REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Domain: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

NAME	REGISTER NUMBER
SWETHA V	2019504596
EVANGELINE DIVYA SAGAYEE G	2019504518
DIVYA SREE K	2019504516
BRINTHA J S	2019504015

FROM

MADRAS INSTITUTE OF TECHNOLOGY

In fulfillment of project in ***IBM-NALAYATHIRAN 2022***

TEAM ID: **PNT2022TMID35929**

PROJECT GUIDES

Industry mentor: Bharadwaj

Faculty mentor: Balamurugan Gopalakrishnan

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1.INTRODUCTION

1.1 Project Overview:

Real time river water quality monitoring and control system

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. Any imbalance in the quality of water would severely affect the human health and at the same time it would affect the ecological balance among all species. Water quality refers to the chemical, biological, radiological, and biological parameters of the water

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

1.2 Purpose:

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

2.LITERATURE SURVEY

2.1 Existing problem:

Water is uniquely vulnerable to pollution. Known as a "universal solvent," water is able to dissolve more substances than any other liquid on earth. It's the reason we have Kool-Aid and brilliant blue waterfalls. It's also why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, nearly half of our rivers are polluted and unfit for human consumption and survival of aquatic organisms. Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertilizer runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. There is also all the random junk that industry and individuals dump directly into river water.

2.2 References:

S. No	Title	Published Date	Conference paper/ Journal	Inference
1	Real time wireless monitoring and control of water systems using Zigbee	29 Sept, 2013	International conference on computational intelligence and communication networks	This paper deals with how to monitor the water systems such as water tanks, rivers and borewells. It can monitor the quality of water with the help of water quality sensors such as turbidity sensors and dissolved oxygen sensor In this monitoring system, sensors monitor the water level, dissolved oxygen, turbidity, temperature and pH level of the water
2	Design of IOT based river water monitoring robot data transmission model using low power wide area network (LPWAN) communication network	7 Nov, 2019	IEEE International conference on internet of things and intelligence systems	In this paper, a design of IOT based river water quality monitoring system using LPWAN communication technology is proposed. It presents the result of the test to implement LoRa communication using mesh network topology as a medium of long-distance transmission from the acquisition

				of river water quality data from several sensors (River water temperature, pH level, metal concentration (Pb and Fe) and river water turbidity)
3	Real-time water quality monitoring and estimation in a IOT for fresh water biodiversity conservation	15 Aug, 2022	IEEE Internet of things journal	In this paper, a comprehensive literature review on water quality parameters that impact the biodiversity of fresh water is conducted and identified the top 10 crucial water quality parameters Among these parameters, the interrelationships between the IOT measurable parameters and IOT unmeasurable parameters are estimated using a general regression neural network model and a multi variate polynomial regression model based on historical water quality monitoring data
4	IOT based smart water quality monitoring system	14 Oct, 2019	Science direct	In this paper, the proposed system comprises of different sensors like temperature sensor, turbidity sensor and pH sensor that are interfaced with Raspberry Pi via an analog to digital converter Based on the data obtained from various sensors and processing of data by the Raspberry Pi, the solenoid valve will be directed to either continue or stopped flow of water and it checks if water quality parameters are in the desired range or not

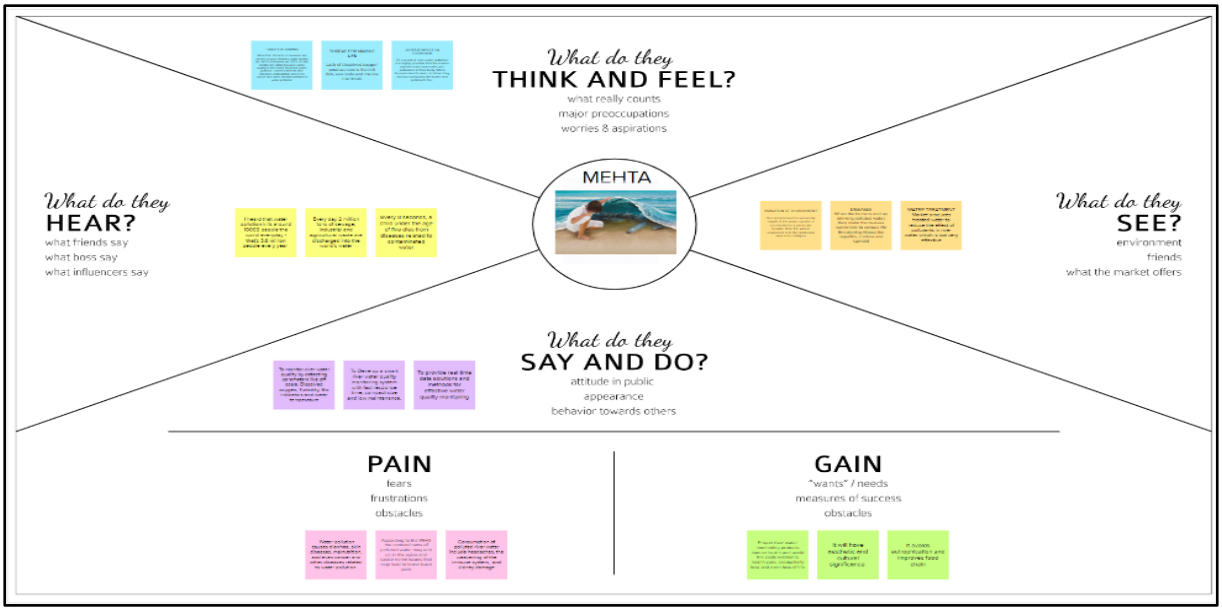
2.3 Problem Statement:

To detect and monitor the qualityof river water since river water pollution is a global environmental threat and to determine the parameters such as pH, temperature and turbidity.

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas:

An empathy map is a simple, easy to digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help 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/her goals and challenges.



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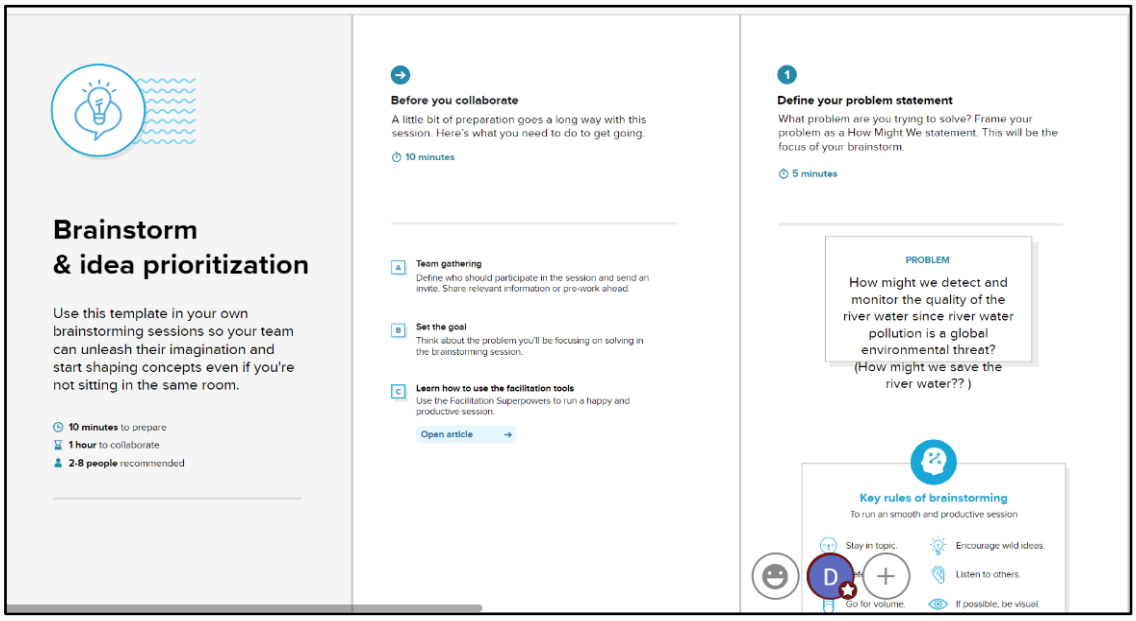
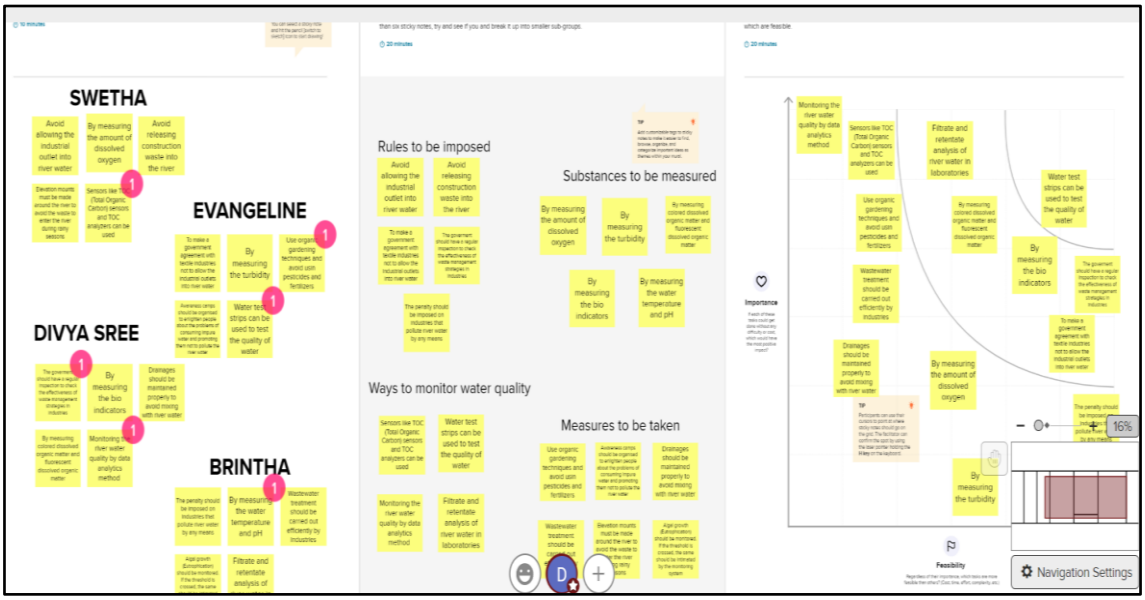
3.2 Ideation and Brainstorming:

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 number of creative solutions.





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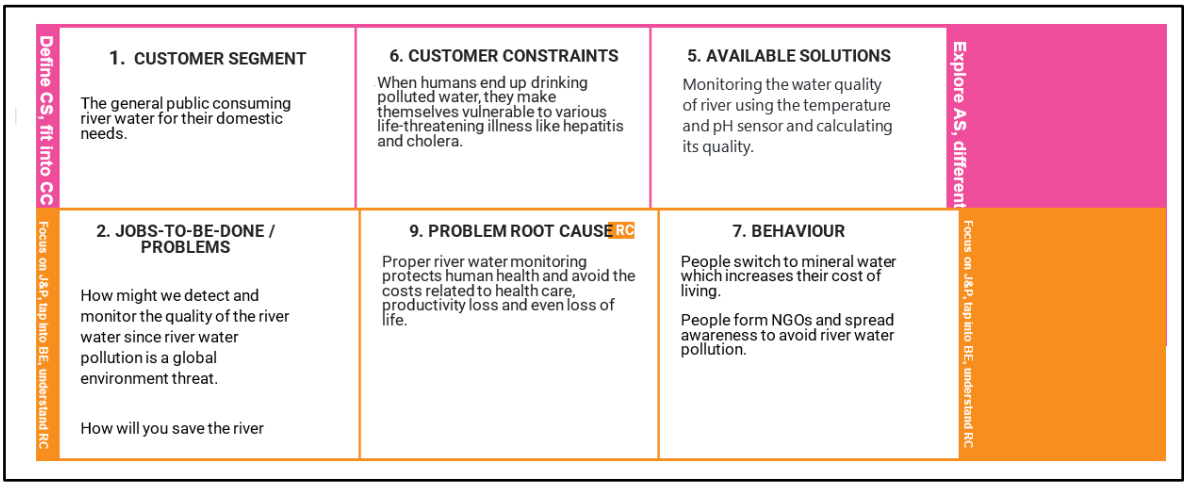
3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	To detect and monitor the qualityof river water since river water pollution is a global environmental threat (To save the river water)
2.	Idea / Solution description	Developing an IOT based water quality monitoring system using Arduino and sensors which will check if the pollutants present in theriver water are under the threshold value or not and displays whether the water is suitable for consumption.
3.	Novelty / Uniqueness	LPWAN Communication technology. Space and power optimization compared to existing system.
4.	Social Impact / Customer Satisfaction	Monitoring water quality is an important part of helping us determine whether or not we aremaking progress in cleaning up our waterways.It reveals the health and composition of streams, rivers, and lakes at a snapshot in time, as well as over weeks, months, and years
5.	Business Model (Revenue Model)	This proposed system can be implemented as government funded project to ensure the sanity of rivers across our nation. Industrial effluents after waste water treatment can be monitored by the proposed system before letting it into the river.

3.4 PROBLEM SOLUTION



3. TRIGGERS When customers are exposed to diseases like Diarrhea, skin diseases, malnutrition and even cancer. **4. EMOTIONS: BEFORE / AFTER** BEFORE: According to WHO, the contaminants of polluted water may end up in the spine and cause nerve issues that may lead to lower back pain AFTER: Proper river water monitoring protects human health and avoid the costs related to healthcare, productivity loss and even loss of life.	**10. YOUR SOLUTION** Developing an IOT based water quality monitoring system using Arduino and sensors which will check if the pollutants present in the river water are under the threshold value or not and displays whether the water is suitable for consumption.	**8.CHANNELS of BEHAVIOUR** ONLINE: The data is sent through the application for the user to know about the purity level of water OFFLINE: The control action is taken by the officials to make the water, pollution free.

4.REQUIREMENT ANALYSIS

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Sign up for new registration
FR-2	User confirmation	Confirmation via OTP for registered Email and mobile number
FR-3	User login	Once user confirmation is done, login using the user credentials
FR-4	View water details	View the quality parameter measures of various river water resources in the website
FR-5	Logout	User can logout from the website

4.2 Non-functional Requirements:

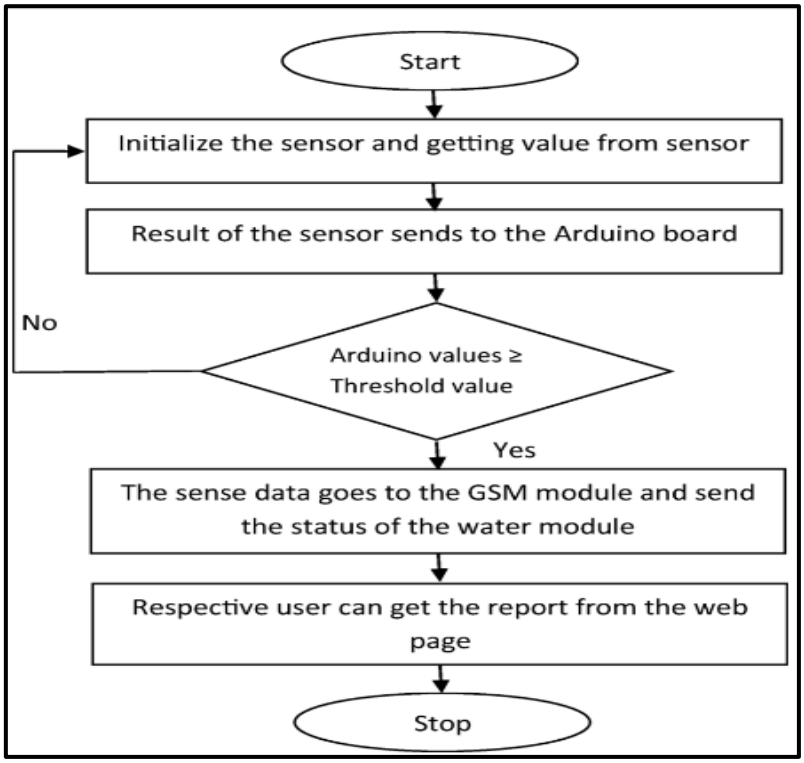
Following are the non-functional requirements of the proposed solution

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	Server run time restrictions shall be avoided. Load time of the server shall not be more than 3 seconds.
NFR-2	Security	User confirmation is done via OTP for registered Email and mobile number. Individual user account is password protected
NFR-3	Reliability	User can access the information at any time through their account
NFR-4	Performance	Login time will be less than 5 seconds
NFR-5	Availability	Down time for the website will be about 2 hours
NFR-6	Scalability	Server can handle many numbers of users at any instant without any issues

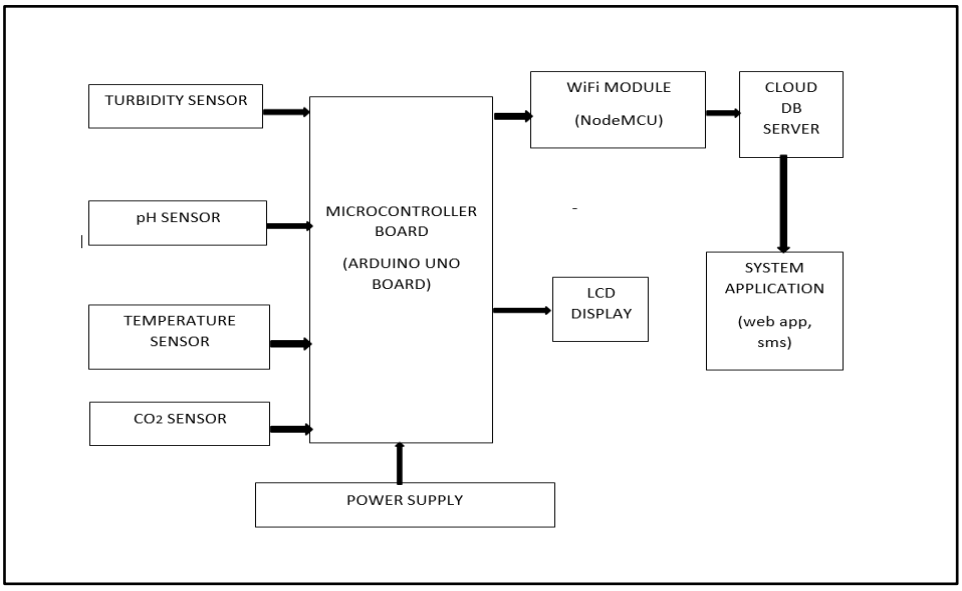
5.PROJECT DESIGN

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.



5.2 Solution and Technical Architecture:



Components and technologies:

S. No	Component	Description	Technology
1.	User Interface	Mobile App	HTML, CSS, Node-Red, Cloud, etc.
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Integer datatype, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	The data collected from the sensor should be stored in an external storage and can be used for further analysis	IBM Block Storage
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Here we are not using any machine learning architecture	NA
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / CloudLocal Server Configuration: Cloud Server Configuration	Local, Cloud Foundry, Kubernetes, etc.

Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented,use of firewalls etc.	SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g., use ofload balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use ofCache, use of CDN's) etc.	Technology used

5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user) / (web user)	Registration	USN-1	As a user, I can register for the application/website by entering my email, password, and confirming my password.	I can access my account / dashboard through email	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application/website	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application/website through Gmail	I can access my account / dashboard through Gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application/website by entering email & password	I can access the application/website	High	Sprint-1
	Dashboard	USN-6	As a user, I can access various types of river water samples	I can view the contents of dashboard	Medium	Sprint-1
	View information	USN-7	As a user, I can view the quality parameters of water samples such as pH, temperature, turbidity etc.	I can view the information in the application/website	High	Sprint-2
	Logout	USN-8	As a user, I can logout from my account	I can logout from the account	Medium	Sprint-2
Customer Care Executive	Feedback	USN-9	As a customer care executive, I can receive the feedback from the user	I can look through the feedbacks	High	Sprint-3
	Respond	USN-10	As a customer care executive, I can respond to customer queries	I can answer to the customer call and	High	Sprint-3

				respond to their feedbacks		
	Communicate	USN-11	As a customer care executive, I can communicate the user queries to the administrator	I can share the views of user toward the website to the administrator	High	Sprint-3
Administrator	Update	USN-12	As an administrator, I can update the information	I can update the changes in the information whenever required	High	Sprint-4
	Troubleshoot	USN-13	As an administrator, I can analyse and solve serious problems in the application/website, if any	I can fix the errors in application/ website	High	Sprint-4
	Backup	USN-14	As an administrator, I can create backup from the information	I can recover the lost information by having backups	High	Sprint-4

6.PROJECT PLANNING AND SCHEDULING

6.1 Sprint planning and scheduling:

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gatheringinformation by referring the, technical papers, research publications etc.	1 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvasto capture the user Pains & Gains, Prepare list of problem statements	7 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session andprioritize the top 3 ideas based on the feasibility & importance.	15 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solutiondocument, which includes thenovelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fitdocument.	20 SEPTEMBER 2022
Solution Architecture	Prepare solution architecture document.	22 SEPTEMBER 2022
Customer Journey	Prepare the customer journeymaps to understand the user interactions & experiences with the application (entry to exit)	5 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	12 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit forreview.	13 OCTOBER 2022
Technology Architecture	Prepare the technologyarchitecture diagram.	14 OCTOBER 2022

Prepare Milestone & ActivityList	Prepare the milestones &activity list of the project.	22 OCTOBER 2022

6.2 Sprint delivery schedule:

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	Swetha V, Evangeline Divya Sagayee G
		USN-2	As a user, I can register for the application through Gmail	10	High	Divyasree K, Brintha J S
Sprint -2	Confirmation	USN-3	As a user, I will receive confirmation email once I have registered for the application	4	Low	Divyasree K, Brintha J S
	Login	USN-4	As a user, I can login to the application by entering email and password	6	Medium	Divyasree K, Brintha J S
	IBM Cloud service Access	USN-5	Get access to IBM Cloud services	10	High	Swetha V, Evangeline Divya Sagayee G
Sprint-3	Create a node red service	USN-6	To create a node red service to integrate the IBM Watson along with the web UI.	5	Medium	Swetha V, Evangeline Divya Sagayee G
	Create the IBM Watson IOT and device settings	USN-7	To create the IBM Watson IOT platforms and integrate the microcontroller with it to send the sensed data on cloud.	5	Medium	Divyasree K, Brintha J S
	Developing Python Code	USN-8	Create a python code to sense the physical quantity and store data.	5	High	Divyasree K, Brintha J S

	Create a web UI	USN-9	To create a web UI to access the data from the cloud and display all the parameters.	5	High	Swetha V, Evangeline Divya Sagayee G
Sprint-4	Publish data on the cloud	USN-10	Publish data that is sensed by the microcontroller to the cloud	5	Medium	Divyasree K, Brintha J S
	Fast SMS service	USN-11	To create and use fast SMS to send alert messages once the parameters like pH, Turbidity and Temperature goes beyond the threshold.	5	Medium	Swetha V , Evangeline Divya Sagayee G
	Testing	USN-12	Testing of project and final deliverables	10		Divyasree K, Brintha J S, Swetha V , Evangeline Divya Sagayee G

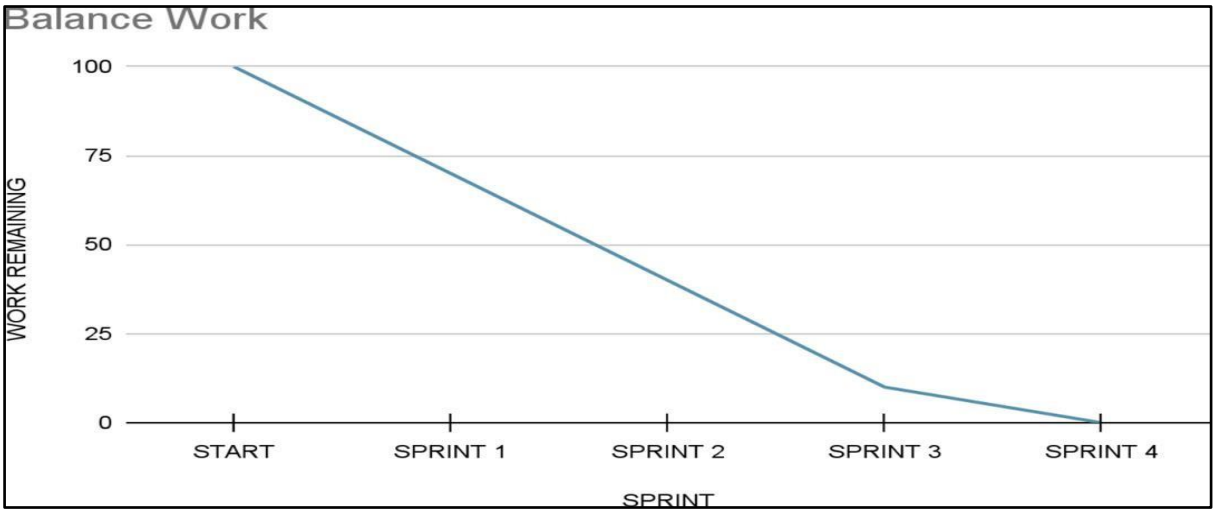
Project Tracker, Velocity & Burndown Chart:

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	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	7 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	14 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov2022

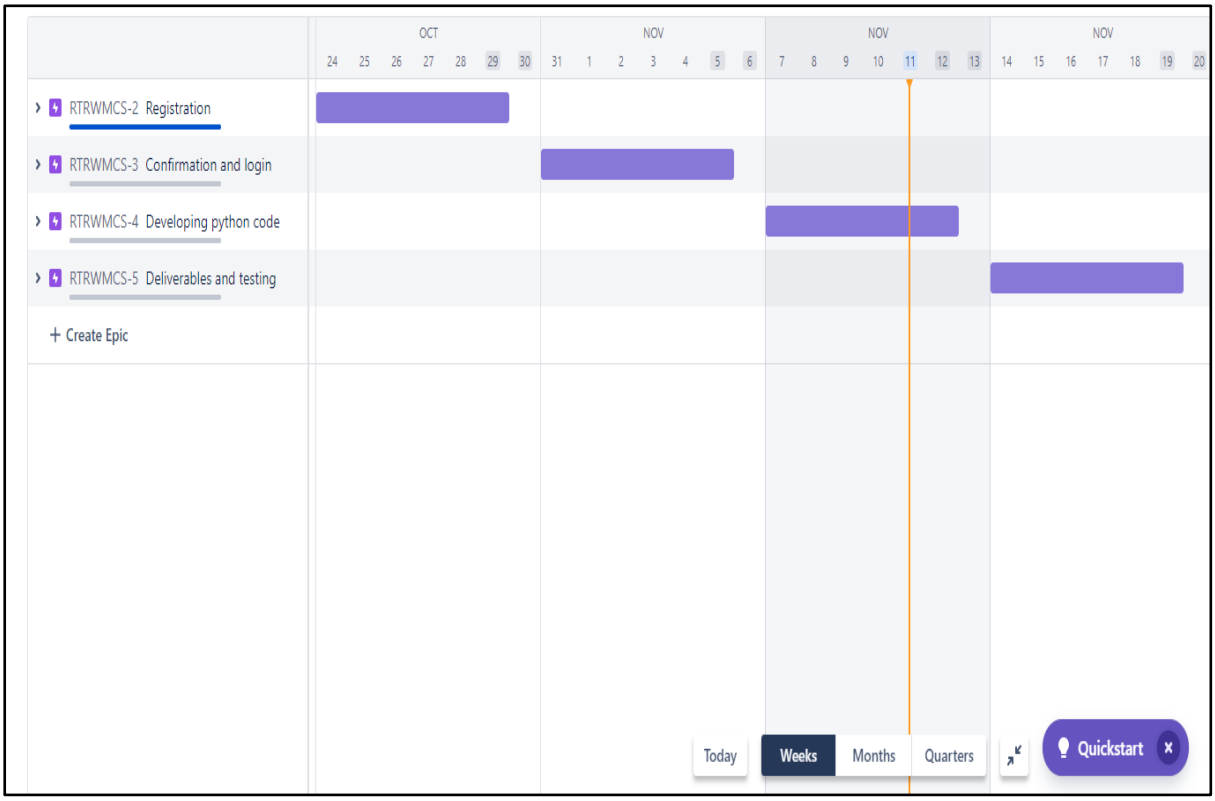
Velocity:

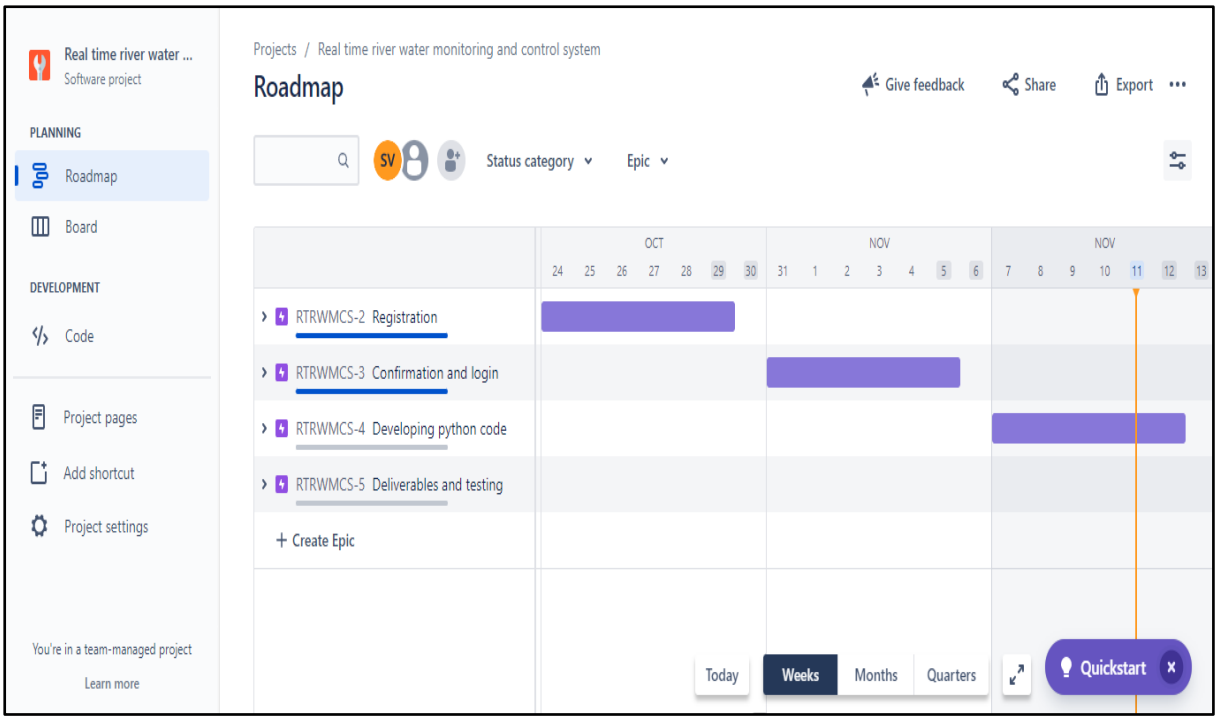
$$AV = \text{sprint duration/ velocity} = 20/6 = 3.333$$

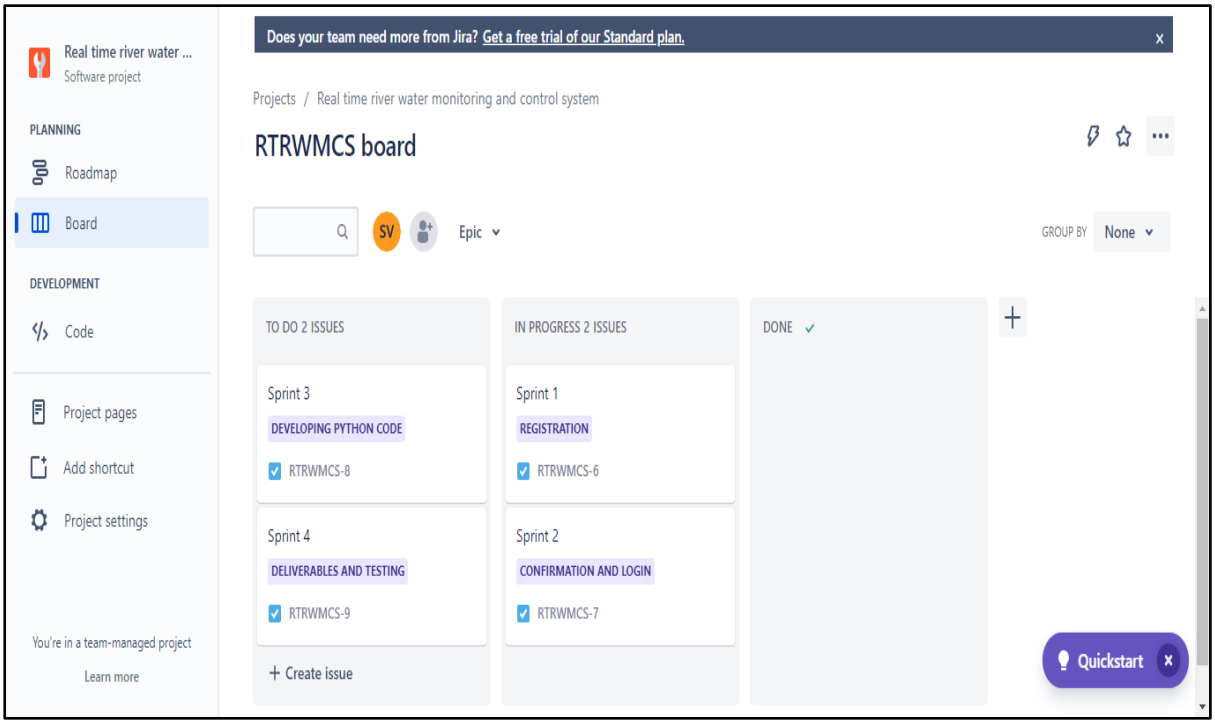
Burndown Chart:



6.3 Report from Jira:




Real time river water ...
Software project
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Real time river water monitoring and control system
Roadmap
Give feedback
Share
Export
Status category
Epic
OCT
NOV
NOV
RTRWMCS-2 Registration
RTRWMCS-3 Confirmation and login
RTRWMCS-4 Developing python code
RTRWMCS-5 Deliverables and testing
Create Epic
Today
Weeks
Months
Quarters
Quickstart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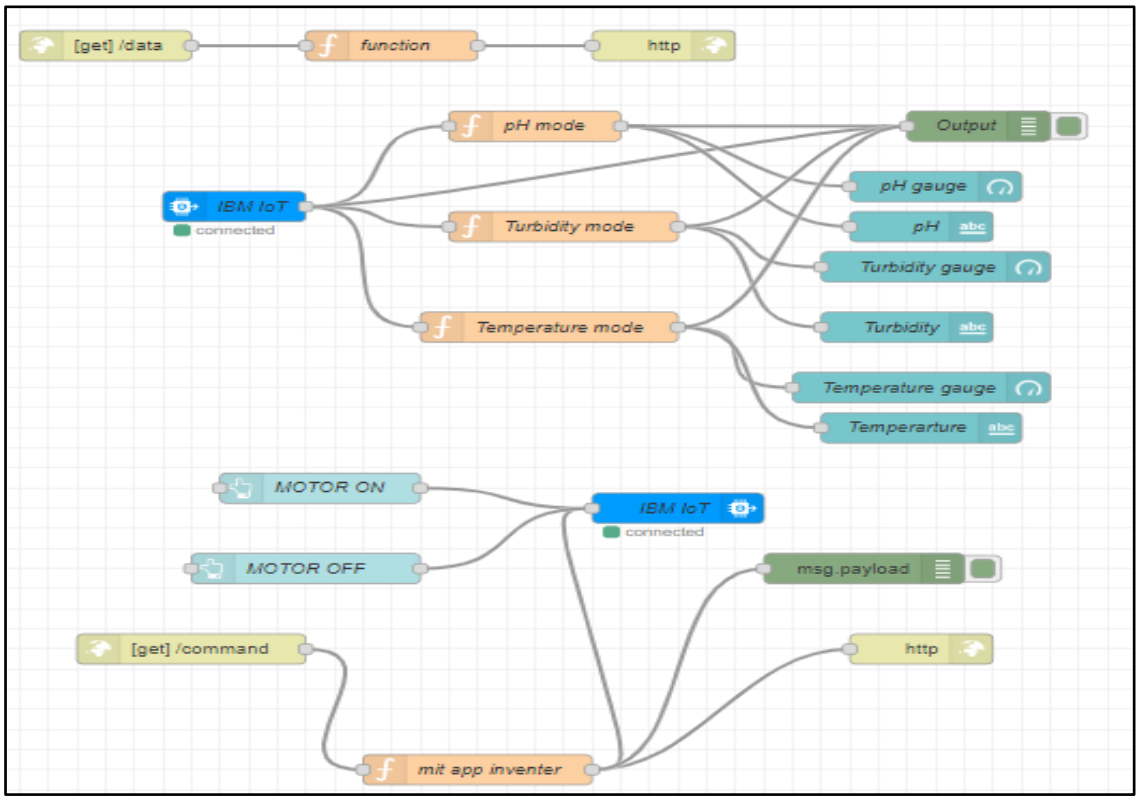
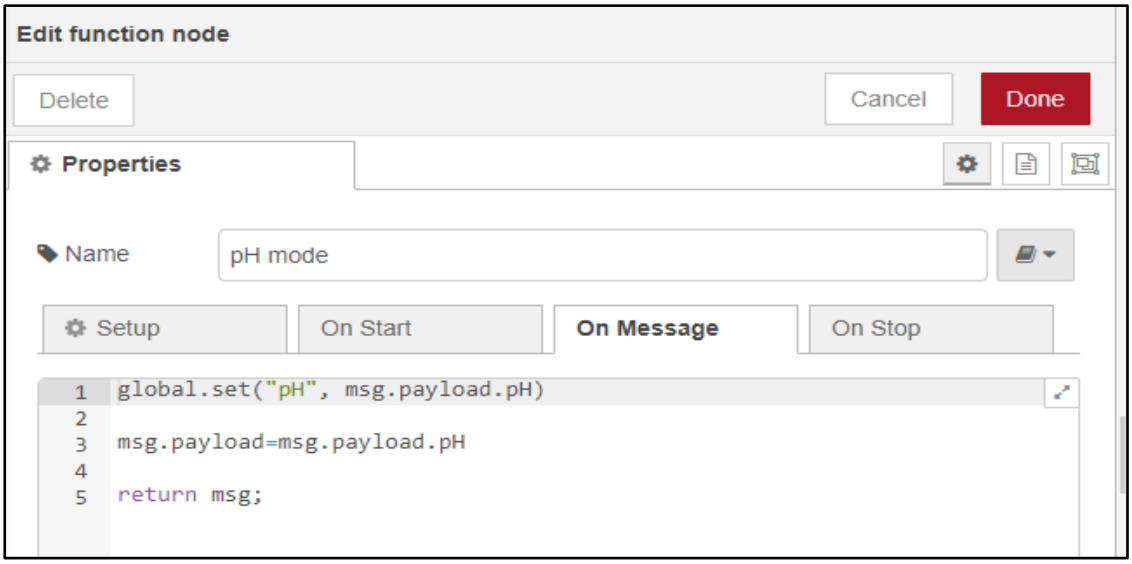
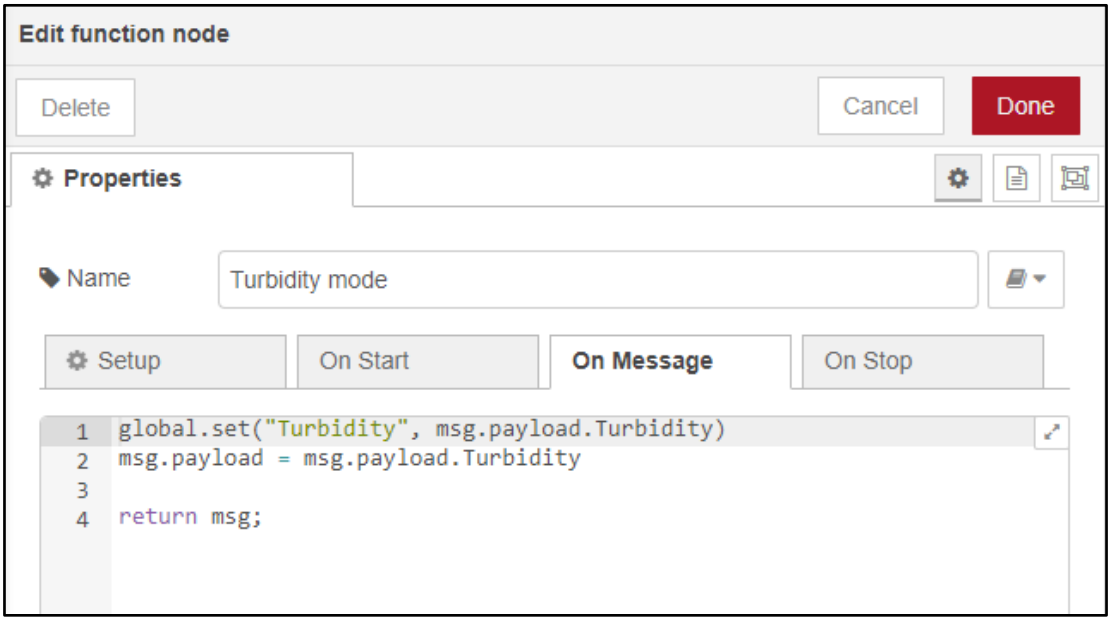
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Real time river water monitoring and control system
RTRWMCS board
Epic
GROUP BY
None
TO DO 2 ISSUES
IN PROGRESS 2 ISSUES
DONE
Sprint 3
DEVELOPING PYTHON CODE
RTRWMCS-8
Sprint 1
REGISTRATION
RTRWMCS-6
Sprint 4
DELIVERABLES AND TESTING
RTRWMCS-9
Sprint 2
CONFIRMATION AND LOGIN
RTRWMCS-7
Create issue
Quickstart

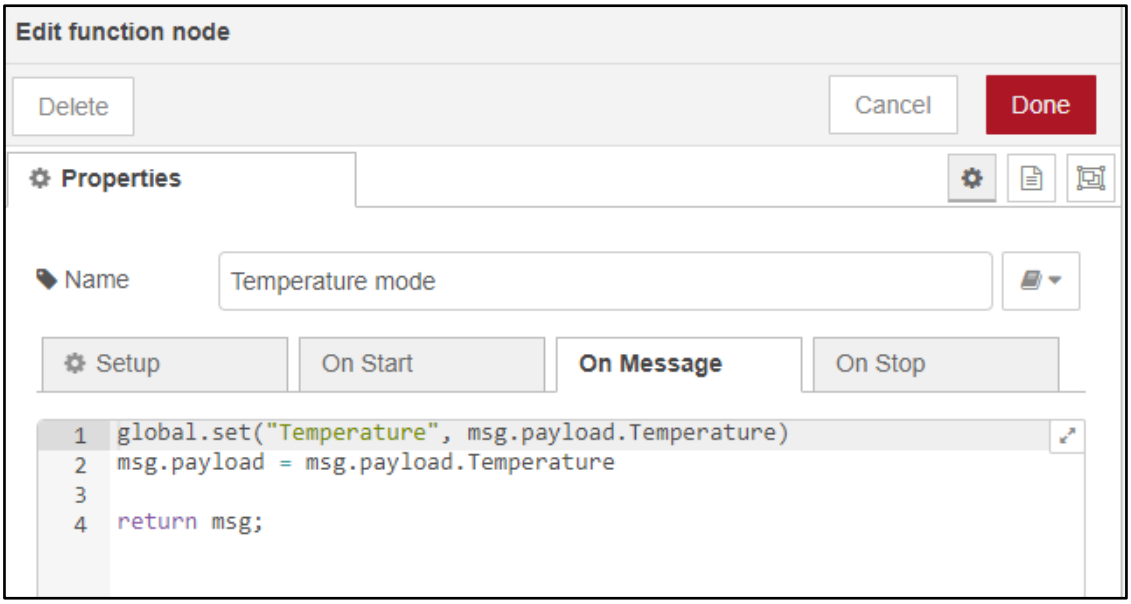
7. CODING AND SOLUTIONING

7.1 Node Red service associated with IBM cloud:

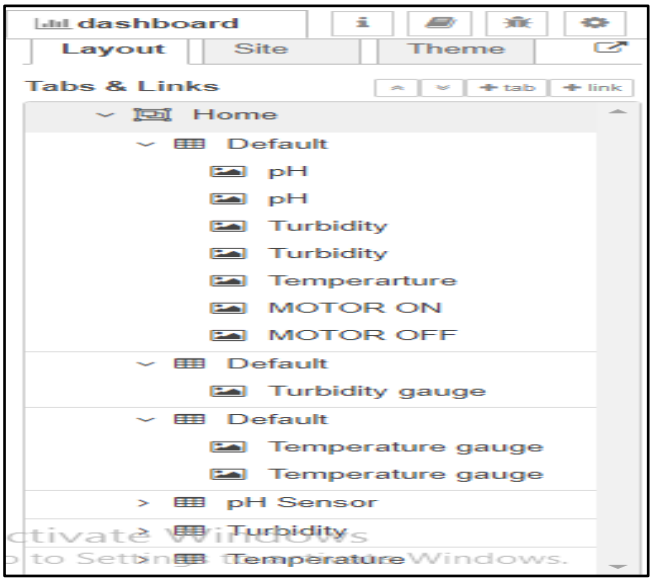


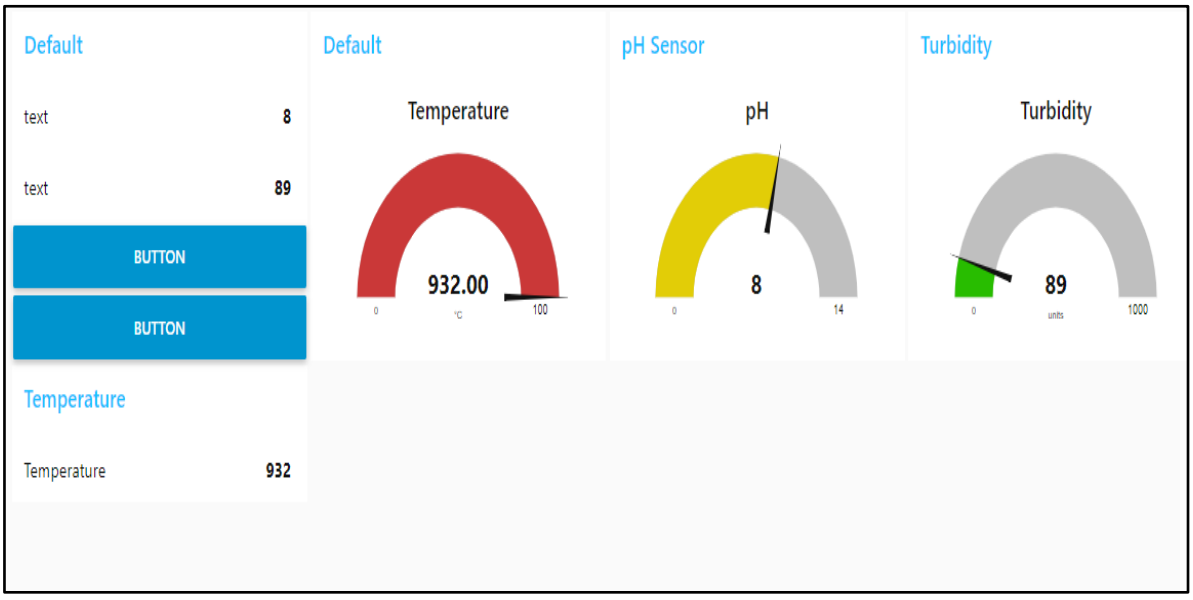



Edit function node
Delete
Cancel
Done
Properties
Name
Turbidity mode
Setup
On Start
On Message
On Stop
1 global.set("Turbidity", msg.payload.Turbidity)
2 msg.payload = msg.payload.Turbidity
3
4 return msg;


Edit function node
Delete
Cancel
Done
Properties
Name
Temperature mode
Setup
On Start
On Message
On Stop
1 global.set("Temperature", msg.payload.Temperature)
2 msg.payload = msg.payload.Temperature
3
4 return msg;

Node red dashboard:





8.TESTING

8.1 Test case analysis:

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	14	0	0	14
Client Application	40	0	0	40
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	10	0	0	10
Final Report Output	4	0	0	4
Version Control	3	0	0	3

8.2 User acceptance testing:

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	1	4	2	10
Fixed	14	1	6	10	31
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	0	1
Won't Fix	0	0	2	1	3
Totals	22	11	14	25	72

9.RESULT

9.1 Performance table:

PARAMETER	PERFORMANCE	DESCRIPTION
ADMIN TESTING	95%-100%	The testing done before it is deployed as an app
CUSTOMER SATISFACTION	75-85%	The customer need to be satisfied with the mobile application
USER INTERFACE	65-85%	The app can used by anyone. (Ease of access)
SEVER RESPONSE	50-75%	URL - response
DATA VALIDATION WITH NO. OF TEST CASE	60-80% (15-30 TESTCASE)	Valid data from the app
ERROR	3-5%	Real-time delay may occur

10.ADVANTAGES AND DISADVANTAGES

Advantages:

- The prototype developed for river water quality monitoring helps to safeguard human health and ecological balance.
- The use of sensors, microcontrollers and software makes the prototype more efficient.
- The web application on developed is very useful in updating the pollution level at regular intervals.

Disadvantages:

- It is difficult to implement the automation system in various water bodies.
- High design and maintenance cost.

11.CONCLUSION

Monitoring of real time quality of river Water makes use of PH, turbidity and temperature sensor with Raspberry Pi and existing Cloud system for data analytics. The system can monitor water quality automatically, triggers alarms immediately to prevent any health hazards and it is low in cost and does not require people on duty. So, the system 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.

12.FUTURE SCOPE

The results of the test for all times have been successful. We conclude that all the objectives of the proposed system have been achieved. To test more parameters of the water quality for some applications, other sensors can be included in the system. The system has wide application and it is usable and affordable by all categories of users.

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

13.APPENDIX

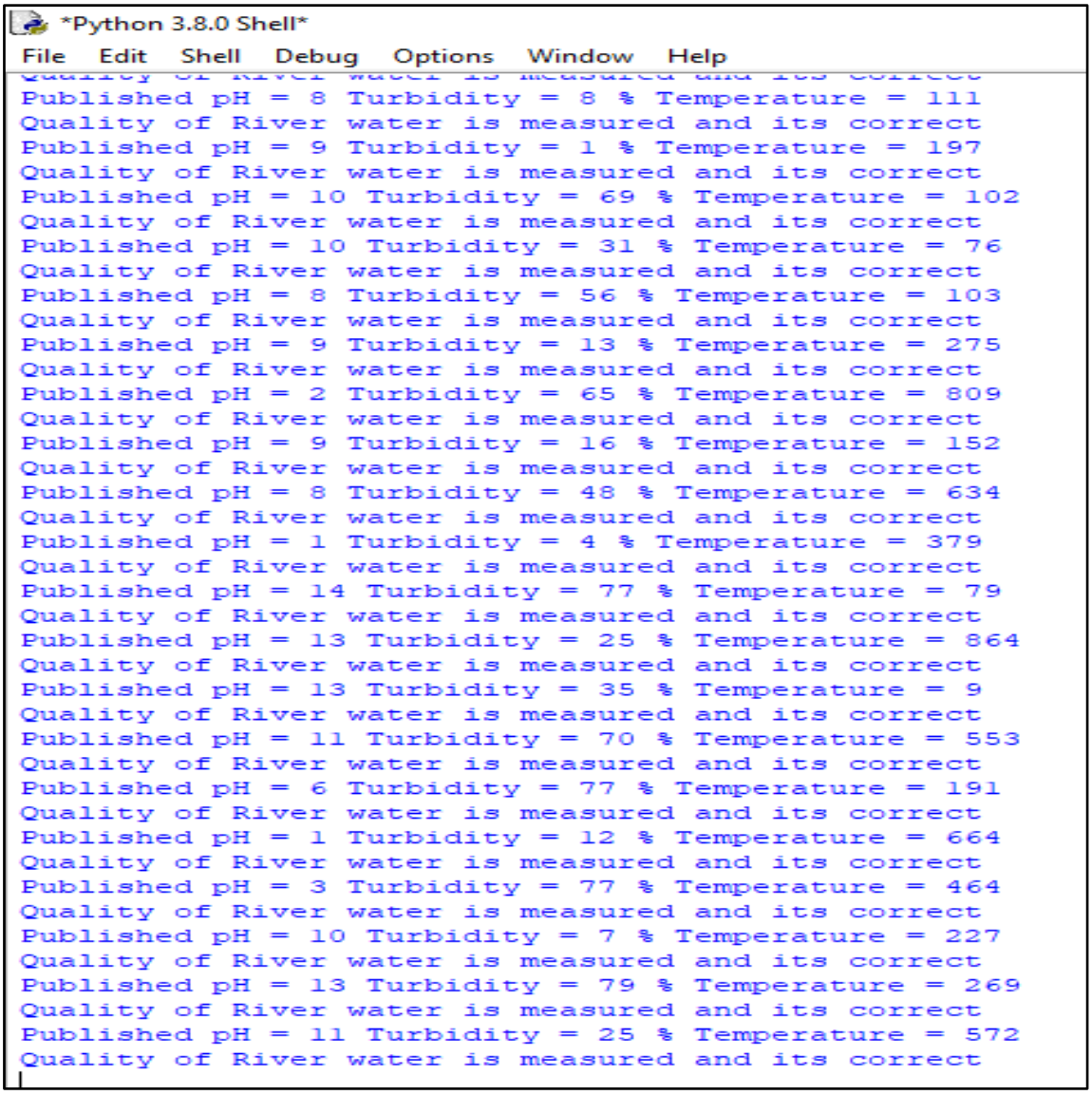
13.1 Source code:

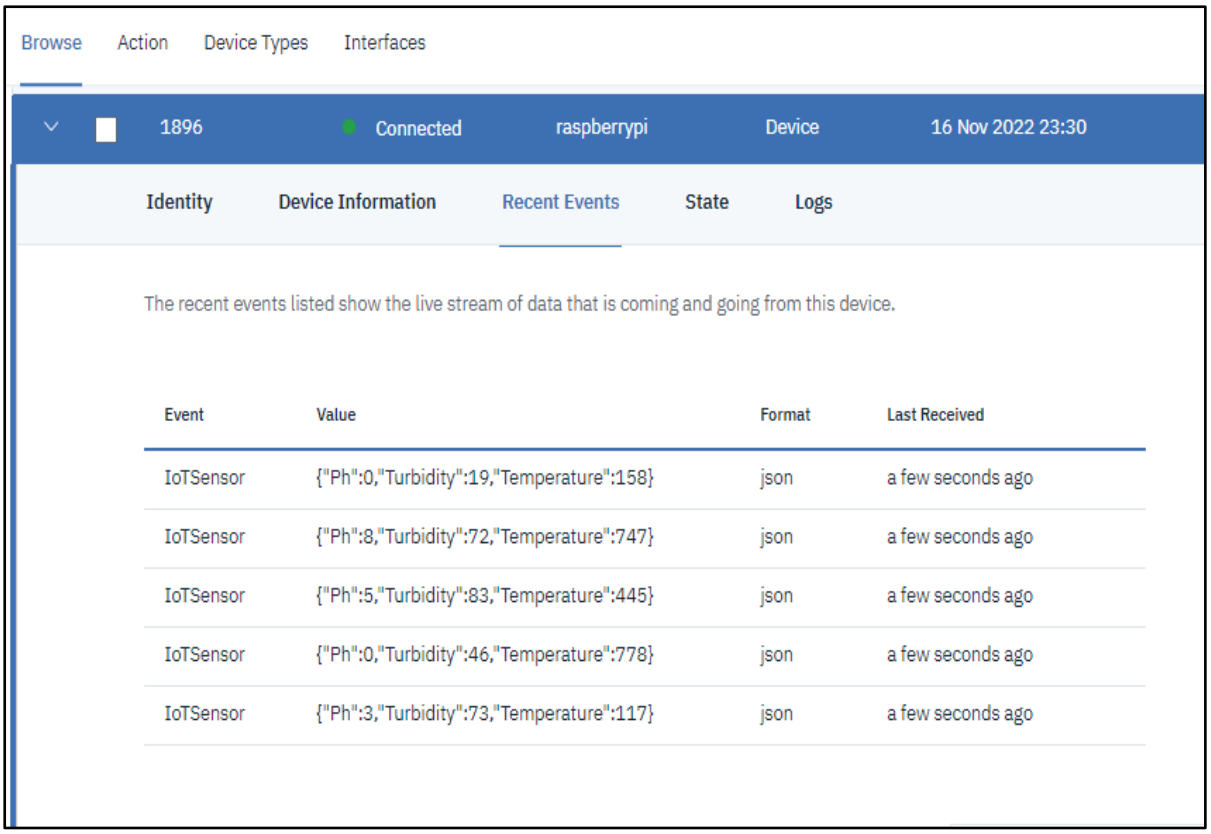
Python Code to Publish Data

```
# program to publish data in ibm watson iot platform
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

# Provide your IBM Watson Device Credentials

# Org_ID
organization = "9zsxrs"
# Device Type
deviceType = "raspberrypi"
# device ID
deviceId = "1896"
# Method of Authentication
authMethod = "token"
# Auth-token
authToken = "12345678"

# exception handling method
# try block
try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method":
authMethod,
                     "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
```

```
# to handle the errors
except Exception as e:
    print("Caught evention connecting device: %s" % str(e))
    sys.exit()
# device connection
deviceCli.connect()
# while Loop for getting the values
while True:
    pH = random.randint(0, 14)
    Turbidity = random.randint(0, 100)
    Temperature = random.randint(0, 1000)
    data = {'pH': pH, 'Turbidity': Turbidity, 'Temperature': Temperature}



    # define myonpublishcallback function
    def myonPublishCallback():
        print("Published pH = %s" % pH, "Turbidity = %s %%" % Turbidity, "Temperature = %s"
% Temperature)
        if (pH > 7.4 and Temperature > 100 and Turbidity >1000):

            print("UNSAFE, THE VALUES OF PARAMETERS ARE NOT IN THE RANGE")
        else:
            print("Quality of River water is measured and its correct")



    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myonPublishCallback)
    if not success:
        print("Not connected to IOTF")
    # sleep time

    time.sleep(10)
# disconnect device
deviceCli.disconnect()
```

Output


Python 3.8.0 Shell
File Edit Shell Debug Options Window Help
Published pH = 8 Turbidity = 8 % Temperature = 111
Quality of River water is measured and its correct
Published pH = 9 Turbidity = 1 % Temperature = 197
Quality of River water is measured and its correct
Published pH = 10 Turbidity = 69 % Temperature = 102
Quality of River water is measured and its correct
Published pH = 10 Turbidity = 31 % Temperature = 76
Quality of River water is measured and its correct
Published pH = 8 Turbidity = 56 % Temperature = 103
Quality of River water is measured and its correct
Published pH = 9 Turbidity = 13 % Temperature = 275
Quality of River water is measured and its correct
Published pH = 2 Turbidity = 65 % Temperature = 809
Quality of River water is measured and its correct
Published pH = 9 Turbidity = 16 % Temperature = 152
Quality of River water is measured and its correct
Published pH = 8 Turbidity = 48 % Temperature = 634
Quality of River water is measured and its correct
Published pH = 1 Turbidity = 4 % Temperature = 379
Quality of River water is measured and its correct
Published pH = 14 Turbidity = 77 % Temperature = 79
Quality of River water is measured and its correct
Published pH = 13 Turbidity = 25 % Temperature = 864
Quality of River water is measured and its correct
Published pH = 13 Turbidity = 35 % Temperature = 9
Quality of River water is measured and its correct
Published pH = 11 Turbidity = 70 % Temperature = 553
Quality of River water is measured and its correct
Published pH = 6 Turbidity = 77 % Temperature = 191
Quality of River water is measured and its correct
Published pH = 1 Turbidity = 12 % Temperature = 664
Quality of River water is measured and its correct
Published pH = 3 Turbidity = 77 % Temperature = 464
Quality of River water is measured and its correct
Published pH = 10 Turbidity = 7 % Temperature = 227
Quality of River water is measured and its correct
Published pH = 13 Turbidity = 79 % Temperature = 269
Quality of River water is measured and its correct
Published pH = 11 Turbidity = 25 % Temperature = 572
Quality of River water is measured and its correct



HTML Code:

```
<!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;
}
```

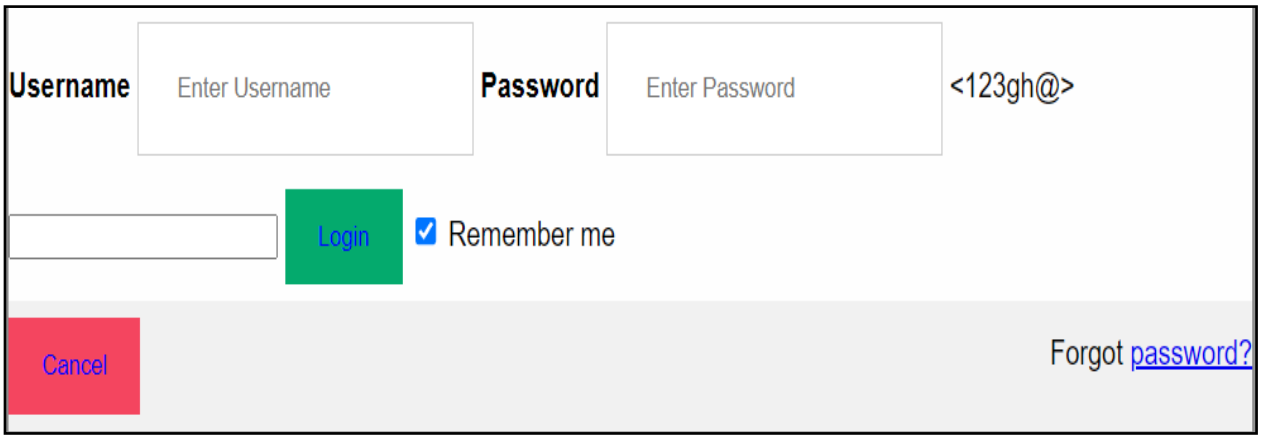
```
/* The Modal (background) */
.modal {
  display: none; /* Hidden by default */
  position: fixed; /* Stay in place */
  z-index: 1; /* Sit on bottom*/
  left: 0;
  top: 0;
  width: 100%; /* full width */
  height: 100%; /* medium height */
  overflow: auto; /* Enable scroll if needed */
  background-color: 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 {
```

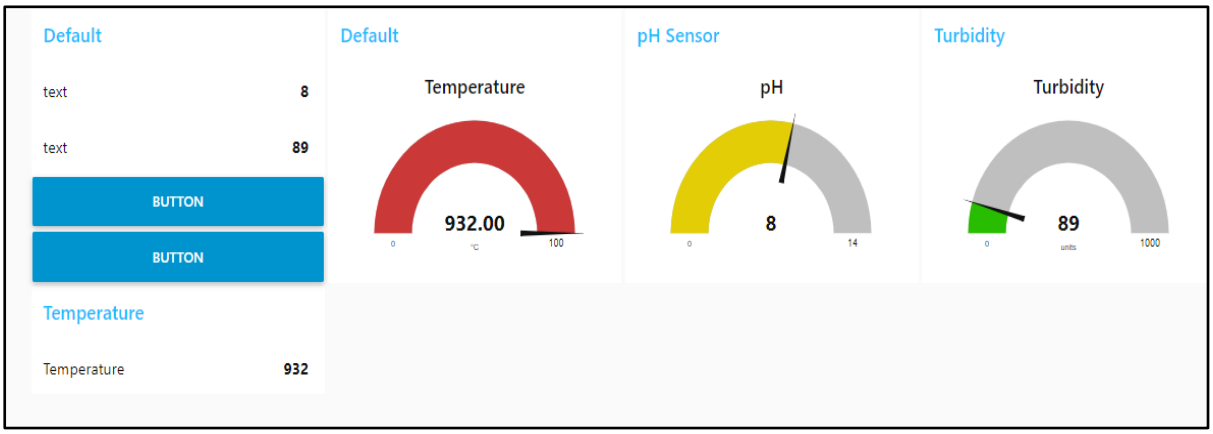
```
  position: absolute;
  right: 25px;
  top: 0;
  color: #888;
  font-size: 35px;
  font-weight: initial;
}

.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">
```

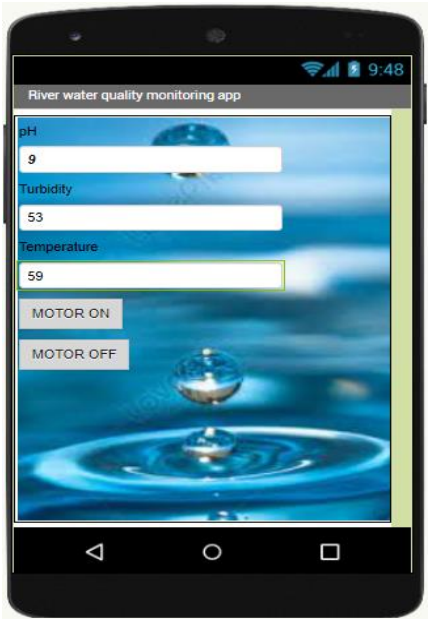
```
<form class="modal-content animate" action="/action_page.php" method="post">

 <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>
```


Username
Enter Username
Password
Enter Password
<123gh@>
Login
Remember me
Cancel
Forgot password?


Default
text
8
text
89
BUTTON
BUTTON
Temperature
Temperature
932
Default
Temperature
932.00
0
100
pH Sensor
pH
8
0
14
Turbidity
Turbidity
89
0
1000

Mobile App


9:48
River water quality monitoring app
pH
9
Turbidity
53
Temperature
59
MOTOR ON
MOTOR OFF

13.2 Git-Hub Link:

https://github.com/IBM-EPBL/IBM-Project-521-1658304886

Project Demo Link:

https://drive.google.com/file/d/1nu2VluEEKTKN22-Idzzu5l-2UQJ4sO_k/view?usp=share_link