REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROLLING SYSTEM

PROJECT REPORT

TEAM ID	**PNT2022TMID17622**
MENTOR NAME	**LAKSHMI S V**

TEAM MEMBERS

1.KALAIARASI

2.ANANTHA KUMAR D

3.GANESH M

4.SABARISHWARAN

1. **INTRODUCTION**
    1. Project Overview
    2. Purpose
2. **LITERATURE SURVEY**
    1. Existing problem
    2. References
    3. Problem Statement Definition
3. **IDEATION & PROPOSED SOLUTION**
    1. Empathy Map Canvas
    2. Ideation & Brainstorming
    3. Proposed Solution
    4. Problem Solution fit
4. **REQUIREMENT ANALYSIS**
    1. Functional requirement
    2. Non-Functional requirements
5. **PROJECT DESIGN**
    1. Data Flow Diagrams
    2. Solution & Technical Architecture
    3. User Stories
6. **PROJECT PLANNING & SCHEDULING**
    1. Sprint Planning & Estimation
    2. Sprint Delivery Schedule
    3. Reports from JIRA
7. **CODING & SOLUTIONING (Explain the features added in the project along with code)**
    1. Feature 1
    2. Feature 2
    3. Database Schema (if Applicable)
8. **TESTING**
    1. Test Cases
    2. User Acceptance Testing
9. **RESULTS**

1.INTRODUCTION

1.1PROJECT OVERVIEW

This paper proposes a sensor-based water quality monitoring system. 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 people to become conscious against contaminated water as well as to stop polluting the water.The essential parameters of the water quality vary based on the application of water. For example, for aquariums, it is necessary to maintain the temperature, pH level, dissolved oxygen level, turbidity, and the level of the water in a certain normal range in order to ensure the safety of the fish inside the aquarium. For the industrial and household applications, however, some parameters of the water are more essential tobe monitored frequently than the others, depending on the usage of the water.The traditional method for monitoring of the water quality is such that the water sample is taken and sent to the laboratory to be tested manually by analytical methods. Although by this method the chemical, physical, and biological agents of the water can be analyzed, it has several drawbacks. Firstly, it is time consuming and labor intensive. Secondly, the cost for this controlled, displayed, and transferred. Compared to the conventional water quality testing techniques, sensor based water quality testing has many advantages such as accurate, high sensitivity, good selectivity, speed, fast response, low cost etc.

1.2PURPOSE

The main aim of this project is to detect the quality of river water and quantity of pollutants present in water and so that river water quality is monitored and effective measures can be taken accordingly . To develop a system for real time quality assessment for river water health at residential places using Raspberry Pi. Sensors are used to gather different parameters in River water to monitor water health in real time. IoT is appeared to be a better solution as reliability, scalability, speed, and persistence can be provided.

2.LITERATURE SURVEY

2.1EXISTING PROBLEM

We examined many existing systems produced by researchers. Various authors have developed distinct methods to assess water quality by examining characteristics such as temperature, pH, and conductivity, among others. We built a smart water monitoring system that can conduct all of these monitoring functions after taking into account all of these factors. Stephen Brosnan researched the use of a WSN to collect real-time water quality information (WQP). QuioTie-Zhn created an online water quality monitoring system using GPRS/GSM. The data was transmitted through the GPRS network, allowing the WQP to be checked remotely. Kamal Alameh demonstrated a web-based WSN that uses ZigBee and WiMAX networks to detect water contamination.The system gathered, analysed, and routed measured data from sensors through ZigBee gateway to the web server over WiMAX network to monitor water quality from great distances in real time. Dong He created a WQM system based on WSN. The ZigBee network was used to power the remote sensor. WSN tested WQP and used GPRS to send data to the Internet. Information was acquired at a distant server via the Web. A low-cost system architecture for real-time water quality monitoring in IoT employs sensors to examine a variety of critical physical and chemical characteristics of water. Water factors including turbidity, temperature, pH, and dissolved oxygen conductivity may be monitored. In our proposal, we presented an IoT-based water quality monitoring system.

2.2REFERENCES

1.IoT Based Real-time River Water Quality Monitoring System Mohammad Salah UddinChowdury, Talha BinEmran, SubhasishGhosh, AbhijitPathak, Mohd. ManjurAlam, NurulAbsar KarlAndersson.
2.Real-Time Water Quality Monitoring System Jyotirmaya Ijaradar, Subhasish Chatterjee
3.River Water Quality Robot Embedded with Real-Time Monitoring System: Design and Implementation Mohd Amirul Aizad M. Shahrani; Safaa Najah Saud Al-Humairi; Nurul Shahira Mohammad Puad; Muhammad Asyraf Zulkipli.
4.S. Selvin, R. Vinayakumar, E. A. Gopalkrishnan, V. K. Menon and K. P. Soman - Stock price predictionusing LSTM, RNN and CNN-sliding window model - 2017.
5. Murtaza Roondiwala, Harshal Patel, Shraddha Varma, “Predicting Stock Prices Using LSTM” in Undergraduate Engineering Students, Department of Information Technology, Mumbai University, 2015.
6. Xiongwen Pang, Yanqiang Zhou, Pan Wang, Weiwei Lin, “An innovative neural network approach for stock market prediction”, 2018.

2.3PROBLEM STATEMENT DEFINITION

Our goal is to develop a system for real time quality assessment for water health using Internet of things. pH, Turbidity and Temperature sensors are used to gather the parameters necessary to monitor water health in real time. Following are the objectives of the proposed system. To measure various chemical and physical properties of water like pH, temperature and particle density of water using sensors. Send the data collected and send it to IBM cloud based Database Send alert messages when any discrepancies are found in the water quality.

3.IDEATION & PROPOSED SOLUTION

3.1EMPATHY MAP CANVAS

An empathy map is a straightforward, easy-to-understand picture that gathers information about a user's behaviour and attitudes.

It is a valuable tool for assisting teams in better understanding their users.

Understanding the real problem and the person experiencing it is necessary for developing an effective solution. The map-making activity lets participants analyze things from the user's point of view, as well as his or her goals and obstacles.

REFERENCE:https://app.mural.co/t/kalaiarasir1577/m/kalaiarasir1577/1666178334730/ba29418dc08efd6a604f8151d98f7258ed510402?sender=u6e206caa4702bf63b1574822

Template

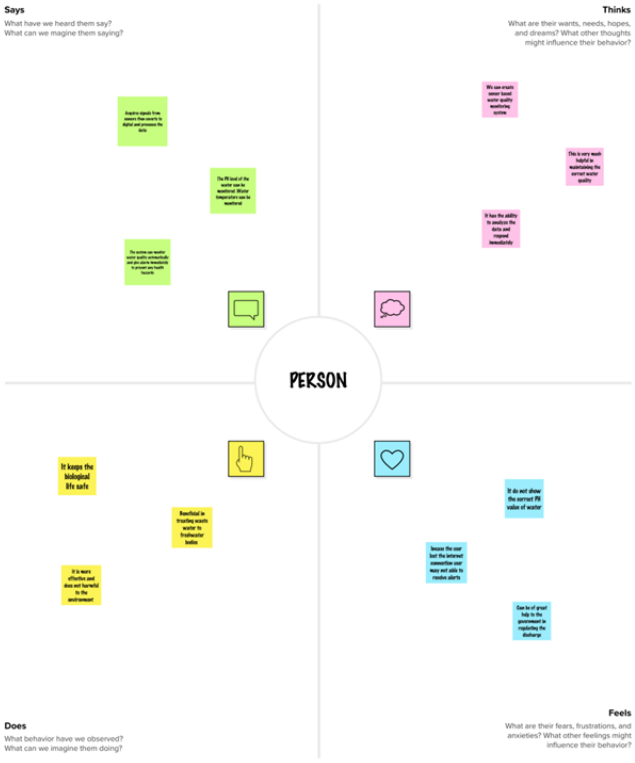
Empathy map

Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.

Share template feedback

Build empathy

The information you add here should be representative of the observations and research you've done about your users.



Need some inspiration?

See a finished version of this template to kickstart your work.

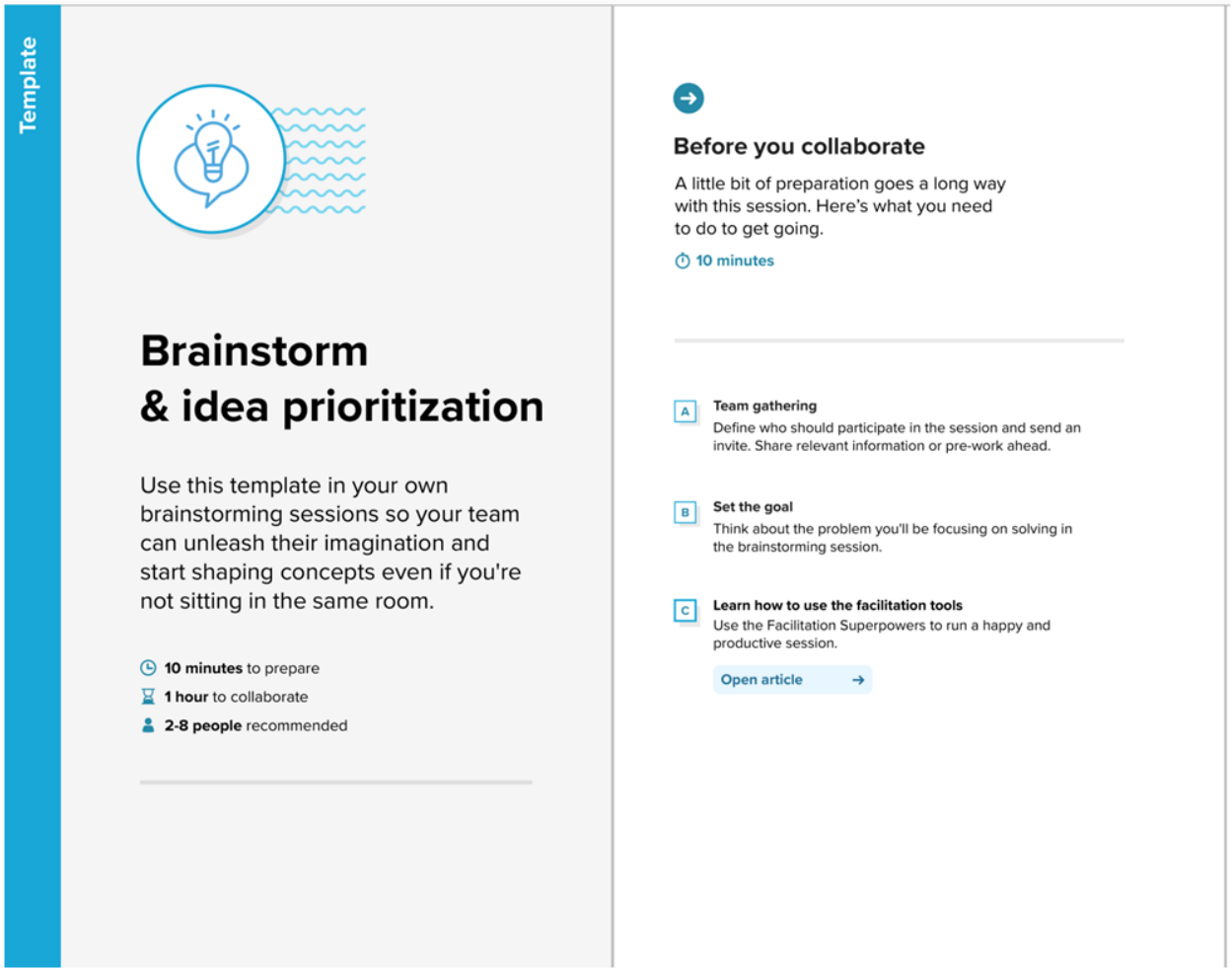
Open example →

3.2IDEATION & BRAINSTORMING

Brainstorming creates a free and open environment in which everyone in a team is encouraged to engage in the creative thought process that leads to issue solutions. Prioritizing volume above value, unconventional ideas are welcomed and developed upon, and all participants are encouraged to contribute, assisting each other in developing a wealth of innovative solutions.

Use this template in your own brainstorming sessions so that your team may let their imaginations run wild and begin molding notions even if you aren't all in the same room.

REFERENCE:https://app.mural.co/t/kalaiarasir1577/m/kalaiarasir1577/1666183101442/85768c32423edfbc414f43ab29c012f39a6597b5?sender=u6e206caa4702bf63b1574822



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

kalaiarasi R

- Affects the aquatic organisms
- Level of nutrients increases
- Water sample testing
- Excessive growth of algal blooms
- Create the alert warning system
- The toxics harmful to humans

Anantha kumar D

- Awareness to the farmers to reduce the fertilizers
- No clearance in water transparency
- Lower oxygen concentration
- Agricultural areas affect from erosion and leaching
- It distrupt the wildlife
- Encourage to use the organic manure

Ganesh M

- Creating dead zones
- Fast . growing algae species
- Decreased oxygen concentration
- Affects agro fertilizers
- PH level monitoring
- Analyze dust particles present in water

Sabarishwaran G

- Physical and chemical parameters analyses
- Avoid sewage disposal in the lake
- Causes eeutrophication
- Alerting through sms
- Testing river water condition
- Way to reduce fertilizers use

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

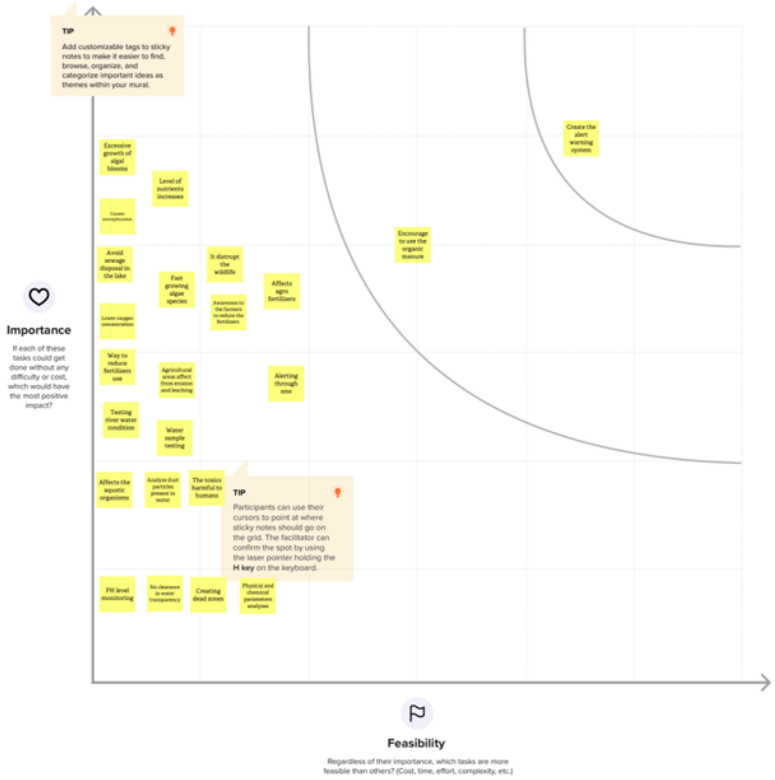
20 minutes

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

A **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

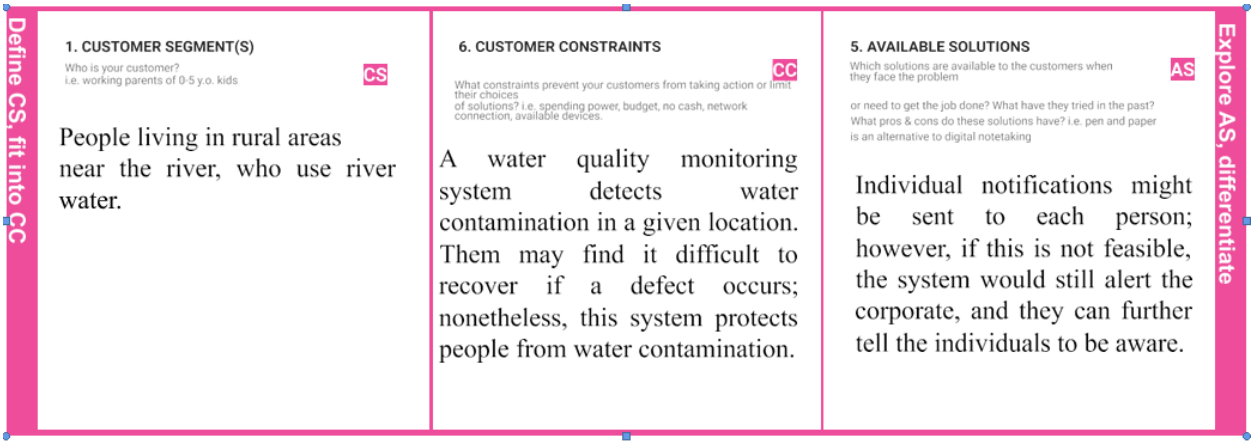
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

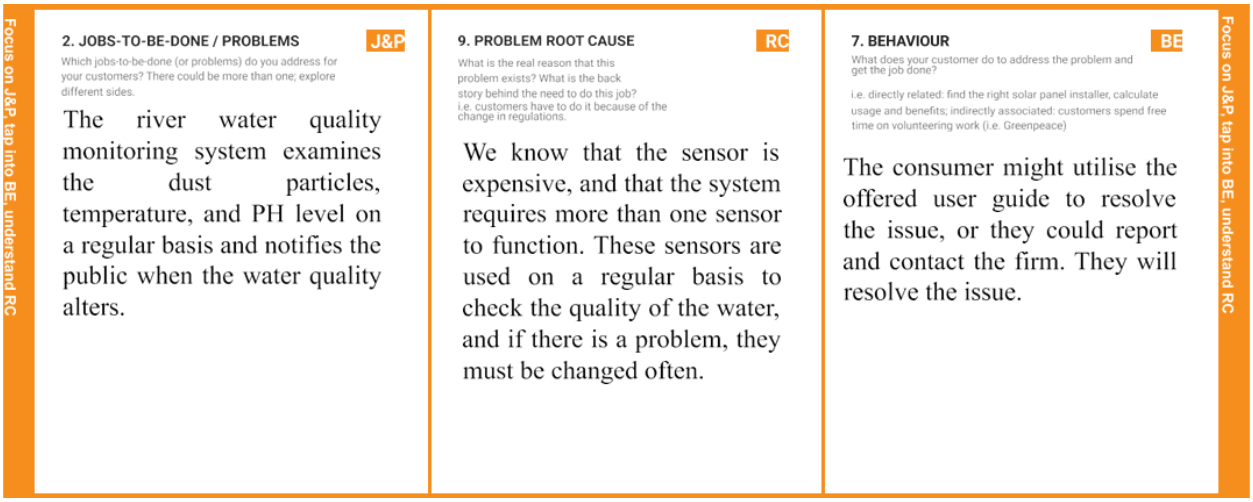
Share template feedback

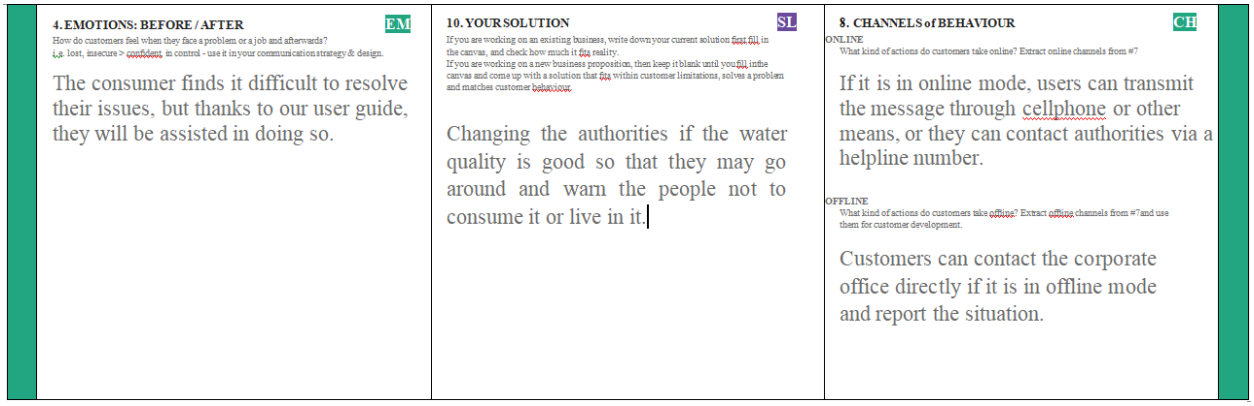
3.3PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	Collecting water samples from all areas of the water body is tough. Because lab testing and analysis require time, the lab result does not match real-time water quality assessment owing to measurement delay.
2.	Idea / Solution description	Detecting dust particles, monitoring the PH level of the water, and changing the authority if the water quality is poor.
3.	Novelty / Uniqueness	The novelty of our suggested idea is that the authorities will not have to regularly check the water. A web application can be used monitor the quality of river water. The quality parameter will be regularly tracked with standard measurements.
4.	Social Impact / Customer Satisfaction	By warning people when the water quality is low, communities will not suffer from poor water quality.
5.	Business Model (Revenue Model)	This project is helpful for identifying pollutants, simulating and evaluating quality parameters for quality control, and monitoring water quality.
6.	Scalability of the Solution	The measurement of real-time readings and constant monitoring in the maintenance of water quality.

3.4PROBLEM SOLUTION FIT







4.REQUIREMENT ANALYSIS

4.1FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR NO:	FUNCTIONAL REQUIREMENT (EPIC)	SUB REQUIREMENT (STORY/SUB-TASK)
FR 1	Arduino(control system)	Sensors are connected to Arduino, which takes measurement data from them on a regular basis.
FR 2	Ph level detection	Ph sensor is used to monitor the water quality and the signals are send to Arduino.
FR 3	Turbidity detection	The turbidity sensor TS-300B monitors the turbidity in the water and sends the results to Arduino.
FR 4	Ultrasonic generator	Waves created at regular intervals to remove algae at 25%, 50%, and 100%

4.2NON-FUNCTIONAL REQUIREMENTS

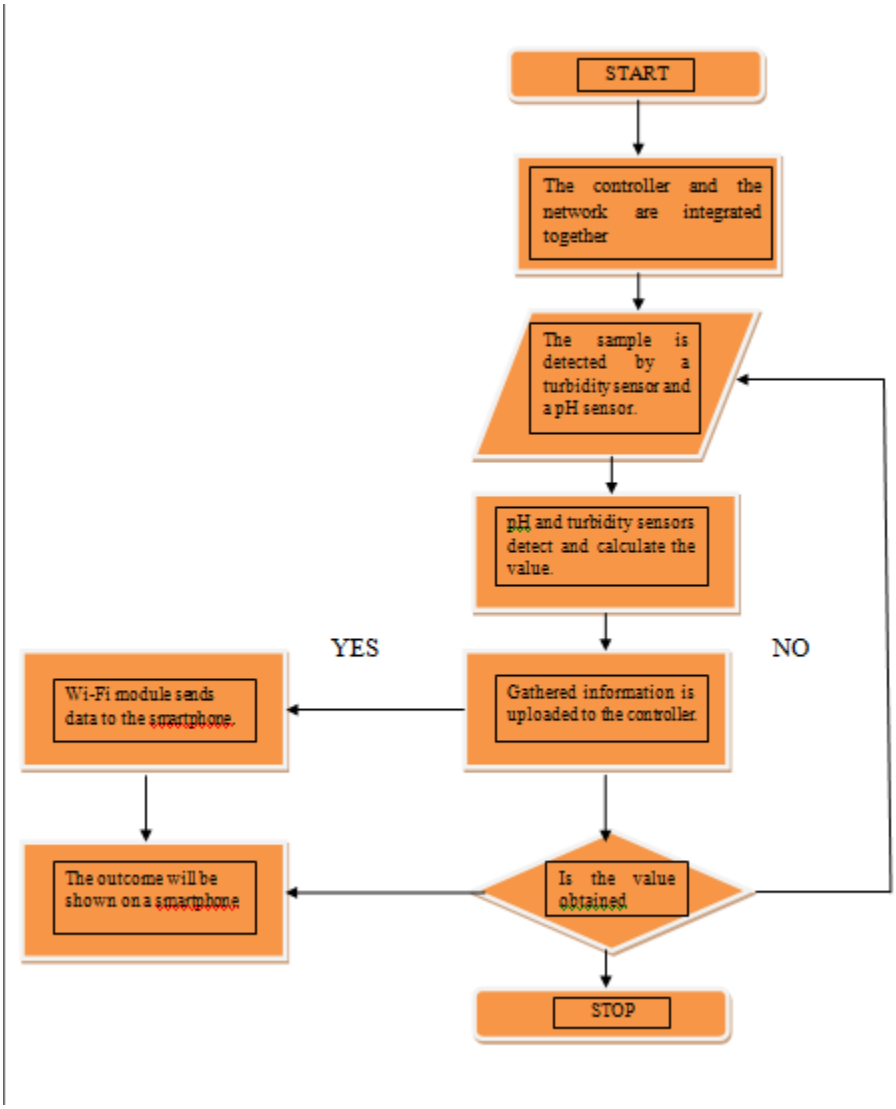
Following are the non-functional requirements of the proposed solution.

NFR NO:	NON-FUNCTIONAL REQUIREMENT	DESCRIPTION
NFR 1	Usability	Water quality must be monitored to ensure that it is safe for humans to drink as well as for wildlife and marine life, as well as to understand environmental implications and to avoid harming sea life.
NFR 2	Security	IoT networks are extremely secure, and communication speeds are fast. All concerns are easily resolved with technology.
NFR 3	Reliability	The water quality and monitoring system is dependable, and its production is guaranteed. Because standardized hardware and software designs are employed.
NFR 4	Performance	Water quality is monitored in real time, and authorities are notified if the quality is poor.
NFR 5	Availability	The monitoring system is made accurate and ready for usage at any moment.
NFR 6	Scalability	The system with high scalability and low-powered system.

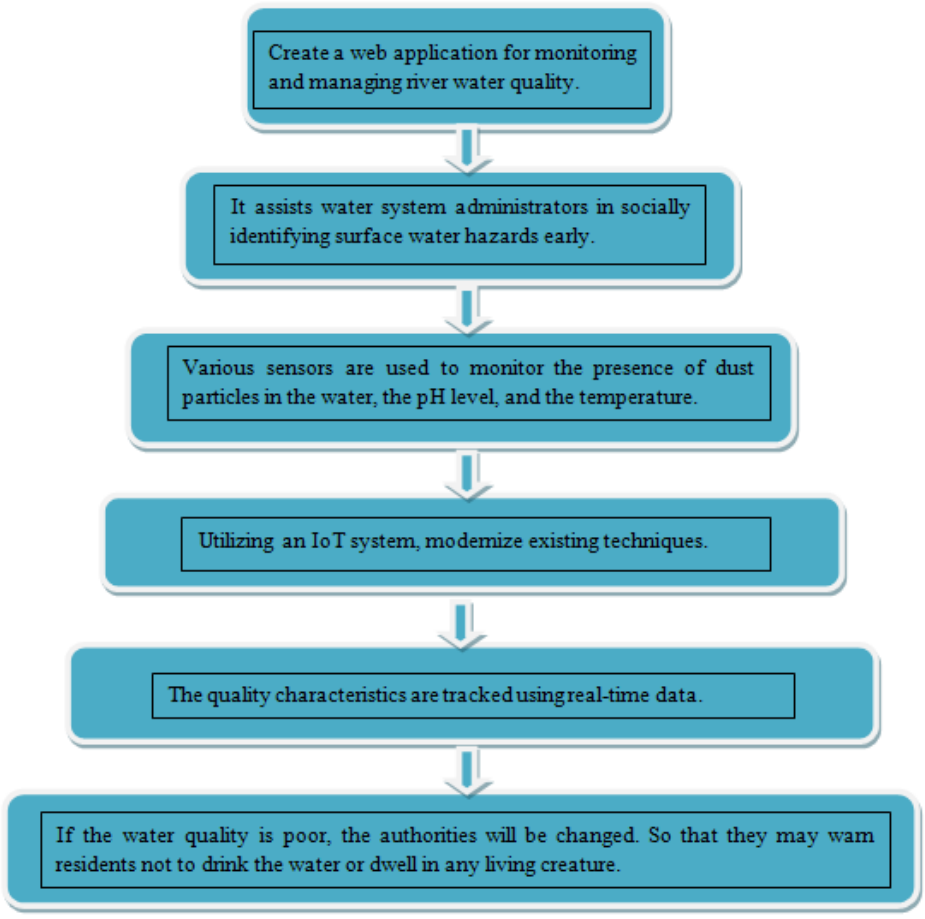
5.PROJECT DESIGN

5.1DATA FLOW DIAGRAMS

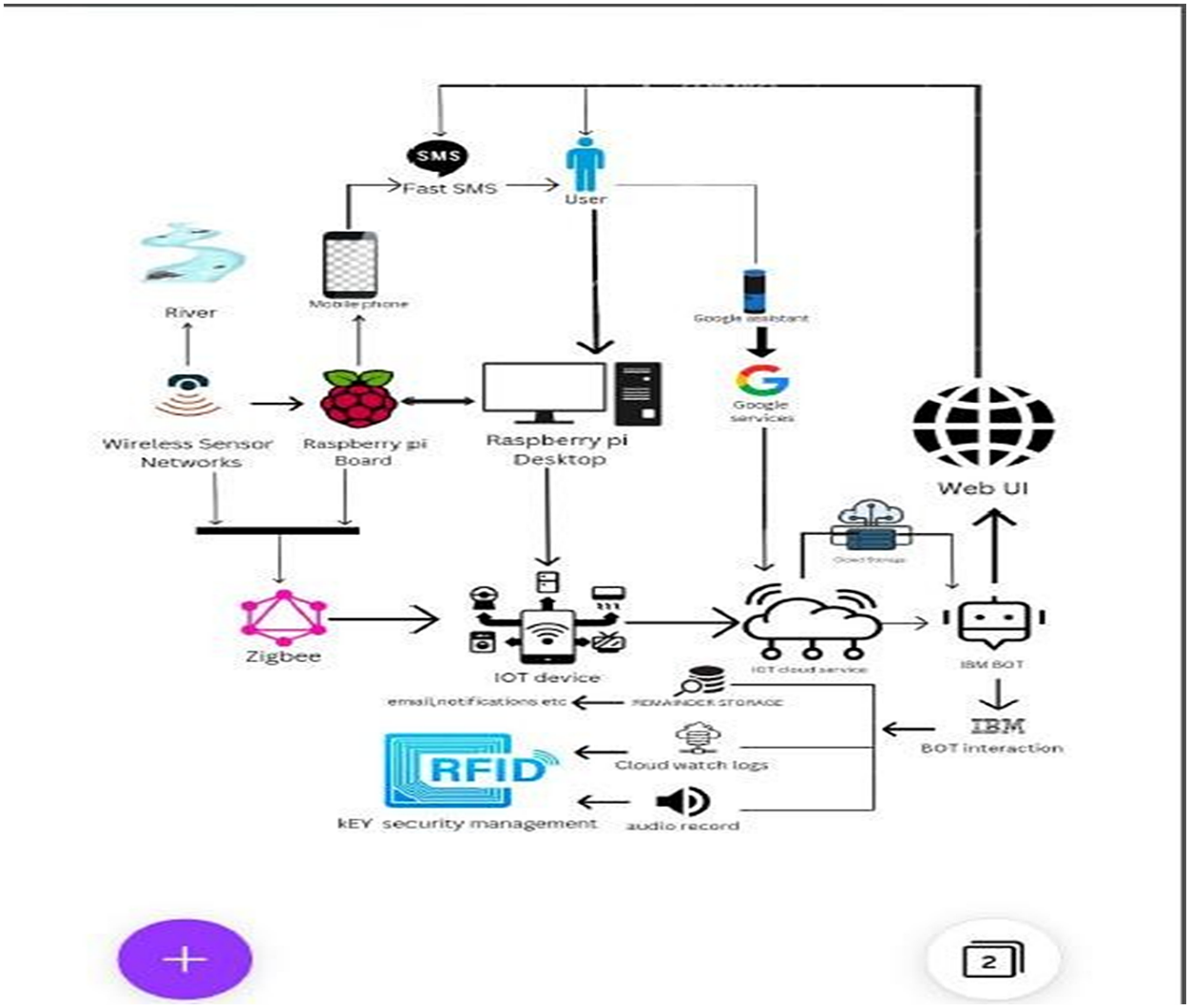
A Data Flow Diagram (DFD) is a classic visual depiction of a system's information flows. A tidy and clear DFD may graphically display the appropriate quantity of system need. It demonstrates how data enters and exits the system, what alters the data, and where it is kept.



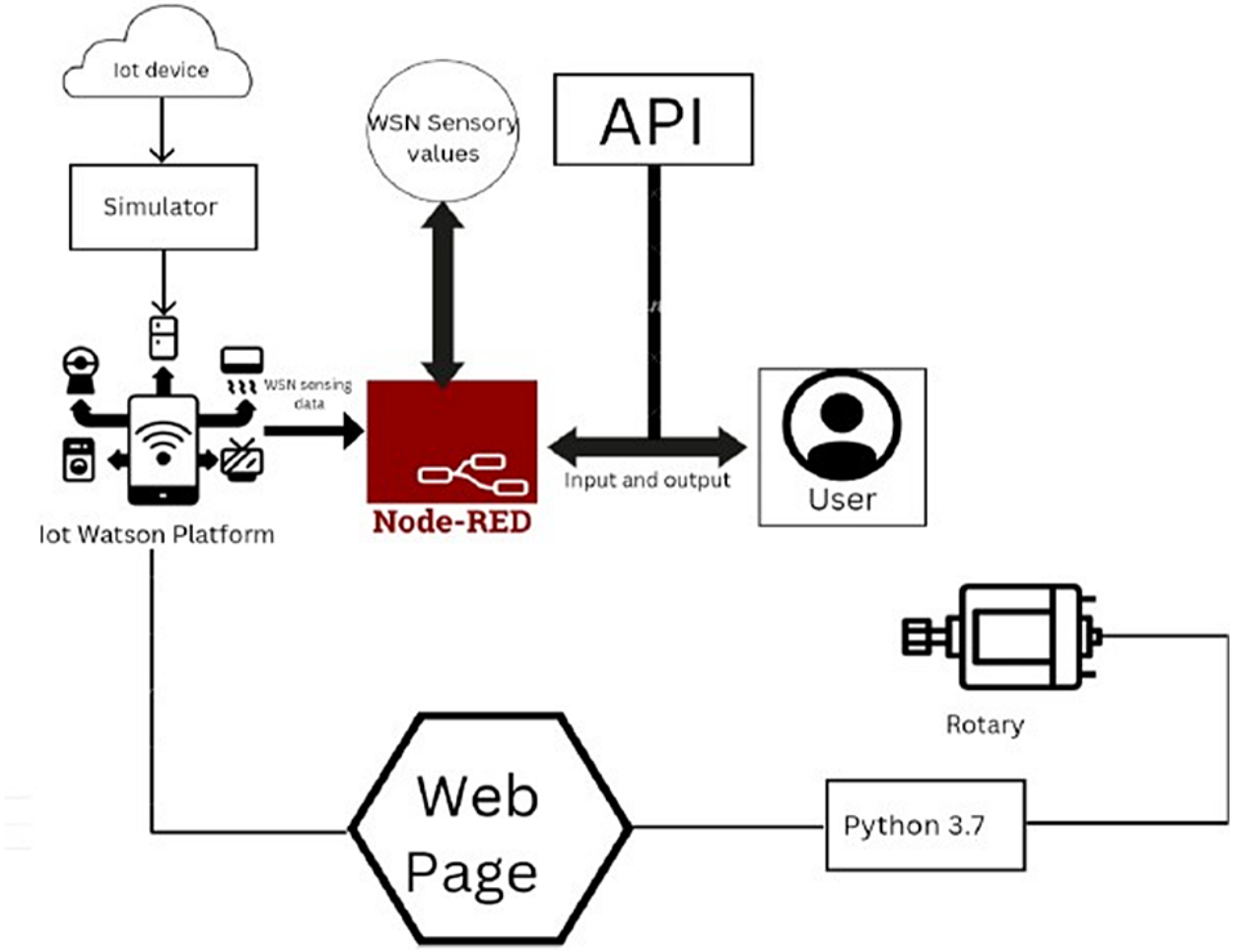
5.2SOLUTION AND TECHNICAL ARCHITECTURE

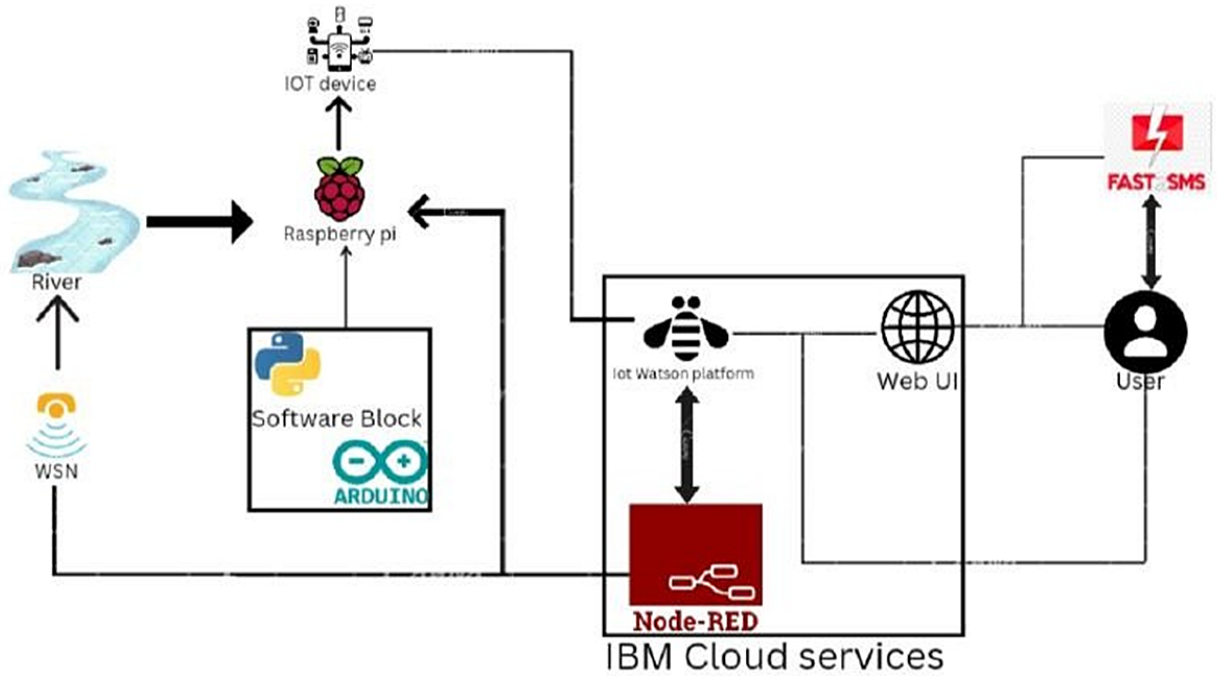


SOLUTION ARCHITECTURE



TECHNICAL ARCHITECTURE

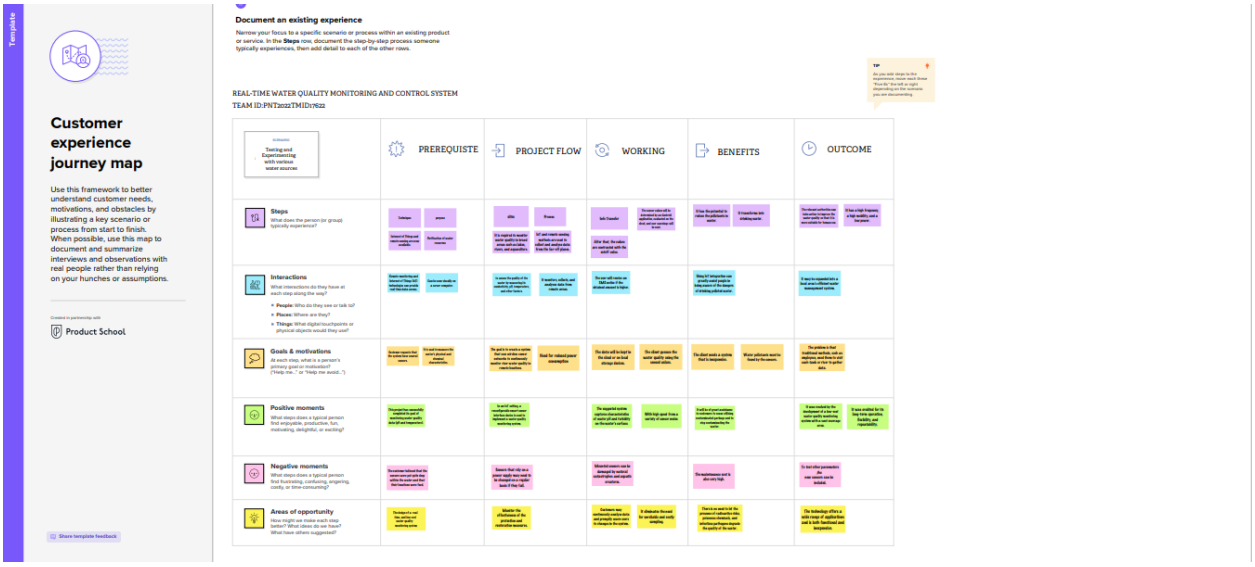



IOT device
Raspberry pi
River
WSN
Software Block
ARDUINO
Iot Watson platform
Web UI
User
FAST SMS
Node-RED
IBM Cloud services

5.3USER 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 may register for the application by providing my email address, password, and password confirmation.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, once I have registered for the application, I will receive a confirmation email.	I can receive e confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I may sign up for the app using Google.	I can register & access the dashboard with Google	Low	Sprint-2
		USN-4	As a user, I may sign up for the application using Gmail.	I can register through the mail.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password.	I can get login information.	High	Sprint-1
	User Interface	USN-6	As a user, the interface should be user-friendly manner	I can able to access easily	Medium	Sprint-1
Customer (Web user)	Dashboard	WUSN-1	As a web user, you have access to the sensor inputs.	I can know quality of water	High	Sprint-1
Customer Care Executive	View Manner	CCE-1	As a customer service, data visualization must be easy to grasp.	I can understand the various data comparisons by visuals	High	Sprint-1
	Taste	CCE-2	As a customer service representative, I can see the water's quality (saltiness).	I can easily know whether it is salty or not	High	Sprint-1
	Colour Visibility	CCE-3	As a customer care , I can able predict the water color	I can easily know the condition of the water by color	High	Sprint-1
Administrator	Risk Tolerant	ADMIN-1	The administrator should manage the system, the server, and the application	Admin should monitor and store the records with caution	High	Sprint-2

CUSTOMER JOURNEY MAP



6.PROJECT PLANNING AND SCHEDULING

6.1SPRINT PLANNING AND ESTIMATION

S.NO	ACTIVITY TITLE	DESCRIPTION	DURATION
1.	Understanding the project requirement	Create a repository and assign team members using Github, give them the assignment, all persons educate students how to use, open, and classify the Github, IBM education career.	1 WEEK
2.	Starting of project	Students should attend IBM portal classes to construct and develop a preliminary diagram based on the project description and obtain knowledge on IOT and IBM projects, and the team leader should allocate tasks to each project member.	1 WEEK
3.	Attend class	Team members and the team captain must attend IBM and NALAYATHIRAN classes to watch and learn, and they must apply in advance for MIT project permission.	4 WEEK
4.	Budget and scope of project	Budget and assess the utilization of IOT in the project, and talk with team for budget projection to anticipate the customer's willingness to buy.	1 WEEK

6.2SPRINT DELIVERY SCHEDULE

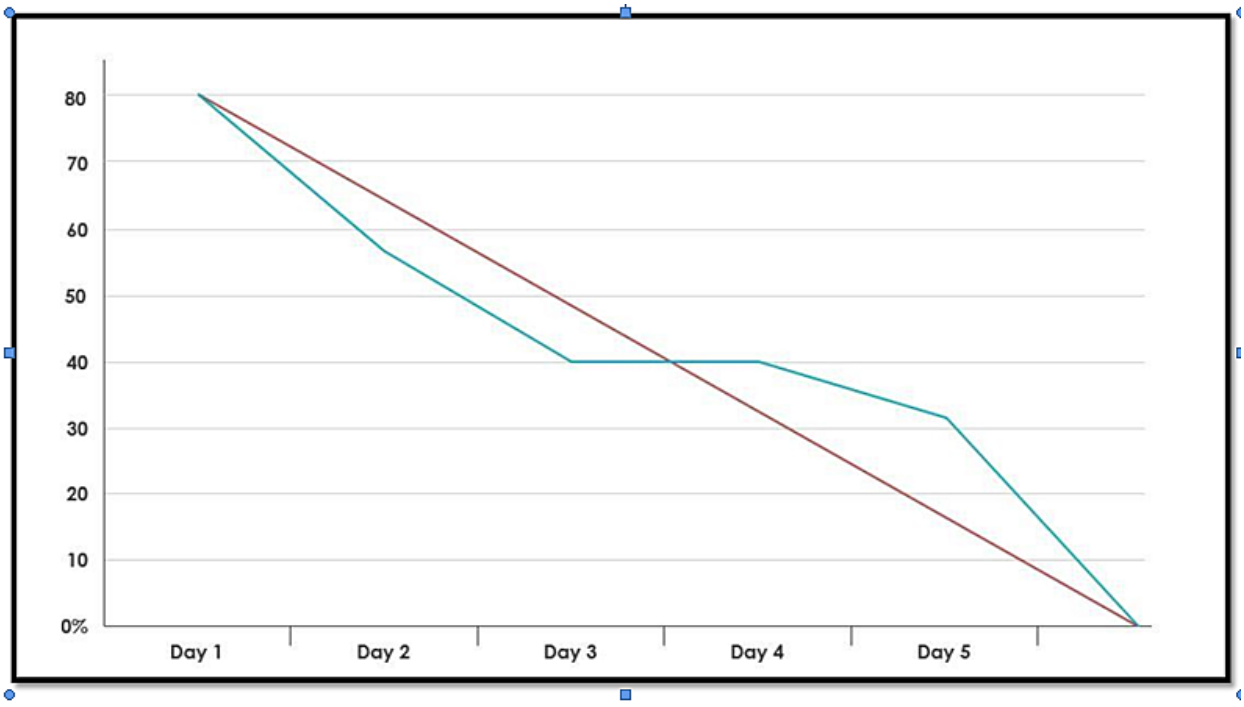
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Kalaiarasi R
Sprint-1		USN-2	As a user, I will receive confirmation email onceI have registered for the application	1	High	Sabarishwaran G
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Anantha kumar D
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Ganesh M
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	Kalaiarasi R
Sprint-1	User Interface	USN-6	As a user, I should not need any pre requisites to handle theUI	1	Medium	Sabarishwaran G
Sprint-1	Dashboard	WUSN-1	As a web user,able to accessthe inputs fromthe sensors	2	High	Ganesh M
Sprint-1	View Manner	CCE-1	As a customer care,Data visualization mustbe in good understandable view.	2	High	Anantha kumar D
Sprint-1	Taste	CCE-2	As a customer care,I can able to view thecomposition of water(e.g. Minerals, etc.)	1	High	Kalaiarasi R
Sprint-1	Colour Visibility	CCE-3	As a customer care,I should know the water colour	1	High	Sabarishwaran G
Sprint-2	Risk Tolerant	ADMIN-1	Administrator shouldhandle the system,server and takecare of the application.	1	High	Kalaiarasi R

6.3REPORTS FROM JIRA

Imagine we have a10-day sprint duration, and the velocityof the team is 20 (points per sprint). Let's calculate the team's averagevelocity (AV) per iteration unit (story points per day)

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

BURNDOWN CHART



7.CODING AND SOLUTION

7.1FEATURE 1

```
float myph(){
int16_t adc0;// we read from the ADC, we have a sixteen bit integer as a result
adc0 = ads.readADC_SingleEnded(0);
for(int i=0;i<10;i++){
buf[i]= adc0;
delay(100);
}
for(int i=0;i<9;i++){
for(int j=i;j<10;j++){
if(buf[i]>buf[j]){
temp=buf[j];
buf[i]=buf[j];
buf[j]=temp;
}
}
}
avgval=0;
for(int i=2;i<8;i++){avgval+=buf[i]; }
float ads_avg= avgval/6;
float phvol=(ads_avg * 0.1875)/1000;
float phval=-3.7429*phvol + 15.791;
MY_SERIAL.print("Sensor = ");
MY_SERIAL.println(phval);
MY_SERIAL.print("Voltage = ");
MY_SERIAL.println(phvol);
delay(1000);
if (phval <=1 || phval>13.90){
MY_SERIAL.print("Check the pH meter");
return 13.89 ;
}
return phval;
}
```

7.2FEATURE 2

```
float myturb(){
int16_t adc1; // we readfrom the ADC, we have a sixteenbit integer as a result
adc1 = ads.readADC_SingleEnded(1);
float voltage= (adc1 * 0.1875)/1000; //converting analog readingto
voltage(digital value)
senseTurbidity= voltage+1; // converting
sensorvoltage to 5Vreturn senseTurbidity;
MY_SERIAL.print("TURBIDITY VALUE:"); //Print the output data to the serial
MY SERIAL.println(senseTurbidity);
MY SERIAL.print("\n"); delay(1000);
if (senseTurbidity>=3.90 ){
MY_SERIAL.println("\tWater is clear \n");
}
if (senseTurbidity<3.90 && senseTurbidity>=3.30 ){
MY_SERIAL.println("\t Wateris normal clear \n");
}
else if(senseTurbidity<3.30)
MY_SERIAL.println("\t Warning.Water is muddy or very cloudy!!!!!!! \n");
}
```

8.TESTING

8.1TEST CASES

DEFECT ANALYSIS

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

TEST CASE ANALYSIS

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

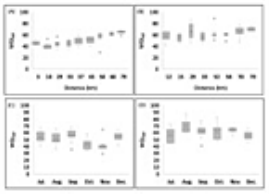
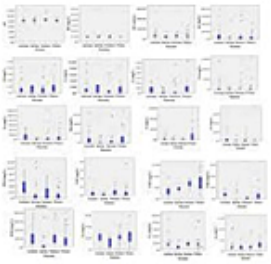
8.2USER ACCEPTANCE TRAINING

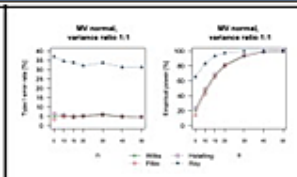
Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	Registration form
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup	Email
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials	Facebook
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	Gmail
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	Bot interaction
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	Web interface

Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets
1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://shopenzer.com/	Login/Signup popup should display	Working as expected	Pass	login credentials are simple, but anyways an autologin option is better.
1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	https://shopenzer.com/	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	pass	Steps are not clear to follow
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123	User should navigate to user account homepage	Working as expected	pass	yeah the process and refreshing of home page is good.
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail password: Testing123	Application should show 'incorrect email or password ' validation message.	Working as expected	pass	Shows username or password is invalid, can't always remember the credidentials
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123678686786876876	Application should show 'incorrect email or password ' validation message.	Working as expected	pass	difficult to login the page due to many conditions
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam password: Testing123678686786876876	Application should show 'incorrect email or password ' validation message.	Working as expected	pass	correct password or username is to be entered till then it serves invalid credidentials message.Or it is imminent to recreate the password. it's complex and tired.

9.RESULTS

9.1PERFORMANCE METRICS

S.no	Parameter	Values	Screenshot
1.	Model summary	-Real time river water quality monitoring system is based on iot which is implemented such a way for best product performance.	
2.	Accuracy	Training accuracy- While training the start point may be front end or back end.so there is no disturbance while training as	

		objects,modules and methods are perfectly implemented. Validation accuracy- Risk management is immediate and efficient as risk resources act immediately.its because resources are implemented long before testing of products.		
3.	Confidence level(only yolo project)	Class detected- Yes Confidence score- 90%		

10.ADVANTAGES

- It collect various parameters from water, such as pH, dissolved oxygen, turbidity, conductivity, temperature, and so on.
- This sleek and easily portable water quality meter can give you accurate measurements on pH, total dissolved salts, electrical conductivity and the temperature of your water.

DISADVANTAGES

- Due to the limitation of the budget, we only focus on measuring the quality of river water parameters.
- Thisproject can be extended into an efficient water management systemof alocal area.
- Moreover, other parameterswhich wasn’t the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygencan also be quantified.
- So the additional budget is required for further improvement of the overall system.

11.CONCLUSION

During the project development phase, a thorough comparison of real-time analytics technologies such as Spark streaming analysis through Spark MLlib, Deep learning neural network models, and the Belief Rule Based (BRB) system will be carried out. This study would advocate for systematic testing of the suggested technologies in various quality of river water in Bangladesh. Due to funding constraints, we are merely assessing the quality of river water parameters. This idea may be expanded into a local area's effective water management system. Furthermore, other factors not covered by this research, such as total dissolved solids, chemical oxygen demand, and dissolved oxygen, can be measured. As a result, extra funds are necessary to strengthen the whole system.

12.FUTURE SCOPE

Thisproject can be extended into an efficient water management system of a local area. Moreover, other parameterswhich wasn’t the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygencan also be quantified. So the additional budget is required for further improvement of the overall system.

13.APPENDIX

SOURCE CODE

```
#include "DHTesp.h"
#include <cstdlib>
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "pfrrli"
#define DEVICE_TYPE "Rasp"
#define DEVICE_ID "12345"
#define TOKEN "12345678"
#define speed 0.034

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/data/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);
float temperature  = 0;
int pH = 0;

String quality_status = "";
String temperture_status = "";



void setup() {
```

```
  Serial.begin(99900);


   wifiConnect();
   mqttConnect();
}

void loop() {

  srand(time(0));

    //initial variable
    int p;

    temperature = random(-20,40);
    pH = random(0,14);
    if(pH > 6.5 && pH < 8.5){
        p = 0;
    }
    else{
        p = 1;
    }

    //set a quality status

    switch (p) {
    case 0:
        quality_status = "Drinkable";
        break;
    case 1:
        quality_status = "Not Drinkable";
        break;
    }
```

```
  //Obivously the output.It is like json format 'cause it will help us for future sprints
    String payload = "{";
    payload+="\"pH level is \":";
    payload+=pH;
    payload+=",";
    payload+="\"Temperature of Water\":";
    payload+=(int)temperature;
    payload+=",";
    payload+="\"Alert\":\""+quality_status+"\"}";
    Serial.println(payload);


  if(client.publish(publishTopic, (char*) payload.c_str()))
  {
    Serial.println("Publish OK");
  }
  else{
    Serial.println("Publish failed");
  }
  delay(1000);


  if (!client.loop())
  {
    mqttConnect();
  }



}


void wifiConnect()
{
```

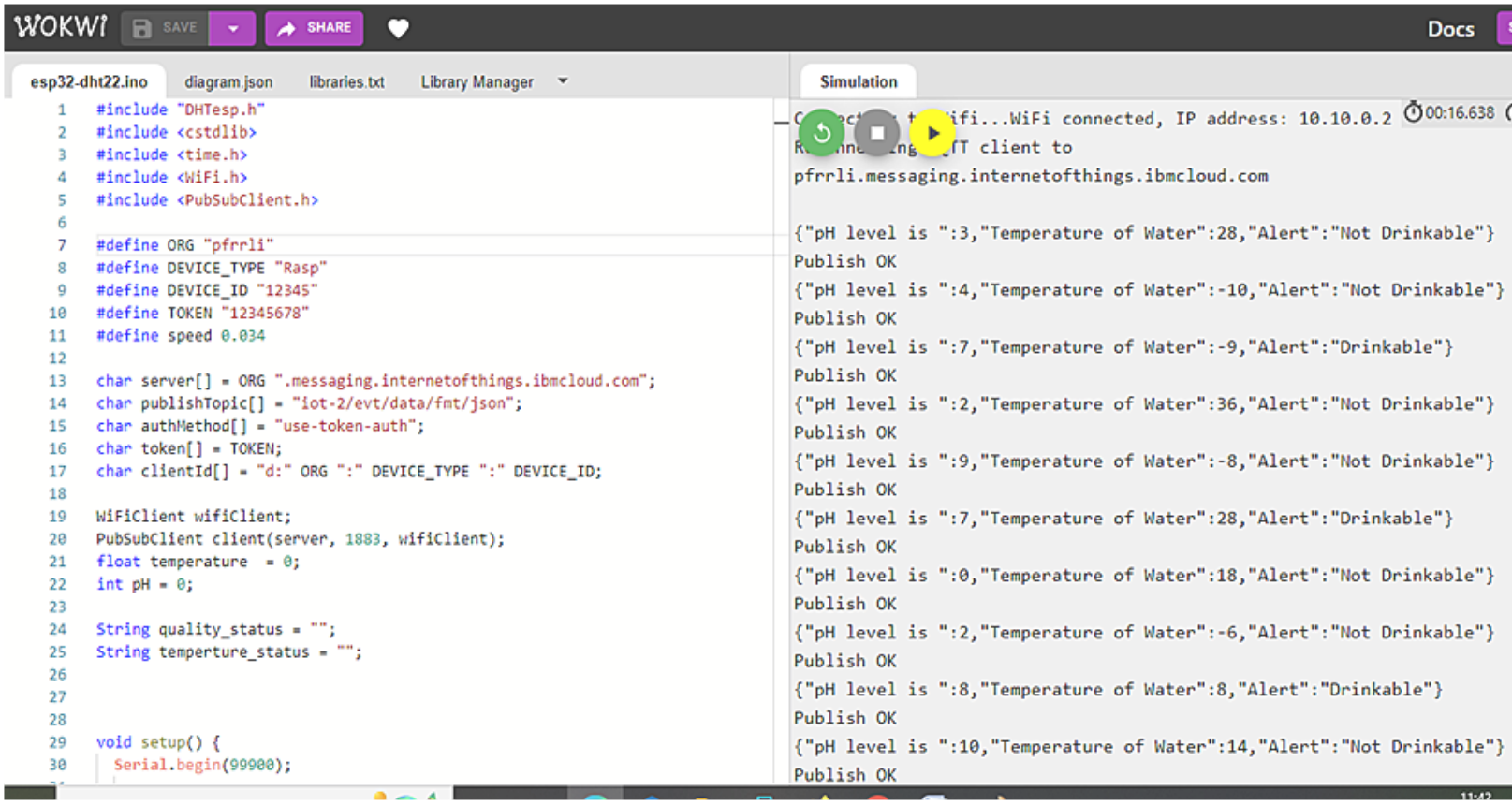
```
  Serial.print("Connecting to ");
  Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

}


void mqttConnect()
{
  if (!client.connected())
  {
    Serial.print("Reconnecting MQTT client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token))
    {
      Serial.print(".");
      delay(500);
    }

    Serial.println();
  }
}
```

DIAGRAM.JSON:-

```
{
  "version": 1,
```

```
 "author": "PNT2022TMID51903",
 "editor": "wokwi",
 "parts": [
  { "type": "wokwi-esp32-devkit-v1", "id": "esp", "top": -16.32, "left": -0.82, "attrs": {} },
  {
   "type": "wokwi-dht22",
   "id": "dht1",
   "top": -30.22,
   "left": 165.89,
   "attrs": { "temperature": "59.3" }
  }
 ],
 "connections": [
  [ "esp:TX0", "$serialMonitor:RX", "", [] ],
  [ "esp:RX0", "$serialMonitor:TX", "", [] ],
  [ "dht1:SDA", "esp:D15", "green", [ "v0" ] ],
  [ "dht1:VCC", "esp:3V3", "red", [ "v0" ] ],
  [ "dht1:GND", "esp:GND.1", "black", [ "v0" ] ]
 ]
}
```

OUTPUT:-



GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-44134-1660722550

PROJECT DEMO LINK:

https://tinyurl.com/ycxxyaj8