NALAIYA THIRAN PROJECT BASED LEARNING

On

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

Real-Time River Water Quality Monitoring and Control System

MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Project report submitted by

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ABSTRACT

Pollution of water is one of the main threats in recent times as drinking water is getting contaminated and polluted. The polluted water can cause various diseases to humans and animals, which in turn affects the life cycle of the ecosystem. If water pollution is detected in an early stage, suitable measures can be taken and critical situations can be avoided. To make certain the supply of pure water, the quality of the water should be examined in real-time. Solutions for monitoring of water are getting more and more significant these days with innovation in sensors, communication, and Internet of Things (IoT) technology. In this paper, a detailed review of the work that were implemented in the arena of real – time river water quality monitoring and control system is presented. The paper proposes a cost effective and efficient IoT based real – time river water quality monitoring and control system which monitors the quality parameters such as pH, turbidity (caused by particles suspended or dissolved in water that scatter light making the water appear cloudy or murky) and temperature of the water uninterruptedly.

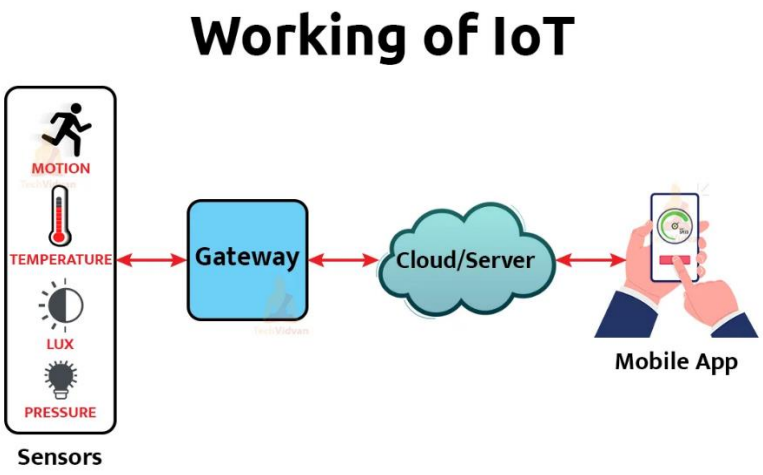
CONTENT

1. INTRODUCTION

Internet of Things (IoT) is a network of physical objects or people called “things” that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster. IoT makes virtually everything “smart,” by improving aspects of our life with the power of data collection, AI algorithm, and networks. The thing in IoT can also be a person with a diabetes monitor implant, an animal with tracking devices, etc.

HOW IOT WORKS?

The Internet of things consists of a **large network of interconnected devices**. These devices transfer and collect huge amounts of data about how they operate and details about the information they store. This data is sent to large cloud servers located across the globe. The cloud sends relevant instructions based on the information received.



1.1 PROJECT OVERVIEW

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming This paper proposes a real time river water quality monitoring and control system. The parameters such as temperature, pH and turbidity of the water can be measured using this system. The main components of Wireless Sensor Network (WSN) include a micro-controller for processing the system, communication systemfor inter and intra node communication and several sensors Real-time data access can be doneby 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 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.

2. LITERATURE SURVEY

2.1 & 2.2 EXISTING PROBLEM AND REFERENCE

1.IoT Based Real-time River Water Quality Monitoring System

Author: Mohammad salah Uddin chowdury, Talha Bin emran, Subhasish ghosh, Abijith Pathak

About: 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 system consists of several sensors which is used to measure physical and chemical parameters of the water. The main components of Wireless Sensor Network (WSN) include a microcontroller 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 apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models, Belief Rule Based (BRB) system and is also compared with standard values. If the acquired value is above the threshold value automated warning SMS alert will be sent to the agent. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low powered. Therefore, our proposed system will immensely help Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water.

Limitations:

- 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

2.An IoT Based System for Water Quality Monitoring

Authors: Pranita Mahajana ,Prachi Shahaneb

About: Potable water quality is important in socio-economic aspects. Many researchers developed various systems to ensure clean drinking water.The traditional system works by manually collecting the samples; manual analysis is done in the laboratory causing delay and manualerrors. Existing systems may reduce the errors but incur a delay as the analysis is not done at user site. A system is needed which will dynamically monitor and ensure water quality to users. Proposed system has various sensors to check and ensure the quality of water-based on pH, temperature, conductivity, turbidity, ORP, Nitrate and free residual chlorine. Data is collected through sensors and send for further processing. LEDs deployed on the system are for general users to immediately identify the water quality. The system aims to reduce the delay in existing systems by deploying indictors on system itself so that the person using the system will be able to decide

whether water is safe to drink or not, which can avoid further health hazards. Implemented system is economical and dynamic. Use of LEDs on system makes it user friendly and even common people can assure quality of water. System is specially designed for public places like schools and colleges.

Limitations:

- Sensors are available but no system is available for real time monitoring
- thus deploying such a system in the public places especially school and colleges will help people aswell as water monitoring boards.

3.IoT based smart water quality monitoring system

Author: Varsha Lakshmikantha, Anjitha Hiriyannagowda, Akshay Manjunath, Aruna Patted Jagadeesh Basavaiah

About: Pollution of water is one of the main threats in recent times as drinking water is getting contaminated and polluted. The polluted water can cause various diseases to humans and animals, which in turn affects the life cycle of the ecosystem. If water pollution is detected in an early stage, suitable measures can be taken and critical situations can be avoided. To make certain the supply of pure water, the quality of the water should be examined in real-time. Smart solutions for monitoring of water pollution are getting more and more significant these days with innovation in sensors, communication, and Internet of Things (IoT) technology. In this paper, a detailed review of the latest works that were implemented in the arena of smart water pollution monitoring systems is presented. The paper proposes a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly. The developed model is tested with three water samples and the parameters are transmitted to the cloud server for further action.

Limitations:

- Due to the limited drinking water resources, intensive money requirements, growing population, urban change in rural areas, and the excessive use of sea resources for salt extraction has significantly worsened the water quality available to people

4.Iot based Smart Water Quality Monitoring System

Author: Monira Mukta, Samia Islam, Surajit Das Barman, Ahmed Wasif Reza and M Saddam Hossain Khan

About: This paper represents an IoT (Internet of things) based smart water quality monitoring (SWQM) system that aids in continuous measurement of water condition based on four physical parameters i.e., temperature, pH, electric conductivity and turbidity properties. Four sensors are connected with arduino-uno in discrete way to detect the water parameters. Extracted data from the sensors are transmitted to a desktop application developed in NET platform and compared with the WHO (World Health Organization) standard values. Based on the measured result, the proposed SWQM system can successfully analyze the water parameters using fast forest binary classifier to classify whether the test water sample is drinkable or not.

Limitations:

- The system is less effective as sensors are installed very deep inside the water and their positions are fixed.

- ❖ The sensors are very expensive. Moreover their maintenance cost is also very high. This leads to higher cost on the regulatory body.
- ❖ The sensors which work on power source may often required to be replaced in case of malfunctioning.
- ❖ Mounted Sensors may get damage during natural disasters and often by aquatic animals.

5.Smart Water Quality Monitoring System Using Iot Technology

Authors: Vennam Madhavireddy and B. Koteswarrao

About: The economical and effective system of water quality observation is the most robust implementation of impure water. Drinking water could be precious for all people as water utilities face more challenges. These challenges arise due to the high population, fewer water resources, etc. So, different methods are used to monitor in the real-time water quality. To make sure that safe distribution of water is done, it must be observed in real time for a new method in the "Internet of Things (IoT)" based water quality has been projected. Realtime water quality observation is examined by data acquisition, method, and transmission with an increase in the wireless device network method in the IoT. Microcontroller and the processed values remotely to the core controller ARM with a WI-FI protocol are used to interface the measured values from the sensors. This projected the water quality observation interface sensors with quality observation with IOT setting. WQM selects parameters of water like temperature, pH level, water level and CO2 by multiple different device nodes. This methodology sends the information to the web server. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world. If the sensors do not work or get into abnormal conditions, then a buzzer will be ON.

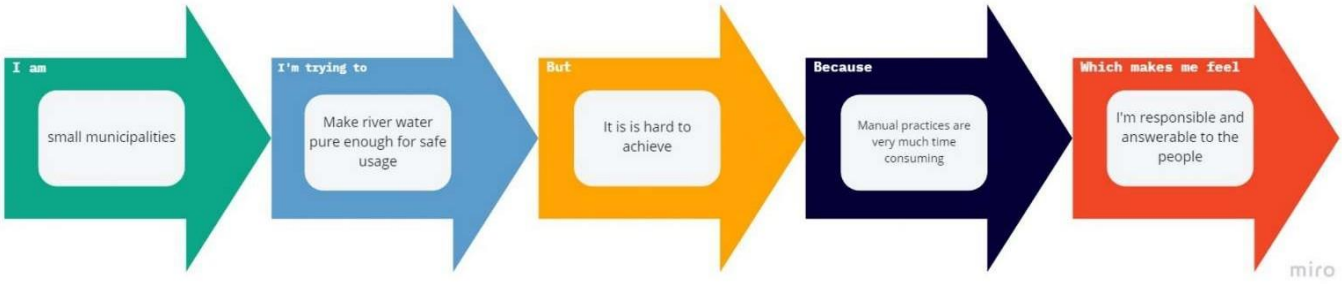
Limitations:

- ❖ Reliability, Bandwidth and Range

2.3 PROBLEM STATEMENT

As a common people:

As a small municipality:



Problem Statement	I am	I'm trying to	But	Because	which makes me feel
[PS-1] To use river water for domestic purpose	common people	Use river water for drinking and domestic utilizes	I couldn't able to achieve since as an individual it is very tedious and doesn't know the way to do	It can't be achieved by an individual alone	This could lead to prone to various diseases
[PS-2] To assure and provide people a quality river water	small municipality	Make sure that the water is pure enough for usage	I couldn't able to find proper solution or the perfect river monitoring system	The most river monitoring systems are inaccurate in detection and more expensive	That I'm answerable and responsible and to make sure that the water is clean and pure

3. 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.

SAYS
How many sensors required ? Parameters required to implement? How much it will cost to set up ? Monitoring of quality of water? Usage of sensors ?

THINKS
Additional budget is required for futher improvement of the overall system. Temperature , turbidity, pH sensors..

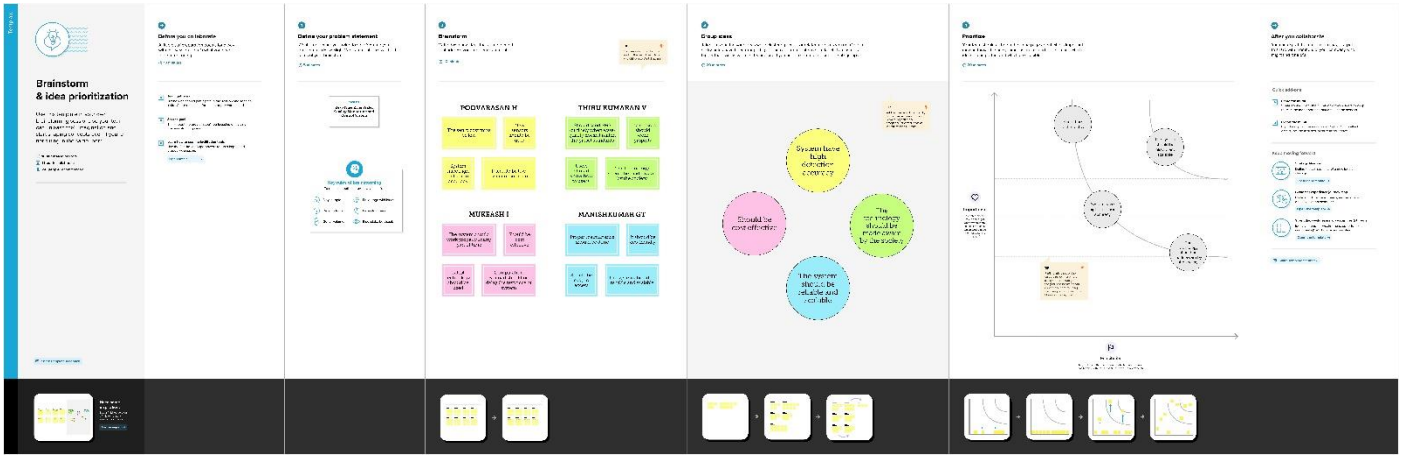
Real-Time River Water Quality Monitoring and Control System

FEELS
It will ensure the quality of water. Clean water supports a diversity of plants and wildlife. Ways for sending messages to authorized person.

DOES
Monitors the turbidity,pH value and temperature of water. Sends SMS to an authorized person routinely when water quality detected does not match the standards.

3.2 IDEATION & BRAINSTORMING

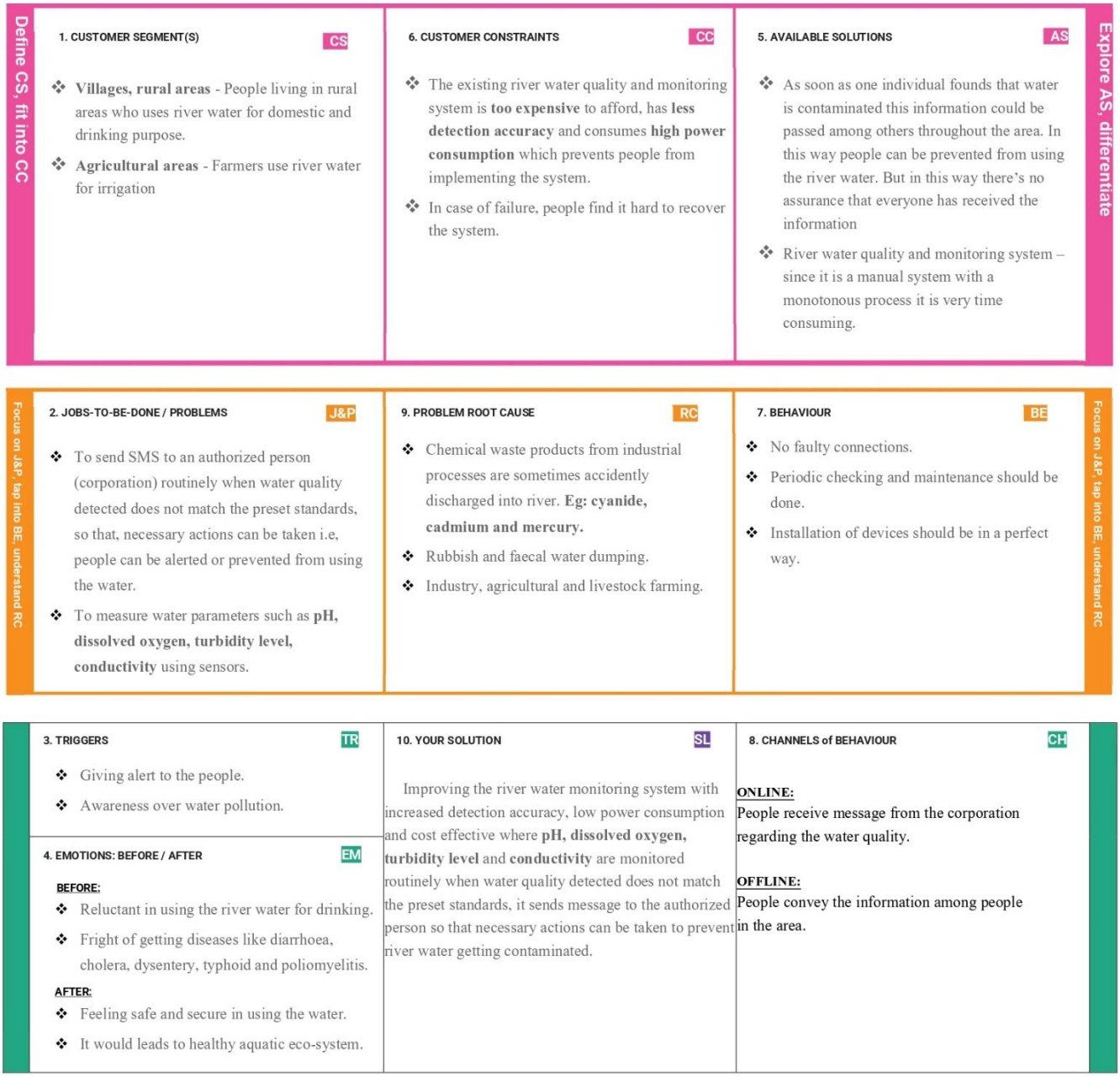
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate,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



3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To improve the water quality monitoring system. Now -a -days the number of industries are more and waste water which contains chemicals from industries are left out into the river, which is the major reason for reducing the water quality level and causes water pollution. Water pollution causes environmental and health issues.
2.	Idea / Solution description	The current water quality monitoring system are monotonous and time consuming. It lacks capability for real time data collection. Hence authorities can't take timely and appropriate decision and actions. Hence to implement the water monitoring and management system based on IOT using Arduino UNO board using real time water quality monitoring and control system and using some sensors(pH sensor, TDS sensor, Turbidity sensor, temperature sensor)with GPS tracking system.
3.	Novelty / Uniqueness	To obtain monitoring system with high frequency, high mobility, low powered by using microcontroller for processing the system and sensors, real time data access can be done using IOT technology. Data can be collected and can be displayed in visual format on server. If the acquired value is above the threshold value automated warning SMS alert will be sent.
4.	Social Impact / Customer Satisfaction	It will be useful for maintaining the quality of water. The system works accurately and user friendly. As the automation of water monitoring system is done, water pollution can be controlled and reduces the side effects caused due to the water pollution.
5.	Business Model (Revenue Model)	It can be used in many industries. If it is made at easy installation there will lot of use for this device and it should be user friendly and eco-friendly as well.
6.	Scalability of the Solution	It could be done in cost effective and work effective. In the field of IOT we proposed to deal with brilliant sensors and other equipments to achieve an "**Real time water monitoring and control system**" which is more beneficial for water monitoring.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR NO:	Functional requirements (Epic)	Sub requirements(story/Subtask)
FR-1	User Registration	The system shall support registration through forms. The system will provide a quick and secure registration process. The online payment also system will allow the access

FR-2	User Access	The system shall allow access to the details using a web browser. The mobile application also can be use in the system to access
FR-3	User alert	The system shall allow access to the details using a web browser. The mobile application also can be use in the system to access

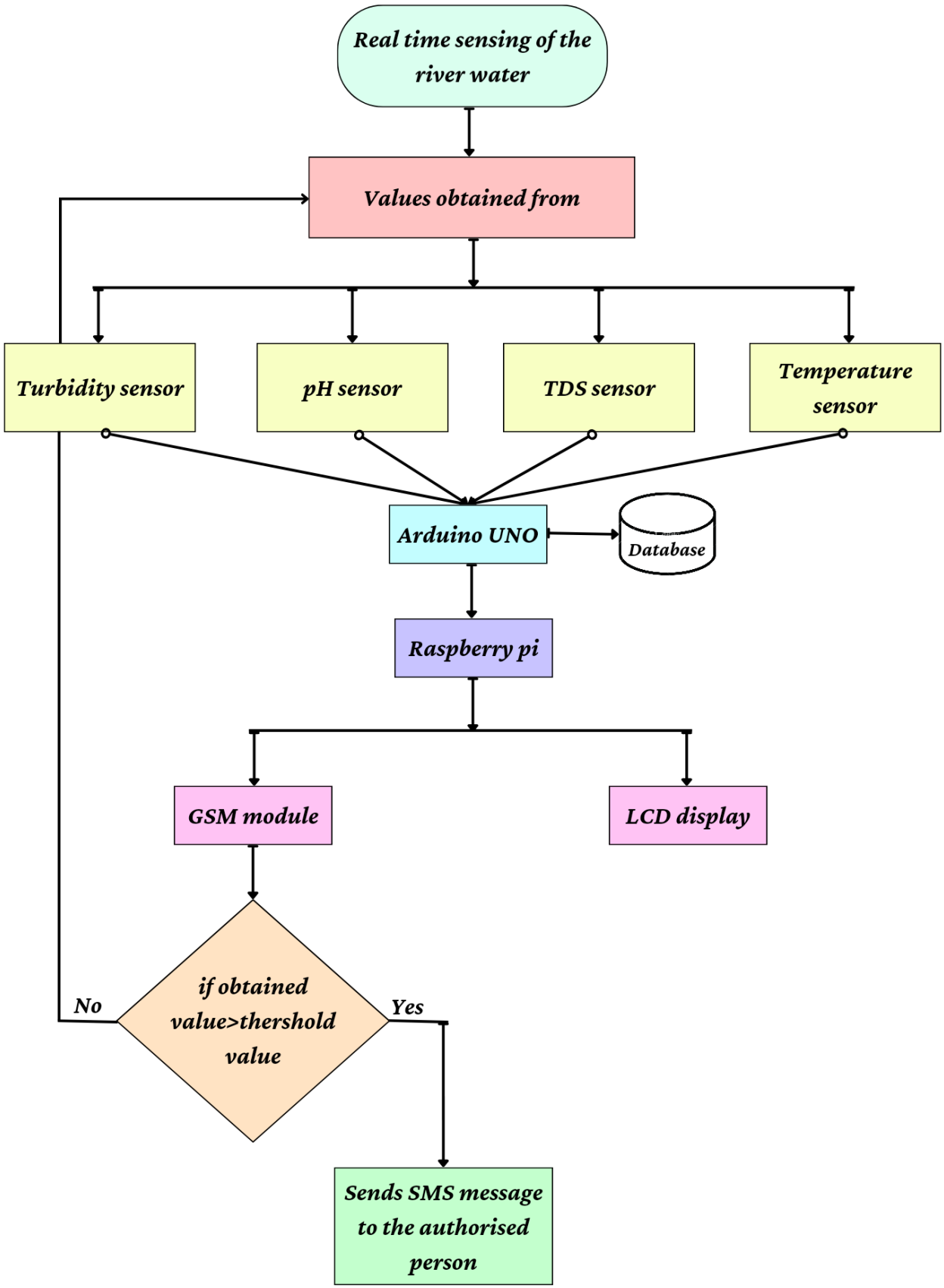
4.2 NONFUNCTIONAL REQUIREMENTS

NFR NO:	**Functional requirements (Epic)**	**Sub requirements(story/Subtask)**
NFR-1	Usability	The device usability is very easy because we can use it in anywhere or place The device must be usable by the customer anytime.
NFR-2	Security	Data from the sensors are stored secure and away from other data so data will not been collapse. Only authorized people can access the data stored.
NFR-3	Reliability	Data can be retrieved anytime. No data is discarded without the customer's knowledge.
NFR-4	Performance	The system shouldn't have any type of delay in its performance as it is used for emergency situations. No performance delay in case of large numbers of data or parameters.
NFR-5	Availability	The device doesn't fail even under harsh conditions. Even after going under an alert situation, the device continues to send the parameters.
NFR-6	Scalability	Device must be capable of measuring conditions even in larger industry

5. PROJECT DESIGN

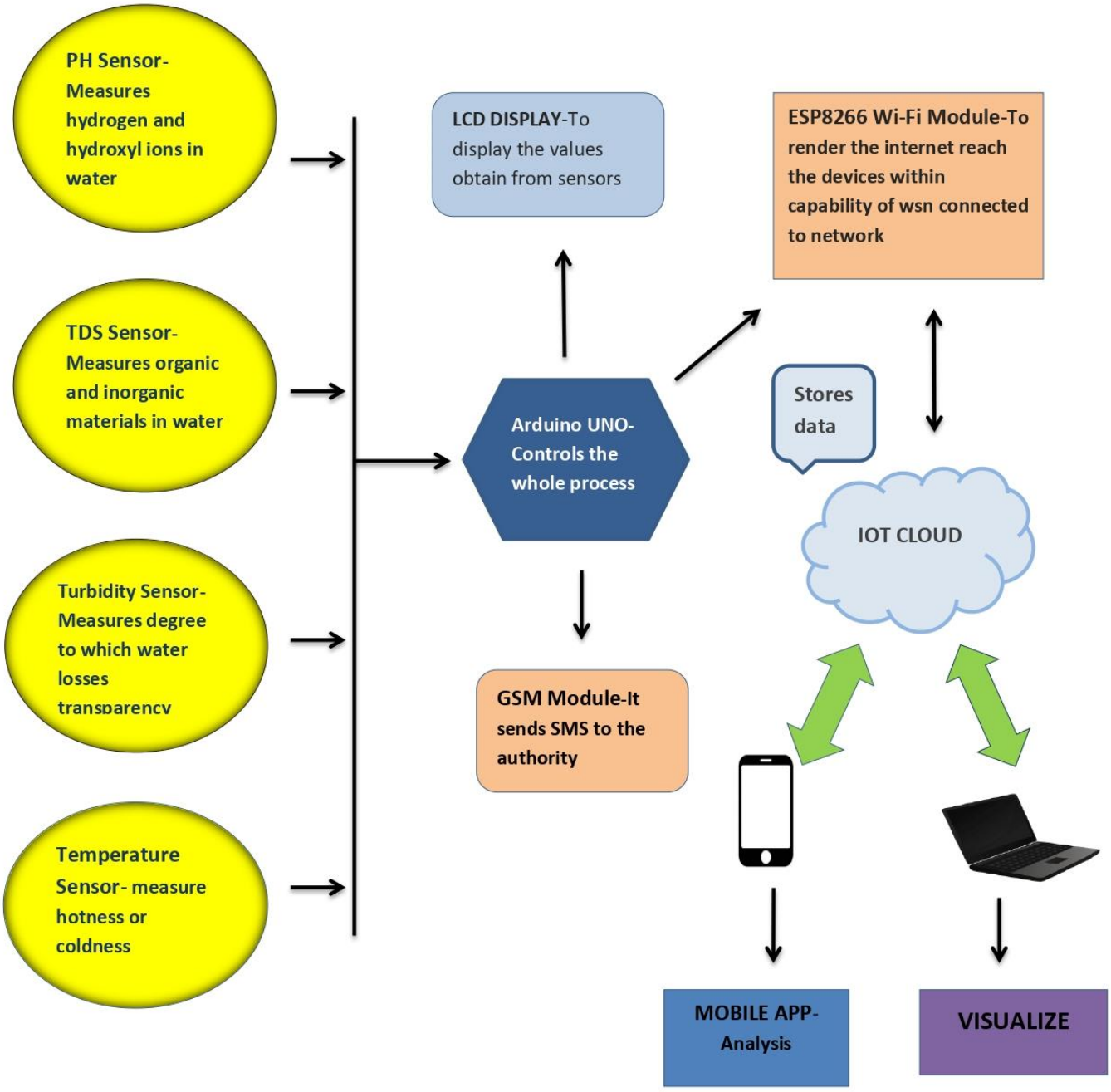
5.1 DATA FLOW DIAGRAMS

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.

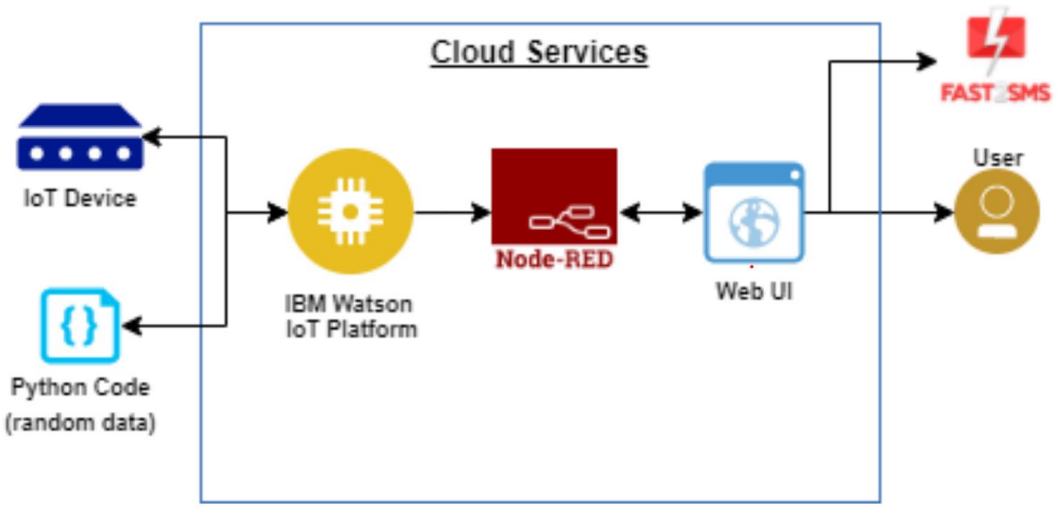

Real time sensing of the river water
Values obtained from
Turbidity sensor
pH sensor
TDS sensor
Temperature sensor
Arduino UNO
Database
Raspberry pi
GSM module
LCD display
if obtained value>thershold value
No
Yes
Sends SMS message to the authorised person

5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.2.1 SOLUTION ARCHITECTURE



5.2.2 TECHNICAL ARCHITECTURE



Guidelines:

1. Include all the processes (As an Application logic/ Technology Block)
2. Provide infrastructural demarcation (Local/Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate DATA STORAGE components / Services.
5. Indicate interface to machine learning modules (if applicable)

Table 1 - Components and Technologies:

Sl.No	Component	Description	Technology
1	User interface	How user interacts with application.	IBM IoT Platforms, IBM Node red, IBM Cloud etc
2	Application Logic-1	Creates IBM Watson IoT platform andcollect connected device data and perform analytics on real-time data.	IBM Watson, IBM Cloudant service, IBM node red
3	Application Logic-2	To develop a python script to publishand subscribe to IoT Platform	Python
4	Application Logic-3	To build a web application using node-red service.	IBM Node-red
5	Database	An organized collection of data, storedin a computer system.	MySQL
6	Cloud Database	Database Service on cloud	IBM DB2, IBM Cloud antetc.
7	File Storage	For developing mobile application to	Web UI, python

		store and receive the sensors 8information and to react accordingly.	
8	External API-1	We can use this to manage the control system.	IBM Water control management API
9	External API-2	It detects the quality (turbidity, PH, Temperature, TDS) of water.	IBM Sensors
10	Infrastructure(server/Cloud)	Application Deployment on Cloud Server Configuration	IBM Cloud ant, IBM IoTPlatform

Table 2 -Application Characteristics:

SL.NO	Characteristics	Description	Technology
1	Open-source Frameworks	Open source is a source code that is available for modification and redistribution.	MIT License
2	Security Implementations	Monitors and filters the incoming and outgoing traffic.	Encryptions,IBM Controls
3	Scalable Architecture	Sensors-IOT Cloud Based architecture	Cloud computing/AI
4	Availability	The sensors are widely used to detectthe temperature, turbidity, TDS	Sensors
5	Performance	The idea of implementing integrated sensors detect the above characteristic and to indicate the parameters to the authority which helps in more efficient For overall monitoring and controlling	Software

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 register for the application by entering my 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 Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register & access the	Medium	Sprint-1

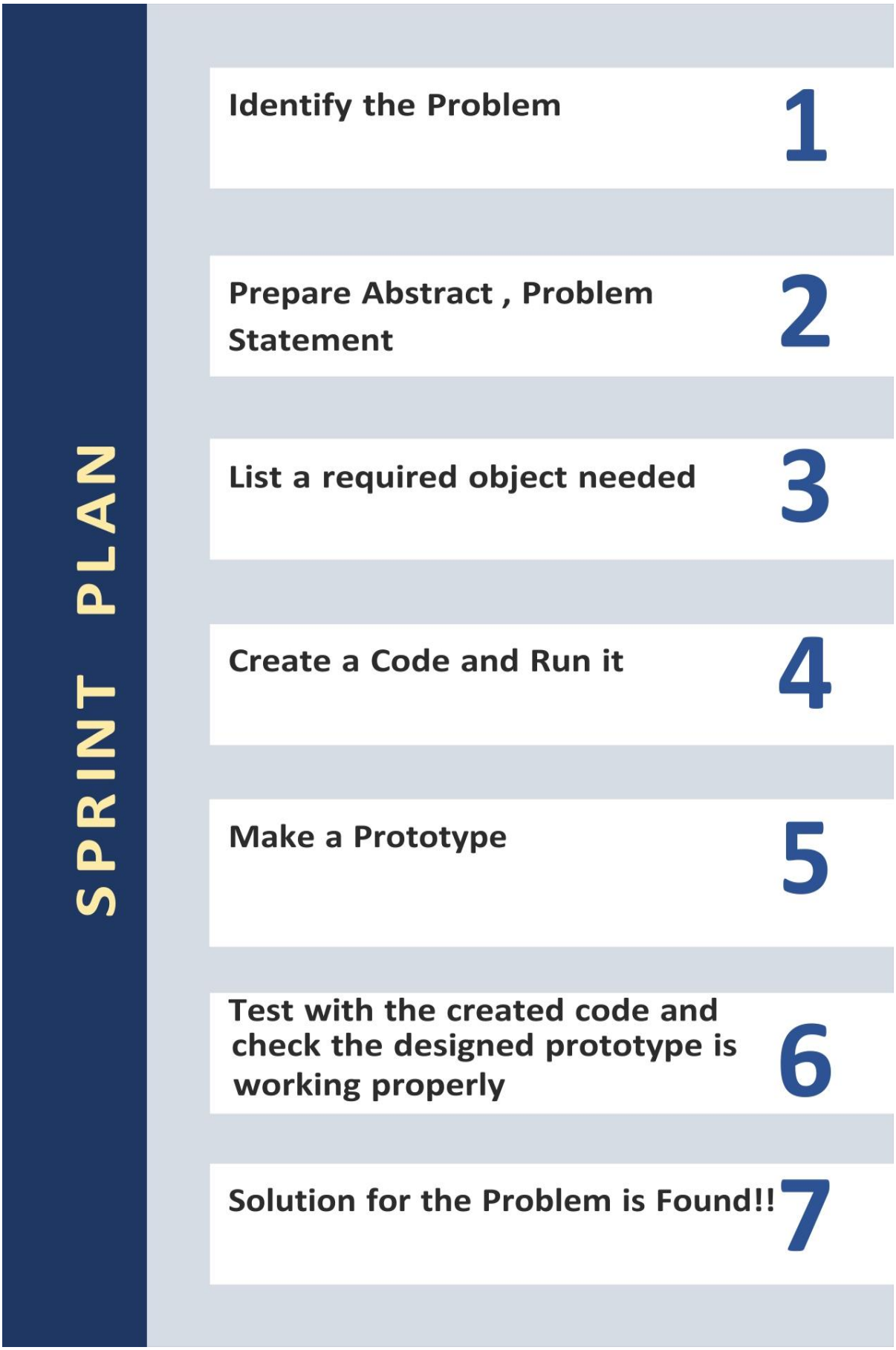
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
				dashboard with Gmail Login		
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive login credentials	High	Sprint-1
Customer (Web user)	Dashboard	WU-1	As a web user, I can access the information of pH levels, turbidity, temperature and TDS	I can know how quality the water is	High	Sprint-1
Customer Care Executive	All specifications	CCE-1	As a customer care executive, I can able to know the quality of water in every aspect	I can easily know whether the water is safe or not	High	Sprint-1
Administrator	Maintenance	ADMIN	As a administrator should organize the whole process in a perfect manner	I can easily maintain the system	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Title	Description	Date
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information byreferring the, technical papers, research publications etc.	12 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements.	12 SEPTEMBER 2022
Brainstorming ideas	List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on thefeasibility & importance.	14 OCTOBER 2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability ofsolution, etc.	22 OCTOBER 2022
Problem Solution Fit	Prepare problem - solution Fit document.	19 OCTOBER 2022
Solution Architecture	Prepare solution Architecture document.	23 OCTOBER 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application	14 NOVEMBER 2022
Data Flow Diagrams	Draw the data flow Diagrams andsubmit for review.	01 NOVEMBER 2022
Technology Architecture	Architecture diagram.	02 NOVEMBER 2022

6.2 SPRINT DELIVERY SCHEDULE



7. CODING & SOLUTIONING

7.1 FEATURE 1

SOURCE CODE:

```
import ibmiotf.application

import ibmiotf.device

import time

import random

import sys

import requests

import json

import urllib.request

import urllib.parse

url="https://www.fast2sms.com/dev/bulkV2"

organization = "swz5ou"

deviceType = "abcd"

deviceId = "12"

authMethod = "token"

authToken = "12345678"


def sms(ph,temp,turbidity):

   message='Water quality degraded PH value:'+str(ph)+'temperature value:'+str(temp)+'tubidity
value:'+str(turbidity)

   my_data = {

      'sender_id': 'TXTIND',

      'message': message,

      'language': 'english',

      'route': 'p',

      'numbers': '9150661026, 6369521344,9840981094'

   }

   headers = {

      'authorization':
'cjshq2uY05KWVOxSDndGMNyvAmR6rgzfUpI3Pe8JkE49ZXlBbwq2plfEB6IZ31CjywSchzNtRQkixoV0',

      'Content-Type': "application/x-www-form-urlencoded",
```

```
    'Cache-Control': "no-cache"
    }
    response = requests.request("POST",url,data=my_data,headers=headers)
    returned_msg = json.loads(response.text)
    print(returned_msg['message'])

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()

while True:
    pH = random.randint(1, 14)
    turbidity = random.randint(1, 1000)
    temperature = random.randint(0, 100)

    if pH<6 or temperature >120 or turbidity > 500:
        alert = 1
    else:
        alert = 0

    data = {'pH': pH, 'turbid': turbidity, 'temp': temperature, 'alert':alert}

    def myOnPublishCallback():
        print("Published pH= %s" % pH, "Turbidity:%s" % turbidity, "Temperature:%s" % temperature)
    success = deviceCli.publishEvent("water monitoring", "json", data, qos=0, on_publish=myOnPublishCallback)
    if not success:
        print("Not Connected to ibmiot")
```

time.sleep(1)

deviceCli.disconnect()

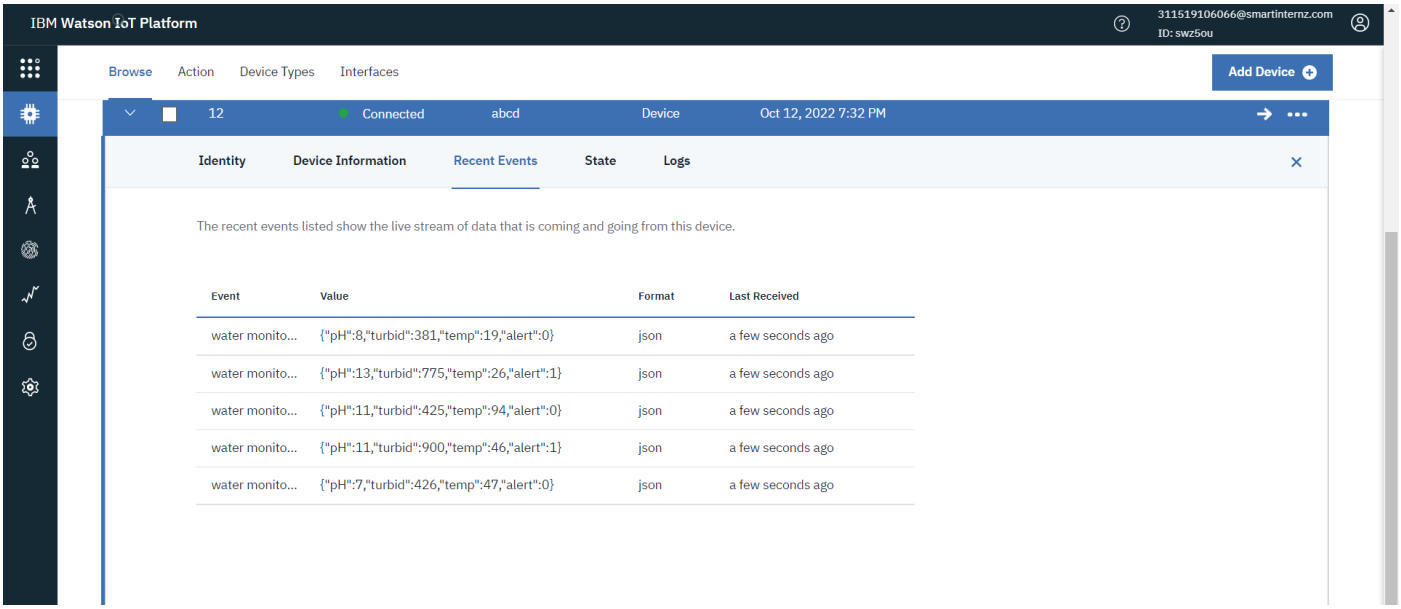
SOURCE CODE-OUTPUT

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\IBM\new source code.py ==========
2022-11-19 11:27:36,018  ibmiotf.device.Client  INFO  Connected successfully: d:swz5ou:abcd:12
Published pH= 8 Turbidity:270 Temperature:75
Published pH= 5 Turbidity:7 Temperature:83
Published pH= 3 Turbidity:931 Temperature:11
Published pH= 2 Turbidity:657 Temperature:7
Published pH= 7 Turbidity:410 Temperature:47
Published pH= 14 Turbidity:353 Temperature:25
Published pH= 3 Turbidity:968 Temperature:60
Published pH= 12 Turbidity:751 Temperature:86
Published pH= 3 Turbidity:80 Temperature:89
Published pH= 4 Turbidity:814 Temperature:41
Published pH= 1 Turbidity:401 Temperature:96
Published pH= 9 Turbidity:389 Temperature:53
Published pH= 4 Turbidity:294 Temperature:9
Published pH= 11 Turbidity:838 Temperature:76
Published pH= 6 Turbidity:739 Temperature:60
Published pH= 12 Turbidity:661 Temperature:44
Published pH= 13 Turbidity:744 Temperature:31
Published pH= 11 Turbidity:963 Temperature:13
Published pH= 12 Turbidity:117 Temperature:93
Published pH= 12 Turbidity:855 Temperature:39
Published pH= 4 Turbidity:242 Temperature:100
Published pH= 4 Turbidity:190 Temperature:16
Published pH= 12 Turbidity:509 Temperature:92
Published pH= 14 Turbidity:50 Temperature:93
Published pH= 8 Turbidity:688 Temperature:71
Published pH= 7 Turbidity:969 Temperature:52
Published pH= 8 Turbidity:517 Temperature:89
Published pH= 8 Turbidity:461 Temperature:83
```

7.2 FEATURE 2

IBM IOT WATSON

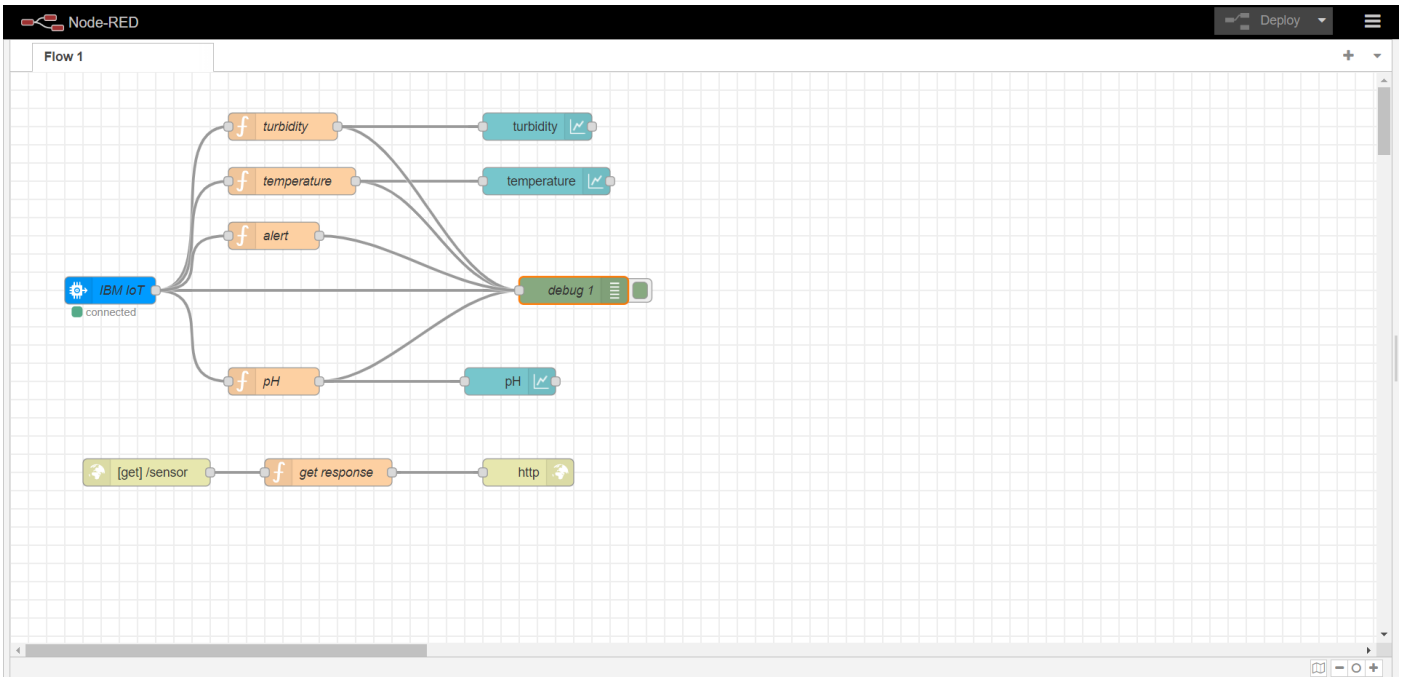
PUBLISHING DATA TO IBM IOT WATSON



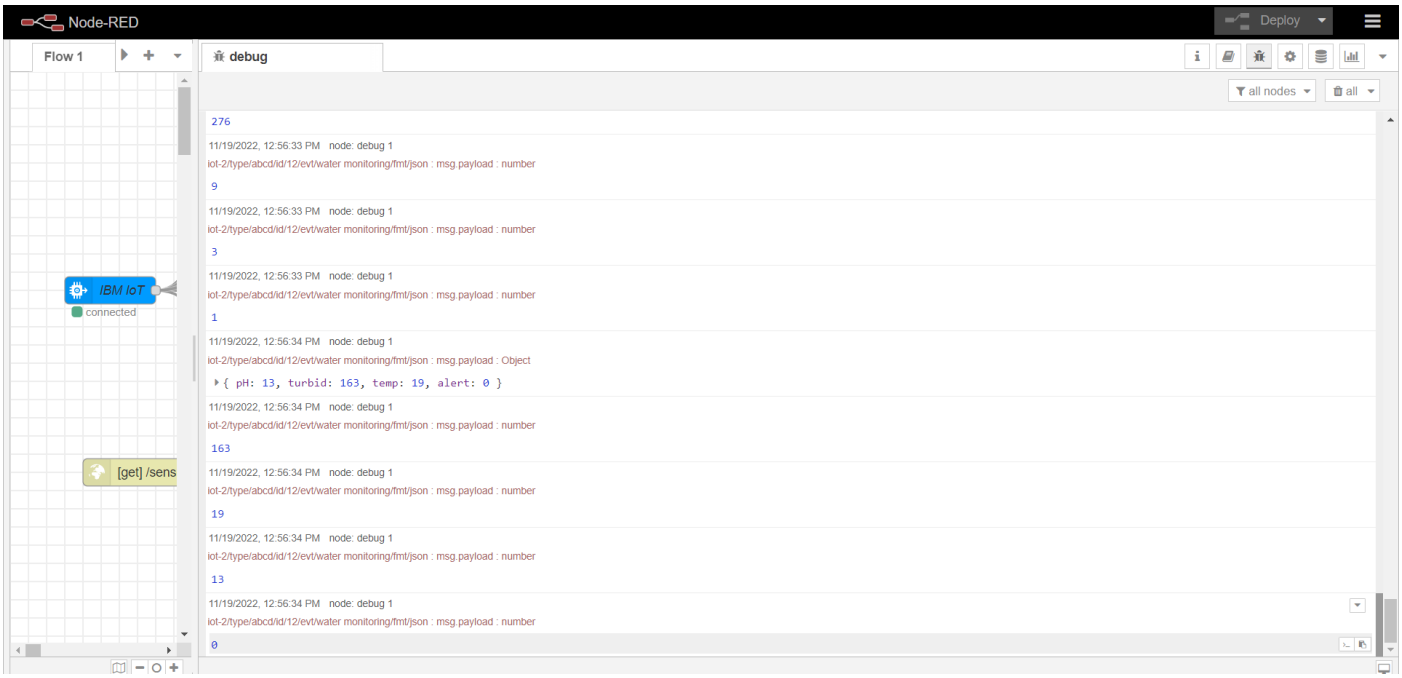
7.3 FEATURE 3

NODE-RED

NODE-RED FLOW DIAGRAM



PUBLISHING DATA FROM IBM IOT WATSON TO NODE-RED

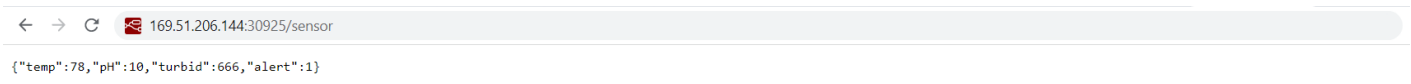


SOURCE CODE

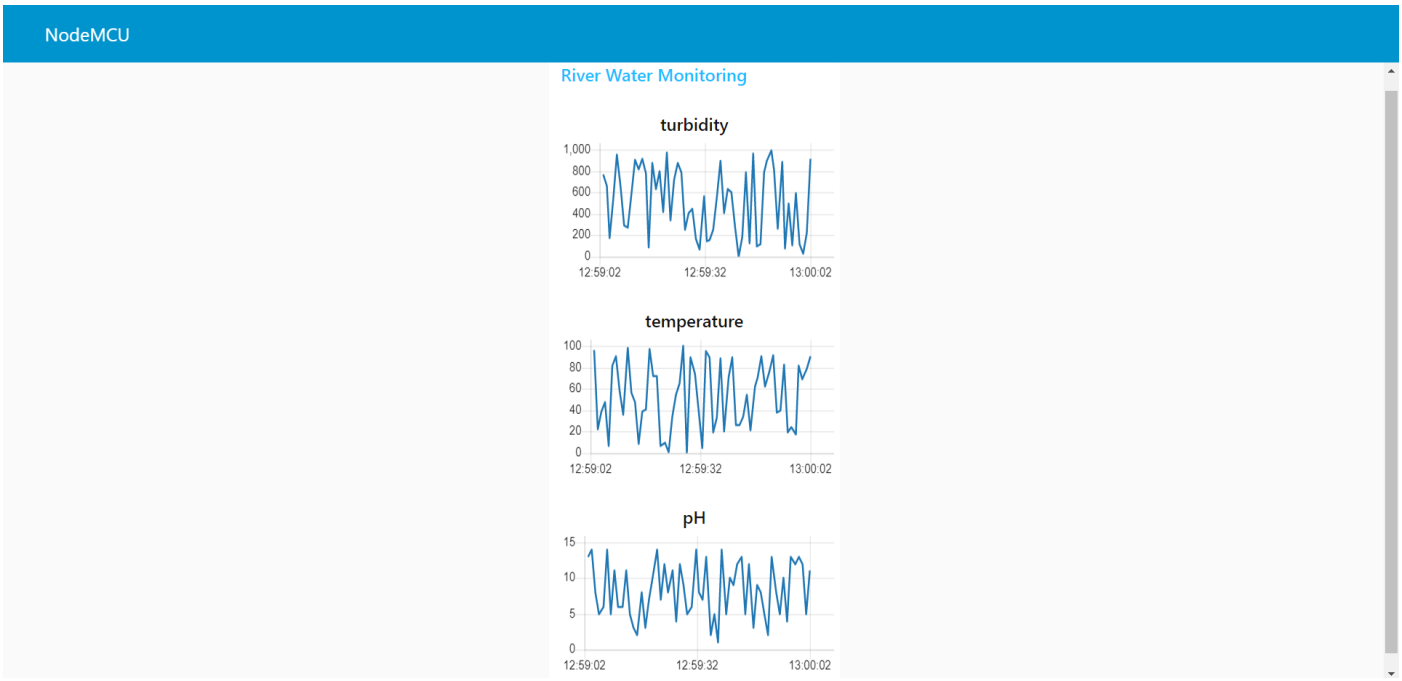
msg.payload = {"temp":global.get('t'),"pH":global.get('pH'),"turbid":global.get('tur'),"alert":global.get('a')}

return msg;

HTTP REQUEST USING NODE RED



GENERATING THE OUTPUT FOR RECENT EVENTS:

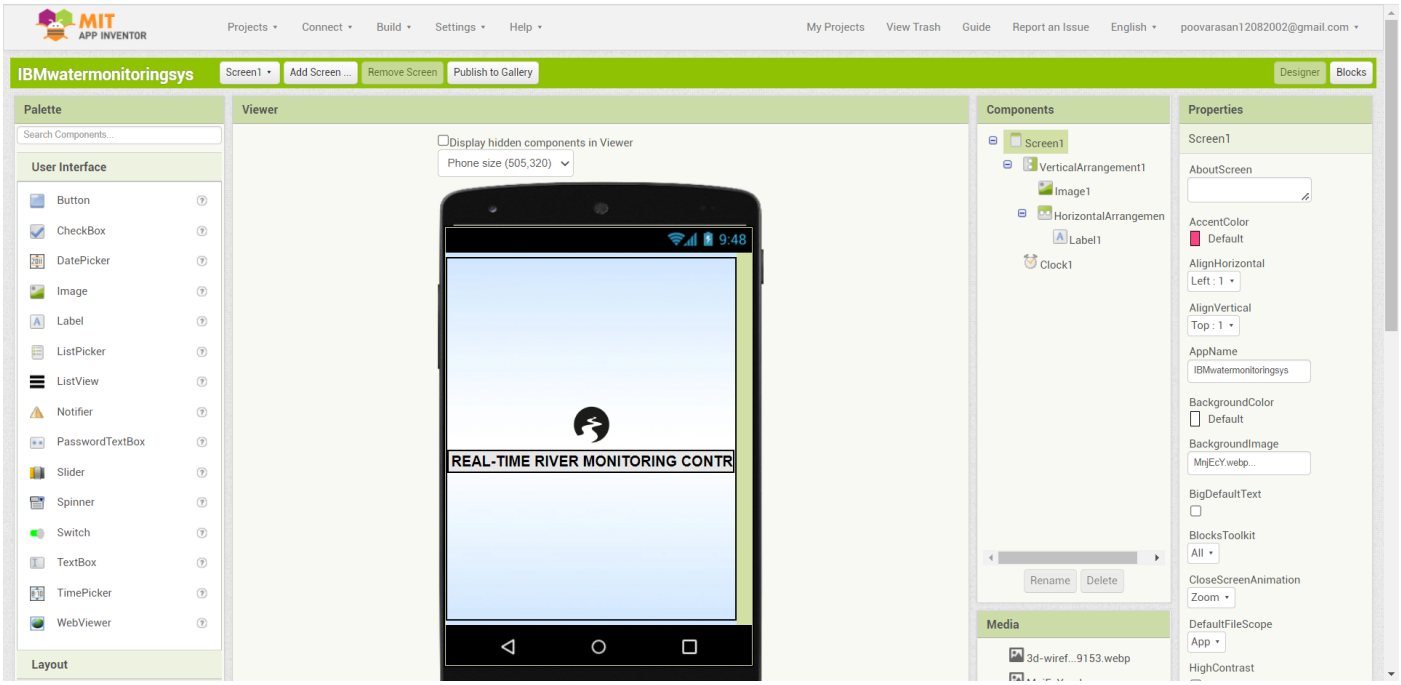


7.4 FEATURE 4

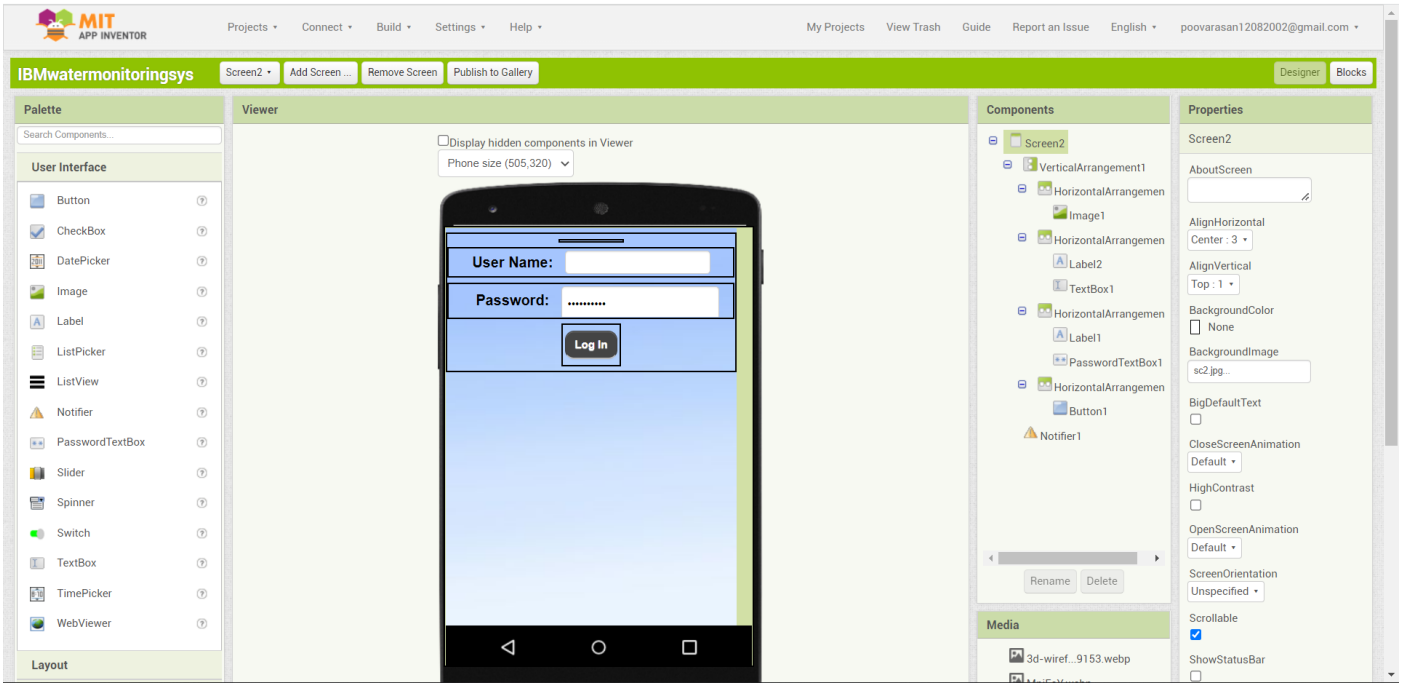
MIT APP INVERTOR:

FRONT END

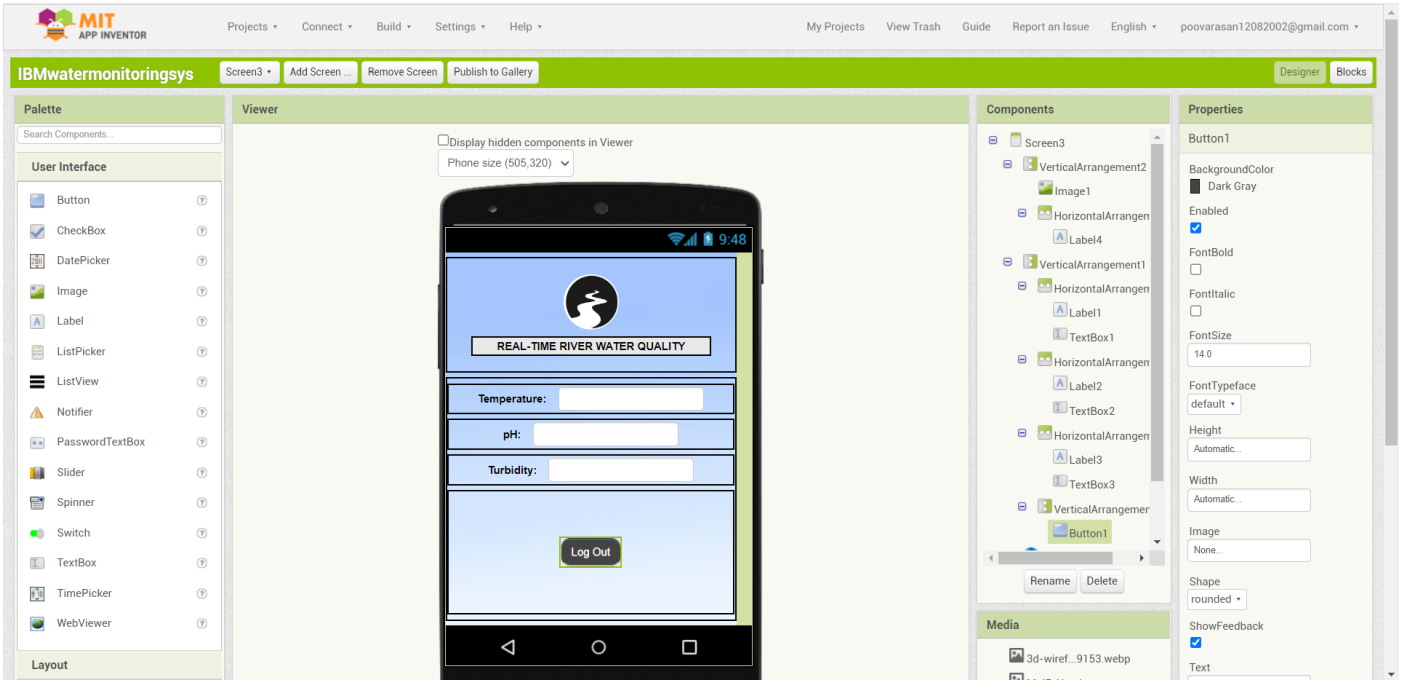
SCREEN-1



SCREEN-2

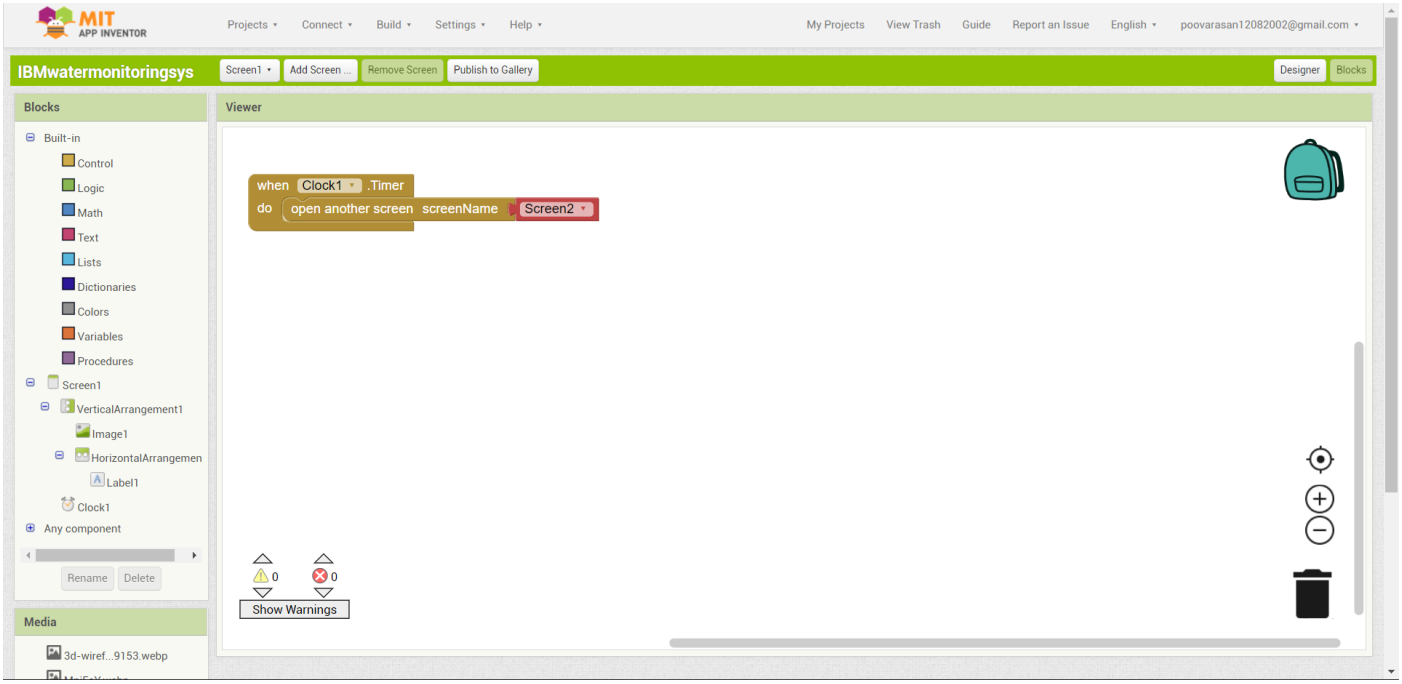


SCREEN-3

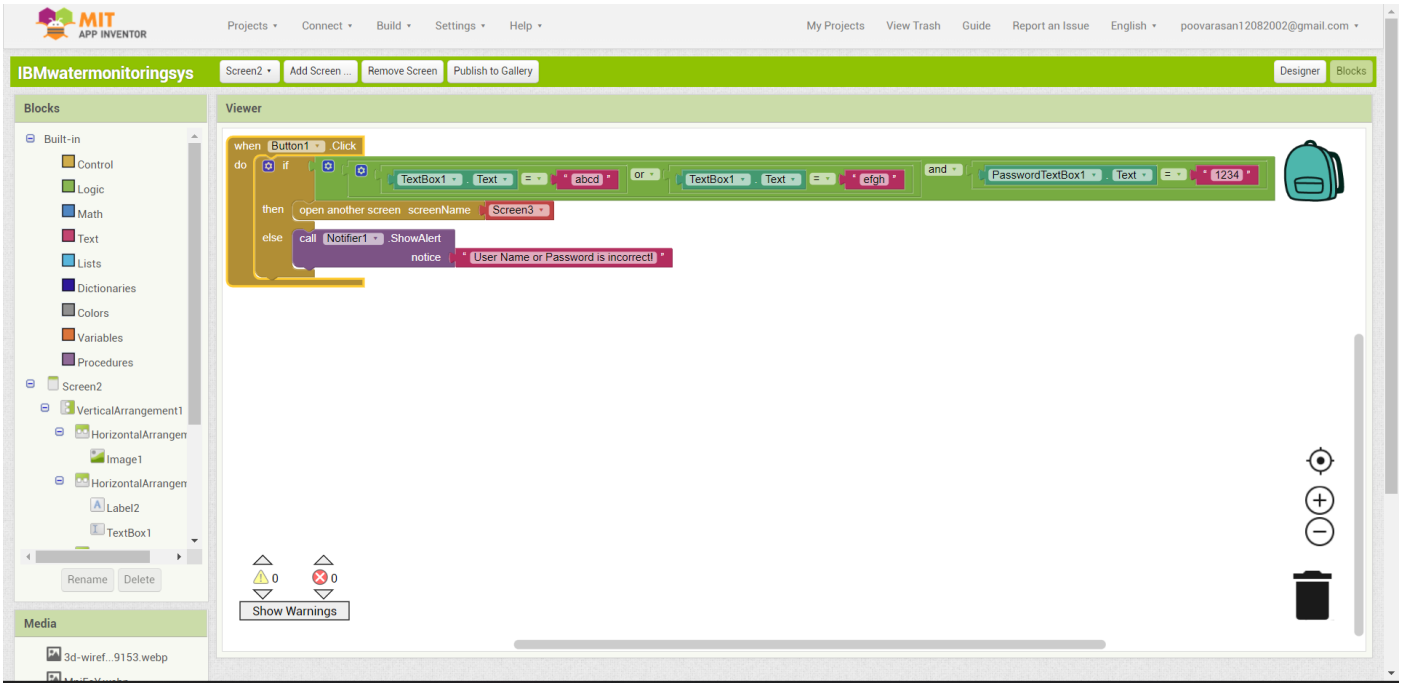


BACK END

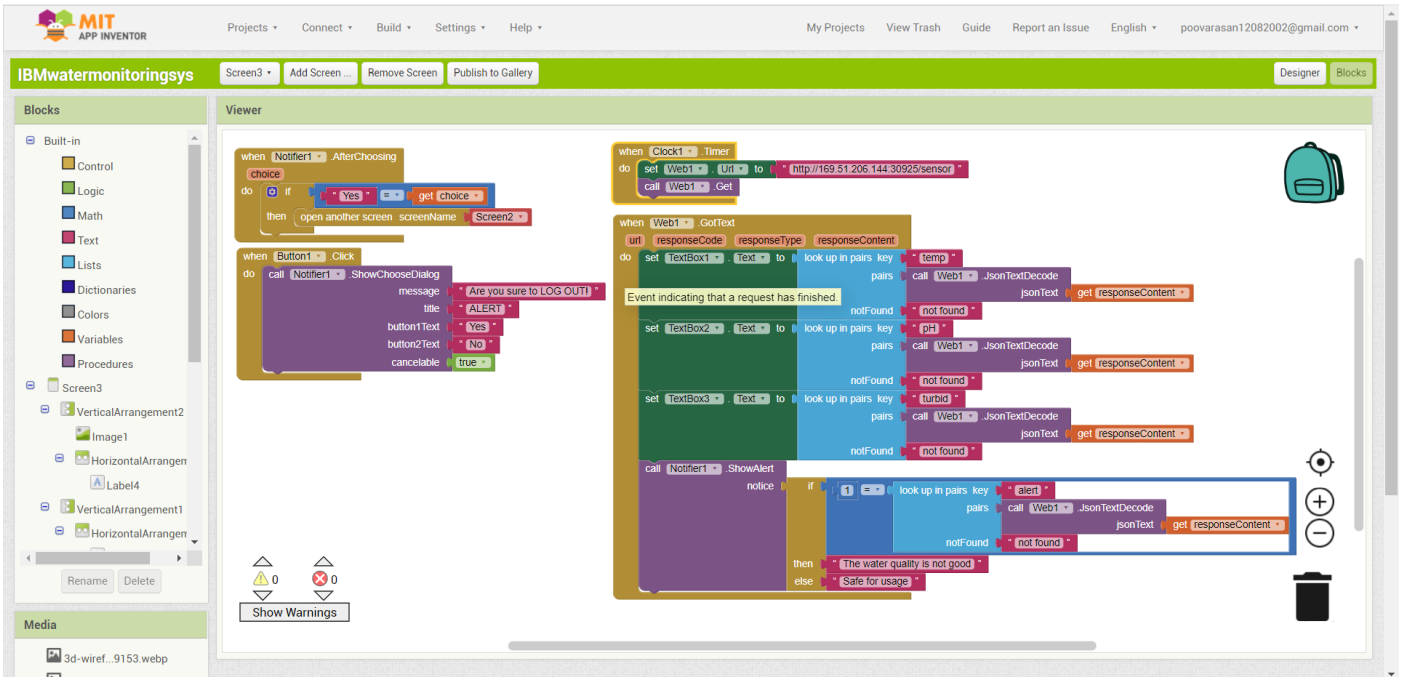
SCREEN-1



SCREEN-2



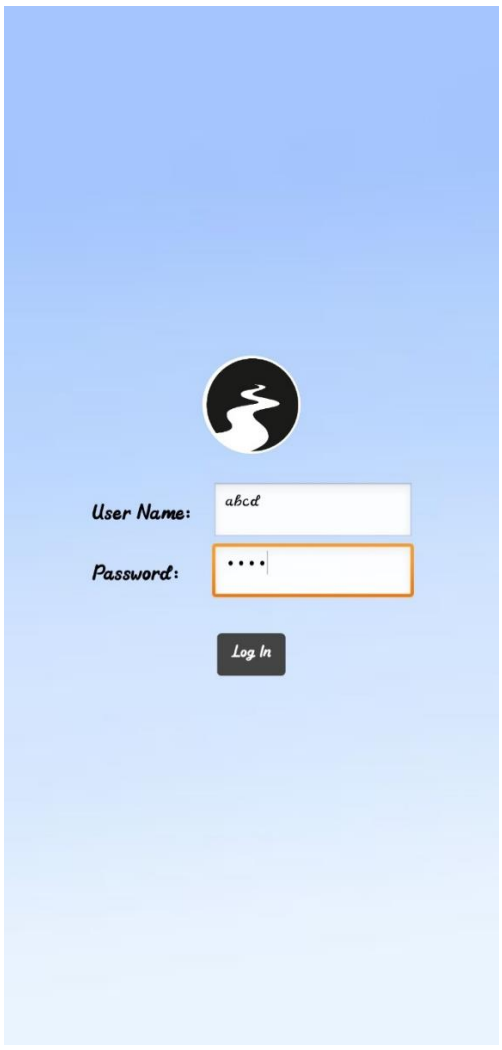
SCREEN-3



MIT APP INVERTOR OUTPUT-MOBILE PHONE

SCREEN-1:

SCREEN-2(LOG IN PAGE)



SCREEN-3

If temperature>120, pH>6 and turbidity <500.

The app shows "**SAFE FOR USAGE**".

If temperature<120, Ph<6 and turbidity>500.

The app shows "**THE WATER QUALITY IS NOT GOOD**".

LOG OUT PAGE

8.TESTING

TEST SCENARIOS

1. Verify python code is run without error.
2. Verify the login the Cloud Services.
3. Verify create a device in the IBM Watson IoT platform and get the device credentials.
4. Verify the events is shown in the card.
5. Verify the events is stored in the database.
6. Verify to create a node -red services.
7. To create a web UI to interact with user.
8. Verify user is able to log into app with Valid credentials.
9. Verify it show the location in app.

8.1 TEST CASES

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	12	0	0	12
Client Application	35	0	0	35
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	8	0	0	8
Final Report Output	3	0	0	3
Version Control	2	0	0	2

8.2 USER ACCEPTANCE TESTING

8.2.1 PURPOSE OF DOCUMENT

The purpose of this document is to briefly explain the test coverage and open issues of the **REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM** project at the time of the release to User Acceptance Testing (UAT).

8.2.2 DEFECT ANALYSIS

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

9. ADVANTAGES AND DISADVANTAGES

9.1 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.
- more user friendly, efficient.

9.2 DISADVANTAGES

- Due to the limitation of the budget, we only focus on measuring the quality of river water parameters. So the additional budget is required for further improvement of the overall system.
- **Drawback is high cost for smart sensors**.
- **Manual Inspection** of probes and sensors also waste a lot of productive time that could have been utilized for efficient reading procedures.

10. CONCLUSION

Real-time monitoring of water quality by will immensely help people to become conscious against using contaminated water as well as to stop polluting the water. 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.

11. FUTURE SCOPE

In future we can monitor the various parameters by addition of multiple sensors this would make the system highly effectively. This project can be extended into an efficient water management system of a local area. Moreover, other parameters which wasn’t the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygen can also be

quantified. The scalability of this project gives the addition of more different type of sensors. 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.

12. APPENDIX

SOURCE CODE

```
import ibmiotf.application

import ibmiotf.device

import time

import random

import sys

import requests

import json

import urllib.request

import urllib.parse

url="https://www.fast2sms.com/dev/bulkV2"

organization = "swz5ou"

deviceType = "abcd"

deviceId = "12"

authMethod = "token"

authToken = "12345678"


def sms(ph,temp,turbidity):

   message='Water quality degraded PH value:'+str(ph)+'temperature value:'+str(temp)+'tubidity
value:'+str(turbidity)

   my_data = {

      'sender_id': 'TXTIND',

      'message': message,

      'language': 'english',

      'route': 'p',

      'numbers': '9150661026, 6369521344,9840981094'

   }

   headers = {
```

```
        'authorization':
'cjshq2uY05KWVOxSDndGMNyvAmR6rgzfUpI3Pe8JkE49ZXlBbwq2plfEB6IZ31CjywSchzNtRQkixoV0',
        'Content-Type': "application/x-www-form-urlencoded",
        'Cache-Control': "no-cache"
    }
    response = requests.request("POST",url,data=my_data,headers=headers)
    returned_msg = json.loads(response.text)
    print(returned_msg['message'])


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()


while True:
    pH = random.randint(1, 14)
    turbidity = random.randint(1, 1000)
    temperature = random.randint(0, 100)


    if pH<6 or temperature >120 or turbidity > 500:
        alert = 1
    else:
        alert = 0


    data = {'pH': pH, 'turbid': turbidity, 'temp': temperature, 'alert':alert}


    def myOnPublishCallback():
        print("Published pH= %s" % pH, "Turbidity:%s" % turbidity, "Temperature:%s" % temperature)
```

```
    success = deviceCli.publishEvent("water monitoring", "json", data, qos=0, on_publish=myOnPublishCallback)
    if not success:
        print("Not Connected to ibmiot")
    time.sleep(1)
deviceCli.disconnect()
```

GITHUB LINK - IBM-EPBL/IBM-Project-18499-1659686261