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Security Robot with Gas Leak Detection

Gokuldas.T¹, Adarsh.C², Farsha.M³, Muhsina.C⁴, Thasneem.P⁵, Reshmi R Das⁶

U.G. Student, Department of Electronics and communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India¹, <https://orcid.org/0009-0001-0025-4196>

U.G. Student, Department of Electronics and Communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India², <https://orcid.org/0009-0004-2708-4563>

U.G. Student, Department of Electronics and Communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India³, <https://orcid.org/0009-0003-8162-7541>

U.G. Student, Department of Electronics and Communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India⁴, <https://orcid.org/0009-0009-3081-5933>

Assistant Professor, Department of Electronics and Communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India⁵, <https://orcid.org/0009-0001-1099-0541>

Head of The Department, Department of Electronics and Communication, Eranad Knowledge City Technical Campus, Manjeri, Malappuram, Kerala, India⁶, <https://orcid.org/0009-0002-2587-628X>

ABSTRACT: The number of accidents due to gas leakages increasing day by day, we can see these accidents mainly in gas Industries or in the time of transporting it, and we can see several examples of accidents due to flammable gases. Many individuals got injured seriously and some died in these accidents. The gas leakages are mostly happening in Industries or in the pipelines which transport gases. In the suggested system we use a ‘Security robot with gas leakage detection’ to identify the gas leakage. It will send an alert to the desired authority and the officers if any leakage is detected. It is a robot which moves around an industry or it follows gas pipeline for identifying gas leakages, the robot is also equipped with a surveillance camera for identifying trespasses and crimes. The robot can be controlled in both automatic and manual mode.

I. INTRODUCTION

Gases are commonly used for cooking and used as a fuel, as we all know gases are highly inflammable and it need more care and security while using and transporting it. Leakage of these kinds of gases cause accidents and the humans get affected harmfully. By the development of technologies, now the world can witness different advanced types of security equipment for different uses. Today, technology is one step ahead than human extension.

This proposed system specifically aimed at reducing the risk of gas leakage anywhere in the home, office, industry, or utility line. Main purpose of this paper is to develop a robot that can detect and locate leaks and reduce the hazard of leaks and warning relevant officers and authorities. Here we use a NODEMCU for controlling other assembled circuits or devices that helps to achieve the goal of reducing accidents due to gas leakages. The robot mainly consists of an MQ-2 gas sensor which rapidly senses any presence of gases like methane (CH₄), propane (C₃H₈), butane (C₄H₁₀) etc. The robot relates to a camera for surveillance purpose and also uses an IR sensor for avoiding objects in its path.

Furthermore, the system relates to a GPS module to locate the accurate spot of gas leakage, it will help the authority to identify the accurate spot of leakage and clear up it quickly for avoiding hazardous situations over there.

II. RELATED WORK

The number of explosion accidents increasing day by day. Majority of these accidents are forms by explosion of gas cylinders. This type of accidents is increased recently [1]. In 1910 LPG is invented by Dr. Walter Snelling. Both LPG and natural gas are very environmentally friendly and they can be easily detectable when it spread in the atmosphere [2].



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Underground gas pipeline may undergo to corrosion. This corrosion will lead into gas leakage. The implemented robot will go to hazardous and dangerous area [3]. In some situation some people a get injured and some people got dead due to explosion. The aim of this project is to detect the gas leakage in underground pipeline and it can be continuously monitoring through this [4]. Moreover, this project contains MQ6 gas sensor it can be detecting the gases and GPS module will give the information about that gas leaked location [5].

Gas leakage detection methods became a major issue after the effects of harmful gases on human health. Before modern electronics, faulty detectors are used for the gas leakage detection. In 19th and 20th centuries coal miners are used to leave Canaries in tunnels as early detection system to find poisonous gases such carbon dioxide, carbon monoxide and methane. The first gas detector is introduced by Sir Humphry Davy, it was the flame safety lamp or Davy lamp. Which is used to detect the methane content in coal mines. In flame safety lamp contain a oil flame which can be adjusted to particular height in fresh air. This oil flame is varied to specific height when it found a harmful gas. Its flame height will be higher become when it detects the presence of methane content and lower become lack of oxygen. Johnson-Willians instruments is the world's first gas detection company was invented in 1928 in Palo Alto. This company produced so many portable oxygen detectors and combustible gas detectors [6]. The instantaneous values of the extracted dynamic response/recovery plots for various test gases viz., LPG, CCl4, CO, and C3H7OH were correlated to its neighboring response plots by the use of proposed ASM technique [7]. There are numerous strategies available for booking an LPG gas in the gas office. Strategies include web-based booking, telephonic booking and so on. In some cases, we may neglect to do the booking because of the different reasons. It will be troublesome circumstance for the person who utilizes LPG gas for cooking consistently. So, we have proposed a method which naturally book a cylinder when the gas is going to empty by sending a SMS by utilizing GSM. In our task we have utilized load cell to find the weight of the LPG gas consistently [8-10].

III. METHODOLOGY

Gas pipes play very vital roles for towns, industries and developing economies. Gas leakages result in losses and are risky because they also cause health injuries. Putting sensors at every pipe segment could be very expensive. In this project we are using a robotic vehicle that So here we present a progressive robotic that directly inspects the outer surface of the gas pipe for leaks. Gas leaks are detected by its gas sensor. The robot monitoring of gas leaks continues, As soon as a leak is detected, it transmits the location of the leak to the IOT login system via an interface GPS sensor, and give a alert message to the mobile phone.

This project will use a NODEMCU based on Blynk esp8266. A blynk notification will be sent to your smartphone when the gas concentration increases. The system detects gas leaks in this way. And find the location in the gas leaked area by using GPS module. Here the robot works on two ways one is automatically and another one is manually controlling by the mobile phone. Line follower using the automatically and blynk app for manually controlling. And also a surveillance camera in the robot for security purposes.

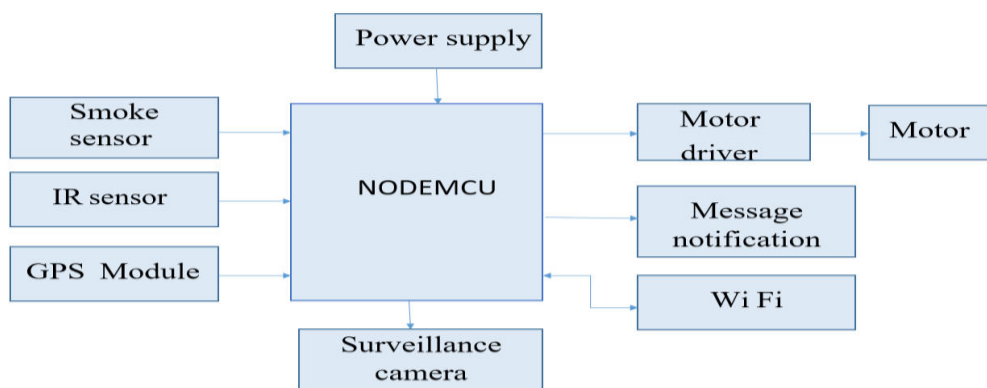


Fig 3.1 Block Diagram

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The principle part of this project is NODEMCU. It used ESP8266 microcontroller within the board with WIFI capability. MQ2 gas sensor is used as the smoke sensor to come across the gas leakage. GPS module is used to discover the area of the gas leakage and digital camera is used to track the location with visualization. We're using the usage of BO vehicles and IR sensor for robotic movement. Strength financial institution or a battery is used to deliver electricity for this assignment. The robot moves in line follower using the help of IR sensors and the help of mobile app. The hardware sections the NODEMCU is the part and MQ2 gas sensors. The software section we are using Arduino IDE. In this software we are using C programming.

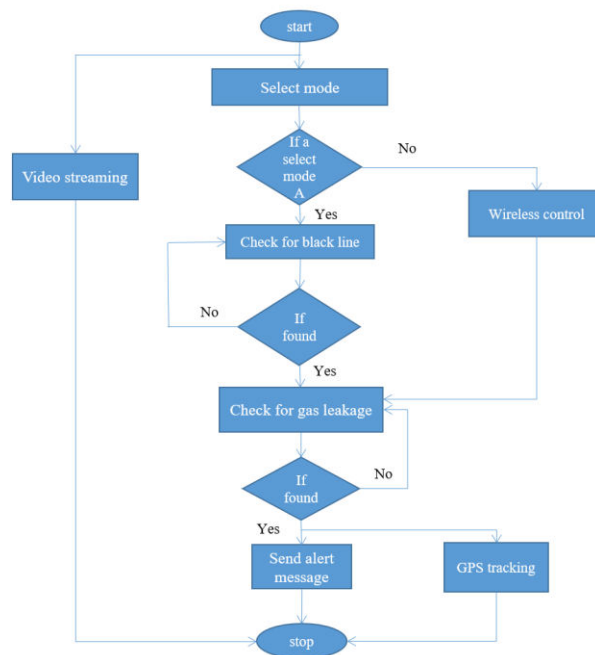


Fig 3.2 Flow Chart

Fig 3.2 shows the flow chart of the project when the device is turned on the system start streaming the video camera and also identify the mode of operation if the mode operation is automatic the system check for black line. When the gas detect it immediately send an alert message and find the location. And the mode of operation is wireless the system check for gas leakage while the described by the operator. When the gas is detected it send an alert message and find the location using GPS.

HARDWARE

NODEMCU: NODEMCU is an open source software and hardware development environment. The ESP8266 contains all the main components of a modern computer: CPU, WIFI network, RAM, as well as modern hardware and SDK. ESP8266 is inexpensive, so it has good opportunities for IoT projects. Each microcontroller can access WIFI network

through ESP8266 WIFI module with TCP/IP protocol stack. The ESP8266 is a 32bit microcontroller with a clock speed of 80MHz and 3v working voltage. It has 11 digital I/O pins, 1 analog input pin and 17 GPIO pins.

LPG Gas Sensor: The MQ2 is LPG gas detecting sensor. It is a MOS (metal oxide semiconductor) sensor it also called chemiresistor. It operates at 5V DC and 800mW. It also detects range from 200 to 10000ppm smoke, methane, propane and carbon monoxide. MQ2 has two parts the lower part is clamp ring and upper part is anti-explosion network.

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GPS Module: Here we are using Neo 6m GPS Module. Neo 6m are lower power consumption and very popular with 2.5 m horizontal position accuracy. It has 4 pins GND, TX, RX and VCC. Neo 6m GPS Module are easily interface with Arduino and NODEMCU.

ESP32CAM: The ESP32-CAM is a small length, low energy consumption digital camera module based on ESP32. It comes with an OV2640 camera and presents onboard TF card slot. The ESP32-CAM can be broadly utilized in wise IoT programs which include wireless video monitoring, WiFi photo add, QR identification, and so forth.

SOFTWARE

ARDUINO IDE

Arduino ide is a open software that used to program the Arduino, NODEMCU boards. c programming used in this software's.

IV. EXPERIMENTAL RESULTS

Figure shows the software part of this project. Fig 4.1 shows the Blynk IOT mobile application settings it is a mobile application the alert message to the NODEMCU come to this application and also manually controlling of the robot using in this application.

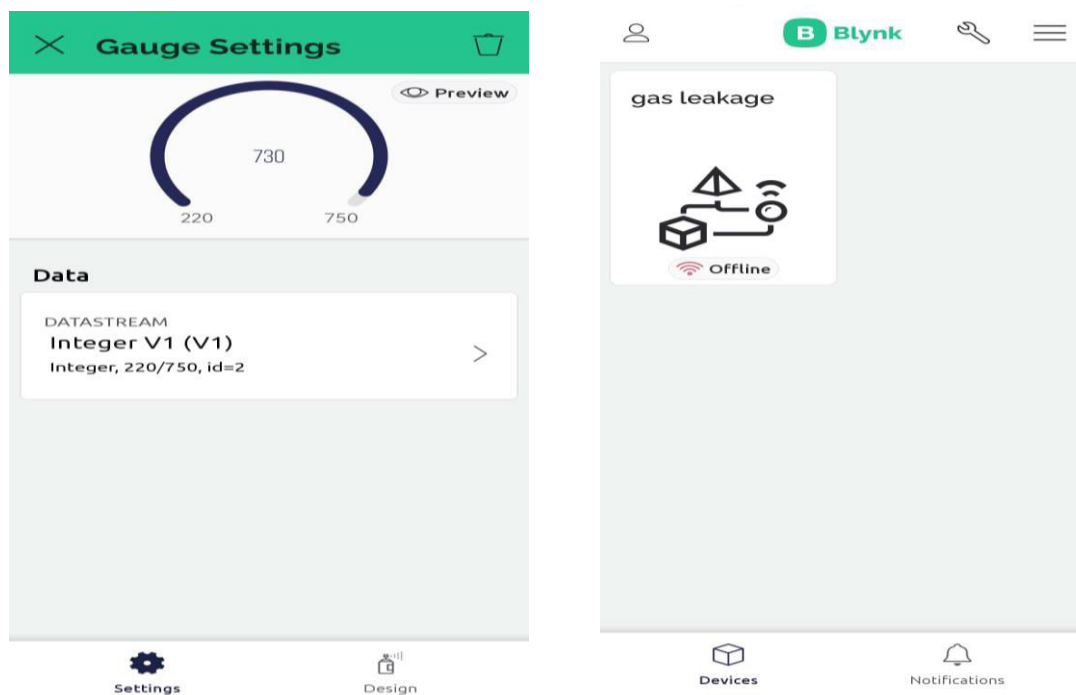
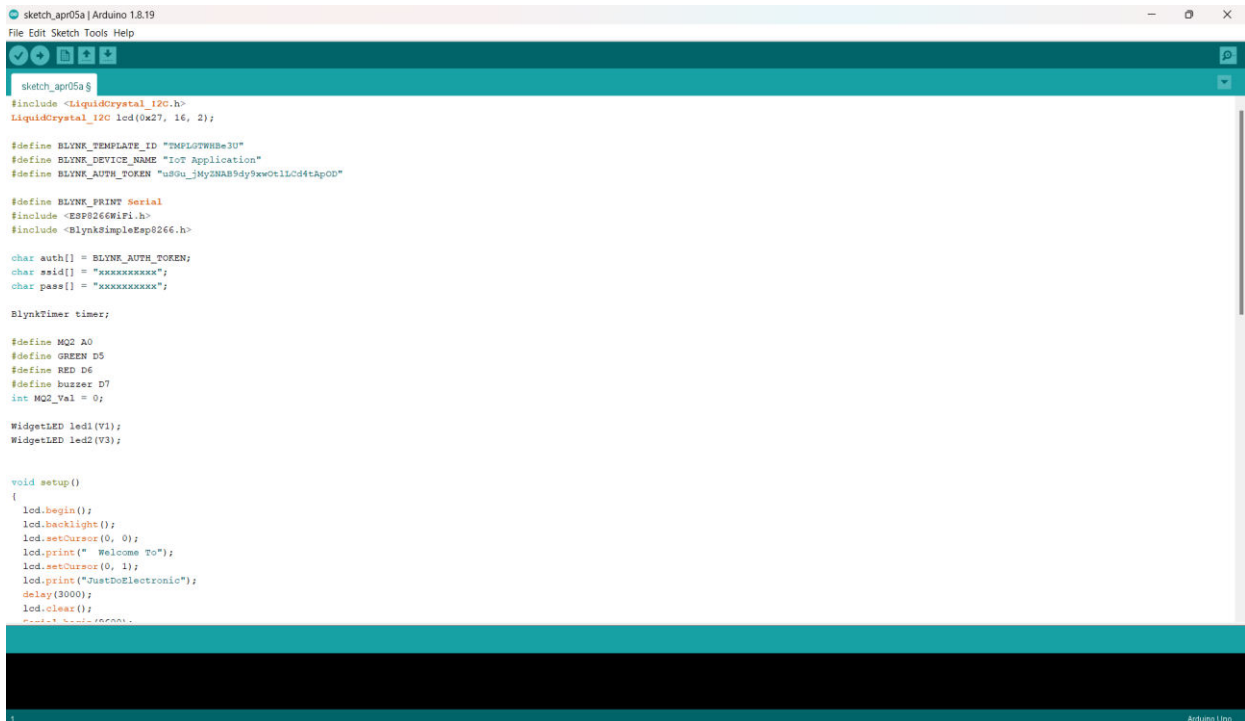


Fig 4.1 Blynk IOT Mobile Application Settings



```

sketch_apr05a | Arduino 1.8.19
File Edit Sketch Tools Help

sketch_apr05a
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);

#define BLYNK_TEMPLATE_ID "TMPL0TWR8e3U"
#define BLYNK_DEVICE_NAME "IoT Application"
#define BLYNK_AUTH_TOKEN "u8Ou_My2MAB5dy9xw0t1Lc04tAp0D"

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "XXXXXXXXXX";
char pass[] = "XXXXXXXXXX";

BlynkTimer timer;

#define MQ2_A0
#define GREEN_D5
#define RED_D6
#define buzzer D7
int MQ2_Val = 0;

WidgetLED led1(V1);
WidgetLED led2(V3);

void setup()
{
  lcd.begin();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print(" Welcome To");
  lcd.setCursor(0, 1);
  lcd.print("JustDoElectronio");
  delay(3000);
  lcd.clear();
  pinMode(buzzer, OUTPUT);
}
    
```

Fig 4.2 Upload the code to the NODEMCU using Arduino IDE Software

Fig 4.2 is showing the Arduino IDE software to upload the codes to the NODEMCU .it upload the codes into the microcontroller. C program is used to coding the NODEMCU.In the gas detection program we assuming a threshold value and the greater than the threshold value the alert message come to the phone. And also, the robot controlling GPS working programs uploaded using in this software.

V. CONCLUSION

We have implemented a security robot with gas leakage detection technique. Our robots can detect gas leaks and locate the gas leak area in industrial areas and prevent large explosions. We implemented this project in commercial and industrial areas and provided gas leakage. Gas sensors are used in industry to detect gas leaks. This product can also detect methane gas in vehicles or service stations, it has good sensitivity and fast response time.

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