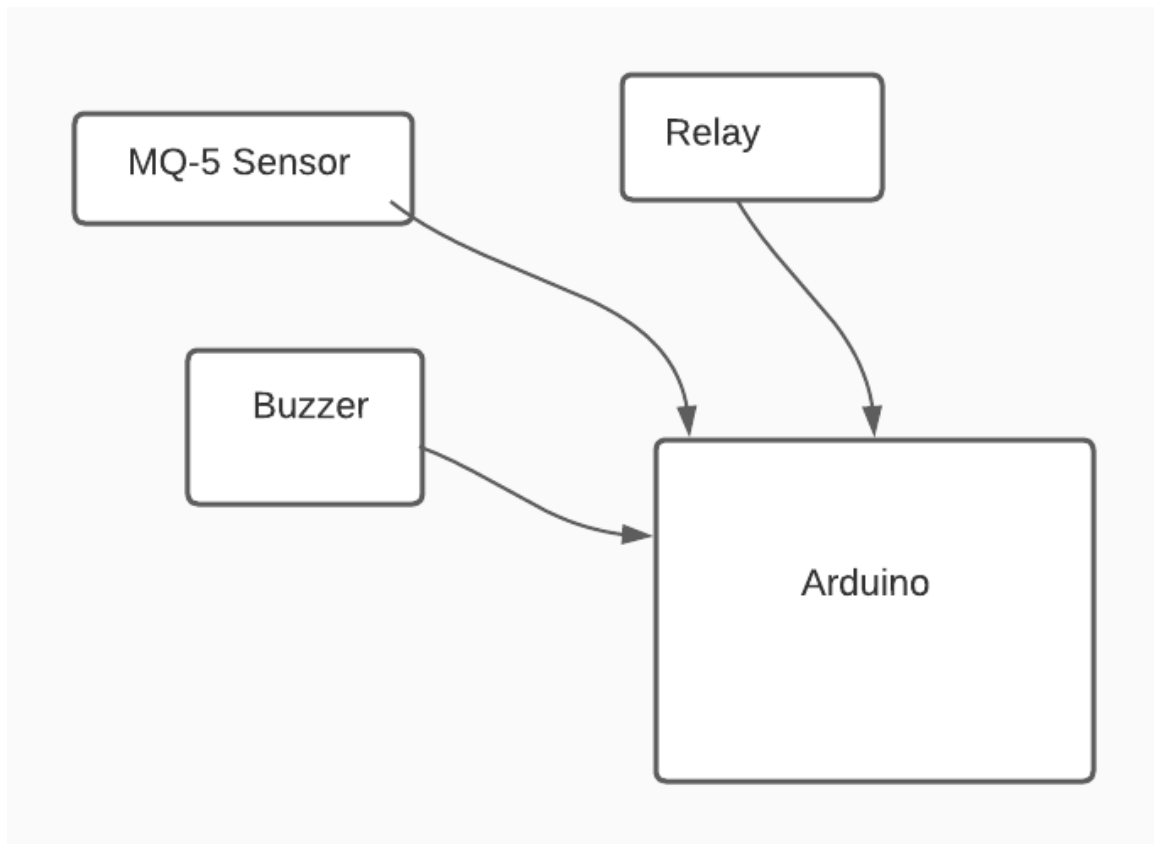
**Figure 3.1:** Arduino IDE

# Chapter 4

## Methodology

- Firstly,MQ5 sensor and Arduino MEGA is connected using jumper cable.
- And also 9V battery connected with relay and two motors.
- And connection between 5V DC buzzer and arduino using jumper wire.
- The ultrasonic sensor's four pin connect to Arduino respectively vcc to 5v, A0, GND to GND.
- 5V DC Buzzer connected with Arduino respectively MEGA 8 and GND.
- Brush motor connected with relay and battery ,Brushless motor connected with realy and battery.
- Brush motor represent as Home Appliances

## 4.1 Block Diagram:



**Figure 4.1:** Circuit Diagram

## 4.2 Circuit Diagram:

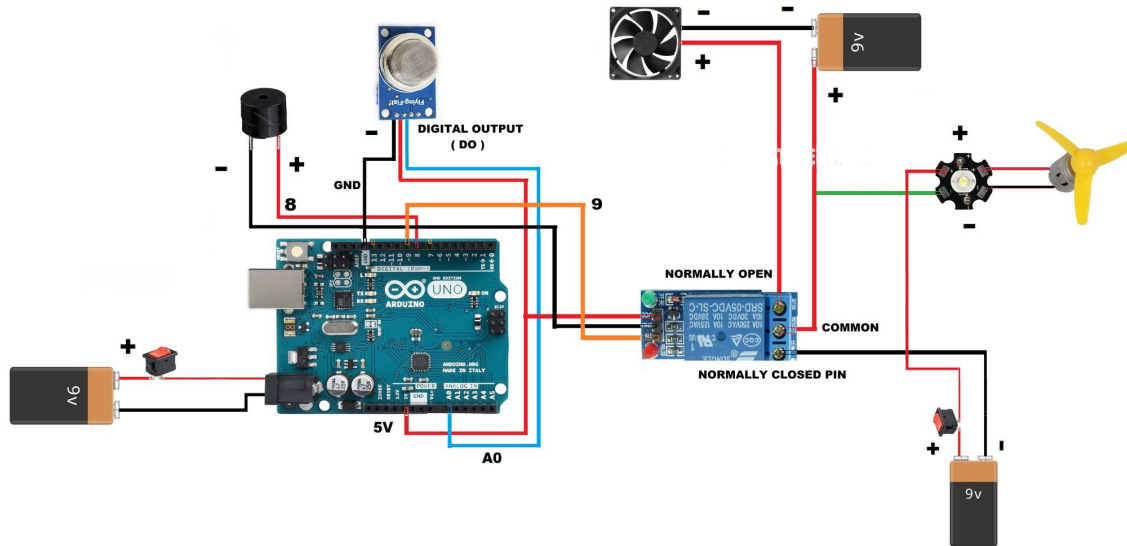


Figure 4.2: Circuit Diagram

### 4.3 How Device in Action:

- We connected our Arduino with computer and open the Arduino IDE and uploaded our code for the project.
- Disconnect the Arduino from the computer after the code uploaded successfully.
- Now, Connect all the sensors and devices with our Arduino to work properly.
- We use the gas lighter which is fill with LPG gas and put it front of our MQ-5 sensor.
- When the MQ-5 sensor sense the LPG gas the buzzer will start the sound and a brushless motor will start to dispose all the gas
- All the electric connection will be stop immediately.
- If all the gas got clear from the sensor and the buzzer will stop beeping and the brushless motor will go off.
- All the electric connection will restart again.



# Chapter 5

## Source Code

```
#define Sensor pin = A0;
#define relay pin = D9;
#define Buzzer Pin = D8;
#define sensorDigital A0
#define relay 9
#define buzzer 8
#define sensorAnalog A1
void setup() {
    pinMode(sensorDigital , INPUT);
    pinMode(relay , OUTPUT);
    pinMode(buzzer , OUTPUT);
    Serial.begin(9600);
}

void loop() {
    bool digital = digitalRead(sensorDigital);
    int analog = analogRead(sensorAnalog);
    Serial.print("Analog value : ");
    Serial.print(analog);
    Serial.print("t");
    Serial.print("Digital value :");
    Serial.println(digital);

    if(digital == 0) {
        digitalWrite(relay , LOW);
        digitalWrite(buzzer , HIGH);
        delay(5000);
    }
}
```

```
    digitalWrite(relay , HIGH);  
    digitalWrite(buzzer , LOW);  
} else {  
    digitalWrite(relay , HIGH);  
    digitalWrite(buzzer , LOW);  
  
}  
  
}
```

# **Chapter 6**

## **Advantage and Limitations**

**Advantage of blind stick is listed below:**

- This system will stop any unwanted accident causes by LPG leakage.
- It is simple to use and is affordable.
- It is very reliable and efficient.
- It consumes low power.
- It is a small but a effective system.

**Limitations are listed below:**

- It is not yet tested in a real home.
- It can't detect small amount of gas leakage.

# **Chapter 7**

## **Future work and Conclusion**

### **Future Work**

We will test the system in real life condition and will make it more portable and efficient. After it becomes trustful we will provide this to people to use at their home.

### **Conclusion**

It is worth mentioning at this point that the aim of the of this study is design and implementation of a LPG leakage detection and safety has been fully achieved .The project as a basic device for the coming generation of more adding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads the good result in detecting the obstacles on the path of the user in a range. This project offer low cost, reliable, portable, low power consumption and robust technology for navigation with obvious short response time .In this project, different types of sensors and other component with the light weight.

## **Discussion**

Firstly, Everything is connected just as the image and the code is the same. But It wasn't a easily task to implement. It was unfamiliar to us what is Arduino, ultrasonic sensor , embedded system , and all other thing.

There was few troubleshooting issues which we faces during the development time. These are given below :

- Code upload problem
- Port mismatch
- Broken buzzer problem
- In-efficient sensor

We work collaboratively to complete our goal then completed to our task .

## Bibliography

1. <https://github.com/masudursourav/Arduino-Code-LPG-Leakage-Detection-and-Safety>