REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

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SARANATHAN COLLEGE OF ENGINEERING , PANJAPPUR

In fulfillment of project in IBM-NALAYATHIRAN 2022

Team Id: PNT2022TMID32705

PROJECT GUIDES

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1.INTRODUCTION

1.1 Project Overview:

River Water quality monitoring System

River water which is used as drinking water is a very precious commodity for all human beings.The system consists of several sensors which are used for measuring physical and chemical parameters of water. The parameters such as temperature, pH, and dissolved oxygen of the water can be measured. Using this system a person can detect pollutants from a water body from anywhere in the world.Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming This paper proposes a sensor based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a micro-controller for processing the system, communication system for inter and intra node communication and several sensors Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology Data collected at the IBM cloud Server and verify them to trigger the actions to be performed.

1.2 Purpose:

Water quality refers to chemical, physical biological and radio logical characteristics of water. It is a measure of the condition of water relative to the necessities of one or more bio-tic species and or to any human need or purposes

.Water quality monitoring is defined as a sampling and analysis of the water in lake, stream, ocean and river and conditions of the water body. Smart water quality monitoring is a process of real-time monitoring and the analysis of water to identify changes in parameters based on the physical, chemical and biological characteristics.Monitoring water quality is clearly important: in our seas, our

rivers, on the surface and in our ports, for both companies and the public. It enables us to assess how they are changing, analyze trends and to inform plans and strategies that improve water quality and ensures that water meets its designated use.There are several indicators determining water quality. These include dissolved oxygen, turbidity, bio indicators, nitrates, pH scale and water temperature.Monitoring water quality helps to identify specific pollutants, a certain chemical, and the source of the pollution.There are many sources of water pollution: wastewater from sewage seeping into the water supply; agricultural practices (e.g., the use of pesticides and fertilizer); oil pollution, river and marine dumping, port, shipping and industrial activity. Monitoring water quality and a water quality assessment regularly provides a source of data identify immediate issues – and their source.

- Identifying trends, short and long-term, in water quality.
- Data collected over a period of time will show trends, for example identifying increasing concentrations of nitrogen pollution in a river or an inland waterway. The total data will then help to identify key water quality parameters.

- Environmental planning methods: water pollution prevention and management.
  - Collecting, interpreting and using data is essential for the development of a sound and effective water quality strategy. The absence of real-time data will however hamper the development of strategies and limit the impact on pollution control. Using digital systems and programs for data collection and management is a solution to this challenge.
  - Monitoring water quality is a global issue and concern: on land and at sea. Within the European Union, the European Green Deal sets out goals for restoring biological biodiversity and reducing water pollution, as well as publishing various directives to ensure standards of water quality. Individual nation states, for example France, have also clear regulatory frameworks requiring the effective monitoring of water quality. In the United States, the Environmental Protection

Agency (EPA) enforces regulations to address water pollution in each state. Across the world, countries increasingly understand the importance of effective water quality monitoring parameters and methods.

2.LITERATURE SURVEY

2.1 Existing Problem:

Due to population growth, urbanization ,and climatic change ,competition for water resources is expected to increase, with a particular impact on agriculture, river water. Water will be suitableness to potable water monitoring compound spillage identification done rivers, remote estimation for swimming pools. It holds self-sufficient hubs that unite with the cloud to ongoing water control .The River water needed to be treated before it is used in agriculture feilds,hence the parameters affecting the quality of river-water need to be analysed and to be used for water treatement purpose.

2.2 Reference :

1.Jyotirmaya Ijaradar,Subhasish Chatterjee

REAL TIME WATER QUALITY MONITORING SYSTEM: International -Research Journal of Engineering and Technology.

2.Prasad M pujar,Harish Kenchannavar,Raviraj Kulkarni,UmakantP.kulkarni

INTEGRATING WIRELESS SENSOR TECHNOLOGY TO WATER MONITORING : Research Gate

3.Mohammad salah Uddin Chowdurya,Talha Bin Emranb,subhasish Ghosha,Abhijit Pathaka , Mohd.Manjur Alama,Nurul Absara, karl Anderssonc , Mohammad Shahadat Hossiand

IOT Based Real Time River Water Quality Monitoring System : ScienceDirect

4.Vaishnavi v.Daigavane and Dr.M.A Gaikwad

WATER QUALITY MONITORING SYSTEM BASED ON IOT : Research India Publication

2.3 Problem Statement:

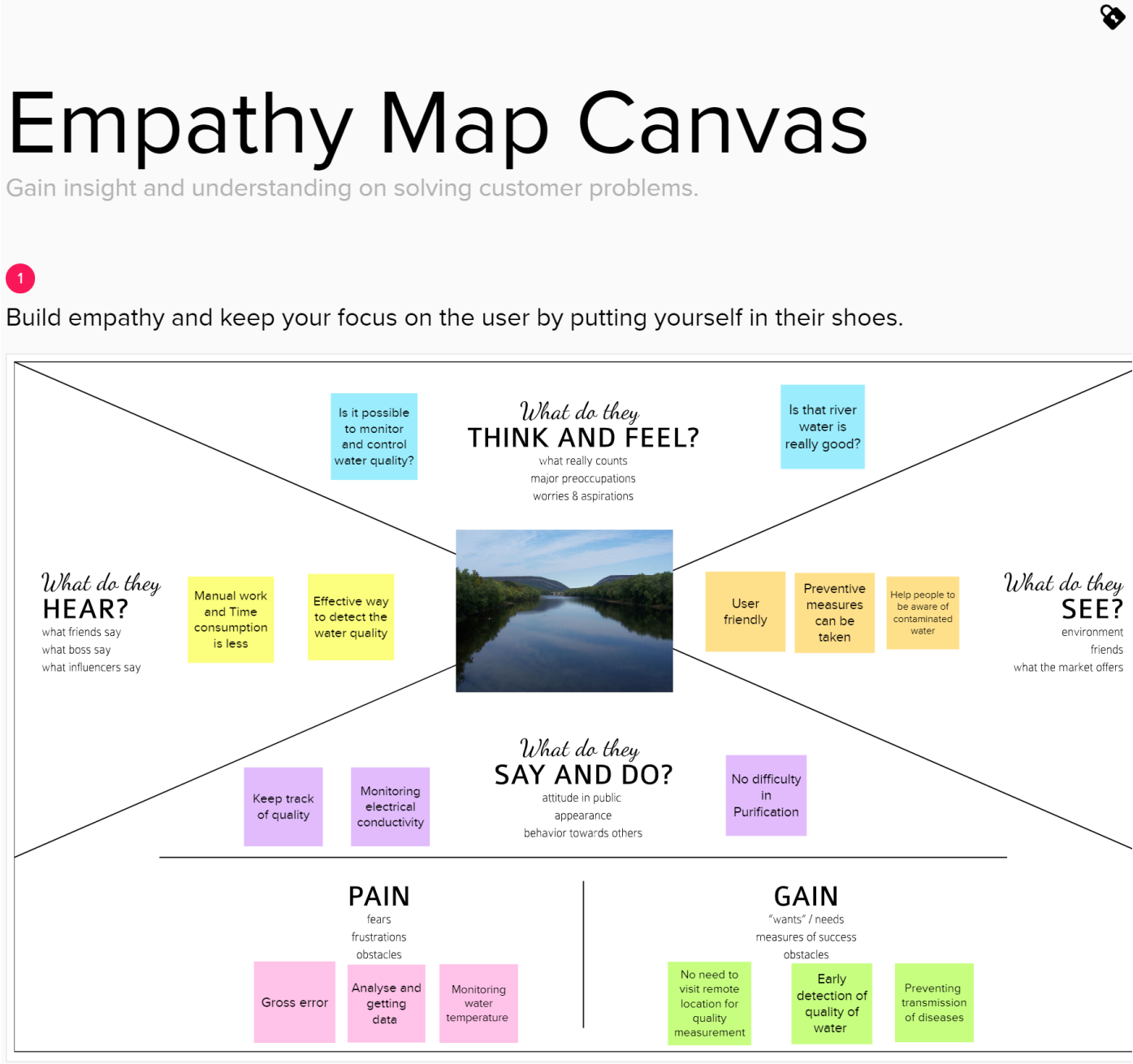
The reduce the river water pollution and to monitor the parameters of river water

and control measures can impact vegetation,health. The Real time analysis of Indicators of River water(Ph,salinity,nutrients,etc..,)

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

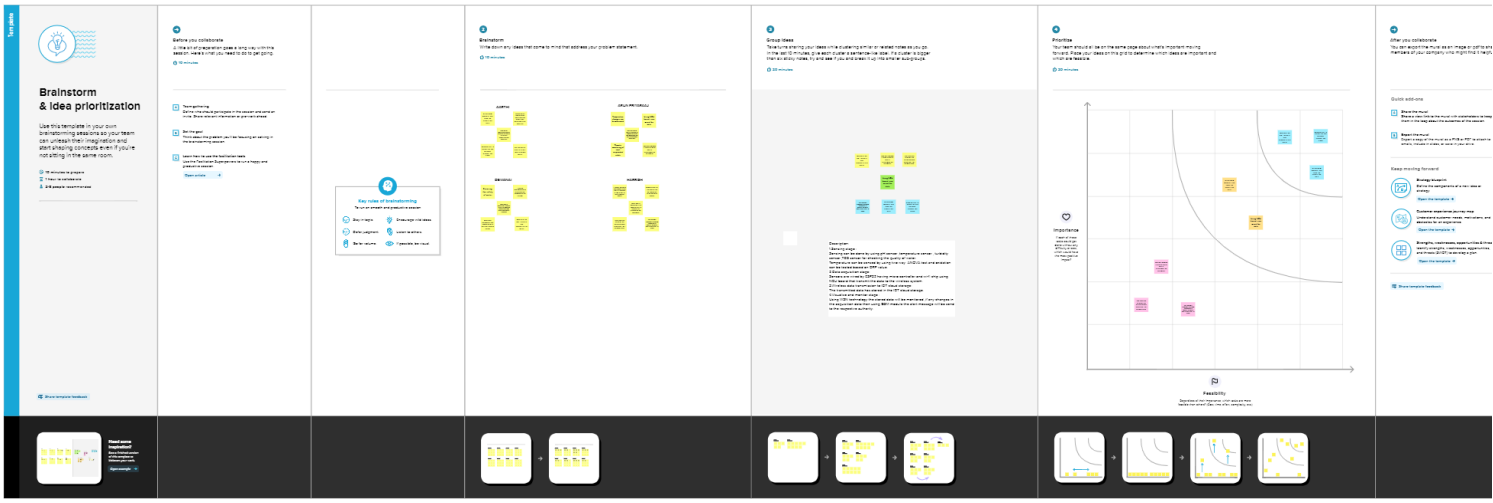
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.



3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Control the Algal bloom and monitor the water parameters such as ph, turbidity and dissolved solvents.
2.	Idea / Solution description	Monitoring water parameters by using Arduino and Sensors and control measures by ultrasonic frequency.
3.	Novelty / Uniqueness	Controlling Algal Blooms using Ultrasonic frequencies.
4.	Social Impact / Customer Satisfaction	People come to know about the quality of water
5.	Business Model (Revenue Model)	Quality drinking water can be sold for commercial purpose.
6.	Scalability of the Solution	By using MPC Buoy software we can control the difficulties faced by algal bloom

3.4 PROBLEM SOLUTION:

Project Title: Real time river water quality monitoring and control system **Project Design Phase-I - Solution Fit** **Team ID:** PNT2022TMID3

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
i.e. working parents of 0-5 y.o. kids

Government sector
Farmers
Industrialist

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

The proposed water quality monitoring system based on WSN can be divided into three parts:

1. IOT Platform
2. Big data analytics and water quality management system

5. AVAILABLE SOLUTIONS

Which solutions are available to the customers when they face the problem
or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

The main aim is to develop a system for continuous monitorin of river water quality at remote places using WSN with low pow consumption , low cost and high detection accuracy.

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

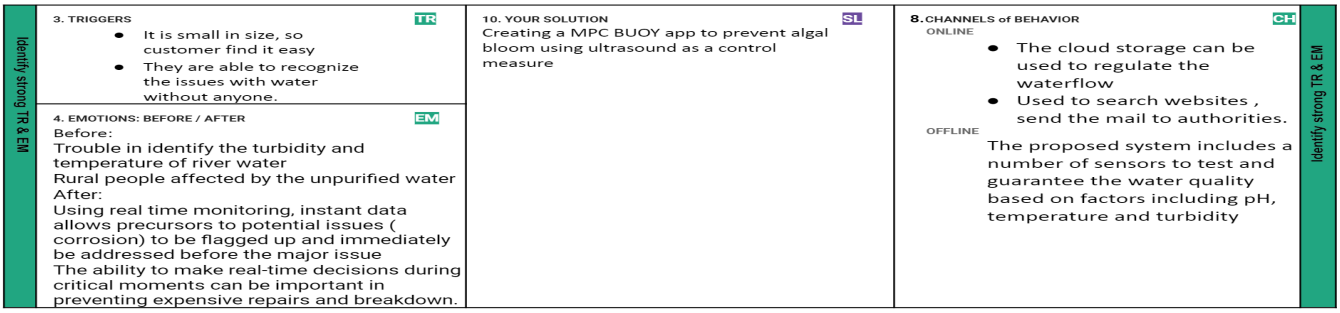
- To identify the presence of algal bloom in the tank or water bodies
- To identify the temperature and turbidity

9. PROBLEM ROOT CAUSE RC

The quality of the river water will be affected due to large amount of farm fertilizer or farm waste drain into river concentration of nitrate and phosphate increase

7. BEHAVIOUR B

It uses less data and power. Additionally , it might serve as a best safety step for maintaining water quality



4 REQUIREMENT ANALYSIS

4.1 *Functional Requirements:*

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration To track the River Water Quality	Fill the form with your gmail login or through mobile app to register yourself
FR-2	User Confirmation	Confirmation through OTP Confirmation through the password verification
FR-3	User Sign-UP	Type a strong password to log in.password should have more than 8 characters.
FR-4	View Water Details	View water details from website View water strategy details in website show in percentage to understand easy as well as faster notification from regular interval of time to monitor the water from the website
FR-5	Sign out	Log out the user successfully

Non-functional Requirements:

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

FR	Non-Functional Requirement	Description

No.		
NFR-1	**Usability**	User interface page takes not more than two seconds.It is a user friendly Monitoring
NFR-2	**Security**	User account is password protected Account creation done only after email verification
NFR-3	**Reliability**	User can access thier account 97..6% of time without failure
NFR-4	**Performance**	Lpoad time for user screen shall not be more than 2 seconds Login information verified within 10 seconds
NFR-5	**Availability**	It can be accessible from any locations
NFR-6	**Scalability**	The system can support more users concurrently .

5 PROJECT DESIGN

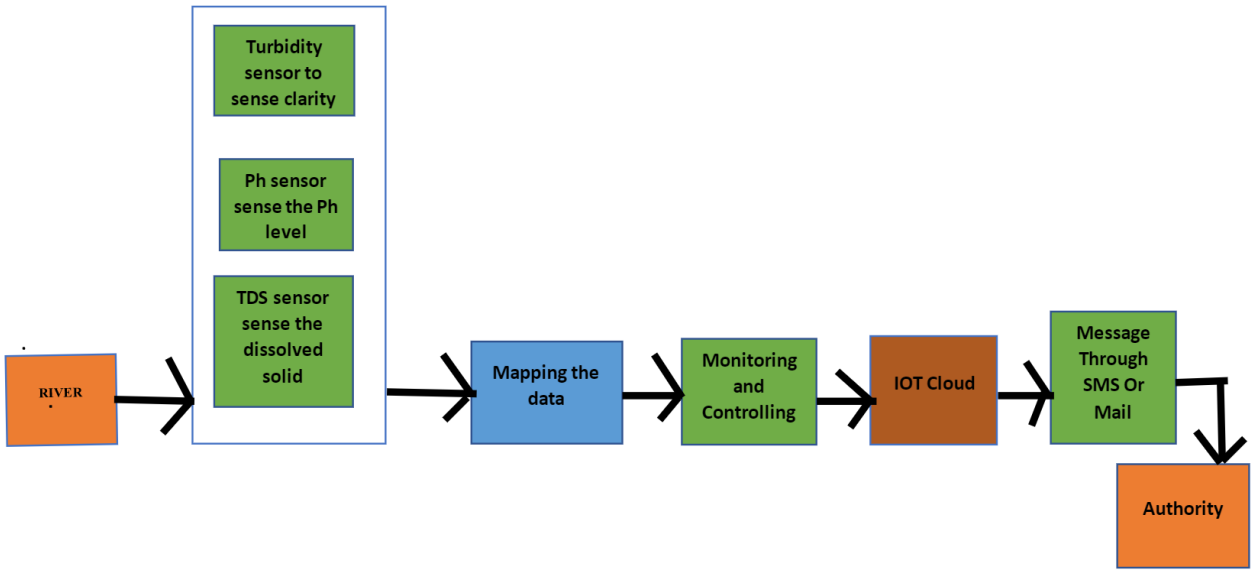
5.1 Data Flow Diagrams:

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.

Project Design Phase-II
Data Flow Diagram & User Stories

Date	15 October 2022
Team ID	PNT2022TMID32705
Project Name	Real Time Water Quality monitoring And Control Systems
Maximum Marks	4 Marks

Data Flow Diagrams:



5.2 SOLUTION AND TECHNICAL ARCHITECTURE

Summary

This code pattern explains how to build an IOT based river water monitoring and controlling system with some predefined values.

Flow

- Feed the data received from the Sensor unit which are placed in the river sides.

- The collected data will be displayed in the Web page to the user.
- Then the collected data is sent to the data base, where the collected data and the predefined data are checked and monitored.
- If any data exceed the predefined data then the control signal will send to the Admin.
- The collected data will be stored in the IBM cloud storage. Later the data will be controlled by the admin via Web UI.**Table-1 : Components & Technologies:**

S.No	Component Description	Technology
1.	User Interface Web UI	HTML, CSS, JavaScript
2.	Application Logic-1 Web UI to enter the Register/login	HTML,CSS,JavaScript
3.	Application Logic-2 Get the river body data from the cloud	IBM Watson IoT API call data
4.	Application Logic-3 Set some threshold values for the data set and alert the user about the abnormalities	IBM Watson Assistant
5.	Database Dissolved oxygen,pH,Ammonia,Chloride levels	MySQL
6.	Cloud Database Call the data IBM Cloudant is used and user login credentials	IBM DB2, IBM Cloudant
7.	File Storage Web UI code and ioT credentials are stored and API keys	IBM Block Storage
8.	External API-1 To get the user login credentials to find the data they require	IBM Login API
9.	External API-2 To get the data set of the water quality monitored by the sensor network	Monitoring API
10.	Machine Learning Model For interfacing hardware and software	Platforms:Node.js.
11.	applications(a virtual wiring tool) Infrastructure (Server / Cloud) Application Deployment on Cloud Cloud Server Configuration : :application-client-end	IBM Cloud

Table-2: Application Characteristics:

S.No	Characteristics Description	Technology
1.	Open-Source Frameworks App development and Machine learning model development	Python Script
2.	Security Implementations IBM cloud service IBM Watson IoT platforms and Device Node -Red Service	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.

S.No	Characteristics Description	Technology
3.	Scalable Architecture As the proposed system involves only three sensors,the application can be easily developed into many numbers	IoT
4.	Availability Maximum down time will be about 4 hours	IoT
5.	Performance Load time for user interface Screen shall not be more than 2 seconds. Login info verified within 10 seconds..	IoT

Authority

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 register for the application by entering email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through google	I can register & access the dashboard with google	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through mail	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive login credentials	High	Sprint-1
	Interface	USN-6	As a user,the interface should be user-friendly manner	I can be able to access the webpage easily	Medium	Sprint-2
Customer (Web user)	Dashboard	USN-7	As a user,I can access the information of water like Ph level,Turbidity level,Total dissolved solid,Temperature	I can able to know the quality of water and monitor	High	Sprint-1
Programmer	Creating program for water quality	USN-8	As a user,I can create program in a user understandable manner	I can create a simple program	Medium	Sprint-2

	monitoring					
Customer (Data Input)	View manner	USN-9	As a user,I can view data in a Visual representation manner like graphs,tables	I can easily understand by visual manner	High	Sprint-1
	Taste	USR-10	As a user,i can able to view the quality of water like salty or nor	I can easily know whether it is salty or not	High	Sprint-1
	Color visibility	USR-11	As a user,I can predict the water color	I can easily know the condition by color	High	Sprint-1
	Algae control	USR-12	As a user, I can Monitor the presence of algae in water	I can easily know whether the water contains algae or not and take some preventive measures using ultrasound	High	Sprint-1
Authority	Checks the water alert	USR-13	As a user,I check the quality values of the water that is sent to me	I can make sure that the people in my zone gets quality water and take neccessary actions if required	High	Sprint-1

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & SCHEDULING:

S. No	Milestones	Activities Timeline
1.	Empathy map	Prepared empathy map canvas to capture the user gains and pains. 12 September 2022
2.	Literature survey	Literature survey on the handwritten digit recognition system and information gathering. 17 September 2022
3.	Ideation Phase	Ideas are listed and top 3 ideas are prioritized based on the feasibility and importance. 22 September 2022
4.	Proposed Solution	Proposed solution document is prepared which includes Novelty, feasibility of idea, social impact, 26 September 2022

		scalability of solution, etc.
5.	Problem Solution fit	Includes customer segments and customer constraints, the problem root cause and jobs to be done. 5 October 2022
6.	Solution architecture	From data collection to digit recognition by the web application are represented in architectural diagram. 5 October 2022
7.	Customer Journey	Prepare Customer Journey maps to 10 October 2022 understand user interactions and experiences with the application

8.	Functional Requirements	Functional requirementsandnon functional requirementsalike scalabilityandaccuracyaredescribed. 18October2022

9.	Data flow diagram and user stories	Data flow diagram and user stories are 16 October 2022 prepared and four sprint phases are described.
10.	Technology Architecture	Technical flow graphs are created and 18 October 2022 the functions of technical stacks are defined.

6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and 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, and confirming my password.	2	High	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M
	Registration via Mail ID	USN-4	As a user, I can register for the application through Gmail	2	Medium	
Sprint-2	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	

	IBM Cloud service access		Get access to IBM cloud services.	2	High	
Sprint-3	Create the IBM Watson IoT and device Settings	USN-6	To create the IBM Watson IoT Platform and integrate the microcontroller with it, to send the sensed data on cloud	2	High	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M
	Create a node red service	USN-7	To create a node red service to integrate the IBM Watson along with the Web UI	2	Medium	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M
	Create a Web UI	USN-8	To create a Web UI, to access the data from the cloud and display all parameters.	2	Medium	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M \
	To develop a Python code	USN-9	Create a python code to sense the physical quantity and store data.	2	Medium	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M
	Publish Data to cloud.	USN-10	Publish Data that is sensed by the microcontroller to the Cloud	3	High	
Sprint-4	Fast-SMS Service	USN-11	Use Fast SMS to send alert messages once the parameters like pH, Turbidity and temperature goes beyond the threshold	3	High	AARTHI.M ARUNPRIYARAAJ.PV DEIVANAI.M HARRISH.M
	Testing	USN-12	Testing of project and final deliverables	3	Medium	

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Re (Actual)
Sprint-1	20	2 Days	24 Oct 2022	26 Oct 2022	20	2
Sprint-2	20	4 Days	26 Oct 2022	30 Oct 2022	40	
Sprint-3	20	12 Days	1 Nov 2022	12 Nov 2022	60	
Sprint-4	20	6 Days	13 Nov 2022	19 Nov 2022	80	19

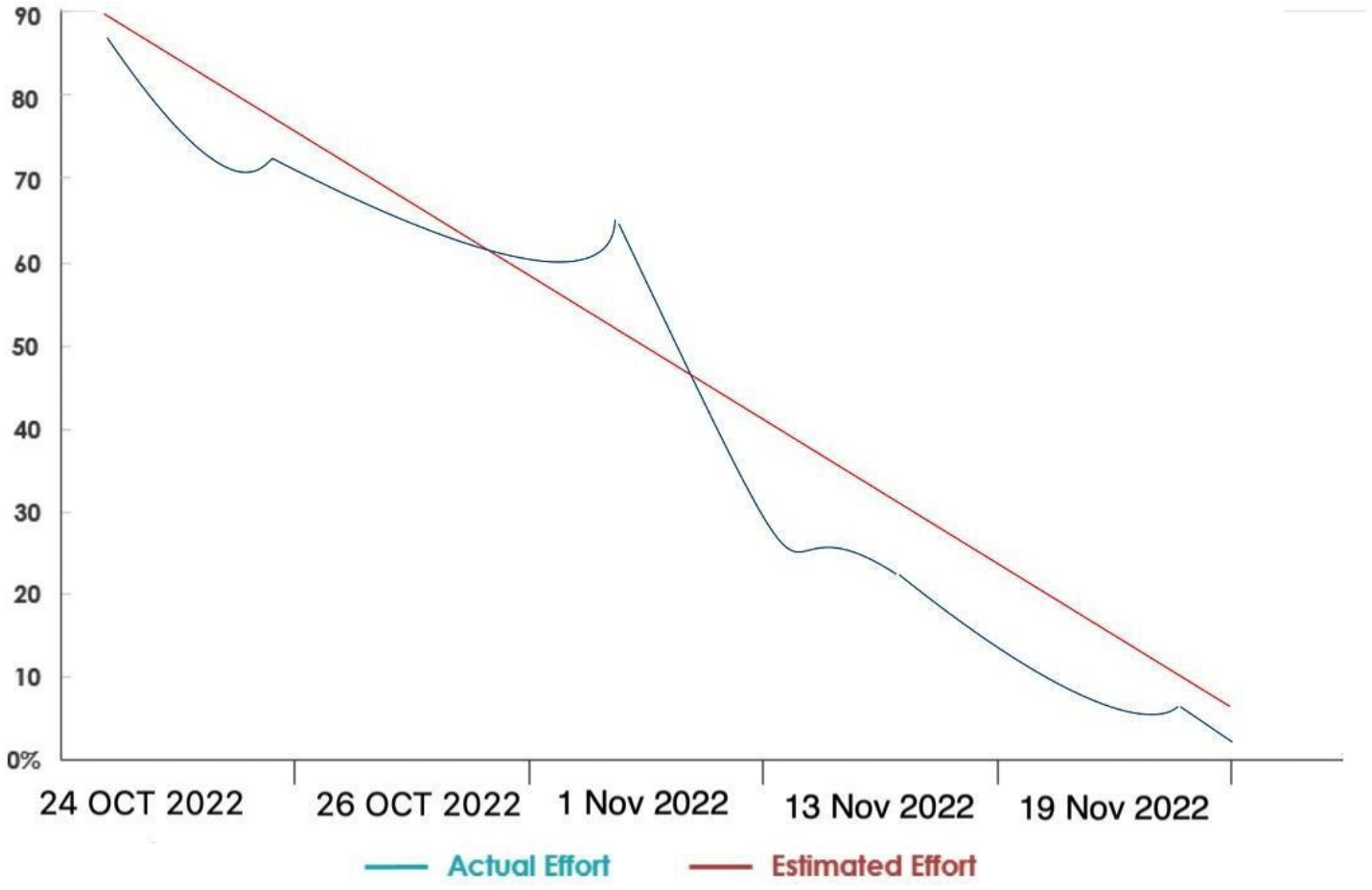
Velocity:

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)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



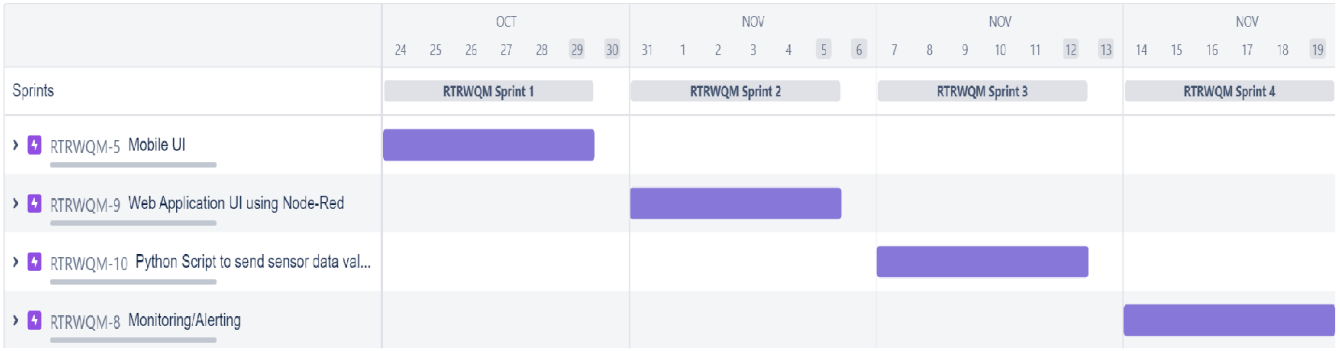
6.3 REPORT FROM JIRA

REFERENCE LINK (JIRA SOFTWARE):

Project Planning Phase
JIRA Roadmap

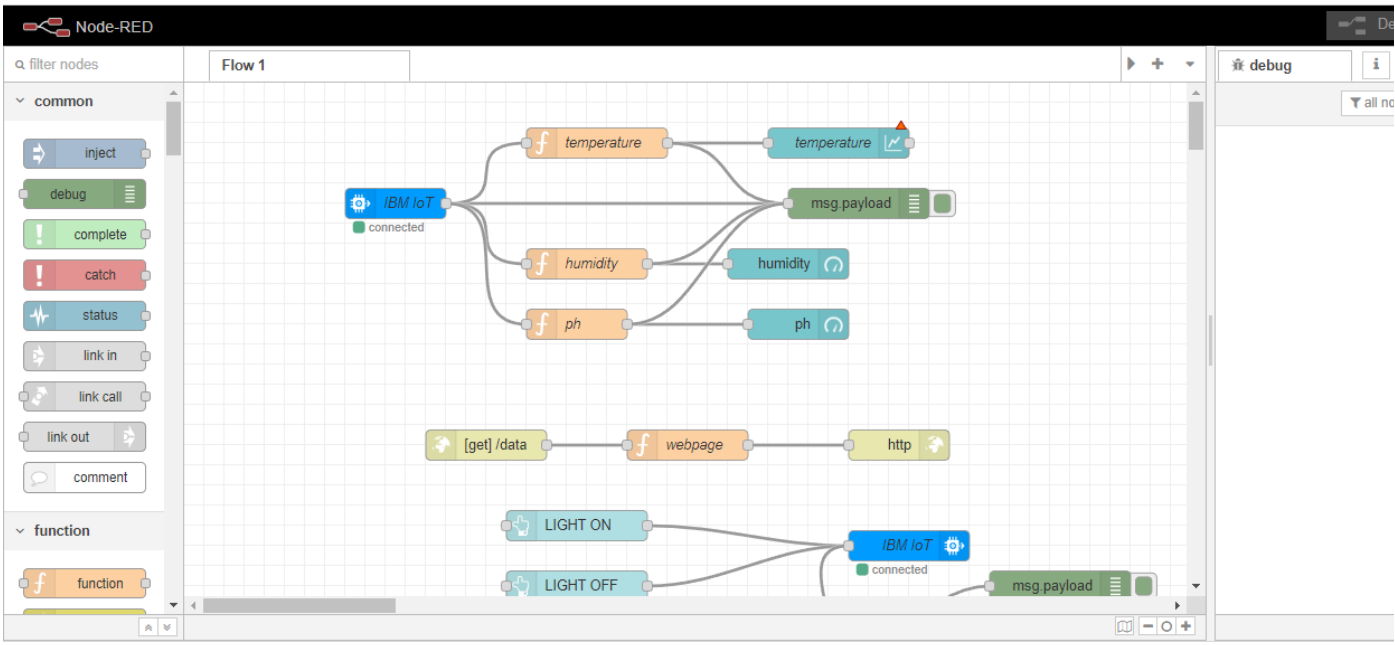
Date	22 October 2022
Team ID	PNT2022TMID32705
Project Name	Real-Time River Water Quality monitoring and control system
Maximum Marks	2 Marks

Project planning using JIRA software

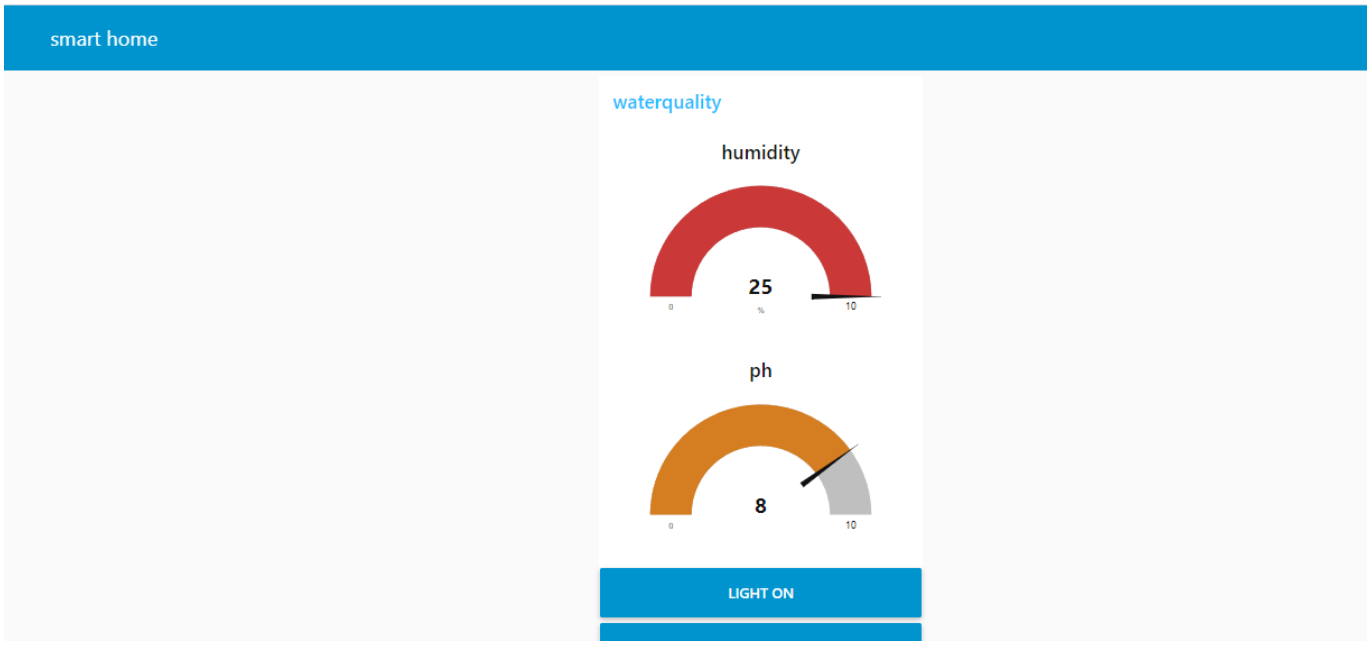


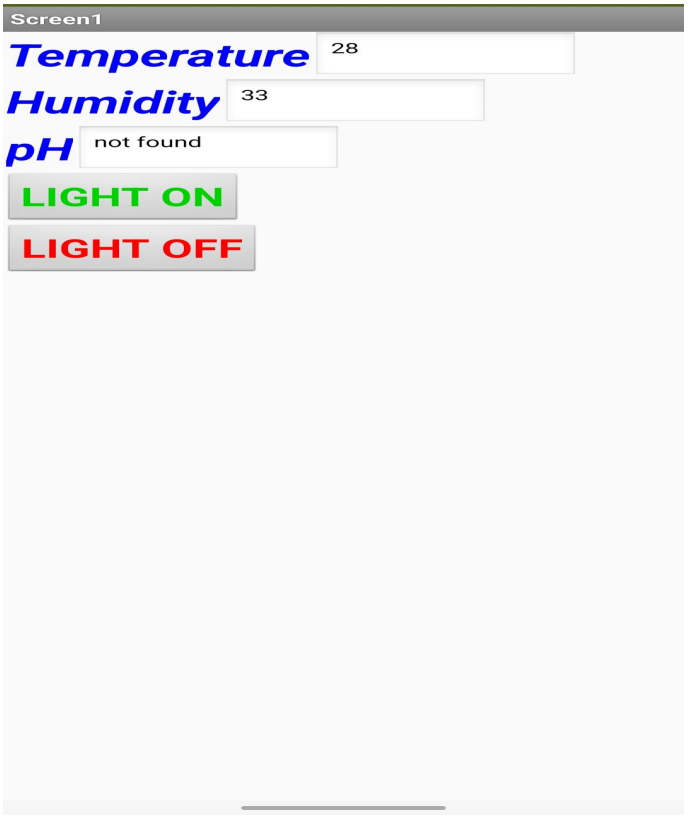
7.CODING AND SOLUTIONING

7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:



Node red Dashboard:





8. TESTING

8.1 Test Case Analysis

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

Section	Total Cases	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 Reporting	10	0	0	10
Final Report Output	4	0	0	4
Version Control	3	0	0	3

8.2 USER ACCEPTANCE TESTING:

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open is sues of

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

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	5	4	3	21
Duplicate	2	0	2	0	4
External	3	4	1	2	10
Fixed	10	1	5	17	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	2	3
Won't Fix	0	3	3	1	7
Totals	24	13	17	25	79

9.RESULT

9.1 PERFROMANCE METRICS:

PERFORMANCE TABLE

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 BY ANYONE.(EASE OF ACCESS)
SEVER RESPONSE	50-75%	url - response
DATA VALIDATION WITH NO. OF TEST CASE	60-80% (15-30 TESTCASE)	VALID DATA FROM THE APP
ERROR	3-5%	REAL-TIME DELAY MAY OCCUR

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- 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. Real time monitoring on mobile phone which is possible through the interface of plc with Arduino and Bluetooth module allows remote controlling of the system.

DISADVANTAGES:

- It is difficult to collect the water samples from all the area of the water body.
- The cost of analysis is very high.
- The lab testing and analysis takes some time and hence the lab results does not reflect real time water quality measurement due to delay in measurement.
- The process is time consuming due to slow process of manual data collection from different locations of the water body. ● The method is prone to human errors of various forms.

11.CONCLUSION

Thus our project is used to Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters.

The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and

extension value.By keeping the embedded devices in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network.

Then the collected data and analysis results will be available to the end user through the Wi-Fi.

FUTURE SCOPE

We use water detection sensor has unique advantage.It consumes less time to monitor than a manual method for checking polluted levels,and notifies immediately to reduce affected rate of pollution in water.People who are living in rural areas near to the river will be very satisfied with our idea.It will be useful to monitor water pollution in specific area.So this system prevent people from water pollution.It will be used for farming purpose to check quality water,temperature and PH level.Our Impact of this project is also create a social satisfaction for farmers too.The scalabilty of this project gives the addition of more different type of sensors.By interfacing the relay we can control the supply of water. We can also implement as a revenue model.This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

13.APPENDIX

13.1 SOURCE CODE:

PYTHON CODE TO PUBLISH DATA

```
import wiotp.sdk.device

import time

import random

import requests

import os

from twilio.rest import Client



myconfig = {

    "identity": {

        "orgId": "pyvd3r",

        "typeId": "waterquality",

        "deviceId": "1357911"

        },

    "auth": {
```

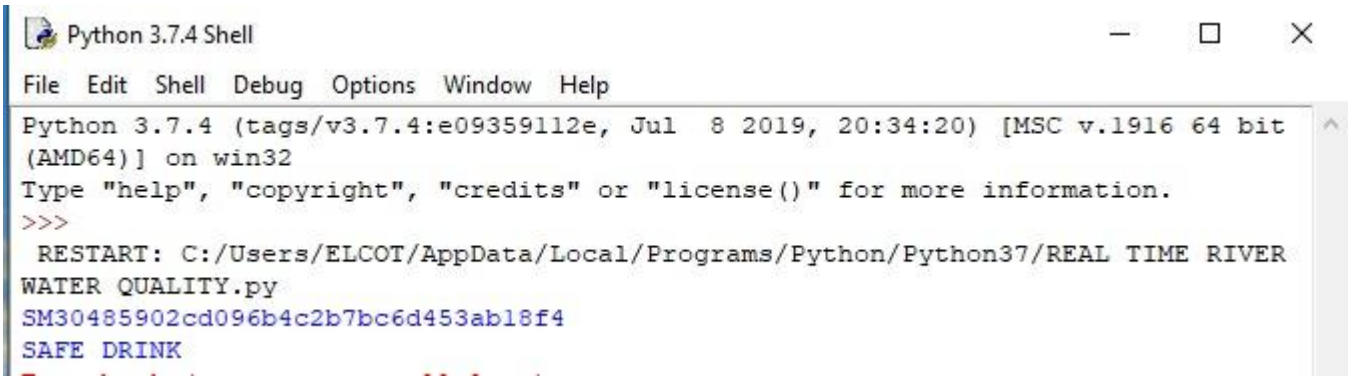
```
        "token": "Aarthi0908"
        }
    }
def mycommandCallback(cmd) :
    print("Message received from IBM IOT Platform: %s" % cmd.data[ 'command' ])
    m=cmd.data[ 'command' ]
    client = wiotp.sdk.device.DeviceClient(config=myconfig, logHandlers=None)
    client.connect_apps()
    count=0
account_sid = "AC2f35bc97048c9abb2368fc243b07fcbc"
auth_token = "be94bf37c71bfbcc86e8f80542840fe7"
client = Client(account_sid, auth_token)
while True:
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    pH=random.randint(1,14)
    if(temp>90 and pH>8) :
```

```
        myData={'temperature':str(temp)+chr(176)+"C", 'humidity':str(hum)+" %",'pH
level':str(pH)+" %", 'condition':"Turn On Water Quality System" }

        message = client.messages \

                .create(

                    body='Temperature:'+str(temp)+chr(176)+"C"+'\nHumidity:'+str(hum)+"
%"+'\npH level:'+str(pH)+" %"+"\nCondition:The Water quality Is Not Good",

                    from_='+18176705441',

                    to='+918610214540'

                 )

        print(message.sid)

        print("Turn on Water Qualiy System")

    elif(temp<15 and pH>8) :

        myData={'temperature':str(temp)+chr(176)+"C", 'humidity':str(hum)+" %",'pH
level':str(pH)+" %", 'condition':"Turn On Water Quality System" }

        message = client.messages \

                .create(

                    body='Temperature:'+str(temp)+chr(176)+"C"+'\nHumidity:'+str(hum)+"
%"+'\npH level:'+str(pH)+" %"+"\nCondition:The Water quality Is Not Good",

                    from_='+18176705441',

                    to='+918610214540'
```

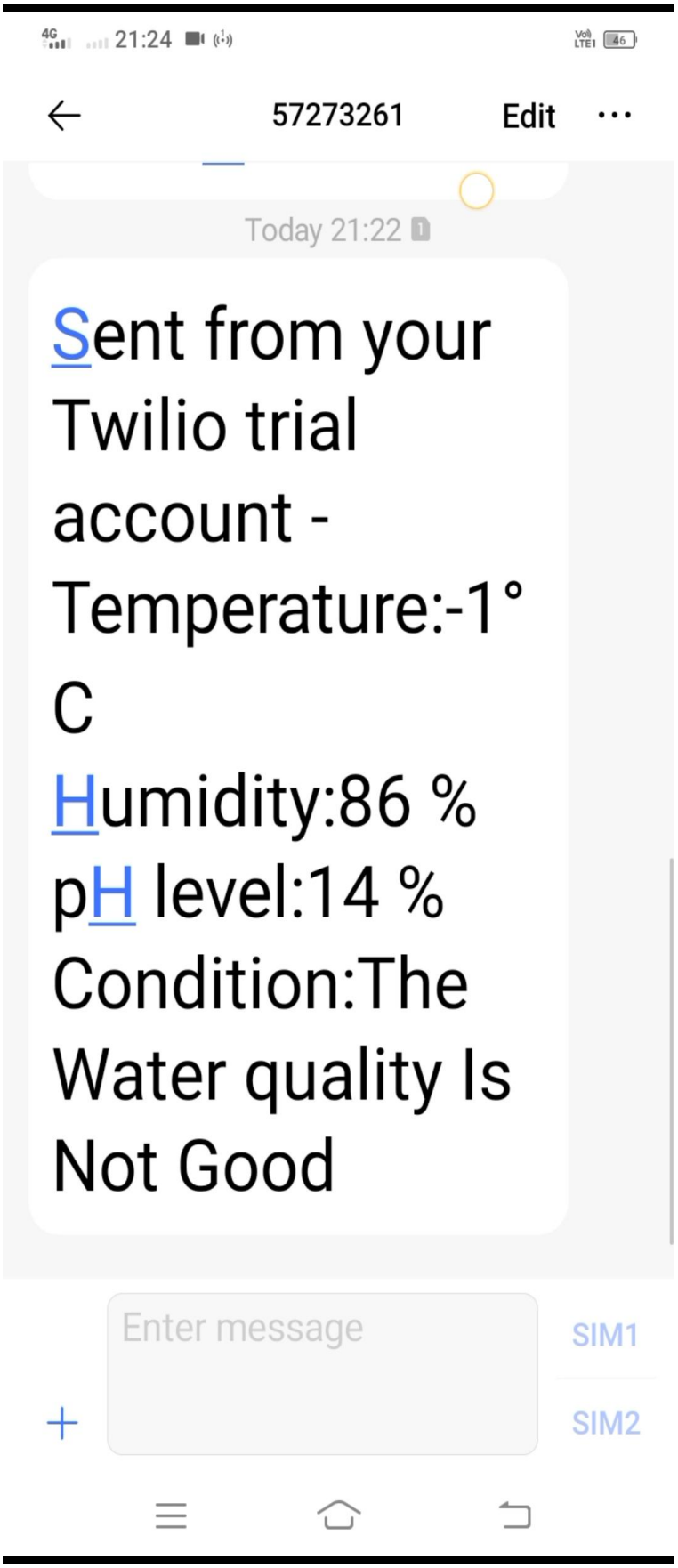
```
                )

        print(message.sid)

        print("Turn on Water Qualiy System")

    else :

        myData={'temperature':str(temp)+chr(176)+"C", 'humidity':str(hum)+" %",'pH
level':str(pH)+" %", 'condition':"SAFE" }

        message = client.messages \

                .create(

                    body='Temperature:'+str(temp)+chr(176)+"C"+'\nHumidity:'+str(hum)+"
%"+'\npH level:'+str(pH)+" %"+"\nCondition:SAFE DRINK",

                    from_='+18176705441',

                    to='+918610214540'

                )

        print(message.sid)

        print("SAFE DRINK")



    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)

    print("Published data Successfully: %s", myData)
```

```
    client.commandCallback = myCommandCallback


    time.sleep(20)









client.disconnect()
```

OUTPUT :



sms alert:(Twilio Sms Messaging Services):



13.2 GIT-HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-16453-1659614617

PROJECT DEMO LINK:

https://photos.google.com/u/2/photo/AF1QipP53V1O0hrX0VCPX6JP1OxfPRkBlXjWlwiw2nVn