PROJECT REPORT

REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

TEAM ID: PNT2022TMID41928

TEAM MEMBERS

1)S.R.SHOBIKA

2)G.GOVINDHARAJ

3)S.SETHURAMAN

4)G.JAISANKAR

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Water is the primary need of all living beings and living without water is impossible. With the advancement of technology and industrialization, environmental pollutions have become a major concern. Water pollution is one of the most serious types of this environmental pollution. Our lives depend on the quality of water that we consume in different ways, from juices which are produced by the industries. Any imbalance in the quality of water would severely affect the humans health and at the same time it would affect the ecological balance among all species. Water quality refers to the chemical, biological, radiological, and biological parameters of the water.

The essential parameters of the water quality vary based on the application of water. For example, for aquariums, it is necessary to maintain the temperature, pH level, dissolved oxygen level, turbidity, and the level of the water in a certain normal range in order to ensure the safety of the fish inside the aquarium. For the industrial and household applications, however, some parameters of the water are more essential tobe monitored frequently than the others, depending on the usage of the water.

1.2 PURPOSE

The traditional method for monitoring of the water quality is such that the water sample is taken and sent to the laboratory to be tested manually by analytical methods. Although by this method the chemical, physical, and biological agents of the water can be analyzed, it has several drawbacks. Firstly, it is time consuming and labor intensive. Secondly, the cost for this method was somwwhat high.

Compared to the conventional water quality testing techniques, sensor based water quality testing has many advantages such as accurate, high sensitivity, good selectivity, speed, fast response, low cost etc.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Existing system has a mechanisms which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. There is need to have human intervention in taking various reading of the water parameters.

The instruments or tools are used either by putting/inserting a water sensing part into water and seeing the result on small display device or by directly inserting a portable device in water and watching the output on the display. Central Water Commission (CWC) monitors water quality, by collecting samples from representative locations within the processing and distribution system.

These samples are analyzed at the well-equipped laboratories. At these laboratories, samples of raw water, filter water and treated water are taken for analysis, these analysis can be performed by human intervention which for specific period only. The disadvantage of this system is, water is not monitoring seamlessly, and it always needs a human intervention.

2.2 REFERENCES

J.Navarajan et al.[1]: Paper focuses on Detection on water pollution and water management using smart sensors iotTo ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed.This system consists some sensors. Which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time.

NatasaMarkovic et al. [2]: this research paper focuses on Sensor Web for River Water Pollution Monitoring and Alert SystemSensor Web has provided infrastructure for collecting and processing data from distributed and heterogeneous sensors. This set of technologies has found various implementations, especially in the area of environmental monitoring. The Sensor Web architecture for crisis management, described in this paper, provides active monitoring of measuring parameters and timely responses in cases of environmental disasters. The River Water Management and Alert System built on this architecture enable access, control and management of river water pollution.

K.A. UnnikrishnaMenon et al,[3]: This research paper focuses on Wireless Sensor Network for River Water Quality Monitoring in India This paper introduces a river water quality monitoring system based on wireless sensor network which helps in continuous and remote monitoring of the water quality data in India. The wireless

sensor node in the system is designed for monitoring the pH of water, which is one of the main parameters that affect the quality of water. Wireless sensor Network which aids in River Water Quality Monitoring. This paper also proposes a novel technique for the design of a water quality sensor node which can be used for monitoring the pH of water.

Aswinkumar et al.[4]: This research paper focuses on Detection on water pollution and water management using smart sensors iotTo ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed.This system consists some sensors. Which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time

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2.3 PROBLEM STATEMENT DEFINITION

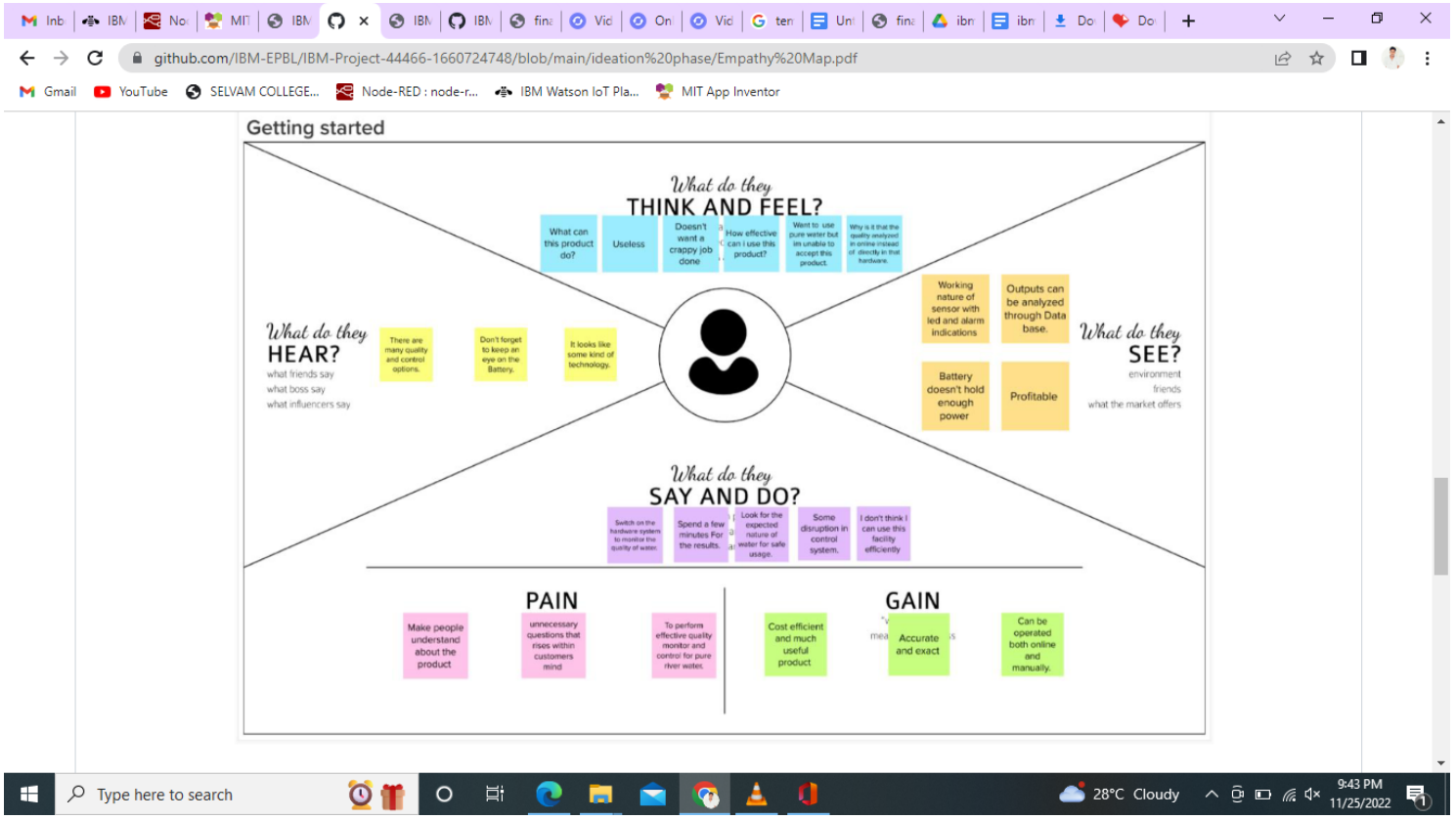
Agriculture is the backbone of Delta region in Tamil nadu. 80% of cultivation depends on Cauvery river water. The river water is carried through the agricultural fields via canals. And the river water is the main source of drinking water supply for the localities. But it was polluted by fertilizers, pesticides, chemicals and also by some biological activities. It directly affects people's health and aquarium lifestyle. So, the quality of water needs to be monitor, that is ulmost important to use it for various purposes.

It is mandatory to monitor pH level and temperature of the river water. If the quality of the water is not good it will be announced to localities not to use the water.

Problem Statement(PS)	I am	I'm trying to	But	Because	Which makes me feel
PS -1	Farmer	Cultivate paddy, sugercane, maize	Not able to harvest good quality of crops	Inadequate Supply of good quality of water	and it also affect cattles
PS -2	General public	Use good quality of water for various purpose	It is not good to drink and use	High usage of pesticides, and sewage mixes with river water	Unhealthy and struggles for daily usage of water

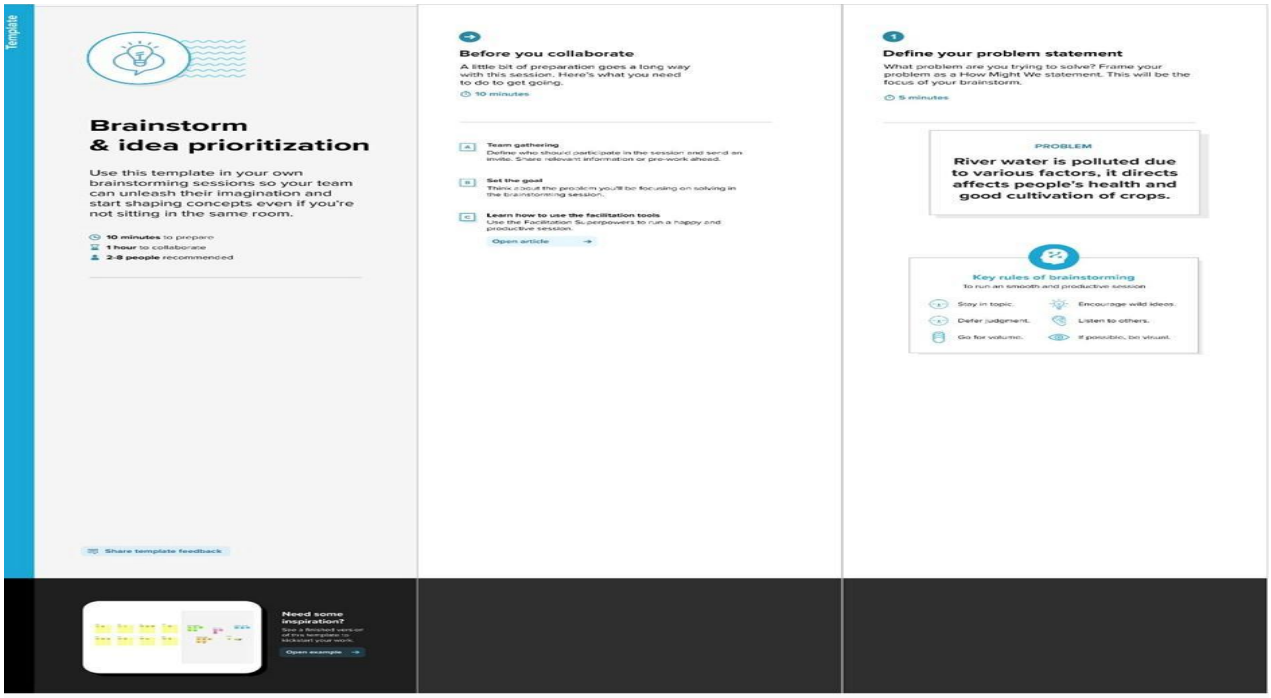
3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

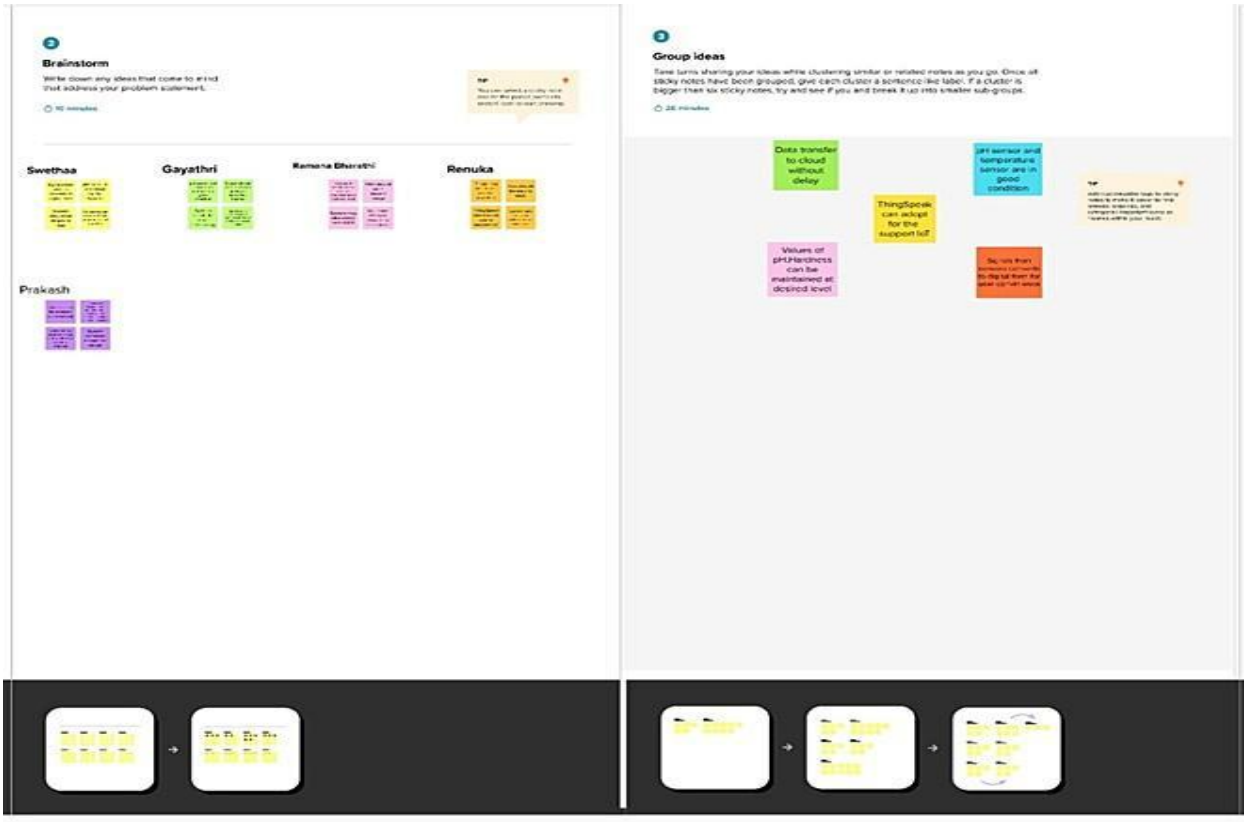


3.2 IDEATION AND BRAINSTROMING

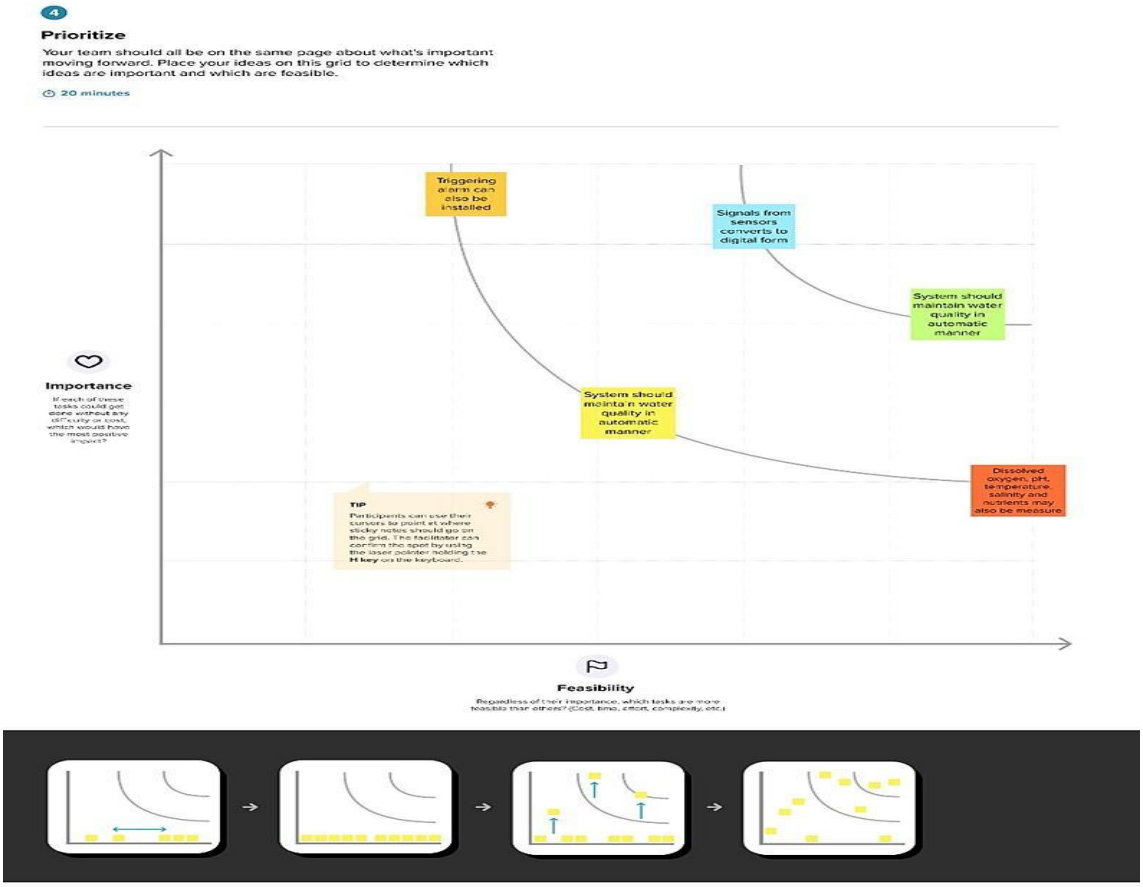
Step-1: Team Gathering, Collaboration and Select the Problem Statement:



Step-2: Brainstorm, Idea Listing and Grouping:



Step-3: Idea Prioritization:

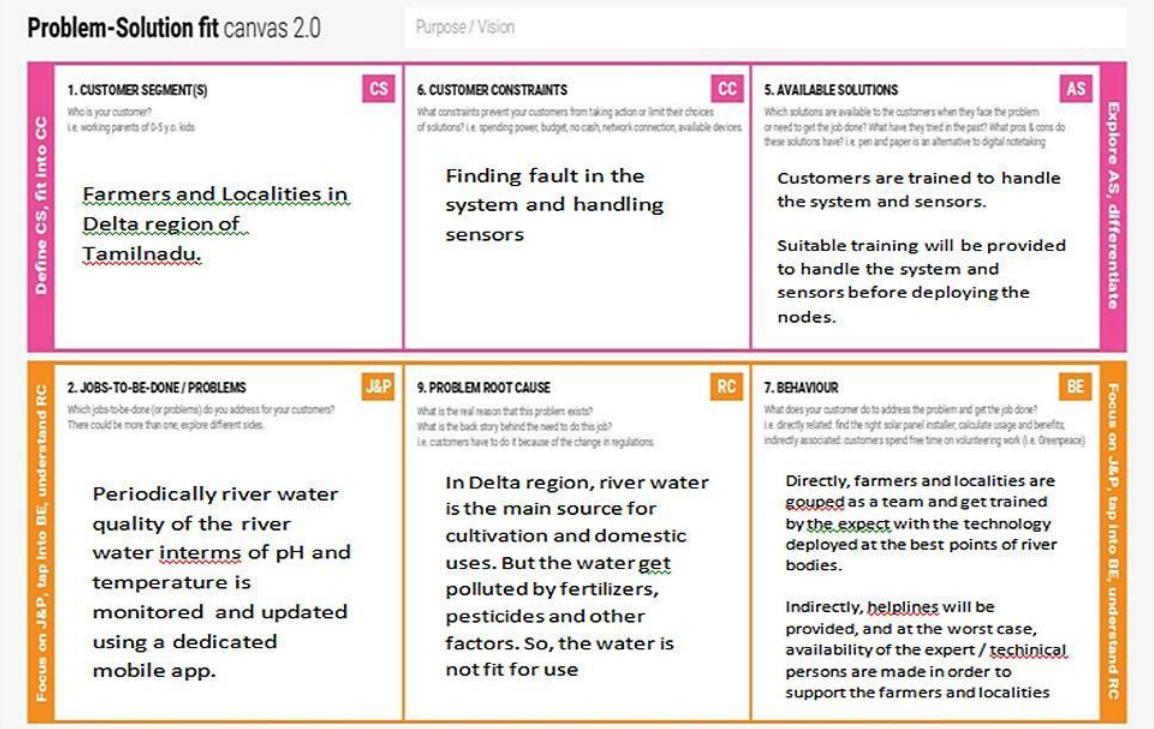


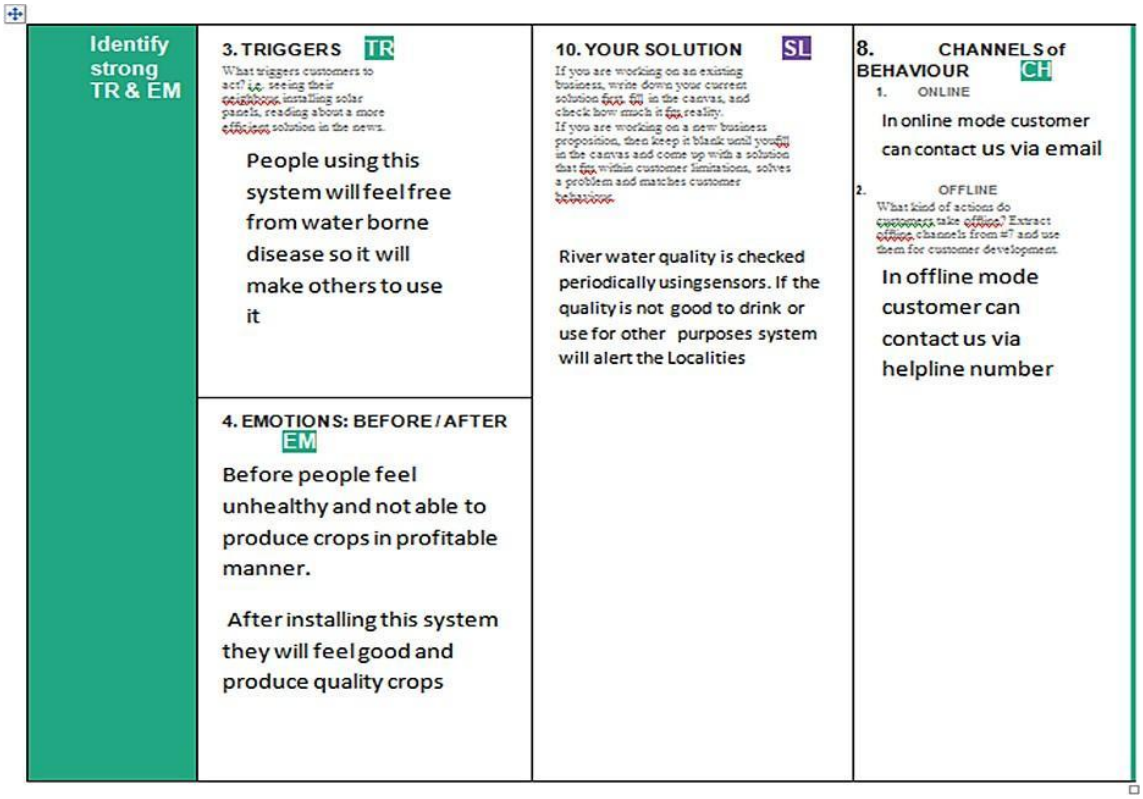
3.3 PROPOSED SOLUTION

S.No	Parameter	Description
1.	**Problem Statement (Problemto be solved)**	In Delta regions, the river wateris the majorsource and backbone for farmers for cultivating crops and drinking water supply for the localities. Butit is polluted by fertilizers, pesticides, chemicals and also by some biological activities. It directly affects people's health and aquarium lifestyle. So, the quality of water needsto bemonitored.

2.	**Idea / Solution description**	Monitoring the quality of river water/water bodies usingsensors and arduinofor domestic and agriculture purposes.
3.	**Novelty / Uniqueness**	Measured pH and temperature can be monitored by using mobile app
4.	**Social Impact/ CustomerSatisfaction**	People come to know about the quality ofwater
5.	**Business Model(Revenue Model)**	Water Monitoring and ControlModel
6.	**Scalability of the Solution**	The process of operating this Model is user friendly and more suitable for domestic and agricultural purposes

3.4 PROBLEM SOLUTION FIT





4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

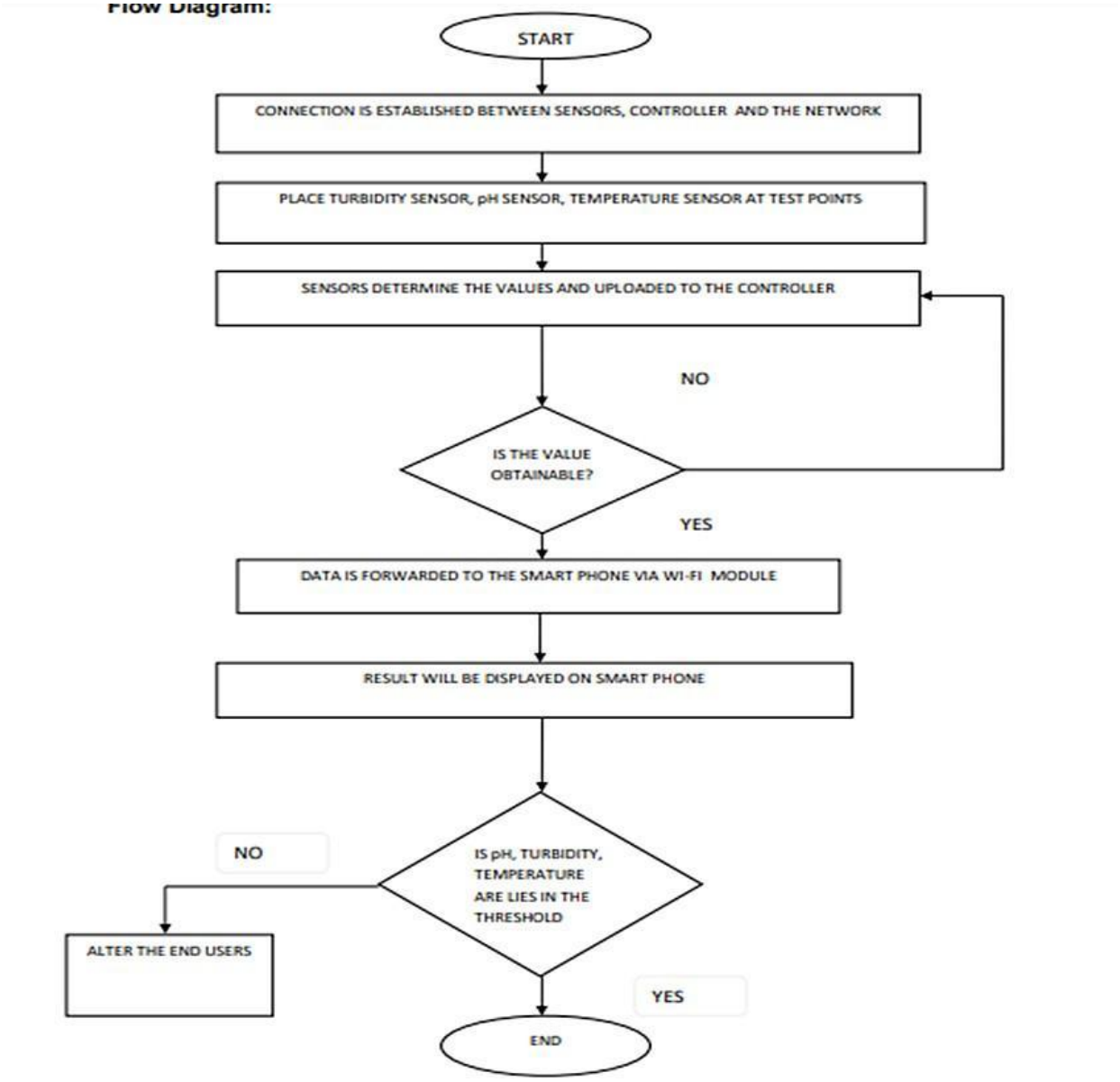
FR No.	Functional Requirement	Sub Requirement(Story/Sub-Task)
FR-1	User Login	Confirmation through verified password
FR-2	View Water Details	View current water detail sin website View traditional water eligibility in website
FR-3	Logout	Logs out the user successfully

4.2 NON FUNCTIONAL REQUIREMENT

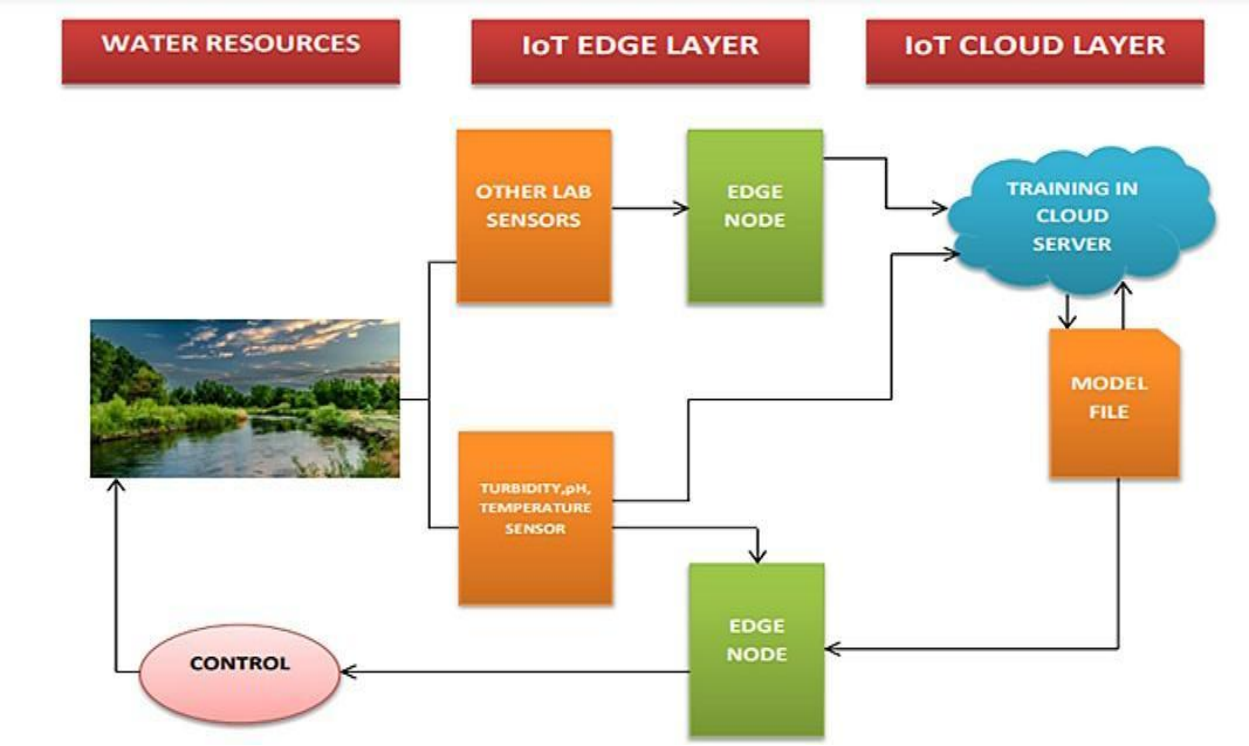
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Load time for user interface screens shall not be more than2 seconds.
NFR-2	**Security**	User account is password protected Account creation done only after email verification
NFR-3	**Reliability**	Users can access their account 98%of the time without failure
NFR-4	**Performance**	Load time for user interface screens shall not be more than2seconds. Logininfoverifiedwithin10 seconds.
NFR-5	**Availability**	Maximum down time will be about4hours
NFR-6	**Scalability**	System can handle about1000 users at any given time

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	UserStory Number	User Story/ Task	Acceptancecriteria	Priority	Release
Customer (Mobileuser)	Registration	USN-1	As a user, I can register for the application by entering myemail, password, and confirming my password.	I can access myaccount / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonce I haveregistered for the application	I can receive confirmation email& click confirm	High	Sprint-1

		USN-3	As a user, I can register forthe application through Facebook	I can register &access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email& password		High	Sprint-1
Customer (Web user)	Registration	USN-1	As a user, I can register for the application by entering myemail, password, and confirming my password.	I can access myaccount / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonce I haveregistered for the application	I can receive confirmation email& click confirm	High	Sprint-1
		USN-3	As a user,I can register forthe application through Facebook	I can register &access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email& password		High	Sprint-1
Customer CareExecuti ve	Login	USN-5	As a, Customer Care Executive I can log into the application by entering server email &password	I can accessDBMS	High	Sprint-1

Administrator	Login	USN-5	As a Administrator, I can log into the application by entering severemail & password	I can accessDBMS	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

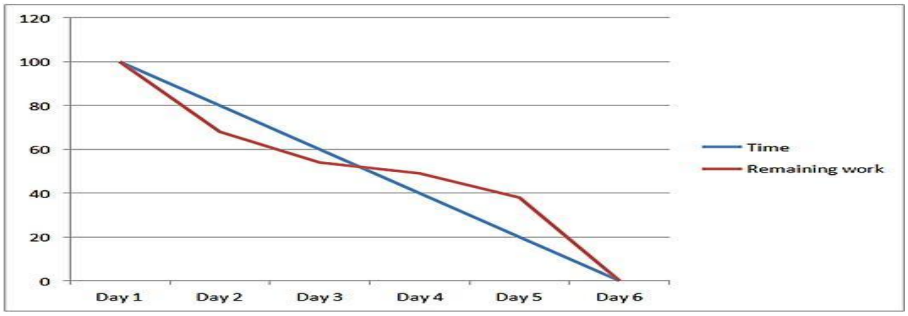
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, andconfirming my password.	2	High	S. Ramana Bharathi
Sprint-1		USN-2	As a user,I will receive confirmation email once I have registered for the application	1	High	A.Prakash
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	SM.Swethaa
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	K.Renuka
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email &password	1	High	S.Gayathri
Sprint-3	Login	USN-5	As a, Customer Care Executive I can log into the application by entering server email &password	2	High	SM.Swethaa
Sprint-4	Login	USN-5	As a Administrator, I can log into the application byentering sever email & password	2	High	S. Ramana Bharathi

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as onPlanned EndDate)	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	06 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	14 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORTS FROM JIRA

Burndown Chart:



7. CODING & SOLUTIONING

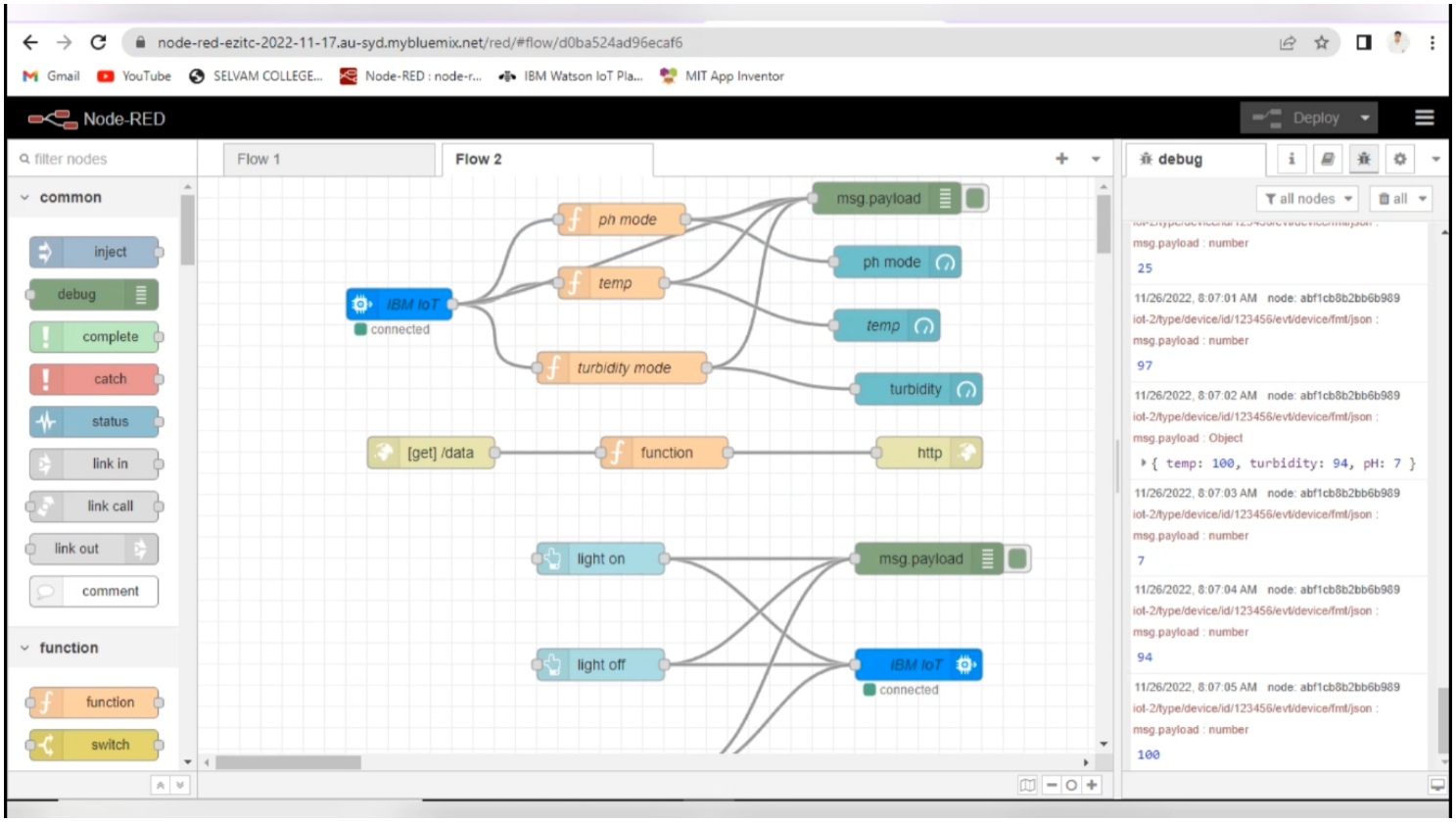
7.1 FEATURE 1

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "zjr7ti"
deviceType = "device"
deviceId = "123456"
authMethod ="token"
authToken ="1234567890" # Initialize GPIO
```

```
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status=="lightoff":
        print ("led is off")
    else:
        print("please send the 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 DHT11
    temp=random.randint(0,100)
    turbidity=random.randint(0,100)
    pH=random.randint(0,14)
    data = { 'temp' : temp, 'turbidity':turbidity,'pH' : pH }
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Turbidity = %s %%" %turbidity,
"pHValue =%s" % pH, "to IBM Watson")
    success = deviceCli.publishEvent("device", "json", data,
qos=0,on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(4)
```

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

7.2 FEATURE 2



8. TESTING

8.1 TEST CASES

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

Section	TotalCases	Not Tested	Fail	Pass
Print Engine	15	0	0	15
Client Application	45	0	0	45
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reportin	10	0	0	10

g				
Final ReportOutput	4	0	0	4

Version Control	3	0	0	3

8.2 USER ACCEPTANCE TESTING

1. PURPOSE OF DOCUMENT

The purpose of this documentis to briefly explain the test coverageand open issuesof the REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEMS project at the time of the release to User Acceptance Testing (UAT).

2. DEFECT ANALYSIS

This report shows the number of resolved or closed bugs at each severity level,and how they were resolved

9. RESULTS

9.1 PERFORMANCE METRICS

PARAMETER	PERFORMANCE	DESCRIPTION
ADMIN TESTING	95%-100%	THE TESTING DONE BEFORE IT IS DEPLOYED AS AN APP
CUSTOMER SATISFACTION	75-85%	THE CUSTOMER NEED TO BE SATISFIED WITH THE MOBILE APPLICATION

USER INTERFACE	65-85%	THE APP CAN USED BYANYONE.(EASE OF ACCESS)

10. ADVANTAGES & DISADVANTAGES ADVANTAGES

- User friendly
- Data accuracy
- Reliability
- Efficiency

DISADVANTAGES

- High cost for smart sensors

11. CONCLUSION

The prototype developed for water quality maintenance is very beneficial for safeguarding public health and also adds to the clean environment. The automation of this water monitoring, cleaning and control process removes the need of manual labor and thus saves time and money. The automation of the system makes the control and monitoring process more efficient and effective.

12. FUTURE SCOPE

Expanding and ability to connect the different buildings in the city to one network and continuously monitor the water quality and consumption

in different area, in different area, inaddition, investigate the causes that changes water quality and adjust them immediately.

13. APPENDIX

13.1 SOURCE CODE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "zjr7ti"
deviceType = "device"
deviceId = "123456"
authMethod ="token"
authToken ="1234567890" # Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status=="lightoff":
        print ("led is off")
    else:
        print("please send the 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 DHT11
    temp=random.randint(0,100)
    turbidity=random.randint(0,100)
    pH=random.randint(0,14)
    data = { 'temp' : temp, 'turbidity':turbidity,'pH' : pH }
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Turbidity = %s %%" %turbidity,
"pHValue =%s" % pH, "to IBM Watson")
    success = deviceCli.publishEvent("device", "json", data,
qos=0,on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(4)
    deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

13.2 GITHUB & PROJECT DEMO LINK

Github link : https://github.com/IBM-EPBL/IBM-Project-44466-1660724748

Demo link: https://youtu.be/l1Bn5i7FJ8w