International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 241-244 www.ijaem.net ISSN: 2395-5252

Gas, Fire Detection and Prevention Using Arduino

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Date of Submission: 01-06-2023 Date of Acceptance: 10-06-2023

ABSTRACT:Gas leaks and fire incidents are major problems for our country. Our equipment is intended for use in home security, industry, residential and gas vehicles such as (CNG), natural gas and liquefied petroleum gas (LPG) equipment and heaters in buses. Unfortunately, many people in our country are not aware of gas leak detection. In our project, we are focused on developing such tools. We have based this device on two main sectors: detection and transmission modules and reception modules.

KEYWORDS: Arduinouno(Atmega328P), Node MCU (ESP8266), GSM Module, MQ-5 sensor, Flame sensor, Blynk cloud & app.

I. INTRODUCTION

Gas leakage and fire accidents are serious problems and now residential, industrial and vehicles like compressed natural gas (CNG), buses, cars etc. liquefied petroleum gas (LPG) is observed in many places. or propane, high calorific value, low smoke, etc. A flammable hydrocarbon gas mixture that is used as a fuel in many applications such as home, industry, cars, and vehicles because of its desirable properties, liquefied petroleum gas (LPG) is flammable and has the ability to ignite at a safe distance from a spark. This energy source mainly consists of propane and butane, which are highly flammable chemicals. This gas is very flammable.

In households, LPG is mainly used for cooking. If there is a leak, the leaking gas can cause an explosion. Gas leaks can cause a variety of incidents that lead to property loss and serious injury. Fires often occur in buildings, industries and vehicles and threaten human life and property in recent years. The danger of explosion, fire, suffocation based on its physical properties, poisoning, burning, etc. In recent years, the number of deaths due to gas canister explosions has increased. The Bhopal gas disaster is an example of an accident due to a gas leak.

To reduce human injury/fatality, this system is designed to detect gas, fire leaks and operates on a 5-step basis and is as follows:

a. The MQ-5 sensor first detected a gas leak.
b. Smoke detectors are used to detect fires.
c. Once gas or fire is detected, it will alert the owner or those who see a gas leak at home with an alarm.
d. The GSM module is used to notify users of gas or fire incidents when they are not at home.
e.The user is connected with Arduino through Blynk APP, he can control the Servo motor interfaced with Arduino and now he can turn off the gas cylinder button with the help of the servo motor.

II. METHODOLOGY

Gas fire detection and prevention using Arduino works as per above flowchart:

- Where flame and MQ-5 sensors are placed within the vicinity of the fuel source.
- In case of leakage of gas, its detected by MQ-5 sensor if the fuel (i.e., Butane or LPG) concentration is above 220ppm and gives analog and digital output of which former is fed to the Arduino and latter activates the buzzer.
- Generally, fire starts after gas leaks and lights up so if source i.e., is turned off it can be avoided. So, when gas is detected or even fire via flame sensor buzzers will alert nearby members to switch off manually.
- After gas leak is detected the Arduino board which is configured to activate the GSM module will do so and send and SMS to registered numbers within the code below.

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- The registered user after receiving the notification can open the Blynk App, and control the servo motor (via Blynk Cloud) attached to the regulator and shut it off mitigating large scale damages.
- Controlling of the servo motor is done using Node MCU i.e., a wi-fi module connected to home wi-fi network. Using this the servo motor is controlled via Blynk App.

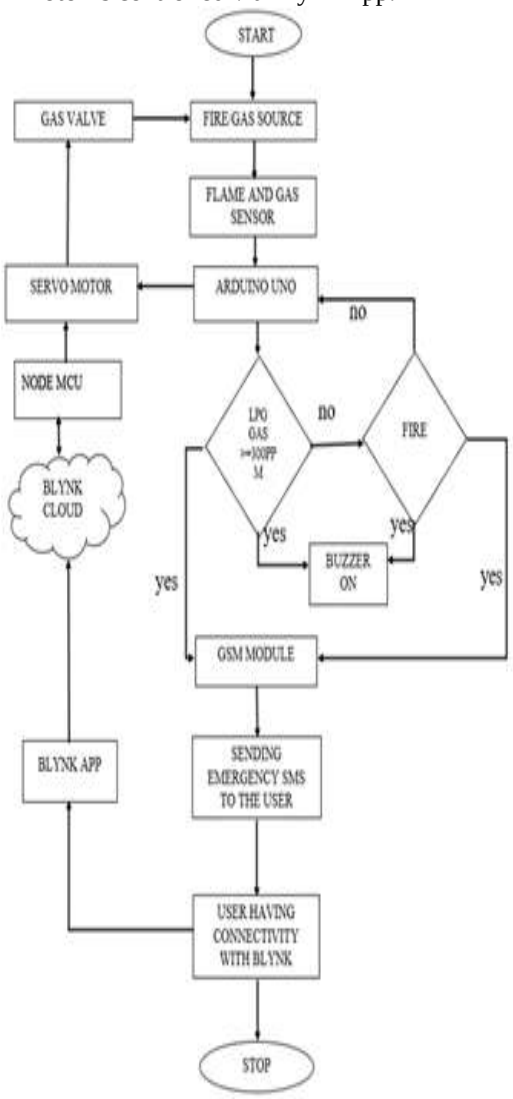

Fig.1 Flowchart

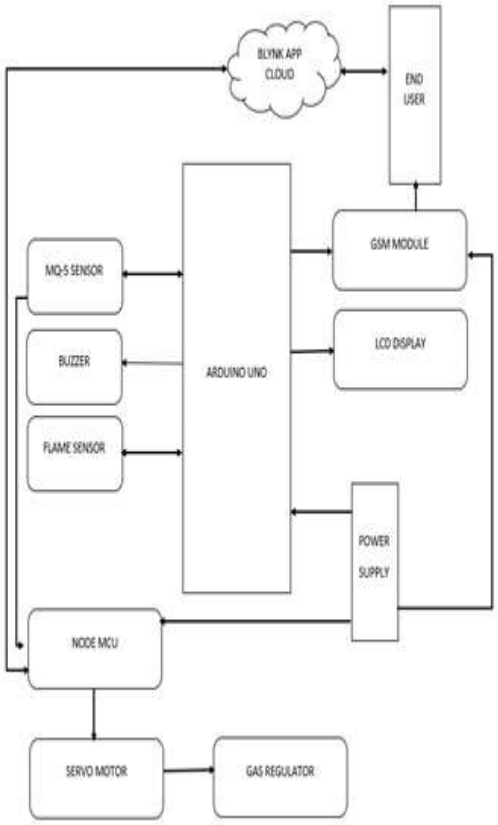

Fig.2 Block Diagram

Code:

```
#include <SoftwareSerial.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2); // set the LCD address to 0x27 for a 16 chars and 2 line display
SoftwareSerialmySerial(9, 10);
const int buzzer = 13;
const int flame = 6;
const int smoke = A0;
int thresh= 300;
int status = true;
String alertMsg;
String mob1="+919908205311";                    // Enter first mobile number with country code
String mob2="+918217050099";                    // Enter second mobile number with country code

void setup()
{
  pinMode(smoke,INPUT);
  pinMode(flame,INPUT);
  pinMode(buzzer, OUTPUT);

  lcd.init();                    // initialize the lcd
  lcd.clear();
  lcd.backlight();
```

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```
  mySerial.begin(9600);   // Setting the baud rate of GSM Module
   Serial.begin(9600);    // Setting the baud rate of Serial Monitor (Arduino)
  delay(100);
}
void siren(int buzzer){
  for(int hz = 440; hz< 1000; hz++){
    tone(buzzer, hz, 50);
    delay(5);
  }

  for(int hz = 1000; hz> 440; hz--){
    tone(buzzer, hz, 50);
    delay(5);
  }
}

void loop()
{
                Serial.println("Gas Val: "+String(analogRead(smoke))+", Flame state: "+String(!digitalRead(flame)));
       if (digitalRead(flame)== LOW || analogRead(smoke)>thresh) //Flame or Smoke or Button detected
  {
    siren(buzzer);

    if(digitalRead(flame)== LOW){
      lcd.setCursor(2, 1);
      lcd.write(1);
      lcd.setCursor(4,1);
      alertMsg= "FIRE HIGH";
      lcd.print(alertMsg);
      lcd.setCursor(4,0);

lcd.print("SMOKE:"+String(analogRead(smoke)));
    }
    if(analogRead(smoke)>thresh){
      lcd.setCursor(2, 0);
      lcd.write(1);
      lcd.setCursor(4,0);
      alertMsg= "SMOKE HIGH";
      lcd.print(alertMsg);
      lcd.setCursor(4,1);

lcd.print("FIRE:"+String(digitalRead(flame)==LOW?"HIGH":"LOW"));
    }
    Serial.println(alertMsg);  //print on lcd
     if(status){   // run 1 time only when detects the fire after fire detection
       status = false;
       String msg= "Alert Type: "+alertMsg;
       SendMessage(msg,mob1);
       delay(100);
       SendMessage(msg,mob2);
     }
   }
   else{
     status = true;
     lcd.setCursor(4,0);

lcd.print("SMOKE:"+String(analogRead(smoke)));
     lcd.setCursor(4,1);

lcd.print("FIRE:"+String(digitalRead(flame)==LOW?"HIGH":"LOW"));
     noTone(buzzer);
   }
   delay(0);
   lcd.clear();
}

 void SendMessage(String msg, String mob)
{
  Serial.println(msg);  //Message sent to Mobile
   mySerial.println("AT+CMGF=1");      //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\""+mob+"\"\r"); // Replace x with mobile number
  delay(100);
  mySerial.println(msg);// The SMS text you want to send
  delay(100);
    mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);

}
```

III. RESULT AND DISCUSSION

The results and analysis of gas fire detection and prevention using Arduino, can be evaluated based on its effectiveness, accuracy, and reliability in detecting gas leakage or fire, turning off the gas regulator, and sending a notification to the user. The system has been found to be effective in detecting gas leakage and fire using sensors, and turning off the gas regulator using the servo motor. The GSM module has also been found to work well in sending notifications to the user about the potential danger.

In terms of accuracy, the system has been found to be quite reliable. The sensors used in the system are sensitive enough to detect even small amounts of gas leakage or fire, and the servo motor is able to turn off the gas regulator quickly and

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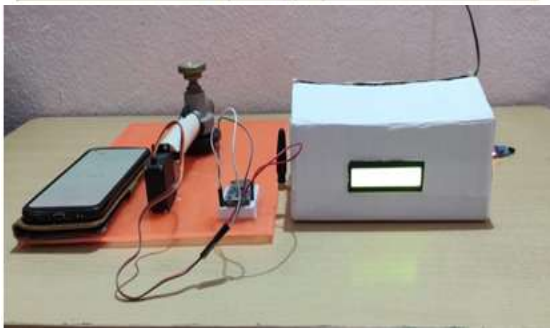
efficiently. The reliability of the system can be further improved by using more advanced sensors and machine learning algorithms to improve the accuracy of the system.



IV. CONCLUSION

The objective of the project was to design and implement a gas, fire detector for giving an alarm and emergency call warning when there is fire detection. The detector has been designed that uses a MQ-5 for gas and flame sensor for sensing fire and a fluorescent starter for detecting high temperature fire. The both the sensor give a buzzer warning to show that there is gas and fire detected and the fluorescent starter is used to make an emergency call when high temperature fire is detected. The sensor is capable of showing a gas concentration from 300ppm to 10,000 ppm. The objective of designing a highly accurate low-cost gas leakage detector has been well achieved and shown in demonstration.

There are many ways in which this safety system can be built and it may involve complex circuitry. The other modification which can be implemented in this gas leak detector is using a tripper circuit which will trip off the main electric supply once the gas leak is detected. During a gas leak, it is dangerous to switch any appliances as it may spark and this tripper circuit helps to reduce the

V. FUTURE SCOPE

The future scope of gas fire detection and prevention using Arduino is very promising. With the increasing use of gas appliances in homes and commercial spaces, the need for a reliable gas fire detection and prevention system is becoming more important.

Some further improvements to our project are:

- Using Raspberry Pi module and configuring it to transmit live situation of the kitchen in case of emergency and to control fire extinguisher and put out the fire.
- Integration of artificial intelligence and machine learning algorithms to improve the accuracy and efficiency of the system. This can allow the system to learn from previousincidents and predict potential hazards before they occur.

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