IBM SMARTINTERNZ PROJECT

GAS LEAKAGE AND MONITORING SYSTEM FOR INDUSTRIES.

Batch no. : **B9-3A5E**

Team ID: **PNT2022TMID21445**

Team Leader: **ARIKARASHRI. K – 917719D114**

Team Members:

1. NITHISH KUMAR. M - **917719D127**
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TABLE OF CONTENT

1. INTRODUCTION

a. Project Overview:

- Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed inindustries and this system also be used in homes and offices. Gas Leakages in open or closed areas can prove to be dangerous and lethal. Leakage in any kind of gas are concern in recent years,whether it is an residential area, a cafe, or a canteen or industrial sectors. The traditionalGas Leakage Monitoring Systems though have great precision, fail to acknowledge a few factors in the field of alerting the people about the leakage. Therefore we use latest technology like Internet of Things basedGas leakage monitoring, leakage detecting and alerting system is proposed. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM module

.

b. Purpose:

- The main purpose of this project is to achieve a successful working prototype that is capable to detect the presence of gas leakage, which in this case, the Liquefied Petroleum Gas (LPG). The device should also perform automatic response with the implementation of alert SMS system and the emergency shut down valve, once the leakage has occurred and detected. The essential part of this project is to detect the occurrence of leakage. Once this condition is true, this will lead to the sending alert message to user mobile as well as activating the emergency shut down valve. Further research is especially done to comprehend in some infrared radiation detector knowledge, LPG characteristics, alarm and relay circuits. As a conclusion, this project has given the opportunity

for us to integrate theories into solving the problems related with the engineering scope of work.

2. LITERATURE SURVEY:

a. Exisitng Problem:

NAME: Natural Gas Detector, Home Gas Alarm, Gas Leak Detector, High Sensitivity LPG LNG Coal Natural Gas Leak Detection, Alarm Monitor Sensor for Home Kitchen.
About this item
FEATURES:
Detect Multiple Gases: Home natural gas detector suitable for detecting LPG, natural gas, coal gas, gas fuel, artificial gas, liquefied petroleum gas, liquefied natural gas etc.
Easy-to-install: Gas leak detector adopts Easy-to-install Design, can be used by plugging directly into the power socket to detect leaked gas.
Notice: We would like to remind you that after connecting the gas alarm to the power supply, wait 3-5 minutes for gas detection the product needs a warm-up process.

b. References:

I. NAME: IoT based Gas leakage detection system with database logging, prediction and smart alerting system.
AUTHOR: Chaitali Bagwe, Vidya Ghadi, Vinayshri Naik, Neha Kunte CONTENT: The system provides constant monitoring and detection of gas leakage along with storage of data in database for predictions and analysis. The IOT components used helps in making the system much more cost effective in comparison with traditional Gas detector systems.

II. NAME: Internet of things (IoT) based gas leakage monitoring and alerting system with Mq-6 sensor. AUTHOR: Rohan Chandra Pandey , Manish Verma , Lumesh Kumar Sahu , Saurabh Deshmukh CONTENT: An overall conclusion IOT based toxic gas detector is it has become more efficient, more

applicable to today's applications and smarter.

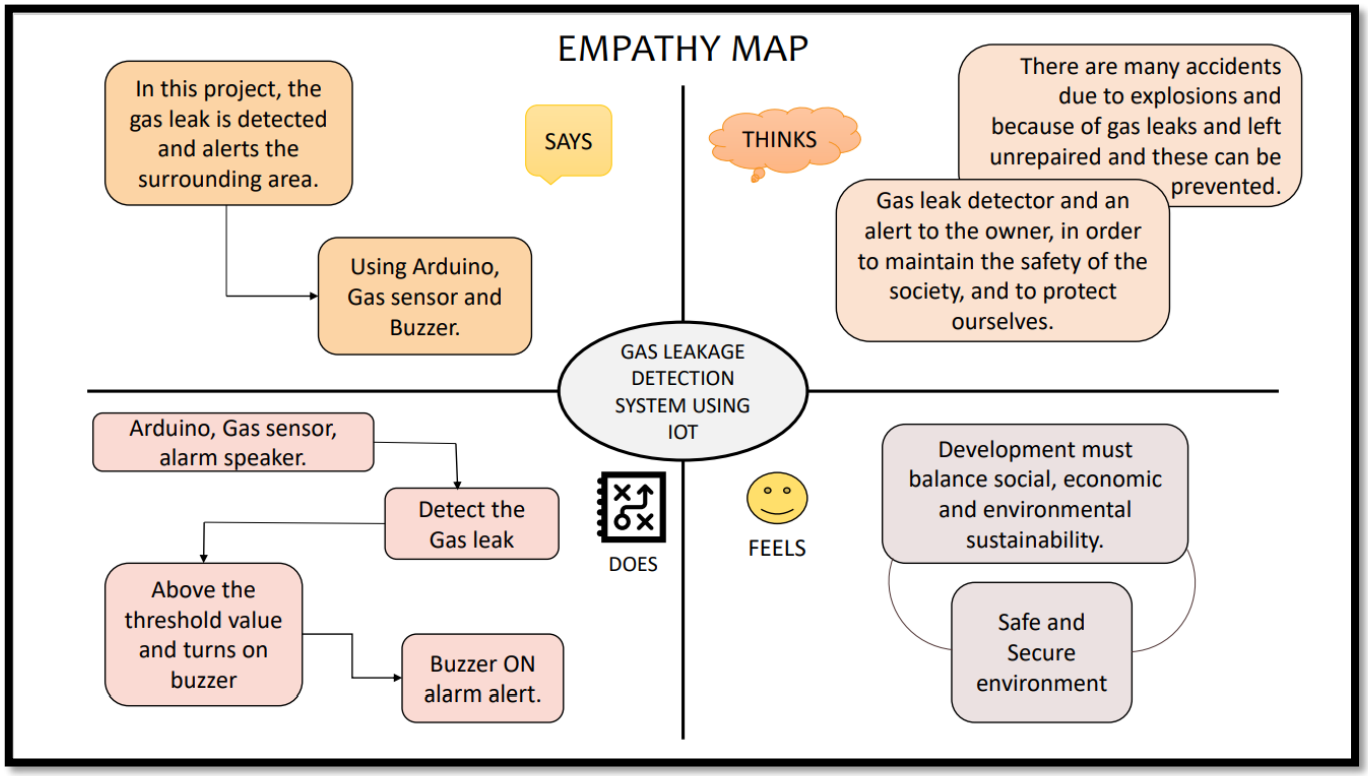
III. NAME: Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor AUTHOR: Rohan Chandra Pandey , Manish Verma , Lumesh Kumar Sahu CONTENT: This paper choice of using a real time gas leakage monitoring and Sensing the output levels of gas has been clearly observed by the help of this system

c. Project Statement Definition:

- A gas leak refers to an unintended leak of natural gas or another gaseous product from a pipeline or other containment into any area where the gas should not be present.
- Gas leaks can be hazardous to health as well as the environment. Even a small leak into a building or other confined space may gradually build up an explosive or lethal concentration of gas.
- Leaks of natural gas and refrigerant gas into the atmosphere are especially harmful due to their global warming potential and ozone depletion potential.
- Leaks of gases associated with industrial operations and equipment are also generally known as fugitive emissions. Natural gas leaks from fossil fuel extraction and use are known as fugitive gas emissions.
- If there is a gas leak around, it is important that the leaked gas must be ventilated and source must be turned off.
- So, to ensure safety of our environment, we took on this project and to build a device for it.

3. IDEATION & PROPOSED SOLUTION:

a. EMPATHY MAP:



b. IDEATION & Brainstorming

IBM PROJECT

Gas Leakage Monitoring & Alerting System For Industries

TEAM ID: PNT2022TMID21445

- This project helps the industries in monitoring the emission of harmful gases
- In several areas, the gas sensors will be integrated to monitor the gas leakage
- If in any area gas leakage is detected the admins will be notified along with the location
- In the web application, admins can view the sensor parameters.

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM STATEMENT

Domestically we use natural gas and it is very useful for burning purposes. If this gas is leaked in our kitchens, offices or factories and not sensed in time, it may lead to a fatal disaster, and may cause human loss. For this purpose, we came forward with an idea of making such an electronic device to sense that leakage and alarm the respective persons to solve that leakage problem and save assets and human lives.

Key rules of brainstorming

To run an smooth and productive session

Stay in topic.

Defer judgment.

Encourage wild ideas.

Listen to others.

If possible, be visual.

c. Proposed Solution:

- This project mainly focuses on the detection of gas leakage and providing security when the user is around or away from home. The use wireless technology for providing security against gas leakage to users hence cost effective and more adaptable. The system comprises of sensors for detecting gas leak interfaced to microcontroller that will give an alert to user whenever there is a gas leakage, display warning information by using Liquid Crystal Display (LCD). This will enable the user to take precaution of explosion disaster which may result on Liquefied Petroleum Gas (LPG) cookers like loss of properties, injury or even death. GLDS provides ideal solution to gas leakage problems faced by home owners in daily life.

Problem Statement	**Develop an efficient system & an application that can monitor and alert the users(workers)**
Idea / Solution description	**This product helps the industries in monitoring the emission of harmful gases.In several areas, the gas sensors will be integrated to monitor the gas leakage.If in any area gas leakage is detected the admins will be notified along with the location. In the web application, admins can view the sensor parameters.**
Novelty / Uniqueness	**Fastest alerts to the workers. User friendly**

d. Problem Solution fit:

Project Title: Gas Leakage monitoring & Alerting system for Industries

Team Members : ARIKARASHRI.K, RUTHRAM.M, NITHISH KUMAR. M, RANJITH KUMAR.P, UDHAYAKUMAR.U

1. CUSTOMER SEGMENT (CS)

- The customers for our project is people Such industries include agriculture, manufacturing, construction, transportation, and communication, among others.

2. CUSTOMER CONSTRAINTS (CC)

- Detect and ventilate the leaked gas.
- Turn off gas valve automatically.

3. AVAILABLE SOLUTIONS (AS)

- **PROS:** Monitors the gas level in the present atmosphere.
- Alert us ,when any gas leakage.
- Low power consumption.
- **CONS:** The challenge of operating electrical equipment as exhaust fan.
- Needs an UPS for uninterrupted

4. JOBS-TO-BE-DONE / PROBLEMS (J&P)

- Detection of gas leak,
- Alert surrounding through ALARM,
- Send SMS through GSM module.

5. PROBLEM ROOT CAUSE (RC)

- The danger happens when gas leaks out. It is dangerous because gas is flammable, which means that if there's a flame or even a spark in the area of a leak, it could cause a fire or explosion.
- A gas leak can happen if a gas pipe is damaged or a fitting is loose.
- There is a possibility of avoiding such dangerous problems, by ventilating the leaked gas out of the area, and by alerting the people.
- Goal of our Project, " Provide the safe and best product using Internet of Things, to people which detects the gas leakage and alert them , and ensure their Safety ".

6. BEHAVIOUR (BE)

- Choosing the right sensor
- Reliable components
- Calculating the usage

7. EMOTIONS: BEFORE / AFTER

- Prevents gas leak
- Avoid fire accidents
- Safe environment

8. PROPOSED SOLUTION

- Gas detection
- Alert alarm
- Alert sms

4. REQUIREMENT ANALYSIS:

a. Functional Requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	The level of gas can be monitored by users if there is any leakage, alerts can be sent throughmessages.
FR-2	User Reception	The data like the level of gas can be sent throughmessages
FR-3	User Understanding	The user can monitor the level of gas with thehelp of the data. If there is an increase in gas level, then the alert will be given. They also getnotified by the alert.
FR-4	User Convenience	Through messages we can easily get data of gas level and in case of gas leakage, it can directly sendnotifications to nearby police stations and hospitals.
FR-5	User Performance	When the user gets notified, he could turn on theexhaust fan/sprinkler.

b. Non- Functional Requirement:

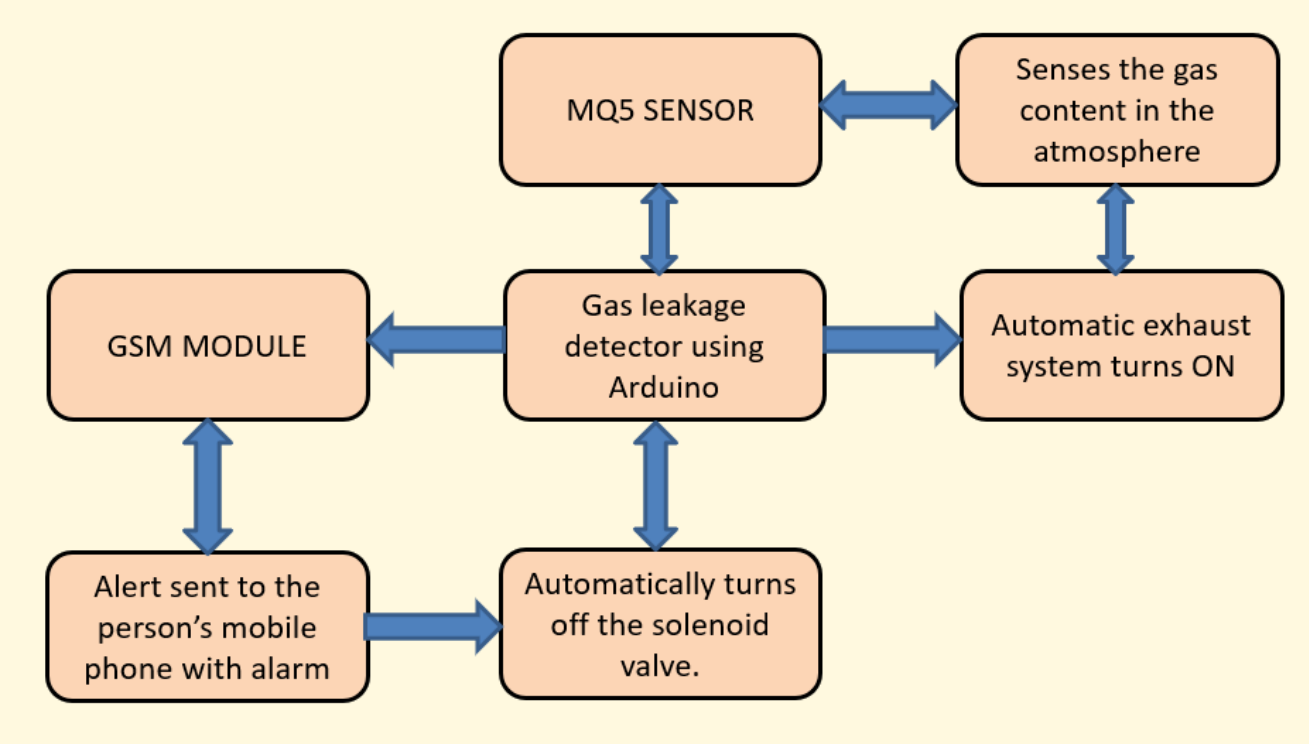
Business Requirements	User Requirements	Product Requirements
The said system can be deployed in homes, hotels, factory units, LPG cylinder storage areas, and so on. The main advantage of this IoT and Arduino-based application is that it can determine the leakage and send the data over to a site. It can be monitored, and preventive measures can be taken to avoid any disaster.	The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vital.	Detecting gasses is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfil.

PROBLEM ANALYSIS:

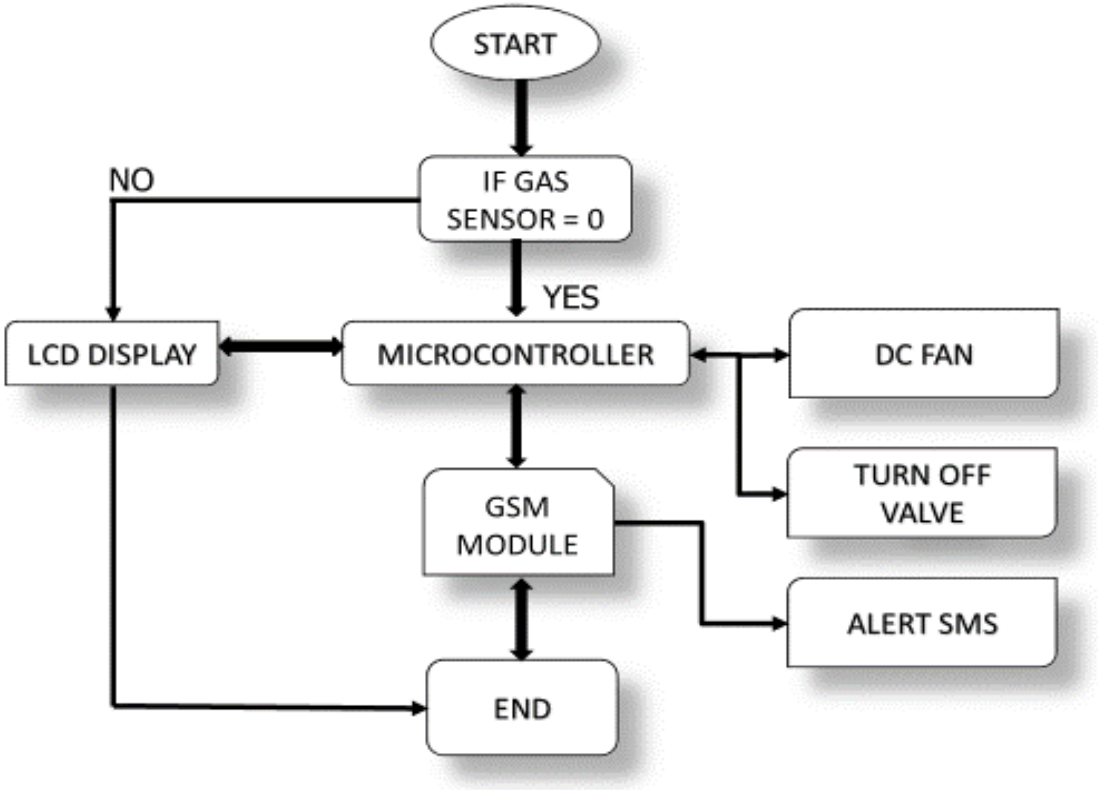
Problem Statement (PS)	I am (Customer)	I am trying to	But	Because	Which makes me feel
PS-1	Industrialist	Monitor gas leakage in the industry	I don't have any system for monitoring	The affordable of the system is high and the systems are sometimes making disasters	Unsafe
PS-2	Industrialist	Control the gas leakage	Also, the installation process is too complicated	The number of sensors is unpredictable and the positioning of equipment is improper	Disastrous

5. PROJECT DESIGN:

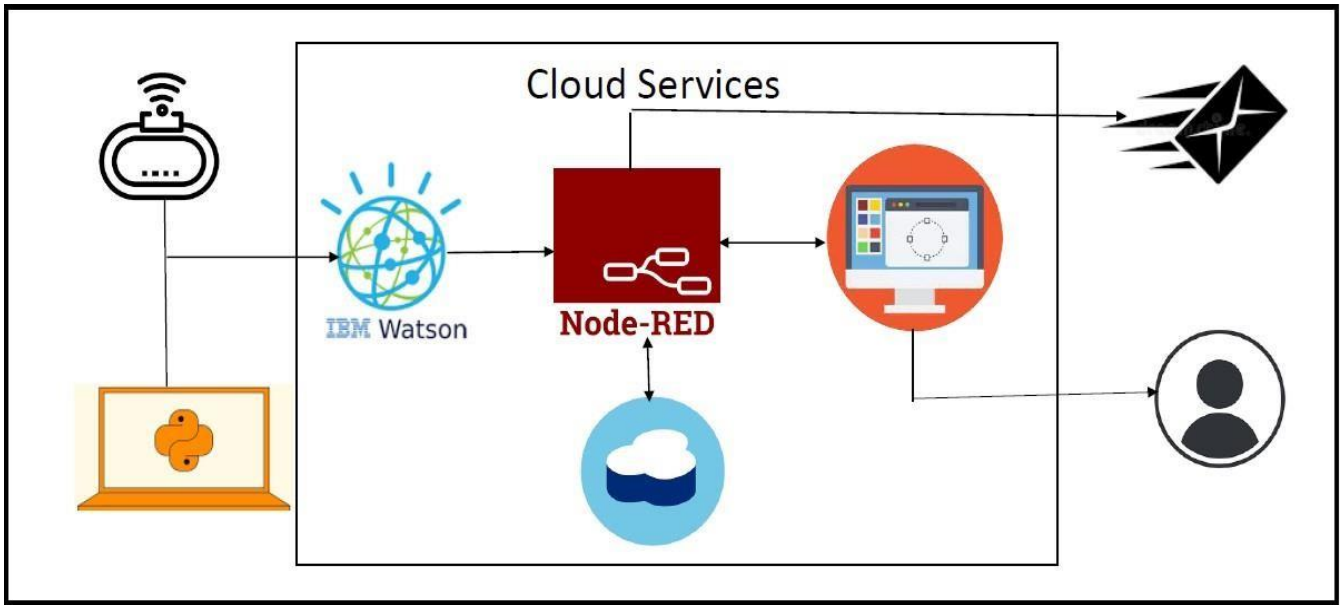
a. Data Flow Diagrams

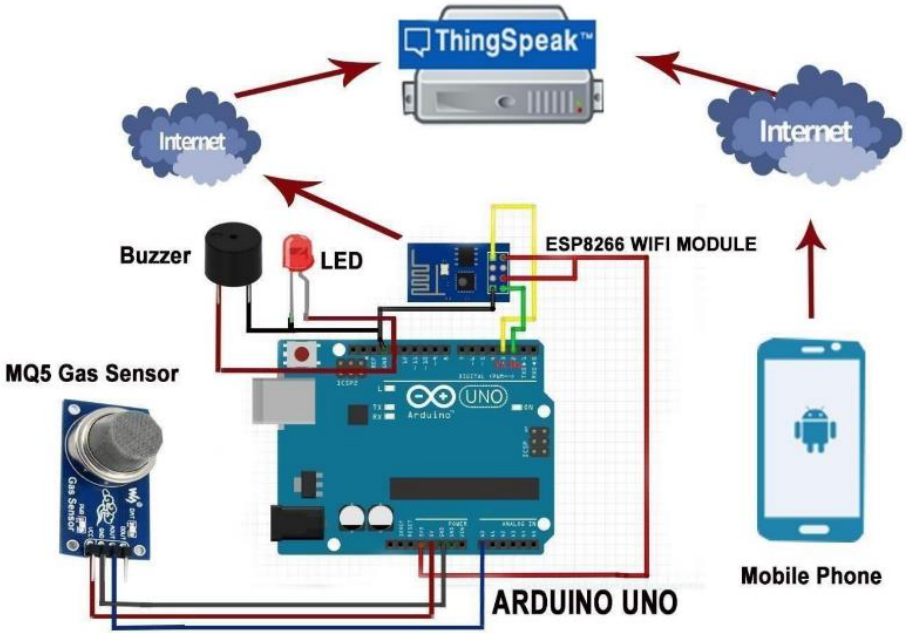


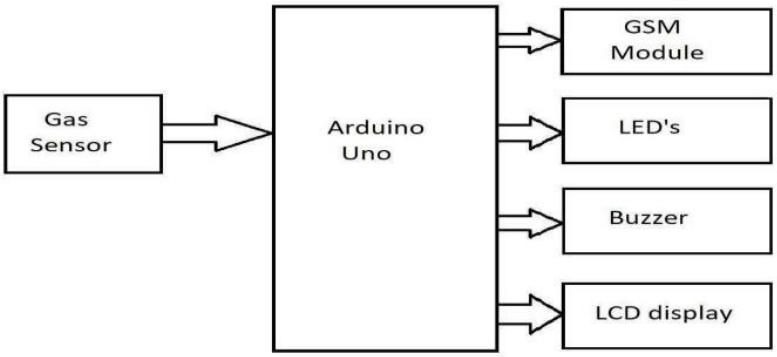
FLOW CHART:



b. Solution & Technical Architecture




ThingSpeak™
Internet
Internet
Buzzer
LED
ESP8266 WIFI MODULE
MQ5 Gas Sensor
Mobile Phone
ARDUINO UNO

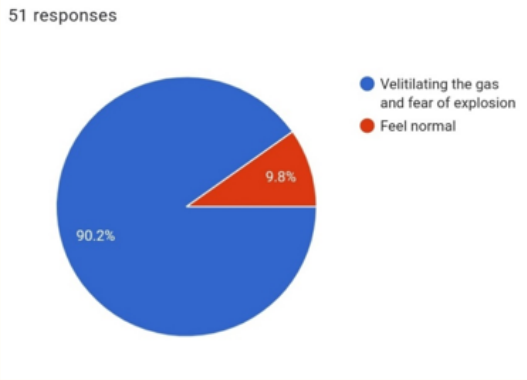

Gas Sensor
Arduino Uno
GSM Module
LED's
Buzzer
LCD display


IoT

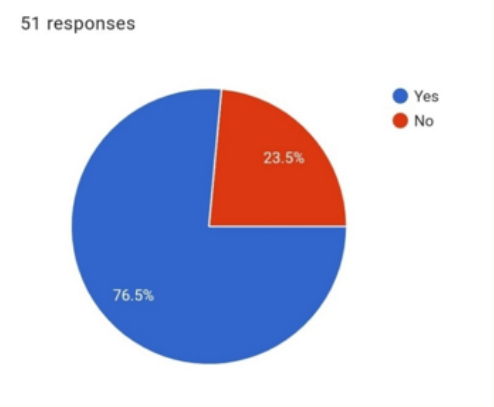
c. USER STORIES:

User Type	Functional Requirement(Epic)	User Story Number	User Story / Task	Acceptancecriteria	Priority	Release
Customer(Mobileuser)	Registration	USN-1	User can enter into thewebapplication	I can access myaccount /dashboard	High	Sprint-1
		USN-2	Users can register their credentials like email idandpassword	I can receive confirmation emailand click confirm	High	Sprint-1
	Login	USN-3	User can log in to the application by entering emailand password	I can login to myaccount	High	Sprint-1
	Dashboard	USN-4	User can view the temperature	I can view the datagiven by the device	High	Sprint-2
		USN-5	User can view the level of gas	I can view the datagiven by the device	High	Sprint-2
Customer (Web user)	Usage	USN-1	User can view the webpageand get the information	I can view the datagiven by the device	High	Sprint-3
Customer	Working	USN-1	User act according to thealertgiven by the device	I can get the data work accordingtoit	High	Sprint-3
		USN-2	User turns ON the exhaust fan/sprinkler when theleakageoccurs	I can get the data work accordingtoit	High	Sprint-4
CustomerCare Executive	Action	USN-1	User solve the problems whensomeone faces anyusage issues	I can solve theissues when someone fails tounderstand the procedure	High	Sprint-4
Administrator	Administration	USN-1	User stores every information	I can store thegained information	High	Sprint-4

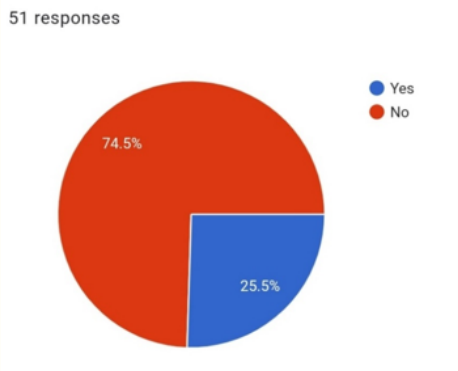
Q1. What are the difficulties you have faced during the gas leaking situations?



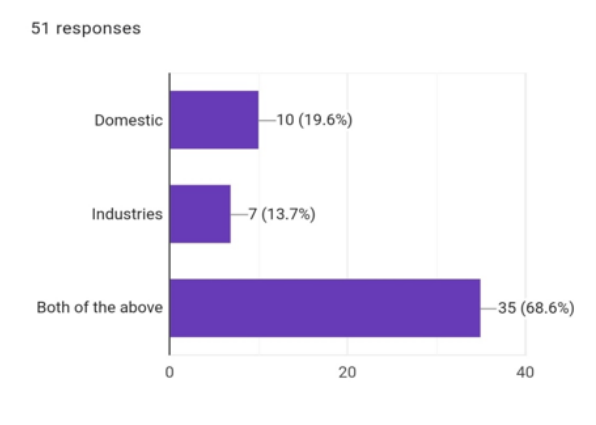
Q2. Do you need any device which will alert you when there is any gas leak and turns on the exhaust system and turns off the valve?



Q3. Have you ever seen any device like this?



Q4. In which places do this device is required?



6. PROJECT PLANNING & SCHEDULING:

a. Sprint Planning & Estimation

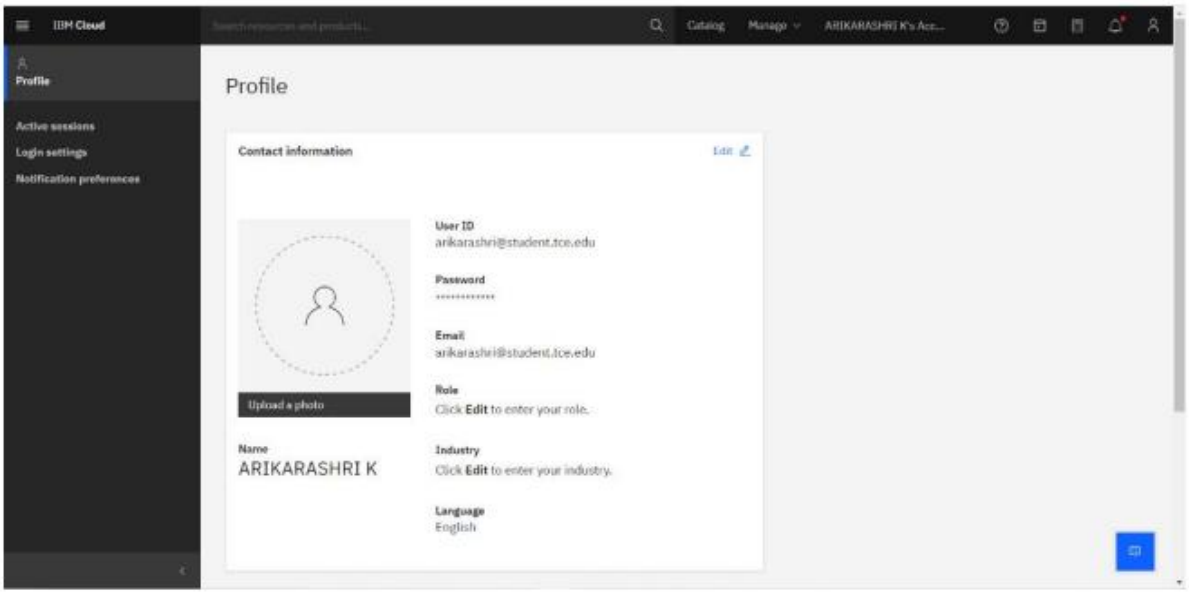
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IBM Watson IOT platform	USN-1	Creating devices and board and generating data	1	medium	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U
Sprint-2	Storing Data using node-red	USN-2	Storing the data in IBM Cloud ant DB through Node-red functions	2	High	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U
Sprint-3	IoT device/ Microcontroller Board	USN-4	The board connect with the cloud and node- red platform and send information about the gas leakage.	2	Low	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U
Sprint-4	Fast SMS	USN-5	Fast SMS sent SMS to the users.	1	High	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U

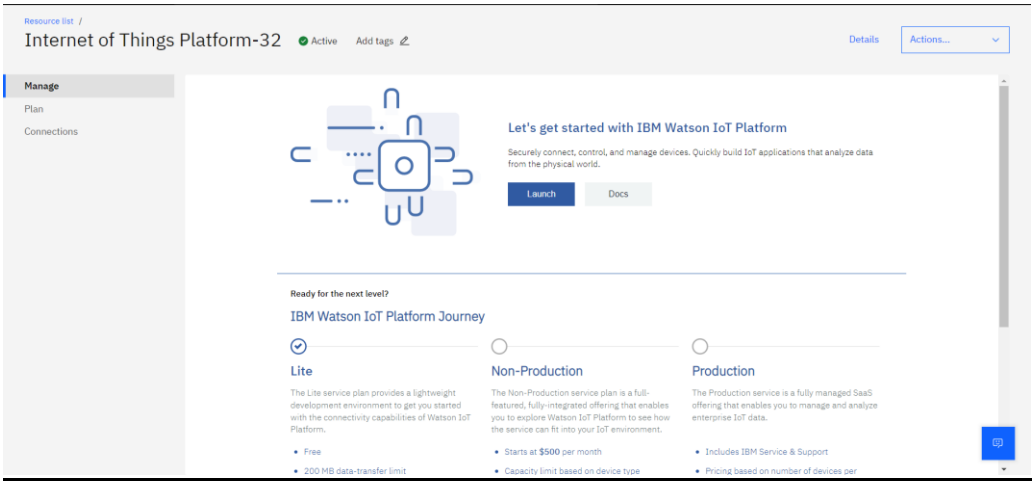
C. Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IBM Watson IOT platform	USN-1	Creating devices and board and generating data	1	medium	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U
Sprint-4	Fast SMS	USN-5	Fast SMS sent SMS to the users.	1	High	ARIKARASHRI. K NITHISH KUMAR. M RANJITH KUMAR. P RUTHRAM. M UDHAYAKUMAR. U

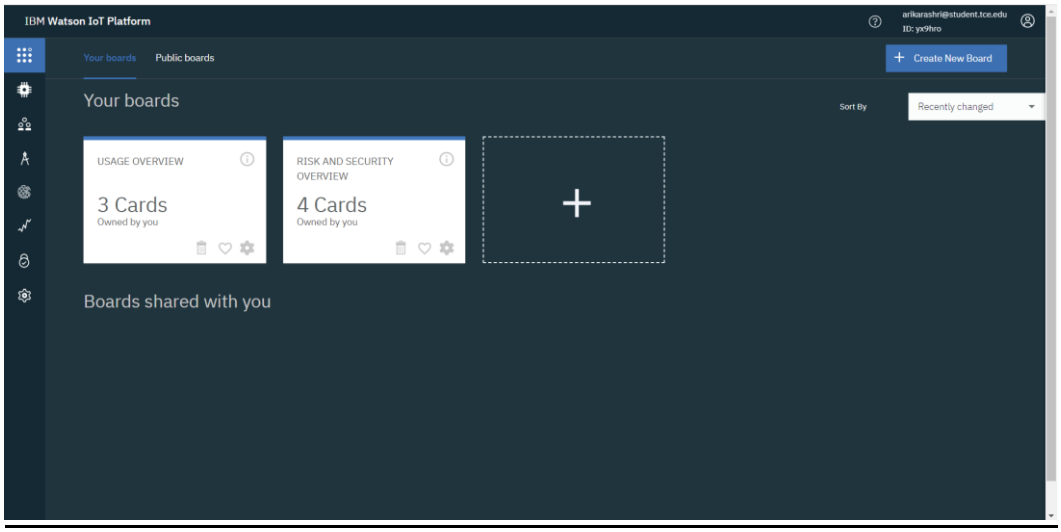
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

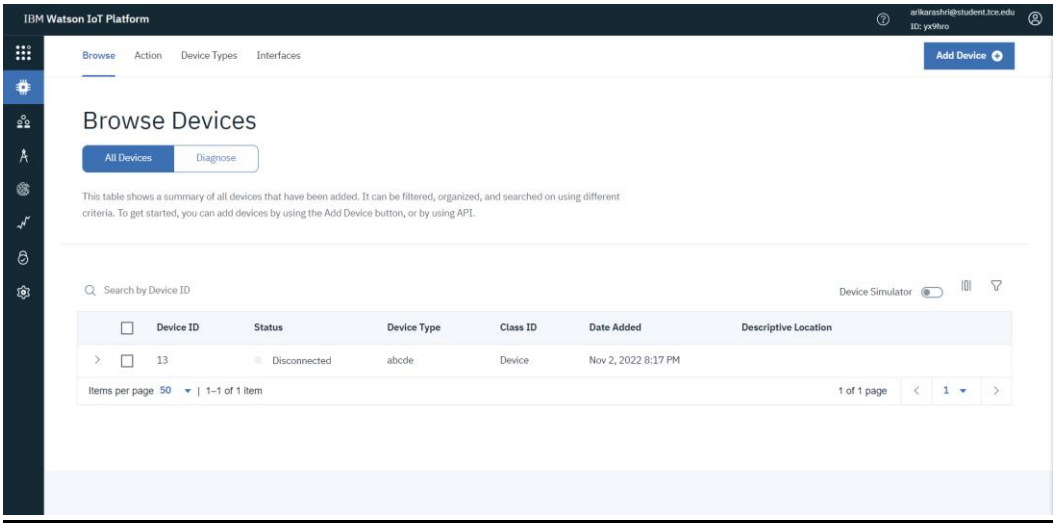
SPRINT

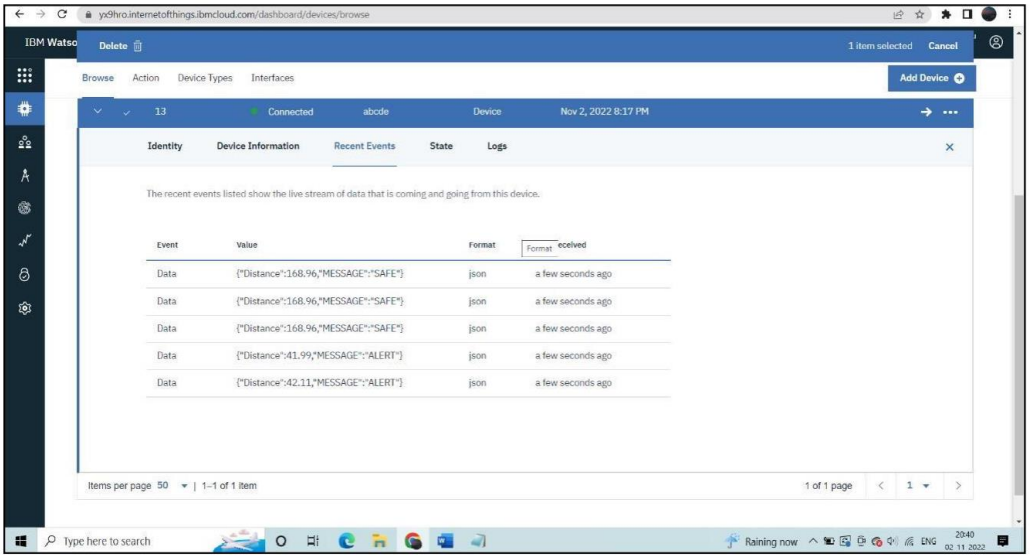




IBM IOT WATSON OUTPUT



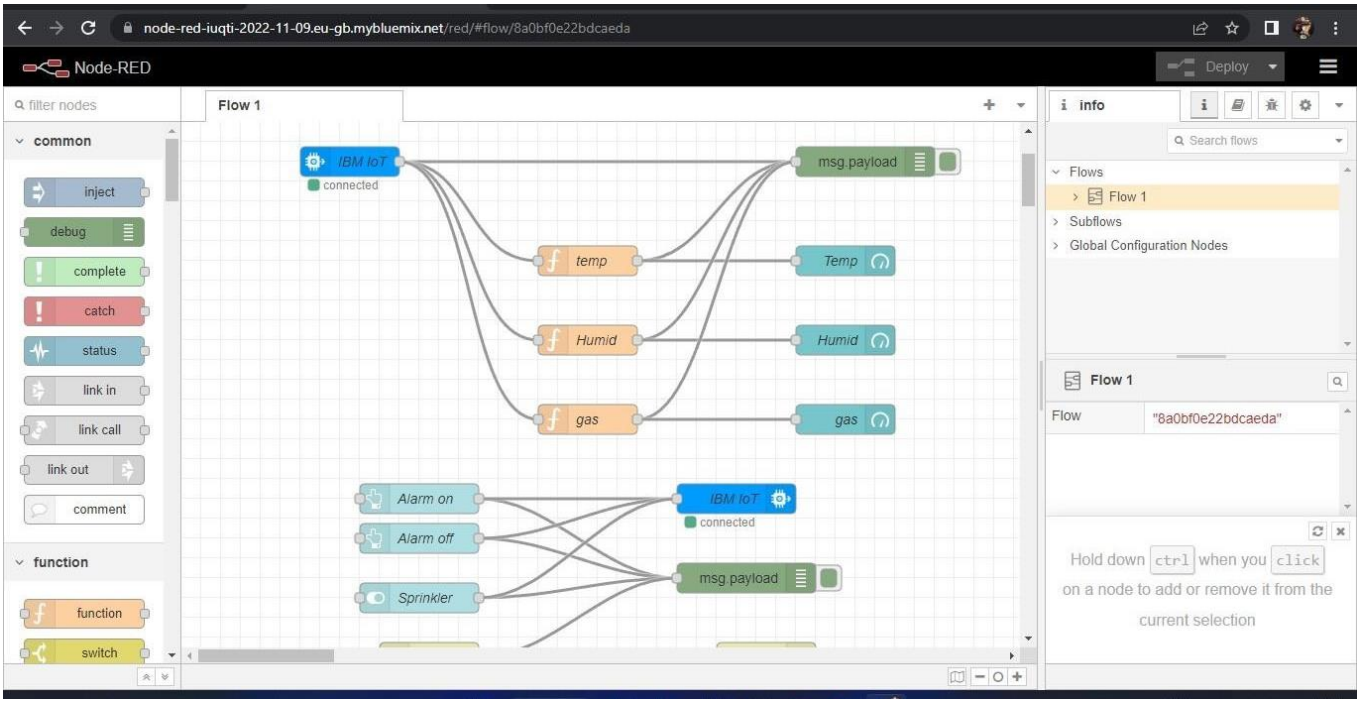




7. CODING & SOLUTIONING:

S.NO	Components
1.	Arduino Uno R3
2.	Breadboard
3.	Piezo
4.	Resistor
5.	LCD 16 X 2
6.	DC Motor
7.	Gas Sensor
8.	LED
9.	Pushbutton
10.	Rotary Potentiometer

NODE – RED WEB APPLICATION CIRCUIT:



Steps:

1. IBM IoT node is used to gather sensor data.

a. Necessary API key is provided to establish a connection.

2. Using functions namely Temperature, Humidity, and Gas the data is obtained independently and displayed in the dashboard.

3. Dashboard Nodes are used to display the sensed data to the user in a portal.

Source code:

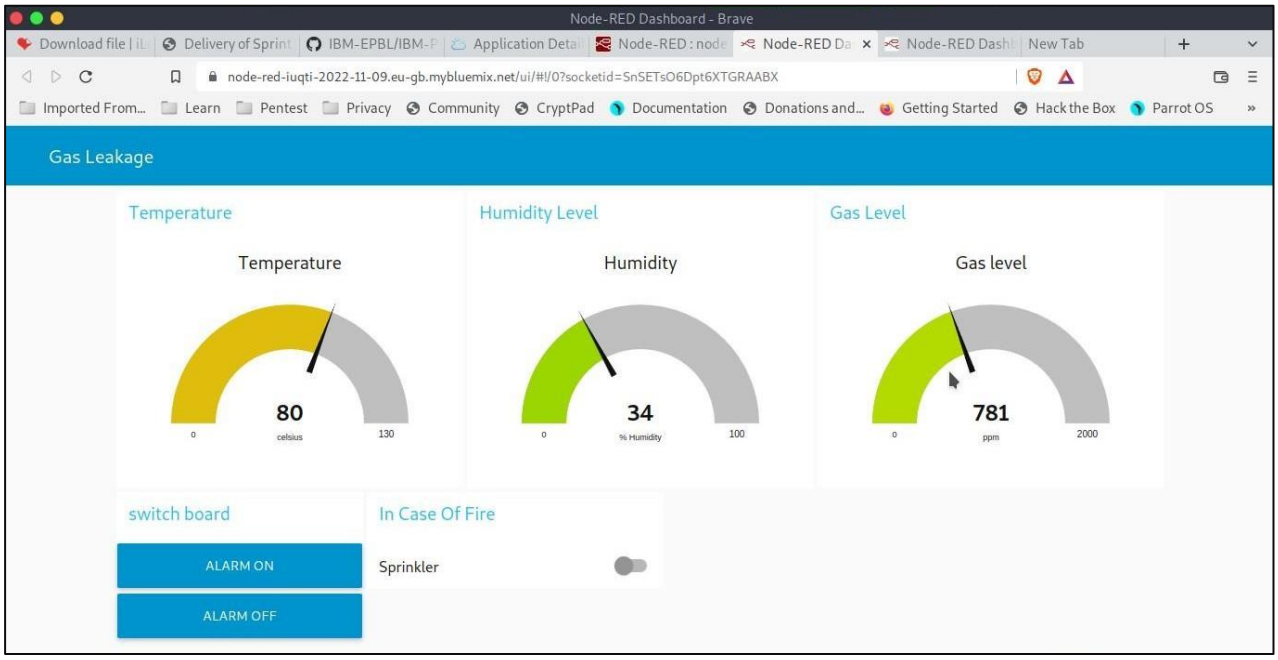
Temperature: msg.payload = msg.payload.Temp;

return msg;

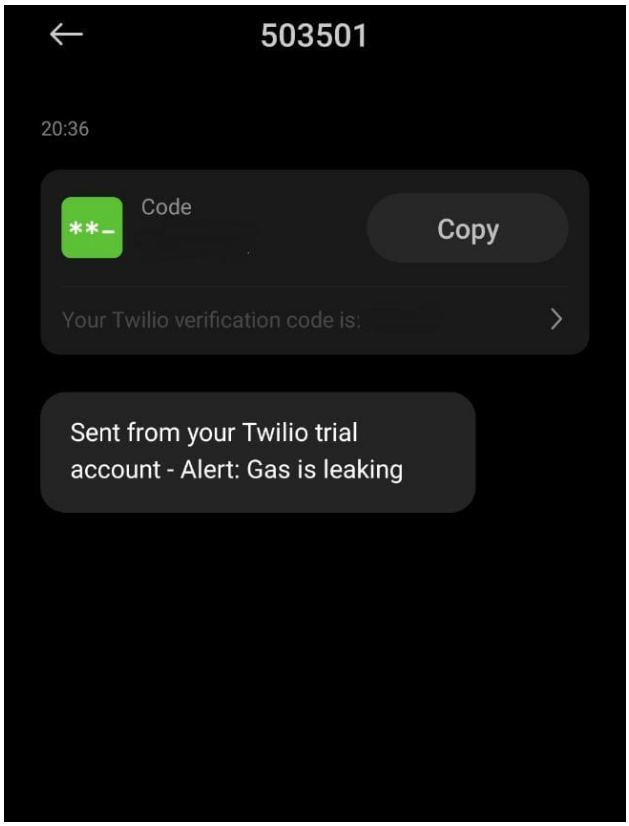
Humidity: msg.payload = msg.payload.Hum;

return msg;

Concentration of Gas: msg.payload = msg.payload.gas;
return msg



MESSEGE:



Code:

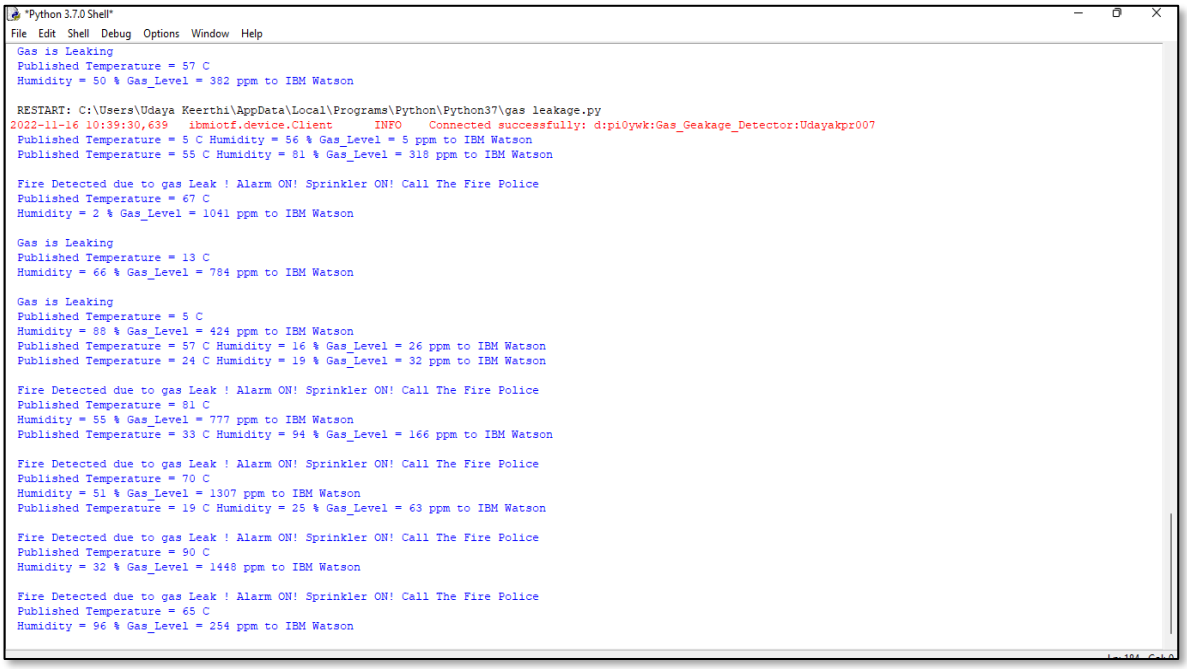
```
import time import sys

import ibmiotf.application import ibmiotf.device import random


#Provide your IBM Watson Device Credentials organization = "pi0ywk"

deviceType = "Gas_Geakage_Detector" deviceId = "Udayakpr007" authMethod = "token"

authToken = "8148922991"


# Initialize GPIO
```

```
def myCommandCallback(cmd):

print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']

if status == "alarmon":

print ("Alarm is on please all Evacuate Fans On") elif
status == "alarmoff":

print ("Alarm is off and Fans Off")


elif status == "sprinkleron":

print ("Sprinkler is On Evacuate Faster") elif status ==
"sprinkleroff":

print("Sprinkler is Off") else:

print("Please send proper command") #print(cmd)

try:

deviceOptions = {"org": organization, "type": deviceType,
"id": deviceId, "auth-method": authMethod, "auth-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 datapoint "hello" with value "world"
into the cloud as an event of type "greeting" 10 times

deviceCli.connect() while True:

#Get Sensor Data from random function
```

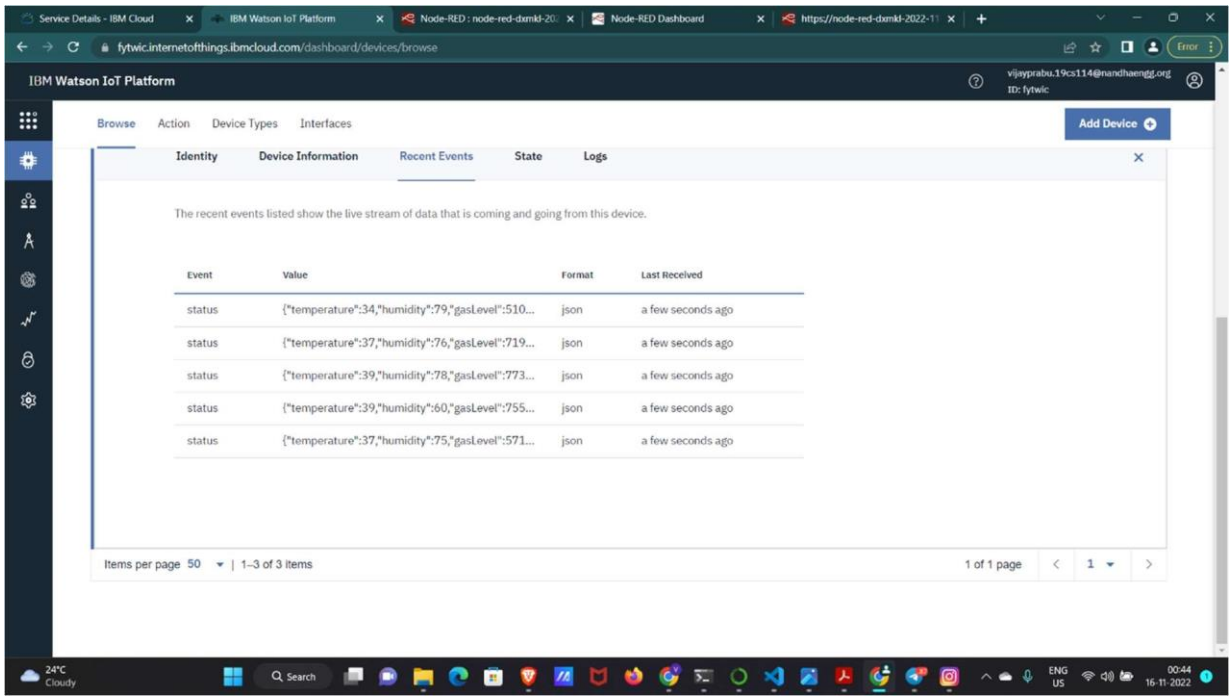
```
temp=random.randint(0,120)
Humid=random.randint(0,100)
gas=random.randint(0,1500)
data={'temp':temp,'Humid':Humid,'gas':gas}


#print data


def myOnPublishCallback():

print (" Published Temperature = %s C" % temp,
"Humidity = %s %%" % Humid, "Gas_Level =

%s ppm" %gas, "to IBM Watson")

success = deviceCli.publishEvent("IoTSensor", "json",
data, qos=0, on_publish=myOnPublishCallback)

if not success:

print("\n Not connected to IoTF") if temp>60 :

print("\n Fire Detected due to gas Leak ! Alarm ON!
Sprinkler ON! Call The Fire Police \n") elif gas>350:

print("\n Gas is Leaking \n")

time.sleep(10)

deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

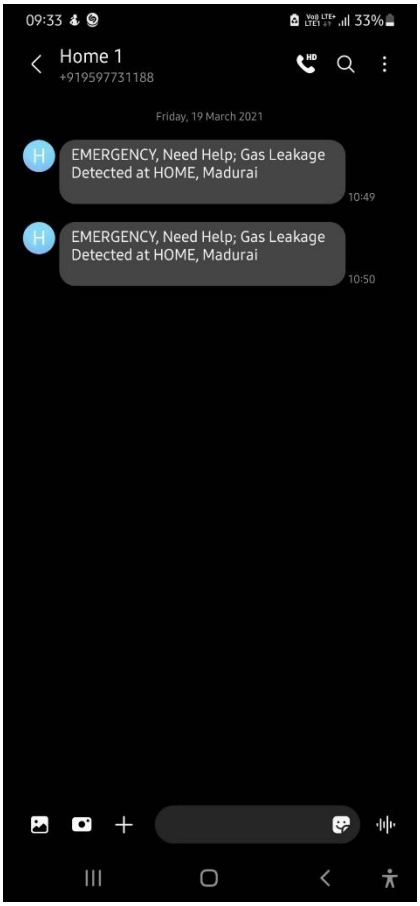
OUTPUT:

Python:

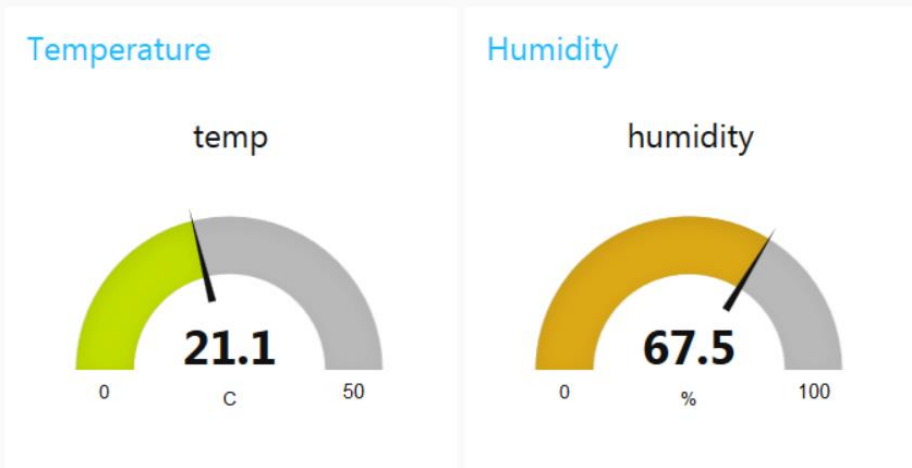


IBM WATSON MESSEGE:




09:33
33%
Home 1
+919597731188
Friday, 19 March 2021
EMERGENCY, Need Help; Gas Leakage Detected at HOME, Madurai
10:49
EMERGENCY, Need Help; Gas Leakage Detected at HOME, Madurai
10:50

READINGS:


Temperature
temp
21.1
0
C
50
Humidity
humidity
67.5
0
%
100

8. UAT Execution & Report Submission

a.. Purpose of Document

- The purpose of this document is to briefly explain the test coverage and open issues of the
- [ProductName] project at the time of the release to User Acceptance Testing (UAT).

b. Defect Analysis

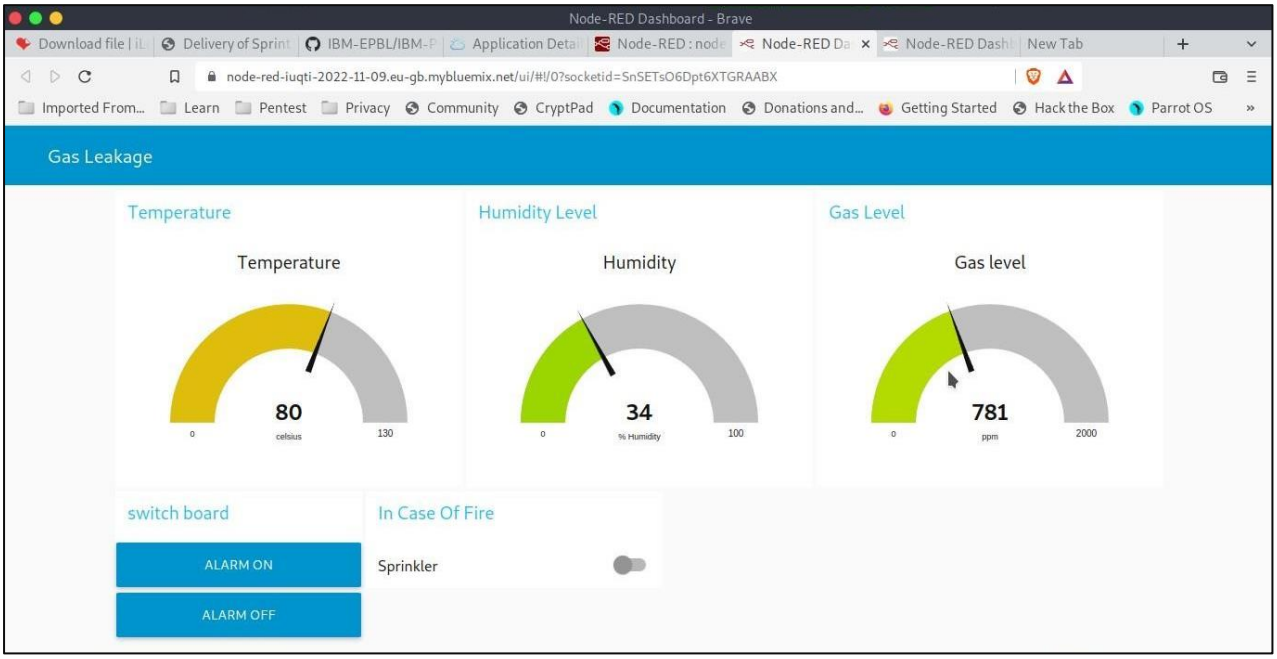
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

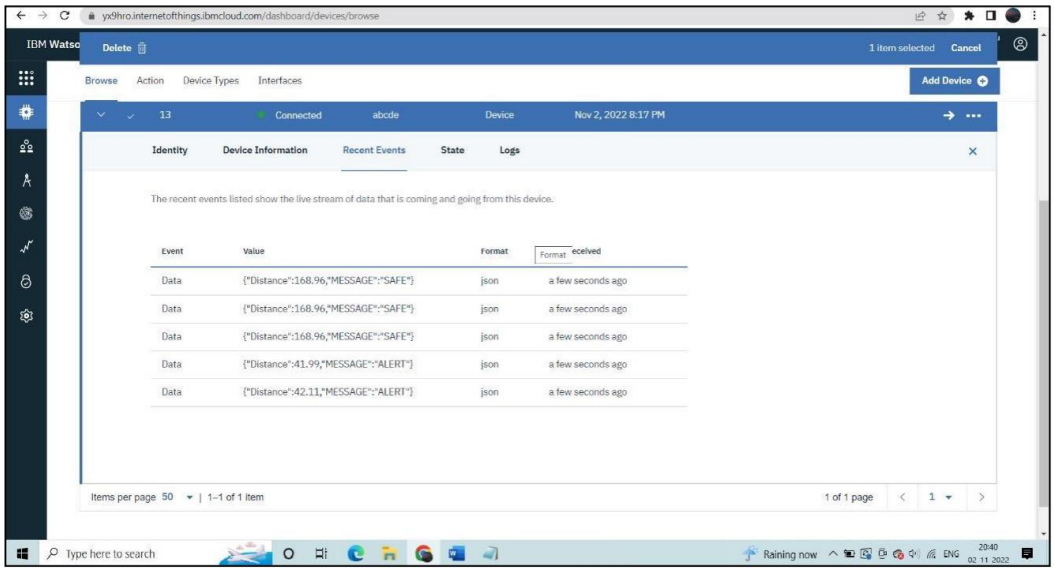
C. Test Case Analysis

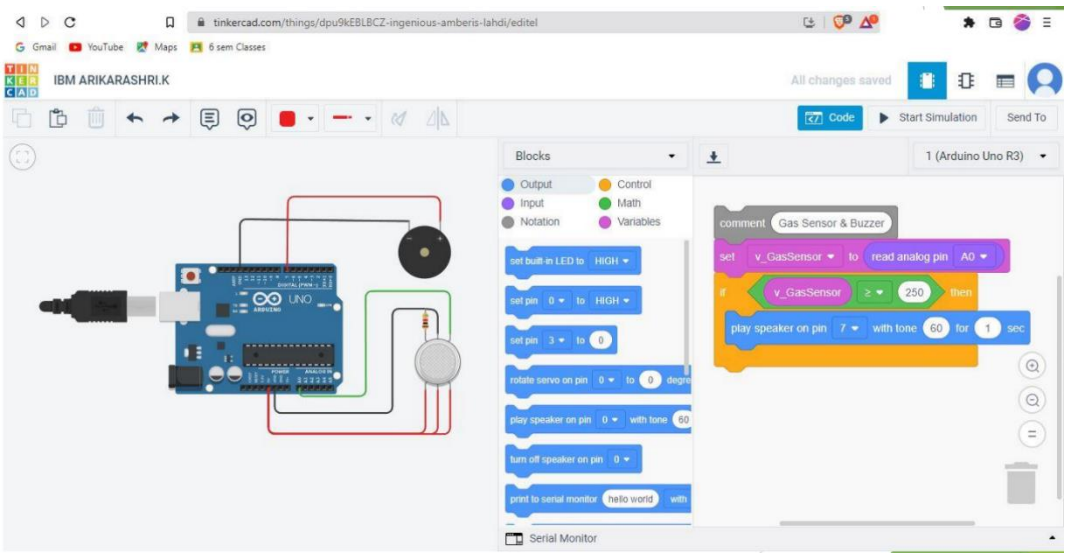
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. Results:

- This project helps the industries in monitoring the emission of harmful gases
- In several areas, the gas sensors will be integrated to monitor the gas leakage
- If in any area gas leakage is detected the admins will be notified along with the location
- In the web application, admins can view the sensor parameters.
- Explosions at home and industries because of gas leaks, and it is a major problem to be rectified.
- Situations like gas leakage are dangerous, which will cause a major accident.
- Even a small amount of heat can fire up the gas and explode.
- The leaked gas need to be ventilated and the leakage must be identified and service the fault immediately.
- And with the IBM platform smartinternz, we have executed on IBM IOT platform, Created IBM Watson IOT and developed a circuit and a web application have created and simulated and datas have read through IBM cloud and simulated.

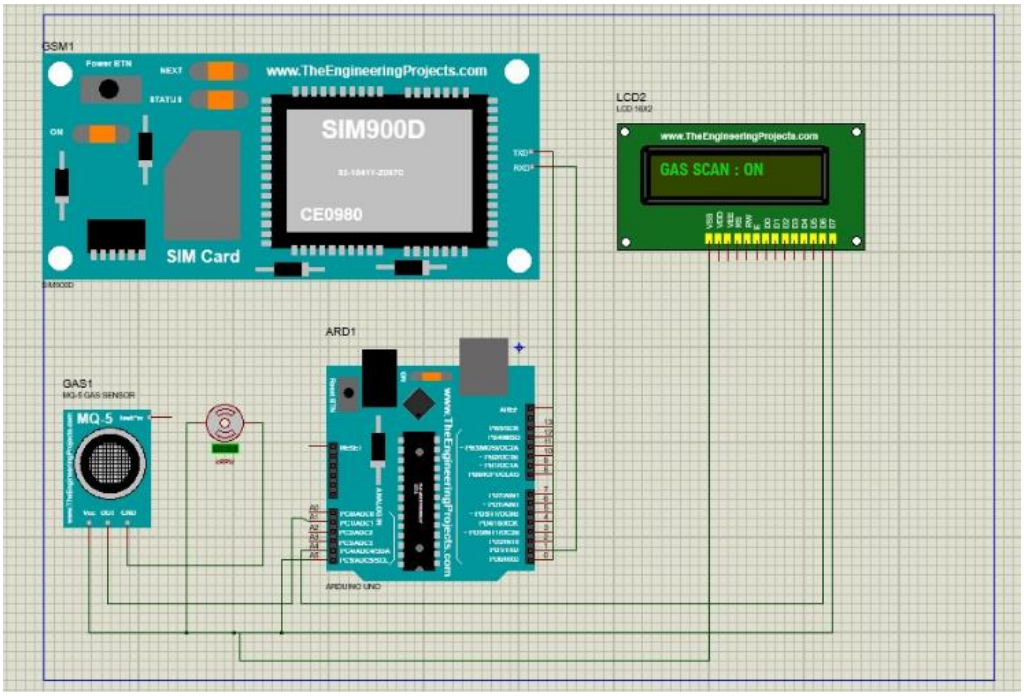



IBM Watso
Delete
1 item selected
Cancel
Browse
Action
Device Types
Interfaces
Add Device
13
Connected
abcde
Device
Nov 2, 2022 8:17 PM
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Format
eceived
Data
{"Distance":168.96,"MESSAGE":"SAFE"}
json
a few seconds ago
Data
{"Distance":168.96,"MESSAGE":"SAFE"}
json
a few seconds ago
Data
{"Distance":168.96,"MESSAGE":"SAFE"}
json
a few seconds ago
Data
{"Distance":41.99,"MESSAGE":"ALERT"}
json
a few seconds ago
Data
{"Distance":42.11,"MESSAGE":"ALERT"}
json
a few seconds ago
Items per page 50
1–1 of 1 item
1 of 1 page
Type here to search
Raining now
ENG
20:40
02 11 2022


tinkercad.com/things/dpu9kEBLBCZ-ingenious-amberis-lahdi/editel
Gmail
YouTube
Maps
6 sem Classes
IBM ARIKARASHRI.K
All changes saved
Code
Start Simulation
Send To
Blocks
1 (Arduino Uno R3)
Output
Input
Notation
Control
Math
Variables
set built-in LED to HIGH
set pin 0 to HIGH
set pin 3 to 0
rotate servo on pin 0 to 0
play speaker on pin 0 with tone 60
turn off speaker on pin 0
print to serial monitor hello world
comment Gas Sensor & Buzzer
set v_GasSensor to read analog pin A0
if v_GasSensor ≥ 250 then
play speaker on pin 7 with tone 60 for 1 sec
Serial Monitor


temp chart
30
25
20
15
10
17:37:00
18:07:00
18:38:00
humidity chart
70
68
66
64
17:37:00
18:07:00
18:38:00

SOFTWARE SIMULATION:



OUTCOMES:

- The parameters like hazardous gas levels, fire, humidity, and temperature data are published to the Watson IoT platform
- The device will subscribe to the commands from the application and take decisions accordingly to switch on the rainwater sprinkler in case of emergencies
- Sensor data is visualized in the Web Application
- To accomplish this, we have to complete all the activities and tasks listed below:
- Create and configure IBM Cloud Services
- Create IBM Watson IoT Platform and Device
- Create Node-RED service
- Develop the Python Script
- Develop the Python Script
- Develop a web Application using Node-RED Service.

- Develop the Web application using Node-RED
- Testing the Web UI by giving the required inputs

10. ADVANTAGES:

- **Detect the concentration of the gases**
- The sensor-enabled solution helps prevent the high risk of gas explosionsand affecting any casualties within and outside the premises.
- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy

Disadvantages:

- Only one gas can be measured with each instrument.

- When heavy dust, steam or fog blocks the laser beam, the system will notbe able to take measurements.

11. CONCLUSION:

- As we shorted out the problems faced by LPG gas consumers so we come up with some solutions to meet the few requirements of them, as we made us system is completely automating the process of identification of leak and an expert required to repair the fault. Is also reasoned to help customers to upgrade them safety norms, act in accordingly with minimum requirements on environmental issues and mostly the basic function being prevented by major disasters and protect life and property from reputed accidents. The primary objective of us project is to detect when there is a leak and to ventilate the gas also turns off

the valve and alert the user through alert SMS to him/her mobile number.

12. FUTURE SCOPE OF IMPROVEMENTS:

- Major cities of India are pushing Smart Home application, gas monitoring system is a part of SmartHome application. Enhancing Industrial Safety using IoT. This system can be implemented in Industries, Hotels and wherever the gas cylinders are used. This systemcan be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylindersused in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder. As many students are naive the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Several medicalequipment requires gas cylinders.

13. **APPENDIX:**

CODE:

```
#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("PNT2022TMID21445");
  delay(500);
  lcd.clear();
}


void loop(){
  // Read the value from gas sensor and buttongasLevel =
  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 ONvoid
gasDetected(float gasLevel){
  if(gasLevel >= 200){
   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(100);
   lcd.clear();
  }
}
//BUZZER
void buzzer(float gasLevel){
if(gasLevel>=200)
```

```
{
   for(int i=0; i<=30; i=i+10)
   {
   tone(4,i);
   delay(300);
   noTone(4);
   delay(4300);
   }
   }
 }
 // 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();
   }
 }
```

LINKS

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-27862-1660069153

DEMO LINK:

https://www.tinkercad.com/things/dpu9kEBLBCZ

https://wokwi.com/projects/347227854809858643

IBM CLOUD CREDENTIALS:

Organization ID

yx9hro

Device Type

abcde

Device ID

13

Authentication Method

use-token-auth

Authentication Token

12345678