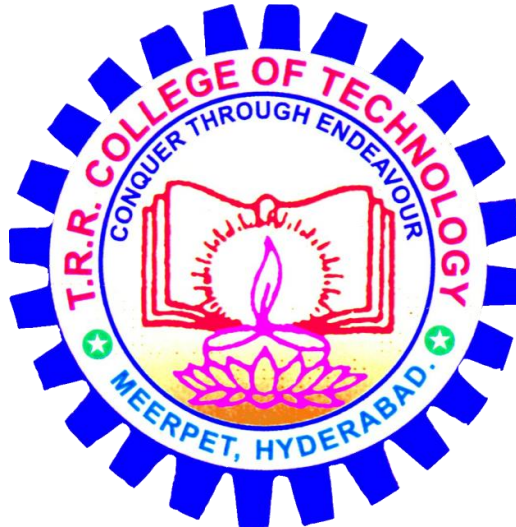


PROJECT REPORT
ON
FIRE AND GAS DETECTION USING NODE MCU



**Submitted in partial fulfillment of the requirements for the award of the
degree of**

DIPLOMA

IN

**ELECTRONICS AND COMMUNICATION
ENGINEERING**

**T.R.R COLLEGE OF TECHNOLOGY
(POLYTECHNIC)**

(Approved by AICTE, New Delhi & Affiliated to SBTET Hyderabad)

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DIPLOMA IN

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This is to certify that the project entitled on
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EXTERNAL EXAMINER

Project Guide

(Approved by AICTE, New Delhi & Affiliated to SBTET Hyderabad)



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ABSTRACT :

Fire and gas detections are vital issues for all spheres of lives where precautions are very Important. To ensure safety condition this research aims to build a prototype system that quickly helps house owners and firefighters to detect fires and gas leaks. However, in the past years, only few literature reviews have been proposed to researchers until year 2015. Provide sufficient safety devices and redundancy to detect, isolate and minimize uncontrolled releases of Flammable and toxic Liquids and gases. Methodology to provide a reference for predicting smoke detector response with computational fluid dynamics is presented. the system is designed to detect fire outbreaks as well as gas leakage using gas and temperature sensors, alert on detection. Fire detection systems located in aircraft cargo compartments which are currently based on smoke detectors. There are many incidents like explosions and fire accidents due to LPG gas leakage. such incidents can cause dangerous effects and also affect the human lives. An IOT based LPG leakage monitoring system will alert the people in the house if a gas leakage will be detected by the sensor, also it will send the data value to the Thing speak cloud. So the user can get these data's at any time. In this project , we are using Node MCU ESP8266 as a controller. LPG gas sensor is connected with a microcontroller, if a sensor detects the gas it will turn ON the buzzer and alert message will be displayed in the LCD display. Gas sensor value periodically updated in the cloud. LPG (Liquid Petroleum Gas) is used almost in every house for cooking purpose. This gas is highly inflammable and need to be careful while using it. There are situations where accidents have occurred and huge damage has been done. In this article we will build a LPG gas detection system using MQ5 Sensor.

INTRODUCTION :

Today, we live in a real world that implements (simulated) results, a simulated world in actual beginnings, depend on circumstances. Environmental conditions are carried out with data recorded to assure the situation. Are these worlds, that have been created, actually real or simulated? Have human inventions harmed the environment? Some would say that their inventions are working in harmony with nature while some will say that their inventions have been damaged by the environment that they lived in. That the power of nature against human inventions (e.g. tsunami, hurricane, heavy snowfall, flood, etc.)

At present, engineering based on human invention is based on a simulated world where it all begins. Models are scrutinized at various organizations, and some are applied in the petrochemical or oil and gas facilities. Inventors of internal combustion engines linked back to 2nd century in Switzerland where a crank shaft or connection rod was documented. Later used and developed up to present stage as a reciprocating device. Henry Ford the founder of Ford Motor Company sponsored the development of assembly line technique of mass production. Today, we see internal combustion engines massively in use with a variety of lean gas mixture designs.

In some applications, the complete Fire and Gas Detection SYSTEM are required at a huge cost for implementation for the safety and wellbeing of a defined population, e.g. including Motor Control Centre MCC/Switchgear Room, FM-200, Battery Room, and Control Room. Some requires only a SUB-SYSTEM, for smaller groups, where it will be safe for all in the vicinity (entry from process into utility areas/control building and addressable system to protect the personnel in living quarters). Or probably requires only a fire watch (in quarters) and a portable detector that accompanies the person to detect a gas leakage in its defined walk (utility) on occasional visits to the platform. Other method of studies: To apply noise detectors or microphone, due to small leakages. This is used to measure the amplitude of the noise as the frequencies are visible on the spectrum.

LIST OF COMPONENTS :

- Node mcu
- Flame sensor
- Gas sensor
- 5v amp adapter
- Channel Relay module
- LCD module
- DC fan
- Jumpers wires
- Buzzer

SOFTWARE :

- Arduino IDE software
- Blynk app

NODE MCU :



ESP8266 NodeMCU is an open source IoT platform.

It includes firmware which runs on the low cost Wi-Fi enabled ESP8266 Wi-Fi SoC from Express if Systems, and hardware which is based on the ESP-12 module. It has GPIO, SPI, I2C, ADC, PWM AND UART pins for communication and controlling other peripherals attached to it.

On board NodeMCU has CP2102 IC which provides USB to TTL functionality.

In this IoT Fire Alarm, we are using two GPIO pin to get the digital data from the flame sensor and gas sensor. The Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H₂, LPG, CH₄, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

NodeMCU is an open source platform based on ESP8266 which can **connect objects and let data transfer using the Wi-Fi protocol**. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc, it can solve many of the project's needs alone

ADVANTAGES OF NODE MCU :

- low cost
- integrated support for WiFi networks
- A smaller board size, and lower energy consumption.
- Better Processor & Memory

DISADVANTAGES OF NODE MCU :

- Memory limitations.
- Less powerful
- Processing power is weaker than the microcontroller

APPLICATIONS OF NODE MCU :

- Internet Smoked Alarm.
- VR Tracker.
- Octopod.
- Serial Port Monitor.
- ESP Lamp.
- Incubator Controller.
- IoT home automation.
- Security Alarms

SPECIFICATIONS OF NODE MCU :

OFFICIAL NODEMCU	NODEMCU CARRIER BOARD
Microcontroller	ESP-8266 32-bit
NodeMCU Model	Amica
NodeMCU Size	49mm x 26mm
Carrier Board Size	n/a
Pin Spacing	0.9" (22.86mm)
Clock Speed	80 MHz
USB to Serial	CP2102
USB Connector	Micro USB
Operating Voltage	3.3V
Input Voltage	4.5V-10V
Flash Memory/SRAM	4 MB / 64 KB
Digital I/O Pins	11
Analog In Pins	1
ADC Range	0-3.3V
UART/SPI/I2C	1 / 1 / 1
WiFi Built-In	802.11 b/g/n
Temperature Range	-40C - 125C

FLAME SENSOR :



The flame sensor is a short, thin metallic rod that **creates a small current of electricity to confirm the presence of a flame burning within the furnace**. As the gas valve opens to kickstart the combustion process, the current moves from the sensor to detect the heat from a flame. The IR flame sensor is **used to detect the presence of fire or other infrared source** (Flame or a light source of a wavelength in the range of 760 nm to 1100 nm can be detected). It can be used in fire fighting robot or heat seeking robot. **It can detect infrared light with a wavelength ranging from 700nm to 1000nm**. The far-infrared flame probe converts the light detected in the form of infrared light into current changes. Sensitivity is adjusted through the onboard variable resistor with a detection angle of 60 degree. A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 60°. The output of this sensor is an analog signal or digital signal. These sensors are used in fire fighting robots like as a flame alarm

ADVANTAGES OF FLAME SENSOR :

- industrial gas turbines, and many others to
- help mitigate a potential catastrophic fire
- Avoid of explosion
- Toxic gas release
- High-speed response

DISADVANTAGES OF FLAME SENSOR :

- it cannot be used for non-carbon fires as well as only being able to detect fires that emits both the UV/IR radiation not individually
- Basic flame tests rely upon the individual scientist to observe the colours produced

APPLICATIONS OF FLAME SENSOR :

- Hydrogen stations.
- Gas-fueled cookers
- Industrial heating and drying systems
- Domestic heating systems
- Industrial gas turbines

SPECIFICATIONS OF FLAME SENSOR :

- Spectrum range: 760nm ~ 1100nm.
- Detection angle: 0 - 60 degree.
- Power: 3.3V ~ 5.3V.
- Operating temperature: -25°C ~ 85°C
- Dimension: 27.3mm * 15.4mm.
- Mounting holes size: 2.0mm.

GAS SENSOR :



Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors.

Depending on their intended environments and functions, the physical makeup and sensing process can vary notably between sensors. One of the most commonly used gas sensors for toxic identification and smoke detection is the metal oxide based gas sensor. This type of sensor employs a chemiresistor which comes in contact and reacts with target gasses. Metal oxide gas sensors increase their electrical resistance as they come into contact with gasses such as carbon monoxide, hydrogen, methane, and butane. Most home based smoke detection systems are oxide based sensors

.

ADVANTAGES OF GAS SENSOR :

- Ability to Detect Fires Faster
- Notifications and Alert Services
- Reliability and Battery Life

DISADVANTAGES OF GAS SENSOR :

- Dense smoke tends to only obscure part of the light beam.
- whereas less-dense smoke particles can move around more freely.
- obscuring more of the light beam and therefore.
- impacting the alarm system
- .

APPLICATIONS OF GAS SENSOR :

- Semiconductor Manufacturing Industries: Gases like Methane (CH₄), Carbon Monoxide (CO), and phosphine (PH₃) are a key ingredient for semiconductor fabrication. ...
- Wastewater Treatment Plants: ...
- Oil and Gas: ...
- Chemical Industry: ...
- Mining:

SPECIFICATIONS OF GAS SENSOR :

- Type: Flame Sensor.
- Brand: Diligent.
- Voltage: 220 V.
- Frequency (Hz): 50 - 60.
- Material: 95% Alumina with glazed, Alloy steel.
- Thickness: 1.2 mm/2 mm.
- Usage: Industry.

5V AMPS ADAPTER :



SPECIFICATION :

Output Voltage	12 V
Current	5 A
Max Output Power	60 watt
Material	ABS Plastic
Color	Black
Input Voltage	240 V
Frequency	50 Hz
Type	adapter

CHANNEL RELAY MODULE :



A power relay module is **an electrical switch that is operated by an electromagnet**. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit. Relay modules **use low-level data signals to switch relays capable of handling loads up to 10 Amps**. Ideal for devices like PIR detectors and other sensors that output low level signals that need to turn another device on or off. Great for use with Arduino and other microcontrollers. Power Relay Module is one of the most simplistic components. However, they are also one of the most important. This is because they are **the link between low-powered digital electronics and high-powered devices**. They allow digital circuits and digital microcontrollers to switch high-powered devices on and off.

Relays are used to protect the electrical system and to minimize the damage to the equipment connected in the system due to over currents/voltages. The relay is used for the purpose of protection of the equipment connected with it. Relays are electric switches that **use electromagnetism to convert small electrical stimuli into larger currents**. These conversions occur when electrical inputs activate electromagnets to either form or break existing circuits.

ADVANTAGES OF RELAY :

- Let's start with the advantages of a relay.
- It allows us to control a remote device. ...
- Change contacts easily.
- Isolates the activating part of the actuating part.
- It works well at high temperatures.
- It is activated with low current, however, it can activate large machines of great power.

DISADVANTAGES OF RELAY :

- Contacts are damaged over time and continuous use (wear, oxidation, etc.)
- They generate a lot of noise with the activation and deactivation of the contacts.
- Switching time is high.

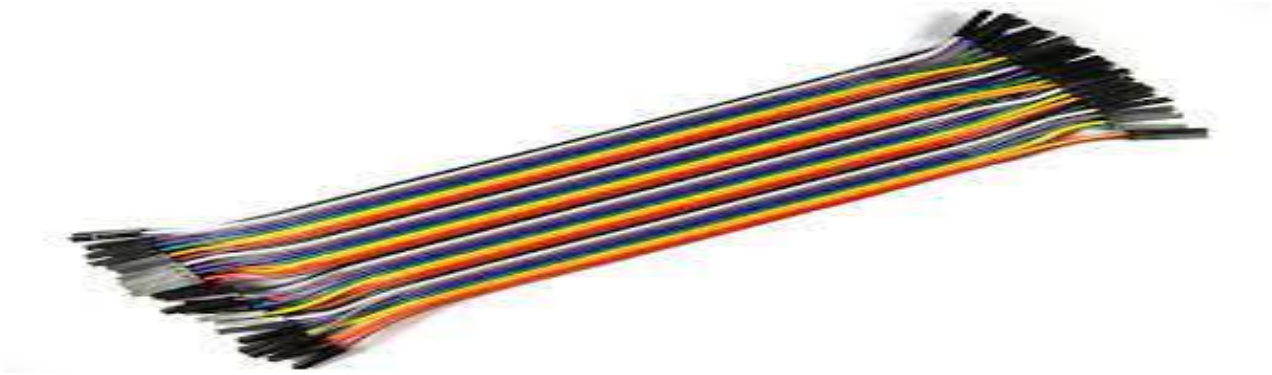
APPLICATIONS OF RELAYS IN ELECTRONIC CIRCUITS :

- Relay Drive by Means of a Transistor.
- Relay Drive by Means of SCR.
- Relay Drive from External Contacts.
- LED Series and Parallel Connections.
- Electronic Circuit Drive by Means of a Relay.
- Power Source Circuit.
- PC Board Design Considerations.

SPECIFICATIONS OF RELAY MODULE :

- Supply voltage – 3.75V to 6V
- Quiescent current: 2mA
- Current when the relay is active: ~70Ma
- Relay maximum contact voltage – 250VAC or 30VDC
- Relay maximum current – 10A

JUMPERS 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. Jumper cables are a pair of isolated wires of sufficient capacity with alligator clips at the ends of them to interconnect the dead battery of a car. **Having jumper cables is essential for every car owner**, because they will save you time and stress if you ever find yourself in an emergency. 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 **Jumper wires are usually solid, insulated copper conductor** with tin/lead plating (i.e.: wire wrap wire), although jumpers less than 25mm (0.984 in.) Jumper wires should not pass **over pads or vias used as test points**. Once jumper wires have been added to a circuit board, the less they are disturbed or moved, the better. Jumper wires shall not be routed under or over component leads or component bodies. In a computer, a jumper is **a pair of prongs that are electrical contact points set into the computer motherboard or an adapter card** . When you set a jumper, you place a plug on the prongs that completes a contact. In effect, the jumper acts as a switch by closing (or opening) an electrical circuit

ADVANTAGES OF JUMPERS WIRES :

- used to connect two points in a circuit.
- connects remote electric circuits used for printed circuit boards.
- Frequently used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

DISADVANTAGES OF JUMPERS WIRES :

- Could be difficult to use depending on connector/part location
- How it is connected into the circuit is critical has the potential of damaging the circuit.

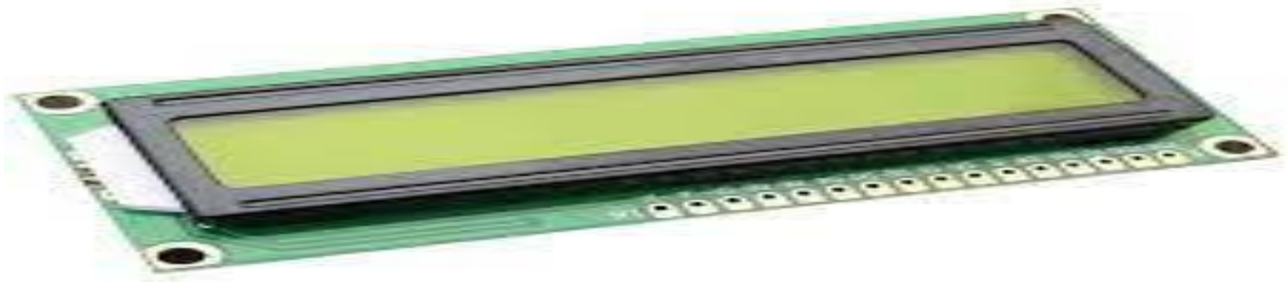
APPLICATION OF JUMPERS WIRES :

- connects remote electric circuits used for printed circuit boards.
- By attaching a jumper wire on the circuit
- A jumper is a conductor that is used to connect two or more points in an electrical circuit.

SPECIFICATIONS OF JUMPER WIRES :

- **Make - up** The conductor shall consist of a solid, wire of commercially pure annealed Copper, smoothly drawn, circular in section, uniform in quality, free from defects, uniformly coated with pure tin. The nominal conductor diameter shall be 0.6mm with a tolerance of +0.01mm
- **Insulation** Each conductor shall be uniformly covered with fire-resistive PVC insulation. The tensile strength of the material shall at least be 120 Kg/cm² and its elongation, minimum 100%. The nominal thickness of the PVC insulation shall be 0.25mm. Over all Insulated Conductor Diameter = 1.10 mm with a tolerance of +0.01mm. The insulation shall neither be loose around the wire nor adhere to it.
- **Twisting** The insulated A- and B- conductors shall be twisted with a uniform pitch to form a pair. The average length of pair twists in any pair in the finished cable, when measured on any 3m length shall not exceed 15cm. Two wires are twisted into a pair. The identification shall be unicolor: - A-wire = white. B-wire = black
- **Electrical Requirement** Reference Temperature: 200 C Loop Resistance of twisted pairs: max 132 Ohms/Km (66 Ohms/km for Single wire). Insulation Resistance: min. 200 Meg Ohms. Km Test Voltage: 500 V .rms. for 2 minutes
- **Admissible Temperature** During laying: 0 C to 500 C Before and after laying: up to 800 C Coil length m/coil: 250 + 1%

LCD MODULE :



LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and [seven-segment displays](#), as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small [pixels](#), while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

LCD screens are also used on [consumer electronics](#) products such as DVD players, video game devices and [clocks](#). LCD screens have replaced heavy, bulky [cathode-ray tube](#) (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and [plasma displays](#), with LCD screens

ADVANTAGES OF LCD DISPLAY :

- Energy Efficient. LCDs are known for their energy-efficient properties.
- Long-Lasting. Another advantage of LCDs is their ability to last for a very long time.
- LED Backlighting.
- No Screen Burn-In.
- Supports Small and Low-Profile Sizes.

DISADVANTAGES OF LCD DISPLAY :

- Sharpness. The CRT's Gaussian beam profile produces images with softer edges that are not as sharp as an LCD at its native resolution. ...
- Interference. All color CRTs produce annoying Moiré patterns. ...
- Geometric Distortion. ...
- Brightness. ...
- Screen Shape. ...
- Emissions. ...
- Physical.

APPLICATION OF LCD DISPLAY :

- Digital cameras
- watches
- digital clocks
- calculators
- mobile telephones
- Including smartphones.

DC FAN :



Direct current fan, uses a power source that is connected to a transformer. The transformer then converts the energy to direct current, or a one-way current. As a result, the quantity of power utilised is ultimately decreased.

A DC fan works pretty much on the same principle as the DC motor. A DC motor uses an internal arrangement of magnets with opposing polarity. As current passes through the coil around this arrangement, a strong magnetic field is produced. This magnetic field then creates a torque that causes the motor to rotate

SPECIFICATIONS :

- Operating Voltage : 12V DC.
- Type : DC.
- Operating Current : 0.08 Amp \pm 10%
- Rated speed : 5200 RPM \pm 10%
- Air volume : 15.5 CFM.
- Noise : 18dBA.
- Length : 50mm.
- Width : 50mm.

BUZZER :

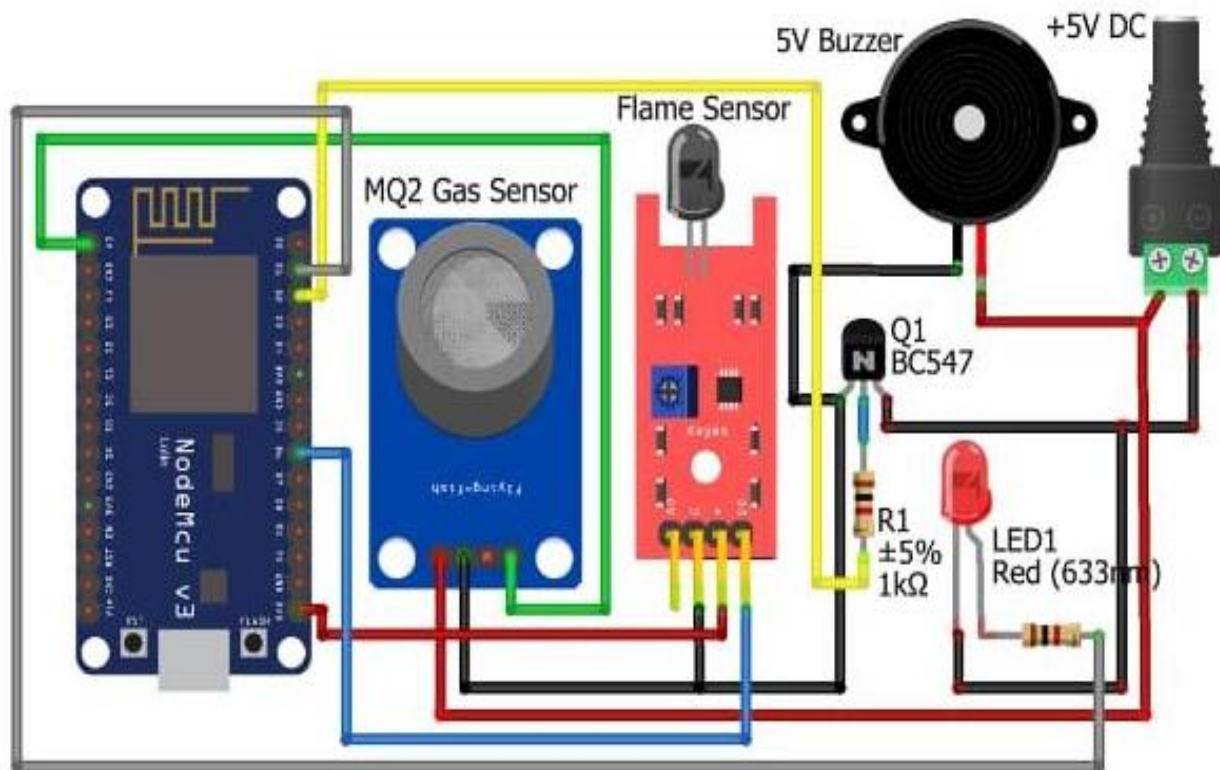


buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices

SPECIFICATIONS :

- Color is black.
- The frequency range is 3,300Hz.
- Operating Temperature ranges from – 20° C to +60°C.
- Operating voltage ranges from 3V to 24V DC.
- The sound pressure level is 85dBA or 10cm.
- The supply current is below 15mA.

BLOCK DIAGRAM OF PROJECT :



SOFTWARE :

ARDUINO IDE SOFTWARE :

The Arduino [integrated development environment](#) (IDE) is a [cross-platform](#) application (for [Microsoft Windows](#), [macOS](#), and [Linux](#)) that is written in the [Java](#) programming language. It originated from the IDE for the languages [Processing](#) and [Wiring](#). It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, [brace matching](#), and [syntax highlighting](#), and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the [GNU General Public License](#), version 2.

The Arduino IDE supports the languages [C](#) and [C++](#) using special rules of code structuring. The Arduino IDE supplies a [software library](#) from the [Wiring](#) project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable [cyclic executive](#) program with the [GNU toolchain](#), also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in [hexadecimal](#) encoding that is loaded into the Arduino board by a loader program in the board's firmware.

BLYNK APP :

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

Our mission is to make Internet of Things simple, accessible, and practical. Blynk is a software company that provides infrastructure for the internet of Things. In 2014 Blynk pioneered the no-code approach to IoT app building and gained global popularity for its mobile app editor

CODE OF PROJECT :

```
//Nextpcb
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

int led = 13; // Connected to D7 pin of NodeMCU
int flame_sensor = 12; //Connected to D6 pin of NodeMCU
int buzzer = 4; //Connected to D2 pin of NodeMCU
int relay = 5; //Connected to D1 pin of NodeMCU
int smoke_sensor = A0; //Connected to A0 pin of NodeMCU
int temp_smoke_sensor;
int flame_sensor_read;

// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "Auth Token"; // Enter Auth Token

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Your WiFi SSID"; //Enter the wifi name
char pass[] = "Your WiFi Password";// Enter the wifi password

void setup()
{
  pinMode(led, OUTPUT);
  pinMode(flame_sensor, INPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(relay, OUTPUT);
  pinMode(smoke_sensor, INPUT);

  digitalWrite(led, LOW);
  digitalWrite(buzzer, LOW);
  digitalWrite(relay, LOW);
  // Debug console
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
}

void loop()
{
  flame_sensor_read = digitalRead(flame_sensor); //reading the sensor data on A0 pin
  Blynk.virtualWrite(V0, flame_sensor_read); //sending data to Blynk
```

```

Serial.print("Flame Status:");
Serial.println(flame_sensor_read);

int led_status = digitalRead(led);
if (led_status == HIGH)
{
  Blynk.virtualWrite(V1, 255);
}
else
{
  Blynk.virtualWrite(V1, 0);
}

temp_smoke_sensor = analogRead(smoke_sensor);
Serial.print("Current Gas Level:");
Serial.println(temp_smoke_sensor);
if (temp_smoke_sensor > 500)
{
  digitalWrite(led, HIGH);
  digitalWrite(buzzer, HIGH);
  digitalWrite(relay, HIGH);
  Blynk.notify("Alert Smoke Detected");
}
else
{
  digitalWrite(led, LOW);
  digitalWrite(buzzer, LOW);
  digitalWrite(relay, LOW);
}

if (flame_sensor_read == 0)
{
  //Blynk.virtualWrite(V1, 255);
  digitalWrite(led, HIGH);
  digitalWrite(buzzer, HIGH);
  digitalWrite(relay, HIGH);
  Blynk.notify("Alert Fire Detected");
}
else
{
  digitalWrite(led, LOW);
  digitalWrite(buzzer, LOW);
  digitalWrite(relay, LOW);
  Blynk.run();}

```

CONCLUSION :

Gas leakage leads to severe accidents resulting in material losses and human injuries. Gas leakage occurs mainly due to poor maintenance of equipments and inadequate awareness of the people. Hence, LPG leakage detection is essential to prevent accidents and to save human lives. This paper presented LPG leakage detection and alert system. This system triggers LED and buzzer to alert people when LPG leakage is detected. This system is very simple yet reliable.