CONTENTS

CHAPTER 1

INTRODUCTION

Project Overview

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.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 sprinkler in case of emergencies.Sensor data is visualized in the Web Application.We use IOT technology for enchancing the existing safetystandards this prototype hasbeen to bring a revolution inthe field of safety against the leakage of harmful gases.

Purpose

The sensor-enabled solution helps prevent the high risk of gas explosions and affecting any casualties within and outside the premises. The gas sensors help detect the concentration of the gases present in the atmosphere to avoid hazardous consequences like fire breakouts.Ensuring employee's life safety and security. Gas detectorscan be used to detect combustible,flammable gases.This type of devices is used widely in industry. Stop accidents associated with gas Leakage.

CHAPTER 2

LITERATURE SURVEY

Existing Problem

In the existing method, gas sensing technology is used.The gas leakageis detected by the semiconductor sensor. The leakage of gas may happen due to the human error, false chemical reaction, lack of service done in the gas valve. In the existing method, periodic check done by manually and partial sensing methodology is used. When the leakage was happened, it leads to major fire accident Before controlling the firemajor accident may happen which leads to heavy loss in industry as well as human life. In addition to that the leak of gas may spread in theatmosphere, it may affect all the living things in an around them.In the existing system MQ5 sensor is used to detect gas leakage. Exhaust fansare used to suck out the gases when the leakage occurs. In the existing method, it raises only alarm whenever Gas leaked or fire is detected at any place in a factory. Due to this alarm, people could start to run hazardly. Fire Service truck vehicle only control the fire accident. Poorstability and greater environmental impact are some of the existing problem. Our environment contains different gases which could be hazardous beyond certain limits.

References

Base Paper
DOI： https://doi.org/10.32628/IJSRST196256
Article DOI: https://doi.org/10.30574/gjeta.2020.5.3.0109video
link: https://youtu.be/ujdjXRdETBI

Problem statement definition

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles .It is noticed that due to gas leakage, dangerous accidents occur. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidentsresulting in both material loss and human injuries.Help the industries in monitoring the emission of harmful gases. In seal areas the gas sensor will be integrated to monitor the gas leakage .If in any area gas leakage is detected the adminwill be notified along with location.In the web application admin can view the sensor parameters. To help the industries in detecting the leakage of harmful gases along with monitoring and alerting the admins by notifying them using IOT. Most of gas explosions are caused by undetectedgas leakage in the pre-detection condition. So that, gas detection system is needed. The purpose of this system is todetect gas leakage, neutralize it, and prevent the explosion. Prevent accidents and to save human's lives worker satisfy is important therefore gas detection systems are frequently upgraded,expanded or replaced.Large industrial equipmentsare prevented from damages.Without this solution industriesundergo large financial losses in case of equipments and workers.By using this solution both life and industrial properties can be prevented.costly machines cannot be bought too often. Due to techonology of sensor they will depeleted overtime and rapidly if exposed to the target gas.

CHAPTER 3

IDEATION AND PROPOSED SOLUTION

EMPATHY MAP CANVAS

The feedback about the project are represented below in form of empathy map**.**

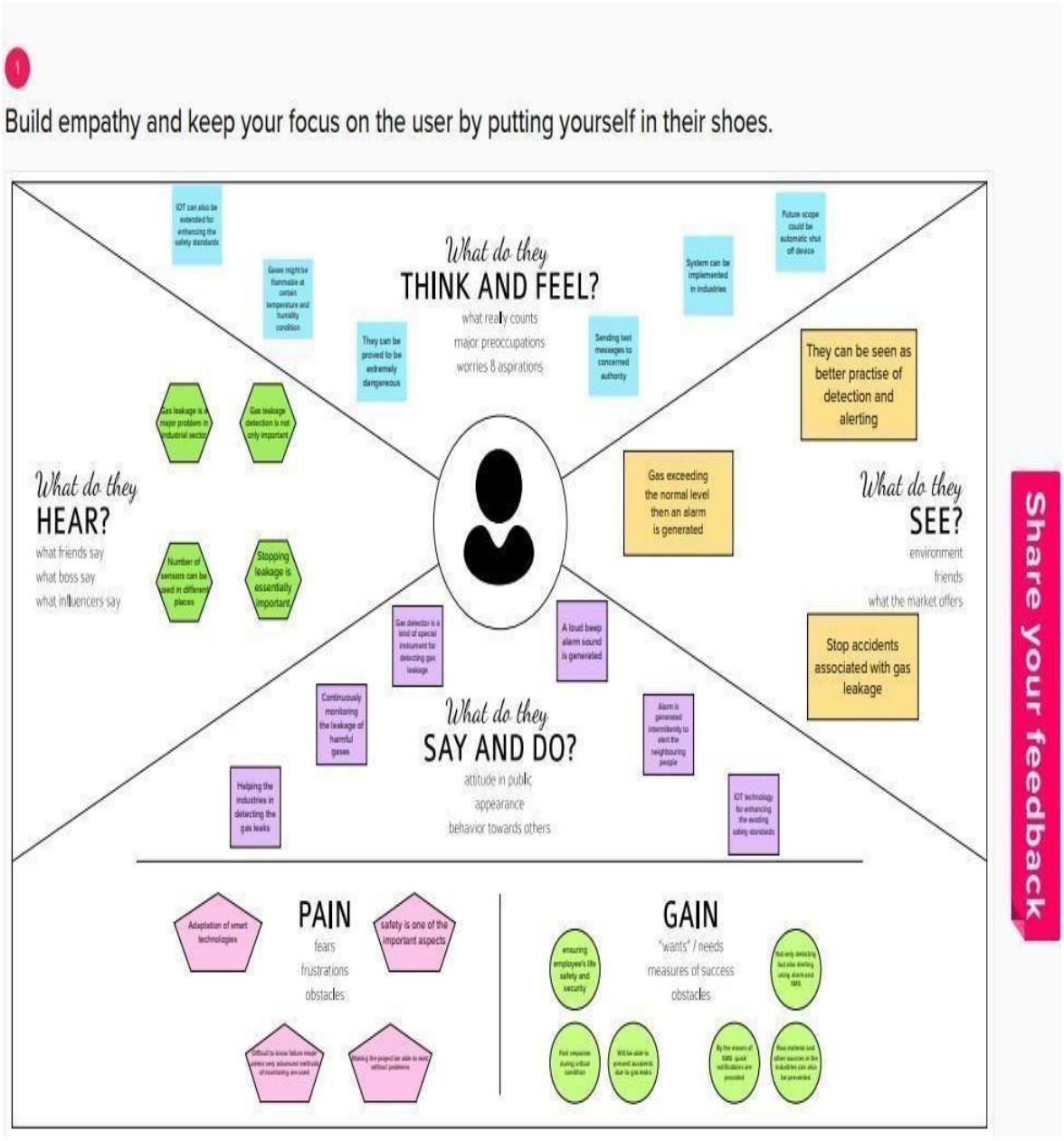


Figure 3.1 empathy map for sharing feedback

IDEATION AND BRAINSTORMING

The problem statmentment and idea prioritise are listed below.

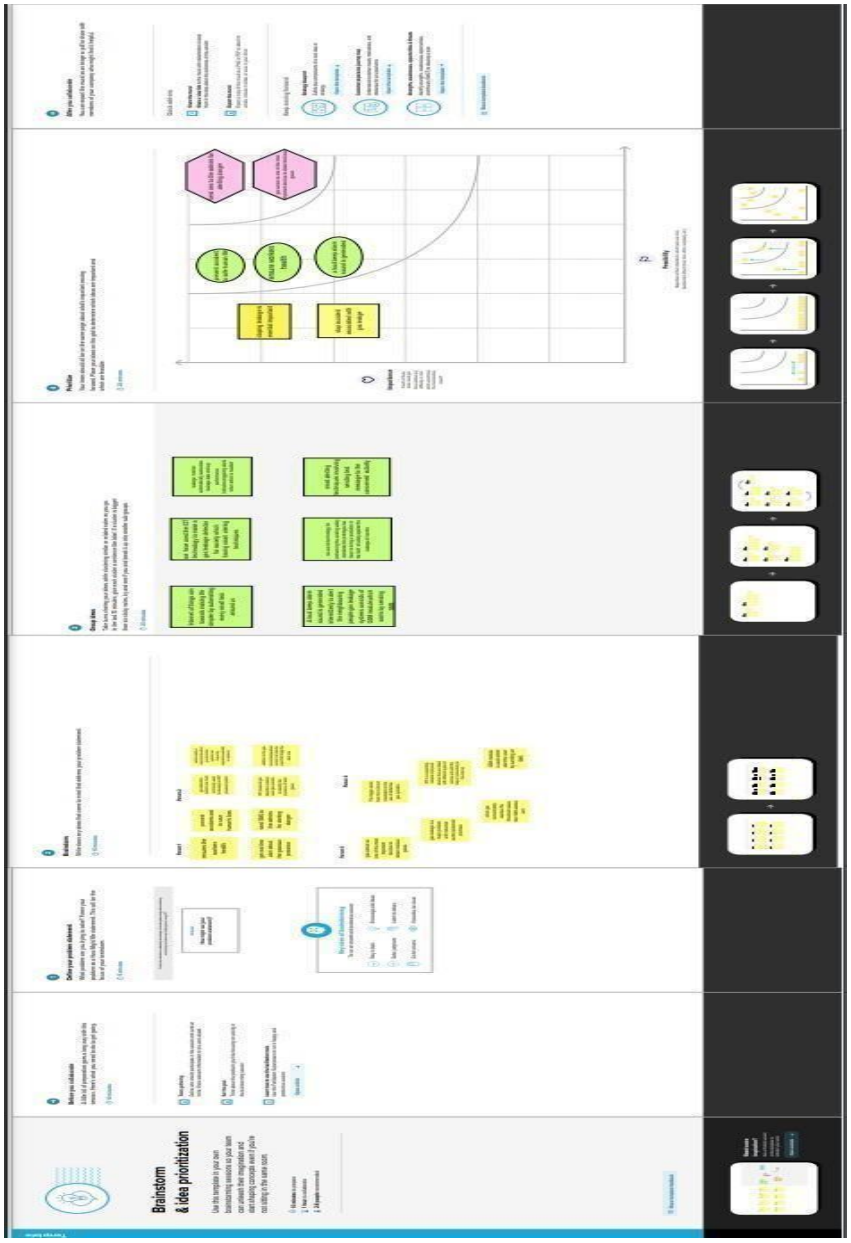


Figure 3.2 Ideation and Brainstorming

PROPOSED SOLUTION

Date	**15 October 2022**
Team ID	**PNT2022TMID11539**
Project Name	**Gas leakage monitoring and alerting system**
Maximum Marks	**2 Marks**

Proposed Solution Template:

Table 3.1 Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	To help the industries in detecting the leakageof harmful gases along with monitoring and alerting the admins by notifying them using IOT.
2.	Idea / Solution description	Gas leakage is a major problem with industrialsector,residential premises when gas concentration reaches the threshold values thenSMS alert is sent
3.	Novelty / Uniqueness	We use IOT technology for enhancing the existing safety standards.This prototype has been to bring a revolution in the field of safetyagainst the leakage of harmful.Gas leakage systems consists of GSM module,which warnsby sending SMS immediately.

4.	Social Impact / Customer Satisfaction	Prevent accidents and to save human's livesworker satisfy is important therefore gas detection systems are frequently upgraded,expanded or replaced.Large industrial equipments are prevented fromdamages.
5.	Business Model (Revenue Model)	Without this solution industries undergo largefinancial losses in case of equipments and workers.By using this solution both life and industrial properties can be prevented.costlymachines cannot be bought too often
6.	Scalability of the Solution	Wi-Fi module can be used for large scale areaslike industries to monitor leak of gas in each room from the control room. We can use temperature sensor, Multi Language Display, audio o/p to make it user friendly. However, this application can also be developed in futureby integrating more number of equipments to measure various parameters, for instance, a humidity sensor or an optical sensor to determine the humidity

PROBLEM SOLUTION FIT

The following figure depicts the customer constraints,behaviour,solutions and our solutions

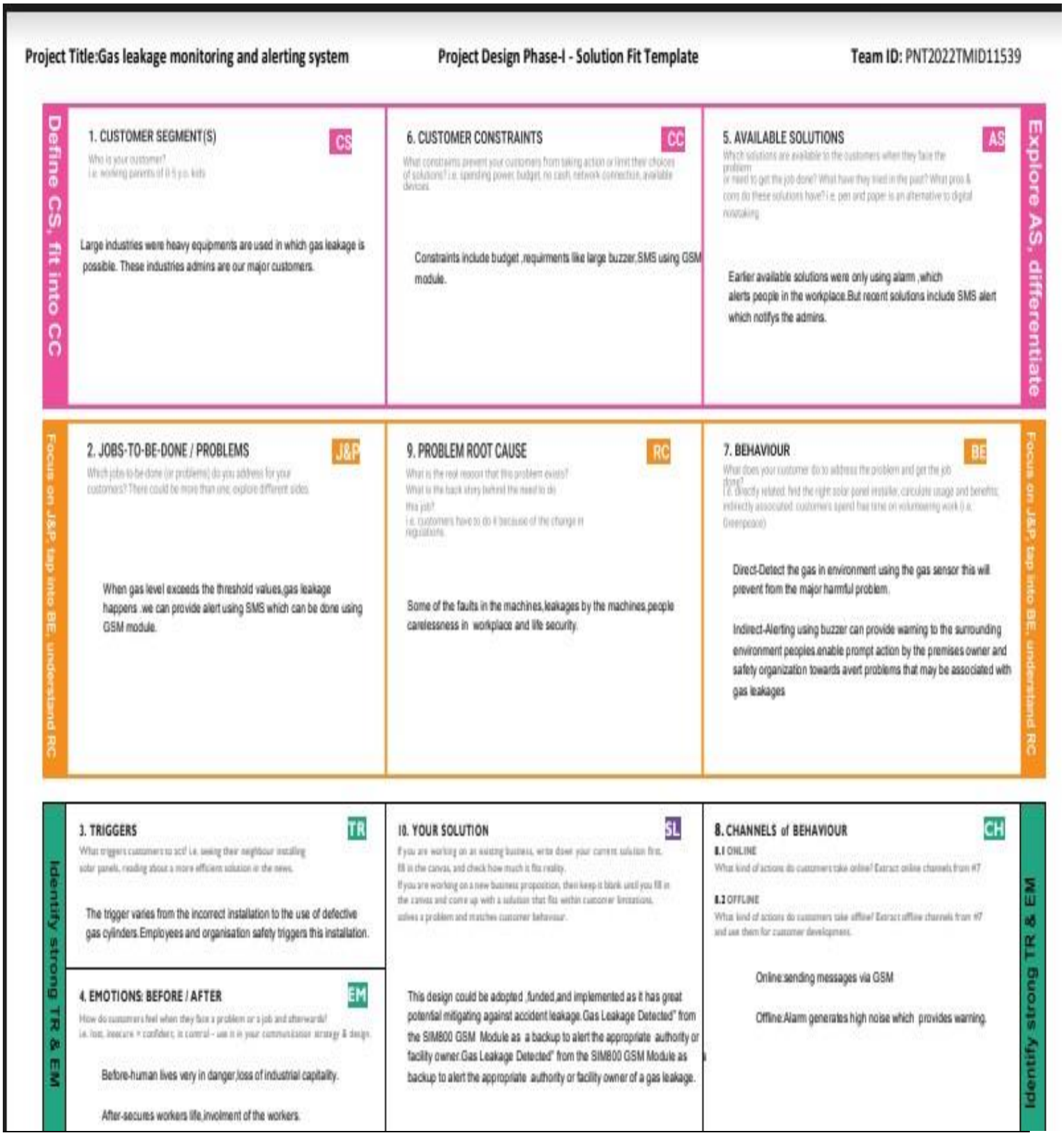


Figure 3.3 Solution Fit Template

CHAPTER 4

REQUIREMENT ANALYSIS

Date	16 October 2022
Team ID	PNT2022TMID11539
Project Name	Gas leakage monitoring and alerting system
Maximum Marks	4 Marks

Functional Requirements:

Table 4.1 Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through phone number.
FR-2	User Confirmation	Confirmation via phone numberConfirmation via SMS
FR-3	Authentication	It can be provided through ONE TIME PASSWORD .
FR-4	Authoritization level	Industrial managers,top level managers,workers andadmins.
FR-5	Bussiness Rules	Easily flame producing materials used be strictlyprohibited in the workplace(lighters,matchbox)

Non-functional Requirements:

Table 4.2 Following are the non-functional requirements of the proposed solution.

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	Arduino uses its own programming language whichis similar to C++.However it is possible to use arduino with python or another high level programming language.Platform like arduino workwell with python.
NFR-2	**Security**	Unauthorised access by other industrial peopleshould be prevented.permissions only to the respective owners.
NFR-3	**Reliability**	Due to techonology of sensor they will depeletedovertime and rapidly if exposed to the target gas.
NFR-4	**Performance**	Gas detectors measure or monitor that depletion of combustible gases,toxic gases within an area as part of a safety system.This detectors typically sound analarm and are deployed in confined spaces.
NFR-5	**Availability**	Old versions like alarm produces by sensors can be Updated using SMS .

CHAPTER 5

Project Design

Date	18 October 2022
Team ID	PNT2022TMID11539
Project Name	Gas leakage monitoring and alerting system
Maximum Marks	4 Marks

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, And where data is stored.

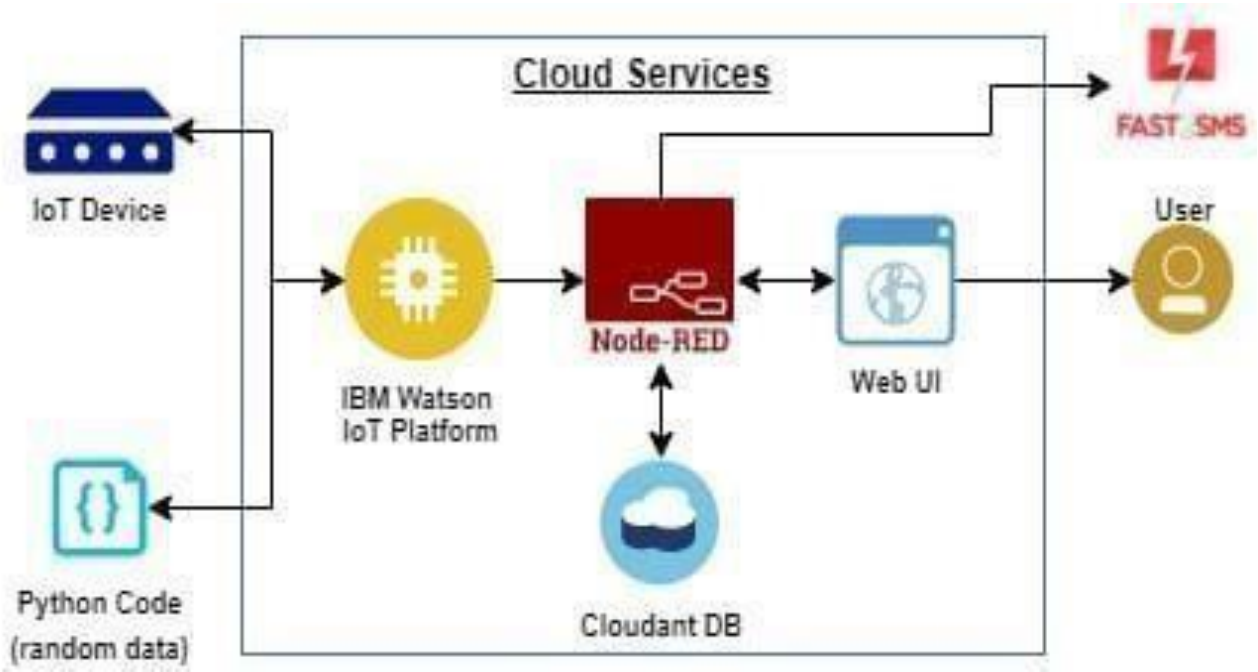


Figure 5.1 Flow Diagram

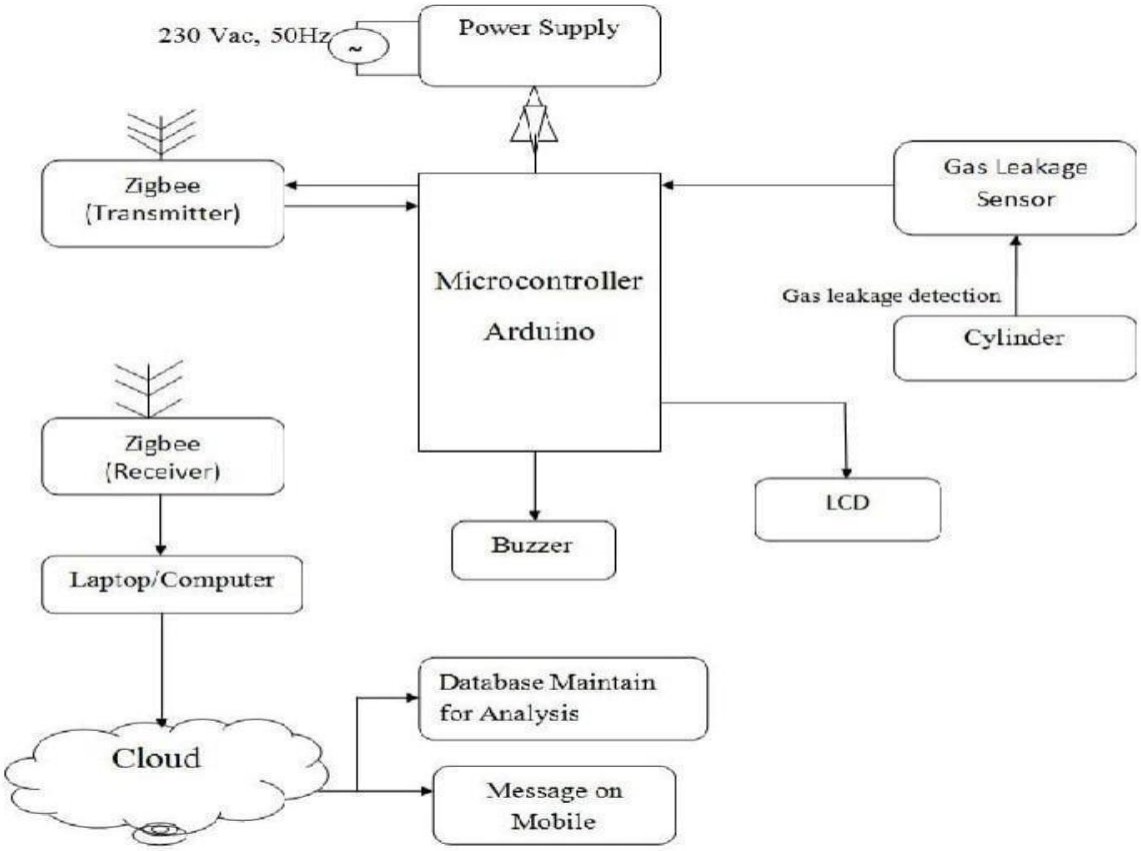


Figure 5.2 DFD Level 0

SOLUTION AND TECHNICAL ARCHITECTURE

Date	15 October 2022
Team ID	PNT2022TMID11539
Project Name	Gas leakage monitoring and alerting system
Maximum Marks	4 Marks

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridgesthe gap between business problems and technology solutions. Its goals are to:

Find the best tech solution to solve existing business problems.

- Describe the structure, characteristics, behavior, and other aspects of thesoftware to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed,and delivered.

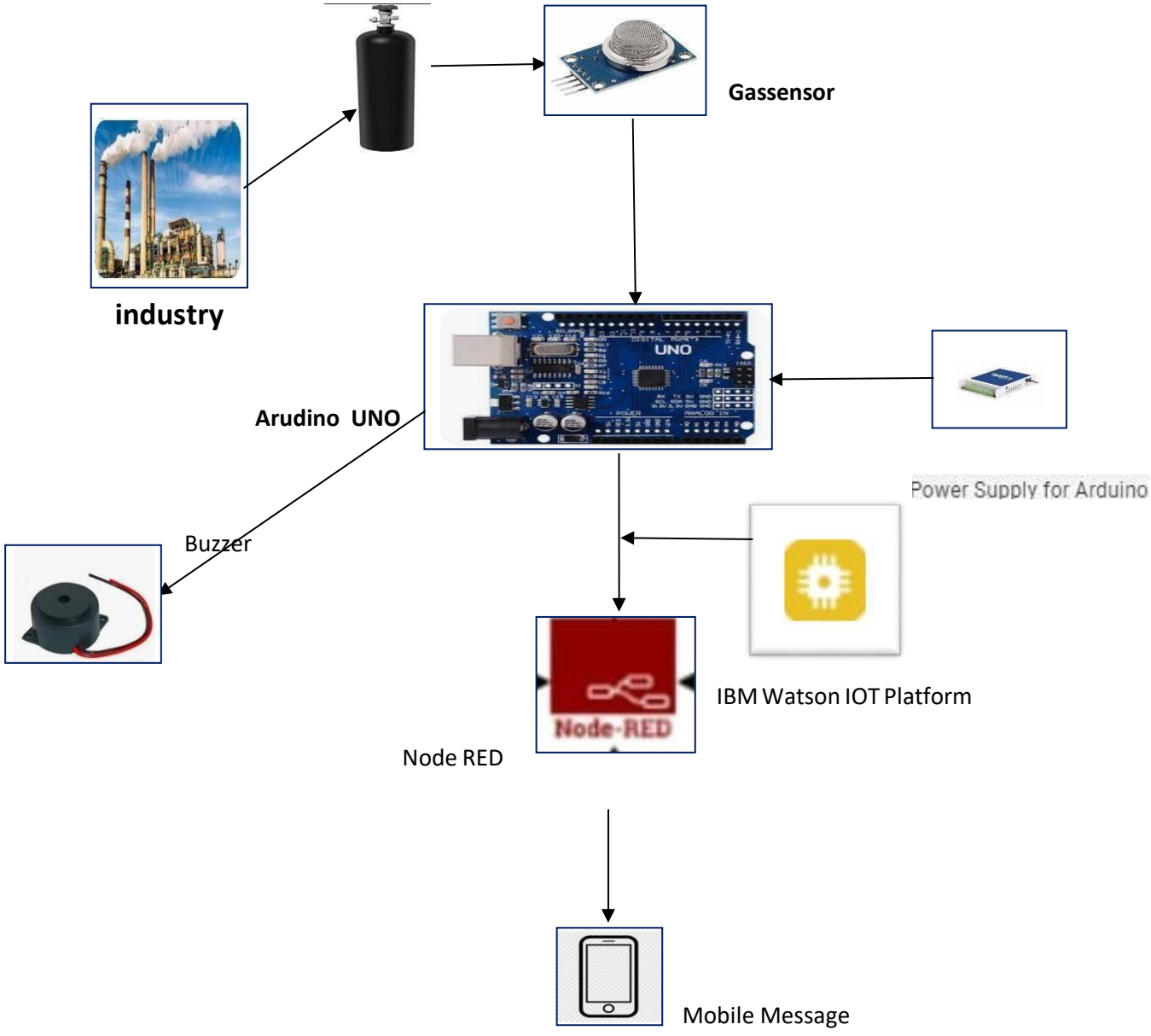


Figure 5.3 Technical Architecure

USER STORIES

Table 5.1 About user stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	IoT devices	USN-1	Sensors	Users can use iot deviceslike arduino and sensors.	High	Sprint-1
Customer	Software	USN-2	IBM Watson IoT platform, Workflows for IoTscenarios using Node-red	A fully managed, cloud- hosted service with capabilities for device registration, connectivity, control, rapid visualization and data storage.	High	Sprint-2
Customer	MIT app	USN-3	To develop an application using MIT	MIT App Inventor is an intuitive, block-based programming environment that allows beginner programmers to build functional apps for smart phones and tablets.	High	Sprint-3
Customer	Web UI	USN-4	To make the user to interact with the software.	User can access the appfor the services.	High	Sprint-4

CHAPTER 6

PROJECT PLANNING AND SCHEDULING

Sprint planning and estimation

The following figure depicts the milestone

Figure 6.1 Milestone

SPRINT DELIVERY SCHEDULE

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Storypoints)

Date	22 October 2022
Team ID	PNT2022TMID11539
Project Name	Gas leakage monitoring and alerting system
Maximum Marks	8 Marks

Table 6.1Product Backlog,sprint Schedule,and Estimation (4 Marks)

use the below template to create product backlog and sprint schedule

Sprint	FunctionalRequirement(Epic)	UserStoryNumber	UserStory/Task	StoryPoints	Priority	TeamMembers
Sprint-1	Hardware	USN-1	Sensors and arduinointegrated with pythoncode.	2	High	Thiviya Sathya Rithikasri Sowmiya

Sprint-2	Software	USN-2	IBM Watson IOT platform, Workflows for IOT scenariosusingNode-red.Fully managed, cloud-hosted service with capabilities for device registration, connectivity	2	High	Thiviya Sathya Rithikas ri Sowmiya
Sprint-3	MITapp	USN-3	Todevelopanmobileapplicationusing MIT. Allows everyone even children to build fully functional apps for smartphones. .	2	High	Thiviya Sathya Rithikas ri Sowmiya
Sprint-4	WebUI	USN-4	Tomakethe userto interactwithsoftware. A Web user interface or Web app allows theuser to interact with content or software running on a remote server	2	High	Thiviya Sathya Rithikasri Sowmiy a

project tracker,velocity& burndown charts(4 marks):

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		5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

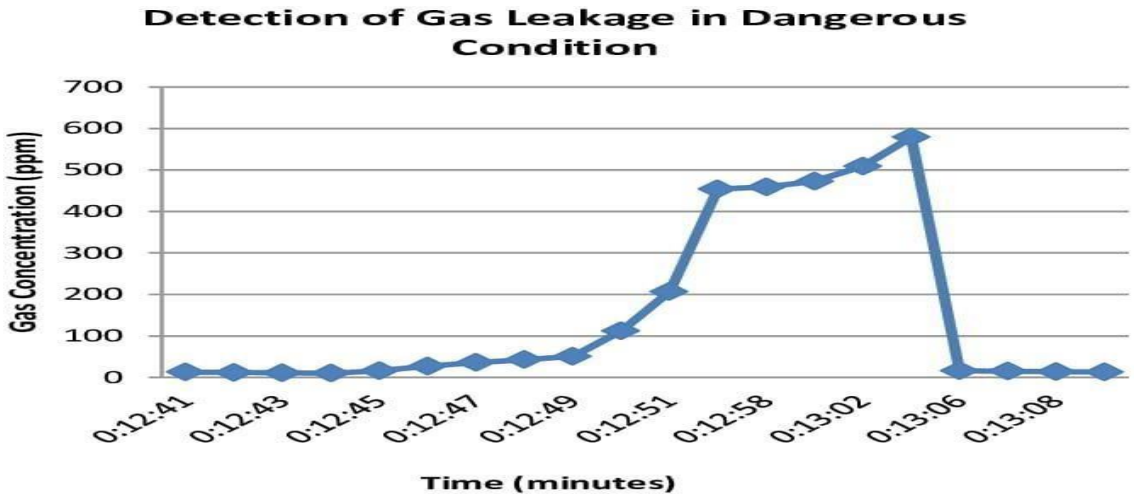


Figure 6.2 Burndown Chart

REPORTS FROM JIRA

Jira is a software application used for issue tracking and project management.The tool,developed by the Australian softwarecompany Atlassian,has become widely used by agile development teams to track bugs,stories,epics,and other tasks.

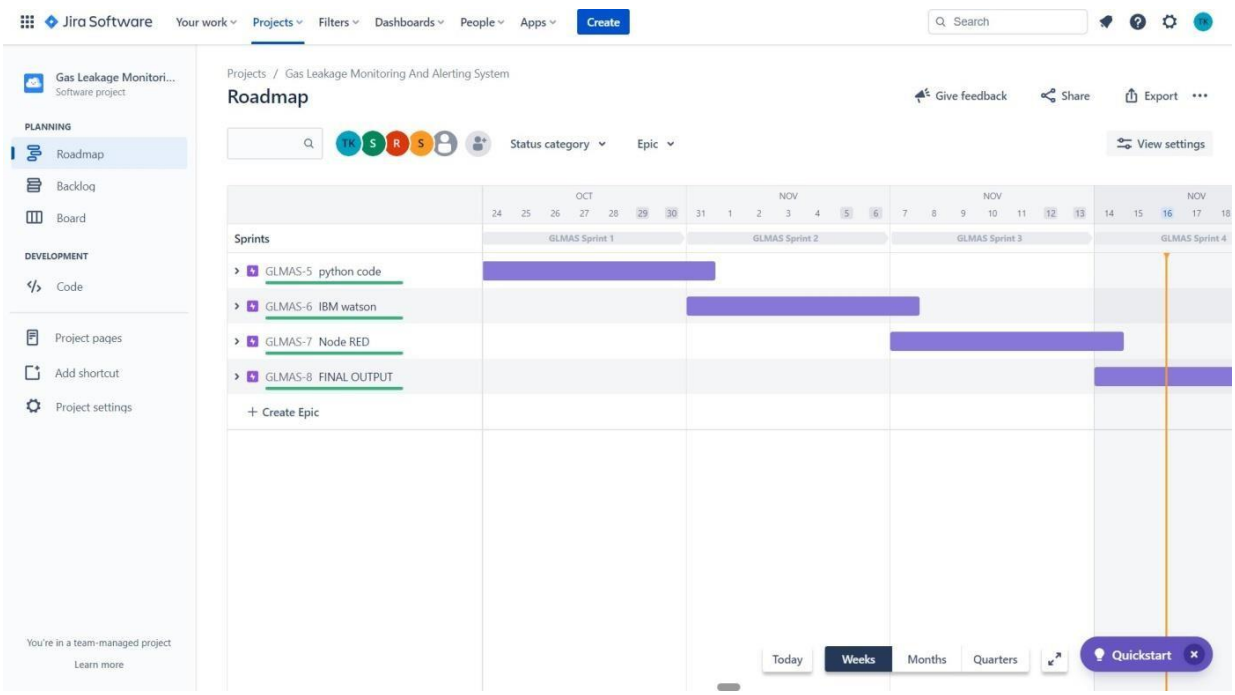


Figure 6.3 Roadmap

CHAPTER 7

CODING & SOLUTIONING

7.1 Feature 1

After installation of python version 3.6.2 ,we have to install ibmiotf package to connect with the IBMwatson Iot platform.

To install the package open the command prompt window and type the command as **pip installibmiotf.**

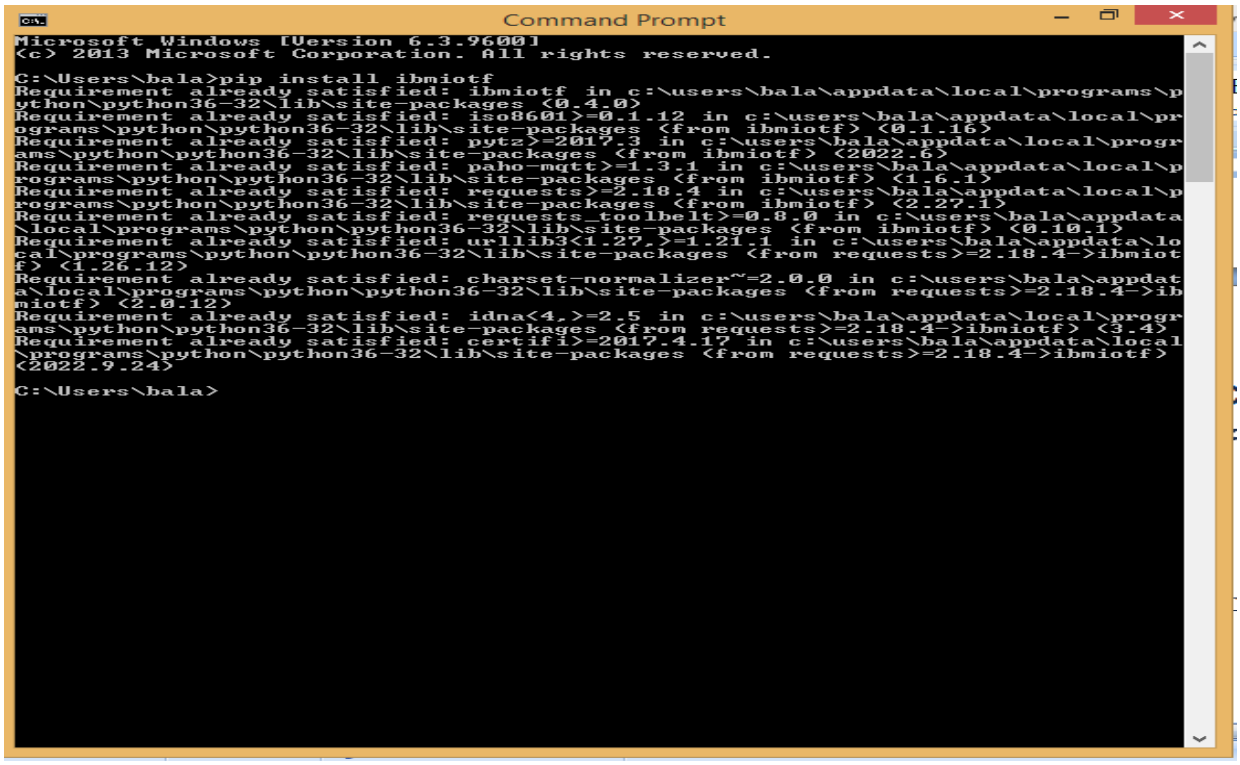


Figure 7.1 Command Prompt

\7.2 Feature 2

Python code

```
import time
import sys
import ibmiotf.application
 import ibmiotf.device import random
#Provide your IBM Watson Device Credentials
organization = "z9xrcm"
deviceType = "ESP32"
deviceId = "1234"
authMethod = "token"
authToken = "12345678"
# Initialize GPIO
def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command']) status=cmd.data['command']
if status=="sprinkleron": print ("Sprinkler is on")
else :
print ("Sprinkler is off") #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 DHT11
temp=random.randint(0,100)
Humid=random.randint(0,100)
gasconcentration=random.randint(0,100)
data = { 'temp' : temp, 'Humid': Humid, "gasconcentration":
gasconcentration}
#print data
def myOnPublishCallback():
print ("Published Temperature = %s C" % temp, "Humidity = %s
%%" % Humid, "gasconcentration = %s %%" % gasconcentration,
"to IBM Watson")
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback) if not success:
print("Not connected to IoTF") time.sleep(1)
deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

output:

ibmiotf library is imported and we are using IBM Watson IoT platform's device details such as organisation id,device id,device type, authentication token.parameters like gas concentration,temperature,humidity are to be monitored by generating the random values which decide the switching on the sprinkler ,delay is given in general.In the output screen you can visualize the connectivity to the IBM IoT platform and the values will be generated.

The python output is as follows

Figure 7.2 Python output

The Ibm watson output is as follows

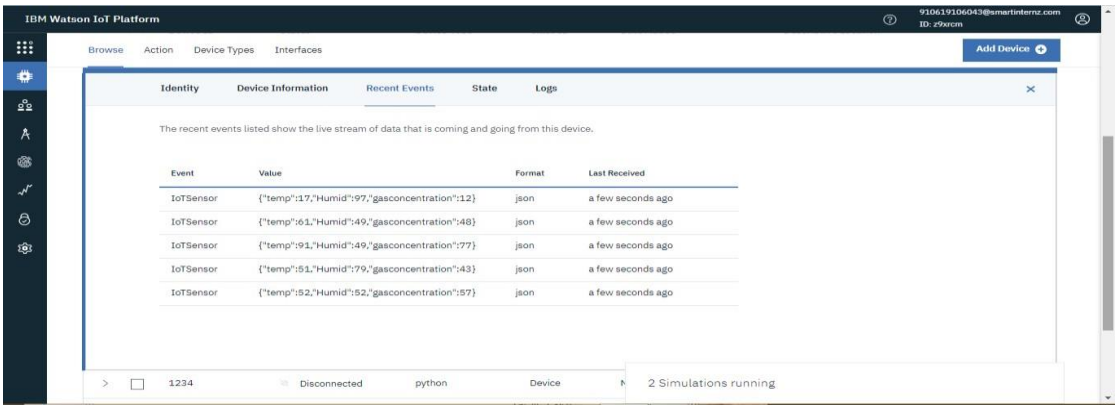


Figure 7.3 Watson Output

CHAPTER 8
TESTING

TEST CASES

The steps to execute the test scenario are listed below

1					Date	3-Nov-22	
2					Team ID	PNT2022TMID11539	
3					Project Name	Gas leakage monitoring and alerting system	
4					Maximum Marks	4 marks	
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data
6	1	python coding		to establish connection in IBM watson iot platform.		1.Install Python 3.6.0 install the package pip install ibmiotf , 3.Import the package in python 4.provide the device credentials from IBM iot watson platform 5.Run the program	
7	2	python coding		To Generate random values for the parametres Temperature,Humidity,PH level,CO2,Soil moisture		1.Open python 2.Write a program to generate random variables for the parameters using random library.3.Run the program	
8	3	Node-Red		To establish connection to IBM iot watson platform and then configuring nodes for the parameters		1.Open Node-red using IBM cloud 2.installing package to connect with IBM watson and configure the node with the Authentication Key and ID using IBM watson iot platform.3 Arrange the functional nodes for the parameters and configure them 4.connect all nodes with msgpayload and deploy them.	
9	4	Watson	Add device	To display values in IBM watson and geneate API key for node red		1.to create ibm watson platform in services in your ibm cloud account.2.Launch the ibm watson to iot platform.3.Create a new device.4.Give credential like device type ,deviceid, authentication token to generate API keys	
10	5	web UI	Temperature,Humid,Gas concentration	To display the sprinkler on off message in the node red		1.we have to take the functional modules and rename as sprinkler 2.And connected to the IBM watson iot platform.	

Figure 8.1 Test Scenario

USER ACCEPTANCE TESTING

Acceptance Testing

UAT Execution & Report Submission

Date	18 November 2022
Team ID	PNT2022TMID11539
Project Name	Gas Leakage Monitoring and Alerting System
Maximum Marks	4 Marks

Purpose of Document

Gas leakage leads to various accidents resulting in both material loss and human injuries. The risk of explosion, firing, suffocation are based on their physical properties such toxicity, flammability, etc. The number of deaths due to explosion of gas cylinders has been increasing in recent years. Testing this project leads to a reliable performance and indicates the weakness as well as strength. Purpose of the document, we haveto analysis with proper way. Taking all the parameter and give the value.

TestCaseAnalysis

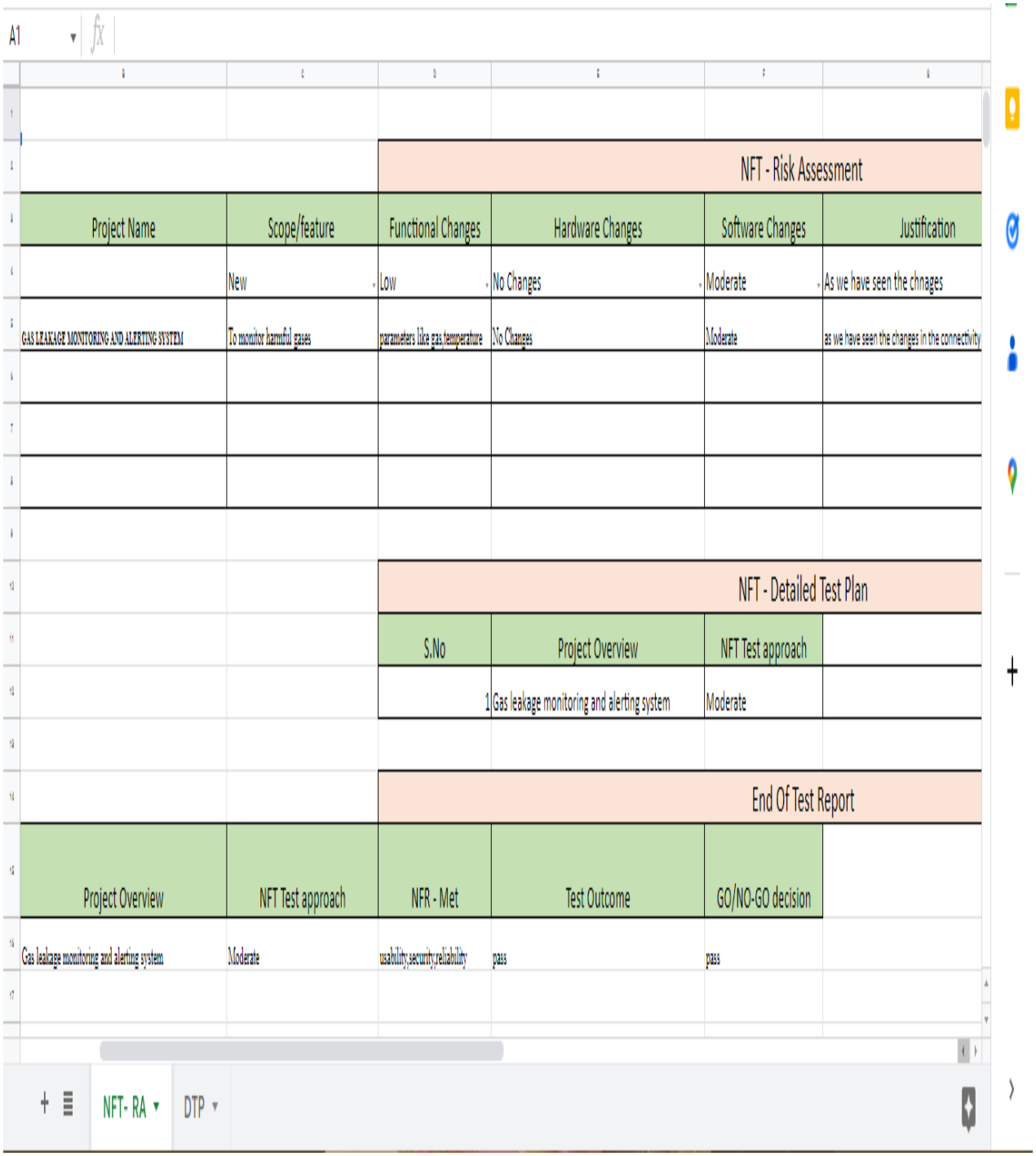
Table 8.1 This report shows the number of test cases that have passed,failed,and untested

Section	TotalCases	Not Tested	Fail	Pass
IBM cloud login	2	0	0	2
Python code	7	0	2	5
IBM Watson login	3	0	0	3
Node Red	3	0	0	3
Connecting python to IBM watson	5	0	2	3
Connecting IBM Watson to Node red	6	0	2	4
WEB UI	2	0	0	2

CHAPTER 9

PERFORMANCE METRICS

Table 9.1Gas leakage monitoring and alerting system IoT application project has a better future scope as its functional characteristics



		NFT - Risk Assessment			
Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Justification
	New	Low	No Changes	Moderate	As we have seen the chnages
GAS LEAKAGE MONITORING AND ALERTING SYSTEM	To monitor harmful gases	parameters like gas,temperature	No Changes	Moderate	as we have seen the changes in the connectivity
		NFT - Detailed Test Plan			
		S.No	Project Overview	NFT Test approach	
		1	Gas leakage monitoring and alerting system	Moderate	
		End Of Test Report			
Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	
Gas leakage monitoring and alerting system	Moderate	usability,security,reliability	pass	pass	

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

Advantage

- This project helpful for detecting gas leakage in Industries.
- Component and Equipment are more efficient.
- Lower power consumption and reliable.
- It is also used in house for LPG gas leakage.

Disadvantage

- Location cannot be identify where gas leaking because there are
- several areas contain gas cylinder.
- It is sensitivity depends on Humidity and Temperature.
- Without Internet, this will not run and work.
- Installation is difficult.

CHAPTER 11

CONCLUSION

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. 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 gas 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.

In general, the project was successful and worked properly and succeeded in delivering the prototype on due time. We are proud and happy for this achievement especially that this our first theoretically, practically online stimulated project . It enabled us to get concrete results and to realize that wecan indeed build products that would be beneficial in real life and that we can customize it upon demand as future projects.

CHAPTER 12

FUTURE SCOPE

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 anydisaster.

Suppose corrective steps are taken promptly after it is reported over the IoT devices. In that case, that can help save the loss of lives, alleviate any mishaps from happening, and cut down on business expenses.

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.

CHAPTER 13

13.1 SOURCE CODE

The python code is executed and output is shown as following

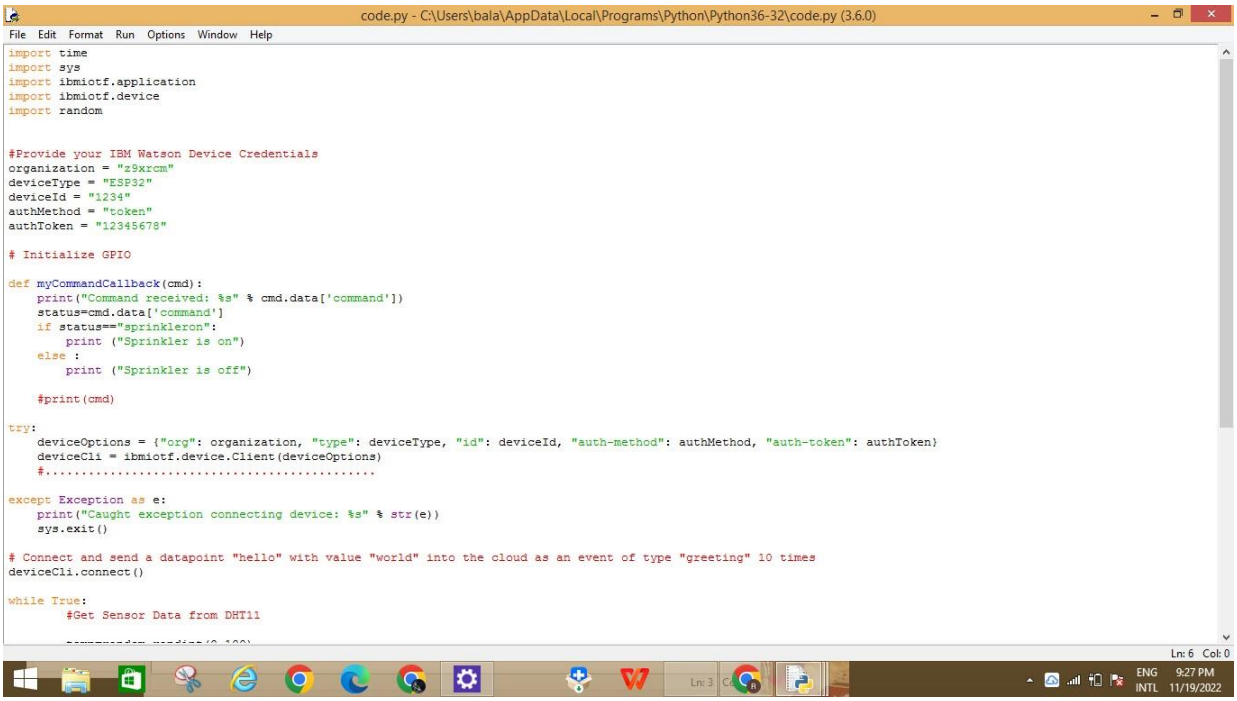


Figure 13.1 python code

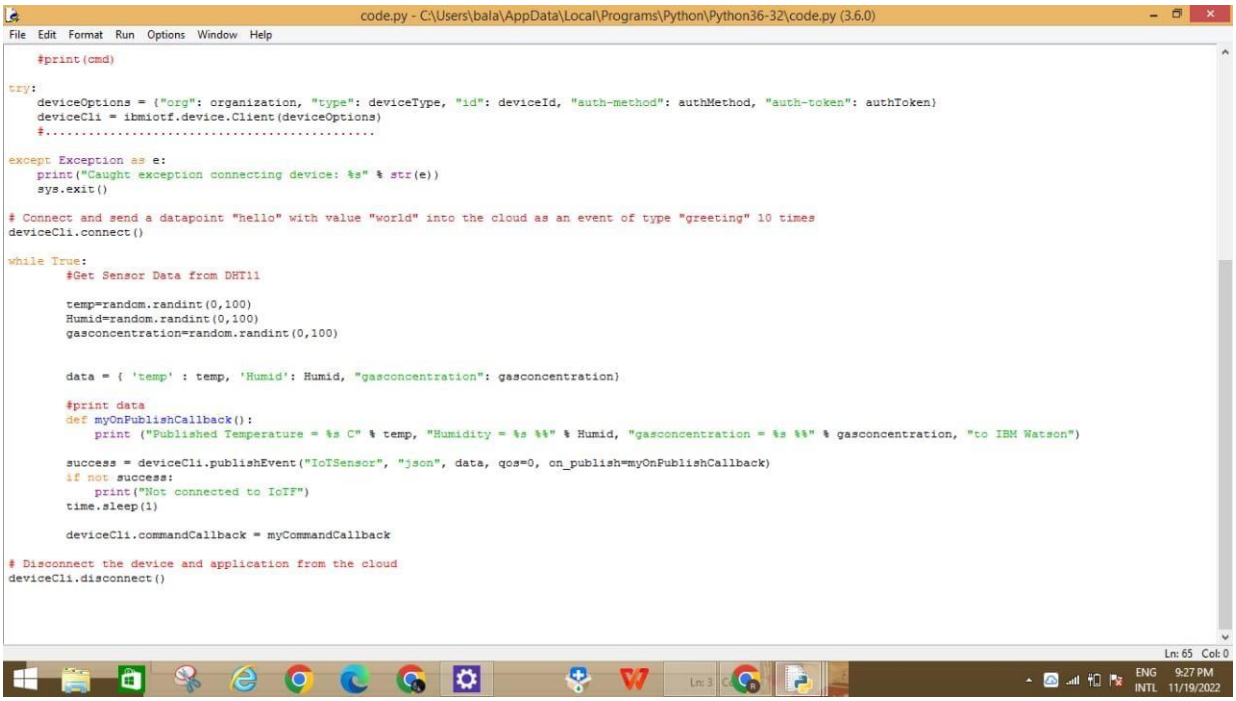


Figure 13.2 python coding

The watson output dispalyed recent events

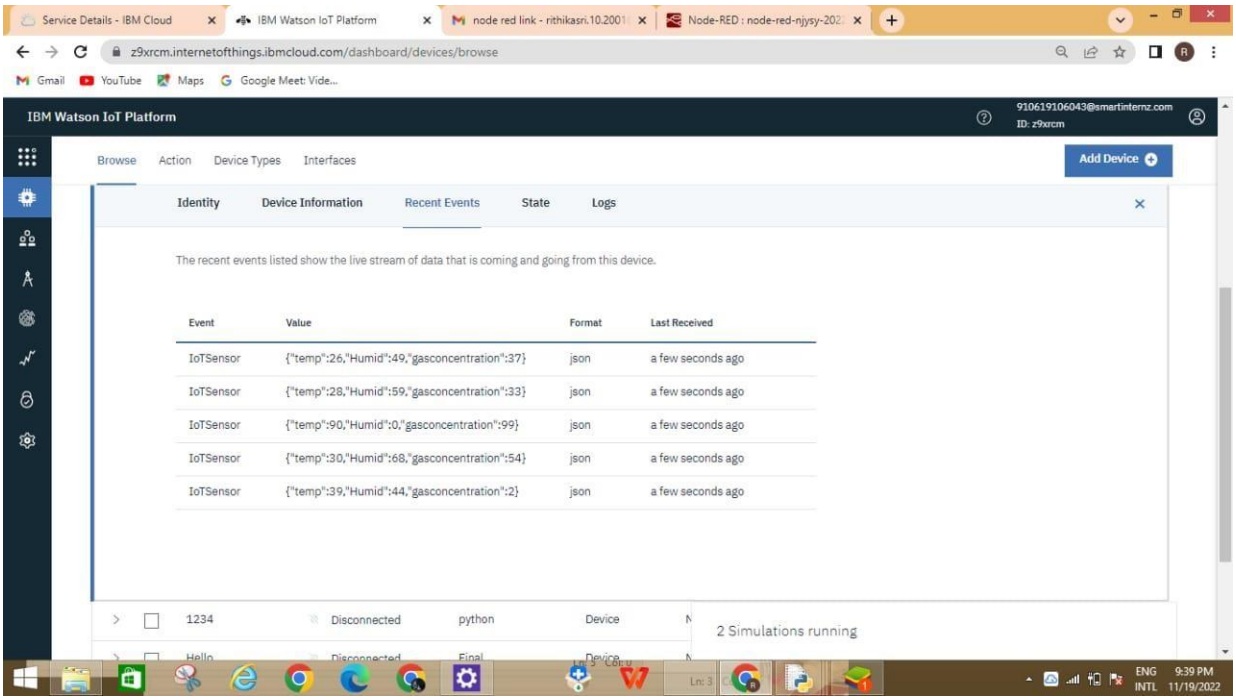


Figure 13.3 watson output

The node red connection are as follows

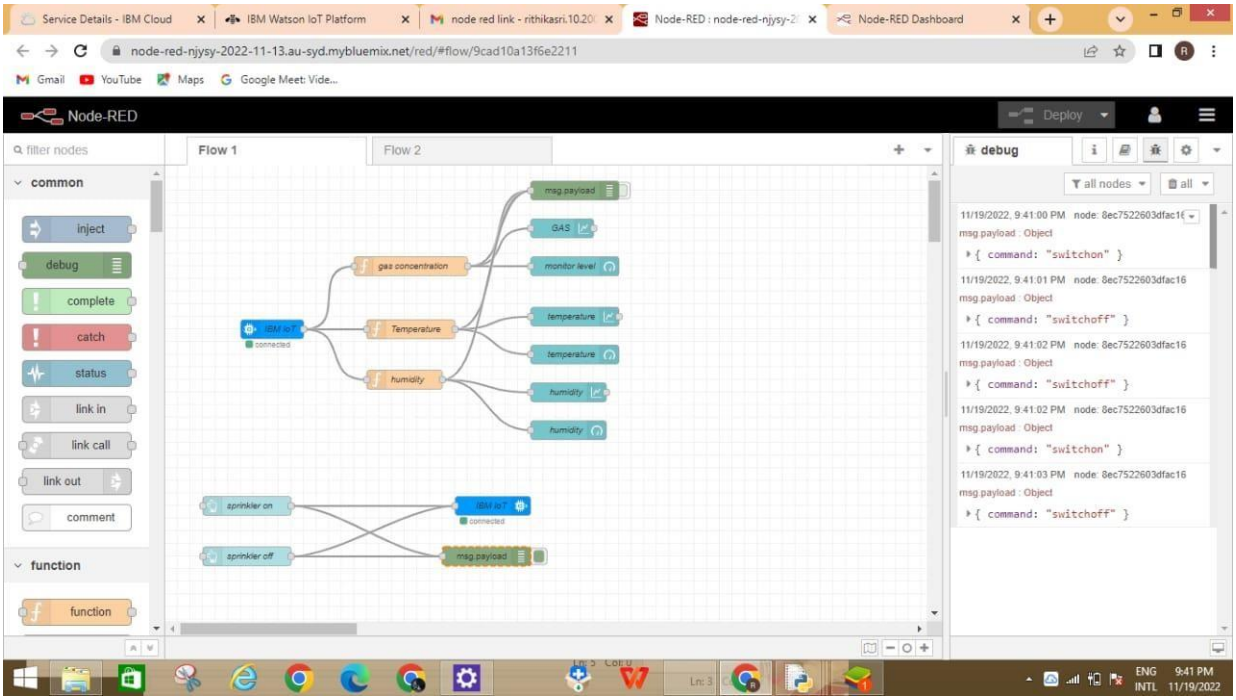


Figure 13.4 Node red output

The node red web ui are as follows

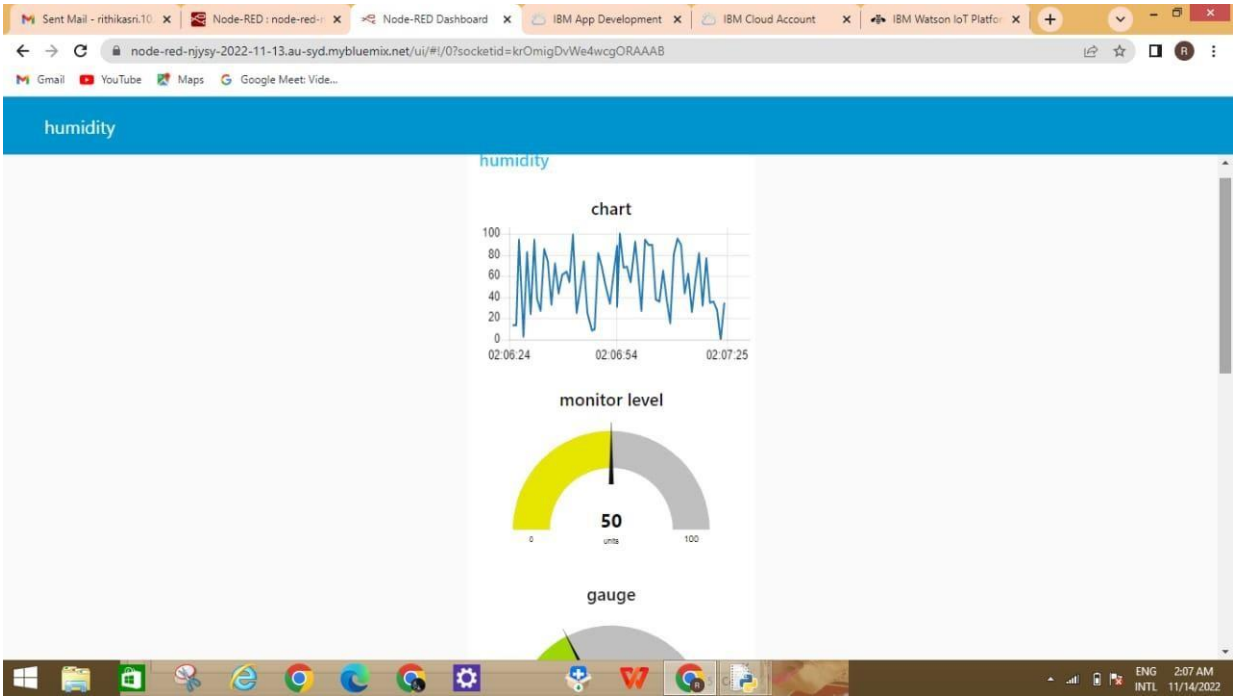
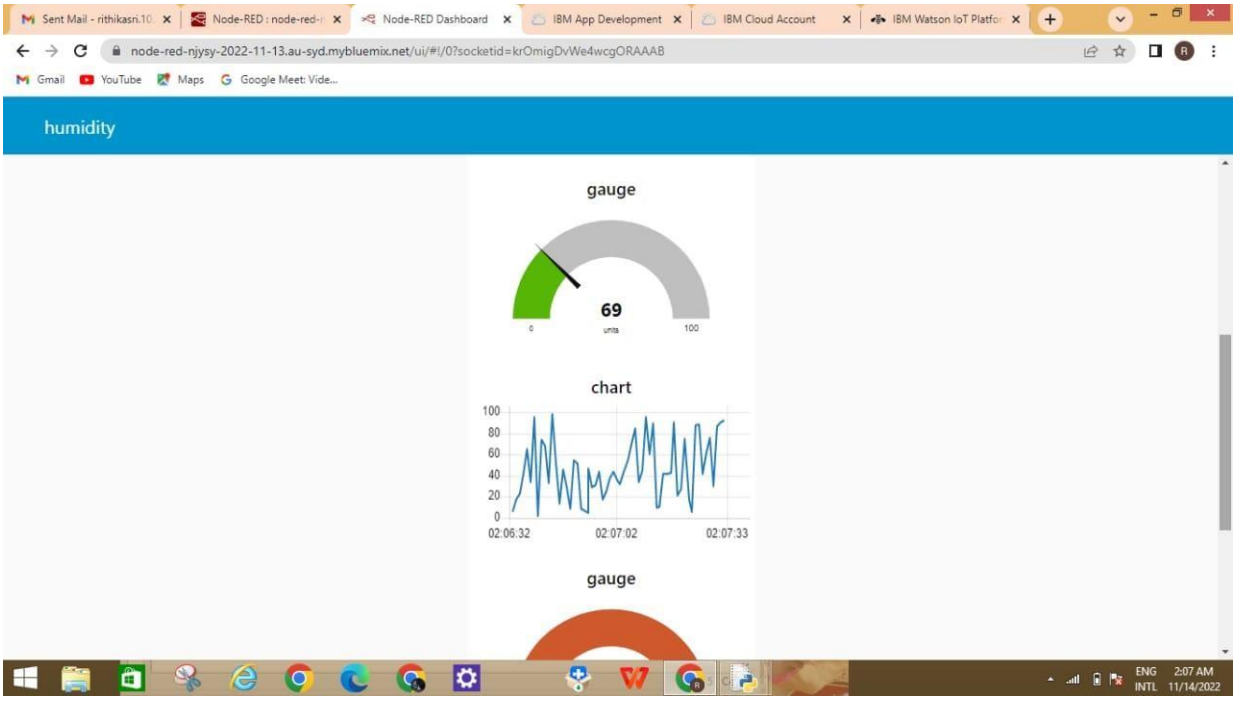


Figure 13.5 web ui humidity output



13.6 Temperature

13.2 GitHub and Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-25720-1659971611

https://youtu.be/Cpl4Fr1q35o