Automatic Gas Leakage Detection System With Smart Alarm

A Project Report

Submitted By

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In partial fulfilment for the award of the degree

Of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Under the Guidance of

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May, 2022

DECLARATION

We hereby declare that the project entitled **"Automatic Gas Leakage Detection System With Smart Alarm"** submitted for the B. Tech. (ECE) degree is our original work and the project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

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CERTIFICATE

This is to certify that the students mentioned below have completed their project entitled **"Automatic Gas Leakage Detection System With Smart Alarm",** under the guidance of **MR. Anirban Ghosal** in partial fulfilment of the requirements for the award of the **Bachelor of Technology** in **Electronics and Communication Engineering** from **JIS college of Engineering** (An Autonomous Institute) is an authentic record of their own work carried out during the academic year 2021-22 and to the best of our knowledge, this work has not been submitted elsewhere as part of the process of obtaining a degree, diploma, fellowship or any other similar title.

Students Concerned:

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5. **Titas Saha**

Signature of External Expert	**Signature of the HOD**	**Signature of the Supervisor**

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We also express our sincere gratitude to **Mr. Biswarup Neogi**, HOD of the Department of Electronics and Communication Engineering of JIS College of Engineering and all the respected faculty members of Department of ECE for giving the scope of successfully carrying out the project work.

This report may contain errors and shortcomings. Thus, we remain open to all criticisms and suggestions which could present us with new sources of inspiration as we develop in our ability to research and learn.

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ABSTRACT

Since the beginning of time, safety plays a crucial role in the day to day life. Nowadays gas leaking detection technique is very essential for everyone because gas leakage can be very dangerous. Some accidents are so hazardous that many people died of Third-degree burns. So, by looking at all kinds of gas leak accidents and generating awareness of security in the mind we can develop a system to detect gas leakage and can take several steps against the accident to prevent any kind of serious damage. This paper aims at designing an "Automated Feedback Gas leakage Detection System". The system can be installed anywhere in the gas plant or room. When the gas leaks from any source like the cylinder or gas storage, the system detects gas, cuts the main power line, opens an alarm system and spread water into those areas through which the gas can reach the outside area. After a fraction of a second, the system sends a pre-programmed message "Gas leakage detected" to the given contact number. This "Automated Feedback Gas leakage detection System" has been designed with a GAS sensor(MQ-6), one Arduino UNO, one buzzer, one Red LED, one water pump, one motor driver module (L293D) and a Relay module.

INTRODUCTION

"Automated Gas leakage detection system" is an act of protection to prevent accidents due to gas leakage. Especially it saves thousands of lives by generating an awareness message to the user. Bursting cylinders and accidental fires from electric to gas bursts, all-cause lots of harm to the economy so gas leakage detectors are the important safety parameters to prevent disasters. Hence today's world it is quite essential to build and install a detector to prevent accidents. It is designed for safety purposes as we know that safety is our topmost priority and the wellness of mankind. So our project is followed by this problem's solution. This automatic system will automatically send a message whenever it detects gas or smoke and alert local people by an alarm system and also an open the water outlet hose. To detect gas leakage using Arduino we have designed this project which represents the design of a monitoring and controlling system. In our project, we use the GAS sensor MQ-6 to detect excess LPG gas. The MQ6 sensor can detect a wide range of gases like hydrogen, methane, Liquefied Petroleum Gas(LPG), and carbon monoxide. Arduino UNO works as the brain of this system. As a result, it is responsible for all the functions and decision makings of this whole system. Through the Relay module, we cut the main power supply from electricity. By switching off the red LED we can demonstrate the power cut system. This system also includes a buzzer that will make an alarming sound if gas leakage is detected. In the end, we attached one water pump which will open when LPG will detect and spray water into the outlet areas. Thus this project has been developed to deal with gas and if there has been a leakage of gas in the gas cylinder or anywhere else then the relay module will turn off the red LED, the pump will be on and the buzzer will make an

alarming sound which will indicate an unsafe atmosphere. As a result, this system provides safe use of LPG gas.

Survey on recent investigations

Survey 1: : (Shruthi Unnikrishnan, et al., (2017)) proposed "LPG Monitoring and Leakage Detection system" focuses on the issue of the monitoring the gas left out and leakage detection and alert the preferred user about the leakage of the gas by alerting with the buzzer and appropriate message. We have come to know how the system makes sure that the user let know the intended amount of LPG remaining in the gas. How the user can be notified about the gas leakage so that he can take preventive measures to avoid the explosion. The user gets alert buzzer whenever a small LPG gas is brought near the MQ-6 gas sensor.

Survey 2: (Rahul Verma and et al., (2013)) proposed "GSM Based Gas Leakage Detection System". This system continuously monitor leakage level of LPG gas by using MQ6 sensor. If the gas level increase beyond threshold value then this system turn on the alarm, sends SMS to the user by GSM module and turn of the main power supply.

Survey 3: (Kumar Keshamoni, et al., 2017)) proposed “Smart Gas Leakage Monitoring Booking and Gas Leakage Detector over IoT”. This System identifies the emptiness of GAS container by creating awareness to the user, with the continuous weight measurement of the container integrated with the principle of piezo electric sensor which is interfaced with a microcontroller. The system is designed with an MQ-2(gas sensor) and LM-35 (temperature sensor), which will detect the surrounding environment for any chance of error.

Survey 4: (Luay Fraiwan, et al., (2011)) proposed “Wireless Home Safety Gas Leakage Detection System”.This method has the design built with detection and transmission modules for gas concentration in household devices like Gas and heaters. From this paper, we learn that depending on the sensor values showing the variation in the gas concentration measurements and audiovisual alarms were activated.

Survey 5: (R.Naresh Naik, et al., (2016)) proposed “Arduino Based LPG gas Monitoring and Automatic Cylinder Booking with Alert System”. This system continuously monitor LPG gas leakage by MQ4 sensor and room temperature by LM-35 sensor. If the sensor value increase beyond threshold value the system alert user by sending SMS by GSM module , turn on the alarm, and open the room window and door by DC motor.In addition, load cell sensor monitor weight of

the cylinder. the weight is less than specific value the system send booking SMS to the LPG agent.

Survey 6: (Ajay Kumar, et al., (2016)) proposed "Designing and Implementation of Smart LPG Trolley with Home Safety". This method is defined for LPG leakage detection, and then alerting the user through a message by switching off the main power supply and turn off the cylinder Regulator.

Survey 7: (Arijit Banik, et al., (2017)) proposed "Microcontroller based low cost gas leakage detector with SMS alert" that can automatically detect and stop gas leakages in those permeable areas. Leakage detection is done with a gas sensor. The system then alerts the customer by sending an SMS to the specified mobilephone.

Survey 8: (Shashi Kumar, et al., (2018)) proposed "Smart LPG Monitoring and Automatic Gas Booking System". This system focused on the gas leakout, temperator and continuous weight measurement of container by load cell sensor. The system designed with an MQ2 gas sensor, LM-35 temperature sensor, which will monitor the environment for any change of error. Blutooth module is used to connect android device and the Microcontroller.

BASIC COMPONENTS

I. ARDUINO UNO:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The Arduino Uno is based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an 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. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

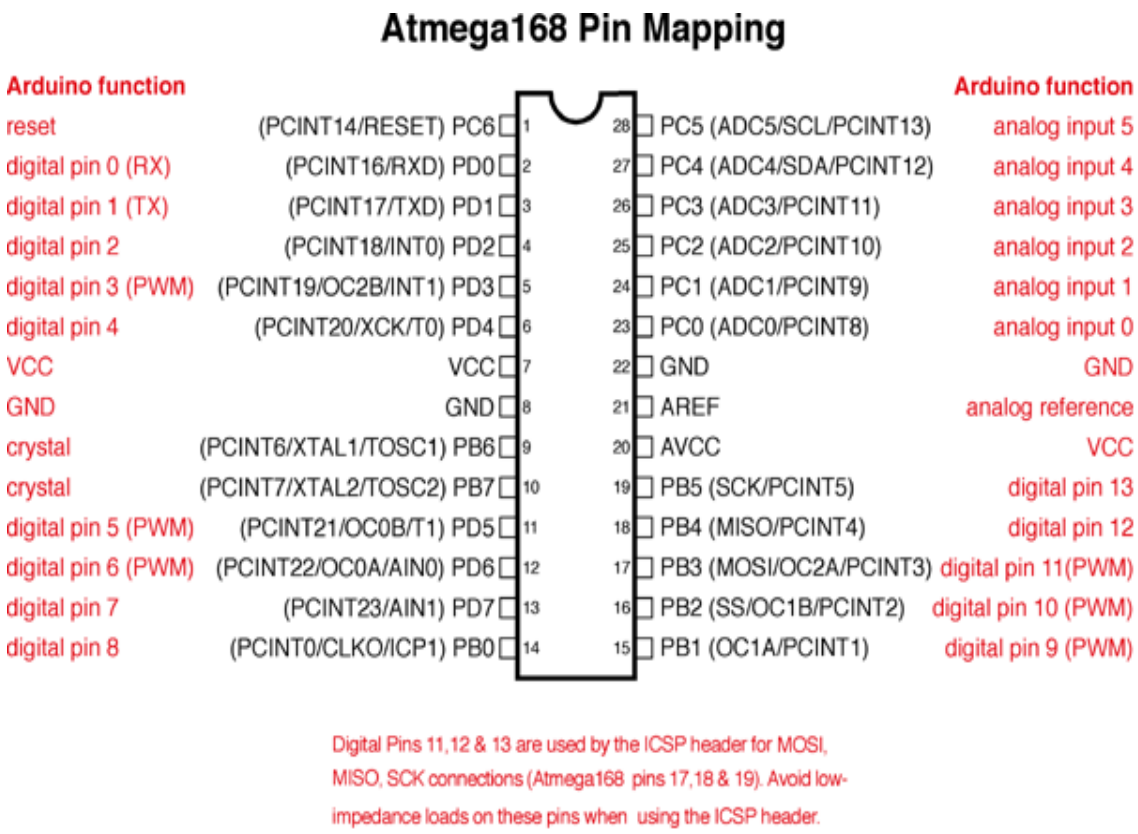


Fig1 : Pin Diagram of Arduino Uno

Technical specifications:

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm

- Width: 53.4 mm
- Weight: 25 g

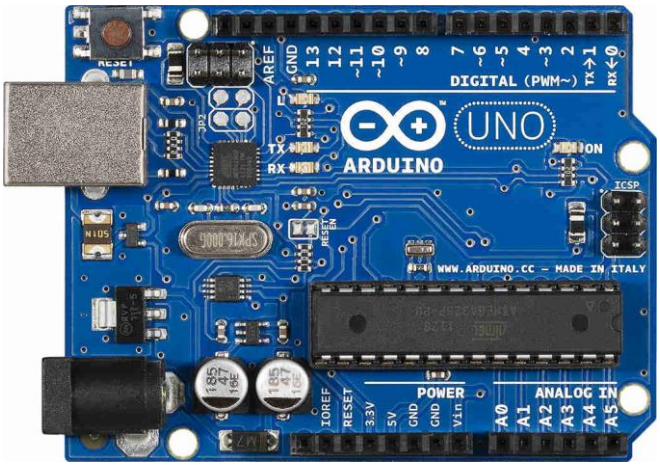


Fig 2: Arduino Uno

2. Relay module : This 5V 1A Relay Module can switch both AC and DC loads. It is an Electromagnetic switch, when the coil inside is energized with a small current, it can switch ON or OFF the high current circuit. It has PCB screw terminals to directly connect. They can be used in Home automation to switch ON or OFF the appliances, in Electronic circuits to perform switching operations, in safety circuits to disconnect or connect the heavy loads in case of any dangerous situation, in Automobile applications like turning on windscreen wipers, power windows fuel pump, cooling fan etc.

The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area through ON or OFF.

Every electromechanical relay consists of

1. Electromagnet

3. Mechanically movable contact

3. Switching points and

4. Spring

COM: common pin

NO: Normally open – there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and power is provided to the load.

NC: Normally closed – there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to the load.

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energises the electromagnetic field which produces the temporary magnetic field.This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch. The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it. Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.

Fig 3: Relay Module

3. Jumper Wire:

A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components.

Fig 4: Jumper Wires

4. 18650 Battery : A 18650 battery is a type of rechargeable battery. Li-ion batteries use an intercalated lithium compound as one

electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery. The batteries have a high energy density, no memory effect (other than LFP cells)[10] and low self-discharge. They can however be a safety hazard since they contain a flammable electrolyte, and if damaged or incorrectly charged can lead to explosions and fires.

Fig 5: Battery

5.Red LED : This is a very basic 5mm LED with a red lens. It has a typical forward voltage of 2.0V and a rated forward current of 20mA.The 5mm LED can be used anywhere where you need low power, high-intensity reliable light, or indication. They go quickly into a breadboard and will add that extra zing to your project.

Fig 6: RED LED

6.Gas sensor MQ6 : 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.

Fig 7: MQ-6 Gas Sensor

7.Buzzer : An active buzzer sensor module has a built-in oscillation circuit, thus the sound frequency is fixed. It is able to generate the sound itself. So, you can simply turn it on and off with an Arduino pin, just like the way of turning on and off a Led which is connected to Arduino board.

Fig 8: Buzzer

8. L298N Motor Driver Module:

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

The module has two screw terminal blocks for the motor A and B, and another screw terminal block for the Ground pin, the VCC for motor and a 5V pin which can either be an input or output. This depends on the voltage used at the motors VCC. The module have an onboard 5V regulator which is either enabled or disabled using a jumper. If the motor supply voltage is up to 12V we can enable the 5V regulator and the 5V pin can be used as output, for example for powering our Arduino board.

This module uses two techniques for the control speed and rotation direction of the DC motors. These are H-Bridge – For controlling rotation direction and PWM – For controlling the speed.

H-Bridge Techniques

L298n motor driver module uses the H-Bridge technique to control the direction of rotation of a DC motor. In this technique, H-Bridge controlled DC motor rotating direction by changing the polarity of its input voltage.

An H-Bridge circuit contains four switching elements, like transistors (BJT or MOSFET), with the motor at the center forming an H-like configuration. Input IN1, IN2, IN3, and IN4 pins actually control the switches of the H-Bridge circuit inside L298N IC.

We can change the direction of the current flow by activating two particular switches at the same time, this way we can change the rotation direction of the motor.

Case 1

When S1, S2, S3, and S4 all switches are open then no current goes to the Motor terminals. So, in this condition, the motor is stopped (not working).

L298N Motor Driver Module Working of H-Bridge Case 1

L298N Motor Driver Module Working of H-Bridge Case 1

Case 2

When the switch S1 and S4 are closed, then the motor left terminal is getting a positive (+) voltage and the motor right terminal is getting a negative(-) voltage. So, in this condition motor start rotating in a particular direction (clockwise).

L298N Motor Driver Module Working of H-Bridge Case 2

L298N Motor Driver Module Working of H-Bridge Case 2

Case 3

When S2 and S3 switches are closed, then the right motor terminal is getting a positive (+) voltage and the left motor terminal is getting a negative (-) voltage. So, in this condition motor start rotating in a particular direction (anticlockwise).

L298N Motor Driver Module Working of H-Bridge Case 3

L298N Motor Driver Module Working of H-Bridge Case 3

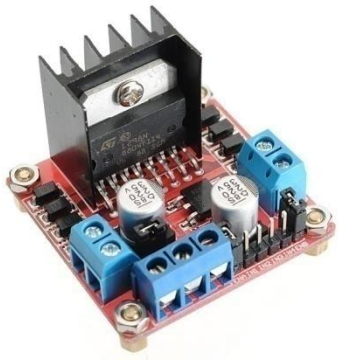


Fig 7: L298N

9. Air Pump:

This is a DC motor driver air pump or air inflator. This is a small air pump and can be used in any DIY projects like aquariums to supply oxygen. It can be controlled by any controller like Arduino, Raspberry Pi, AVR, PIC or any other controller. The pump is very easy to assemble, interface and a low power device.

Fig 11: Air Pump

Working Principle

The initial understanding of the proposed system is shown through a flow chart. Although Schematic circuit diagram, installed prototype, and internal hardware of the system is shown .

In this proposed system we are about to learn how to design a gas leakage detector using GSM and Arduino with an detection alert, pump system and buzzer alert system. The circuit mainly uses an MQ6 gas sensor and Arduino to detect excess gas. The MQ6 gas sensor has great sensitivity with a quick response time. MQ6 gas module has 4 pins, those are - analogue data pin(A0), digital data(D0) pin, power(VCC) pin and ground(GND) pin. Naturally, the GND and VCC pins of the gas sensor are connected with Arduino's ground and 5v+ pin and for this project, we are using the analogue pin for the specific value of gas amount which is connected with the Arduino's A0 analogue pin. When the MQ6 gas sensor sense LPG, it will send data through the analogue pin into Arduino's analogue pin(A0). Then the Arduino calculates the value of the gas(LPG) and how much gas is leaked. Then Arduino decides according to coding what to do next. Now according to the algorithm if the gas(LPG) value is equal to or more than 210 then gas is leaked and it is a dangerous amount of gas leaking. Then Arduino works as per the code. First, it will cut out the main power supply through the relay module. In the relay module we got three basic pins and three cut out pins. Basic pins are used to provide voltage and ground to the relay module and for the data flow from Arduino to the relay module. The other three pins are used to execute the working of the relay's switching function. With the help of a data pin Arduino controls the

relay's switching time according to the coding and gas sensor's value. We connect the main power supply through normally closed pins. When gas will detect, the relay module will be activated and normally closed switches to the normally open switch and the main power supply will be cut off. After that Arduino will high its digital pin no. 7. This means that the buzzer will be on as the buzzer is attached to the Arduino's digital pin 7. Then Arduino will open the water using the digital pin 8 setting as HIGH. This pin is connected with the motor driver module's one of the data pin. So, this pin HIGH means one of the motor driver module's channel is high and that means the pump is on as the pump is connected with the motor driver module. Using one RED LED attached with a resistor we demonstrate the main power cut off process as a low voltage function.

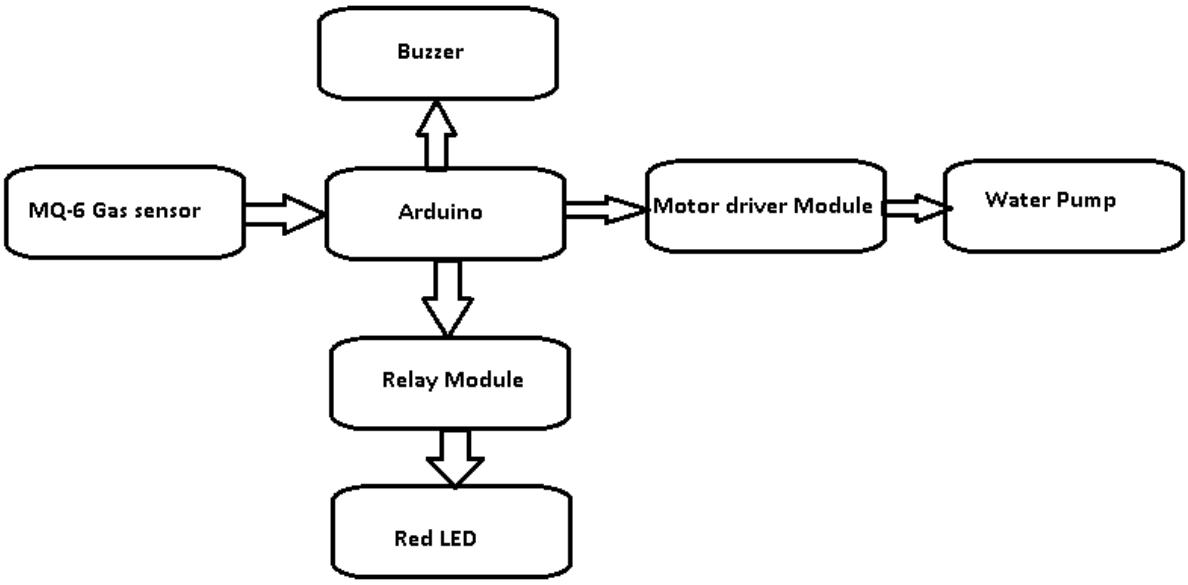


Fig 9: Block Diagram of the Project

In this project, semiconductor sensors are used to detect LPG gas. An MQ6 semiconductor sensor is used. Sensitive material of the MQ-6 gas sensor is SnO2, which has lower conductivity in clean air. When the target combustible gas exists, the sensor conductivity increases along with the rising gas concentration. The MQ6 gas sensor has a high sensitivity to Propane, Butane and LPG, and response to Natural gas. The sensor could be used to detect different combustible gasses, especially Methane; it has a lowcost and is suitable for different applications. The MQ-6 can detect gas concentrations anywhere from 200 to 10,000 ppm. The sensor's output is an analog resistance. Figure 1 shows the block diagram of the gas leakage detection and alert system.

This system is based on the Arduino UNO R3 and MQ-6 gas sensor. When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas in not detected the sensor will give digital output 0. Arduino will receive the sensor output as digital input. If the sensor output is high, then the buzzer will. The buzzer most commonly consists of a number of switches or sensors connected to control unit that determines which button was pushed or whether a preset time has lapsed, and usually illuminates a light on the appreciate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. At last relay module cuts the power supply to stay safe and prevent fire emergency.

We can see the dataflow that data flow from gas sensor through Arduino UNO to motor driver module, buzzer and relay module. Rest blocks are using current to operate and perform as per idea.

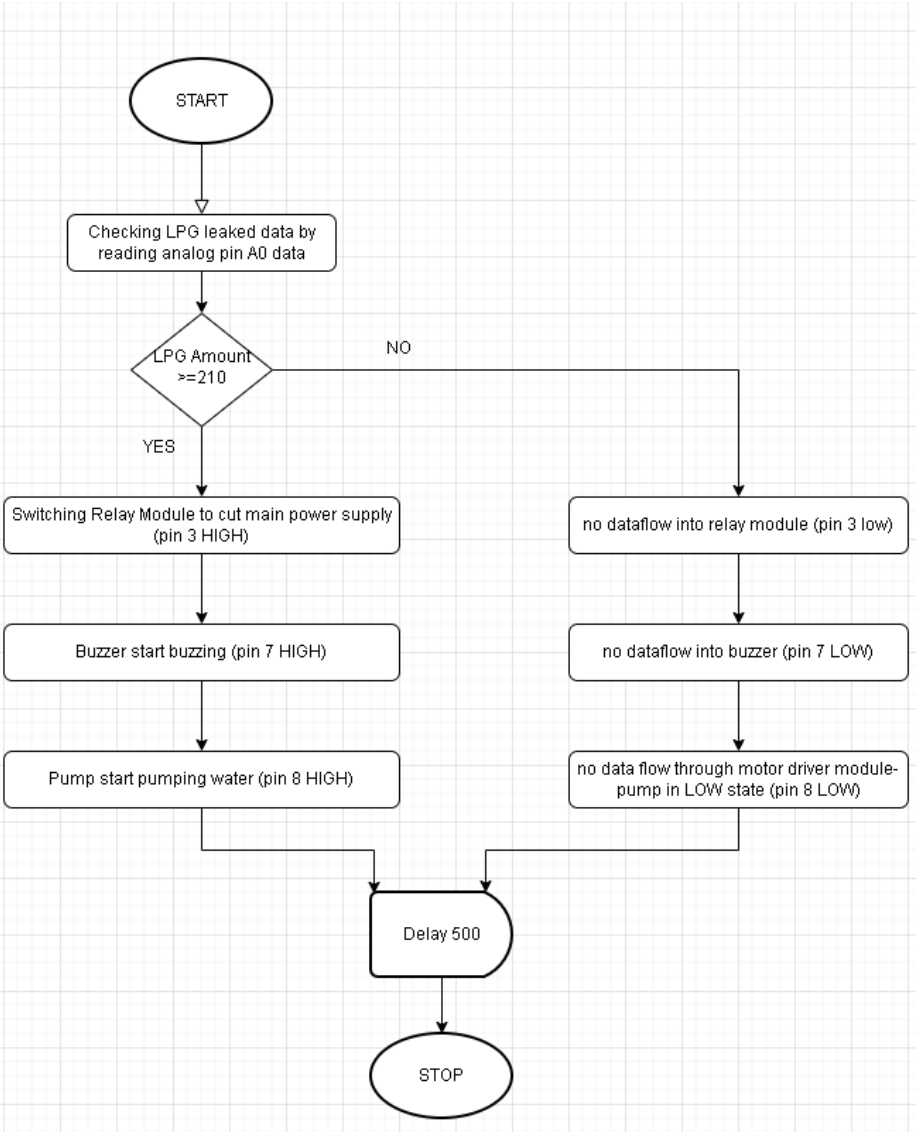
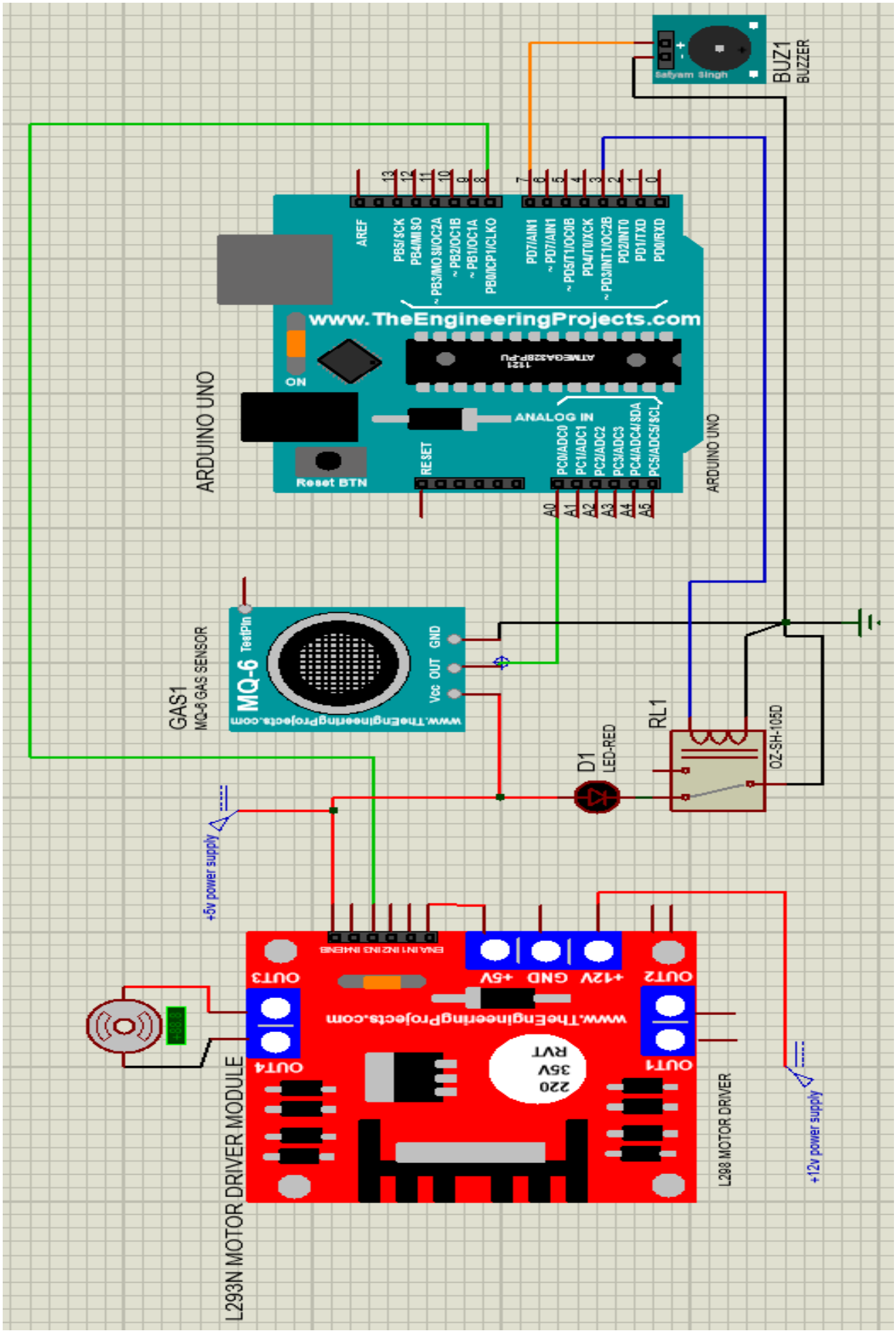


Fig 10: Flow chart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PD1/TXD
PD0/RXD
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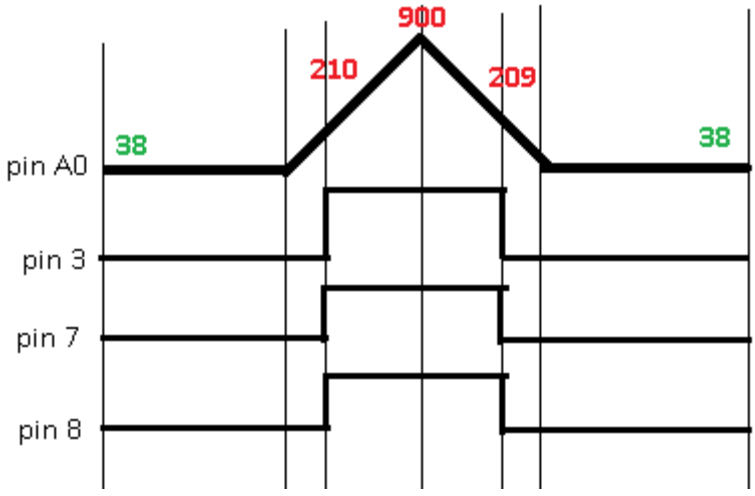
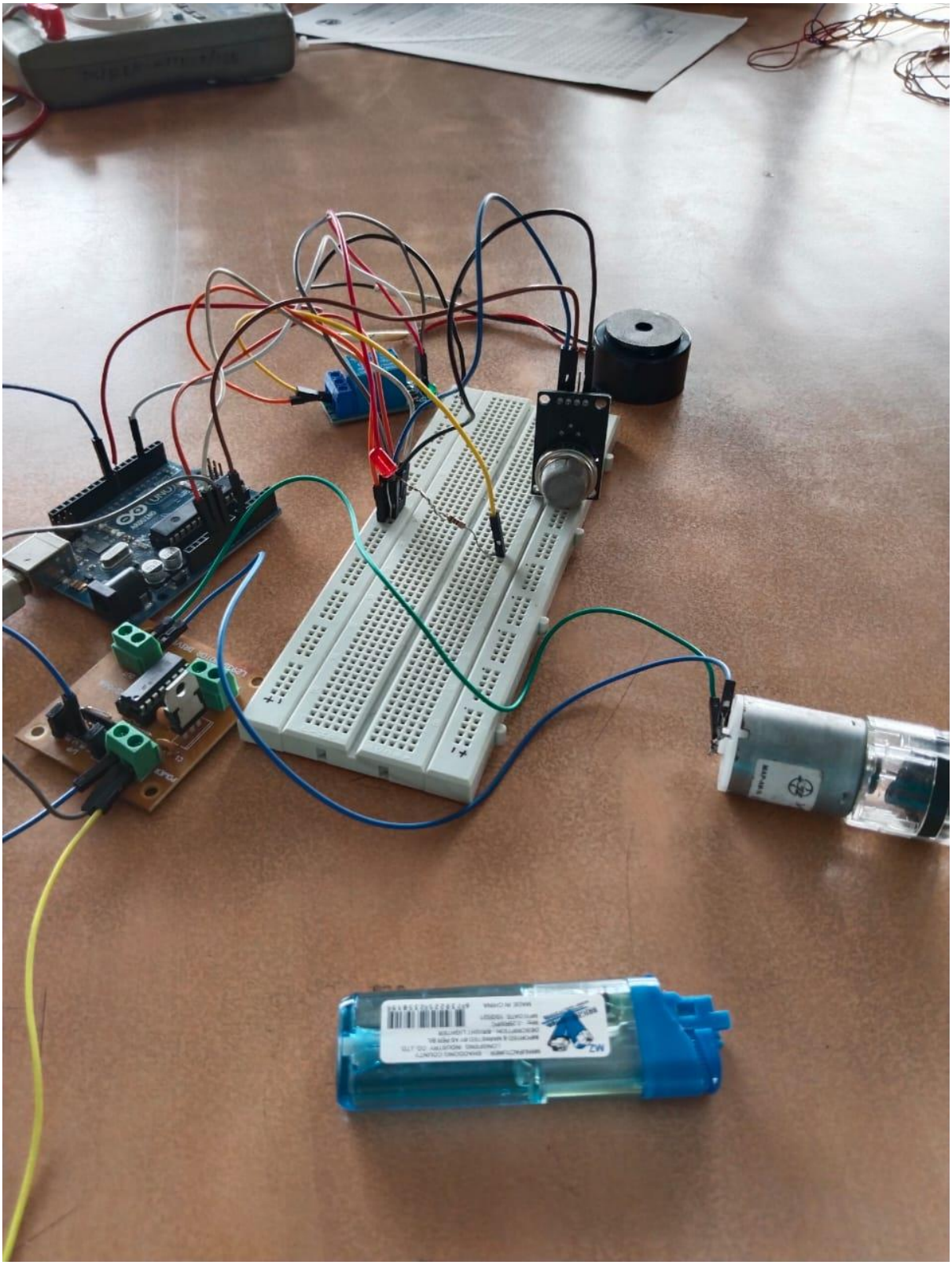
At first when we switch on the power supply, gas sensor starts sensing LPG gas and send the value by changing the value of voltage through jumper wire into Arduino's A0 analogue pin. After receiving the value Arduino starts to calculate as per coding. Whenever the value touch the threshold value or above, Arduino calculate that & as per coding this will be dangerous level of gas leaking amount. Then Arduino set digital pins 3 ,7 & 8 at HIGH state. 3 no. pin is connected with relay module's data pin. 7 no. pin is connected with buzzer and 8 no. pis connected with motor driver module's data pin. As a reason of setting pin 7 & 8 HIGH when the gas leakage will detect the buzzer starts to create alert sound. After that the HIGH signal goes to motor driver module and for that motor driver module's channel 1 will be open and current pass through that channel. Water pumps connected with channel 1 and pump will be also on. Pumps keep spray water on gas leakage outlets. Then when the gas leakage will slow down then automatically all digital pins are low and all safety systems will be off.



Pin function diagram



Project Prototype

Circuit Diagram Explanation:

At first, we start with Arduino. Arduino Uno is a popular microcontroller development board based on an 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists of other components such as a crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. From the schematic circuit diagram, we can see that in this project we use some digital pins and one analogue pin. All the devices without gas sensors that we used in this project are related to digital pins. Buzzer, relay module and motor driver module are controlled through those pin states. For reading the data from the gas sensor we used an analogue pin and we read that pin as we receive analogue values. First Gas sensor sense value and then send the voltage to the transducer and the signal changes according to its voltage. Then the voltage flow through the wire and goes to the A0 pin of Arduino. Then Arduino calculates the voltage and shows us LPG leakage data through the serial monitor. After that Arduino takes a decision. Now Arduino sends the digital HIGH signal through the rest of the pins 3, 7 and 8 that are defined in the code. Causing these pins HIGH BUzzer will start to create sound and alert all the local people. Then relay module will be also activated and the normally open switch will be closed. For that main power system will be cut out and there will be no cause of fire accidents. Then the motor driver will be also HIGH state and it will open its channel and current flow through that channel and reach to pump. Now all the water pumps are on and they are spreading water on the outlet.

Sensor Data Information:

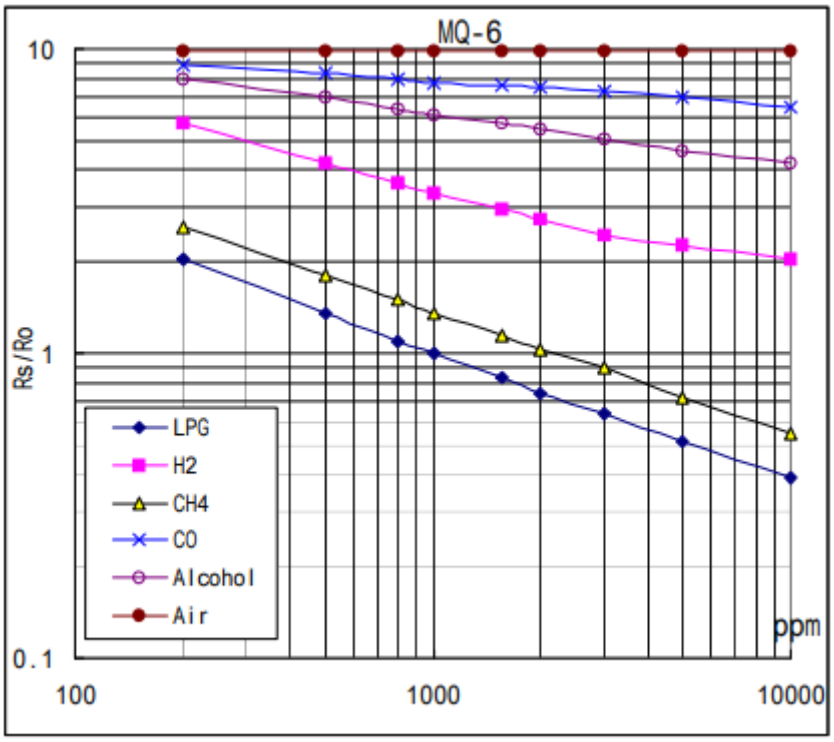
Parameter	Value
High Sensitivity	LPG, iso-butane, propane
Working Voltage	5 V
Heater Resistance	33Ω
Heating Consumption	0.75 W
Related Humidity	95%
Sensing Resistance	10 kΩ - 60 kΩ (200 - 10000 ppm)
Gas Sensing Layer	SnO_2
Preheat Time	over 24 hours

Technical data of MQ6 sensor

Sensor	Content
MQ 2	H_2, LPG, CH_4, CO, Alcohol, Smoke, Propane, Air
MQ 3	LPG, CH_4, CO, Alcohol, Benzine, Hexane, Air
MQ 6	H_2, LPG, CH_4, CO, Alcohol, Air
MQ 7	H_2, LPG, CH_4, CO, Alcohol, Air
MQ 8	H_2, LPG, CH_4, CO, Alcohol, Air
MQ 135	Alcohol, NH_4, CO_2, Air
MQ 137	NH_3, O_2, C_2H_6O, Air
MQ 138	CH_4, CO, Alkohol, Propane, Benzine, n-Hexane, Air

Various kinds of gas that can be detected by various sensors

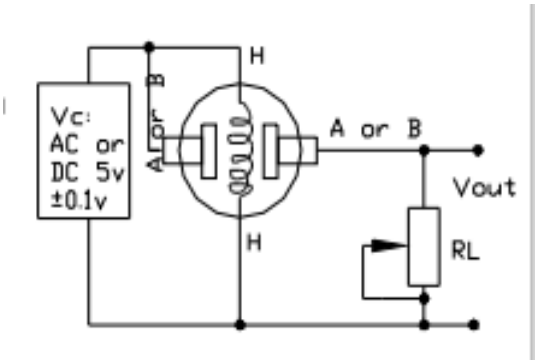
Each sensor has a graph datasheets provided by the manufacturer, which has X axis for mg/L or PPM value and Y axis for the ratio of R3 and Ro. In this development, the ratio value has the main role in determining the appropriate PPM or mg/L value based on the data sheets given



The graph tells us the concentration of a gas in part per million (PPM) according to the resistance ratio of the sensor (Rs/R0). R3 is the resistance of the sensor that changes depending on the concentration of gas. R0is the resistance of the sensor at a known concentration without the presence of other gases, or in the fresh air. For air, Rs/R0= 9.8 for MQ6 gas sensor. Table 1shows some technical data of MQ6 gas sensor whereas table 2shows some various kinds of gas that can be detected by certain sensors. Resistance value of MQ-6 is difference to various kinds and various concentration gases. So, When using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 1000ppm of LPG

concentration in air and use value of Load resistance (RL) about 20KΩ(10KΩ to 47KΩ). When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

Parts	Materials
Gas sensing layer	SnO2
Electrode	Au
Heater Coil	Ni-Cr alloy
Tubular ceramic	Al2O3
Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)



This sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components.

Arduino Code

```
Int pinOut = 3;
Int buzzer=7;
Int pump=8;
    Void setup()
    {
Serial.begin(9600);
pinMode(3, OUTPUT);
pinMode(7, OUTPUT);
pinMode(8, OUTPUT);
    }
    Void loop()
    {
Int LPG_detected = analogRead(A0);
Serial.println(LPG_detected);
      If (LPG_detected>=210)
      {
Serial.println("LPG detected…");
digitalWrite(pinOut, HIGH);
digitalWrite(buzzer, HIGH);
digitalWrite(pump, HIGH);
```

```
        }
        else
        {
Serial.println("No LPG detected.");
digitalWrite(pinOut, LOW);
digitalWrite(buzzer, LOW);
digitalWrite(pump, LOW);
        }
        delay(500);
      }
```

Result:

Gas sensor value	Relay Normally open pin Status	Buzzer	Pump	Serial Monitor
40	OPEN	OFF	OFF	No LPG detected. 40
160	OPEN	OFF	OFF	No LPG detected. 160
210	Close	ON	ON	LPG detected. 210
400	Close	ON	ON	LPG detected. 400
600	Close	ON	ON	LPG detected. 600

As we can see that based on gas sensor value the whole project is changing. So we starts from defining gas sensor values and then we define one by one as we got this values and decision throughout runtime of the project. When Gas sensor value is 40 at that time arduino decides to set low define digital pins. As a result of that relay module has no change, Buzzer is in off mode and pump is not open. And also in serial Monitor it shows that No LPG Detected. For 160value of gas sensor we can see the same. Arduino decides to set low define digital pins. As a result of that relay module has no change, Buzzer is in off mode and pump is not open. When the value is 210, at that time the Arduino takes decision that this value is over threshold value. So, Arduino HIGH all the digital pins and trigger all the rest electronics components. We can see that now relay switch to close circuit, Buzzer is on and buzzing and water pump is on and pumping water. We can also see that Serial monitor shows that LGP detected with LPG leakage value. For the rest time the gas value increasing continuously but as the threshold value is 210, it will not creating any difference but in serial monitor we can see the value will change.

Past Record:

The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak accident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. The industrial disaster is considered the world's worst in history. Over 500,000 people were exposed to methyl isocyanate (MIC) gas. The highly toxic substance made its way into and around the small towns located near the plant. The official immediate death toll was 2,259. In 2008, the Government of Madhya Pradesh had paid compensation to the family members of 3,787 victims killed in the gas release, and to 574,366 injured victims. A government affidavit in 2006 stated that the leak caused 558,125 injuries, including 38,478 temporary partial injuries and approximately 3,900 severely and permanently disabling injuries. Others estimate that 8,000 died within two weeks, and another 8,000 or more have since died from gas-related diseases.

Conclusion

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed and discussed in this paper. This is a low-cost, low power, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere but also wastage of gases will hurt our economy. The proposed system will cost only USD 10 which is easily affordable even for poor people. In the open literatures it is noticed that much work has not been done for a smart gas detection system. In future,

more advanced features will be integrated with this system which will provide users with more safety and relaxation. The proliferation of handheld devices has led to developments in the field of smart gas sensors, which has considerably widened their scope of application. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

Future Scope

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT, IoT turns drone into gas detection sensor. Another major future scope could be including a Automatic Shut-off device which will turn off the gas supply whenever it will detect any gas leakage. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used. This system can be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylinders used in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder. As many students are naïve the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Plenty of medical equipment requires gas cylinders. The model can be enhanced with the help of various sensors like fire sensors, PIR

sensor for total automation detection and alert system. We may also add a feedback system to check the operation of sensor and microcontroller time to time.

Overall, software and hardware parts of the systems have been developed and tested by introducing a small amount of LPG near gas sensor module. The authors of this paper are currently working to include multi functions with this device. One of the notable future functions of this system is to add a sub system where wastage of gas and the uses of gas can be monitored using this system. The system is flexible as a greater number of sensors and relays can be added to it according to the whole LPG supply setup in those premises. The author is adding more software based intelligent functions with this system. This is an automatic gas detection, control and alert system. In future this system will have a feature where it can notify the emergency services if any accidents happen. A mobile app and web-based app for real time monitoring also will be added. In the user app for this system many smart features will be added. The overall features will make the system more safe for the users. The system will be optimized for use in many places like the car, the home, industries and many other places. After designing the final prototype with smart multifunctional features, the system will be implemented in real life scenarios as a pilot project. A survey will be done soon before using the system and another one will be done after implementing the system to discover the KPI. Summarizing all the results, finding and analyzing a research article will be done and author has plans to submit into the MDPI sensors journal for review. In the future paper the features of this final product will be compared with the available gas detector systems presented in other articles.

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