JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

IOT BASED GAS LEAKAGE DETECTOR

[1]Bichitra Behera, [2]Abhini S, [3]Ayush Kumar Choudary, [4]Dr.Nirmala S
AMC Engineering College, Dept. Computer science Data science, Bannerghatta, Bangalore-83.

Abstract:

In the previous decades, technology has played a vital role and has advanced a lot. Sensors have become integral to various aspects of our daily lives, enhancing efficiency, safety, and convenience. According to recent reports over the preceding triennium, there has been a remarkable demand for LPG and natural gas. These gases are used in industries, home appliances, and motor fuels. The demand for gas leakage detectors has risen mainly because of potential for various gas leakages. In such situations, detecting and alerting about gas leaks can help reduce adverse health implications damage and save lives. Keeping track of these highly flammable gases is challenging when everyone is away from their jobs. Gas leakage detection is a framework designed to identify combustible gas leakages using an IoT approach. The sensor employed for gas detection is the MQ2 gas sensor, capable of operating in various atmospheric conditions. The MQ2 gas sensor is known for its sensitivity to a spectrum of combustible gases. Upon detecting a gas leak, the system activates an alarm in the guise of a buzzer, sends the gas level value and alerts the individual through blynk application and automatically activities the exhaust fan to ventilate the area and disperse the gas.

Keywords: Sensors, MQ2 sensor, IoT, buzzer, exhaust fan, Blynk platform, sensitivity.

I INTRODUCTION

Figure 1: Gas leakage

Safety is paramount in every aspect of life. Embracing safety practices is a collective responsibility that helps safeguard lives, property, and the environment. There are many risks and dangers in and around the human locations which may cause accidents or even death. One such danger is gas leakage which poses significant risk to human health and the surrounding environment. Gas leakage mainly occurs due to manufacturing defects or wear and tear of the components which are in use. Whether it's in industrial sector, households, or public spaces, the release of gases, such as LPG, which is a mixture of propane and butane, can lead to severe consequences such as explosions, fires, and respiratory problem for people exposed to these gases. Long-term environmental damage may occur affecting air quality and ecosystem.

Chemical disasters can have severe side effects for people, leading to loss of life, environmental harm, property damage and other health hazards. Industrial plants, their employees, residents in nearby towns, tenants of adjacent buildings, and the public at large are most at risk from these incidents. Such gases when inhaled in high quantities causes suffocation which led to death by hypoxia. When gas is inhaled for a prolonged time relating to a small leak it eventually leads to

nervous system damage, mood swings, impaired memory, depression, seizures.

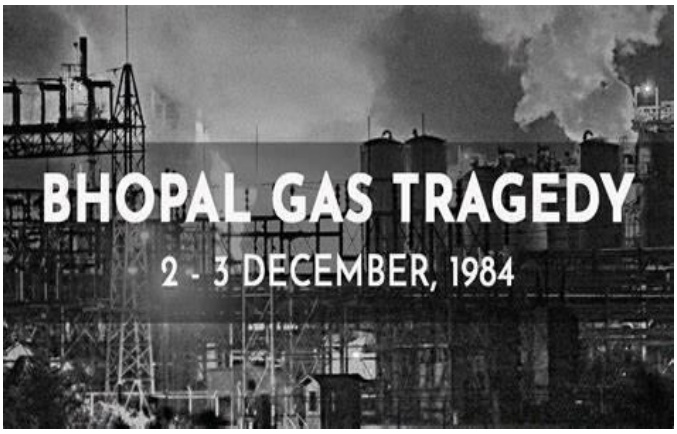


Figure 2: Bhopal Gas Tragedy

One such deadliest chemical accidents which took place in India is the Bhopal gas tragedy, which was caused by the accidental release of the deadly gas methyl isocyanate (MIC), which stands as the most devastating chemical disasters in history, results the tragic loss of over 2500 lives. Beyond the human toll, the incident caused significant property damage and environmental degradation. Such accidents emphasize the prime requirement for strong safety measures and robust protocols to prevent and respond to chemical disasters. Hence, effective preventive measures, regular maintenance, and swift responses to gas leaks are crucial for minimizing risks and ensuring safety of individuals and the surroundings.

The integration of IoT (Internet of Things) enhances our ability to establish early warning alerts. By connecting the devices and sensors through the internet, IoT enables real-time monitoring and data collection. IoT technology allows for continuous surveillance of critical parameters. This data can then be analyzed to detect any irregularities or potential risks, triggering automated early warning systems. When gas detectors team up with Internet of Things (IoT) and cloud computing, things get a lot smarter. They can send data to the cloud, which helps us understand patterns in gas levels. To fix things before this situation becomes a big problem. The cloud also keeps a record of past data, so improving our decision-making relies on learning from past experiences. It is like having a smart system which not only watches for issues but also learns from them to keep us safer. Hence designing a low-cost gas leakage detector with using Iot will minimize the risks and damages caused by these combustible gases. The gas leakage detector comes with technology to monitor the surrounding atmosphere and when it detects a change in gas concentration in the environment it gives an alert through a buzzer or beeping sound.

II LITERATURE SURVEY

In the past one-decade technology have advanced a lot keeping home safe is a very crucial nowadays. Sensors have become integral to various aspects of our daily life we can use sensors to enhance efficiency, safety and convenience. As per the reports in the recent three years, there is tremendous hike in the demands of LPG and natural gas. These gases are used in industry, home appliances and motor fuels. Keeping track on this highly flammable gas has been very difficult in situations where everyone is out for their works or jobs. The sensor used gas leakage detector is MQ6 gas sensor. The MQ6 gas sensor is used to identify the presence of leaked gases, especially LPG and natural gas. The MQ6 gas sensor is known for its sensitivity to wide range of combustible gases. The gas leakage detector comes with a technology to monitor the surrounding atmosphere and when it detects change in gas concentration in the environment it gives an alert or a beeping sound. [1]

This system is crafted for detection of combustible gas leaks in industrial settings using an Iot approach. It employs a gas sensor capable of operating in various atmospheric conditions. The heart of system, Arduino functioning as the central processor, which receives, and processes data received from the gas to sensor. When a gas leak is detected, the system activates an alarm in the form of a buzzer and displays the leakage location on a small LCD screen. This immediate response helps alert individuals to take necessary actions such as turning on exhaust fans on stopping incoming gas flow in the affected mitigate the
task. [2]

Crucially, the system goes beyond mere detection; It aims to prevent gas leaks by providing actionable information. The gas sensor data is transmitted to a data cloud, allowing for remote monitoring and historical analyses. This integration enhances the system's overall efficiency, enabling real-time Hacking of gas level and facilitating proactive maintenance. [2]

The project focuses on creating a gas detector with an audible alarm which aims to enhance the intelligent detection, prompt notification, and interactive management of gas-related events compared to traditional "ring-ring" fire alarm systems. The system incorporates a gas sensor, specifically the MQ-9, designed for detecting carbon monoxide, CH4, and LPG gases. With a 5V supply, the sensor triggers an audible alarm and LED alert when gas is detected. This innovative design is of great help to individuals who may be deaf, mute, or blind, using a series of red LEDs and an audible alert system to ensure effective communication of potential dangers. The main objective is to achieve a more sophisticated and inclusive solution for gas detection and alerting in various environments. [4]

III PROBLEM STATEMENT

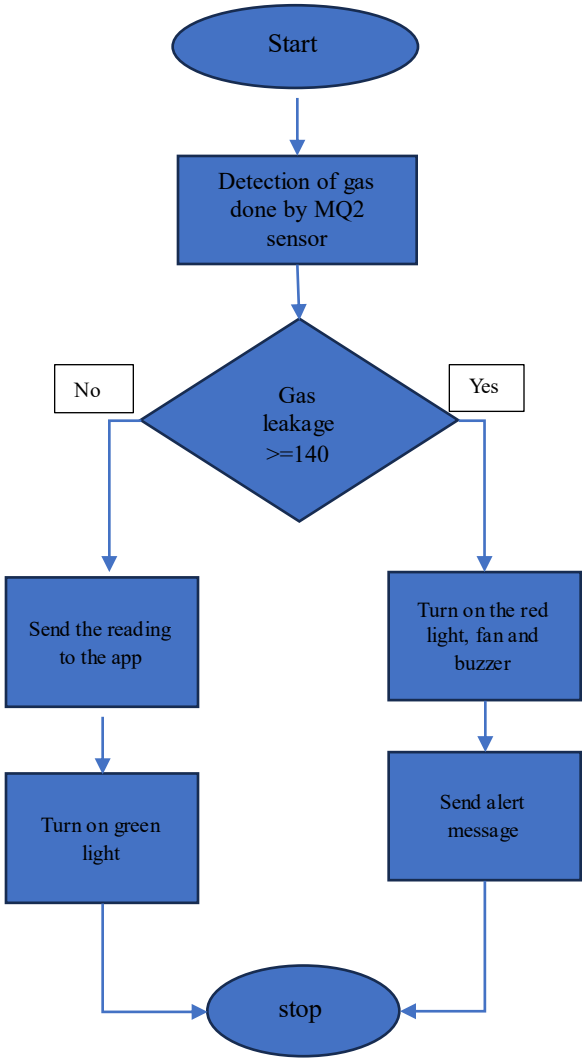
1. Sending alert messages using blynk application.
2. Integration of cloud and Iot to handle data effectively assuring safety.

3. Notifying the gas leak via call.

IV PROPOSED SOLUTION

1. Use the notification feature in the project and set it to notify, by sending alert message through the Blynk app.
2. Secure the integration of cloud and IoT by implementing encrypted communication.
3. Integrating the Arduino with a GSM module along with sim card having valid mobile plan.

V FLOW CHART



Components:

MQ2 Sensor: MQ2 sensor is a gas detecting sensor used to detect LPG gas.

Arduino: A Open Source tool for programming electronic project.

GSM modem: GSM Modem enables communication through mobile networks, facilitating remote connectivity.

GPS Module: PS Module provides precise location data, essential for tracking and navigation applications.

Wi-Fi module: To add Wi-Fi connectivity to Arduino based application.

Buzzer: Buzzer emits audible alerts or signals based on programmed conditions in system.

Resistors and Capacitors: Resistors and capacitors regulate and store electrical energy, respectively, in the circuit.

Cables and connectors: Cables and connectors establish electrical connections between different components.

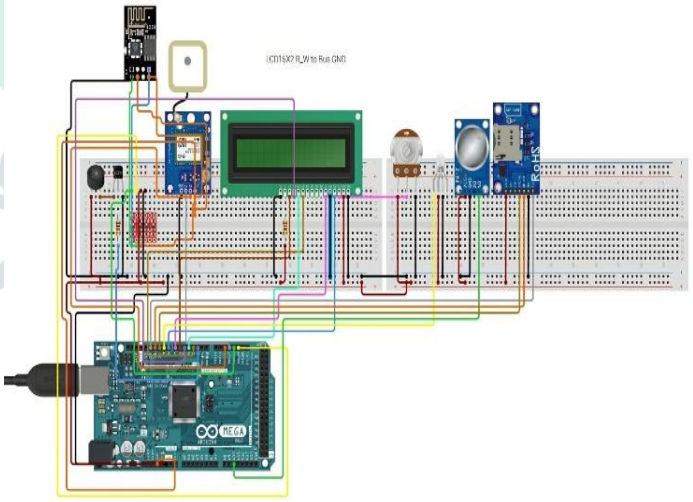
PCB and Breadboards: PCB and Breadboards provide platforms for assembling and prototyping electronic circuits.

Rotary Potentiometer : A rotary potentiometer is be used to adjust sensitivity or set thresholds for triggering alarms.

LEDs: LEDs serve as visual indicators for various states or conditions in the circuit.

Push buttons and LCD: Push buttons and LCD enhance user interaction, allowing input and displaying information.
Switches control the flow of current, enabling users to turn components on or off.

CIRCUIT DIAGRAM



VI WORKING

1. The system focuses on detecting leaks of combustible gases, mainly propane and butane, which lack a distinctive odor.
2. Ethyl Mercaptan, a powerful smelling gas, is added to these gases for easy leak detection.

3. The project utilizes a gas sensor designed for heightened sensitivity and swift detection of LPG in environments such as cars, industrial sectors, and residential areas through a rapid response time.
4. The gas sensor is capable of detecting other gases like isobutene, propane, LPG, and cigarette smoke.
5. When the LPG sensor senses a gas leakage, its output goes low, triggering the system to act.
6. A microcontroller processes the sensor data and activates both visual and audible alerts.
7. An alarm, possibly a buzzer, is sounded, and the concentration of the detected LPG is displayed on a 16x2 LCD screen.
8. To mitigate potential hazards, a fan is burned on after a short delay to expel the leaked gas.
9. An alert notification is sent through blynk application.
10. This integrated approach ensures both prompt detection and clear user indications through alarms, LCD display, notification to device and practical measures like fan activation.

VII IMPLEMENTATION

```
#include <BlynkSimpleEsp8266.h>
#include <SIM800L.h>
#include <GasSensorLibrary.h>

#define BLYNK_AUTH_TOKEN "YourBlynkAuthToken"
#define GAS_SENSOR_PIN A0 // Adjust based on your sensor connection
#define BUZZER_PIN 8
#define LED_PIN 9
#define THRESHOLD 500 // Adjust based on sensor sensitivity and desired threshold

BlynkTimer timer;
SIM800L sim800l; // If using SIM module

void setup() {
  Serial.begin(9600);
  Blynk.begin(BLYNK_AUTH_TOKEN, "YourWiFiSSID", "YourWiFiPassword");
  pinMode(GAS_SENSOR_PIN, INPUT);
  pinMode(BUZZER_PIN, OUTPUT);
  pinMode(LED_PIN, OUTPUT);
  // Initialize SIM module (if using)
  sim800l.begin();
  timer.setInterval(1000L, sendSensorData);
}

void loop() {
  Blynk.run();
  timer.run();
  int sensorValue = analogRead(GAS_SENSOR_PIN);

  if (sensorValue > THRESHOLD) {
    digitalWrite(BUZZER_PIN, HIGH);
    digitalWrite(LED_PIN, HIGH);
    Blynk.notify("Gas Leakage Detected!");
    // Call owner (if using SIM module)
    sim800l.callNumber("OwnerPhoneNumber");
  } else {
    digitalWrite(BUZZER_PIN, LOW);
    digitalWrite(LED_PIN, LOW);
  }
}

void sendSensorData() {
  Blynk.virtualWrite(V1, analogRead(GAS_SENSOR_PIN));
}
```

VIII CONCLUSION

In recent households, the growing use of LPG, whether through cylinders or petroleum pipelines, poses a significant challenge, mainly due to security concerns. This project seeks to offer a viable solution for both households and industries by implementing effective gas leak detection techniques. Despite advancements in sensor manufacturing and computing power with its pros and cons.

To enhance the efficiency, accuracy, and scalability of gas detection, a promising approach involves integrating IoT and cloud technologies into the system. This integration enables real-time monitoring, data analysis, and quick response to gas leaks. Leveraging cloud-based computing and storage that allows for the implementation of advanced analytics and machine learning algorithms to enhance overall system performance.

In essence, the project aims to be a cost-efficient and highly secure solution for gas leak detection, applicable across various fields and industries. The combination of different detection methods with IoT and cloud technologies is expected to bring about improvements in monitoring and analysis, addressing the challenges associated with LPG usage.

IX FUTURE ENHANCEMENT

This paper can be further extended to get notification through email and notify by sending an alert to the nearby fire station.

REFERENCES

[1] Noor Kareem Jumaa , Younus Mohammed Abdulkhaleq , Muntadher Asaad Nadhim, Tariq Aziz Abbas “IoT Based Gas Leakage Detection and Alarming System using Blynk platforms” Volume:18| Issue: 1 (2022)

[2] Dr. C K Gomathy, Mr. S. Megha Shyam Raju, Mr. K. Sheshank Reddy “A GAS LEAKAGE DETECTOR USING IOT” International Research Journal of Engineering and Technology. Volume:

08 | Issue: 10 (2021)

[3] V Praveen Sharma, Dr Raman Dugyala , Dr V Padmavathi, Vijendar Reddy Gurram "Gas Leakage Detection System Using IoT and Cloud Technology: A Review". E3S Web of Conferences 391, 01063 ICMED-ICMPC (2023)

[4] Falohun A.S, Oke A.O, Abolaji B.M., Oladejo O.E "Dangerous Gas Detection using an Integrated Circuit and MQ-9" International Journal of Computer Applications (0975 – 8887) Volume 135 – No.7 (2016)