PROJECT REPORT

PROJECT NAME	GAS LEAKAGE MONITORING & ALERTING SYSTEM FOR INDUSTRIES
TEAM ID	PNT2022TMID12845
TEAM MEMBERS	NITHISH T INDU M HARINI GAYATHRI S SUSHEN SHARMA S
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING

1. INTRODUCTION

1.1 Project Overview:

The internet of Things is a developing topic of technical, social, and economic significance. The usage of the gas brings great problems in the domestic as well as working places. The inflammable gas, which is excessively used in the work places (Industries). The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. Most of the societies have fire safety mechanism. But it can use after the fire exists. As a result, a system for detecting and monitoring gas leaks is required. Through a flame sensor, the system will sense fire and flame. The buzzer begins to ring when a fire is detected. Tests have shown that the system can keep track of the wastage of gas and leaks and notify the user. The performance that was produced showed that it was successful in reducing the amount of gas that was wasted.

1.2 Purpose:

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed. This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. To monitor this gas leak, the system includes an MQ6 gas detector. This sensor detects the amount of leaking gas present in the surrounding atmosphere. In this way, the consequences of an explosion or gas leak can be avoided.

2. LITERATURE SURVEY :

2.1 Existing Problem:

Gas leakage is nothing but the leak of any gaseous molecule from a pipeline, or cylinder etc. in the industries. Gas Leakages in open or closed areas can prove to be dangerous. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, industry and the environment. Therefore, we have used IoT technology to make a Gas Leakage Detector for society which has Smart Alerting techniques involving sending a text message to the concerned authority and the ability to perform data analytics on sensor readings. Our main aim is to propose a gas leakage system for a society where each flat has gas leakage detector hardware. This will detect the harmful gases in the environment and alerting to society members through the alarm and sending notifications.

2.2 References:

1. Shital Imade, Priyanka Rajmanes, Aishwarya Gavali , Prof. V. N. Nayakwadi “GAS LEAKAGE DETECTION AND SMART ALERTING SYSTEM USING IOT” https://www.pramanaresearch.org/gallery/22.%20feb%20ijirs%20-%20d539.pdf

2. Kumar Keshamoni and Sabbani Hemanth. "Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT " International Advance Computing Conference IEEE, 2017.

3. Petros Spachos, Liang Song and Dimitrios Hatzinakos. "Gas Leak Detection and Localization System Through Wireless Sensor Networks" The 11th Annual IEEE Consumer Communications and Networking Conference - Demos. IEEE, 2014.

4. “Design and Implementation of an Economic Gas Leakage Detector” National Institute of Health (2004). What you need to know about natural gas detectors. Available:http://www.nidcd.nih.gov/health/smelltaste/gas dtctr.asp.

5. Prof.M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi,M.Gunasekaran “Gsm based LPG leakage detection and controlling system” the International Journal of Engineering and Science (IJES) ISSN (e): 2319 – 1813 ISSN (p):2319 – 1805 Pages 112-116 March- 2015.

6. Srinivasan,Leela,Jeyabharathi,Kirthika,Rajasree“GAS LEAKAGE DETECTION AND

CONTROL" Scientific Journal of Impact Factor(SJIF): 3.134.

7. Pal-Stefan Murvaya, IoanSileaa "A survey on gas leak detection and localization techniques".

8. Ch. Manohar Raju, N. Sushma Rani, "An android based automatic gas detection and indication robot. In International Journal of Computer Engineering and Applications. 2014;8(1).

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

10. Ashish Shrivastava,Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma "GSM BASED GAS LEAKAGE DETECTION SYSTEM" in International Journal of Technical Research and Applications e-ISSN: 2320- 8163,www.ijtra.com Volume 1, Issue 2 (may-June 2013).

11. C.Selvapriya, S.Sathyaprabha, M.Abdulrahim," LPG leakage monitoring and multilevel alerting system", published in 2013.

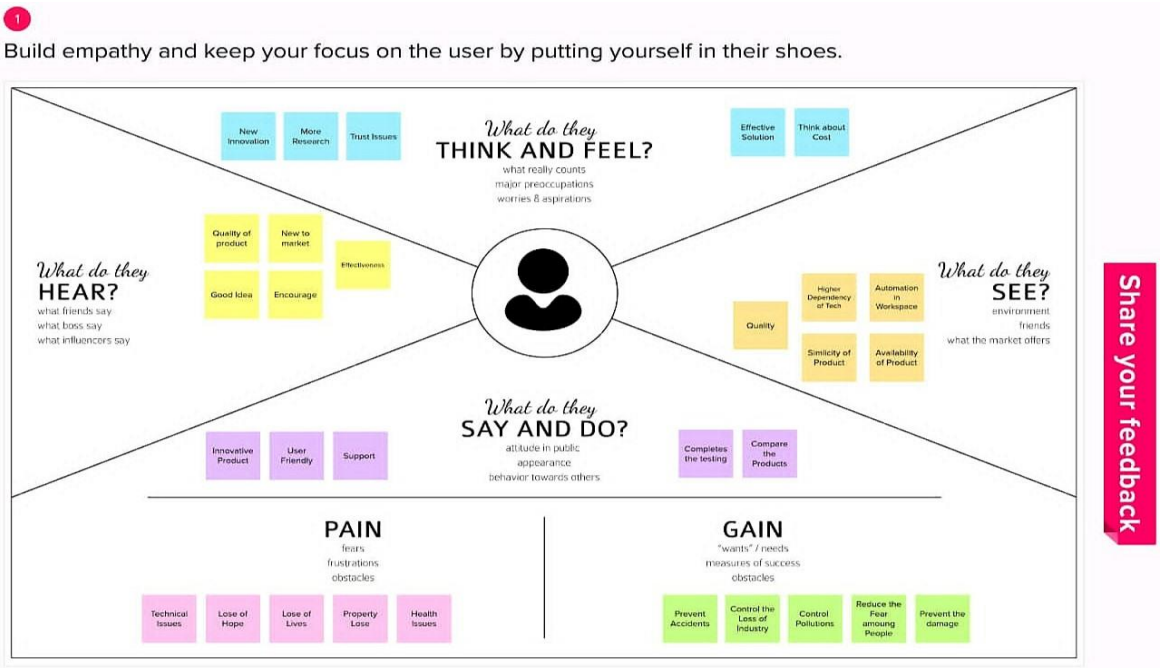
12. Falohun A.S., Oke A.O., Abolaji B.M. "Dangerous gas detection using an integrated circuit and MQ-9. In International Journal of Computer Applications. 2016; 135(7).

2.3 Problem Statement Definition:

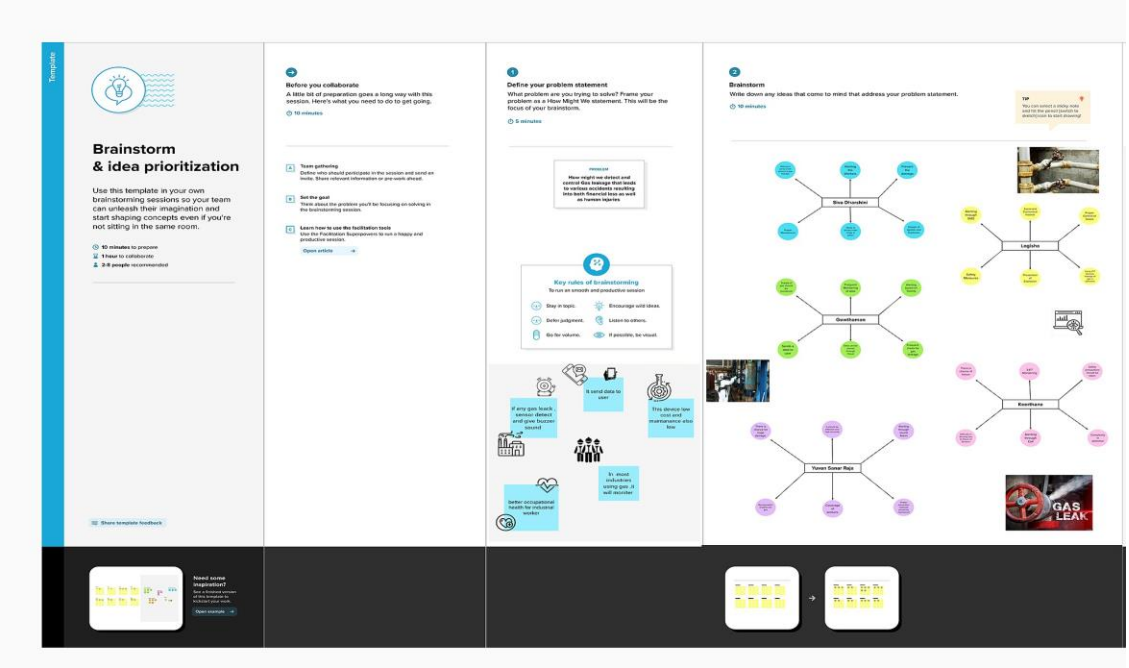
In most industries, one of the key parts of any safety plan for reducing risks to personnel and plant is the use of early-warning devices such as gas detectors. These can help to provide more time in which to take remedial or protective action. They can also be used as part of a total, integrated monitoring and safety system for an industrial plant. Rapid expansion of oil and gas industry leads to gas leakage incidents which are very serious and dangerous. Solutions need to be found out at least to minimize the effects of these incidents since gas leaks also produce a significant financial loss. The challenges are not only to design a prototype of the device that can only detect but also automatically respond to it whenever the leakage occurs.

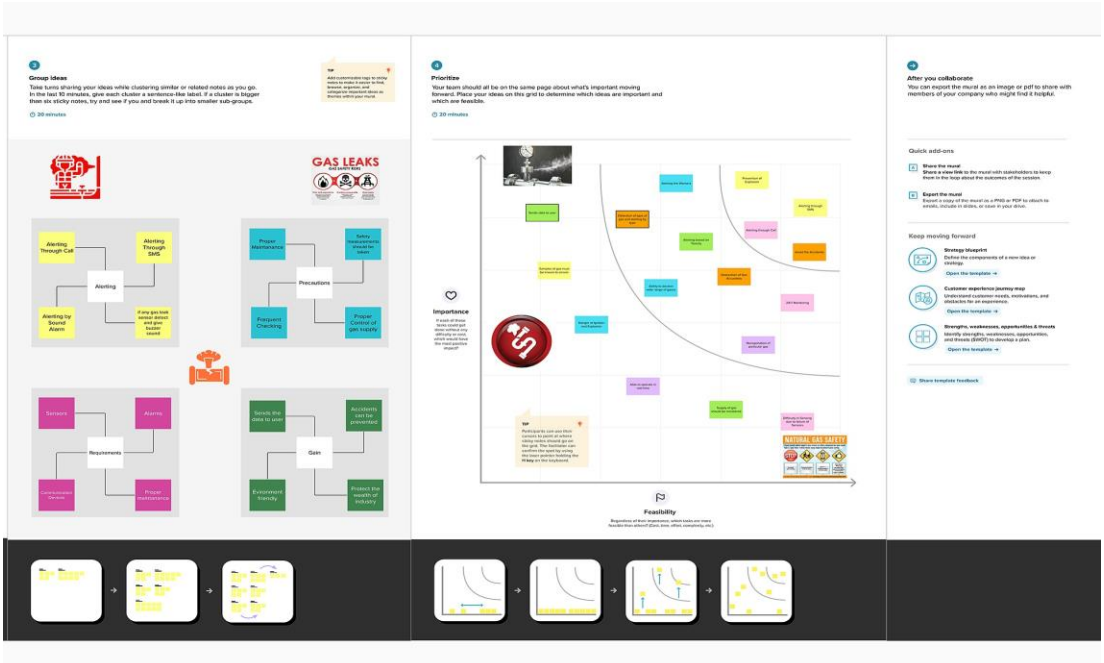
3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:



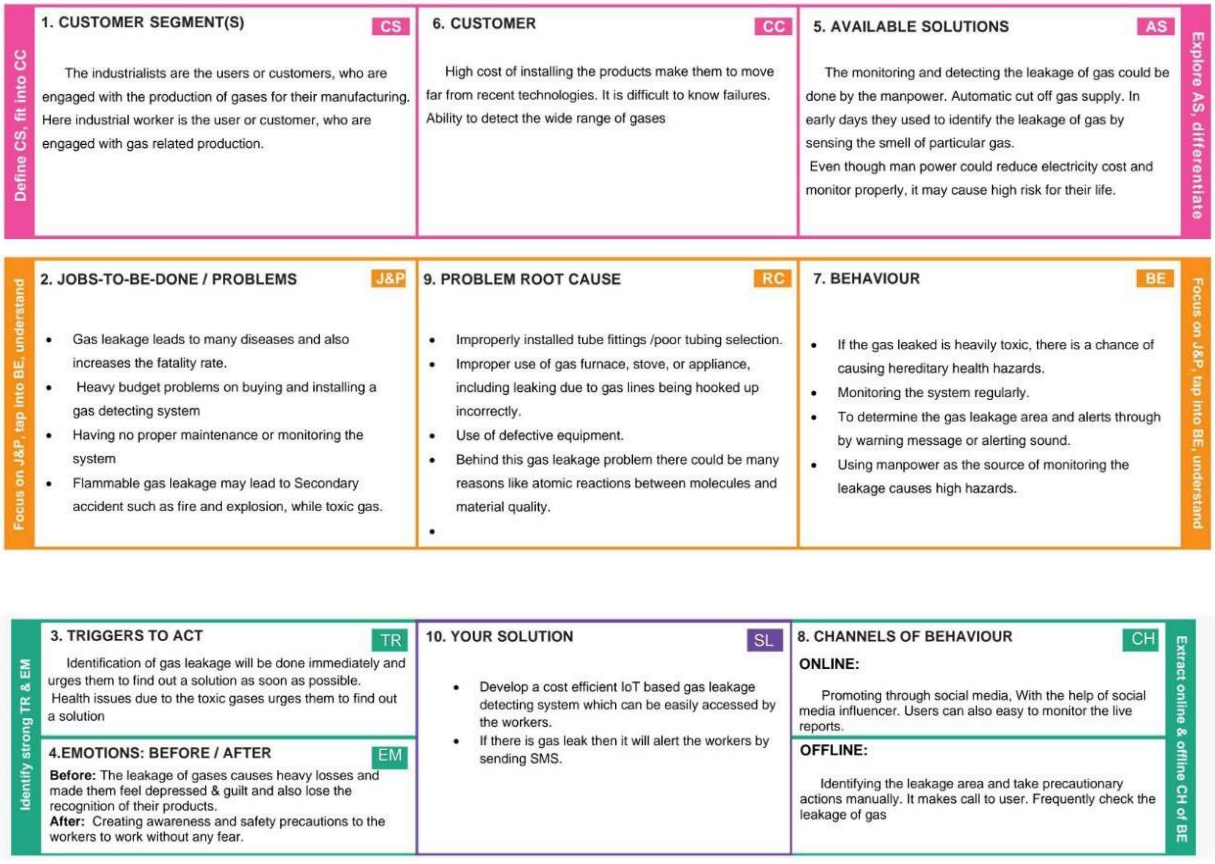


3.3 Proposed Solution:

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas leakage leads to various accidents resulting in loss of human lives and industry properties. Sometimes, the gas leakage cannot be detected by human that has a low sense of smell. Thus, this system will help to detect the presence of gas leakage and alert the users.
2.	Idea / Solution description	It detects the gas leakage by using various sensors. If the gas leakage level is above the threshold level, it sends the alert message through SMS to the user by using GSM module and buzzer the alarm.
3.	Novelty / Uniqueness	We use location tagging and alert service so that the admin and fire department team will be notified the exact location. The system provides constant monitoring and detection of gas leakage along with storage of data in database for predictions and analysis.
4.	Social Impact / Customer Satisfaction	By implementing real-time gas leak detection, industries can monitor their environmental performance, ensure better occupational health. Also, early detection of gas leaks can trigger concerned engineers to curtail the spread and keep a safe environment for better health and safety.

5.	Business Model (Revenue Model)	The product can be made compact, cost efficient and easily installable so that all the industries from small scale to large scale can able to buy the product .
6.	Scalability of the Solution	The system is very simple and easy to maintain and cost efficient. It has the capability to works for a period of time without any damage in the system components.

3.4 Problem Solution fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

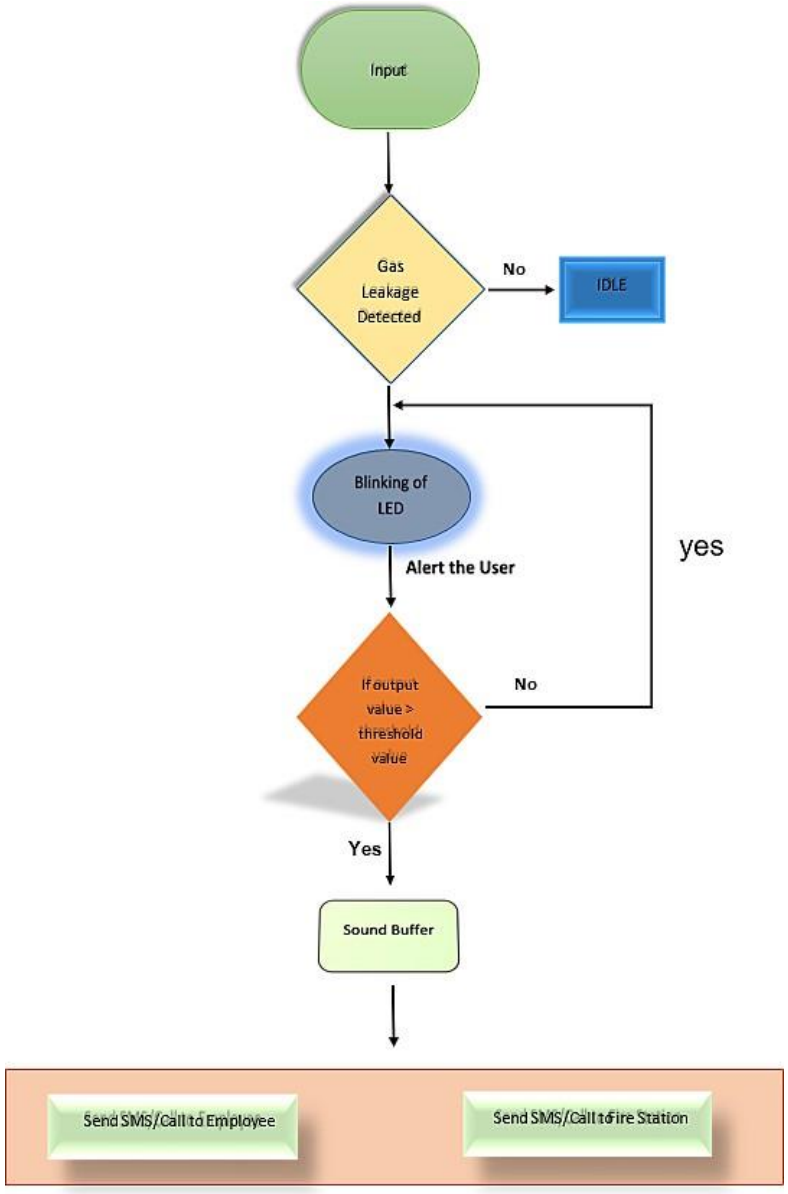
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through FormRegistration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	GPS Access	GPS access to know the location
FR-4	Business Requirements	The device is intended for the use of industries or factories and also for cylinder storage areas. It detects the leakage of gas and sends the data over to a site and preventive measures can be taken to avoid the loss of properties.
FR-5	User Requirements	The Gas leakage detecting system with upgrading technologies which identifies the leakage of gas and also ensures the workers safety.

4.2 Non-Functional requirements:

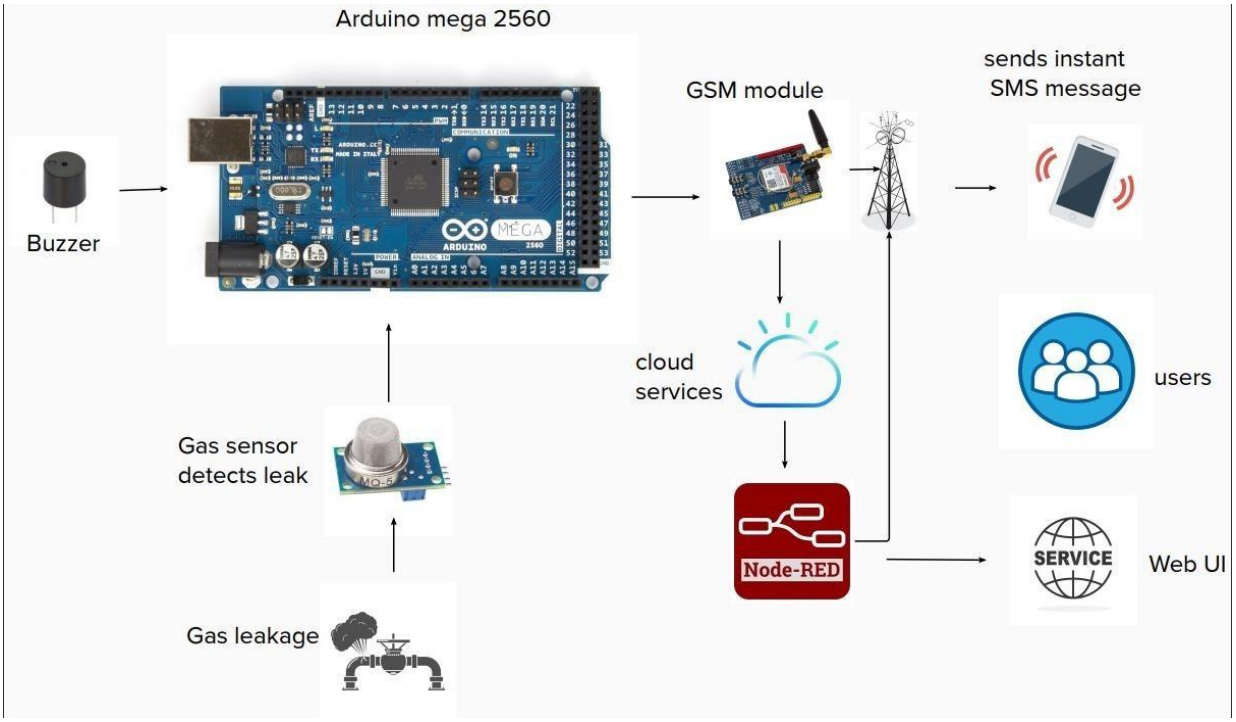
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The sensors used to detect the gas leakage which helps to prevent the high risk of gas explosion and also can prevent the causalities within and outside the covering area of the industries.
NFR-2	Security	The device is intended for the use of industries or factories, where there is a use of explosive gas is a source of risk. This device will help and secures from the causes.
NFR-3	Reliability	Gas leakage detecting system detects the gas leakage at industries or factories which detects the small amount of gas leakage as soon and sends the alerting SMS to users.
NFR-4	Performance	The Gas leakage detecting system is a device with an alarm setting. Whenever there is a gas leak ,which is greater than the threshold level, the in-build sensor detects and alerts the user within a minute much before it can cause any accidents.
NFR-5	Availability	The gas leakage detecting system is readily available in the market which is extremely expensive, but here we are providing a low-cost circuit for gas leakage detecting system and also it is user friendly
NFR-6	Scalability	The system is very simple and easy to maintain with cost efficient. A backup power supply will be included in the design to prevent from the power failure conditions. It has the capability to works for a period of time without any damage in the system components.

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 (Mobile user)	Registration	USN-1	As a user, I can create an account in the application provided.	I can access my account/ dashboard	High	Sprint-1
		USN-2	As a user, I registered using my Gmail.	I can receive confirmation email.	High	Sprint-1
		USN-3	As a user, I can successfully install the app.	I can register and access the dashboard.	Low	Sprint-2
	Login	USN-4	As a user, I can login using my Gmail and password easily.	The login process was easy and simple to access the dashboard.	High	Sprint-1
Customer (Web user)	Registration	WUSN-1	As a web user I can login to web dashboard just like a website.	I can register and access the dashboard.	High	Sprint-2
	Dashboard	WUSN-2	As a user I can view the alert/warning SMS in the web application.	I can login to the website using my login credentials	High	Sprint-2

Customer Care Executive		CCE-1	A customer care executive will always be available for the interaction with the customer to clarify the queries.	An executive will clarify the doubts and note down the complaints of the application if any.	High	Sprint-2
Administrator		ADMIN-1	I as an Admin can access and view the data or information provided by the application &can also check, analyse the threshold value of the gas.	The details of the gas leakage level of the gas are provided to the users through SMS when an alerting sound is received.	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

• SPRINT PLAN

• ANALYZE THE PROBLEM

• PREPARE an ABSTRACT, PROBLEM STATEMENT

• LIST A REQUIRED OBJECT NEEDED

• CREATE A PROGRAM CODE AND RUN IT

• MAKE A PROTOTYPE TO IMPLEMENT

• TEST WITH THE CREATED CODE AND CHECK THE DESIGNEDPROTOTYPE

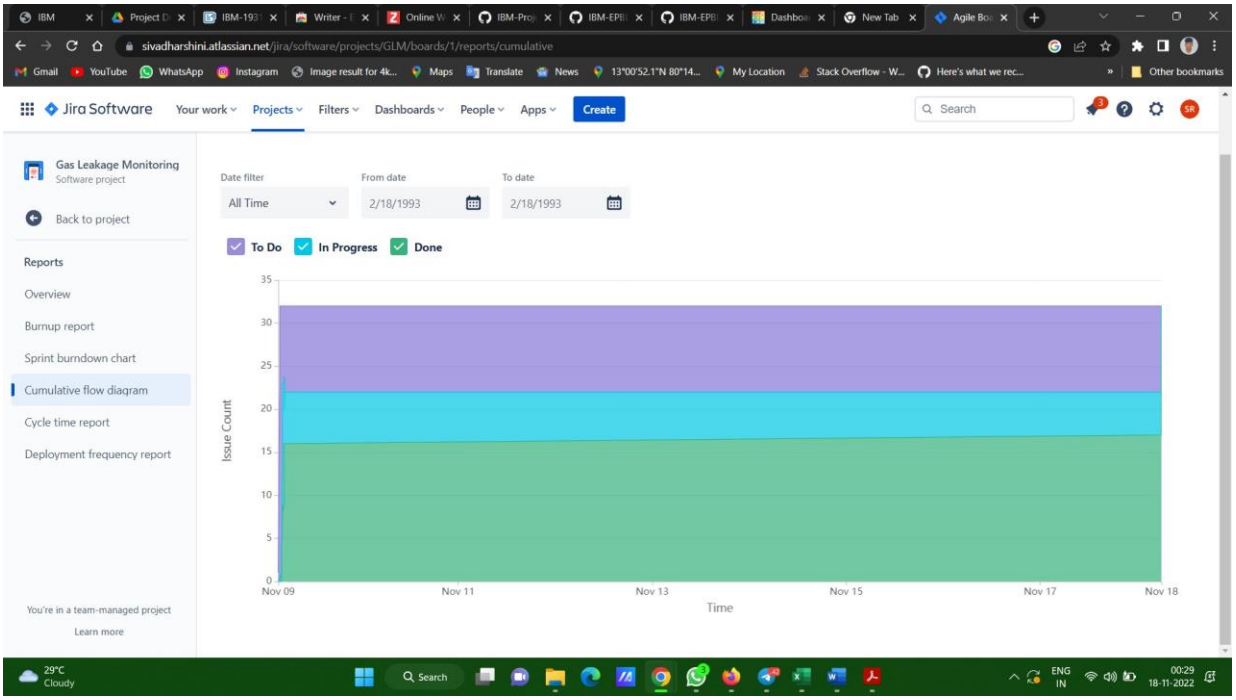
6.2 Sprint Delivery Schedule:

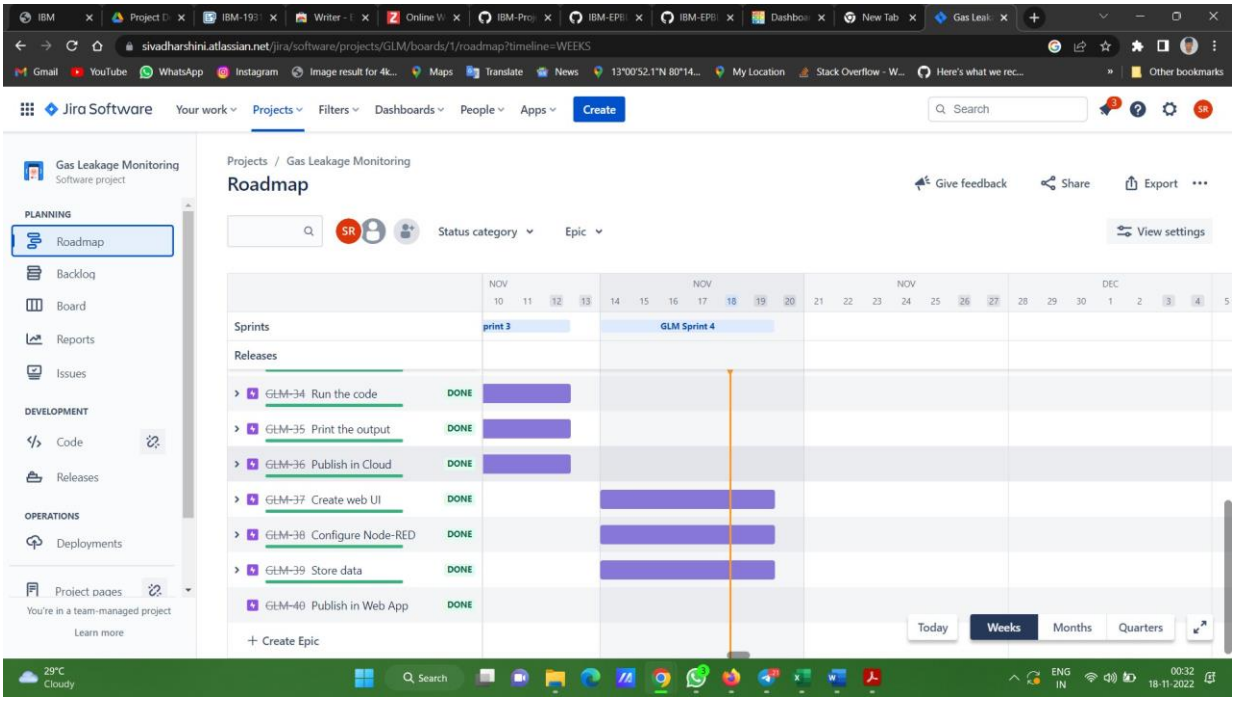
Sprint	Functional Requirement (Epic)	User Story	User Story / Task	Story Point	Priority
Sprint-1	Create	US-1	Create the IBM Cloud services which are being used in this project.	5	High
Sprint-1	Configure	US-2	Configure the IBM Cloud services which are being used in completing this project.	1	Medium
Sprint-1	Create	US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	1	Medium
Sprint-1	Configure	US-4	Configure the IBM Watson IoT which are being used to display the output.	13	High
Sprint-2	Create	US-1	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	13	High

Sprint-2	Configure	US-2	Configure a device in the IBM Watson IoT platform and get the device credentials.	3	Medium
Sprint-2	Create	US-3	Create a Node-RED service.	3	High
Sprint-2	Configure	US-4	Configure the connection security and create API keys that are used in the Node- RED service for accessing the IBM IoT Platform.	1	Medium
Sprint-3	Develop	US-1	Develop a python script to publish random sensor data such as temperature, Flame level and Gas level to the IBM IoTplatform	1 3	High
Sprint-3	Configure	US-2	After developing python code and commands just run the code	1	Medium
Sprint-3	Print	US-3	Print the statements which represent the control of the devices.	1	Low
Sprint-3	Publish	US-4	Publish Data to The IBM Cloud	5	High

Sprint-4	Create	US-1	Create Web UI in Node- Red	5	High
Sprint-4	Configure	US-2	Configure the Node-RED flow to receive data from the IBMIoT platform	5	High
Sprint-4	Configure	US-3	Use cloudant DB nodes to store the received sensor data in the cloudant DB	5	High
Sprint-4	Publish	US-4	Publish the received data inweb-application	5	High

6.3 Report from JIRA:

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Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Gas Leakage Monitoring
Software project
PLANNING
Roadmap
Backlog
Board
Reports
Issues
DEVELOPMENT
Code
Releases
OPERATIONS
Deployments
Project pages
You're in a team-managed project
Learn more
Projects / Gas Leakage Monitoring
Roadmap
Give feedback
Share
Export
Status category
Epic
View settings
NOV
DEC
Sprints
print 3
GLM Sprint 4
Releases
GLM-34 Run the code DONE
GLM-35 Print the output DONE
GLM-36 Publish in Cloud DONE
GLM-37 Create web UI DONE
GLM-38 Configure Node-RED DONE
GLM-39 Store data DONE
GLM-40 Publish in Web App DONE
Create Epic
Today
Weeks
Months
Quarters
29°C
Cloudy
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IN
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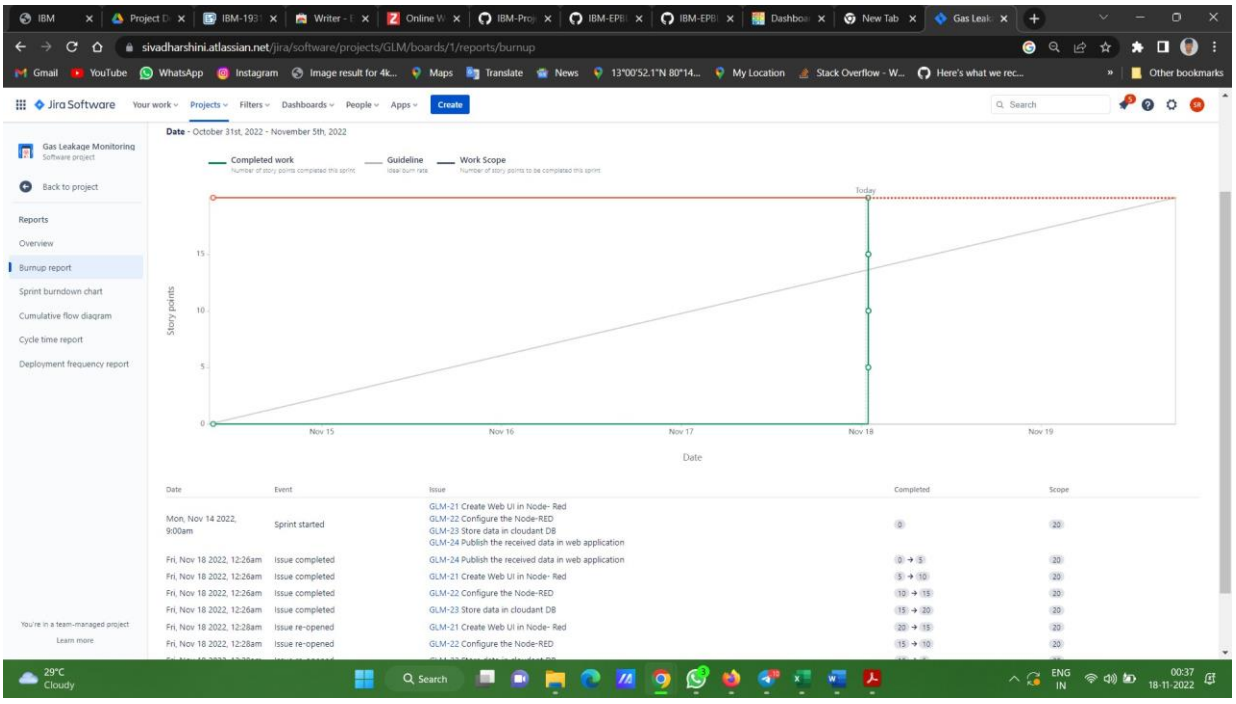
18-11-2022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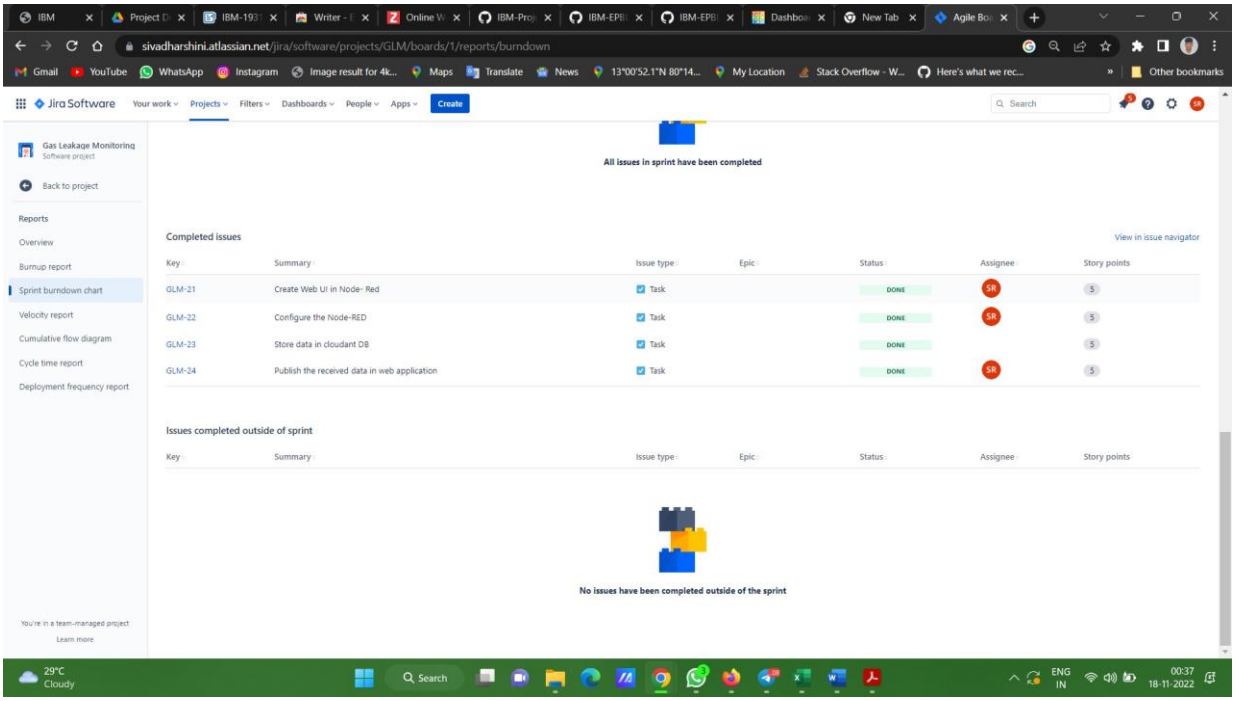
Jira Software
Gas Leakage Monitoring
Software project
Back to project
Reports
Overview
Burnup report
Sprint burndown chart
Cumulative flow diagram
Cycle time report
Deployment frequency report
Date - October 31st, 2022 - November 5th, 2022
Completed work
Guideline
Work Scope
Today
Story points
Nov 15
Nov 16
Nov 17
Nov 18
Nov 19
Date
Date
Event
Issue
Completed
Scope
Mon, Nov 14 2022, 9:00am
Sprint started
GLM-21 Create Web UI in Node- Red
GLM-22 Configure the Node-RED
GLM-23 Store data in cloudant DB
GLM-24 Publish the received data in web application
Fri, Nov 18 2022, 12:26am
Issue completed
GLM-24 Publish the received data in web application
Fri, Nov 18 2022, 12:26am
Issue completed
GLM-21 Create Web UI in Node- Red
Fri, Nov 18 2022, 12:26am
Issue completed
GLM-22 Configure the Node-RED
Fri, Nov 18 2022, 12:26am
Issue completed
GLM-23 Store data in cloudant DB
Fri, Nov 18 2022, 12:28am
Issue re-opened
GLM-21 Create Web UI in Node- Red
Fri, Nov 18 2022, 12:28am
Issue re-opened
GLM-22 Configure the Node-RED
You're in a team-managed project
Learn more
29°C
Cloudy
ENG
IN
00:37
18-11-2022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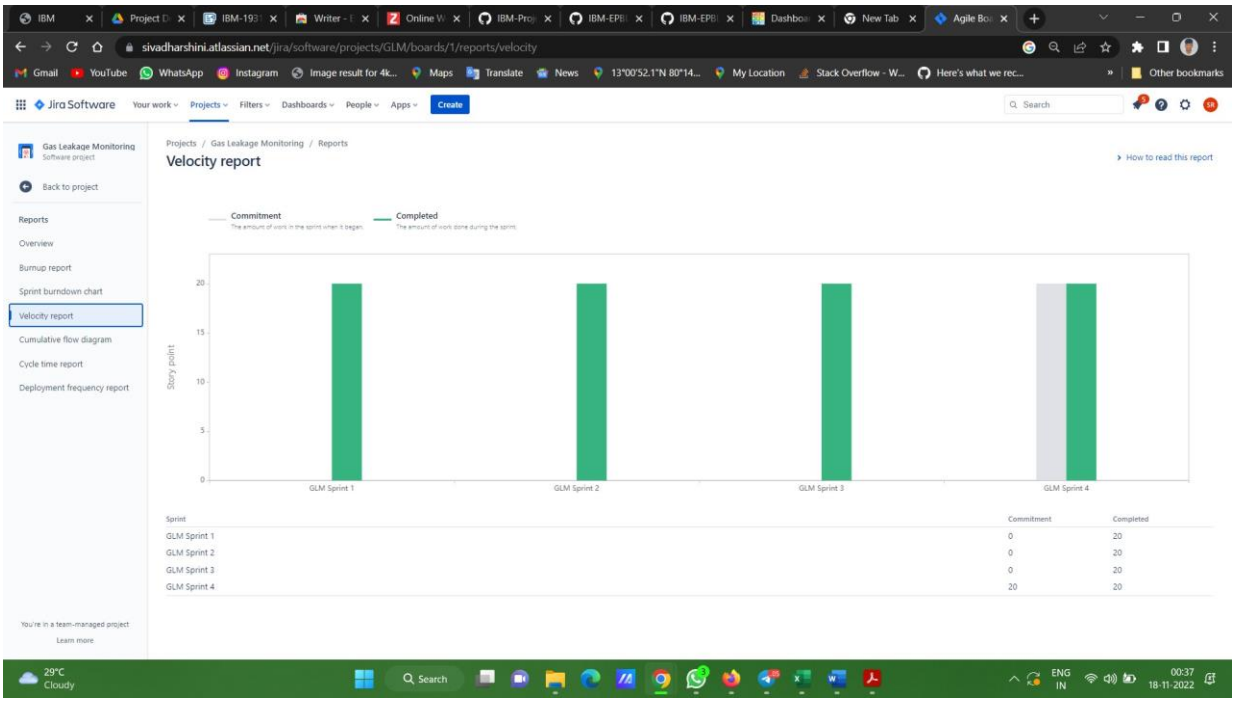
Jira Software
Gas Leakage Monitoring
Software project
Back to project
Reports
Overview
Burnup report
Sprint burndown chart
Velocity report
Cumulative flow diagram
Cycle time report
Deployment frequency report
All issues in sprint have been completed
Completed issues
View in issue navigator
Key
Summary
Issue type
Epic
Status
Assignee
Story points
GLM-21
Create Web UI in Node- Red
Task
DONE
GLM-22
Configure the Node-RED
GLM-23
Store data in cloudant DB
GLM-24
Publish the received data in web application
Issues completed outside of sprint
No issues have been completed outside of the sprint
You're in a team-managed project
Learn more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Jira Software
Gas Leakage Monitoring
Software project
Back to project
Reports
Overview
Burnup report
Sprint burndown chart
Velocity report
Cumulative flow diagram
Cycle time report
Deployment frequency report
Projects / Gas Leakage Monitoring / Reports
Velocity report
How to read this report
Commitment
Completed
Story point
GLM Sprint 1
GLM Sprint 2
GLM Sprint 3
GLM Sprint 4
Sprint
Commitment
Completed
GLM Sprint 1 0 20
GLM Sprint 2 0 20
GLM Sprint 3 0 20
GLM Sprint 4 20 20
You're in a team-managed project
Learn more

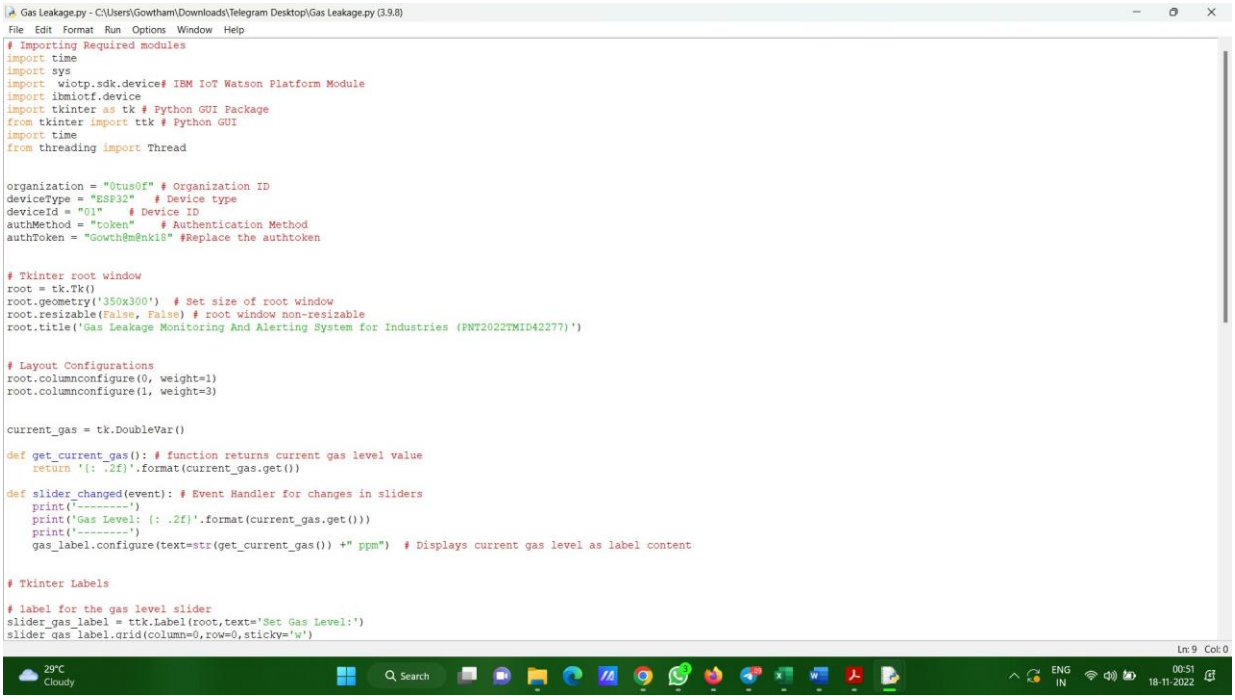
7. CODING & SOLUTIONING:

```
# Importing Required modules
import time
import sys
import wiotp.sdk.device# IBM IoT Watson Platform Module
import ibmiotf.device
import tkinter as tk # Python GUI Package
from tkinter import ttk # Python GUI
import time
from threading import Thread


organization = "0tus0f" # Organization ID
deviceType = "ESP32" # Device type
deviceId = "01"     # Device ID
authMethod = "token"     # Authentication Method
authToken  =  "Gowth@m@nk18"  #Replace  the  authtoken


# Tkinter root window
root = tk.Tk()
root.geometry('350x300') # Set size of root window
root.resizable(False, False) # root window non-resizable
root.title('Gas Leakage Monitoring And Alerting System for Industries
(PNT2022TMID42277)')


# Layout Configurations
root.columnconfigure(0, weight=1)
root.columnconfigure(1, weight=3)


current_gas = tk.DoubleVar()

def get_current_gas(): # function returns current gas level value
    return '{: .2f}'.format(current_gas.get())

def slider_changed(event): # Event Handler for changes in sliders
    print('------ ')
    print('Gas Level: {: .2f}'.format(current_gas.get()))
    print('------ ')
    gas_label.configure(text=str(get_current_gas()) +" ppm")  # Displays current gas level
as label content
```

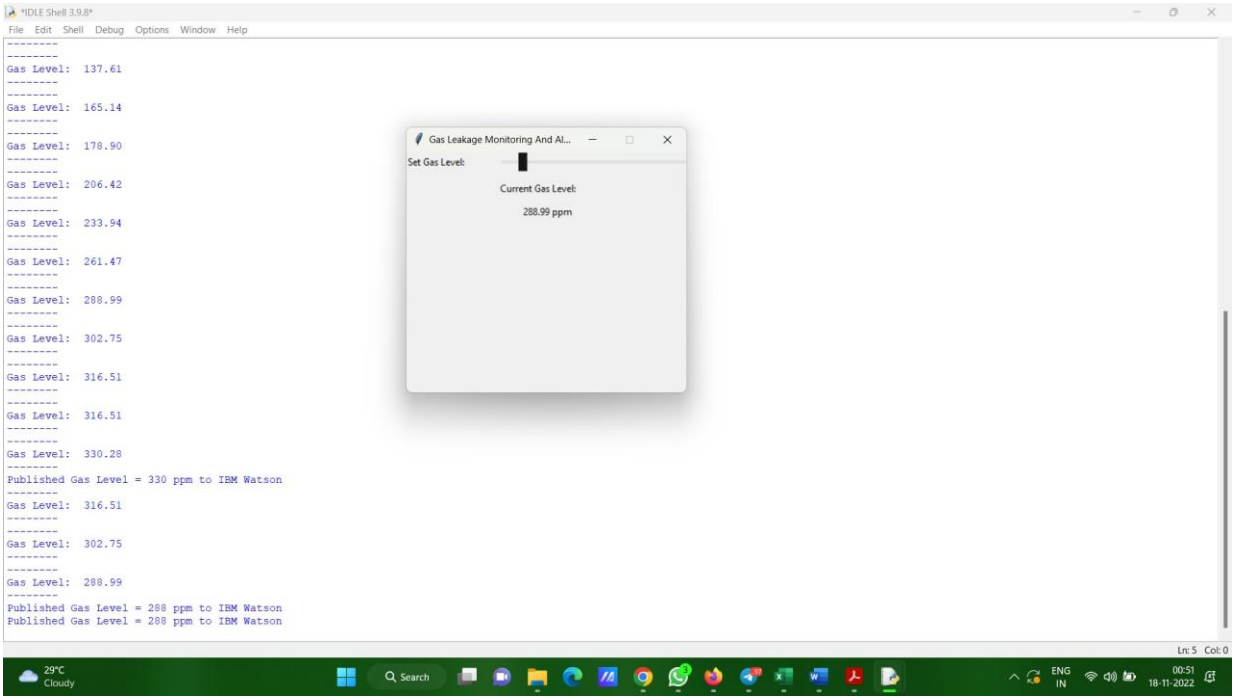
```
# Tkinter Labels

# label for the gas level slider
slider_gas_label = ttk.Label(root,text='Set Gas Level:')
slider_gas_label.grid(column=0,row=0,sticky='w')


#  Gas Level slider
slider_gas = ttk.Scale(root,from_=0,to=3000,orient='horizontal',
command=slider_changed,variable=current_gas) slider_gas.grid(column=1,row=0,sticky='we')


# current gas level label
current_gas_label = ttk.Label(root,text='Current Gas Level:')
current_gas_label.grid(row=1,columnspan=2,sticky='n',ipadx=10,ipady=10)


# Gas level label (value gets displayed here)
gas_label = ttk.Label(root,text=str(get_current_gas()) +" ppm")
gas_label.grid(row=2,columnspan=2,sticky='n')


def publisher_thread():
    thread = Thread(target=publish_data)
    thread.start()

def publish_data():
    # Exception Handling
    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()

    deviceCli.connect()  # Connect to IBM Watson IoT Platform

    while True:
        gas_level = int(current_gas.get())
```

```
        data = {'gas_level' : gas_level}

        def myOnPublishCallback():
            print("Published Gas Level = %s ppm" % gas_level, "to IBM Watson")

        success = deviceCli.publishEvent("event", "json", data, qos=0,
on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(1)

publisher_thread()

root.mainloop() # startup Tkinter GUI

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

CODE:



OUTPUT:


IDLE Shell 3.9.8
File Edit Shell Debug Options Window Help

Gas Level: 137.61

Gas Level: 165.14

Gas Level: 178.90

Gas Level: 206.42

Gas Level: 233.94

Gas Level: 261.47

Gas Level: 288.99

Gas Level: 302.75

Gas Level: 316.51

Gas Level: 316.51

Gas Level: 330.28

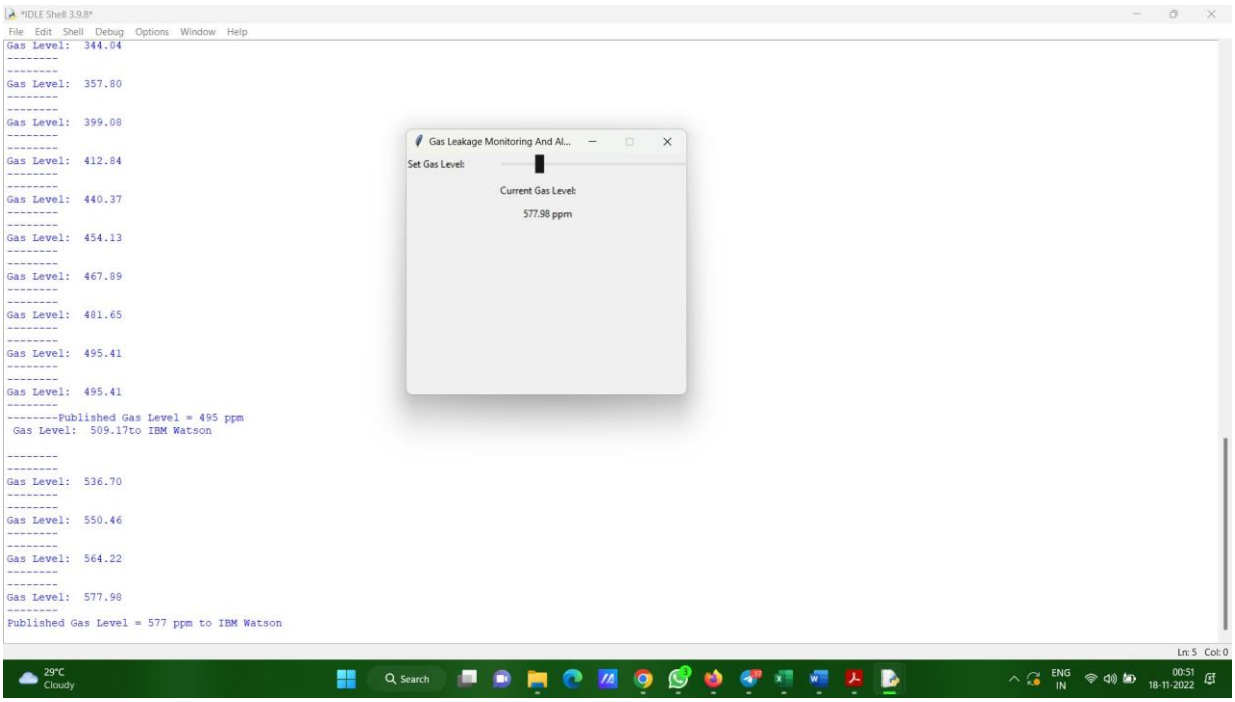
Published Gas Level = 330 ppm to IBM Watson

Gas Level: 316.51

Gas Level: 302.75

Gas Level: 288.99

Published Gas Level = 288 ppm to IBM Watson
Published Gas Level = 288 ppm to IBM Watson
Gas Leakage Monitoring And Al...
Set Gas Level:
Current Gas Level:
288.99 ppm
Ln: 5 Col: 0
29°C
Cloudy
Search
ENG
IN
00:51
18-11-2022


IDLE Shell 3.9.8
File Edit Shell Debug Options Window Help
Gas Level: 344.04

Gas Level: 357.80

Gas Level: 399.08

Gas Level: 412.84

Gas Level: 440.37

Gas Level: 454.13

Gas Level: 467.89

Gas Level: 481.65

Gas Level: 495.41

Gas Level: 495.41

--------Published Gas Level = 495 ppm
Gas Level: 509.17to IBM Watson

Gas Level: 536.70

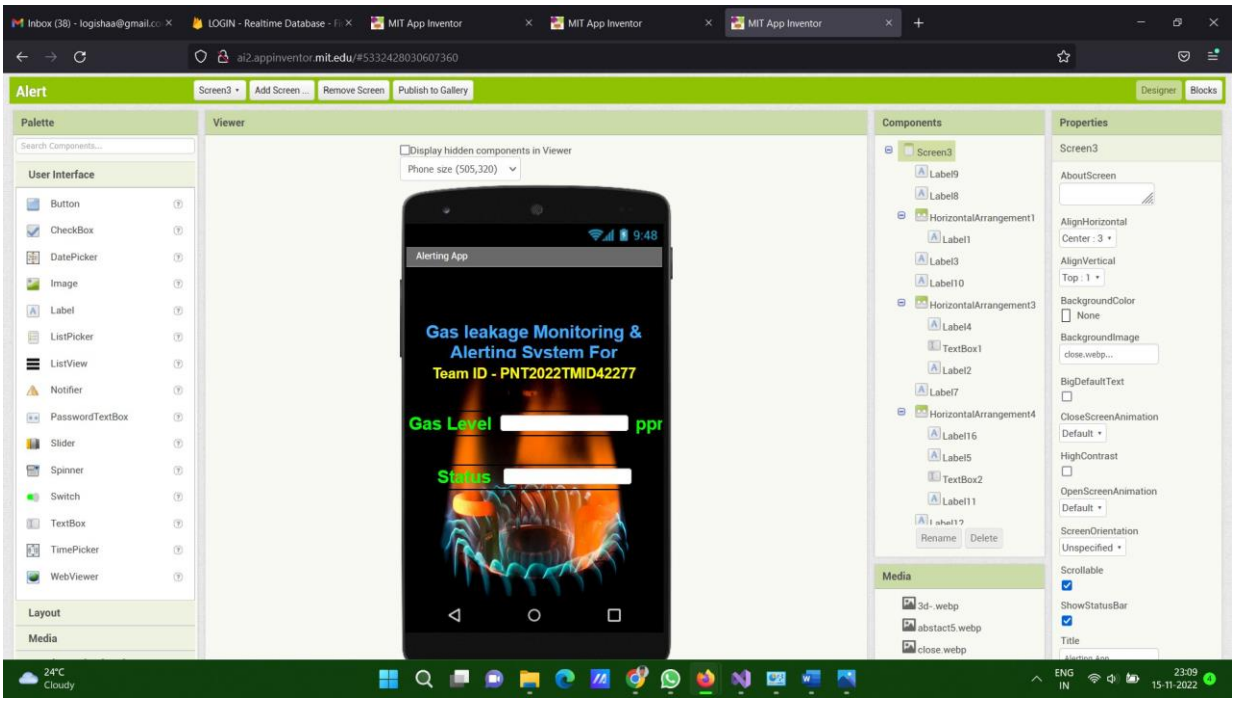
Gas Level: 550.46

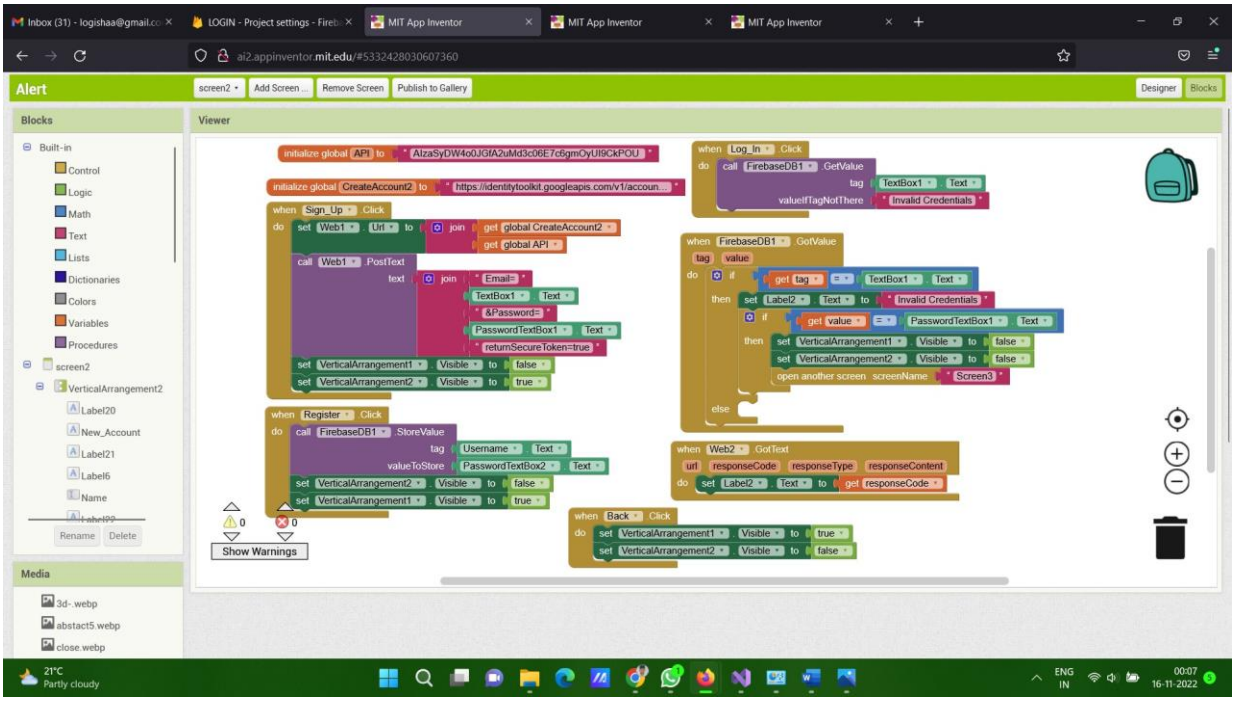
Gas Level: 564.22

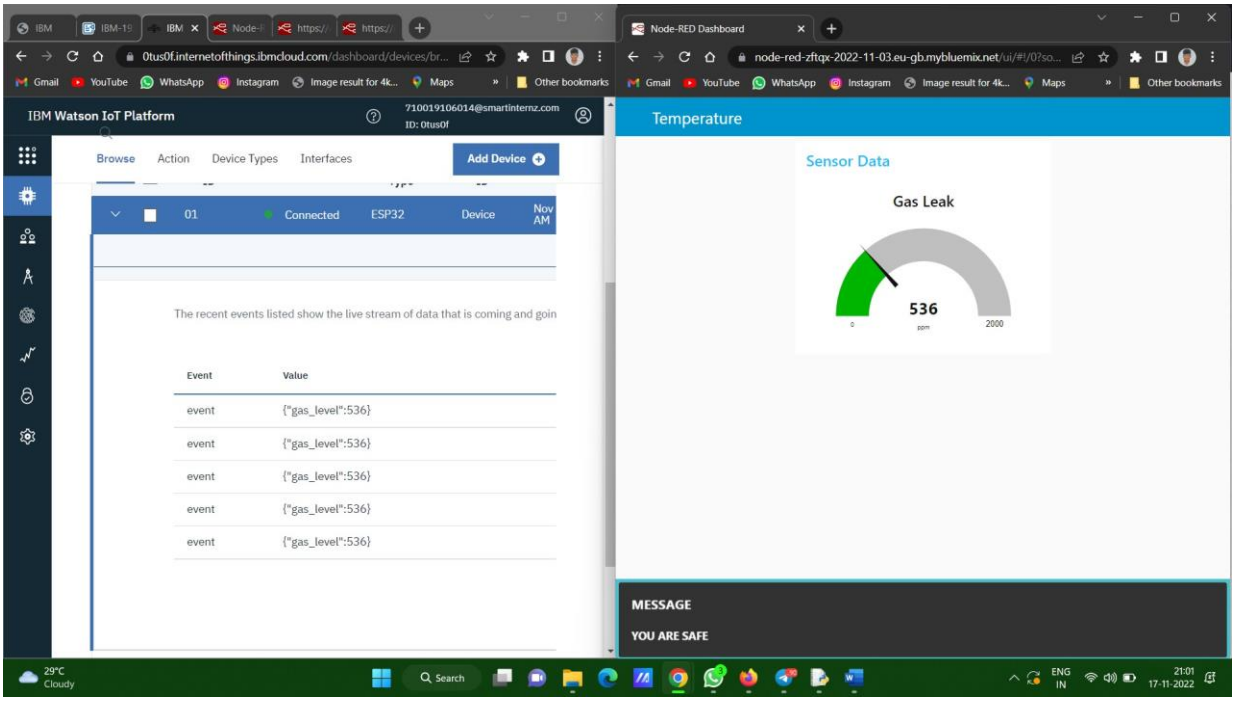
Gas Level: 577.98

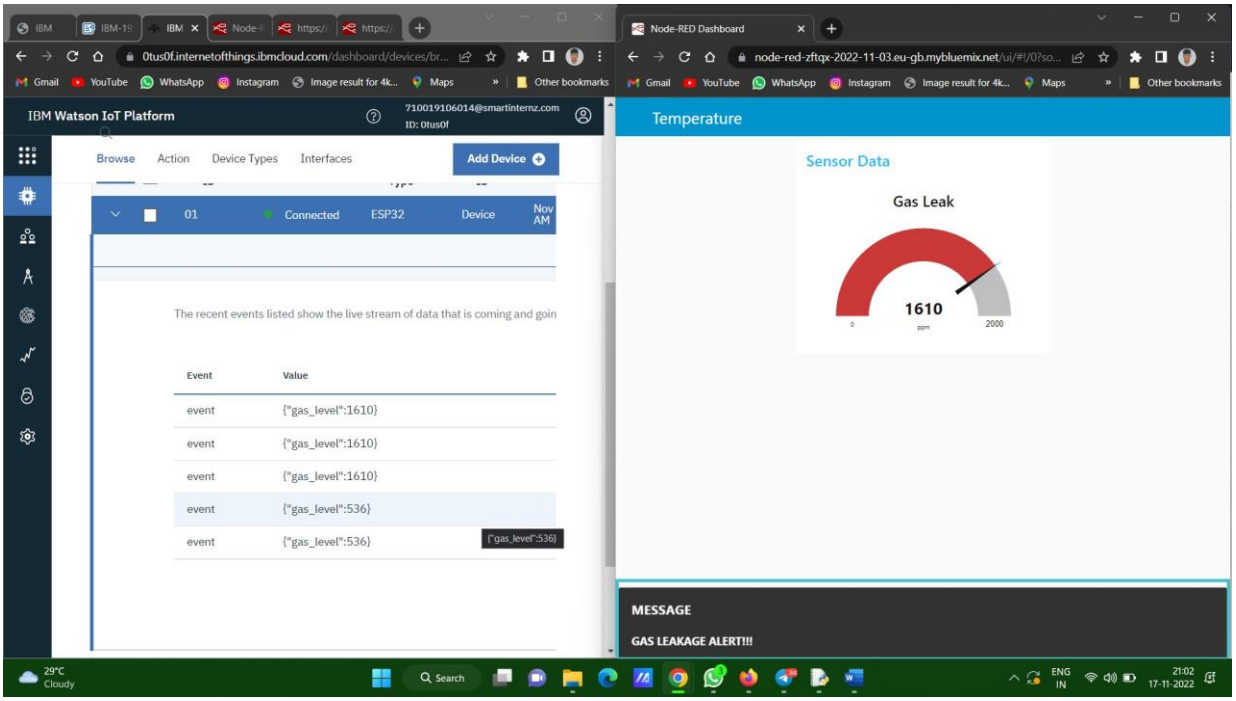
Published Gas Level = 577 ppm to IBM Watson
Gas Leakage Monitoring And Al...
Set Gas Level:
Current Gas Level:
577.98 ppm
Ln: 5 Col: 0
29°C
Cloudy
Search
ENG
IN
00:51
18-11-2022

8. Testing:


Alert
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Viewer
Components
Properties
Display hidden components in Viewer
Phone size (505,320)
Alerting App
Gas leakage Monitoring &
Alerting System For
Team ID - PNT2022TMID42277
Gas Level
ppm
Status
Media
3d-.webp
abstact5.webp
close.webp


Alert
screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
Show Warnings
Media
3d-.webp
abstact5.webp
close.webp


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
01
Connected
ESP32
Device
The recent events listed show the live stream of data that is coming and goin
Event
Value
event
{"gas_level":536}
Node-RED Dashboard
Temperature
Sensor Data
Gas Leak
536
MESSAGE
YOU ARE SAFE


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
01
Connected
ESP32
Device
The recent events listed show the live stream of data that is coming and goin
Event
Value
event
{"gas_level":1610}
event
{"gas_level":536}
Node-RED Dashboard
Temperature
Sensor Data
Gas Leak
1610
MESSAGE
GAS LEAKAGE ALERT!!!

9. Result:

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 1m radius of the rover and the sensor output data are continuously transferred to the local server. The accuracy of sensors is not up to the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Further the availability and storage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material selection of the system in case of corrosive gases is reduced. Thus, the system at this stage can only be use data primary indicator of leakage inside a plant.

10. Advantages/Disadvantages:

10.1 Advantages:

1. Get real-time alerts about the gaseous presence in the atmosphere.
2. Prevent fire hazards and explosions.
3. Supervise gas concentration levels.
4. Ensure worker's health.
5. Real-time updates about leakages.
6. Cost-effective installation.
7. Data analytics for improved decisions.
8. Measure oxygen level accuracy.
9. Get immediate gas leak alerts.

10.2 Disadvantages:

1. It requires air or oxygen to work.
2. It gets reacted due to heating of wire.
3. It can be poisoned by lead, chlorine and silicon

11. CONCLUSION:

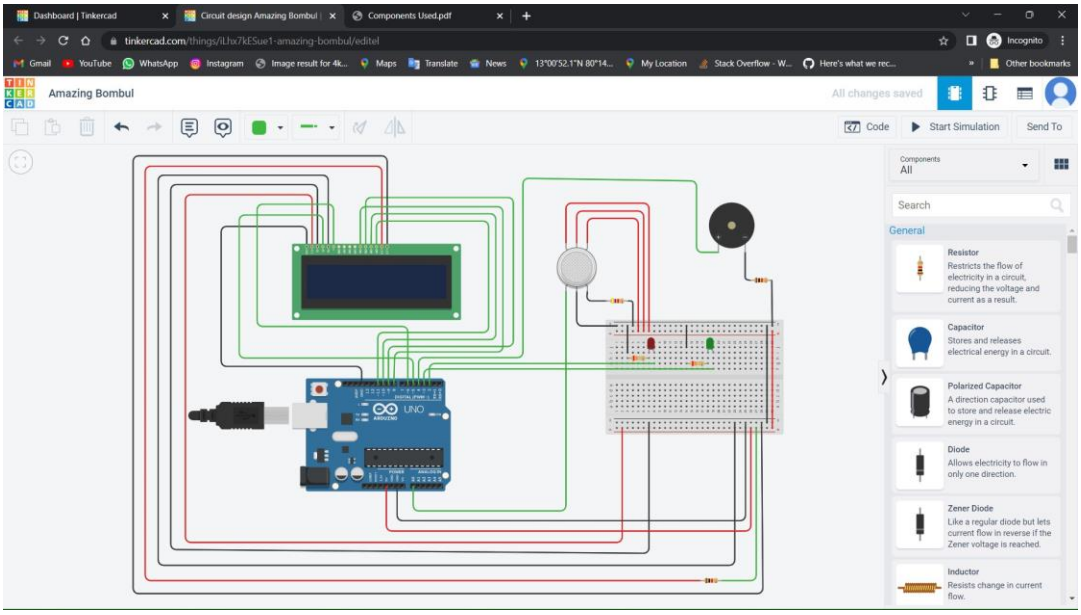
This gas leak detector system contains two features, this includes the SMS Gateway feature for only sending warning information regarding the gas leak to user, and the alarm for the warning alert. There is some improvement which can be applied for the future work, such as regarding the SMS Gateway, it need to enhance with feature such as notifying the user whenever the remaining credit balance is insufficient. Another thing which can be enhanced is regarding the sensor, the sensors in this module do not include somewhat notification for notifying the user whenever the sensor not working properly or not connected to the micro-controller for some cases, therefore, it is recommended to add this kind of features in the future work for better refinement.

12. FUTURE SCOPE:

We propose to build the system using an MQ6 gas detection sensor and interface it with an Aurdino Uno microcontroller along with an LCD Display. This system uses the gas sensor to detect any gas leakages. The gas sensor sends out a signal to the microcontroller as soon as it encounters a gas leakage. The microcontroller processes this signal and a message is displayed on the LCD to alert the user.

13. APPENDIX:

13.1 Circuit Diagram:



13.2 Components:

The design of a sensor-based automatic gas leakage detector with an alert andcontrol system. The components are

S.NO	NAME OF THE COMPONENT	QUANTITY
1	Arduino Uno R3	1
2	LCD 16x2	1
3	Piezo	1
4	Gas sensor	1
5	1 k ohm Resistor	1
6	2.3 k ohm Resistor	1
7	4.7 k ohm Resistor	1
8	Red LED	1
9	Green LED	1

13.4 Source Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);

int redled = A5;
int greenled = A3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;
void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
```

```
lcd.begin(16,2);
}
void loop()
{
 int analogValue = analogRead(sensor);
 Serial.println(analogValue);
 if(analogValue>sensorThresh)
 {
  digitalWrite(redled,HIGH);
  digitalWrite(greenled,LOW);
  tone(buzzer,1000,10000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALERT");
  Serial.print("ALERT");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("EVACUATE");
  Serial.println(" -- EVACUATE");
  delay(1000);
}
 else
 {
  digitalWrite(greenled,HIGH);
  digitalWrite(redled,LOW);
  noTone(buzzer);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  Serial.print("SAFE");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL  CLEAR");
  Serial.println(" -- ALL CLEAR");
  delay(1000);
}
}
```

13.5 GITHUB:

Link: IBM-EPBL/**IBM-Project-37635-1660314797**

13.6 Demo Video:

Link:
https://drive.google.com/drive/folders/1rHceqA7IeAwoj6QAqUpYDpgIcjtNWAq8?usp=sharing