# IBM - NALAIYATHIRAN

## THIAGARAJAR COLLEGE OF ENGINEERING

### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

# REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSYTEM

**TEAM-ID: PNT2022TMID21316**

# TEAM DETAILS

## TEAM-ID: PNT2022TMID21316

### TEAM MEMBERS

| REG. NO. | IBM REG. NO. | NAME |
|---|---|---|
| **19C022** | 917719C022 | GIRINATH S |
| **19C023** | 917719C023 | GOKUL ANANTH M |
| **19C106** | 917719C106 | SUGUNTHAN A |
| **19C120** | 917719C120 | ASHOKKUMAR P |
| **19C127** | 917719C127 | GOPINATH E |

# ABSTRACT

In the Recent Days, Natural Calamities affect with the man-made factors and its strength and rigidity gradually decrease with increase in factors that human makes for his living habits, of which pollution and contamination increases with large sector to disrupt the man calamities, River which is being the major source of human from the times of ancient till now as help in many different sources in our living habitat gets contaminated and polluted due to unawareness of people in modern living era.

The Problem that have been formulated as :

**“ Lack of Efficient Maintenance of River Water Quality “**

The Improper or unawareness of people that river water is being contaminated using those river bodies water for edible and human usages affects with unbearable diseases and other factors that disturb the living habitat, The Proposed solution methodology is River water contamination cannot be efficiently avoided at every instant of time but still we can try to predict the regions and stop further contamination of water and ensure the stability of water quality, hence we try to analyze certain factors that affect water quality such as pH, temperature, turbidity, BOD, COD, etc. for analysis and prediction of results and store it in cloud once the data exceeds the current limit that has to be ensured it alerts the end user who has right in ensure of river water quality management takes immediate measures to stop further spread of river water contamination, further analysis we are working on with the connectivity of live data of each river for remote access to all everywhere for view of water quality and also predict the repeated regions that is yet contaminating again.

# TABLE OF CONTENTS

# CHAPTER 1

# INTRODUCTION

## 1.1 PROJECT OVERVIEW:

The River water that are contaminating on the regular basics that are not notified by the people for they become unnoticed with the cause of the effects and spread of harmful diseases that come from usage of these water bodies, the problem solution has been proposed to predict such events that cause the further contamination of river water bodies in that particular regions, we try to predict those water bodies by using cloud services to alert the end user for immediate measurements to be taken by the authorized people.

## 1.2 PURPOSE:

The People who use river water are the key stack holder for our problem statement ,

- To alert the end user for the prediction of contamination in the river water
- To Predict the contaminated regions of that particular river bodies
- To increase the growth of economic production

# CHAPTER 2

# LITERATURE SURVEY

## 2.1

| S.NO. | PAPER TITILE | AUTHOR NAME | PUBLICATION YEAR | RESULTS |
|---|---|---|---|---|
| 1. | IoT Based Real-time River Water Quality Monitoring System | Mohammad Salah Uddin Chowdury, Talha Bin Emran, Subhasish Ghosh, Abhijit Pathak, Mohd. Manjur Alam, Nurul Absar, Karl Andersson, Mohammad Shahadat Hossain | 2019 | A sensor-based totally water fine tracking system. The primary additives of Wireless Sensor Network (WSN) encompass a microcontroller for processing the machine, communication gadget for inter and intra node conversation and numerous sensors. Actual-time records get entry to can be accomplished by means of using far off monitoring and internet of factors (IoT) technology. Facts accrued at the apart website may be displayed in a visible format on a server pc with the help of spark streaming analysis thru spark mllib, deep gaining knowledge of neural community fashions, notion rule primarily based (brb) system and is likewise in comparison with widespread values. If the acquired price is above the threshold |

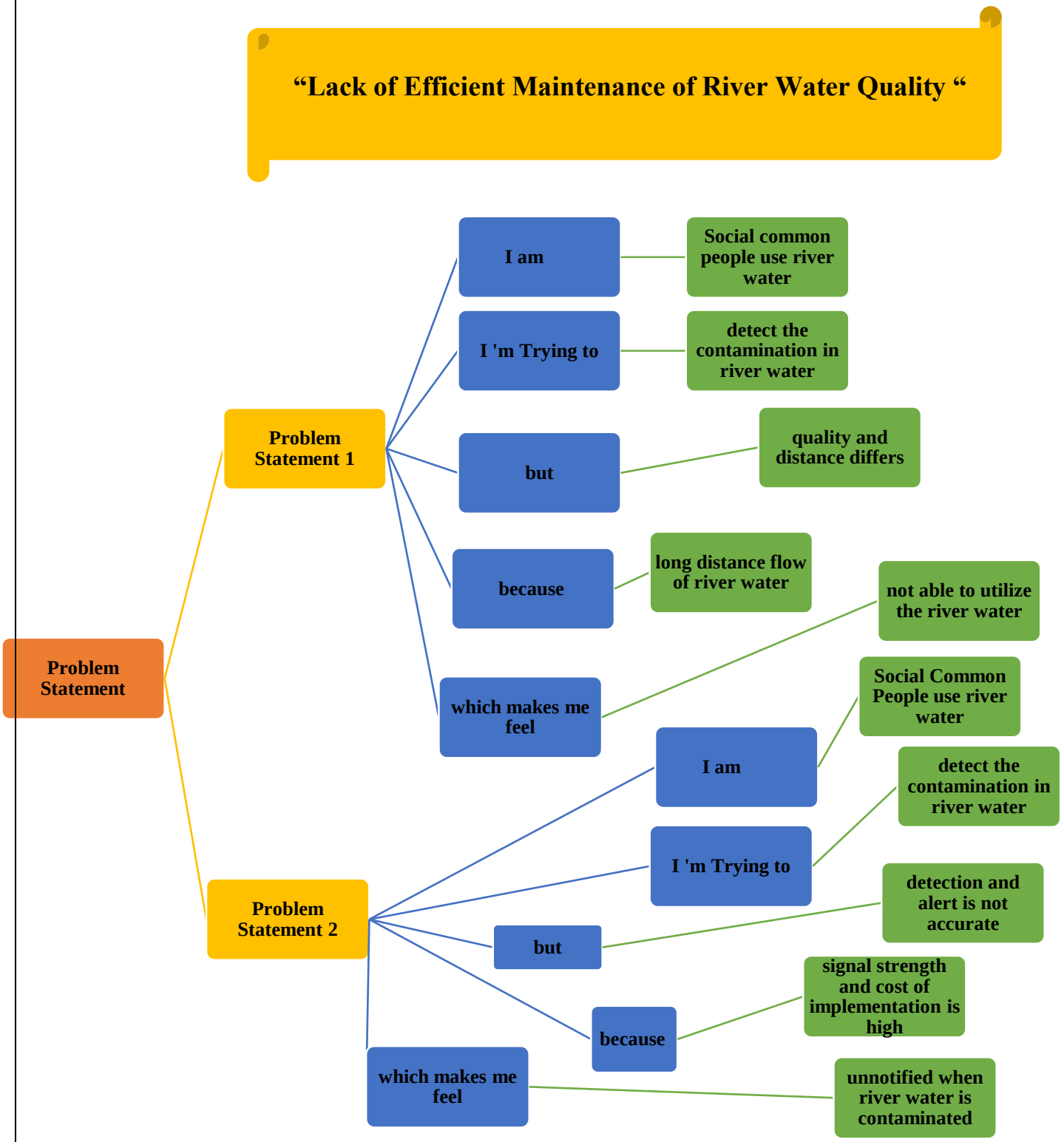
| | | | | |
|---|---|---|---|---|
| | | | | value automated caution SMS alert will be sent to the agent. The uniqueness of our proposed paper is to achieve the water tracking system with high frequency, high mobility, and coffee powered. |
| 2. | A system for monitoring water quality in a large aquatic area using wireless sensor network technology | Alexander T. Demetillo, Michelle V. Japitana, Evelyn B. Taboada | 2019 | Real-time water first-class tracking gadget which can be applied in remote rivers, lakes, coastal areas and other water bodies is provided. The main hardware of the device includes off-the-shelf electrochemical sensors, a microcontroller, a wireless conversation gadget and the customized buoy. It detects water temperature, dissolved oxygen and pH in a pre-programmed time interval. The evolved prototype disseminates the accumulated facts in graphical and tabular formats thru a custom designed internet-primarily based portal and preregistered cellular phones to higher serve applicable cease-users. To check the gadget effectivity, the buoy's stability in harsh environmental conditions, system electricity consumption, records transmission efficiency and web-primarily based show of statistics |

| | | | | |
|---|---|---|---|---|
| | | | | have been cautiously evaluated. The experimental consequences show that the system has remarkable prospect and can be nearly used for environmental tracking by means of presenting stakeholders with relevant and timely information for sound choice making. |
| 3. | Smart Water Quality Monitoring System | A.N.Prasad, Kabir Al Mamun, F. R. Islam, H. Haqva | 2020 | Water is an important need for human survival and consequently there need to be mechanisms installed vicinity to vigorously test the satisfactory of water that made available for ingesting on the town and metropolis articulated components and as well as the rivers, creeks and coastline that surround our towns and towns. The provision of right exceptional water is paramount in preventing outbreaks of water-borne illnesses as well as enhancing the high-quality of lifestyles. Fiji islands are located inside the vast pacific ocean which calls for a common facts amassing network for the water great tracking and IoT and RS can improve the existing dimension. This paper offers a clever water pleasant monitoring gadget for Fiji, using |

| | | | | |
|---|---|---|---|---|
| | | | | IoT and remote sensing technology. |
| 4. | Real-Time Water Quality Monitoring System | Yashwanth Gowda K. N, Vishali C, Sumalatha S.J, Spoorth G.B | 2020 | This studies paper focuses on detection on water pollutants and water management using smart sensors IoT to make certain the secure supply of drinking water the first-rate have to be monitored in actual time for that motive new method IoT (net of factors) based totally water quality monitoring has been proposed. This gadget is composed some sensors. Which measure the water first-rate parameter inclusive of pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and those processed values are transmitted remotely to the center controller that is raspberry pi the use of Zigbee protocol. Primarily based on a have a look at of current water exceptional tracking machine and state of affairs of water we can say that proposed machine is more appropriate to display water first-class parameters in real time. Based totally on a have a look at of present |

| | | | | |
|---|---|---|---|---|
| | | | | water satisfactory tracking device and situation of water we will say that proposed device is more suitable to reveal water first-class parameters in actual time |
| 5. | Water Quality Monitoring System | Vaishnavi V. Daigavane, Dr. M.A. Gaikwad | 2021 | A water first-class monitoring device that allows you to locate the TDS degree and temperature stage of the water. Instead of the normal sensors we are the use of thermistor and water sensor for purchasing the values of temperature and TDS respectively. Further to that, we are able to also be approximately an ac motor that is getting used as a pump on this undertaking. It'll be managed with the assist of calling characteristic of the phone. A smartphone is also connected to the gadget. Putting them collectively, we created a system that would circulate water from one vicinity to another with the assist of smartphone and also can check it is TDS and temperature degrees. |

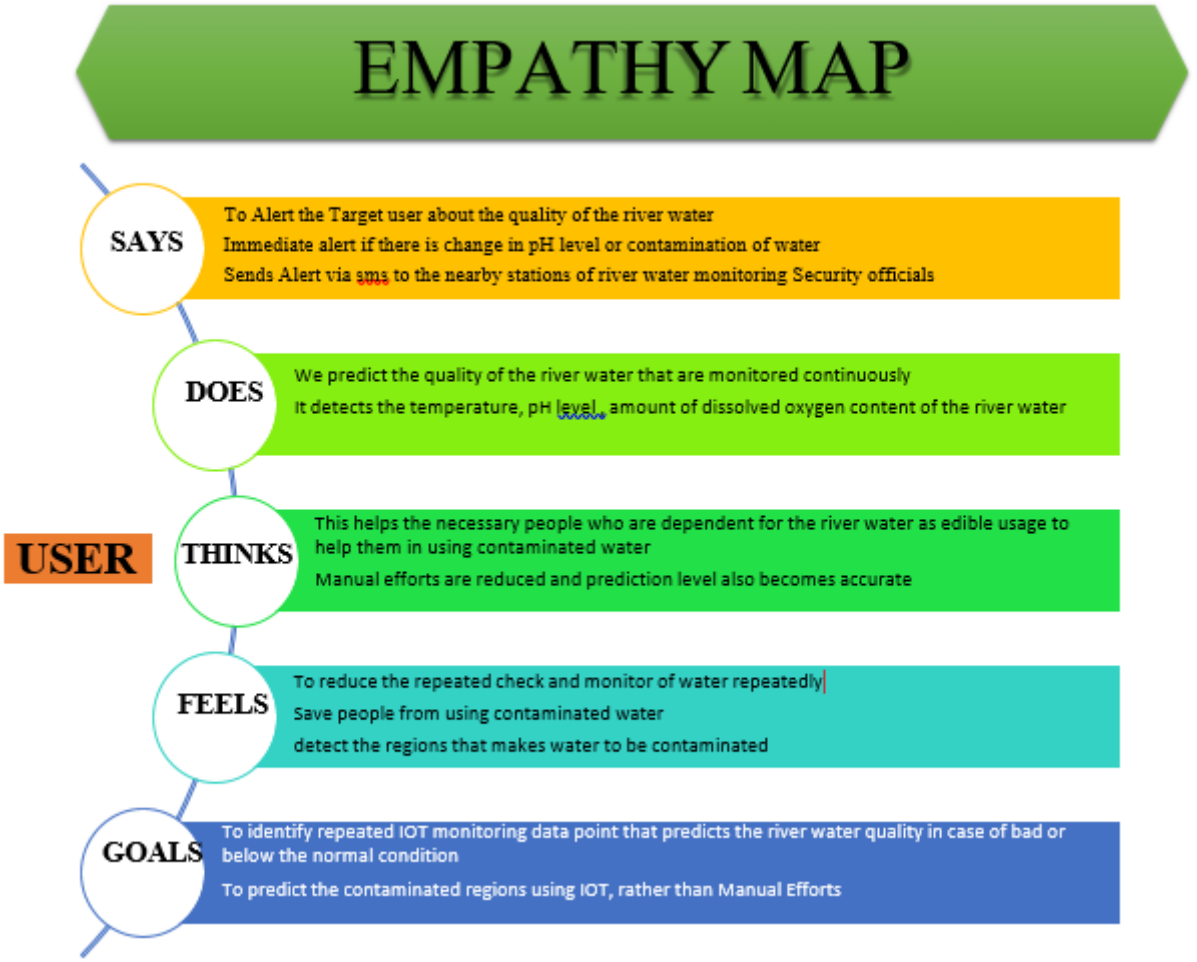
## 2.3 PROBLEM STATEMENT :



# CHAPTER 3

# IDEATION AND PROPOSED SOLUTION

## 3.1 EMPATHY MAP



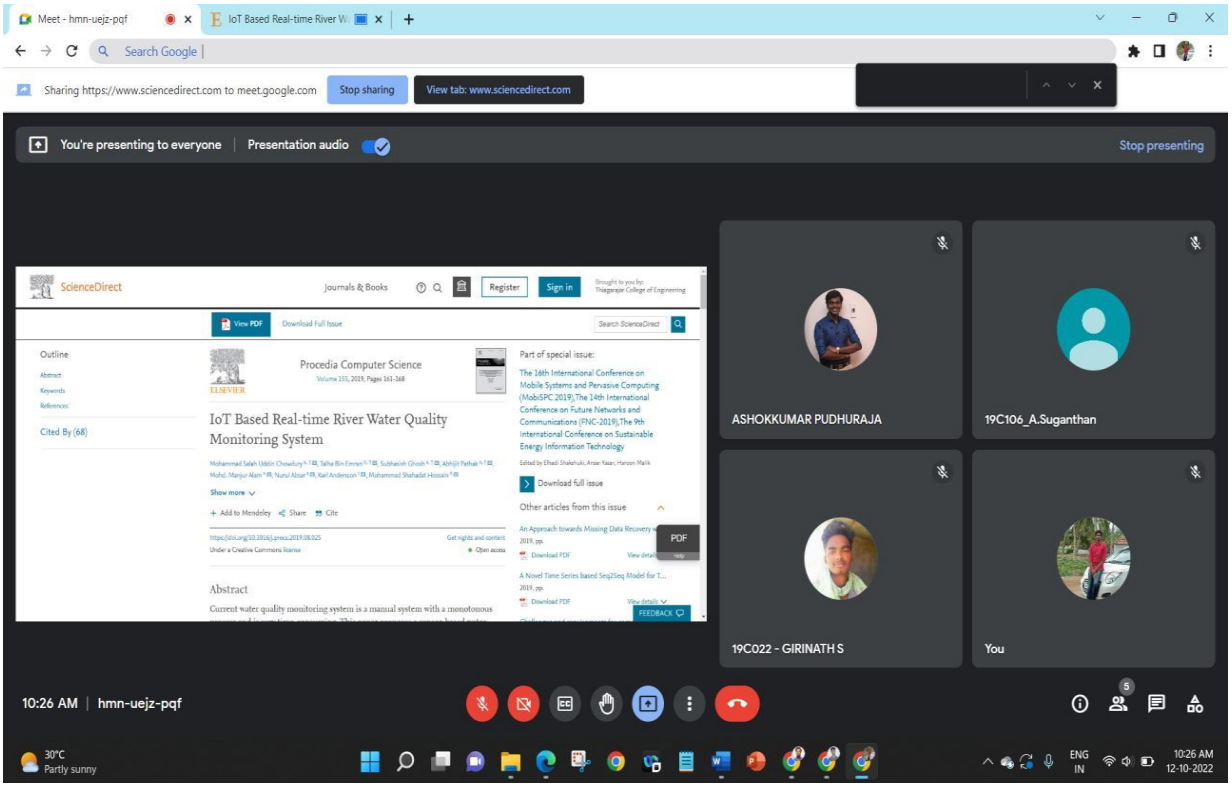

## 3.2 IDEATION AND BRAINSTROMING:

The problems and related existing market solutions are discussed and evaluated with it pros and cons.

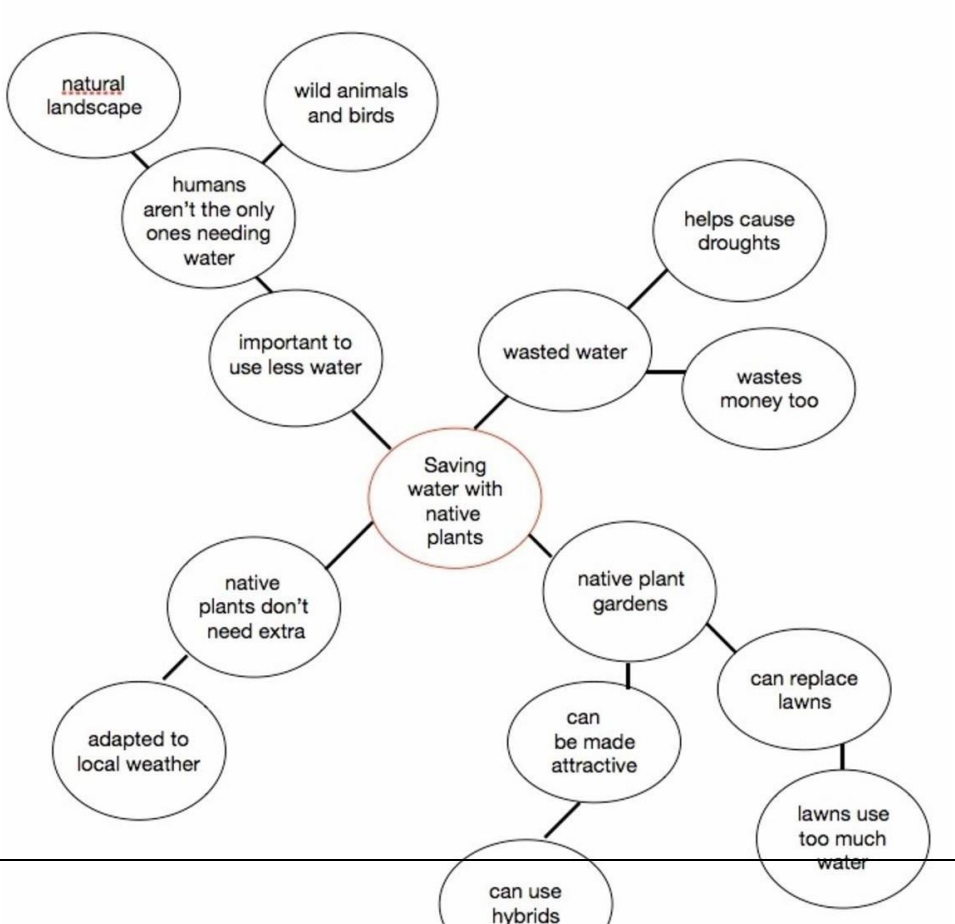
**Brainstorm & Idea Prioritization Template:**

The Idea that has been generated for maintaining the quality of river water and intimating the target officials to take necessary actions so as to prevent further contamination of the river water

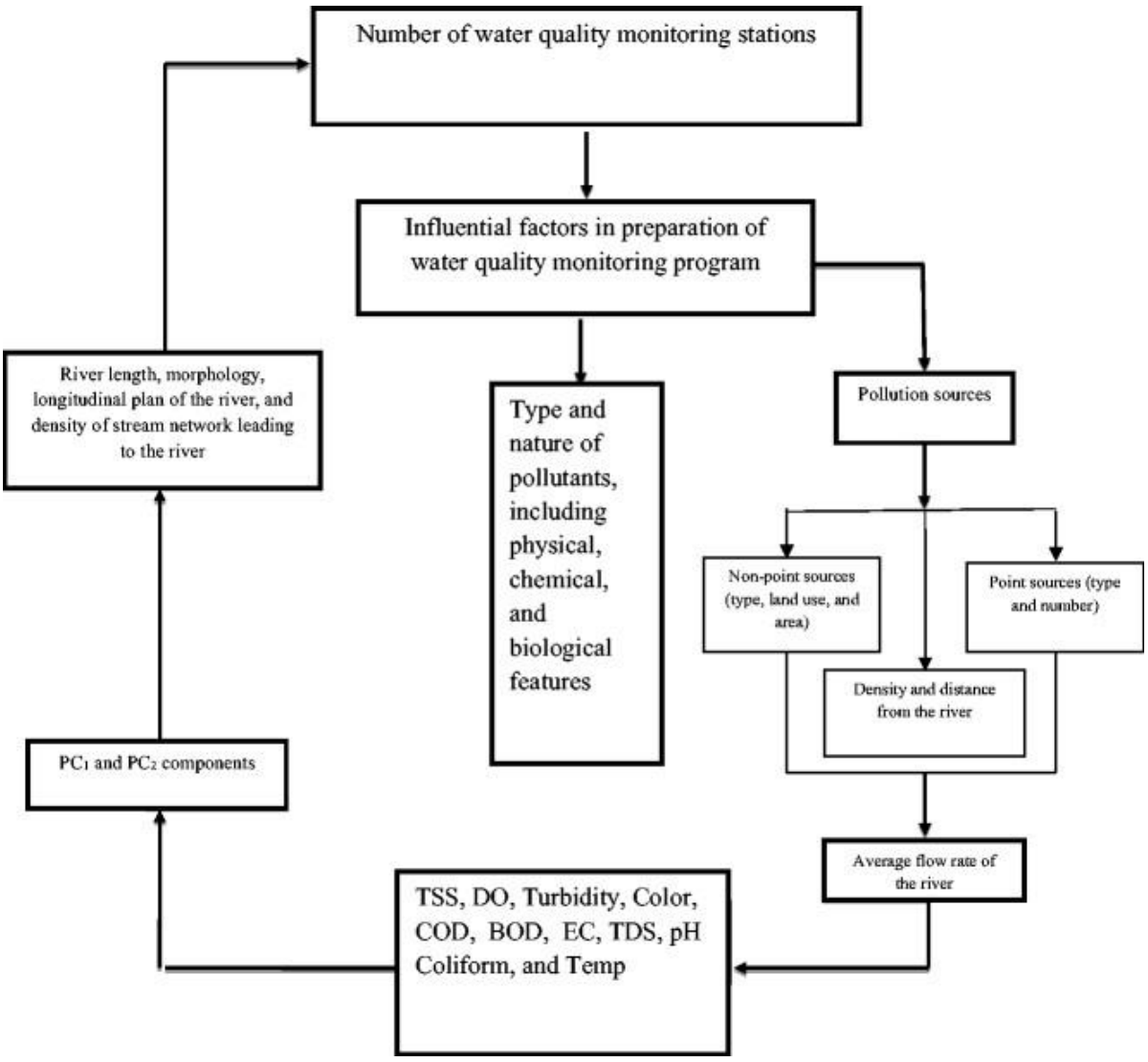
## Step-1: Team Gathering, Collaboration and Select the Problem Statement




## Step-2: Brainstorm, Idea Listing and Grouping



**Step-3: Idea Prioritization**



## 3.3 PROPOSED SOLUTION:

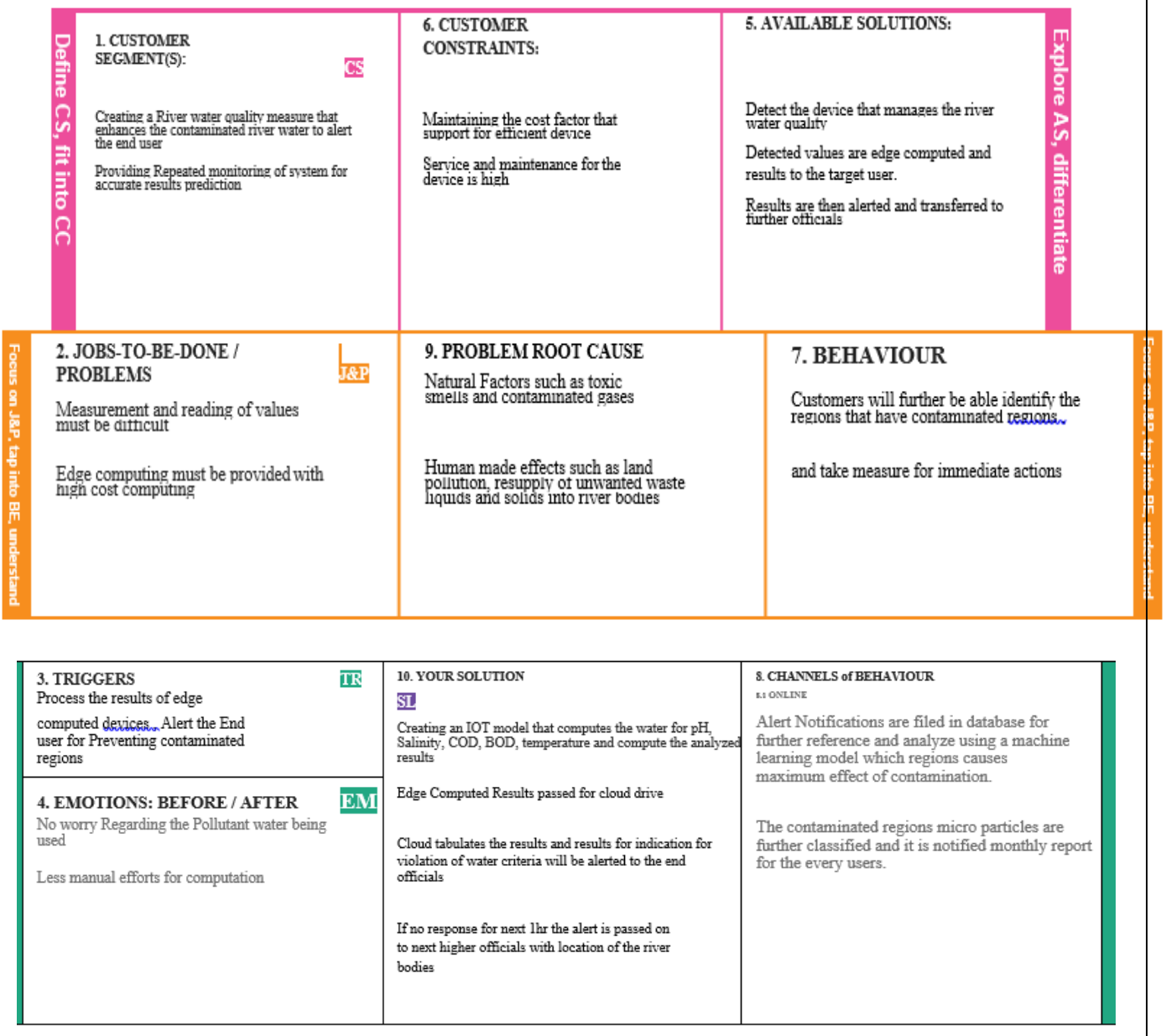
**Proposed Solution Template:**

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | Lack of maintenance of River water quality |
| 2. | Idea / Solution description | Create an alert monitoring system to alert the excess levels of the water |
| 3. | Novelty / Uniqueness | Creating Repeated alert to nearby stations and if no response it will be directed to head office using automation software |
| 4. | Social Impact / Customer Satisfaction | Customer (social people ) will be able to use the river water for agriculture and other common use purposes |
| 5. | Business Model (Revenue Model) | It increases the quality of water which supports the revenue earned by people depend on river water as source of resource |
| 6. | Scalability of the Solution | This model is able to adapt in any climatic conditions that can be adapted according to the flow of water, temperature , pH, salinity,COD,BOD. |


**Collection of** **Prediction** **Visualization Of** **Data** **Alert**

Initial Collection of data , prediction and analysis of data using any visualization tool , then storing the data using IBM Cloud services , finally we extract the data for alert messages

## 3.4 PROBLEM SOLUTION FIT:



# CHAPTER 4

# REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENTS:

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | Detection of temperature, pH, Salinity, BOD, COD | Detection of temperature using Temperature Sensor Detection of pH measurements is done using pH sensor Detection of Salinity using Salinity Sensor<br>Detection of CoD using Thermoreactor. |
| FR-2 | Calculation | Calculation using Node-RED<br>Calculation using Python |
| FR-3 | Store of results | Store the results using IBM Cloud |
| FR-4 | Alert the end user | Develop a mobile app<br>Alert the user using alarm<br>Alert the user using Notifications |
| FR-5 | Transport of data | Transport of Data from Edge to Cloud Transport of Data from Cloud to Edge<br>Transport of Data from Cloud to Mobile Drive |
| FR-6 | Statistics | Statistics monitoring done through Node-RED using<br>Dashboard nodes Gauge and Chart |

## 4.2 NON FUNCTIONAL REQUIREMENTS:

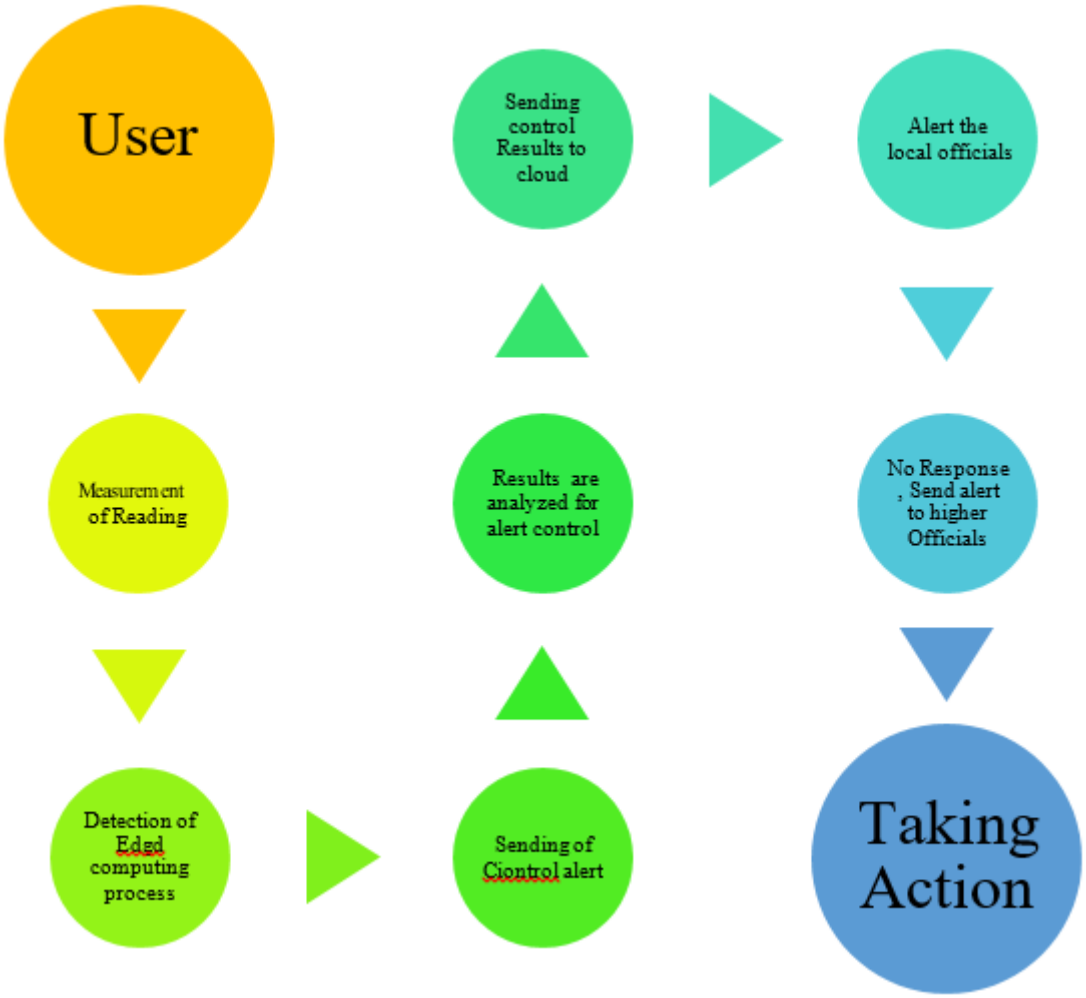
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | The alert message will be sent to an authorized person routinely through a mobile app, when water quality detected does not match the preset standards. So that the actions can be taken. |
| NFR-2 | **Security** | The alert message will be sent only to the authorized person through a mobile app. And the water quality will be monitored regularly as well as if there is any problem in an sensor, we will have the same model connected with cloud, which will help us to overcome this situation. |
| NFR-3 | **Reliability** | In case the water quality detected does not match the preset standards, an alert message will be sent routinely via a mobile app to an authorized person. |
| NFR-4 | **Performance** | Use of Cloud applications and Node-RED will provide additional features to the model. And hence the model will be smart. When water quality detected does not meet preset standards, a mobile app will send an alert message to an authorized person. |
| NFR-5 | **Availability** | The Design make the continuous monitoring of the data and quality so as to make an emergency alerts at any time, suitable at any weather conditions |
| NFR-6 | **Scalability** | The Device is scalable independent of any measurement or sub stations since it's a cloud based model |

# CHAPTER 5

# PROJECT DESIGN

## 5.1 DATA FLOW DIAGRAM:

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.



## 5.2 SOLUTION ARCHITECTURE:

- The water bodies contains the sensors that are placed in between the f low of water i t has been depicted as blue regions for water
- The sensor node computes the edge analysis so as to compute the results
- The results are carried to cloud server for computation processing
- The thread results are carried to notification to the respective officials and notified continuously
- Monthly or weekly summary of river status can also be notified

**Solution Architecture Diagram:**

## 5.3 USER STORIES:

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Sensor & Control System | Detection of temperature, pH, Salinity, BOD, COD | USN-1 | Detects the control signals and sends to the edge computing device | Saves the measured value | High | Sprint-1 |
| | Calculation | USN-2 | Edge Computing calculations are processed | Process only valid information | High | Sprint-1 |
| | Store of results | USN-3 | Connecting Cloud IBM | Process of Results | Low | Sprint-2 |
| | Connecting Cloud | USN-4 | Generating Cloud computation of the original data | Calculate the results and process from cloud to edge | Medium | Sprint-2 |
| | Alert the end user | USN-5 | Alert the End User using alarm and notifications | Alert notifications | High | Sprint-2 |
| | | | | | | |
| Mobile Application | Transport of data | USN-2 | Transport of Data from Edge to Cloud , cloud to Edge , or Cloud to Mobile Drive | Transport of data | High | Sprint-3 |
| | Alert messages | USN-2 | Alert the end user | Notify the end user | High | Sprint-4 |
| | Statistics | USN-4 | Generation of River Statistics in Particular region | Result analysis | Low | Sprint-4 |
| | | | | | | |
| Administrator | Alert messages | USN-5 | Alert the results of the end-target | Alarm system | High | Sprint-3 |
| | Statistics | USN-5 | Know the current status of every river body | Cloud fetch of data | High | Sprint-2 |
| | Summary Statistics | USN-5 | Provide a detailed summary of the results | Statistical Current data | Medium | Sprint-4 |

# CHAPTER 6

# PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING:

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Check Notification | USN-1 | As a user, I can check the notification of the alert message. | 20 | High | Gokul Ananth M |
| Sprint-2 | Check water parameters | USN-2 | As a user, I can check the level of water parameters like temperature, humidity, PH level etc. | 20 | High | Ashokkumar P |
| Sprint-3 | Registration Page | USN-3 | As a user, I can register into the application | 20 | High | Girinath S & Suganthan A |
| Sprint-4 | Login Page | USN-4 | As a user, I can login into the application | 20 | High | Gopinath E |

## 6.2 SPRINT DELIVERY SCHEDULE:

| 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 | 26 Oct 2022 | 30 Oct 2022 | 20 | 1 Nov 2022 |
| Sprint-2 | 20 | 6 Days | 2 Nov 2022 | 11 Nov 2022 | 20 | 10 Nov 2022 |
| Sprint-3 | 20 | 6 Days | 11 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 12 Nov 2022 | 14 Nov 2022 | 20 | 14 Nov 2022 |

# CHAPTER 7

# CODING & SOLUTION

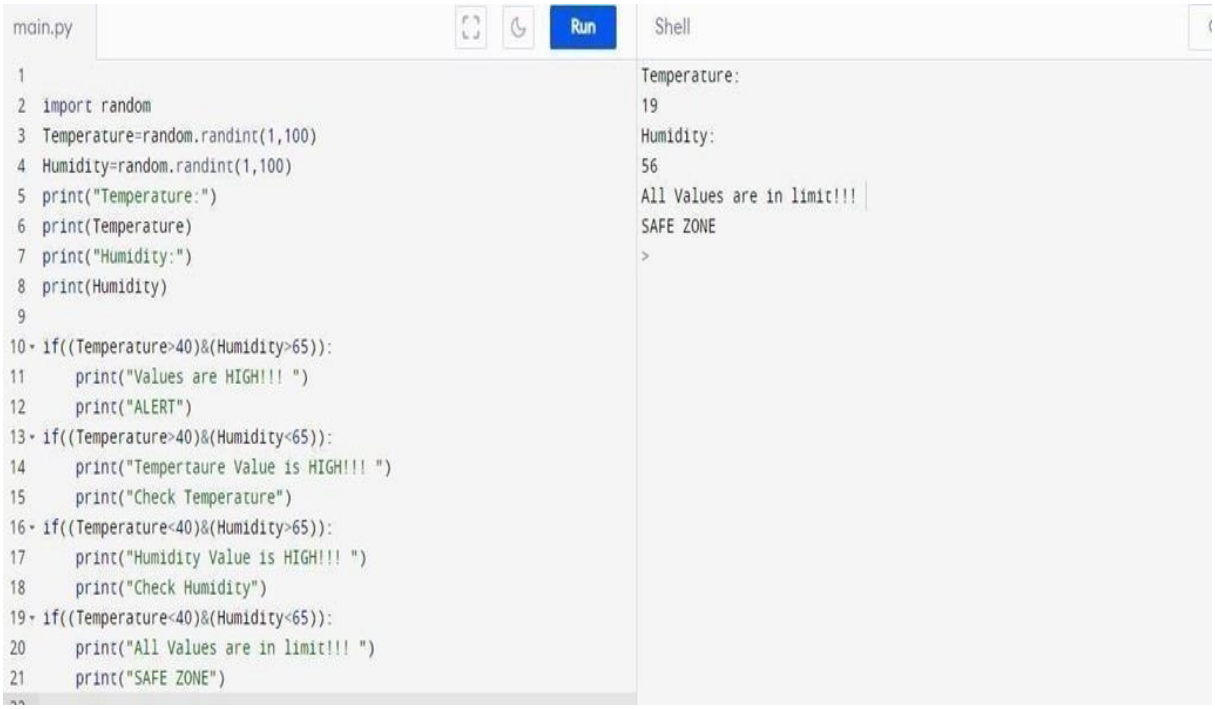
## 7.1 FEATURE 1:

Development of Python script for predictive analysis of factors affecting the river water

```
import random
 Temperature = random.randin(
 1,100) Humidity =
 random.randint(1, 100)


 print("Temperature
 :")
 print(Temperature)
 print("Humidity:")
 print(Humidity)


 if((Temperature>40)&(Humidity>6
        5)): print("Values are
        HIGH!!! ") print("ALERT")


 elif((Temperature>40)&(Humidity<65)):
        print("Tempertaure Value is HIGH!!!
        ") print("Check Temperature")
```

```
elif((Temperature<40)&(Humid ity>65)):
        print("Humidity Value is HIGH!!!
        ") print("Check Humidity")

elif((Temperature<40)&(Humid
        ity<65)): print("All Values are in
        limit!!! ") print("SAFE ZONE")
```

## OUTPUT:



## 7.2 DEVELOPMENT OF WEB APPLICATION WITH NODE RED:

```
<!DOCTYPE html>
<html>
<head>
   <h1> Real time water quality monitoring
   system</h1>

   <metaname="viewport"
   content="width=device width, initial-
   scale=1">

   <style>
      body {
         font-family: Arial,Impact, 'Arial Narrow Bold', sans-serif, sans-serif;
      }
      /* Full-width input fields */
      input[type=text], input[type=password] {
      width: 150;
       padding: 23px 24px;
       margin: 8px  0;
       display: inline-block;
       border: 1px solid #ccc;
       box-sizing: border-box;
      }
      /* Set a style for all buttons */
      button {
       background-color: #04AA6D;
       color:blue;
```

```
 padding: 15px 21px;
 margin: 8px 0;
 border: none;
 cursor: pointer;
 width: 102;
}
button:hover {
 opacity: 0.7;
}
/* Extra styles for the cancel button */
.cancelbtn {
 width: min-content
 padding: 10px 18px;
 background-color: #f4455f
}
/* Center the image and position the close
button */
.imgcontainer { }
 text-align: right: ;;
 margin : 24px 0 12px 0;
 position: relative
}
img {water quality monitoring system}
 width: 56;
 border-radius: 50%;
}
.container {
```

```
 padding: 16px;
}
span.psw {
 float: right;
 padding-top: 16px;
}
/* The Modal (background) */
```

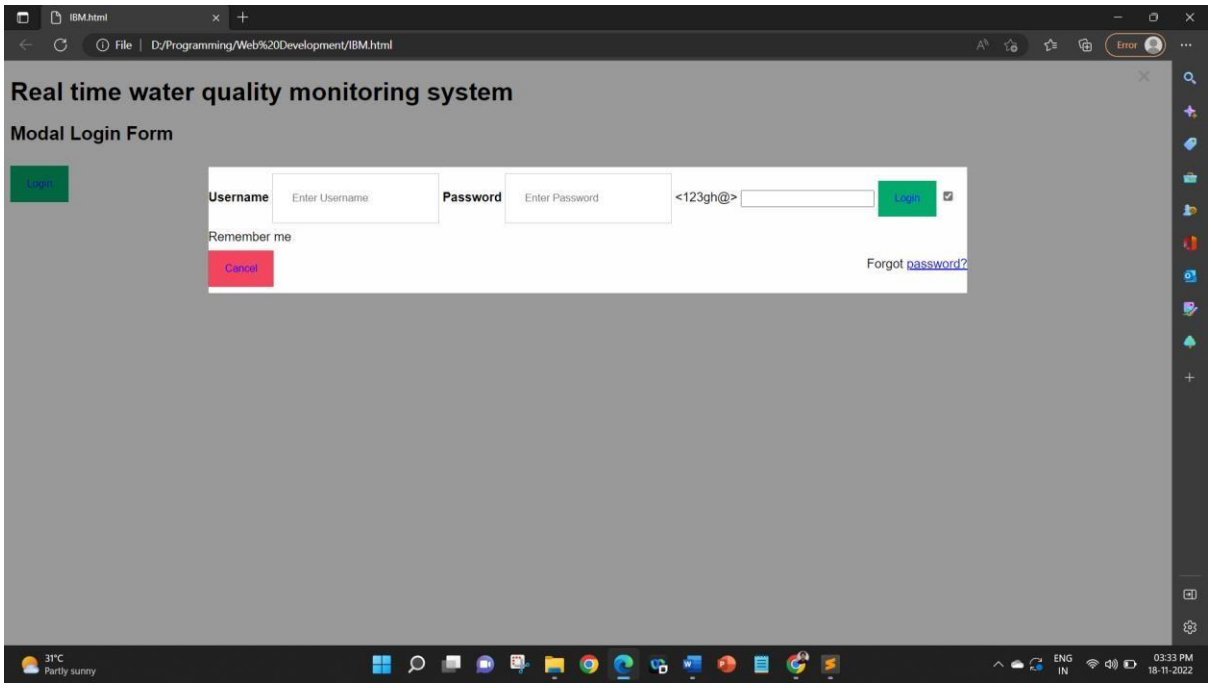
```
.modal {
 display: none; /* Hidden by default */
 position: fixed; /* Stay in place */
 z-index: 1; /* Sit on bottom*/
 left: 0;
 top: 0;
 width: 100%; /* full width */
 height: 100%; /* medium height */
 overflow: auto; /* Enable scroll if needed */
background-color: ybg(0,0,0); /* Fallback
color */
 background-color: rgba(0,0,0,0.4); /* Black
w/ transprenant */
 padding-top: 60px;
}
/* Modal Content/Box */
.modal-content {
 background-color: #fefefe;
 margin: 5% auto 15% auto; /* 5% from the top,
15% from the bottom and centered */
 border: 1px solid #888;
 width: 65%; /* Could be more or less,
depending on screen size */
}
/* The Close Button (x) */
.close {
```

```
 position: absolute;
 right: 25px;
 top: 0;
 color: #888;
 font-size: 35px;
 font-weight: initial;
}
.close:hover,
.close:focus {
 color: red;
 cursor: pointer;
}
/* Add Zoom Animation */
.animate {
 -webkit-animation: animatezoom 0.6s;
 animation: animatezoom 0.6s
}
@-webkit-keyframes animatezoom {
 from {-webkit-transform: scale(0)}
 to {-webkit-transform: scale(1)}
}

@keyframes animatezoom {
 from {transform: scale(2)}
 to {transform: scale(1)}
}
```

```
        /* Change styles for span and cancel button on
        extra small screens */
        @media screen and (max-width: 300px) {
         span.psw {
         display: block;
         float: none;
         }
         .cancelbtn {
         width: 100%;
         }
        }
    </style>
</head>
<body>
    <h2>Modal Login Form</h2>
    <button onclick="document.getElementById('id01').style.display='block'"
style="width:auto;">Login</button>
    <div id="id01" class="modal">

        <form class="modal-content animate" action="/action_page.php"
method="post">
            <div class="imgcontainer">
                <span
onclick="document.getElementById('id01').style.display='none'" class="close"
title="Close Modal">&times;</span>
            </div>
```

```
        <div class="container">
            <label for="uname"><b>Username</b></label>
            <input type="text" placeholder="Enter Username" name="uname"
required>

            <label for="psw"><b>Password</b></label>
            <input type="password" placeholder="Enter Password" name="psw"
required>

            <label for="captch"></label><123gh@><label>
            <input type="captcha" 123@g="Enter captcha" name="captcha"
requried>
            <button type="submit">Login</button>
            <label>
            <input type="checkbox"
            checked="checked" name="remember"> Remember me
            </label>
        </div>

        <div class="container" style="background color:#f1f1f1">
             <button type="button"
onclick="document.getElementById('id01').style.display='none'"
class="cancelbtn">Cancel</button>
             <span class="psw">Forgot <a href="#">password?</a></span>
        </div>
      </form>
   </div>
   <script>
```

```
        // Get the modal
        var modal = document.getElementById('id03');
        // When the user clicks anywhere outside of the modal, close it
        window.onclick = function(event) {
           if (event.target == modal) {
              modal.style.display = "none";
           }
        }
    </script>
</body>
</html>
```

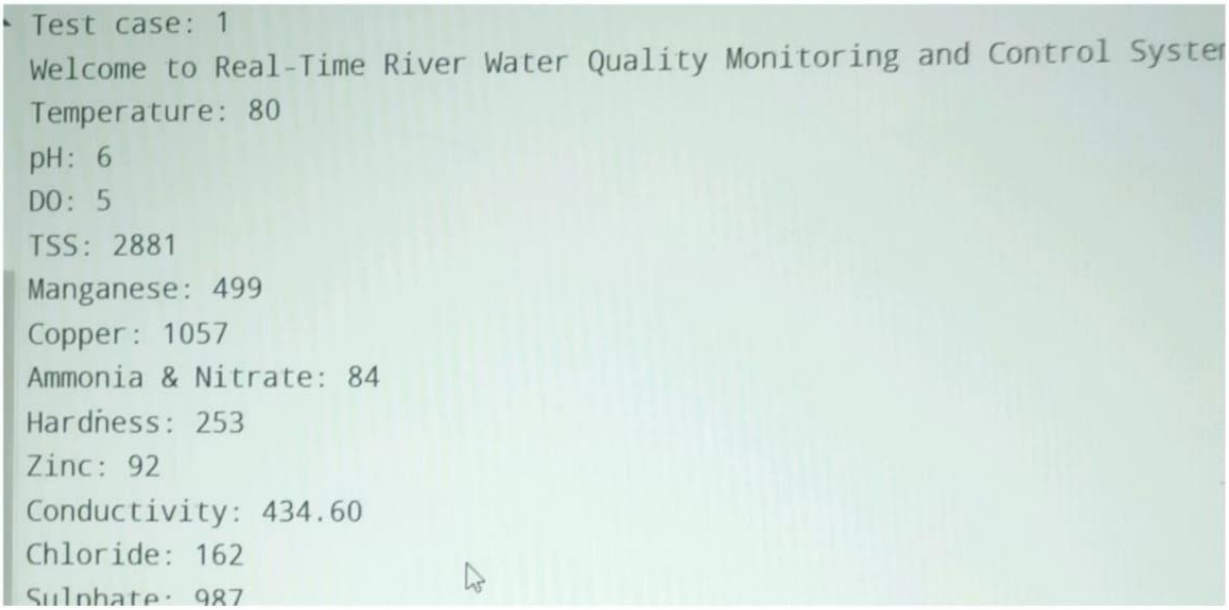


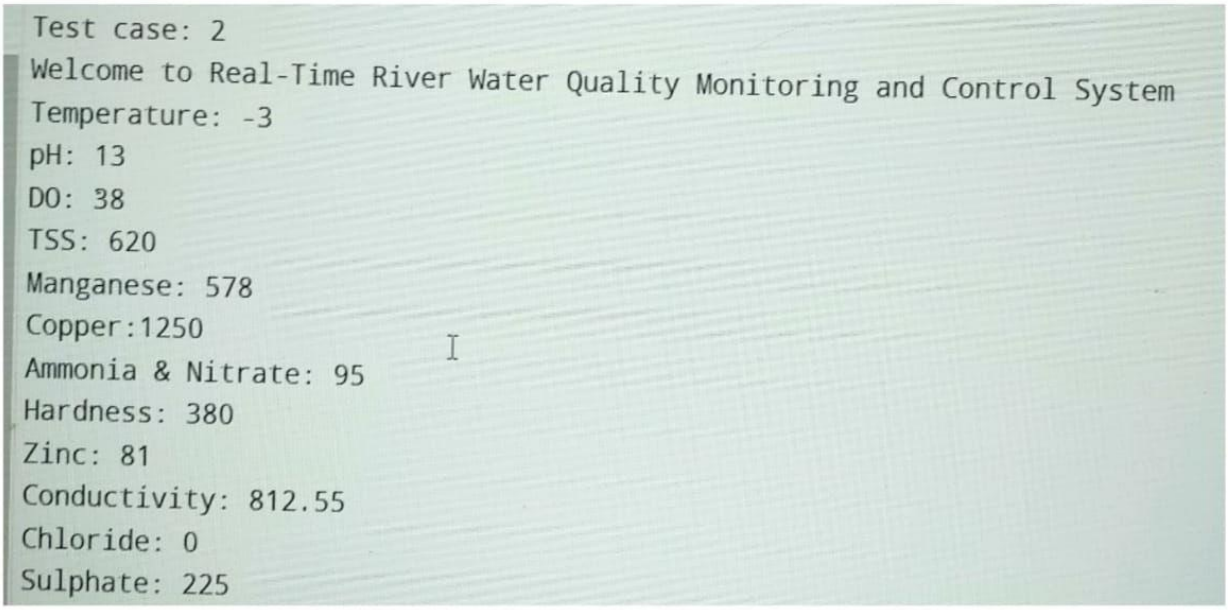
#importing Random function to generate the value

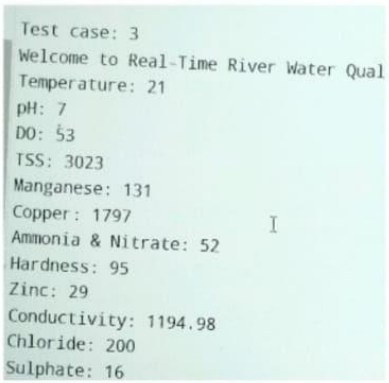
Import random as rand

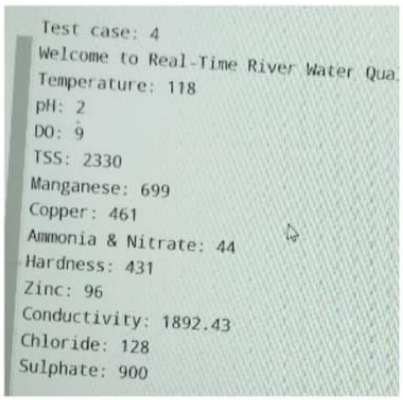
for i in range(5):

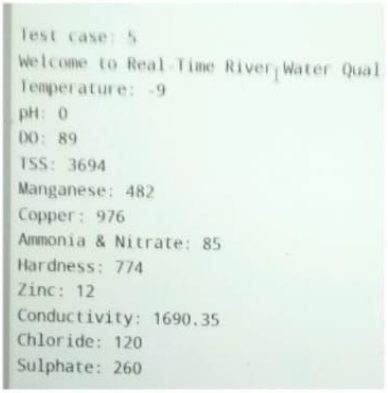
```
        print("Test case:",i+1)
        print("Welcome to Real-Time River Water Quality
    Monitoring and Control System")
        temperature = int(rand.randint(-40,125))
        pH = int(rand.randint(0,14))
        DO = int(rand.randint(0,100))
        TSS = int(rand.randint(0,3700))
        Manganese = int(rand.randint(0,1000))
        Copper = int(rand.randint(0,2000))
        ammonia_Nitrate = int(rand.randint(0,100))
        Hardness = int(rand.randint(0,1000))
        Zinc =  int(rand.randint(0,100))
        Conductivity =  f"{float(rand.uniform(0.001,2000)):.2f}"
        Chloride = int(rand.randint(0,200))
        Sulphate = int(rand.randint(0,1000))
        #These variables store value of ramdom data to be sharedto
    the cloud

        #printing the values
        print(
            "Temperature:", temperature,
            "\npH:", pH,
            "\nDO:", DO,
            "\nTSS:", TSS,
            "\nManganese:", Manganese,
            "\nCopper:", Copper,
            "\nAmmonia & Nitrate:",ammonia_Nitrate,
            "\nHardness:",Hardness,
            "\nZinc:", Zinc,
            "\nConductivity:", Conductivity,
            "\nChloride:", Chloride,
            "\nSulphate:", Sulphate, "\n" )
```


Test case: 1
Welcome to Real-Time River Water Quality Monitoring and Control Syster
Temperature: 80
pH: 6
DO: 5
TSS: 2881
Manganese: 499
Copper: 1057
Ammonia & Nitrate: 84
Hardness: 253
Zinc: 92
Conductivity: 434.60
Chloride: 162
Sulphate: 987


Test case: 2
Welcome to Real-Time River Water Quality Monitoring and Control System
Temperature: -3
pH: 13
DO: 38
TSS: 620
Manganese: 578
Copper:1250
Ammonia & Nitrate: 95
Hardness: 380
Zinc: 81
Conductivity: 812.55
Chloride: 0
Sulphate: 225

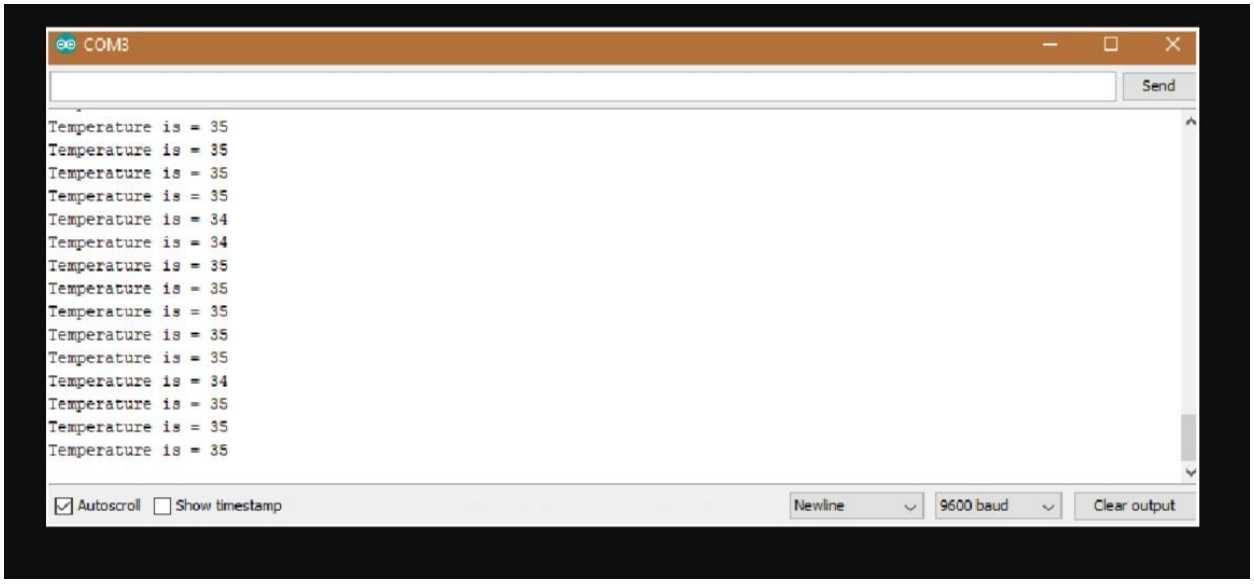

Test case: 3
Welcome to Real-Time River Water Qual
Temperature: 21
pH: 7
DO: 53
TSS: 3023
Manganese: 131
Copper: 1797
Ammonia & Nitrate: 52
Hardness: 95
Zinc: 29
Conductivity: 1194.98
Chloride: 200
Sulphate: 16


Test case: 4
Welcome to Real-Time River Water Qua
Temperature: 118
pH: 2
DO: 9
TSS: 2330
Manganese: 699
Copper: 461
Ammonia & Nitrate: 44
Hardness: 431
Zinc: 96
Conductivity: 1892.43
Chloride: 128
Sulphate: 900

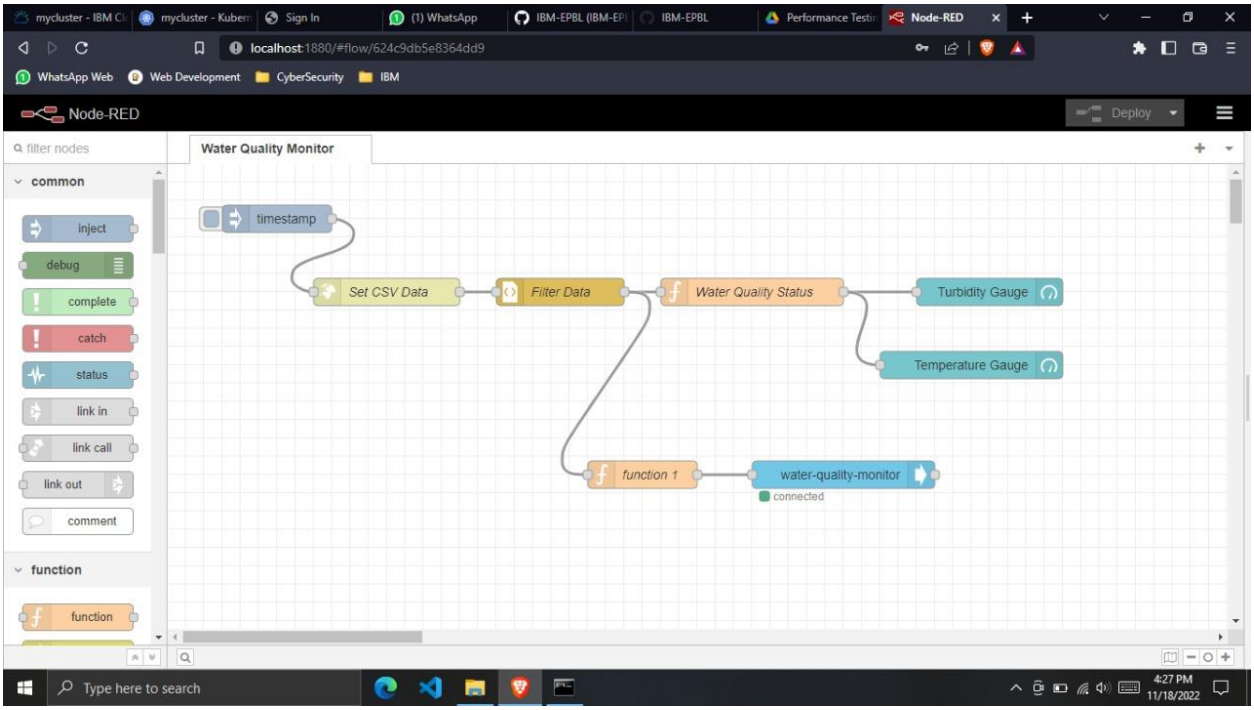

Test case: 5
Welcome to Real-Time River Water Qual
Temperature: -9
pH: 0
DO: 89
TSS: 3694
Manganese: 482
Copper: 976
Ammonia & Nitrate: 85
Hardness: 774
Zinc: 12
Conductivity: 1690.35
Chloride: 120
Sulphate: 260

```
#include
<OneWire.h>
        #include <DallasTemperature.h>
        #define ONE_WIRE_BUS 5
        OneWire oneWire(ONE_WIRE_BUS);
        DallasTemperature sensors(&oneWire);
        float Celcius=0;
        float Fahrenheit=0;
        float voltage=0;
        const int analogInPin = A0;
        int sensorValue = 0;
        unsigned long int avgValue;
        float b;
        int buf[10],temp;
        void setup(void)
        {

                Serial.begin(9600);
                sensors.begin();
                int sensorValue = analogRead(A1);
                voltage = sensorValue * (5.0 / 1024.0);
        }
        void loop(void)
        {
                sensors.requestTemperatures();
                Celcius=sensors.getTempCByIndex(0);
                Fahrenheit=sensors.toFahrenheit(Celcius);
                for(int i=0;i<10;i++)
        {
                buf[i]=analogRead(analogInPin);
                delay(10);
        }
        for(int i=0;i<9;i++)
        {
                for(int j=i+1;j<10;j++)
                {
                if(buf[i]>buf[j])
```

```
  {
  temp=buf[i];
  buf[i]=buf[j];
  buf[j]=temp;
  }
   }
}
for(int i=2;i<8;i++)
avgValue+=buf[i];
float pHVol=(float)avgValue*5.0/1024/6;
float phValue = -5.70 * pHVol + 21.34;
Serial.println(phValue);
Serial.print("pH");


  Serial.print(" C ");
  Serial.print(Celcius);


  Serial.print(voltage);
  Serial.print("V");
  delay(10000);
}
```

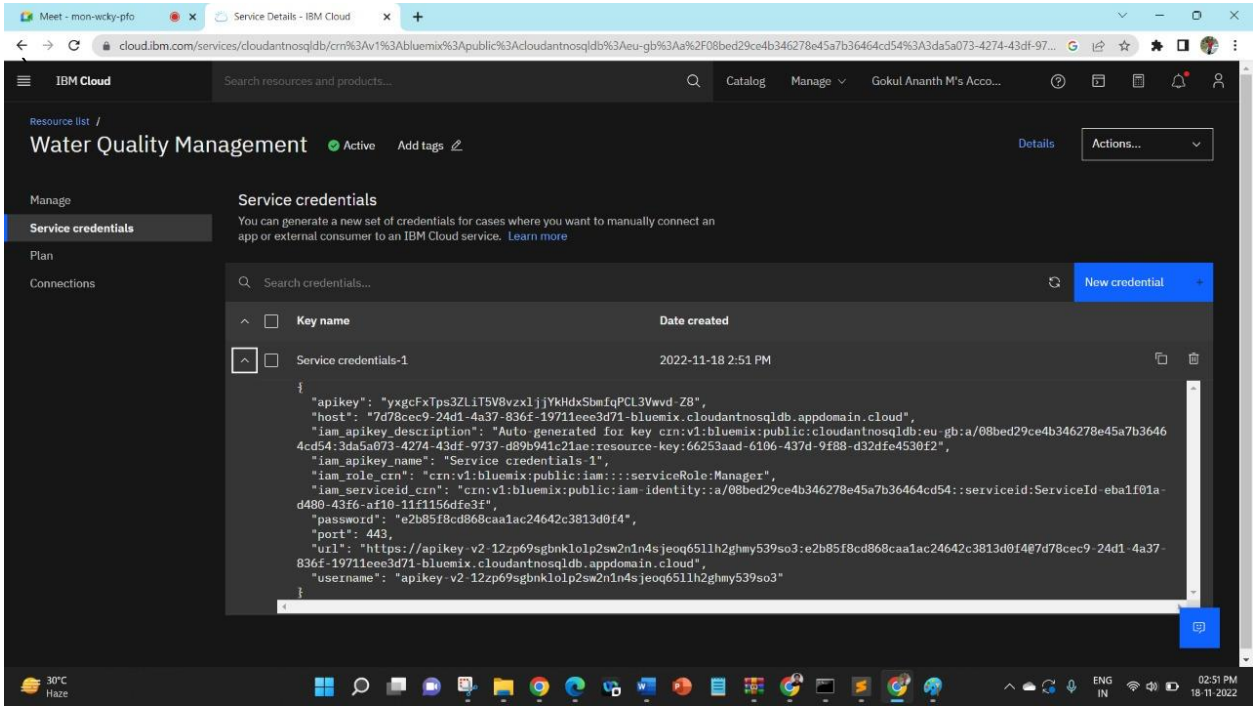


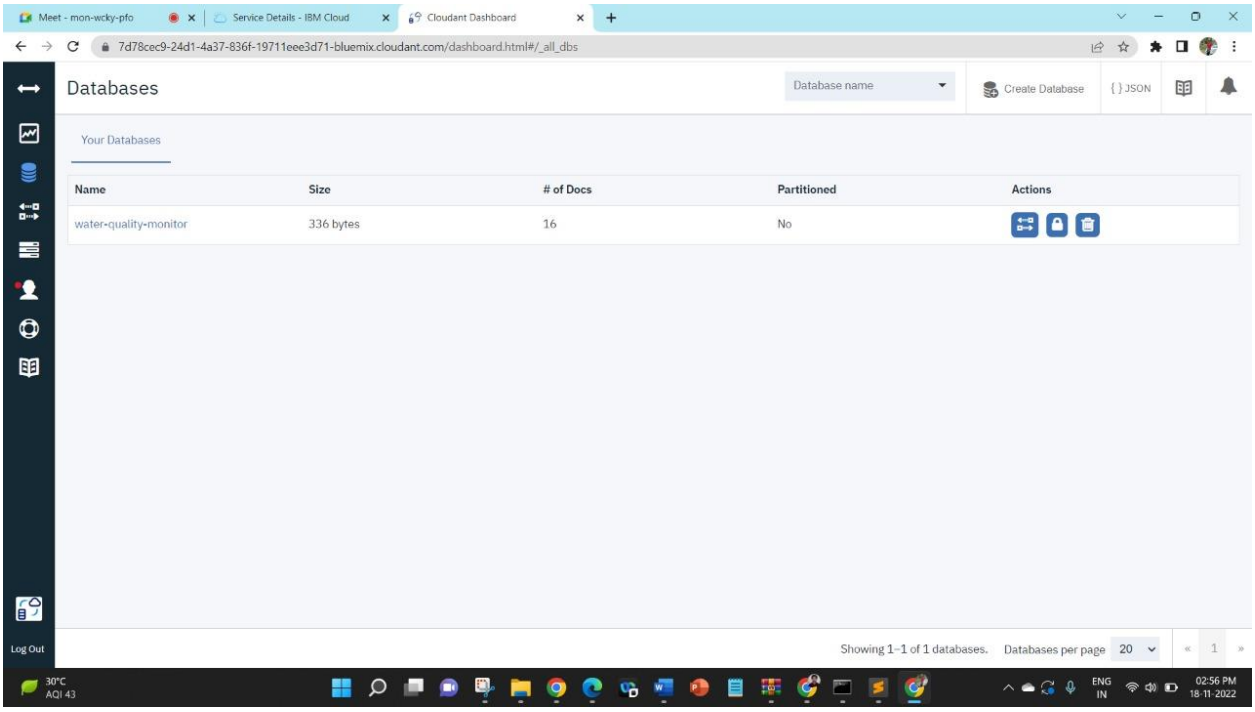
## 7.3 NODE RED IMPLEMENTATION WITH IBM CLOUD:

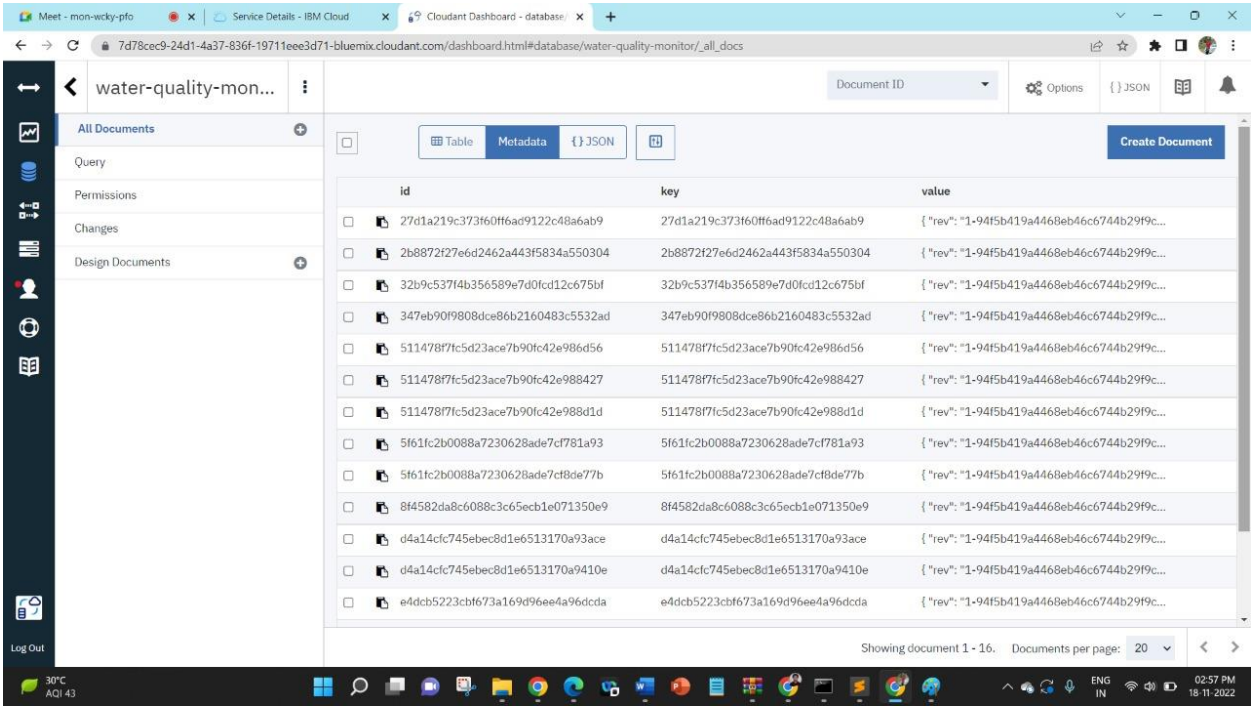


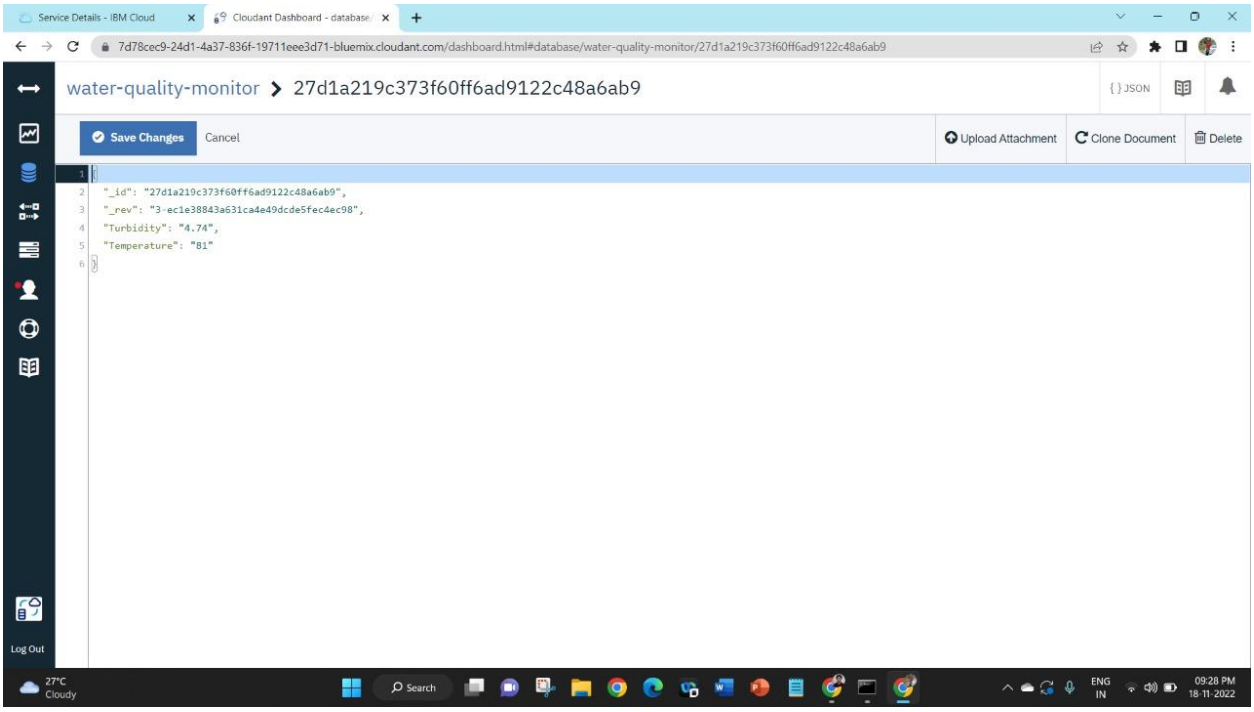

```
global.set("temperature",msg.payload.d.temperature);msg.p
ayload=msg.payload.d.temperature;
global.set("Turb",msg.payload.d.Turbidity);msg.payload=msg
.payload.d.Turbidity;
return msg;
```

- Conclusions from the Visualized data inferred
- The Factors that affect quality of water are:
  - pH value decreases with increase in temperature
  - turbidity increases with increase in temperature (vice versa)
  - pH increases with decrease in turbidity



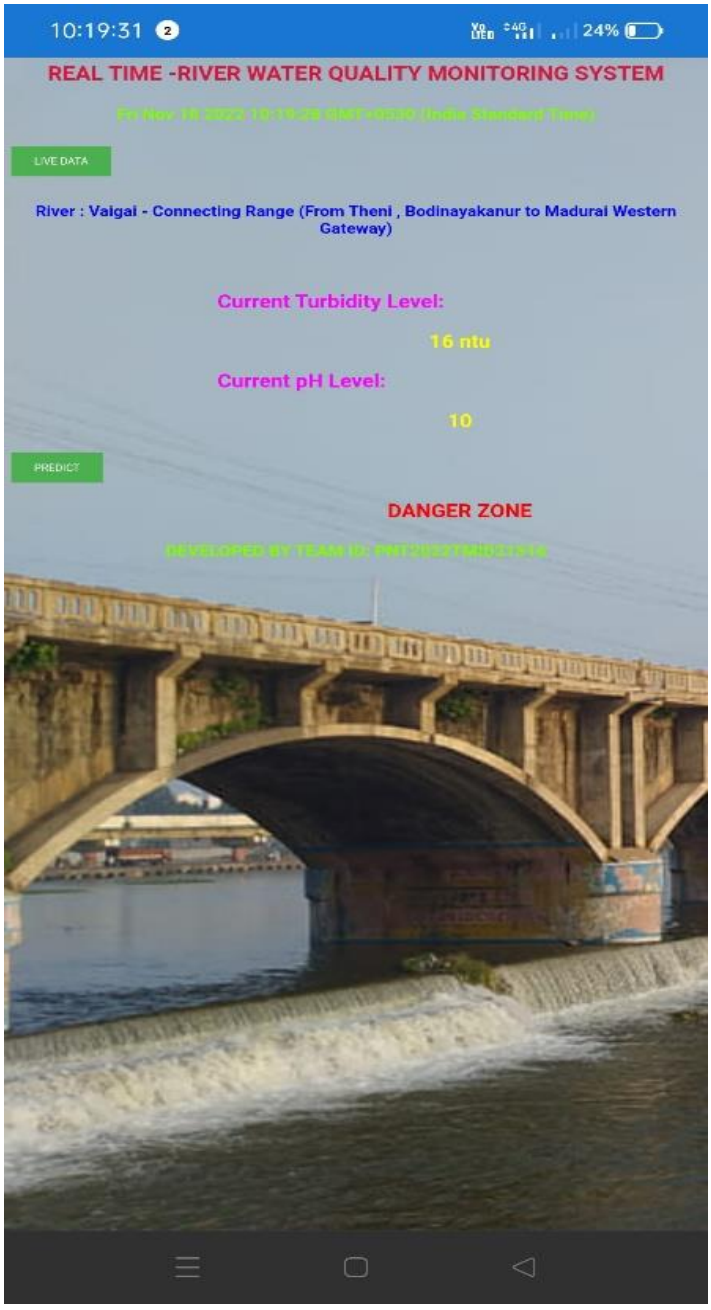

water-quality-mon...
All Documents
Query
Permissions
Changes
Design Documents
Table
Metadata
{ } JSON
Create Document
Document ID
Options
id
key
value
Showing document 1 - 16.
Documents per page: 20
Log Out


water-quality-monitor > 27d1a219c373f60ff6ad9122c48a6ab9
Save Changes
Cancel
Upload Attachment
Clone Document
Delete
{ } JSON
"_id": "27d1a219c373f60ff6ad9122c48a6ab9",
"_rev": "3-ec1e38843a631ca4e49dcde5fec4ec98",
"Turbidity": "4.74",
"Temperature": "81"
Log Out

# CHAPTER 8

# TESTING

## 8.1 TEST CASES (MOBILE APP) :





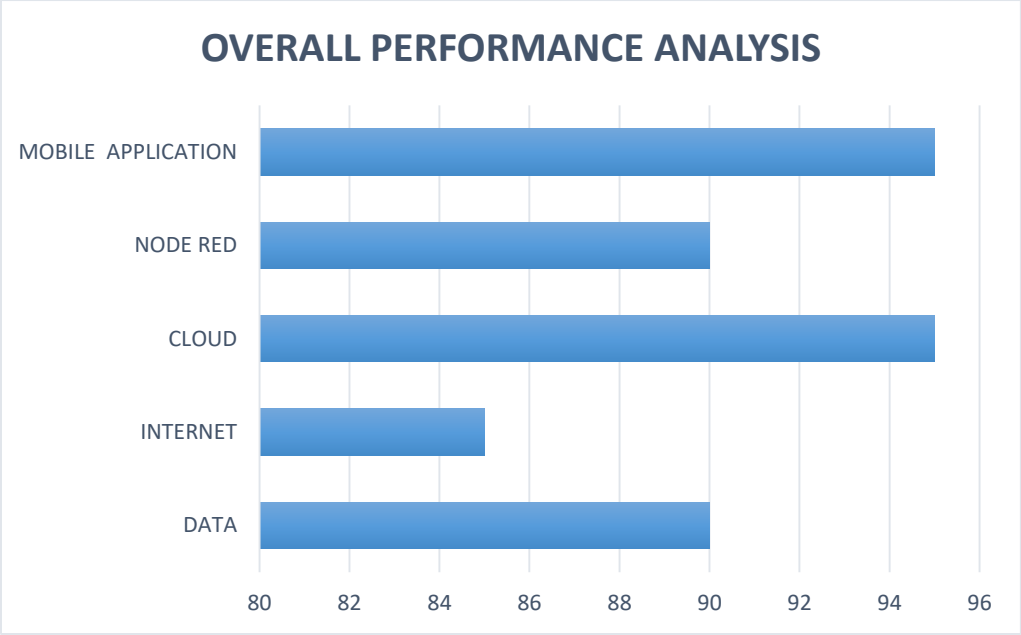
The Mobile application which alerts the end user depending on turbidity & pH value

- ❖ Average pH range- 6.5 – 8.5
- ❖ Average Turbidity level 5-15 ntu

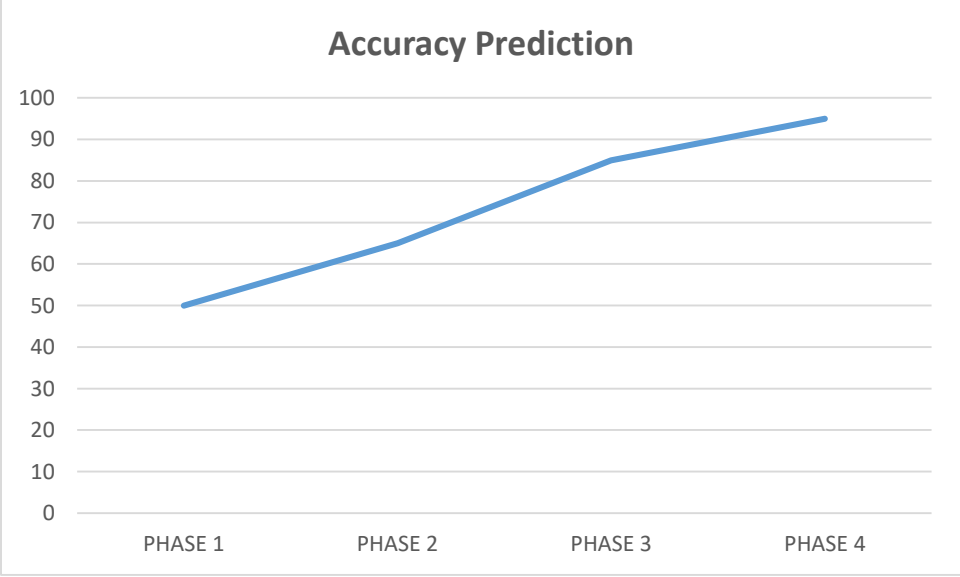
# CHAPTER 9

# RESULTS

## 9.1 PERFORMANCE METRICES:




## 9.2 ACCURACY PREDICTION:



# CHAPTER 10

# ADVANTAGES AND DISADVANTANGES

## 10.1 Advantages of Quality Prediction:

- ❑ Contamination over the particular region could be known
- ❑ Live access & monitor of water bodies from the remote location.
- ❑ User Friendly
- ❑ Efficient, Accurate Results help earlier precautions
- ❑ Instantaneous data
- ❑ Accuracy of measurements
- ❑ Remote Accessibility

## 10.2 Disadvantages of River Water Quality Prediction:

- ❑ Sensors which measures the reading is costly
- ❑ Implementation at all regions and maintenance is required frequently
- ❑ Sometimes signaling, data transmission is challenging in highly remote regions

# CHAPTER 11

# CONCLUSION

## 11.1 CONCLUSION:

The Prediction of river water quality predicts the amount of dissolved chemical substances that a normal water that flows through that region in excess of any amount of the predicted or calculated values it throws an alert alarm which immediately alerts the target officials to take immediate actions.

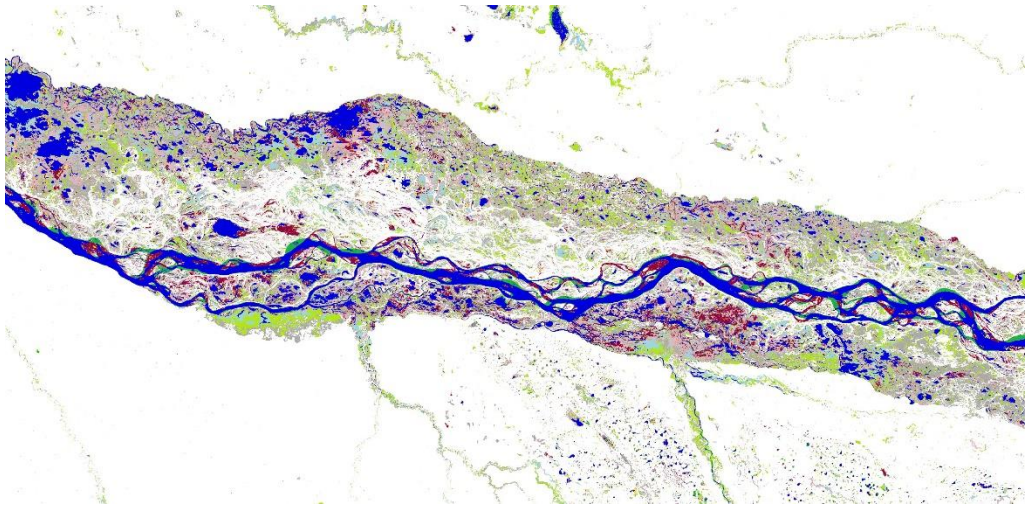

End user is notified immediately using the services by the cloud which responds at instant of time so that premeasures can be built by stopping the water flow and rectifying the problem that caused so that it may not affect the next phases or regions of the river that flow through the path. Thus producing accurate results at instant of time will achieve the goal that is required for estimated problem.

# CHAPTER 12

# FUTURE WORKS

## 12.1 Predict Different Regions:

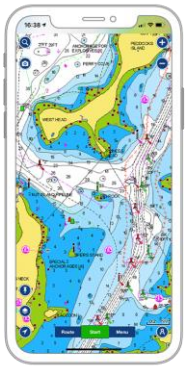
The application is further extended to predict the accurate region that is contaminated by referencing the previous states of the water quality and also it predicts which is the starting point of the occurrence of the quality of water is discriminated. This method helps people to ideate to look at exact location and stop that issue permanently so that it does not occur any more.



**Map of River Vaigai Flows across 3 districts of Tamil Nadu**

## 12.2 Remote All Access in Once Application:

This application will be most useful for any user can view the statistics of any river across anywhere and know the current water flow and it's quality by using the mobile application which at current stage is in development phase will be a huge requirement of cloud database, but will enhance each user to be brought notified by pollutant causing agents around the river bodies.



# CHAPTER 13

# APPENDIX

**Please find below with the link to view the project details & demo :**

**Github:**

**https://github.com/IBM-EPBL/IBM-Project-23882-1659932715**

**App Link:**

**https://drive.google.com/drive/folders/1CW97kGjIWjSyBJGuKxSWcUEdPUFAr-Gj?usp=sharing**

For further Queries,

Please contact us

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**“Better the Quality Better the Future “**