**FINAL REPORT**

| | |
|---|---|
| **Date** | 19TH NOVEMBER 2022 |
| **Team ID** | PNT2022TMID02371 |
| **Project Name** | Project - Gas Leakage monitoring & Alertingsystem Industries |

# 1. INTRODUCTION

## 1.1 Project Overview

Presently, the home safety detection system is playing an important role in the security of people. Since all the people from the home go to work on daily bases, it makes impossible to check on the appliances available at home especially gas cylinders, wired circuits, etc. since the last three years, there is a tremendous hike in the demand for liquefied petroleum gas (LPG) and natural gas. To meet this access amount of energy demand and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on large scale in industry, heating, home appliances, and motor fuel. So Track this leakage gas, the system includes an MQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosions or getting affected by the leakage of gas could be avoided.

**Purpose:**

Leakage of any kind of gas has been a concern in recent years, whether it is in a residential setting, a business, a cafe, or a canteen. In this paper development of an IoT-based gas wastage monitoring, leakage detecting, and alerting system is proposed. This paper elaborates design of such an intelligent system that will help save gas and smartly prevent accidents. The system needs to be integrated with the cooker. The technology includes ultrasonic sensors that determine if the cooker is being utilized for cooking purposes or not. If it is discovered that the cooker is not in use, the system uses an automatic switching-off mechanism to cut off the gas supply. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM, and so that user can solve the issue as soon as possible. The system will monitor flame and fire through the flame sensor. When a fire is detected, the buzzer begins to sound. Aside from that, the system also has a cloud storage capability. The usage of gas for each user each day may be tracked with the aid of this cloud storage solution. At the end of the day, this procedure will assist in detector-user natural gas usage. The system has been tested and it can monitor gas wastage, and leakage and sannd a SMS to the user. The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

## 2. LITERATURE SURVEY:

### 2.1 Existing Problem:

Materials tend to lose their properties with the environmental effects and aging, thereby causing degradation in the sensor response, which is known as the drift error. Most of the studies did not consider the aging effect (long-term stability) which is essential for sensor implementation in a real-world application.

### 2.2 References:


i. Mahalingam, A., R. T. Naayagi, and N. E. Mastorakis. "Design and implementation of an economic gas leakage detector." Recent Researches in Applications of Electrical and Computer Engineering, pp. 20-24, 2012.

ii. Attia, Hussain A., and Halah Y. Ali. "Electronic Design of Liquefied Petroleum Gas Leakage Monitoring, Alarm, and Protection System Based on Discrete Components." International Journal of Applied Engineering Research, vol. 11, no. 19, pp. 9721-9726, 2016.

iii. Apeh, S. T., K. B. Erameh, and U. Iruansi. "Design and Development of Kitchen Gas Leakage Detection and Automatic Gas Shut off System." Journal of Emerging Trends in Engineering and Applied Sciences, vol. 5, no. 3, pp. 222-228, 2014.

iv. T.Soundarya, J.V. Anchitaalagammai, G. Deepa Priya, S.S. Karthick kumar, “C-Leakage: Cylinder LPG Gas Leakage Detection for Home Safety,” IOSR Journal of Electronics and Communication Engineering, vol. 9, no. 1, Ver. VI, pp. 53-58, Feb. 2014.

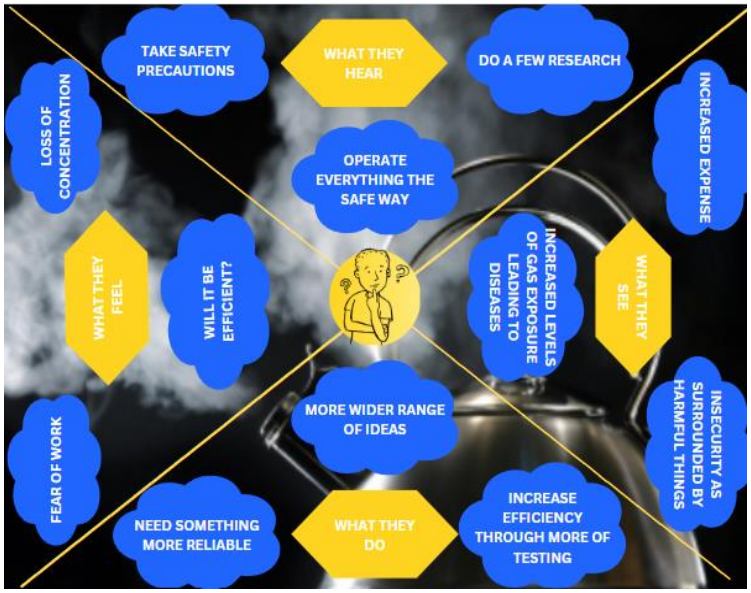
v. Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar, Rahul Verma, "GSM based gas leakage detection system." International Journal of Emerging Trends in Electrical and Electronics, vol. 3, no. 2, pp. 42-45, 2013.


### 2.3 Problem Statement:

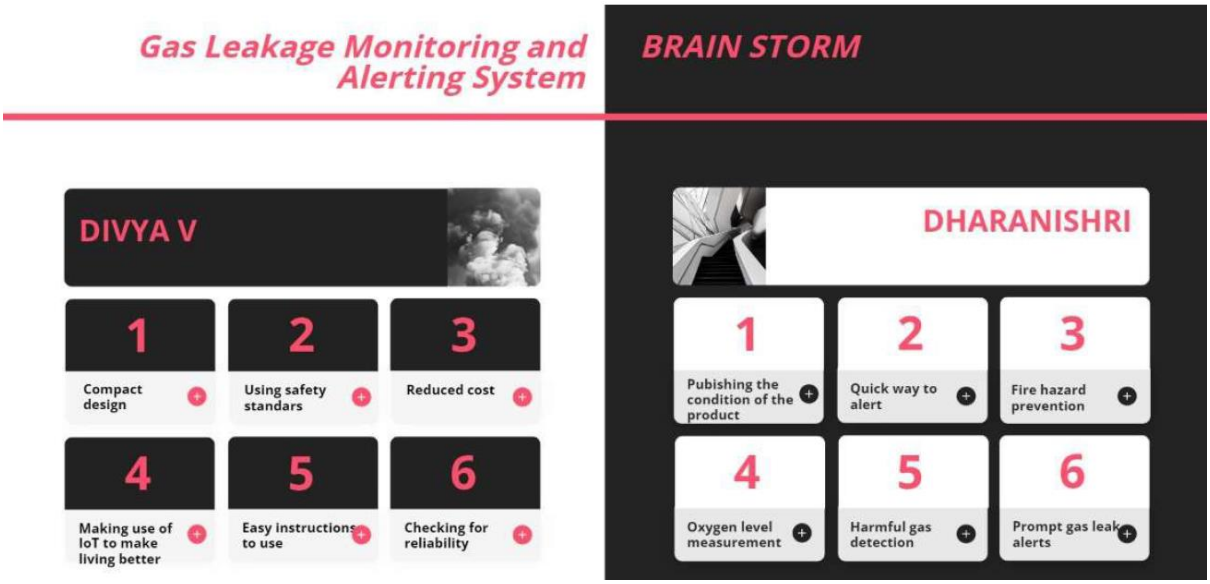
Workers who are engaged with a busy industry packed with gas either harmful or harmless needs a way to monitor their gas pipelines continuously and detect early if there is any leakage of gas in their surroundings so that they can work efficiently on major crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.

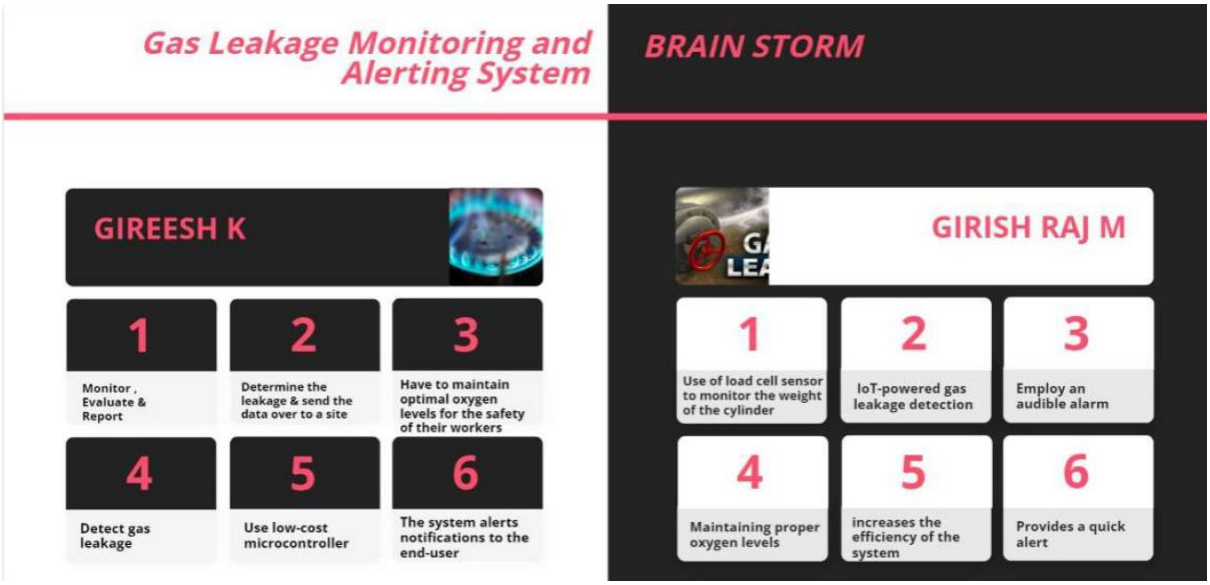
## 3. IDEATION AND PROPOSED SOLUTION

### 3.1 EMPATHY MAP:




### 3.2 IDEATION AND BRAINSTORMING






### 3.3 PROPOSED SOLUTION:

| SNO | PARAMETERS | DESCRIPTION |
|---|---|---|
| 1. | Idea/solution | Workers who are engaged with a busy industries packed wi gas either harmful or harmless needs a way to monitor th gas pipelines continuously and detect early if there is a leakage of gas in their surroundings so that they can wo efficiently on major crises rather than worrying abo monitoring or leakage of gas, this will indeed reduce t manpower of that industry and create a peacef environment. |
| 2. | Novelty/Uniqueness | Even though there are many existing solutions for th problem they failed to satisfy the needs of customer. Sor of the solutions are only detecting some particular gas where some others failed to alert the main department a other solutions are with some delays. Our solution not on notify the industry person but also notify the fire fighters that can take control over the situation and our solution w alert the workers even there is a small leak of gases. |
| 3. | Social Impact/ Customer Satisfaction | Our solution will be very helpful for the workers and t society which is associated or located nearby the industri Our solution will prevent great disasters like Bhopal G Tragedy so that so many lives can be saved. Through th project the workers mental pressure will be reduced so th they can concentrate on other works or by relaxing them |
| 4. | Business model | The main target of our solution is Industries so we ha planned to visit industries and explain them about t benefits of our products. So that they can aware of t importance of this solution and use it. |
| 5. | Scalability of solution | Our solution can be integrated for further future use becau the solution we have provided will be lay on the basic initial stage of any upgraded version. |

## 3.4 PROPOSED SOLUTION FIT:

**Project Design Phase-I - Solution Fit**

**Project Title:** Gas Leakage monitoring & Alerting system for Industries

**Team ID:** PNT2022TMID02371


## 4. REQUIREMENT ANALYSIS:

## 4.1 FUNCTIONAL REQUIREMENT:

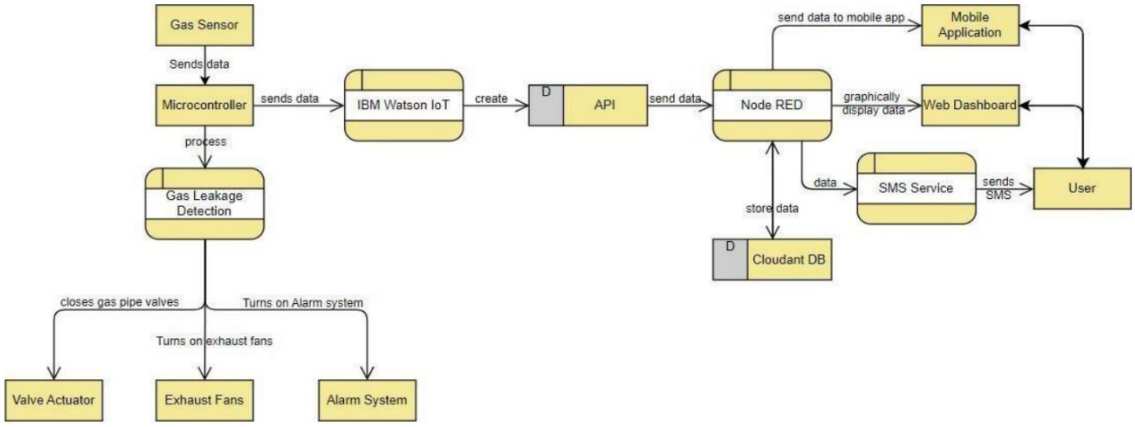
| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | Data fetch | The details of the gas leaked will be transferred to IOT system. |
| FR-2 | Transferring to user | IOT, WIFI module |
| FR-3 | Receiving in the user end | Gas level details will be displayed through LCD, an alarm will be beeps and the same data will be sent to the user mobile or pc. |

## 4.2 NON-FUNCTIONAL REQUIREMENTS:

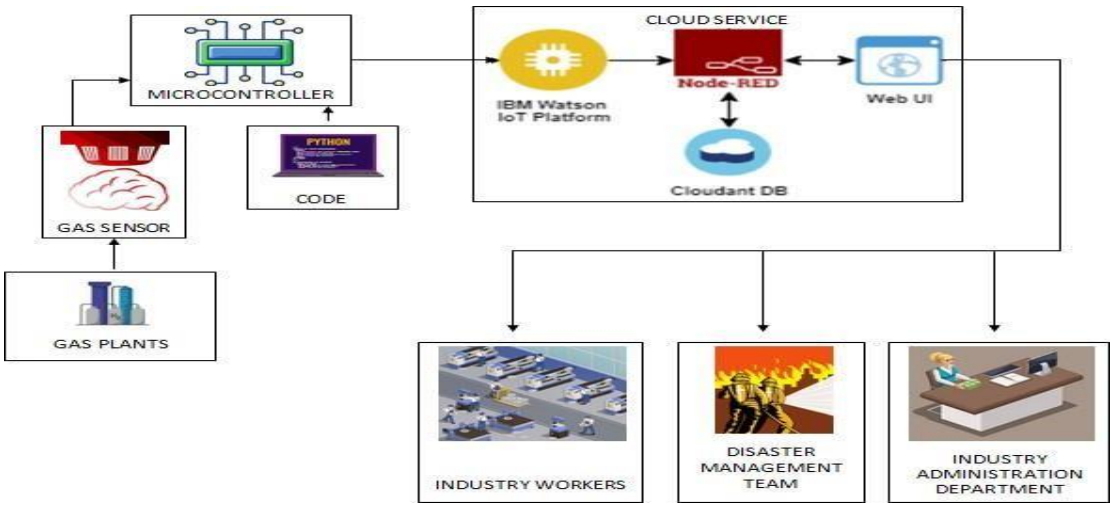
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | Set of techniques for design and development are implemented. |
| NFR-2 | **Security** | Strategical improvement of the process ensures less risk. |
| NFR-3 | **Reliability** | Accuracy and consistency check is properly maintained. |
| NFR-4 | **Performance** | Achieves the goal and contributes to the existing problem in the industry. |
| NFR-5 | **Availability** | Information about the availability of resources are identified. |
| NFR-6 | **Scalability** | Probability of performance is high. |

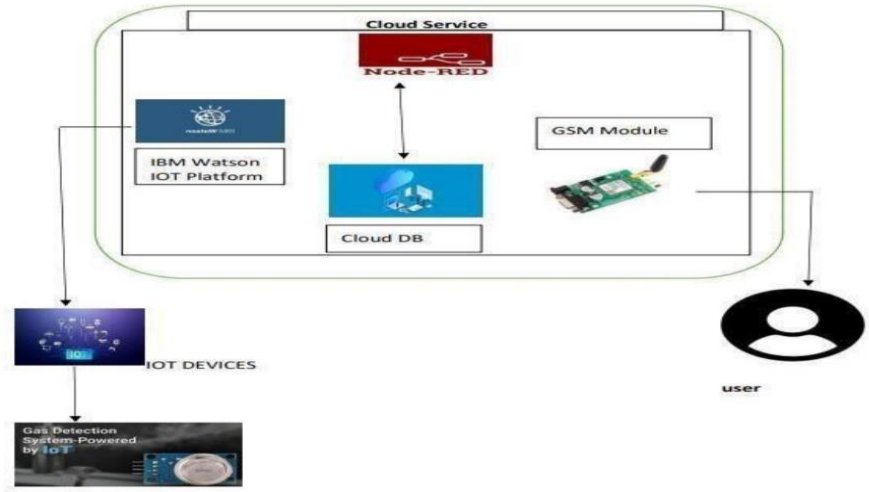
# 5. PROJECT DESIGN

## 5.1 DATA FLOW DIAGRAMS:




## 5.2 SOLUTION & TECHNICAL ARCHITECTURE:



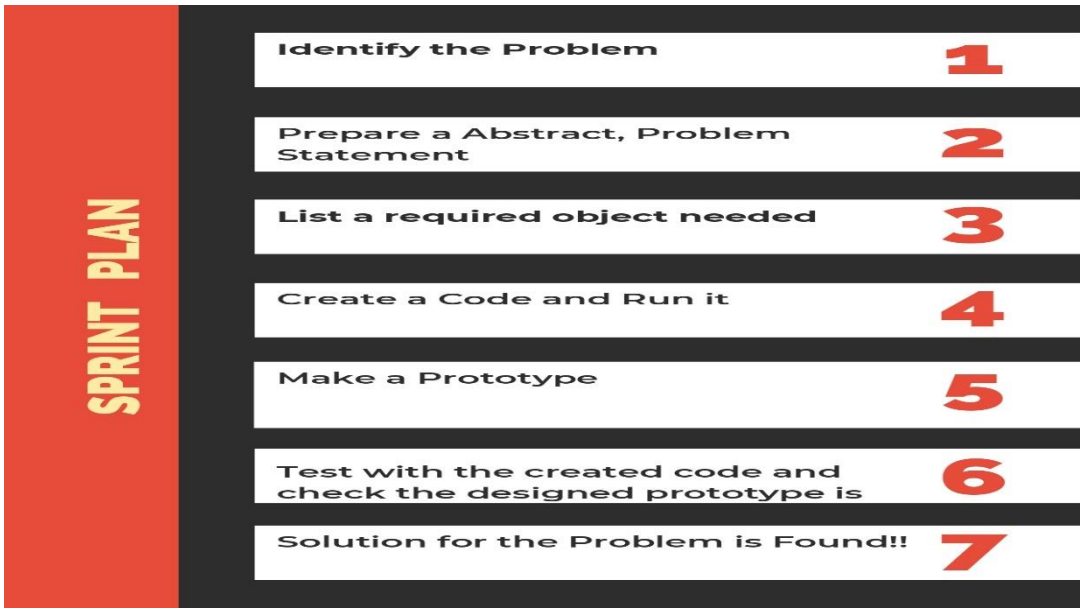



## 5.3 USER STORIES:

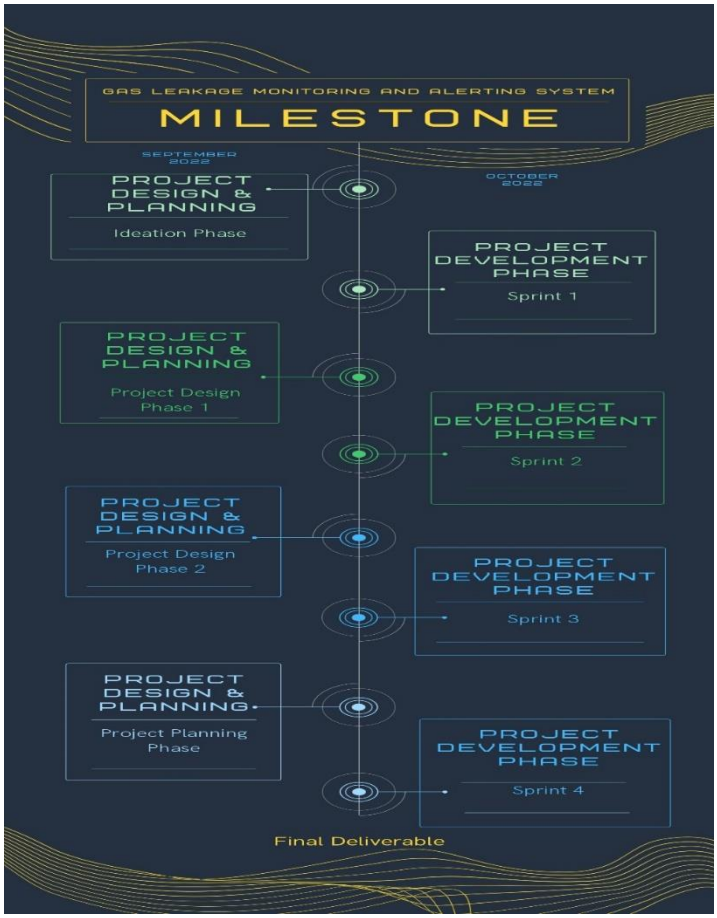
| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Industry owner) | Registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
| Customer (Industry Owner) | Confirmation | USN-2 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
| Customer (Industry Owner) | Authorize | USN-3 | As a user, I will enable the supervisor to monitor the gas leakage system status. | I can provide access to supervisor. | High | Sprint-1 |
| Customer (Supervisor) | Login | USN-4 | As a user, I can log into the application by entering email & password. | I can get access to dashboard. | High | Sprint-1 |
| Customer (Supervisor) | Monitor | USN-5 | As a user, I can monitor the status of the gas leakage system. | I can view the status of gas leakage system. | High | Sprint-1 |
| Customer (Line Workers) | Notification | USN-6 | As a user, I can get (alarm system) alert about gas leakage. | I can get alert about gas leak. | Medium | Sprint-2 |
| Customer (Supervisor) | Notification | USN-7 | As a user, I can get SMS notification & alarming alert about gas leakage. | I can get alert about gas leakage. | Medium | Sprint-2 |
| Customer (Industry Owner) | Notification | USN-8 | As a user, I can get SMS notification about gas leakage. | I can get alert about gas leakage. | Medium | Sprint-2 |
| Customer (Industry Owner) | Sign-Up | USN-9 | As a user, I can sign-up using Facebook login. | I can sign-up with the application using Facebook. | Low | Sprint-3 |
| Customer (Supervisor) | Sign-Up | USN-10 | As a user, I can sign-up using Facebook login. | I can sign-up with the application using Facebook. | Low | Sprint-3 |
| Administrator | Service Request | USN-11 | As a user, I can request for service in case of any issue with gas leakage monitoring system | I can get service from provider | Low | Sprint-3 |
| Administrator | Increased service | USN-12 | As a user, I can request for scaling up the gas leakage monitoring system. | I can get service from the provider. | Low | Sprint-4 |

## 6. PROJECT PLANNING AND SCHEDULING

### 6.1 SPRINT PLANNING AND ESTIMATION:




### 6.2 MILESTONE ACTIVITIES:



## 7. CODING AND SOLUTION:

```
#include
<LiquidCrystal.h>

                    LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
                                        float gasPin = A0;
                    float gasLevel;
                    int ledPin = 2;
                    int buttonPin = 3;
                    int buzzPin = 4;
                    int buttonState;
                    int fan = 5;

                    void setup(){
                     pinMode(ledPin, OUTPUT);
                     pinMode(buttonPin, INPUT);
                      pinMode(gasPin,INPUT);
                      pinMode(fan,OUTPUT);
                      Serial.begin(9600);
                      lcd.begin(16, 2);
                      lcd.setCursor(0,0);
                      lcd.print(" Welcome");
                      lcd.setCursor(0,2);
                      lcd.print("GAS LEAKAGE SYSTEM");
                      delay(500);
                      lcd.clear();
                     }

                     void loop(){
                      // Read the value from gas sensor and button
                      gasLevel = analogRead(gasPin);
                      buttonState = digitalRead(buttonPin);

                      // call the function for gas detection and button work
                      gasDetected(gasLevel);
                      buzzer(gasLevel);
                      exhaustFanOn(buttonState);
                     }

                    // Gas Leakage Detection & Automatic Alarm and Fan ON
                    void gasDetected(float gasLevel){
                      if(gasLevel >= 300){
                       digitalWrite(buzzPin,HIGH);
                        digitalWrite(ledPin,HIGH);
                        digitalWrite(fan,HIGH);
                        lcd.setCursor(0,0);
```

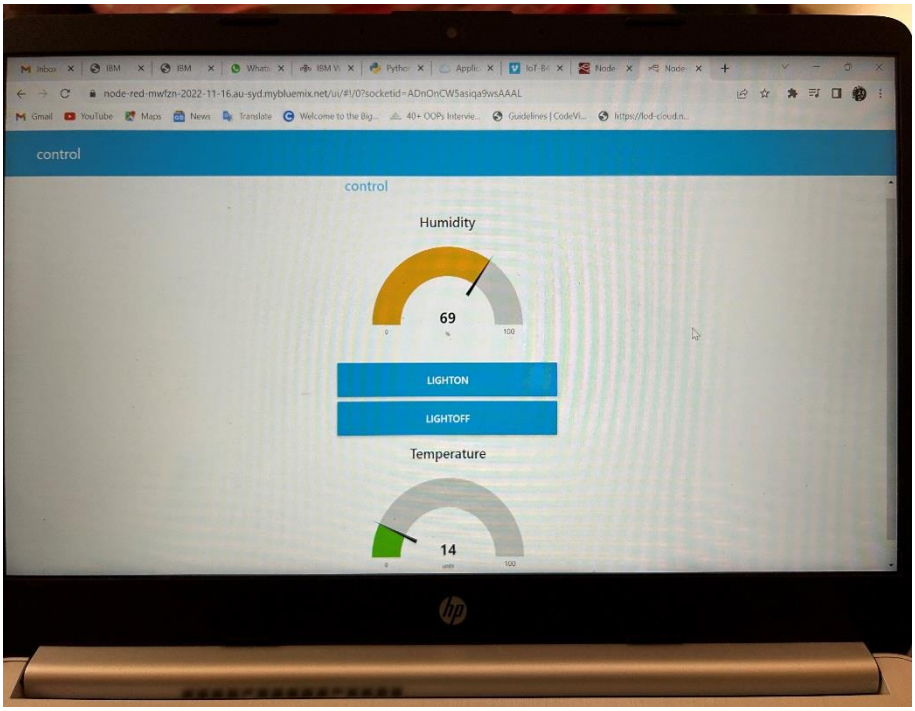
```
   lcd.print("GAS:");
    lcd.print(gasLevel);
   lcd.setCursor(0,2);
   lcd.print("FAN ON");
   delay(1000);
   lcd.clear();
  }else{
   digitalWrite(ledPin,LOW);
    digitalWrite(buzzPin,LOW);
    digitalWrite(fan,LOW);
    lcd.setCursor(0,0);
   lcd.print("GAS:");
    lcd.print(gasLevel);
   lcd.setCursor(0,2);
   lcd.print("FAN OFF");
   delay(1000);
   lcd.clear();
  }
}
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=300)
  {
  for(int i=0; i<=30; i=i+10)
  {
  tone(4,i);
  delay(400);
  noTone(4);
  delay(400);
  }
  }
}
// Manually Exhaust FAN ON
void exhaustFanOn(int buttonState){
  if(buttonState == HIGH){
    digitalWrite(fan,HIGH);
    lcd.setCursor(0,0);
   lcd.print("Button State:");
    lcd.print(buttonState);
    lcd.setCursor(0,2);
    lcd.print("FAN ON");
    delay(10000);
    lcd.clear();
  }
}
```

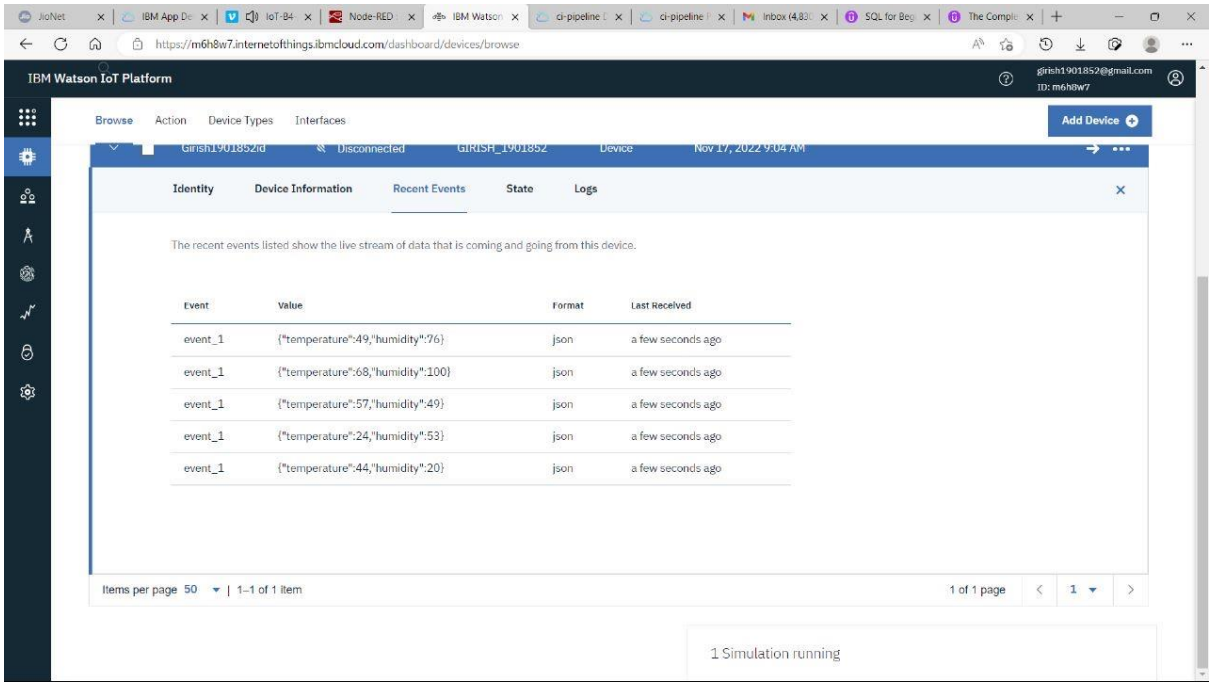
## 8. TESTING

### 8.1 TEST CASE CODE:

```
import
ibmiotf.applicati
n
                    import ibmiotf.device
                    import time
                    import random



                    #provide your ibm Watson Device Credentials



                    organization="ko3qfr"
                    deviceType="temp"
                    deviceid="4321"
                    authMethod="use-token-auth"
                    authToken="123456789"


                    #generate random values for random variables (temperature & humidity)
                    Temp=random.randint(0,100)
                    Humd=random.randint(0,100)
                    oxygen=30
                    lat=17
                    lon=18



                    def myCommandCallback(cmd):
                       print("command received: %s"&cmd.data['command'])
                       print(cmd)
                       try:

                    deviceOptions={'org':organization,'type':deviceType,'id':deviceid,'authentication
                    method':authMethod,'authentication token':authToken}

                           deviceCli=ibmiotf.device.Client(deviceOptions)
                       except Exception as e:
                           print("caught exception connecting device %s" %str(e))
                           sys.exit()
```

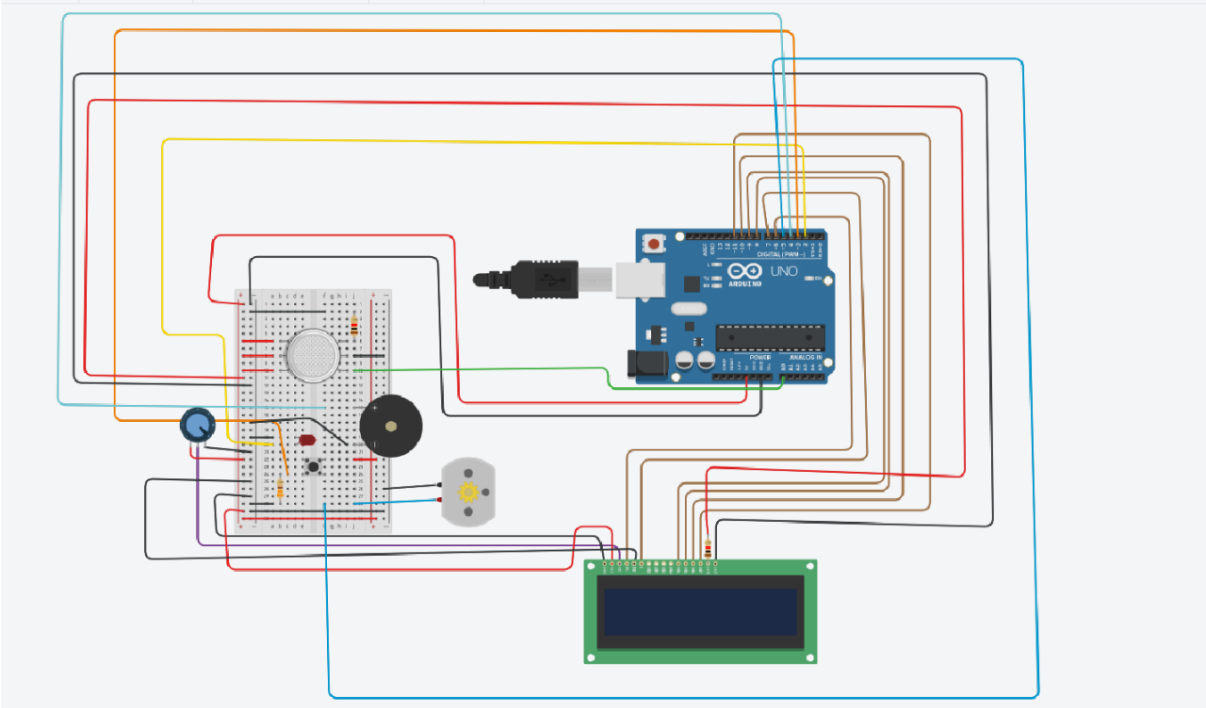
```
#connect and send a data point "temp" value with integer value into the cloud as
type event for 10 seconds
deviceCli.connect()
while True:
    data={"d":{'temp':Temp,'humid':Humd,'oxygen':oxygen,"lat":lat,"lon":lon}}
    print(data)
    def myOnPublishCallBack():
        print("published temperature: %s C" %Temp,"humidity:%s %%" %Humd)

success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=my
OnPublishCallBack)
    if not success:
        print("not connected")
    time.sleep(1)
    deviceCli.commandCallback=myCommandCallback


#disconnect the device
deviceCli.disconnect()
```






## 9. RESULTS:

## PERFORMANCE METRICS:



## 10. MERITS:

Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made. Also send alert SMS to the in charge of the plant whose number is saved in SIM card by using GSM modem.

**DEMERITS:**

One of the drawbacks is that, The SMS received depends upon the leak of gas in the detection area of the sensor.

## 11. CONCLUSION:

The process of the project, marked the significance and the crucial part the problem plays in day to day lives. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gases like CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

## 12. APPENDIX:

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-30752-1660186585