REAL-TIME WATER QUALITY MONITORING AND CONTROL

A PROJECT REPORT

Submitted by

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For the project

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EINSTEIN COLLEGE OF ENGINEEING, TIUNELVELI-627 012

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BONAFIED CERTIFICATE

Certified this Report **"REAL-TIME WATER QUALITY MONITORING AND CONTROL SYSTEM"**, for the project, is the bonafied work of **"K.ARTHI (Team Member) (950619106001), C. DEEPA (Team Member) (950619106003), K. KARTHIKA (Team Lead) (950619106006), M. SELVA PRIYA (Team Member) (950619106025)"** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported here in does not form part of any other thesis or any other candidate.

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A PROJECT REPORT ON

REAL TIME WATER QUALITY MONITORING AND CONTROL SYSTEM

Domain	:	Internet Of Things
Team ID	:	PNT2022TMID49915
College Name	:	Einstein College Of Engineering

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REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

CHAPTER 1

INTRODUCTION:

1.1Project Overview

Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.

1.2 Purpose

Water is one of the most essential natural resource that has been gifted to the mankind. But the rapid development of the society and numerous human activities speeded up the contamination and deteriorated the water resources. For above water quality monitoring is necessary to identify any changes in water quality parameters from time-to-time to make sure its safety in real time. The Central Pollution Control Board (CPCB) has established a series of monitoring stations on water bodies across the country which monitor the water quality on either monthly or yearly basis. This is done to ensure that the water quality is being maintained or restored at desired level. It is important that it is monitored on regular basis. Water quality monitoring helps in evaluating the nature and extent of pollution control required, and effectiveness of pollution control measures. CPCB has plans to establish water quality monitoring network across Ganga river basin. All the stations will operate in real time and central station can access data from any of the above stations using GPRS/GSM or 3G cellular services. State pollution boards and CPCB zonal offices can also access data from central station. Large amount of data can help to take right decisions and also to implement in time accordingly. Cost of the system depends on number of parameters to be measured. Water quality monitoring systems need to quickly identify any changes in the quality of water and report the same to the officials for immediate action. The system is designed for continuous on-site sensing and real time reporting of water quality data where the officials can access the data on the smart phone/PC through Internet. Our proposed system employs use of multiple sensors to measure the parameters, measures the quality of water in real-time for effective action, and is economical, accurate, and required less manpower.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing method:

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a microcontroller for processing the system, communication system for inter and intra node communication and several sensors. Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology. Data collected at the apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models, Belief Rule Based (BRB) system and is also compared with standard values. If the acquired value is above the threshold value automated warning SMS alert will be sent to the agent. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low powered. Therefore, our proposed system will immensely help Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water.

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2.3 Problem Statement Definition

Fig1. Problem Statement

Reference:

https://miro.com/app/board/uXjVPTvSbQA=/

CHAPTER 3

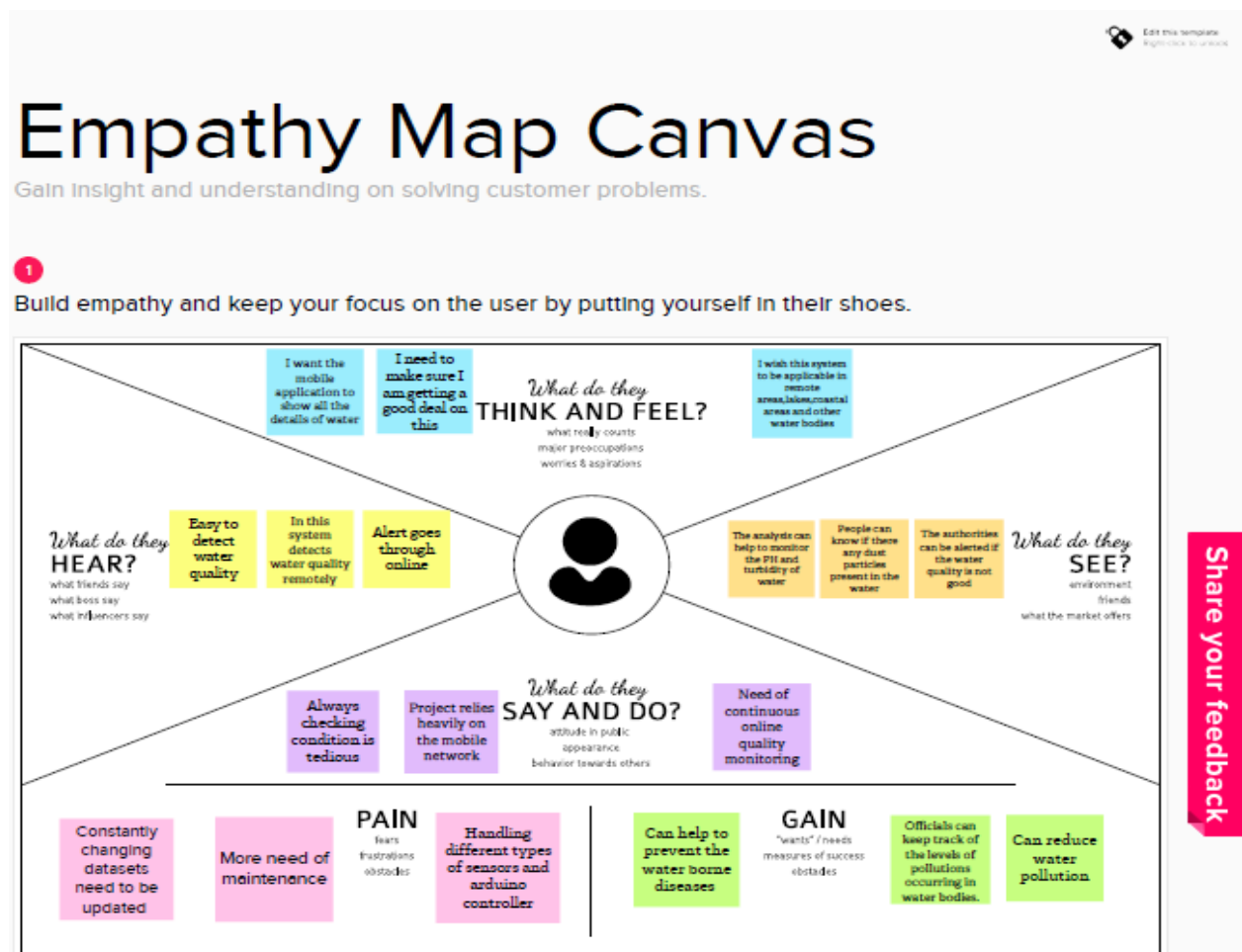# IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Fig2. Empathy Map

3.2 Ideation &Brainstorming

Fig3a. Brainstorming

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕐 5 minutes
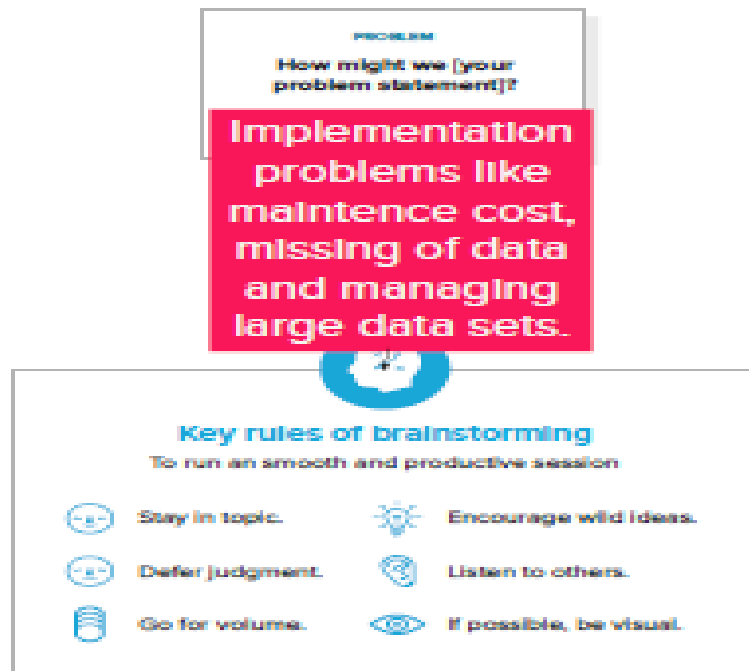
PROBLEM

How might we [your problem statement]?

Implementation problems like maintence cost, missing of data and managing large data sets.

Key rules of brainstorming
To run an smooth and productive session

- Stay in topic.
- Defer judgment.
- Go for volume.
- Encourage wild ideas.
- Listen to others.
- If possible, be visual.

Fig3b. Brainstorming

Fig3c. Brainstorming

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

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Stainless steel sensor or other sensor material can be used to reduce corrosion

Analyzing quality of hard water and software separately.

By keeping the sensors clean the maintenance cost can be reduced.

The data will be stored only when the parameter (ph, Turbidity) exceeds certain level.

Our idea is to make the sensors only works during the time of work.

By continues monitoring of the sensor to reduce the maintenance cost.

Fig3d. Brainstorming

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

Importance

Which of these tasks could get done without any difficulty or cost, which would have the most positive impact?

The data will be stored only when the parameter (ph, Turbidity) exceeds certain level.

Our idea is to make the sensors only works during the time of work.

Stainless steel sensor or other sensor material can be used to reduce corrosion

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the M key on the keyboard.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

Fig3e. Brainstorming

3.3 Proposed Solution

S.No	Parameter	Description
1	Problem statement(problem to be solved)	Implementation problems like missing of data and managing large data sets.
2	Idea / Solution description	Proper implementation helps of avoid missing of data and large water quality datasets can be monitored by statistical tools.
3	Novelty / Uniqueness	Detects anomalous events such as intentional contamination of water.
4	Social Impact / Customer Satisfaction	The water borne diseases can be prevented.
5	Business Model (Revenue Model)	This project is profitable because of its efficiency and its importance.
6	Scalability of the Solution	More no of users can be handled.

Table1. Proposed Solution

3.4 PROBLEM SOLUTION FIT:

Customer Segment:	**Customer Constraints:**	**Available Solution:**
Domestic applications, agriculture,aqua culture and municipal waste recycling.	System hardware need to be handled with care. Only limited users are added to handle the system Only the person who authorized to system able to access it.	The project proposes an IoT. Based low-cost system to monitor water quality in real time, analyse water quality trends & detects anomalous events such as intentional contamination of water.
Jobs-To-Be-Done/Problems: Ever increasing pollution due to urbanizations, industrialization & population growth. To sustain quality of life, it is imperative to detect water pollutants causing contamination.	**Problem Root Cause:** The main cause of water quality problems are over exploitation of natural resources. The rapid pace of industrialization, fertilizier, and non enforcement of laws led to water pollution to a large extent.	**Behaviour:** Our project resemble with the exsisting system that both the systems will collect the water quality parameters and monitors.
Triggers: The Customers get triggered when they read a more efficient solution in the news **Emotions: Before/After** Water Contamination have severe impact on human health (3.7 million Indians were affected).	**Your Solution:** Proper implementation helps to avoid missing of data	**Channel of Behaviour:** Mainly our customers are the people who are staying in the coastal areas.

Fig4. Problem Solution Fit

CHAPTER 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	Registration through Form
		Registration through Gmail
FR-2	User Confirmation	Confirmation via Email
		Confirmation via OTP
FR-3	User Dashboard	Can access the dashboard

Table 2. Functional Requirement

4.2 Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To determine the drinking water standards like PH, Turbidity
NFR-2	**Security**	Manage the safety and security of drinking water services
NFR-3	**Reliability**	The system is more reliable because of its system adequacy and system security.
NFR-4	**Performance**	High performance because of the system efficiency
NFR-5	**Availability**	High availability because it allows continuous functioning, even some of its components fail.
NFR-6	**Scalability**	More number of users can be access the data

Table 3. Non-Functional Requirement
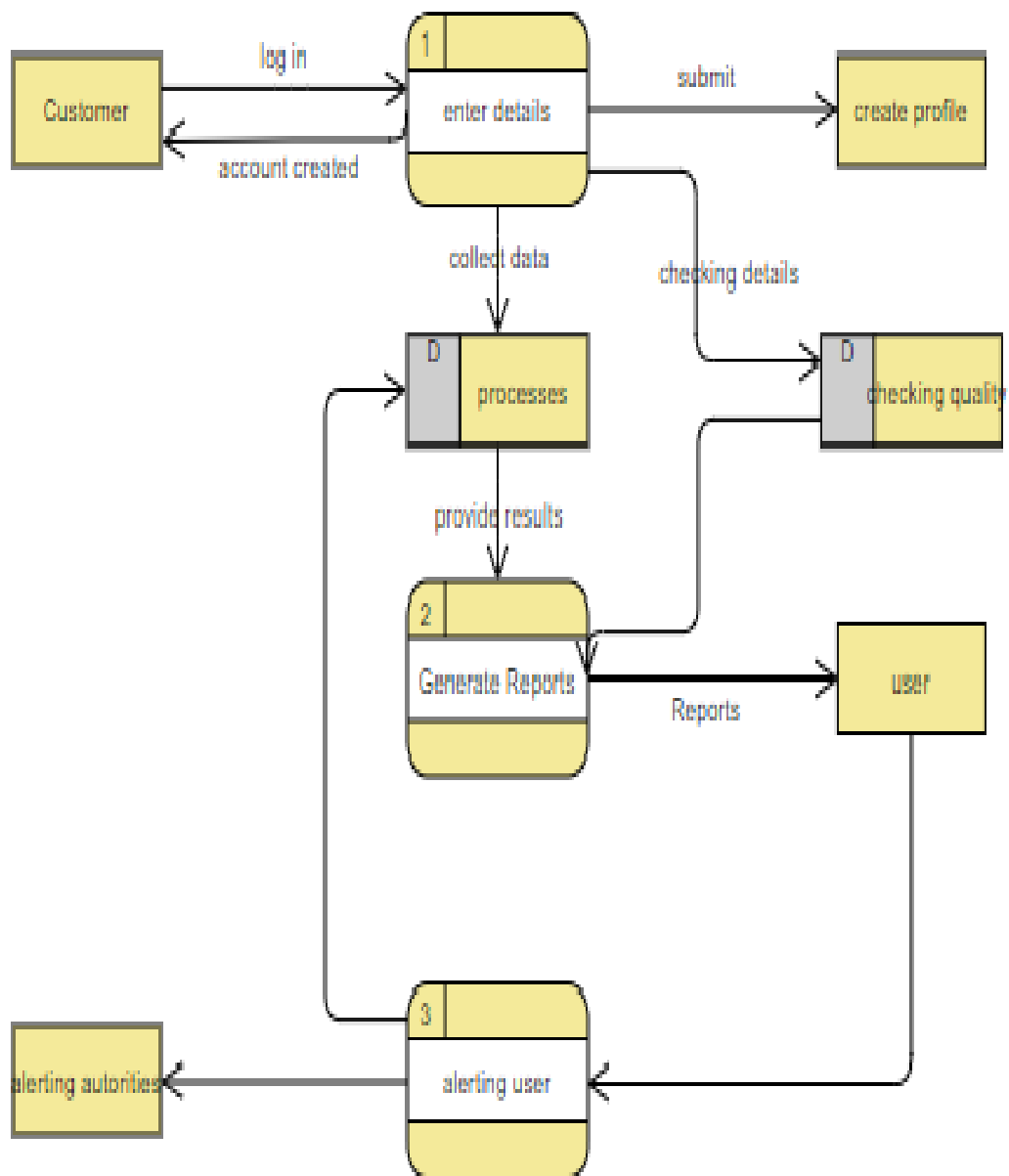
CHAPTER 5

PROJECT DESIGN:

5.1 Data Flow Diagram

Fig5. Project design

5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

Technical Architecture:
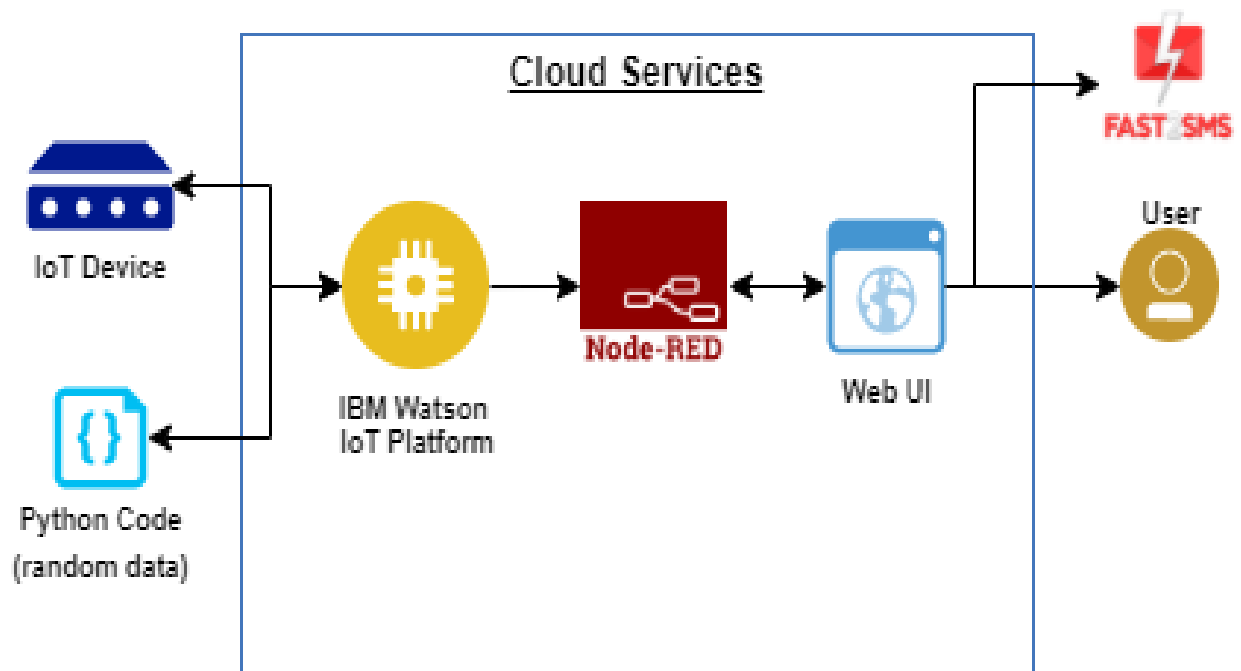
Fig6. Project Architecture

Table-1:

Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	user interacts with application e.g. Mobile App, webapplication.	Python ,C
2.	Application Logic-1	Developing application	Python
3.	Application Logic-2	To add speech transcriptioncapabilities to application.	IBM Watson STT service
4.	Application Logic-3	To automate interactions withcustomers	IBM Watson Assistant
5.	Database	To create data base	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM Cloudant etc.
7.	File Storage	Storing data	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	To deliver accurate andprecious data	IBM Weather API
9.	External API-2	To verify data	Aadhar API
10.	Machine LearningModel	To identify and locate objects	Object Recognition Model
11.	Infrastructure (Server / Cloud)	To compile and run the appslocally	Local, Cloud Foundry, etc.

Table 4. Components & Technologies

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	For wiring hardware devices,,API and online services	Node RED
2.	Security Implementations	Advanced Encryption standard, Data Encryption standard ,RSA algorithm	Encryption
3.	Scalable Architecture	More number of users can be access the data.	Automated bootstrapping
4.	Availability	Increase the availability	Cloud computing
5.	Performance	High performance	Adaptive ContentionWindow

Table 5. Application characteristics

5.3 USER STORIES

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					

Table6. User stories

CHAPTER 6

PROJECT PLANNING AND SCHEDULING:

6.1 Sprint Planning and Estimation:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application byentering email & password		High	Sprint-1
	Dashboard					

Table7. Sprint Planning and Requirement

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	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	06 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 Nov 2022

Table8. Sprint Delivery Schedule

6.3 Reports From JIRA

Fig7. Reports from jira

CHAPTER 7

CODING AND SOLUTIONING

7.1 Feature 1

- Languages-Python
- Tools / IDE-Arduino IDE
- Libraries-Recomennded

CODING:

```
#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;

Serial.println(phValue); Serial.print("pH");
Serial.print(" C ");
Serial.print(Celcius);
Serial.print(voltage);
Serial.print("V");
delay(10000);
}
```

CODE IMPLEMENTATION:

```
import serial
import time
import csv
import numpy as np
import matplotlib.pyplot as plt ser = serial.Serial('/COM6',9600) ser_bytes = ser.readline(10)
print (ser_bytes) ser.flushInput() while True:
```

```python
try:
ser_bytes = ser.readline()
decoded_bytes            =            float(ser_bytes[0:len(ser_bytes)-2].decode("utf-8"))
print(decoded_bytes)
temp = float(decoded_bytes(1:3))

turb   =   float(decoded_bytes(4:6))   pH   =   float(decoded_bytes(6:8))   with
open("test_data.csv","a") as f: writer = csv.writer(f,delimiter=",")
writer.writerow([time.time(),decoded_bytes]) except:
print("Keyboard Interrupt") ser.close()
break()
t = np.arange(0.0, 2.0, 0.01) s = 1 + np.sin(2*np.pi*t) plt.plot(t, s)
plt.xlabel('time (s)') plt.ylabel('Celsisus (C)') plt.title('Temperature') plt.grid(True)
plt.savefig("Temperature.png") plt.show()
Serial.begin(9600);
sensors.begin();
int sensorValue = analogRead(A1);
voltage = sensorValue * (5.0 / 1024.0);
}
void loop(void)
{
sensors.requestTemperatures();

Celcius=sensors.getTempCByIndex(0);

turb   =   float(decoded_bytes(4:6))   pH   =   float(decoded_bytes(6:8))   with
open("test_data.csv","a") as f: writer = csv.writer(f,delimiter=",")
writer.writerow([time.time(),decoded_bytes]) except:
```

```
print("Keyboard Interrupt") ser.close()
break()
t = np.arange(0.0, 2.0, 0.01) s = 1 + np.sin(2*np.pi*t) plt.plot(t, s)
plt.xlabel('time (s)') plt.ylabel('Celsisus (C)') plt.title('Temperature') plt.grid(True)
plt.savefig("Temperature.png") plt.show()
Serial.begin(9600);
sensors.begin();
int sensorValue = analogRead(A1);
voltage = sensorValue * (5.0 / 1024.0);
}
void loop(void)
{
sensors.requestTemperatures();


Celcius=sensors.getTempCByIndex(0);

decoded_bytes        =        float(ser_bytes[0:len(ser_bytes)-2].decode("utf-8"))
print(decoded_bytes)
temp = float(decoded_bytes(1:3)) turb = float(decoded_bytes(4:6)) pH =
float(decoded_bytes(6:8))    with    open("test_data.csv","a")    as    f:    writer    =
csv.writer(f,delimiter=",")
writer.writerow([time.time(),decoded_bytes]) except:
print("Keyboard Interrupt") ser.close()
break()
t = np.arange(0.0, 2.0, 0.01) s = 1 + np.sin(2*np.pi*t) plt.plot(t, s);
```

OUTPUT:
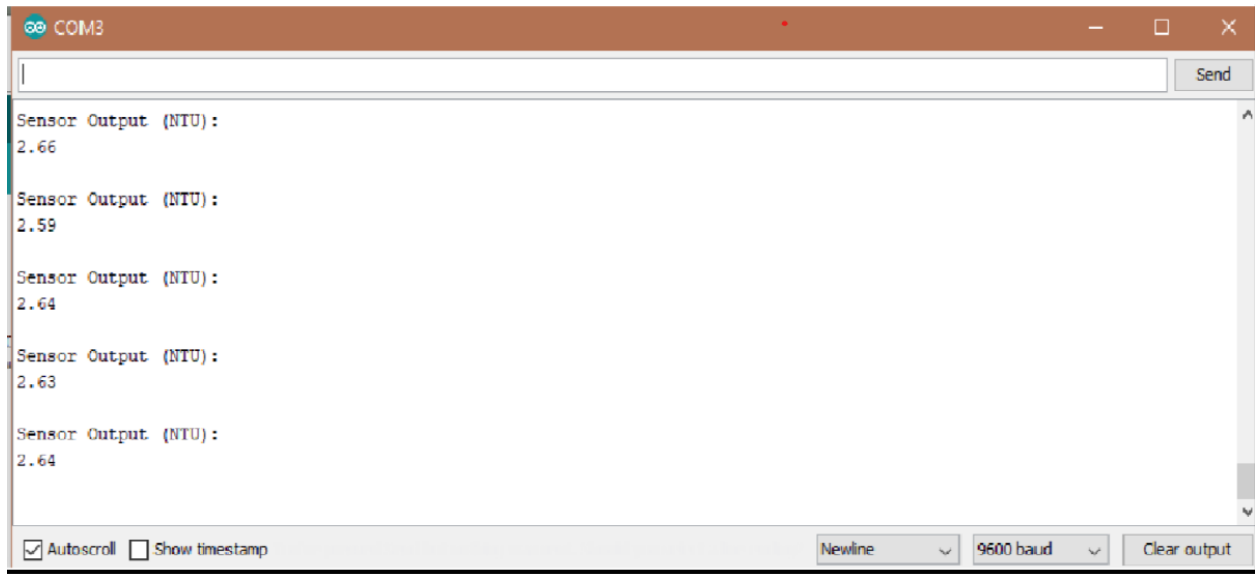**TEST CASE 1:**

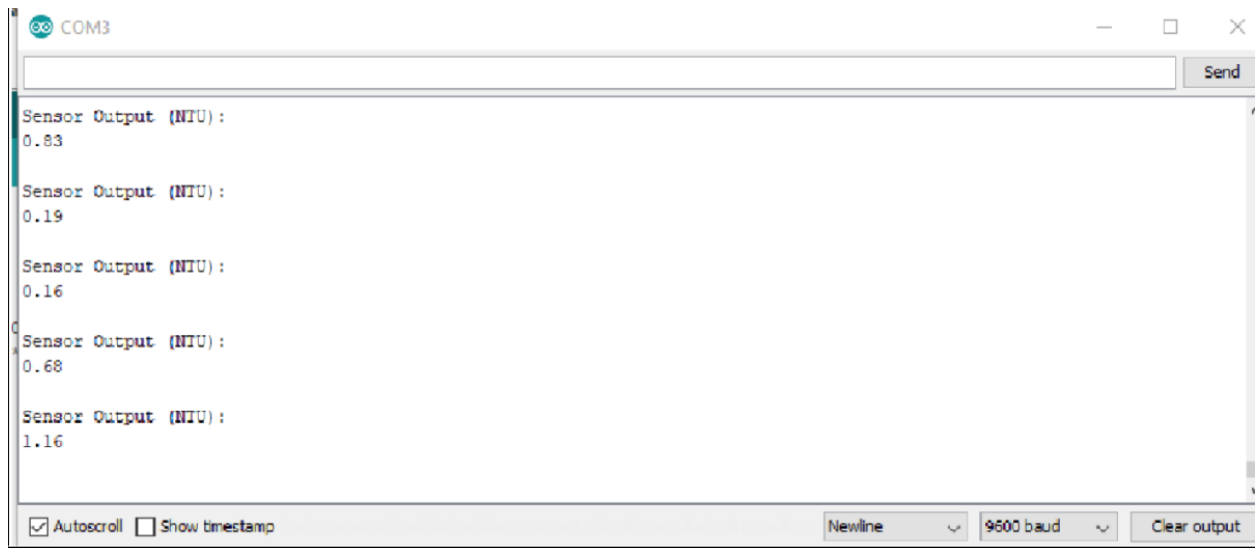**Fig8. Test Case1**

TEST CASE 2:

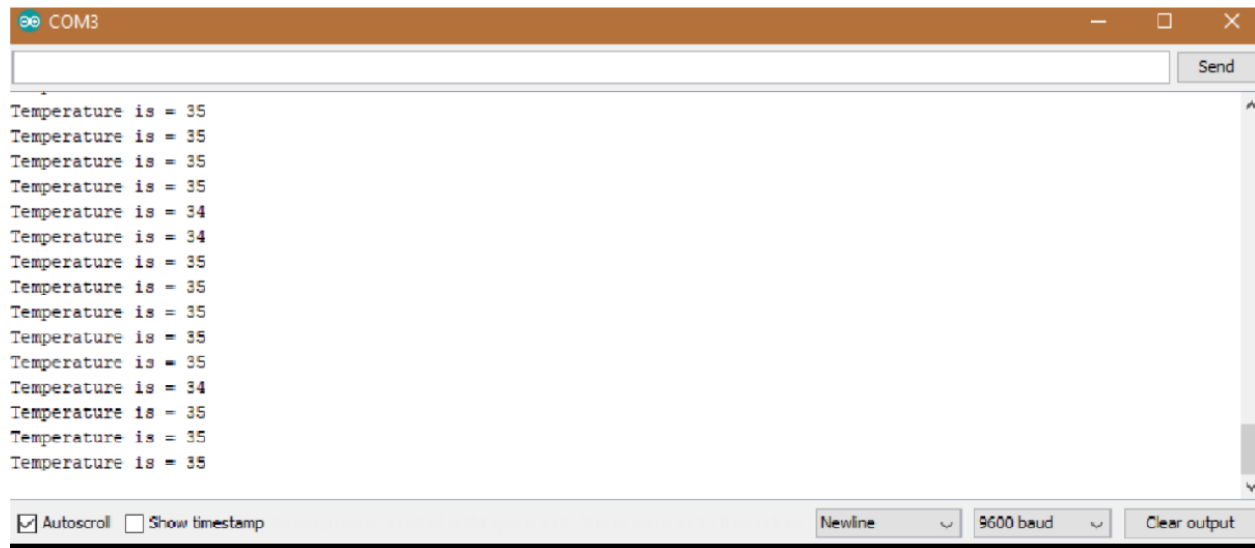

Fig9.Test Case2

FINAL OUTPUT:

Fig10. Final output

7.2 Feature 2

CODING:

#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))

```python
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 shared to 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"
```

OUTPUT:

```
Test case: 1
Welcome to Real-Time River Water Quality Monitoring and Control System
Temperature: 106
pH: 14
DO: 66
TSS: 3671
Manganese: 527
Copper: 897
Ammonia & Nitrate: 36
Hardness: 906
Zinc: 83
Conductivity: 9.31
Chloride: 180
Sulphate: 829

Test case: 2
Welcome to Real-Time River Water Quality Monitoring and Control System
Temperature: 68
pH: 14
DO: 9
TSS: 945
Manganese: 664
Copper: 129
Ammonia & Nitrate: 58
Hardness: 299
Zinc: 9
Conductivity: 1396.60
Chloride: 109
Sulphate: 636

Test case: 3
Welcome to Real-Time River Water Quality Monitoring and Control System
Temperature: 96
pH: 3
DO: 12
TSS: 2028
Manganese: 712
Copper: 162
Ammonia & Nitrate: 48
Hardness: 680
Zinc: 86
Conductivity: 1386.56
Chloride: 57
Sulphate: 527
```

Fig11. Output

CODING:

```
<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%;
```

```css
}
.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 {
```

```css
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>
```

```html
<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" 44equired>

<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>

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>
```

OUTPUT:

Fig12a. Html Output

CODING:

```html
<html>
<head>
<title> Registration Page
</title>
</head>
<body>
<br>
<br>
<form> name
<label> Firstname </label>
<input type="text" name="firstname" size="15"/> <br> <br>
<label> Middlename: </label>
<input type="text" name="middlename" size="15"/> <br> <br>
<label> Lastname: </label>
<input type="text" name="lastname" size="15"/> <br> <br>
</select> project title
1.<label> cloud computing </label> 2.<label> internet of things </label> 3.<label>
machine learning </label> 4.<label> data science </label>
5.<label> artificial intelligence </label>
<br>
<br>
<br>

<input type="radio" name="male"/> Male <br>
<input type="radio" name="female"/> Female <br>
<input type="radio" name="other"/> Other
<br>
<br>
<br>
<label> Phone :
</label>
<input type="text" name="country code" value="+91" size="2"/>
<input type="text" name="phone" size="10"/> <br> <br> Address
```
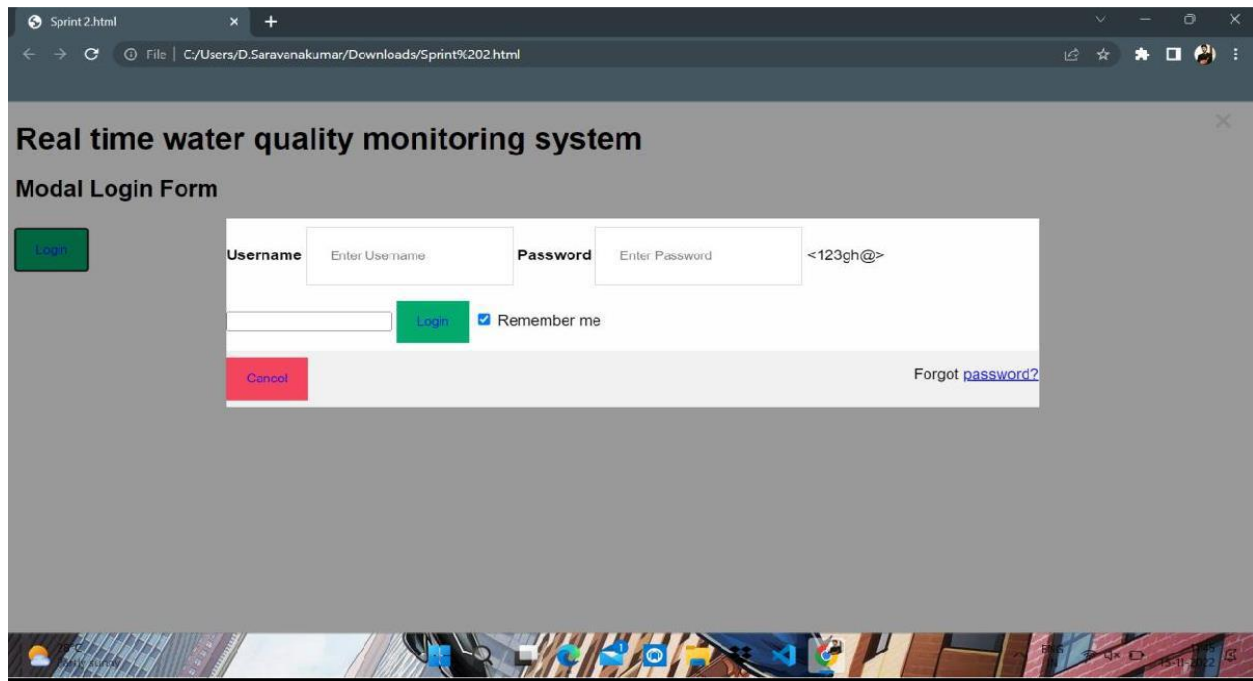
```
<br>
<textarea cols="80" rows="5" value="address">
</textarea>
<br> <br> Email:
<input type="email" id="email" name="email"/> <br>
<br> <br> Password:
<input type="Password" id="pass" name="pass"> <br>
<br> <br>
Re-type password:
<input type="Password" id="repass" name="repass"> <br> <br>
<input type="button" value="Submit"/>
</form>
</body>
alternte phone number
<input type="text" name="country code" value="+91" size="2"/>
<input type="text" name="phone" size="10"/> <br> <br> alternate email id
<input type="altrernate email id" name="alternate email"/> <br>
<br> <br>
<body>
<html>
```
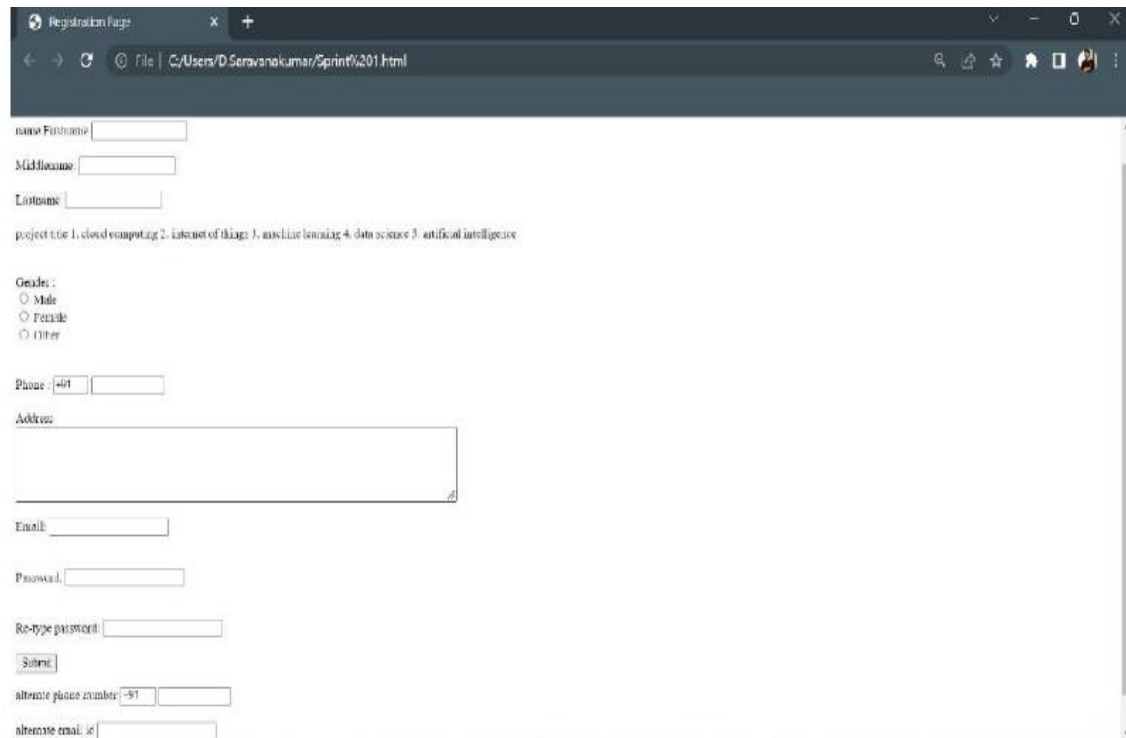
OUTPUT:

Fig12b. Html Output

CHAPTER 8

TESTING

8.1 Test cases

Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
UI	Home Page	Verify user is able to see the Login		1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://127.0.0.14000#	Login/Signup popup should display	Working as expected	Pass
UI	Home Page	Verify the UI elements in Login/Signup popup		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://127.0.0.1400/	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
UI	Home page	Verify user is able to log into application with Valid credentials		1.Enter URL(https://127.0.0.1400/) 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: adks17@gmail.com password: 12345	User should navigate to user account homepage	Working as expected	pass
Functional	Web page	Verify user can able to view the PH and turbidity level of water		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	a. ph level=6.7 b.Turbidity level= 0.7 NTU c. temperature=38 degree	Application should show that the		
Functional	Web page	Verify user can able to view the PH and turbidity level of water		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	a. PH level= 10.8 b. Turbidity level = 0.9 NTU c. temperature=40 degree	Application should show that the PH level is out of range. The water quality is not good	not working	fail
Functional	Web page	Verify user can able to view the PH and turbidity level of water		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	a. PH level =7.5 . b.Turbidity level= 6NTU c. Temperature=45 degree	Application should show that the turbidity level is out of range. The water quality is not good	working as expected	pass

Fig13. Test Cases

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Real time water quality monitoring and control system project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

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

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	7	3	2	3	15
Duplicate	1	0	4	0	5
External	2	2	0	1	5
Fixed	8	2	3	18	31
Not Reproduced	0	0	1	2	3
Skipped	4	4	1	2	11
Won't Fix	6	5	3	1	15
Totals	28	16	14	27	85

Table9. Defect Analysis

3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	45	3	2	40
Security	2	0	1	1
Out source Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	2	0	2
Version Control	2	0	0	2

Table10. Test Case Analysis

CHAPTER 9

RESULT

9.1 Performance Metrics

iotwqms2019@gmail.com
to me, josiahkotey13, izagyen96 ▾

Data collected...

{'temperature': 26.19, 'turbidity': 2.84, 'ph': 10.09, 'water_level': 8.0}

pH out of range(basic water): 10.09

iotwqms2019@gmail.com
to me, josiahkotey13, izagyen96 ▾

Data collected...

{'temperature': 26.19, 'turbidity': 3.25, 'ph': 7.89, 'water_level': 3161.0}

Fig14. Performance Metrics

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

Advantages:

- ➢ More user friendly
- ➢ The system is high efficient
- ➢ Accurate level of ph, turbidity, conductivity, temperature
- ➢ Data accuracy
- ➢ Reliability and efficiency.

Disadvantages:

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

CHAPTER 11

CONCLUSION

This paper is all about discussing many of the proposed systems to automate the traditional water quality monitoring. One of the major issues faced by the world is water scarcity. Another one is water contamination. Reasons for these two can be increased population, growth of urbanization to its peak and tremendous increase of industrialization. The proposed system can be implemented by including basic parameters checking and can be expanded by incorporating various features associated with water quality. These kinds of quality monitoring systems will help the society to achieve more secured future as water pollution can be controlled to a great extent through continuous monitoring. With minimal features implementation will be much easier**.**

CHAPTER 12

FUTURE SCOPE

The prototype developed for water quality maintenance is very beneficial for safeguarding public health and also adds to the clean environment. The automation of this water monitoring, cleaning and control process removes the need of manual labor and thus saves time and money. The automation of the system makes the control and monitoring process more efficient and effective. Real time monitoring on mobile phone which is possible through the interface of plc with Arduino and Bluetooth module allows remote controlling of the system. The future scope of this project is monitoring environmental conditions, drinking water quality, treatment and disinfection of waste water etc. This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers

CHAPTER 13

APPENDIX

13.1.Source code

#IBM Watson IOT Platform

#pip install wiotp-sdk

import wiotp.sdk.device

import time

import random

myConfig = {

"identity": {

"orgId": "hj5fmy",

"typeId": "NodeMCU",

"deviceId":"12345"

},

"auth": {

"token": "12345678"

}

}

```python
def myCommandCallback(cmd):

print("Message received from IBM IoT Platform: %s" % cmd.data['command'])

m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)

client.connect()

while True:

temp=random.randint(-20,125)

hum=random.randint(0,100)

myData={'temperature':temp, 'humidity':hum}

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

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

client.commandCallback = myCommandCallback

time.sleep(2)

        client.disconnect()
```

13.2 GitHub and Project Demo Link

GitHub link: https://github.com/IBM-EPBL/IBM-Project-43825-1660719909

Project demo link:

https://drive.google.com/file/d/1DxbJpjm_j9wHJ10LUBzpjP3yohKcQ_OQ/view?usp=share_link