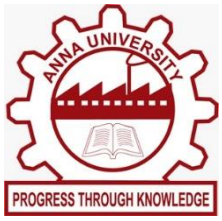

IBM SMARTINTERNZ PROJECT

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

Batch no.: B9-3A5E

Team ID: PNT2022TMID21384

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 PROJECT OVERVIEW:

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties such toxicity, flammability, etc. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage.

1.2 PURPOSE:

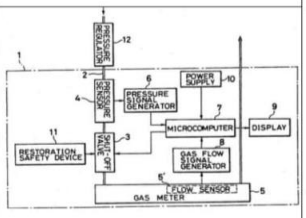
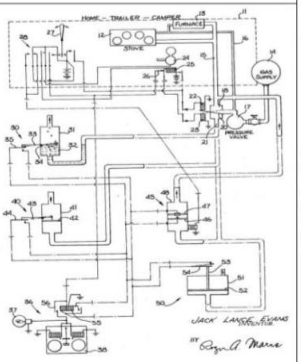
The LPG or Propane (C_3H_8) is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and harm to the environment. To avoid this problem there is a need for a system to detect the leakage of LPG. Gas leak detection is the process of identifying potentially hazardous gas leaks by means of various sensors.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Nowadays, security is the major problem in many fields due to robberies, fire accidents and blasts due to LPG gas leakage. At present, LPG gas can be used in the car, in the storage tank or service station. But, due to some reasons the LPG gas might leak from the gas cylinders, this may cause the cylinder blast, damage the house and risk of a life to the living persons in the house. The fire ignite can be occurred due to many reasons such as an electrical short circuit, oil lamps or candles kept inside the house. Sometimes fire accidents are very small, but if proper action is not taken to control the fire, then it can spread in complete house. To overcome this problem, an LPG gas sensor is used to detect the presence of a dangerous LPG gas leak in various places.

2.2 REFERENCES:

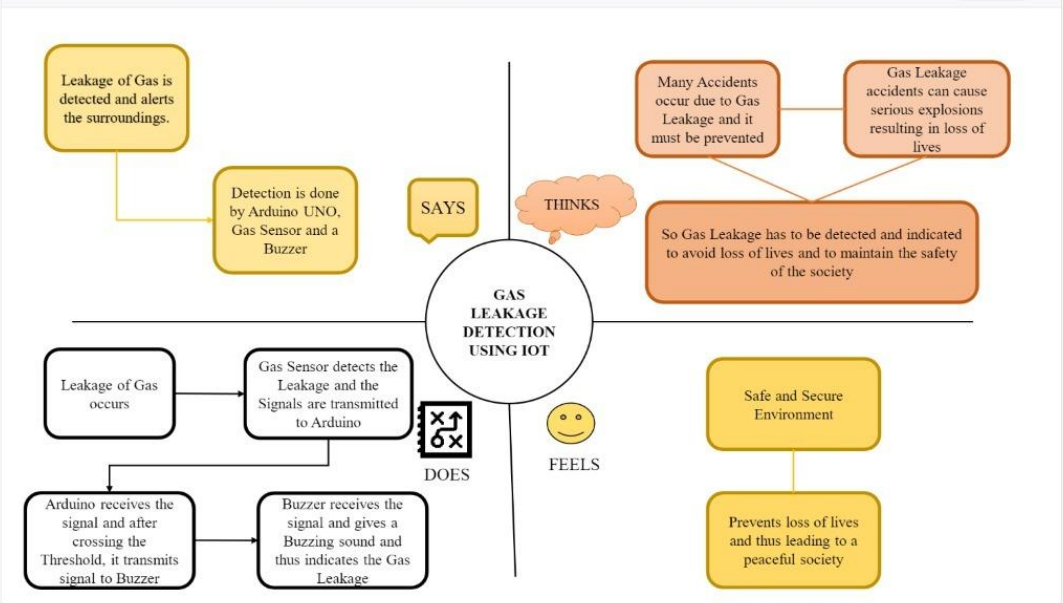
Patent Number/File	Inventor	Applications/Demerits	Diagram
US5261268A GAS LEAK DETECTION SYSTEM	Mitsuo Namba	It comprises a flow sensor for detecting the amount of gas flowing through a gas flow passage, a pressure sensor, a pressure signal generator connected with the flow signal generator and the pressure signal generator	
US3624627A GAS LEAK DETECTION SYSTEM	Jack L. Evans	A system for sensing the presence of a leak in a closed gas network interconnecting a gas source with a plurality of gas consuming appliances Including thermostatic controls for automatically Signalling demand to supply the selected appliances.	

2.3 PROBLEM STATEMENT DEFINITION:

LPG gas can be used in the car, kitchen, and in the storage tank or service station. But, due to some reasons the LPG gas might leak from the gas cylinders, this may cause the cylinder blast, damage the building and risk of a life to the living persons in the building.

3. IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS:



3.2 BRAINSTORMING:

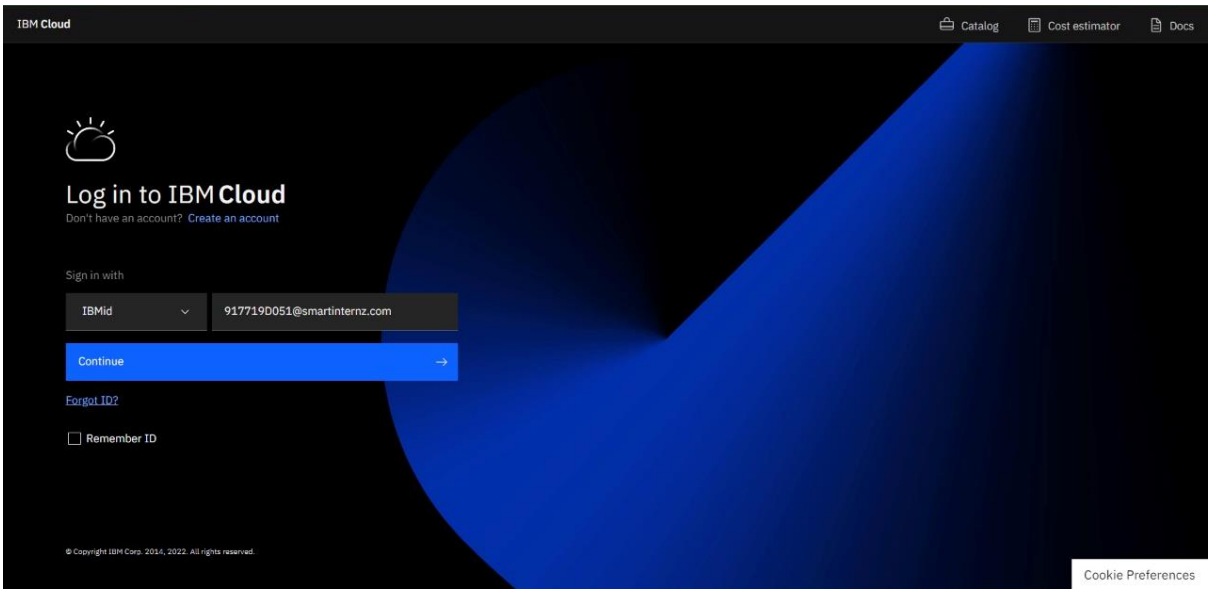
Several brainstorming sessions have been conducted through Google Meet and Offline Meets for the discussion of the features to be incorporated into the LPG Leakage Detection System. We have discussed the need of our device with our Family members.

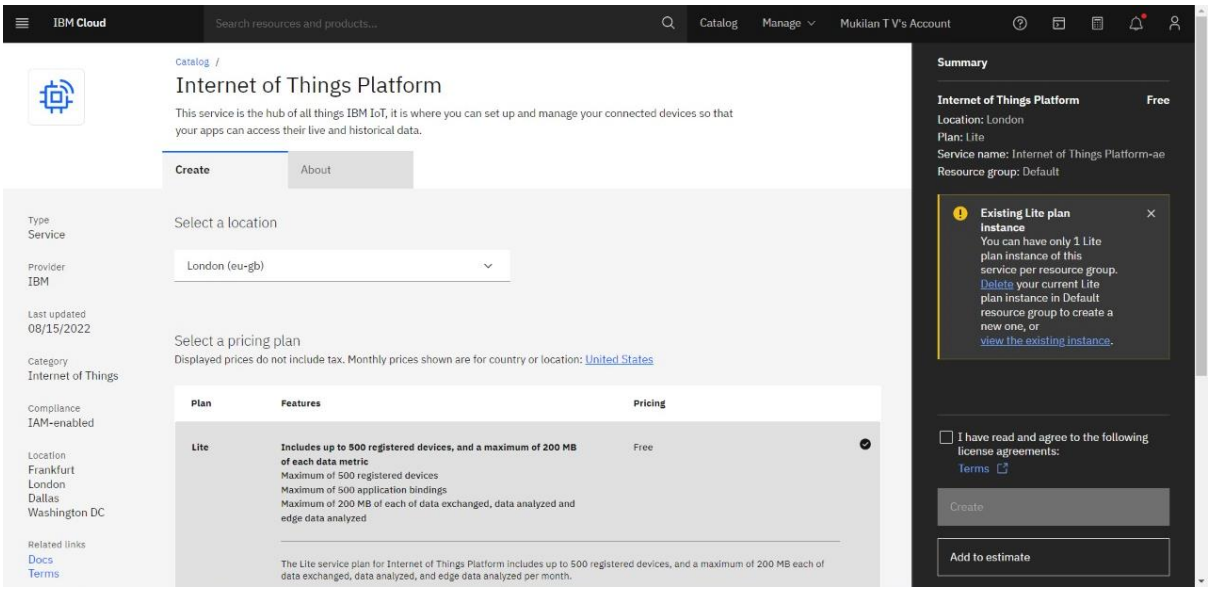
3.3 PROPOSED SOLUTION:

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.

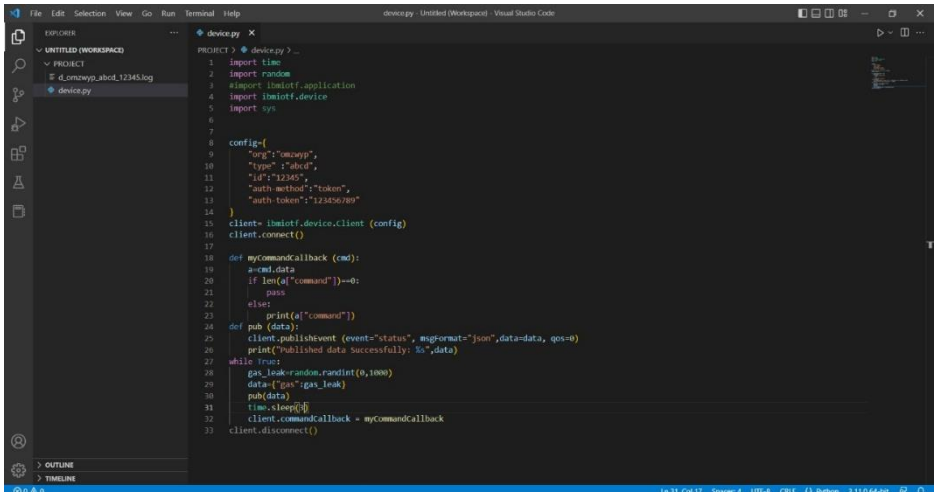
4. REQUIREMENT ANALYSIS

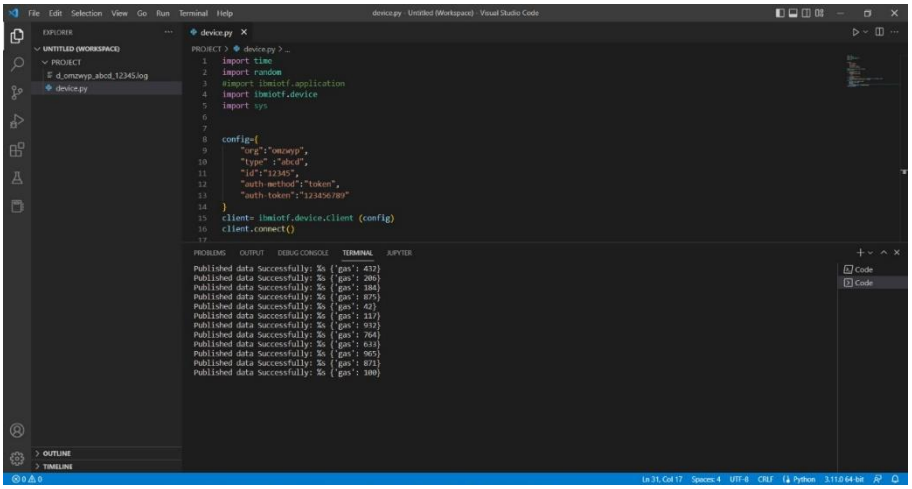
I. CREATION AND CONFIGURATION OF IBM CLOUD SERVICE:

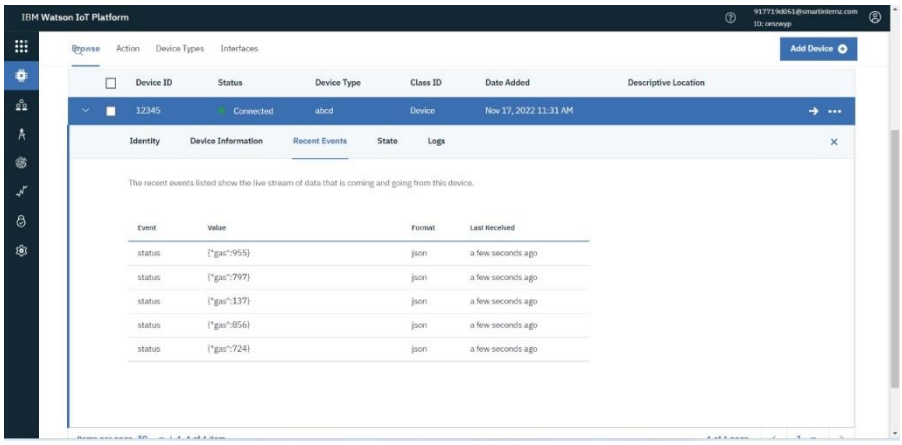




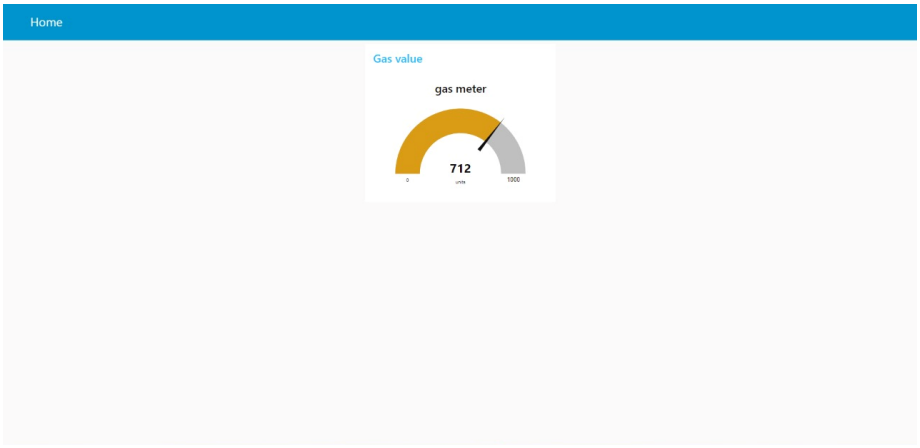
II. DEVELOPMENT OF PYTHON SCRIPT TO PUBLISH AND SUBSCRIBE TO IBM IOT PLATFORM:





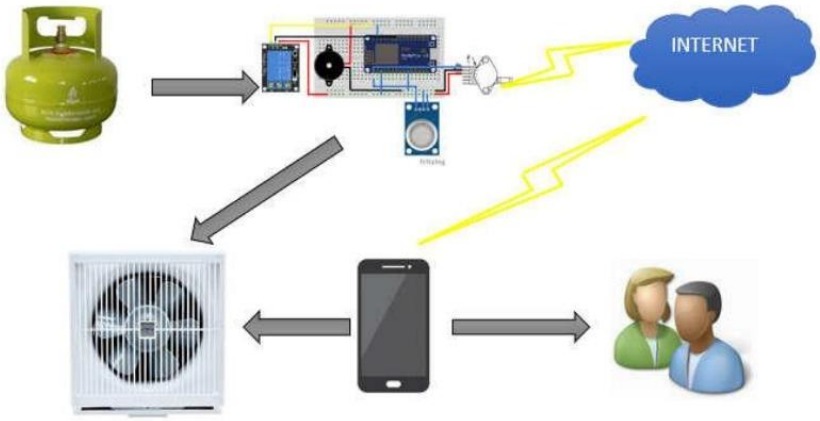


III. DEVELOPING WEB APPLICATION USING NODE-RED SERVICE:

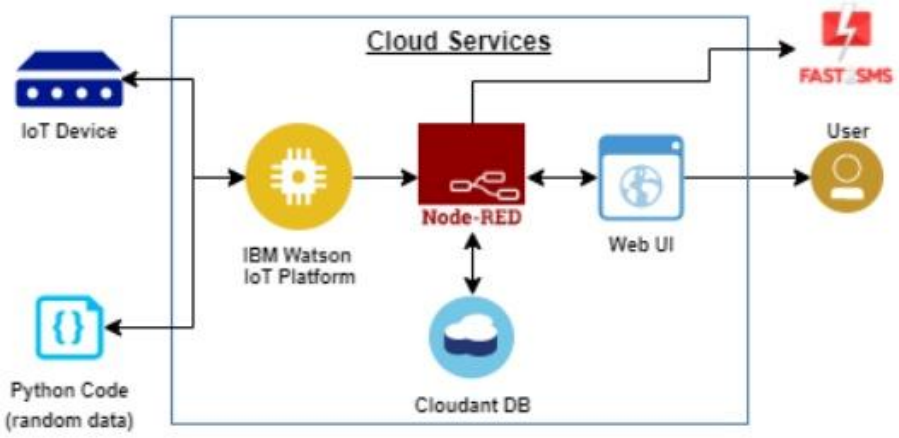


5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:



5.2 SOLUTION AND TECHNICAL ARCHITECTURE:



5.3 USER STORIES:

1. Creating devices and generating data
2. Storing the data in IBM Cloudant DB through node-red functions
3. The board connect with the cloud and node- red platform and send information about the gas leakage.
4. Notification sent to the users.

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	IBM Watson IOT platform	USN-1	Creating devices and generating data	1	Medium
Sprint-2	Storing Data using node-red	USN-2	Storing the data in IBM Cloudant DB through node-red functions	2	Medium
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	High
Sprint-4	Fast SMS/Email notification	USN-5	Notification sent to the users.	1	High

6.2 SPRINT DELIVERY SCHEDULE:

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

7. CODING AND SOLUTIONING

I. PYTHON CODE:

```
import time
import random
import ibmiotf.application
import ibmiotf.device
import sys
config={
    "org":"omzwyp",
    "type" :"abcd",
    "id":"12345",
    "auth-method":"token",
    "auth-token":"123456789"
}
client= ibmiotf.device.Client (config)
client.connect()
def myCommandCallback (cmd):
    a=cmd.data
    if len(a["command"])==0:
```

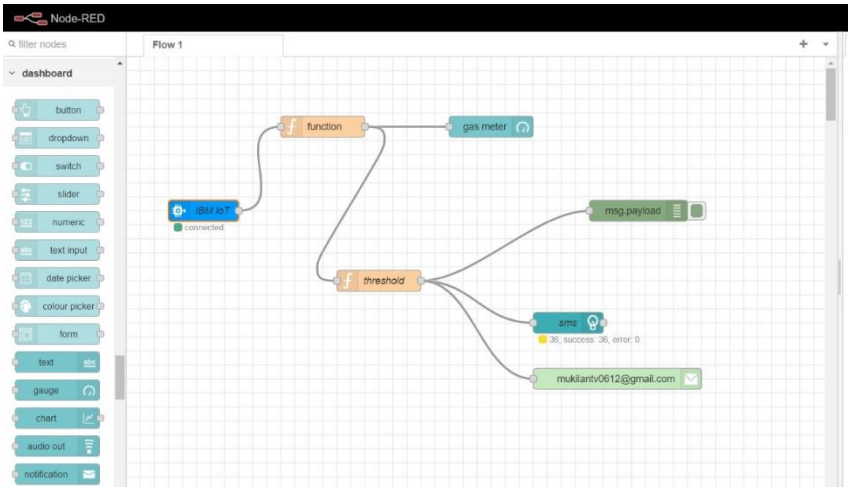
```
        pass
    else:
        print(a["command"])
def pub (data):
    client.publishEvent (event="status", msgFormat="json",data=data, qos=0)
    print("Published data Successfully: %s",data)
while True:
    gas_leak=random.randint(0,1000)
    data={"gas":gas_leak}
    pub(data)
    time.sleep(3)
    client.commandCallback = myCommandCallback
client.disconnect()
```

II. CONNECTION WITH IOT WATSON:

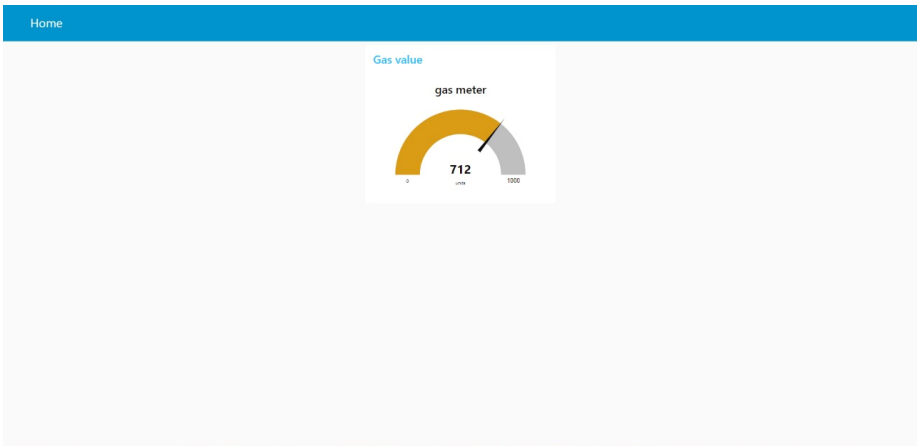
The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
status	{"gas":712}	json	a few seconds ago
status	{"gas":270}	json	a few seconds ago
status	{"gas":581}	json	a few seconds ago
status	{"gas":253}	json	a few seconds ago
status	{"gas":980}	json	a few seconds ago

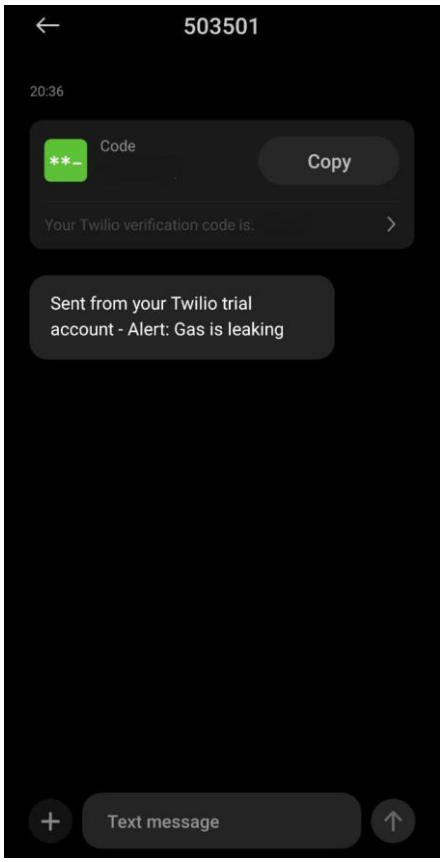
III. NODE-RED SERVICE:

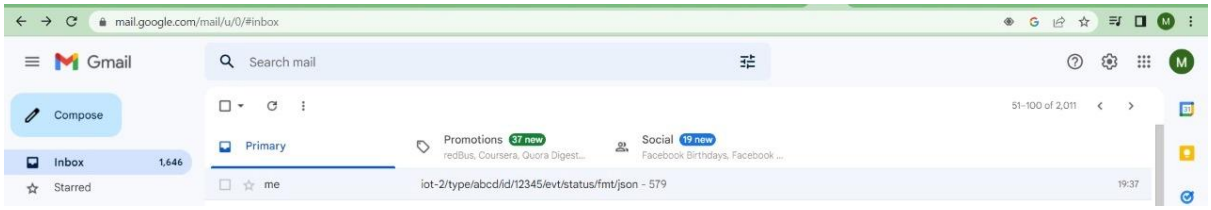


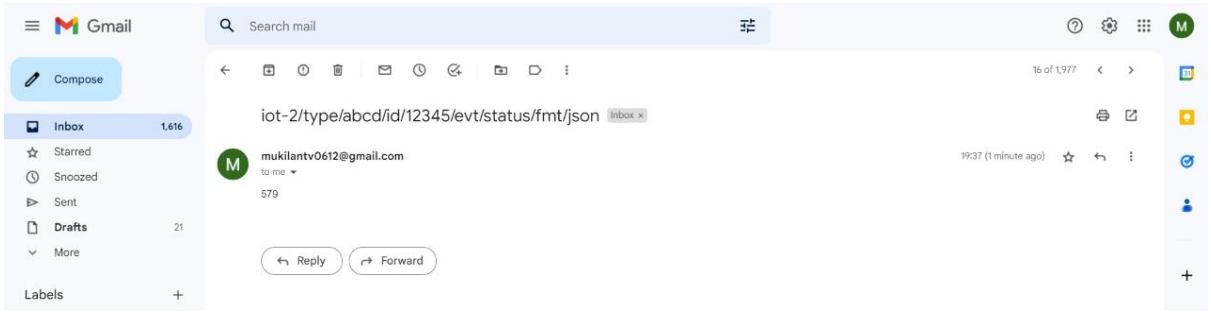
IV. WEB APPLICATION:



V. NOTIFICATION THROUGH SMS AND EMAIL:







8.TESTING

8.1 USER ACCEPTANCE TESTING:

A) 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

B) 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 smart internz, we have executed on IBM IOT platform, Created IBM Watson IOT and developed a circuit and a web application have created and simulated and data have read through IBM cloud and simulated.

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Detect the concentration of the gases
- The sensor-enabled solution helps prevent the high risk of gas explosions and 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 not be able to take measurements.

11. CONCLUSIONS

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

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT. This system can be implemented in Industries, Hotels and wherever the gas cylinders are used. This System can 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 32 cylinders used 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 medical equipment requires gas cylinders.

13. APPENDIX

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-11383-1666241898

DEMO LINK:

https://drive.google.com/file/d/1_xbp9vbt4kHOmMNyWiA29Qm2wAi469eW/view?usp=sharing