

# **GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES**

**A PROJECT REPORT**

*Submitted by*

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# **A PROJECT REPORT**

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# CHAPTER - 1

## 1. Introduction

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meagre harm to the environment.

Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation is based on their physical properties such toxicity, flammability, etc.

The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage. The reason for such explosions is due to substandard cylinders, old valves, no regular checking of gas cylinders, worn out regulators and a lack of awareness of handling gas cylinders. Therefore, the gas leakage should be detected and controlled to protect people from danger. An odorant such as ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage.

## **1.1 Project Overview**

The project which describes about how the smoke is being detected and how it performs operations through logistics available in market in a scientific procedure. In this project the detection of gases like smoke, butane, propane, alcohol can be detected by a sensor named MQ-2 gas sensor. When the gas is detected by this MQ-2 sensor, its voltage fluctuates and when it reaches a value 200 it indicates that as gas. So, this need to be programmed in an Arduino uno in order to experiment practically, as Arduino uno is used in various multitasking purposes, we can use it here for detecting smoke and need to give a cautious buzzer or LED blinking that smoke is detected. so, this Arduino uno is programmed in such a way that when the smoke sensor MQ-2 value reaches 200 or above it needs to give a buzzer or light as output.

It also shows the message to the mobile phones to the respective persons as per with the MQ-2 value it as useful to know about the gas leakage level with range so the suitable action has been taken as per the situation of gas leakage level and also it automatically turns on the exacter fan encase the gas has been a harmful gas it has been the rise the emergency messages to the nearby hospitals in the surrounding. The Arduino has been programmed in the such way.

## **1.2 Purpose**

Gas leakage detection systems are an integral part of a safety system, providing the first line of defence against the possible disasters of gas leakage. It detects the gas leakage and triggers an alert system to activate safety precautions. Some leakages are too small to be smelled or are of an unscented gas, so it's a necessary investment to install a gas leakage detection system. The use of gas in both industrial and residential environments is ever-increasing. Gas is mainly used for energy generation and as a process requirement in manufacturing industries. The aftermath of a gas leak can be devastating irrespective of the scale of leakage. It will be helps to save the humans life the unexpected gas leakage death of humans will be reduced.

## CHAPTER - 2

### 2. Literature Survey

A.Mahalingamet.al. proposed a gas leak detector that meets the UK occupational and health standards. Gas leakage is a major concern with residential, commercial premises and gas-powered transportation vehicles. One of the preventive measures to avoid the danger associated with gas leakage is to install a gas leakage detector at vulnerable locations. The objective of this work is to present the design of a cost-effective automatic alarming system, which can detect liquefied petroleum gas leakage in various premises.

K Padma Priya et al. proposed an embedded system for Gas Cylinder maintenance, the proposed system consists of three main modules a GSM and PIC module, leakage detection module and protection circuitry. The detection module detects the gas leakage and sends SMS to the consumer through GSM. The GSM module is used to send short messages about the possibility of gas leak and as an added feature indicate that it may book a refill cylinder or can program the device to automatically book the cylinder via SMS. The weight of the cylinder is monitored by interfacing load cell to micro-controller.

Sunithaa.J et al. designed a wireless LPG leakage monitoring system for home safety. The proposed system detects the leakage of the LPG and alerts the consumer using GSM about the leakage and it will switch on the exhaust fan. This system also has a feature that the consumption is approximately indicated in terms of the total weight. Whenever the system detects the increase in the concentration of the LPG leakage it immediately alerts by activating an alarm and simultaneously sending message to the particular mobile phones. The fan is switched on to exhaust gas and an LPG safe valve fitted to the cylinder is closed through signals to avoid further leakage. The device assures safety and prevents explosion.

Jolhe et al. have designed a microcontroller-based system where a gas sensor (MQ6) is used in detection of LPG leakage. This unit is also integrated with an alarm unit, to sound an alarm or give a visual indication of the leakage. The sensor has high sensitivity with quick response time at affordable cost. If leakage is detected, message to the particular user or to family member using cellular network called GSM is sent automatically. It also measures the

weight of LPG cylinder and displayed in LCD display. A gas quantity of less or equal to 10kg, it requests for the new cylinder by automatically sending text message to a distributor. Also when cylinder weighs less than or equal to 0.5 Kg, it informs the consumer by sending a message to refill the cylinder.

## **2.1 Problem Statement**

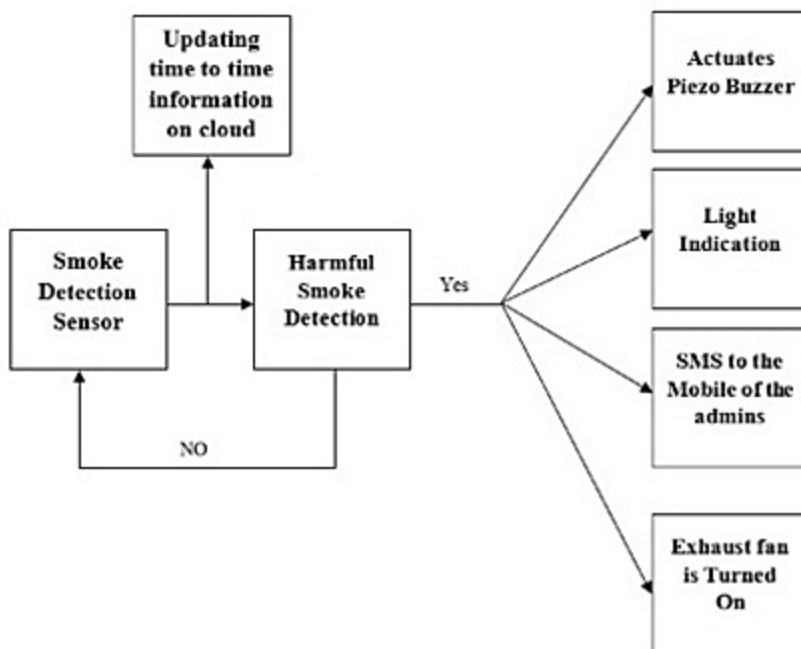
The need of a gas detection system isn't only to watch the environment continuously but also must prevent the further leakage of gas within the environment to attenuate the probabilities of fireside. Leakage of any sort of gas has become a drag in present times whether it's with regard to a domestic household, factory, kitchens in restaurants, canteens, etc. A gas leakage detection system makes use of gas sensors (depending on the need of the place). The proposed system makes use of an MQ2 sensor for detection of LPG leakage. The first objective of this project is to supply a completely unique means for safely detecting any malfunction of a pressurized facility so as to stop accumulation of combustible gases in order that damage or explosion thanks to such an accumulation of gases is prevented.

## CHAPTER - 3

### 3. Ideation and Proposed Solution:

#### 3.1 Empathy Map Canvas

##### Empathy Map Canvas



#### 3.2 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.

Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of Methyl Isocyanate was leaked from this insecticide plant. Methyl



Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, poisonous and flammable liquid is something that human beings have to be away from.

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.

### **3.3 Problem Solution**

The Gas leakage cause the major problem it will be affects the human health when the dangerous gases has been released from the industries. The sudden leakage will affect the human's health and also it will cause death. The LPG gas leakage in the house is also cause explosion. In order to have a control over such hazardous conditions we have proposed a system that uses sensors which is capable of detecting the gases such as LPG, CO, etc. This system will not only detect the leakage of gas, but it will also alert the user through alarms. It will help to protect the human's and the surrounding living organisms from the harmful gases. This system will create a vital impact in the society because, there are lot of people who are not able to detect the gas leakage prior to the fire accident. We have used the IOT technology to make a Gas Leakage Detector for society, which includes Smart Alerting techniques involves sending an alert message or mail to the concerned users.

### **3.4 Problem Solution Fit**

The industries who use the gases for their manufacturing and the chemical industries where they work with the harmful gases have been able. In this case the gas leakage system is used to check the gas leakage and also protect the workers life and surrounding environment from the harmful gas. In home the LPG gas has been used in some situation when the gas has been leaked it will be case explosion. In this case also the gas leakage detector has been very useful. The most of the gas explosions are caused by undetected of gas leakage in the pre-detection condition, so that, gas leakage monitoring and altering system is needed. The purpose

of this system is to detect gas leakage, neutralize it, and prevent from the explosion. The leakage of the gas will be led to the heavy loss of the production will be reduced greatly. When the workers failed to monitor properly, the gas can cause high risk to their health or the properties of the industries. The sensor enabled solution helps to prevent the high risk of gas explosions and affecting any casualties within and outside the premises the gas sensors help detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts.

## **CHAPTER - 4**

### **4. Requirements Analysis**

#### **4.1 Hardware Requirements**

1. Arduino
2. LCD
3. Wi-Fi module
4. Dc fan
5. Gas sensor
6. Buzzer
7. Resistors
8. Capacitors
9. Transistors
- 10.Cables and Connectors
- 11.Diodes
- 12.Breadboards
- 13.LED
- 14.Transformer/Adapter
- 15.Push Buttons
- 16.Switch
- 17.IC
- 18.IC Sockets

## Arduino

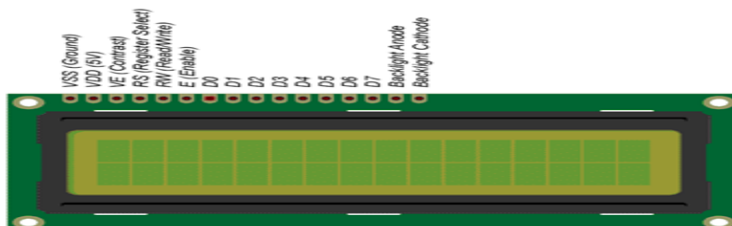


### Arduino UNO

[Arduino Uno](#) is a microcontroller board based on the ATmega328P ([datasheet](#)). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a [16 MHz quartz](#) crystal, a USB connection, a [HYPERLINK "https://www.tomsonelectronics.com/HYPERLINK "https://www.tomsonelectronics.com/collections/power-dc/products/dc-barrel-power-jack"m/collections/power-dc/products/dc-barrel-power-jack"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 an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong. The worst-case scenario is that you would have to replace the chip and start again

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

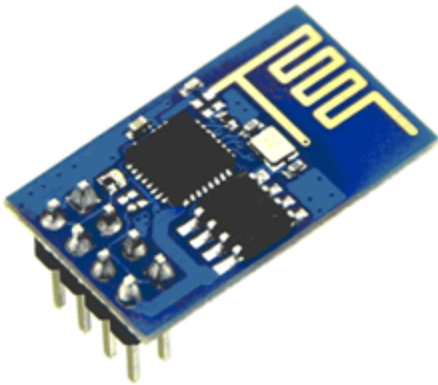
### LCD Display



## **LCD Display**

Lcd (Liquid Crystal Display) is a display panel or flat panel display that uses a light-waves to display the message or the contents on the screen. They were widely used in calculators, watches and in computer monitors. In our project we have used the display that is used for the calculator.

## **ESP8266 wifi module**



## **ESP8266 wifi module**

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT ([Internet of things](#)) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.

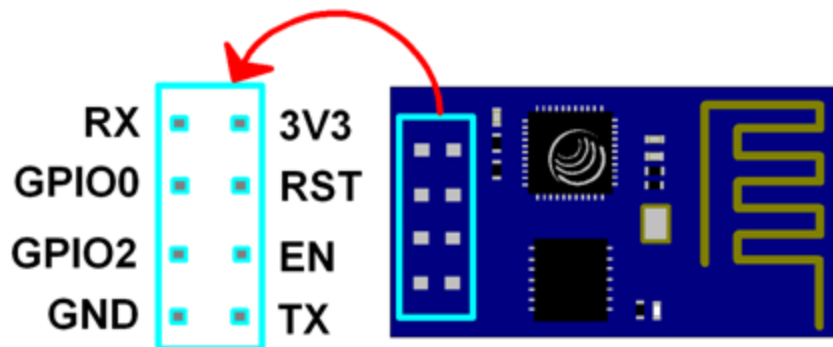
Espressif systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design. It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, [amplifiers](#), filters, digital baseband, power modules, external circuitry, and other necessary components. The ESP8266 Wi-Fi module is a microchip shown in the figure below.

### ESP8266 wifi module Specification

1. 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
2. General-purpose input/output (16 GPIO).
3. Inter-Integrated Circuit (I<sup>2</sup>C) serial communication protocol.
4. Analog-to-digital conversion (10-bit ADC).
5. UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2).
6. Pulse-width modulation (PWM).

### ESP8266 WiFi Module Pinout



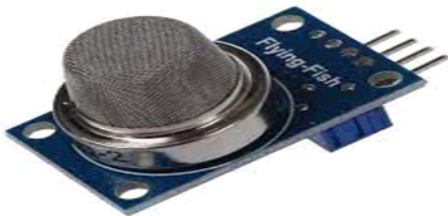
- 1.
2. **3V3**: – 3.3 V Power Pin.
3. **GND**: – Ground Pin.
4. **RST**: – Active Low Reset Pin.
5. **EN**: – Active High Enable Pin.
6. **TX**: – Serial Transmit Pin of UART.
7. **RX**: – Serial Receive Pin of UART.
8. **GPIO0 & GPIO2**: – General Purpose I/O Pins. It also known as TX/RX pins are used for Programming the module or for serial I/O purpose.

## DC Fan



This is a miniature-size exhaust cooling fan. This fan is as small as your palm. Its working voltage is 12V DC. It can work with a simple 12V battery without any difficulty. This mini fan has the ability to run at a speed of 6800 ~ 13000 rpm. The body of the fan is built from a combination of resin and plastic material. The combination provides strength and insulation to the fan. Due to its manufacturing, It is light in weight and strong enough to bear some falls on the ground. So if you are looking for a perfect combination of strength and insulation in a single fan, then you are in the right place.

## MQ-2 Gas Sensor



The MQ-2 smoke sensor is sensitive to smoke and to the following flammable gases:

1. LPG	4. Methane
2. Butane	5. Alcohol
3. Propane	6. Hydrogen

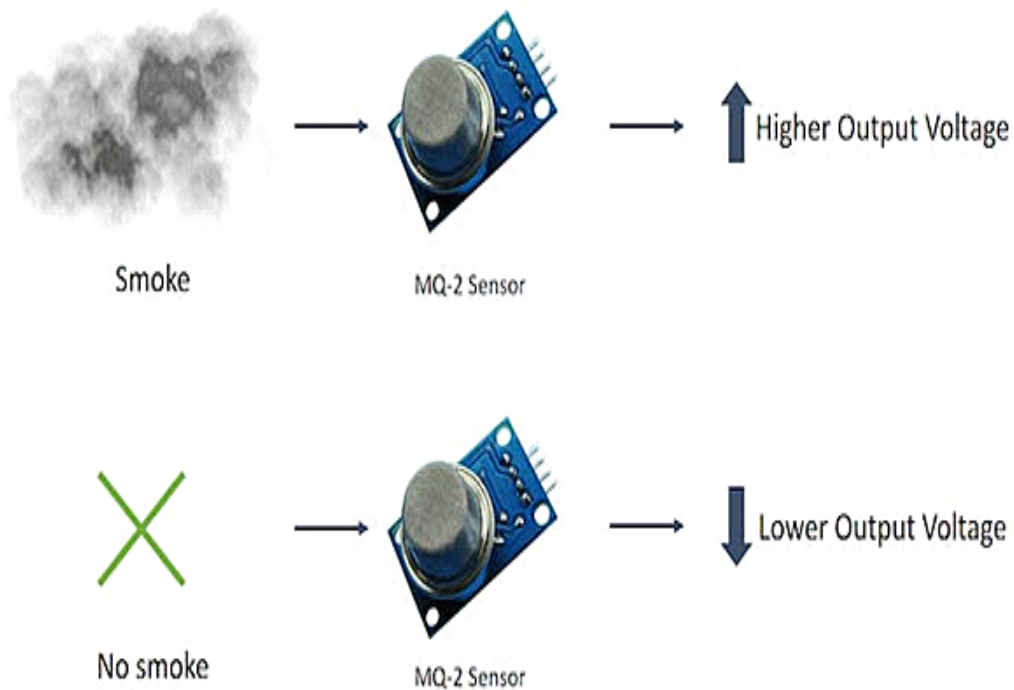
The resistance of the sensor is different depending on the type of the gas. The smoke sensor has a built-in potentiometer that allows you to adjust the sensor sensitivity according to how accurate you want to detect gas.

The voltage that the sensor outputs change accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of smoke/gas.

In other words, the relationship between voltage and gas concentration is the following:

The greater the gas concentration, the greater the output voltage

The lower the gas concentration, the lower the output voltage





## Working Mechanism of MQ-2

### Buzzer



An Arduino Buzzer is basically a beeper. The Arduino buzzer is a device that produces sound when an electric current is passed through it. The Arduino buzzer can be directly connected to the Arduino and produce different tones by giving different frequency electric pulses to the buzzer. The Arduino buzzers are most commonly used as beepers in any system, Alarm devices, timers, security systems and to produce sound on confirmation of user input in many systems. The buzzers are of different types such as Mechanical buzzers, Electromechanical buzzers and Piezoelectric buzzers.

The piezoelectric buzzer is most commonly used with the Arduino. As it is lightweight, simple in construction, typically a low-cost product that can generate different sound tones of different frequencies and does not require a separate oscillating circuit. In this blog, we will produce different sound tones using a buzzer by applying different frequency electric pulses.

### Resistor



A resistor is a [passive two-terminal electrical component](#) that implements [electrical resistance](#) as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to [divide voltages](#), [bias](#) active elements, and terminate [transmission lines](#), among other uses. High-power resistors that can dissipate many [watts](#) of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for [generators](#). Fixed resistors have resistances that only change slightly with temperature, time or operating voltage.

Resistors are common elements of [electrical networks](#) and [electronic circuits](#) and are ubiquitous in [electronic equipment](#). Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within [integrated circuits](#).

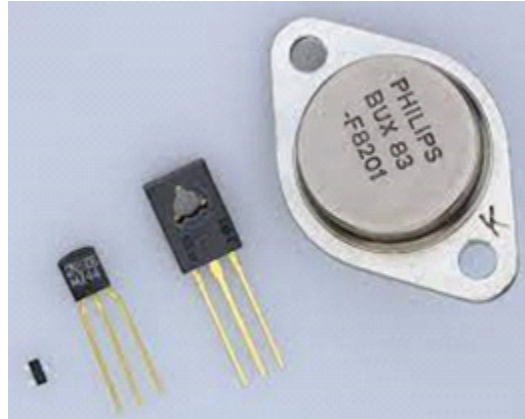
## Capacitors



A capacitor is a device that stores [electrical energy](#) in an [electric field](#) by virtue of accumulating [electric charge](#) [HYPERLINK "https://en.wikipedia.org/wiki/Electric\\_charge"](https://en.wikipedia.org/wiki/Electric_charge) on two close surfaces insulated from each other. It is a [passive electronic component](#) with two [terminals](#).

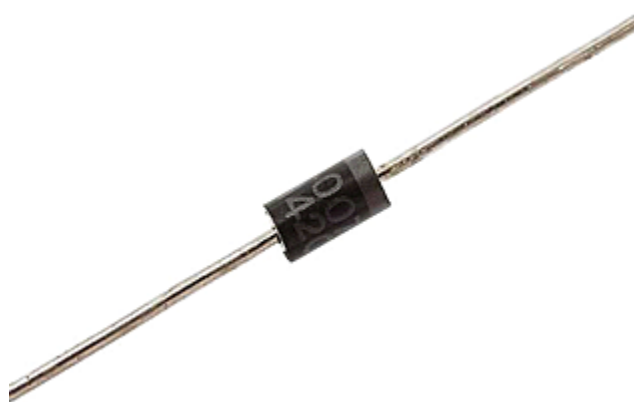
The effect of a capacitor is known as [capacitance](#). While some capacitance exists between any two electrical conductors in proximity in a [circuit](#), a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a condenser, a term still encountered in a few compound names, such as the [condenser microphone](#).

## Transistors



A transistor is a [semiconductor device](#) used to [amplify](#) or [switch](#) electrical signals and [power](#). The transistor is one of the basic building blocks of modern [electronics](#).<sup>[1]</sup> It is composed of [semiconductor material](#), usually with at least three [terminals](#) for connection to an electronic circuit. A [voltage](#) or [current](#) applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Some transistors are packaged individually, but many more are found embedded in [integrated circuits](#).

## Diode

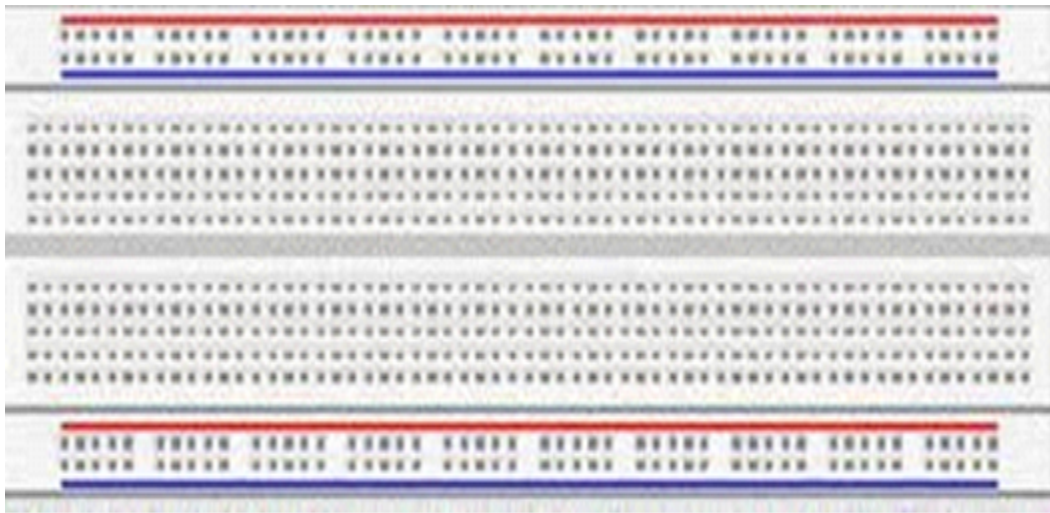


Diode

A diode is a two-terminal [electronic component](#) that conducts [current](#) primarily in one direction (asymmetric [conductance](#)); it has low (ideally zero) [resistance](#) in one direction, and high (ideally infinite) [resistance](#) in the other.

A diode [vacuum tube](#) or thermionic diode is a vacuum tube with two [electrodes](#), a heated [cathode](#) and a [plate](#), in which electrons can flow in only one direction, from cathode to plate.

## Breadboard



A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent [prototypes](#) of [electronic circuits](#). Unlike a [per board](#) or [stripboard](#), breadboards do not require [soldering](#) or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.

A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete [central processing units](#) (CPUs).

Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signalling is limited to about 10 MHz, and not everything works properly even well below that frequency.

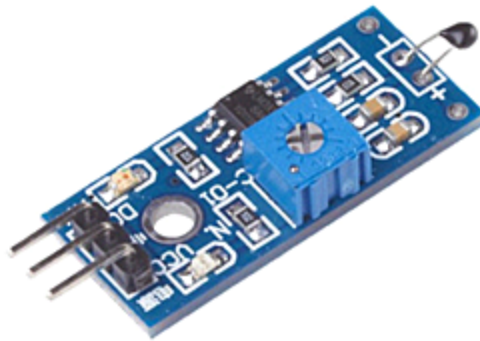
## LED



A Super Bright 5mm LED is exceptionally bright with a wide beam angle, so they're suitable for use in your projects, illuminations, headlamps, spotlights, car lighting, and models. 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. The 5mm T1 3/4 LED is the most common size of LED available.

An LED has a positive (Anode) lead and a negative (Cathode) lead. The schematic symbol of the LED is similar to the diode except for two arrows pointing outwards. The Anode (+) is marked with a triangle, and the Cathode (-) is marked with a line. The longer lead of an LED is generally the positive (Anode), while the shorter lead is the negative (cathode).

## Temperature Sensor



NTC Thermistor temperature sensor module is low cost, small size module. It is very sensitive to ambient temperature. It is generally used to detect the temperature of the surrounding environment. Through potentiometer adjustment, it is possible to change the temperature

detection threshold. DO output can be directly connected to the micro controller to detect high and low, by detecting temperature changes in the environment. The temperature detection range of the module is between 20 and 80 degrees Celsius. This module can be replaced with a line temperature sensor for controlling the water temperature, water tank, etc. Generally, the 4-wire method of thermistor measurement is the most accurate.

#### **Specifications of NTC Thermistor Temperature sensor module: -**

1. NTC thermistor sensor, good sensitivity
2. The comparator output signal is more than 15mA.
3. Possible to adjust the temperature distribution position detection threshold
4. Working voltage: 3.3V-5V
5. Output form: DO digital switching outputs (0 and 1) and AO analog voltage output
6. Fixed bolt hole for easy installation
7. Small PCB board size: 3.2cm x 1.4cm
8. uses a wide voltage comparator LM393

#### **Cables and Connectors**



A jump wire (also known as jumper, jumper wire, DuPont wire) 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, without soldering.

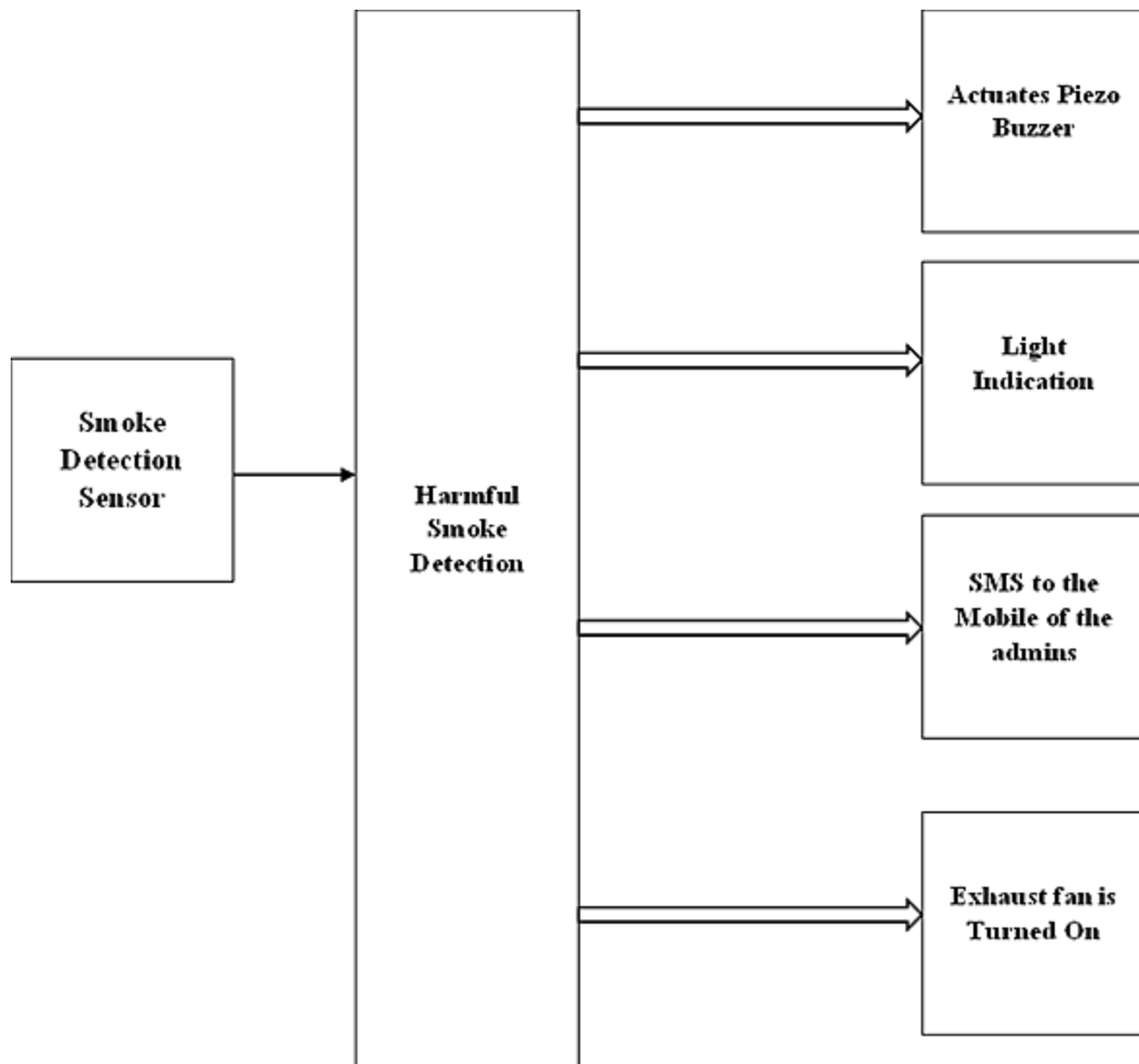
A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit.

By placing the jumper wire on the circuit, it becomes possible to control the electricity, stop the operation of the circuit, and operate a circuit that does not operate with ordinary wiring. Also, when specification change or design change is necessary on the printed circuit board, reinforcement of the defective part.

## CHAPTER - 5

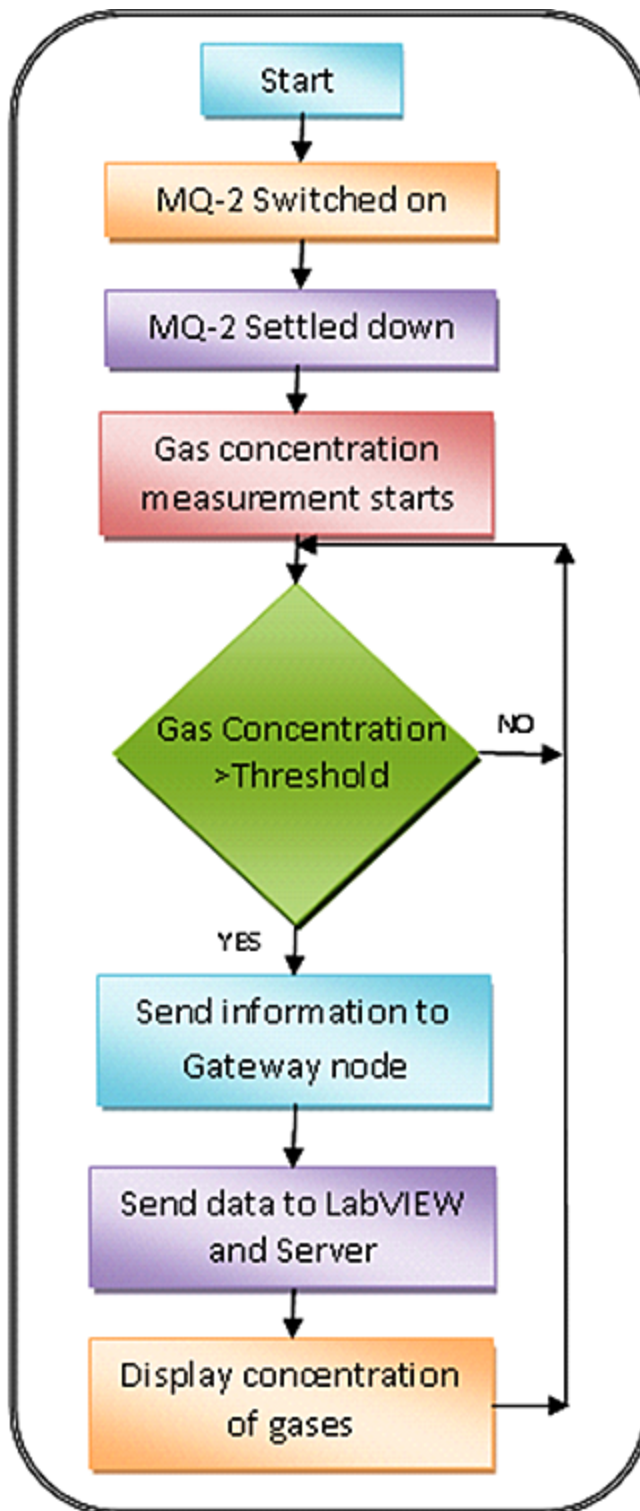
### 5. Project Design:

#### 5.1 Data Flow Gram





## 5.2 Technical Architecture



## CHAPTER - 6

### 6. Project Planning & Scheduling

#### 6.1 Sprint Planning & Estimation



## CHAPTER - 7

### 7. Coding and Solution

#### 7.1 FEATURE 1

```
#include <LiquidCrystal.h>
```

```
#IBM Watson IOT Platform
```

```
#pip install wiotp-sdk
```

```
intredLed = 12;
```

```
intgreenLed = 11;
```

```
int buzzer = 10;
```

```
int smokeA0 = A5;
```

```
// Your threshold value
```

```
intsensorThres = 400;
```

```
import wiotp.sdk.device
```

```
import time
```

```
import random
```

```
myConfig = {
```

```
    "identity": {
```

```
        "orgId": "onj4zr",
```

```
        "typeId": "test",
```

```
        "deviceId": "61"
```

```
    },
```

```
    "auth": {
```

```
"token": "Wlu5ClM7!7-r@Ot+9w"
```

```
}
```

```
}
```

```
def myCommandCallback(cmd):
```

```
    print("Message received from IBM IoT Platform: %s" %
```

```
    cmd.data['command'])
```

```
    m=cmd.data['command']
```

```
    client = wiotp.sdk.device.DeviceClient(config=myConfig,
```

```
    logHandlers=None)
```

```
    client.connect()
```

```
#LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
```

```
float gasPin = A0;
```

```
float gasLevel;
```

```
int ledPin = 2;
```

```
int buttonPin = 3;
```

```
int buzzPin = 4;
```

```
int buttonState;
```

```
int fan = 5;
```

```
void setup(){
```

```
    pinMode(ledPin, OUTPUT);
```

```
    pinMode(buttonPin, INPUT);
```

```
pinMode(gasPin,INPUT);

pinMode(fan,OUTPUT);

Serial.begin(9600);

lcd.begin(16, 2);

lcd.setCursor(0,0);

lcd.print(" Welcome");

lcd.setCursor(0,2);

lcd.print("PNT2022TMID51246");

delay(500);

lcd.clear();

}

void loop(){

    // Read the value from gas sensor and button

    gasLevel = analogRead(gasPin);

    buttonState = digitalRead(buttonPin);

    // call the function for gas detection and button work

    gasDetected(gasLevel);

    buzzer(gasLevel);

    exhaustFanOn(buttonState);
```

## 7.2 FEATURE 2

**/\*LED Indication\*/**

```
void setup() {

pinMode(redLed, OUTPUT);

pinMode(greenLed, OUTPUT);

pinMode(buzzer, OUTPUT);

pinMode(smokeA0, INPUT);

Serial.begin(9600);

}

void loop() {

intanalogSensor = analogRead(smokeA0);

Serial.print("Pin A0: ");

Serial.println(analogSensor);

    // Checks if it has reached the threshold value

    if (analogSensor>sensorThres)

    {

digitalWrite(redLed, HIGH);

digitalWrite(greenLed, LOW);

        tone(buzzer, 1000, 200);

    }

else
```

```
{  
  
digitalWrite(redLed, LOW);  
  
digitalWrite(greenLed, HIGH);  
  
noTone(buzzer);  
  
}  
  
delay(100);  
  
}  
  
// Gas Leakage Detection & Automatic Alarm and Fan ON  
  
void gasDetected(float gasLevel){  
  
    if(gasLevel>= 200){  
  
        digitalWrite(buzzPin,HIGH);  
  
        digitalWrite(ledPin,HIGH);  
  
        digitalWrite(fan,HIGH);  
  
        lcd.setCursor(0,0);  
  
        lcd.print("GAS:");  
  
        lcd.print(gasLevel);  
  
        lcd.setCursor(0,2);  
  
        lcd.print("FAN ON");  
  
        delay(1000);  
  
        lcd.clear();  
  
    }else{
```

```
digitalWrite(ledPin,LOW);

digitalWrite(buzzPin,LOW);

digitalWrite(fan,LOW);

lcd.setCursor(0,0);

lcd.print("GAS:");

lcd.print(gasLevel);

lcd.setCursor(0,2);

lcd.print("FAN OFF");

delay(100);

lcd.clear();

}

}

//BUZZER

void buzzer(float gasLevel){

if(gasLevel>=200)

{

for(int i=0; i<=30; i=i+10)

{

tone(4,i);

delay(300);

noTone(4);
```



```
delay(4300);

}

}

}

// Manually Exhaust FAN ON
void exhaustFanOn(intbuttonState){
  if(buttonState == HIGH){
    digitalWrite(fan,HIGH);
    lcd.setCursor(0,0);
    lcd.print("Button State:");
    lcd.print(buttonState);
    lcd.setCursor(0,2);
    lcd.print("FAN ON");
    delay(10000);
    lcd.clear();
  }
}
```

## **CHAPTER-8**

### **8. Advantages**

1. Because of the very narrow 0.3 nm line width of the laser emission, there is no interference from other gases.
2. Response times are in the order 1 second. This allow for fine resolution/control when making process measurements.
3. The intense laser light concentrated at the absorption wavelength enables path lengths up to 1 km to be measured.
4. An average measurement is taken over the total path so that a narrow plume of gas has less chance of escaping detection.
5. The range of measurement can be up to 4 orders of magnitude, enabling concentrations of 0.1 ppm to 1000 ppm to be measured.
6. Because of the internal reference cell, the system is self-calibrating.
7. There is no 'poisoning' or degradation of the instrument with long term exposure to a gas.
8. Can easily be conformed to be 'Intrinsically Safe'.
9. Low maintenance and low operating costs.
10. Reliable technology.

### **Disadvantages**

1. 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.

## **CHAPTER - 9**

### **9. Conclusion**

The integration of fire detection and alarm systems with other building systems should increase fire safety in the building. The fire detection system will be able to communicate with other building systems, correctly discriminate between fire and non-fire threats, identify the exact location of a fire in the building and provide continuous estimates on smoke and fire spread in the building. However, the integration technology may also create new risks. Sensor technologies, for example, will need to be robust enough to prevent false alarms, and ensure that vital information such as the location of occupants is not lost due to data overload during a fire. Integrated building systems will need to be designed not only to give fire safety priority over other building activities but also that fire emergencies do not crash the building service system

## **CHAPTER - 10**

### **10. FUTURE SCOPE**

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.

## **CHAPTER 11**

### **11.Appendix**

#### **11.1 Source Code**

```
int redLed = 12;

int greenLed = 13;

int buzzer = 11;

int smokeA0 = A3;

// Your threshold value

int sensorThres = 400;

void setup() {

    pinMode(redLed, OUTPUT);

    pinMode(greenLed, OUTPUT);

    pinMode(buzzer, OUTPUT);

    pinMode(smokeA0, INPUT);

    Serial.begin(9600);

}

void loop() {

    int analogSensor = analogRead(smokeA0);

    Serial.print("Pin A0: ");

    Serial.println(analogSensor);

    // Checks if it has reached the threshold value

    if (analogSensor > sensorThres)

    {

        digitalWrite(redLed, HIGH);

        digitalWrite(greenLed, LOW);
```

```
tone(buzzer, 1000, 200);  
}  
else  
{  
    digitalWrite(redLed, LOW);  
    digitalWrite(greenLed, HIGH);  
    noTone(buzzer);  
}  
delay(1000);  
}
```

## 11.2 GITHUB & DEMOLINK

GITHUB : <https://github.com/IBM-EPBL/IBM-Project-24752-1659948405>

DEMOLINK : [https://drive.google.com/file/d/1yPsq1Ipe-p8eT2DmFxM9LuDSMYFl7hcz/view?usp=share\\_link](https://drive.google.com/file/d/1yPsq1Ipe-p8eT2DmFxM9LuDSMYFl7hcz/view?usp=share_link)

## **CHAPTER 12**

### **12.Reference**

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