Gas leakage detection kit: At a low cost

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Abstract
Home/Industrial fires had taken toll over many lives and vandalized property in last few decades. LPG is extremely unstable, volatile, and combustible gas and can burn at a fair interval from the sight of leakage. Generally, fire incidents and accidents take place due to use of bad quality rubber tubes or improper regulator shutdown. Although the regulator is turned off, small amount of gas is still present in the tube between knob and regulator. In case, if the knob is turned on, it would result in leakage of gas. This results in necessity of a gas detection system to be installed in accident prone areas for continuous monitoring. The proposed system will monitor the environment for any leakage and alert the user via buzzer in case if leakage is detected.

This paper assists the advancement in industrial science to detect LPG gas leakages and ensuring right response in the times of emergencies.

Introduction

Presently there are more than 278 million LPG connections in India. The rise in number of gas connections has resulted in a rise in the number of accidents due to LPG leakage. In 2019, gas leakage claimed lives of 107 people. Hence, in today's world it is necessary to handle gas cylinders carefully and maintain safety.

Using IoT, the user can be alerted if the leakage is detected, and further leakage and major accidents can be prevented. In the proposed system, sensor will be used to detect gas leakage which will inform the microcontroller board which in turn will perform the further actions like ringing the buzzer. Hence, potential accidents can be prevented.

Liquefied Petroleum Gas (LPG) is a highly flammable gas made up of hydrocarbon gases like propane and butane. It is colourless and odourless gas. Therefore Ethanethiol (Ethyl Mercaptan) is added in it which gives a distinctive smell to gas so that any gas leakage is promptly detected. Other odorants like EN589, tetrahydrothiophene and amyl mercaptan are also used internationally. LPG gas boiling temperature is -42°C thus it is stored under pressure in a cylindrical container.

LPG has come up as one of the alternative fuels nowadays. The gas is used for heating applications like cooking, hot water, and various other purposes. It is even used as alternative fuel in vehicles due to soaring prices of other conventional fuels. So, the gas is widely used across various arenas.

Being a highly volatile gas, it is of much importance to immediately detect any leakage in the system and take further avoiding actions.

Literature Review

1. Koluthungan.S *et.al.* [1]

The paper discusses about the gas leakage detector. The gas leakage security approach is highly essential in order to avoid accidents occurring due to gas leakage. The proposed system makes use of the MQ-6 sensor to detect any leakage. In case of leak, it turns on the buzzer and notifies the client by sending SMS message. GSM module is used to send the SMS message. The system also turns off the main power and gas supplies. The objective of the system is to construct cost effective system for automatic detection and gas leakage.

2. Prof. Pranay Meshram *et.al.* [2]

Designed a wireless LPG gas detection system. The system makes use of MQ-5 sensor to detect LPG gas leakage. When the systems detect LPG gas in the atmosphere above a certain level it alerts the user by sending the SMS on the registered mobile phone, also turns on the sound alarm and displays a notification on the LCD screen. Arduino sensor is used to carry out these

functions simultaneously. The system is useful to avoid the fire accident and provide house safety.

3. Prof. Ashish Srivastava *et.al* [3]
Proposed a fixed system for gas detection and prevention at industrial and residential spaces. The system consists of three main stages 1. Gas leakage detection by using MQ-6 sensor 2. Receiving the information from the sensor and activating other external attachments. 3. Turning on the buzzer, notification on the LCD screen, SMS alert and stepper motor to cut off the gas supply. The system makes use of the GSM module to send the SMS alert. The paper provides design approach to on both software and hardware for leakage detection and prevention.

4. Prof. Huan Hui Yan and Prof. Yusnita Rahayu [4]
With the help of Arduino and Zigbee wireless gas leakage monitoring system has been designed. The system stands apart from the other units by displaying levels of gas concentration in a room. It makes use of LabVIEW GUI display for this purpose. The proposed system is completely autonomous; it can cut off main power supply within 10 minutes of leakage detection and can trigger exhaust fan to ventilate the space to prevent further potential accidents. Thus, the system allows continuous monitoring of the room from safe distance.

5. Prof. Mohammad Monirujjaman Khan [5]
Proposed a sensor-based gas leak detector with an alert system. A gas sensor (MQ6) is used for detection of gas leakage. To give an audio-visual indication of detected gas leakage the system has an alarm unit to sound an alarm. Gas concentration is displayed using LCD and LEDs are used to specify the leakage level. The proposed design is portable, cheap, low maintenance, lightweight and energy efficient.

Problem Statement
Gas leakage may lead to economic loss as well as casualties. In day-to-day life, surrounding environment plays important role in health issues. The chances of fire, explosion and suffocation depend upon physical properties of gases like toxicity and flammability. The increasing number of casualties due to gas cylinder explosions has become cause of concern in recent years. The core reasons for such explosions are inferior cylinders, ruined up regulators, old valves and lack awareness while handling cylinders.

Objective
General Objective: To supply means to detect gas leakage to prevent explosions and damage.
Specific Objective: To construct an unit that will fabricate a sound alarm and show a notification on Blynk app when gas leakage is detected.

Scope
1. Detects Butane, Propane, alcohol, LPG leak, or any such petroleum centred gaseous, volatile material.
2. Alerts user by generating sound alarm whenever leakage is detected.
3. Transmit notification to consent person using Blynk application.

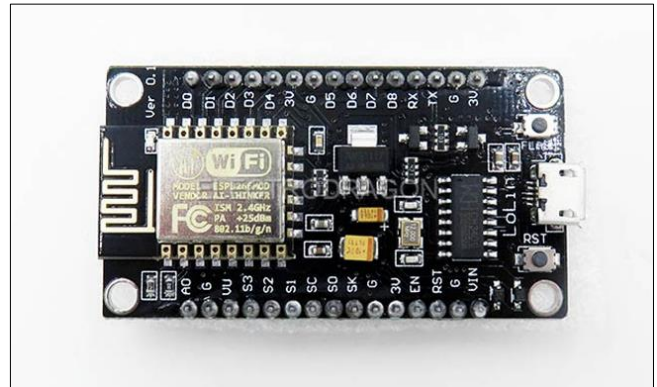**Project Overview**
1. Node MCU

Fig 1

Node MCU is a cheap open-source IoT platform that consists of a microcontroller unit (small computer) on a single IC chip. The micro-controller contains one or more processing units (CPU) along with programmable input/output links and a short memory.

2. Gas sensor MQ3

Fig 2

Gas Sensor (MQ3) unit is used to detect gas leaks in houses, apartments, and industries. Benzene, Alcohol, CH4, CO, LPG can be detected efficiently. Potentiometer can be used to regulate the sensitivity of sensor.

3. Buzzer
A buzzer is an audio signalling device.

Fig 3

4. Power supply

Fig 4

5V DC power supply is used.
5. LED

Fig 6

When current flows through the light-emitted diode it emits light to give a signal.

Experimental setup
Hardware requirements are gas sensor (MQ3), 5V DC power supply, buzzer, LED, MCU.
Software required is ARDUINO Compiler (IDE) – The free publicly available Arduino Software (IDE) enables user to upload the code to the panel. It runs on all operating systems like Mac OS X, Windows, Linux. The program is drafted in C.
Keep the gas sensor in clean environment and upload the program below.

```
#include <ESP8266WiFi.h>
BlynkTimer timer;
#define BLYNK_PRINT Serial // Comment this out to
disable prints and save space
char auth[] = ""; //Enter Authentication code sent by Blynk
on your regested email
 char ssid[] = "hotspot"; // Enter WIFI Name Here
char pass[] = "12345678"; // Enter WIFI Password Here
int mq2 = A0; // smoke sensor is connected with the analog
pin A0
int data = 0;
void setup()
{
```

```
Serial.begin(115200);
pinMode(D5,OUTPUT);//RED LED
pinMode(D6,OUTPUT);//GREEN LED
pinMode(D7,OUTPUT);//BUZZER
}
void loop()
{
timer.run(); // Initiates SimpleTimer
Blynk.run();
}
void getSendData()
{
data = analogRead(mq2);
Blynk.virtualWrite(V2, data);
if (data > 700 )
{
Blynk.notify("Gas leakage Detected!");
digitalWrite(D5,HIGH);
digitalWrite(D6,LOW);
digitalWrite(D7,HIGH);
}
else
{
digitalWrite(D6,HIGH);
digitalWrite(D5,LOW);
digitalWrite(D7,LOW);
}
```
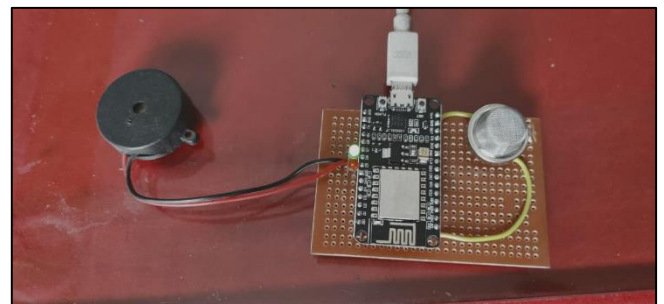
Photo of experimental setup

Fig 7

Table 1: Cost Estimation

Components	Cost
Buzzer	30
Node MCU	260
PCB	180
LED	10
Wires	70
MQ3 Gas sensor	93
Total	643

Conclusion
The LPG gas leakage detection system has the potential to detect gas leakage at industries, restaurants, houses, etc. As the leakage is detected, the user will be alerted with a notification on the Blynk Application platform. The MQ3 gas sensor is operated to detect promptly the escape of gas. After leakage detection, other externally connected devices are triggered, and the microcontroller unit receives the electrical signal. The construction cost involved is less than its other counterparts in the market.

Future Scope

Various control elements can be attached to the existing system in order to automatically control gas leakage when the upper explosive limit is reached. Mobile robots and portable units can be manufactured for industrial purposes which can detect multiple gases. Along with the gas sensor, a temperature sensor can also be installed into the high-pressure gas cylinder and pipeline to alert the user in case of high temperature.

References

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