

**REAL TIME RIVER WATER QUALITY  
MONITORING AND CONTROL  
SYSTEM**

*Submitted by*

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**ANNA UNIVERSITY:: CHENNAI 600 025**

## TABLE OF CONTENT

CHAPTER NO	TITLE	PAGE NO
1	<b>INTRODUCTION</b> 1.1 Project Overview 1.2 Purpose	1
2	<b>LITERATURE SURVEY</b> 2.1 Existing System 2.2 References 2.3 Problem Statement Definition	2
3	<b>IDEATHON &amp; PROPOSED SOLUTION</b> 3.1 Empathy Map Canvas 3.2 Ideathon & Brainstorming 3.3 Proposed Solution 3.4 Problem Solution Fit	3
4	<b>REQUIREMENT ANALYSIS</b> 4.1 Functional Requirement 4.2 Non-Functional Requirement	7
5	<b>PROJECT DESIGN</b> 5.1 Data Flow Diagrams 5.2 Solution & Technical Architecture	8
6	<b>PROJECT PLANNING &amp; SCHEDULING</b> 6.1 Sprint Planning, Schedule & Estimation 6.2 Sprint Delivery Schedule 6.3 Reports From JIRA	11
7	<b>CODING &amp; SOLUTIONING</b> 7.1 Feature	13
8	<b>TESTING</b> 8.1 Test cases 8.2 User Acceptance Testing	25

<b>9</b>	<b>RESULTS</b> 9.1 Performance Metrics	28
<b>10</b>	<b>ADVANTAGES &amp; DISADVANTAGES</b> 10.1 Advantages 10.2 Disadvantages	30
<b>11</b>	<b>CONCLUSION</b>	31
<b>12</b>	<b>FUTURE SCOPE</b>	31
<b>13</b>	<b>APPENDIX</b>	32

# CHAPTER-1

## 1.1 Introduction

Agriculture is a pillar of India's economy and deserves security. Security and protection are required at the very initial stage, like protection from attacks of rodents or insects in the fields and as well as grain stores. Those challenges also need to be taken into account. The security systems that are used today are not smart enough to deliver real-time notification after detecting the problem. Climate change, soil erosion and loss of biodiversity also increase the pressure of farmers and a drastic decrease in the crop production.

## 1.2 Project Overview

Due to the limited drinking water resources, intensive money requirements, growing population, urban change in rural areas, and the excessive use of sea resources for salt extraction has significantly worsened the water quality available to people. The high use of chemicals in manufacturing, construction and other industries, fertilizers in farms and also directly leaving the polluted water from industries into nearby water bodies have made a huge contribution to the global water quality reduction, which has become an important problem. Even due to containment water various water born are increasing day by day, due to which many human beings are losing their lives. The water pollution is detected in an early stage, suitable measures can be taken and critical situations can be avoided. The project proposes a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly. The device will also monitor the ph level, turbidity levels and send them to the IBM IOT Platform. The graph will be retrieved from Object storage and displayed in the web application. A web application is developed to visualize the ph levels, turbidity values.

## 1.3 Purpose:

The Main motive of this project is to protect from the various river water from factors such as dirty water, drainage and chemicals. This system helps the river water to protect from dirty water and chemicals. This system can also find the increase in water in level during extreme rain. With this system the surrounding temperature, turbidity, ph level content can also be detected.

## CHAPTER-2

### LITERATURE SURVEY

#### 2.1 Existing problem

As new technologies has been introduced and utilized in modern world, there is a need to bring advancement in the sector of river water also. Various Researches have been undergone to enhance quality monitoring and controlling are widely used. So as to enhance the river water efficiently, it is necessary to monitor the environmental conditions in and around the river. The parameters that have to be exact monitored to enhance the purity water are turbidity , ph level, temperature, etc., Internet of Things (IOT) is being utilize in a number of real time applications. The introduction of Internet of thing (IOT) along with the sensor network in purity water to the people. Online river water monitoring the use of IOT helps the users to stay related this subject from somewhere and anytime. Various sensors are used to screen and collect records about the area conditions. Collectively the about the water circumstance is disbursed to the user of GSM technology.

#### 2.2 References

1. Official website of the River water monitoring and control System at:  
<https://www.sciencedirect.com/science/article/pii/S1877050919309391>
2. Base paper releated for this project at:  
<https://www.semanticscholar.org/paper/IoT-Based-Real-time-River-Water-Quality-Monitoring-Chowdury-Emran/b630822704ddc9964954ffeffbd01e94515b0e55>
3. Artical related for thi project at:  
[https://www.academia.edu/42095857/IoT\\_Based\\_Real\\_time\\_River\\_Water\\_Quality\\_Monitoring\\_System](https://www.academia.edu/42095857/IoT_Based_Real_time_River_Water_Quality_Monitoring_System)

#### 2.3 Problem Statement Definition

The problem of wild life attack on crops i.e., Animals,Birds cause a lot of damage to crops byrunning over them, eating and completely vandalizing them. This lead to poor yield of crops and significant financial loss to the owners of the farmland.

## CHAPTER-3

### IDEATION AND PROPOSED SOLUTION

#### 3.1 Empathy Map Canvas

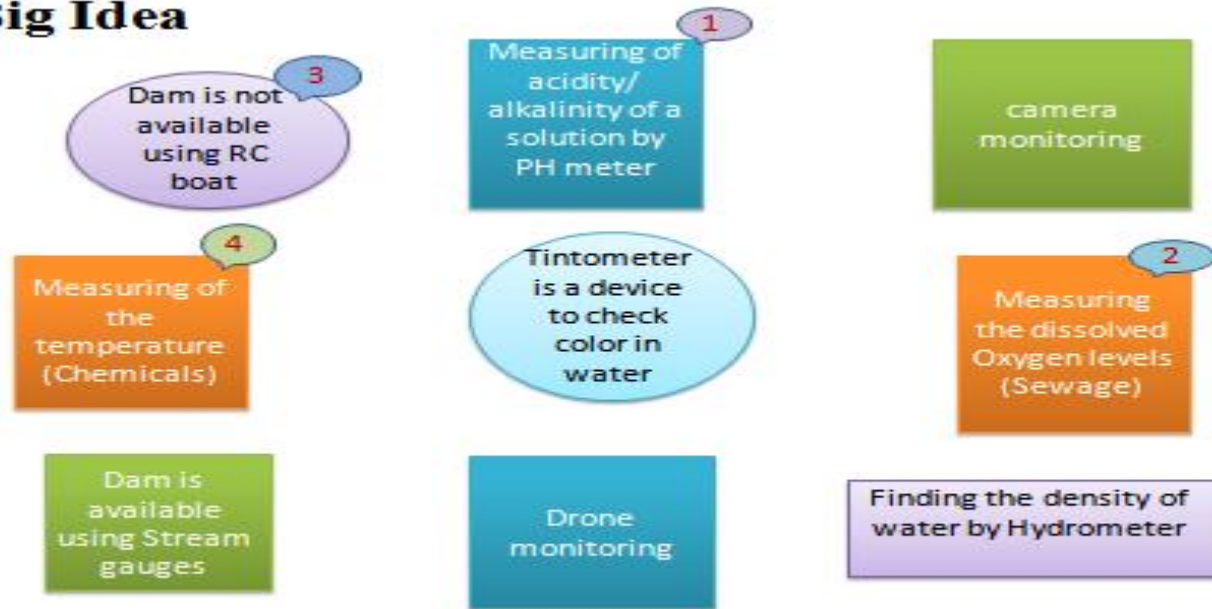
An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment.



## 3.2 Big Ideas

It consists of all the ideas of instruments and equipments that we are going to implement in this project.

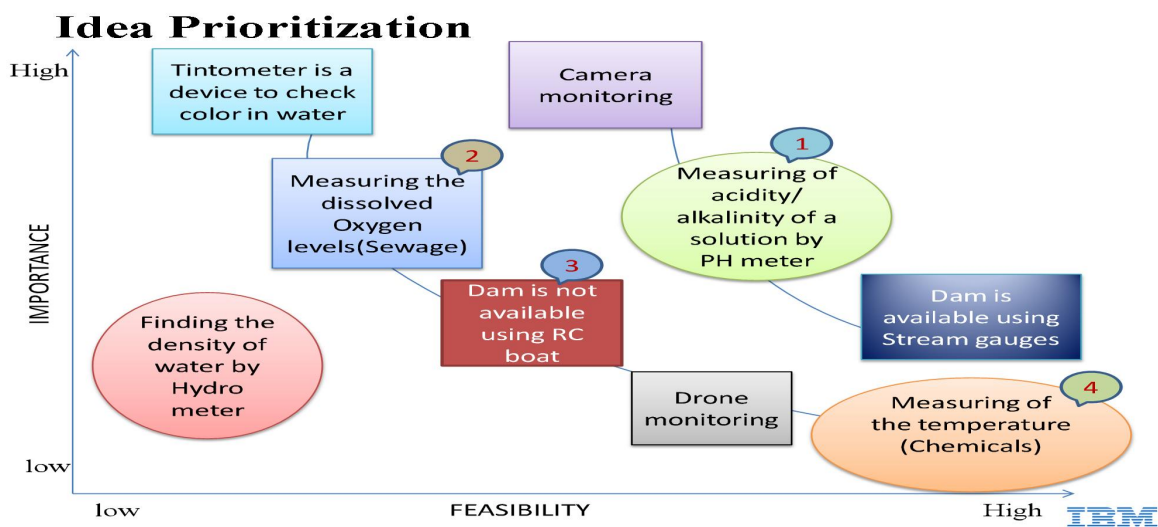
### Big Idea



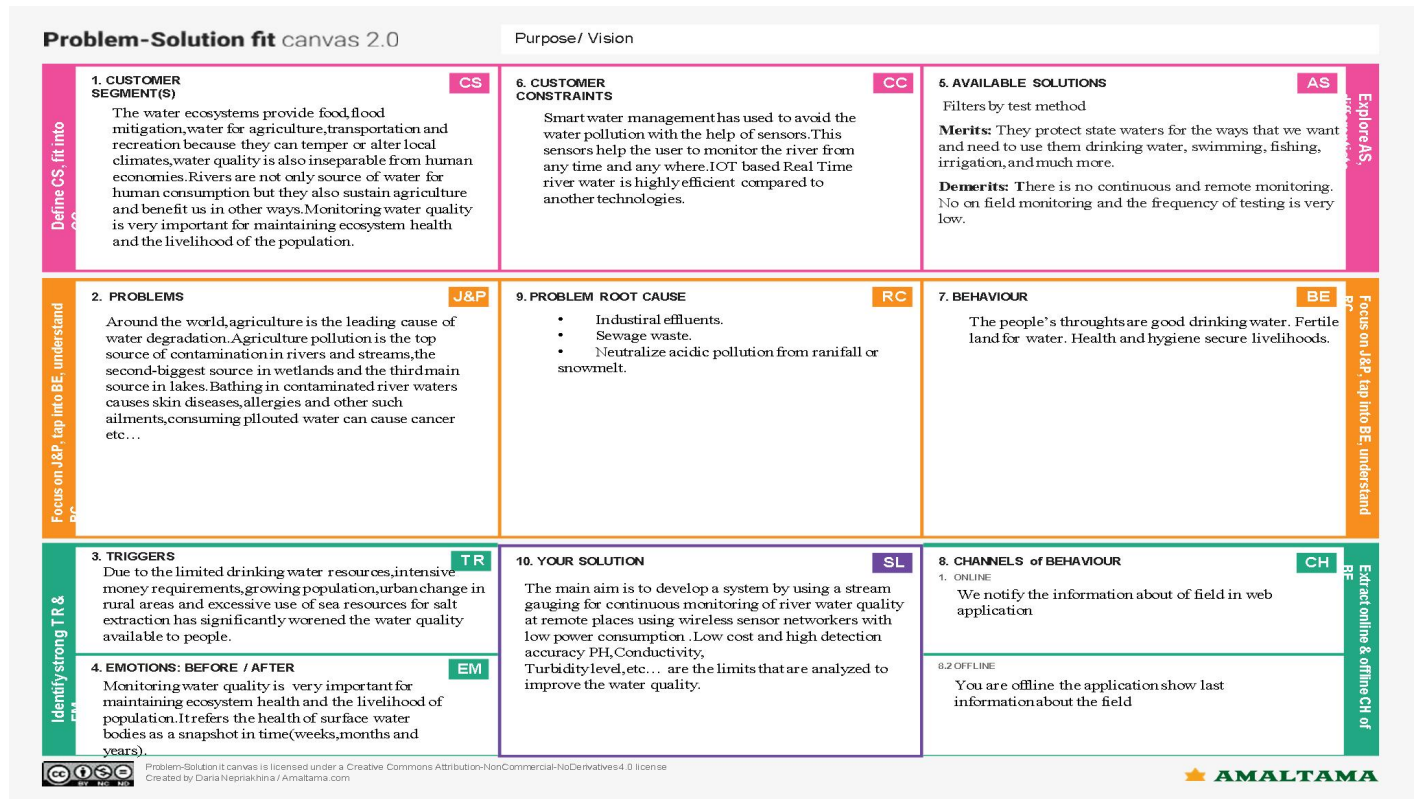
IBM 3.

## 3 Idea Prioritization

It deals with the prioritizing of the big ideas in order of highest to lowest likes.



### 3.4 Problem Solution Fit



### 3.5 Proposed Solution

S.No	Parameter	Description
1.	<b>Problem Statement (Problem to be solved)</b>	IOT Based Real Time River Water Quality Monitoring and Control System.
2.	<b>Idea / Solution description</b>	1. To measure water parameters such as PH, dissolved oxygen, turbidity, conductivity etc. Using available sensors at a remote place. 2. To assemble data from various sensor nodes and send it to the base station by wireless channel. 3. To send SMS to an authorized person.
3.	<b>Novelty / Uniqueness</b>	1. If the water is contaminated, it aware sensor send the alert message to the nearby control room. 2. Sometimes employee is not there message has been sent to his mobile.



4.	<b>Social Impact / Customer Satisfaction</b>	More than 50 kinds of diseases are caused by poor drinking water quality and 80% of disease and 50% of child deaths are related to poor drinking water,agriculture.
5.	<b>Business Model (Revenue Model)</b>	<p>1.Through Advertisment we can sell ourproject to the public sector.</p> <p>2.We can give advertisement through thesocial media</p> <p>3.Purity water is most important in world</p> <p>4.To provide this information in advertisement is useful for society.</p>
6.	<b>Scalability of the Solution</b>	<p><b>IOT Sensor, Camera Drone monitoring&amp; assessment of the water purity.</b></p> <p>We can use it for agriculture and drinking water.Thus the Human begins, Goats and Cows infected should be avoided by this project. By using this water the farmer'sland will be affected. Using this project we can avoid it. The health issues also avoid it.</p>

## CHAPTER-4

### REQUIREMENT ANALYSIS

#### 4.1 Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User registration	Registration through Gmail Create an account Follow the instructions
FR-2	User Confirmation	Confirmation via Email Confirmation via Alarm Confirmation via SMS
FR-3	Interface sensor	Interface sensor if contaminated water enter in the river it gives alarm.
FR-4	Accessing datasets	Datasets are retrieved from Cloudant DB
FR-5	Mobile application	Only can see water is contaminated or not. Had not using Mobile application.

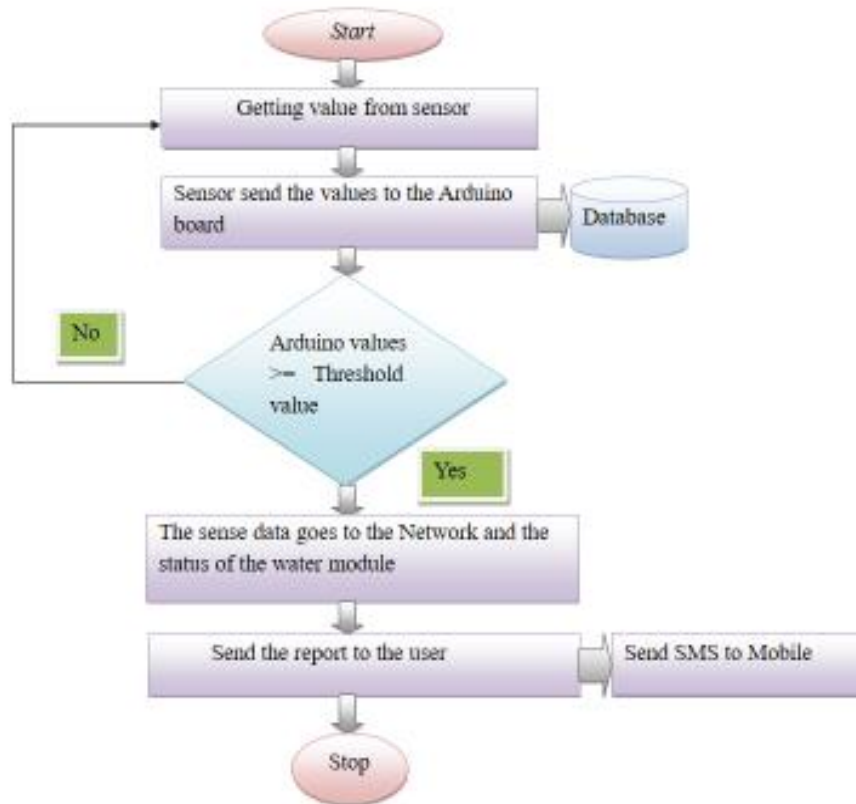
#### 4.2 Non-Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	The smart river system defines that this project helps people's to protect the drinking water and argiculture.
NFR-2	<b>Security</b>	We have designed this project to secure the the water from contaminated water or chemical or sewage
NFR-3	<b>Reliability</b>	This project will help people's in protecting their water and save them from diseases.
NFR-4	<b>Performance</b>	IOT devices and sensors are used to alert the station control person by a message when contaminated water enter in river.
NFR-5	<b>Availability</b>	By developing and deploying resilient hardware and software we can protect the river from contamination chemicals,sewage,etc.....
NFR-6	<b>Scalability</b>	This project used to collect real time information in water and measure quality.

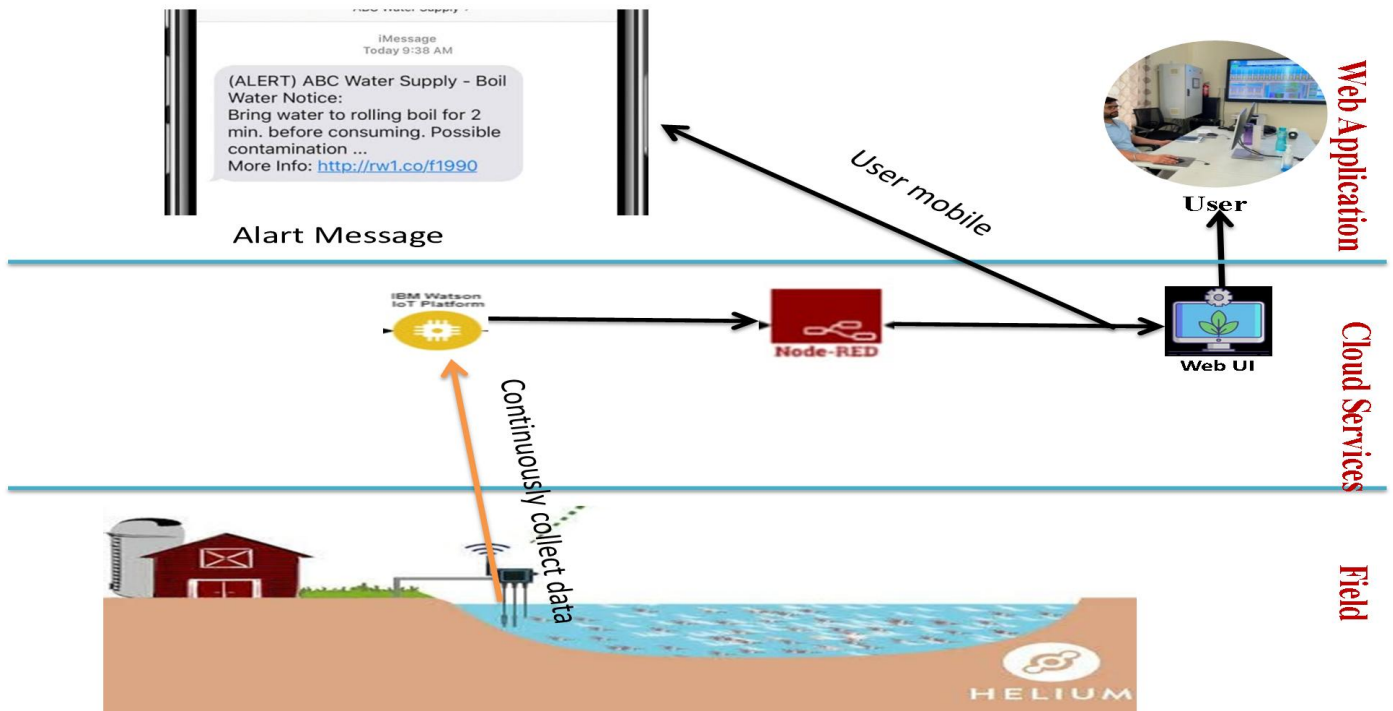
## CHAPTER-5

### PROJECT DESIGN

#### 5.1 Data Flow Diagram



## 5.2 Solution Architecture



## 5.3 Customer Journey Map

<div>1</div> <div>Phases</div> <div>High level steps your user needs to accomplish from start to finish</div>	Fix the sensor in water		Getting sense in water purity		If contaminated water is contained in river		send the alert SMS to the user mobile and station alarm is on		
<div>2</div> <div>Steps</div> <div>Detailed actions your user has to perform</div>	Using arduino board to connect the sensor	To use temperature sensor,PH sensor,LCD display,wifi module,etc....	To check the water purity in river using sensors	To check the level of percentage in water purity in river	Chemical wastage , Sewage contaminated in river water	Death of aquatic life forms in river water	Automatically send the SMS to user mobile.	To close the dam volve	
<div>3</div> <div>Feelings</div> <div>What your user might be thinking and feeling at the moment</div>	<div><div>👍</div><div>👎</div></div>	Informative Insights	Illustrative historical reports	Preventive maintenance checks	Instant alerts	Seamless communication	Cost reduction	Scalable solution	
		Degrading water quality	Reduced water levels,water consumption patterns	Lack of backup resources are a few challenges that water based industries currently face	The reckless use of water has adversely affected biodiversity	Natural habitats to a point where it has become scare across major regions			
<div>4</div> <div>Pain points</div> <div>Problems your user runs into</div>	Dirty water causes water borne diseases by human		It is destruction of whole ecosystem in river water		River water pollution caused by phenomena		Pollutes the natural rock acquifers affecting the groundwater	It effects contaminated river water for plants and animals	Some items that may be present in waste water in such concentrations that they are toxic for plants
<div>5</div> <div>Opportunities</div> <div>Potential improvements or enhancements to the experience</div>	Protect human health and avoid the costs related to medical care,productivity loss and even loss of life		Provides the objective evidence necessary to make sound decisions on managing water quality today and in the future		To ensure that our waters can continue to support the many different ways		To ensure contact center touchpoints with customers are consistent with the brand promise		

Share your feedback

Academia Press

## CHAPTER-6

### PROJECT PLANNING PHASE




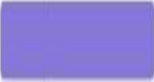




#### 6.1 Sprint Planning, Schedule & Estimation

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.	2	High	A Archana devi
Sprint-1	User Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	Medium	T Ramya
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	2	High	B Nithya
Sprint-2	Interface Sensor	USN-1	A sensor interface is a bridge between a device and any attached sensor. The interface takes data collected by the sensor and outputs it to the attached device.	2	High	M Padmavathi P Vasuki
Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	A Archana devi B Nithya M Padmavathi T Ramya P Vasuki
Sprint-4	Web Application	USN-1	As a user, I will show the current Information of the river.	1	Medium	M Padmavathi P Vasuki

#### 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	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022

## Reports From JIRA

	OCT	NOV	DEC	
Sprints				
 RTRWQMCS-9 Registration				
 RTRWQMCS-10 Interface Sensor				
 RTRWQMCS-11 Coding				
 RTRWQMCS-12 Mobile, Web Application				

## CHAPTER-7

### CODING AND SOLUTION

#### 7.1 Feature

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "mw0wqj"
deviceType = "real"
deviceId = "realtime"
authMethod = "token"
authToken = "vasuki123"
# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    else :
        print ("motor is off")

#print(cmd)

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

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10
times
deviceCli.connect()

while True:
    #Get Sensor Data from DHT11
```



```

ph=random.randint(0,14)
turb=random.randint(0,100)

data = { 'ph' : ph, 'turb': turb }
#print data
def myOnPublishCallback():
    print ("Published PH Level = %s C" % ph, "Turbidity = %s C" % turb, "to IBM Watson")

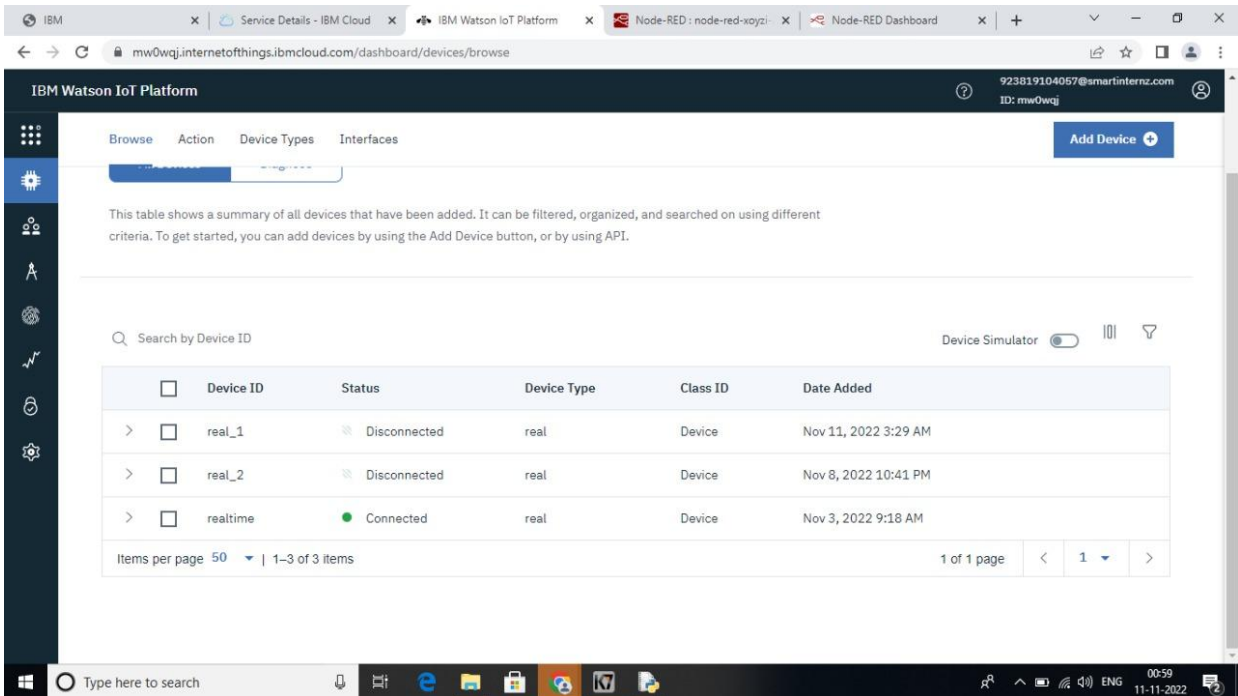
    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoT")
        time.sleep(5)

    deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()

```

## Device Details:



IBM Watson IoT Platform

923819104057@smartinternz.com  
ID: mw0wqj

Browse Action Device Types Interfaces

Add Device

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Search by Device ID

Device Simulator

Device ID	Status	Device Type	Class ID	Date Added
real_1	Disconnected	real	Device	Nov 11, 2022 3:29 AM
real_2	Disconnected	real	Device	Nov 8, 2022 10:41 PM
realtime	Connected	real	Device	Nov 3, 2022 9:18 AM

Items per page 50 | 1-3 of 3 items

1 of 1 page

## Recent Events:

The screenshot shows the IBM Watson IoT Platform dashboard. The top navigation bar includes 'Browse', 'Action', 'Device Types', and 'Interfaces'. The main content area displays a list of devices. The 'realtime' device is selected, showing its status as 'Connected' and a timestamp of 'Nov 3, 2022 9:18 AM'. Below this, the 'Recent Events' tab is active, showing a table of live stream data.

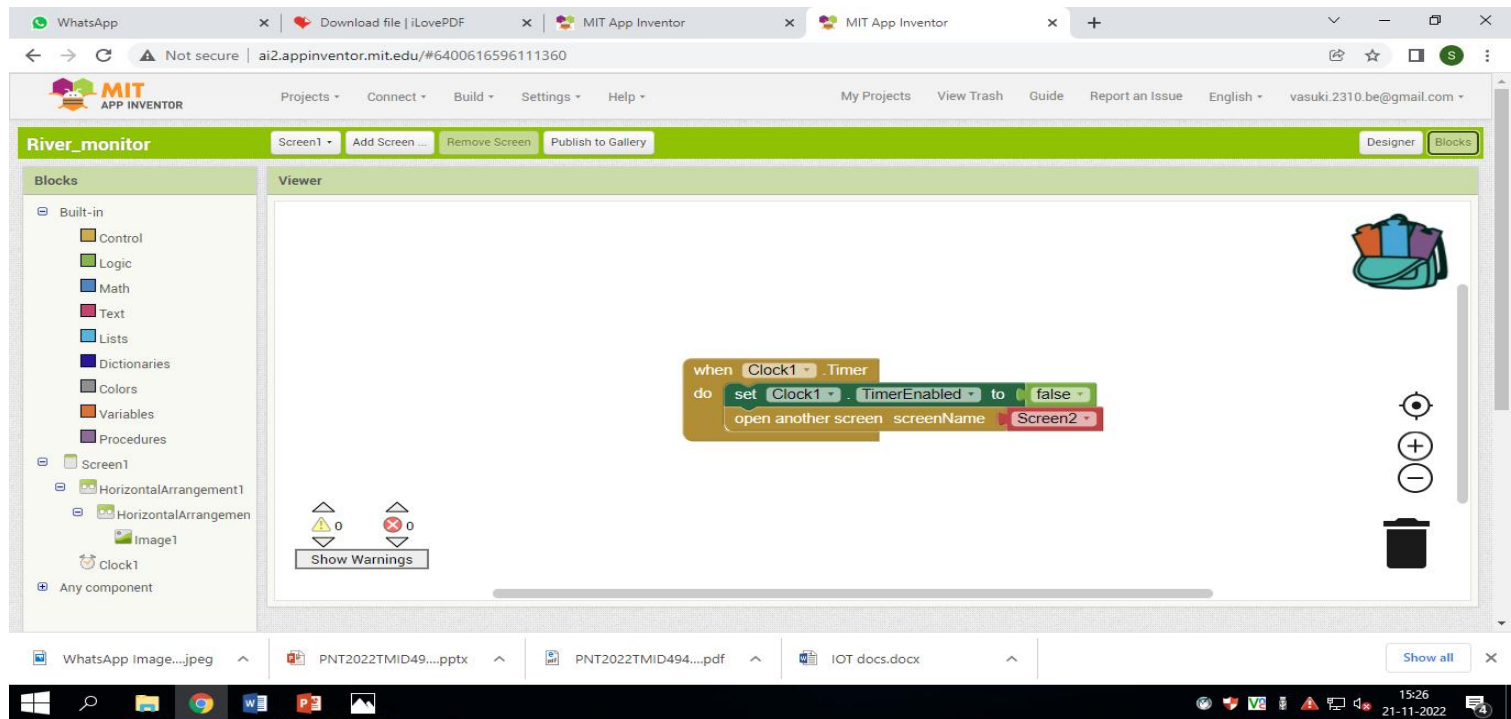
Event	Value	Format	Last Received
IoT Sensor	{"ph":9,"turb":97}	json	a few seconds ago
IoT Sensor	{"ph":1,"turb":41}	json	a few seconds ago
IoT Sensor	{"ph":12,"turb":85}	json	a few seconds ago
IoT Sensor	{"ph":10,"turb":47}	json	a minute ago
IoT Sensor	{"ph":11,"turb":54}	json	a minute ago

## Node-Red Connection and Dashboard Design:

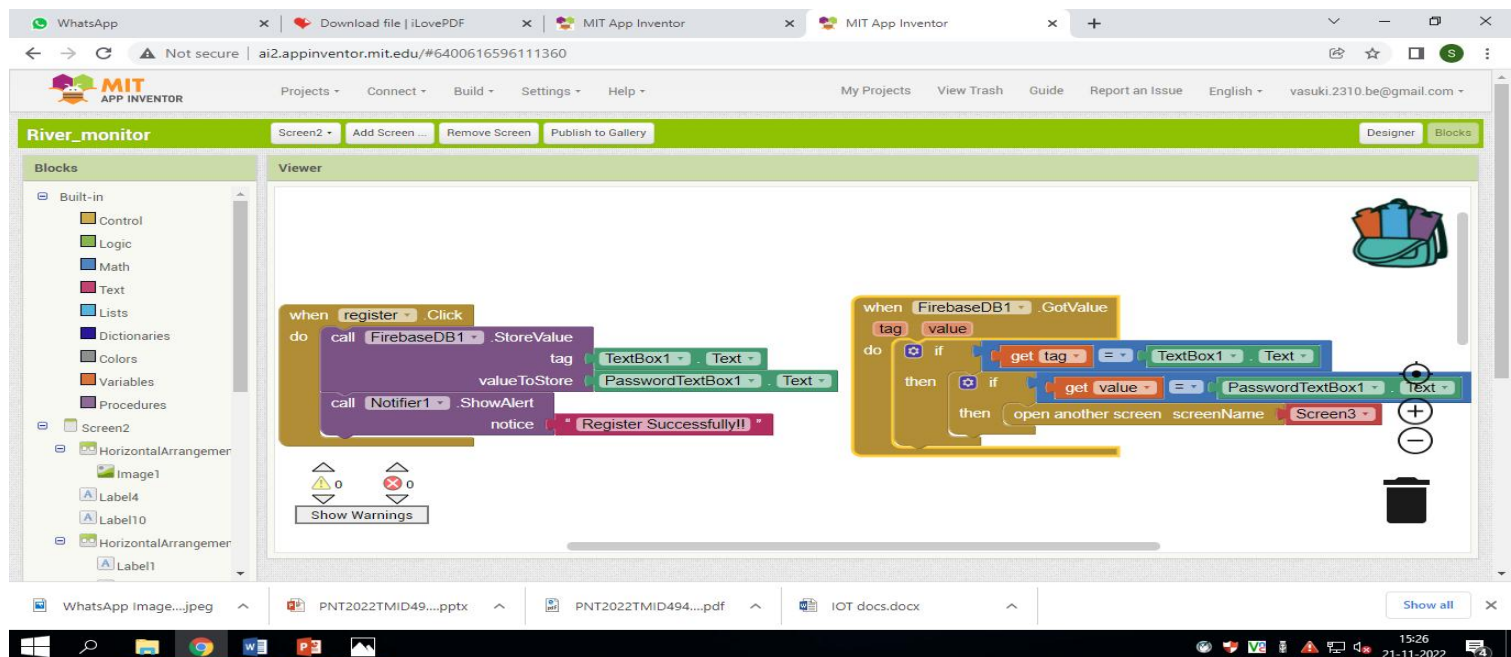
The screenshot shows the Node-RED interface with a flow titled 'River Water Monitoring'. The flow starts with an 'IBM IoT' node (connected) that triggers a 'msg payload' node. This is followed by a 'PH Level' node and a 'Turbidity' node, both of which trigger corresponding 'PH Level' and 'Turbidity' nodes. The flow then branches into two paths: one for 'Motor On' and 'Motor Off' nodes, which trigger an 'IBM IoT' node (connected) and a 'msg payload' node; and another for '[get] /command' and '[get] /data' nodes, which trigger 'http' nodes. The flow ends with a 'data' node and another 'http' node.

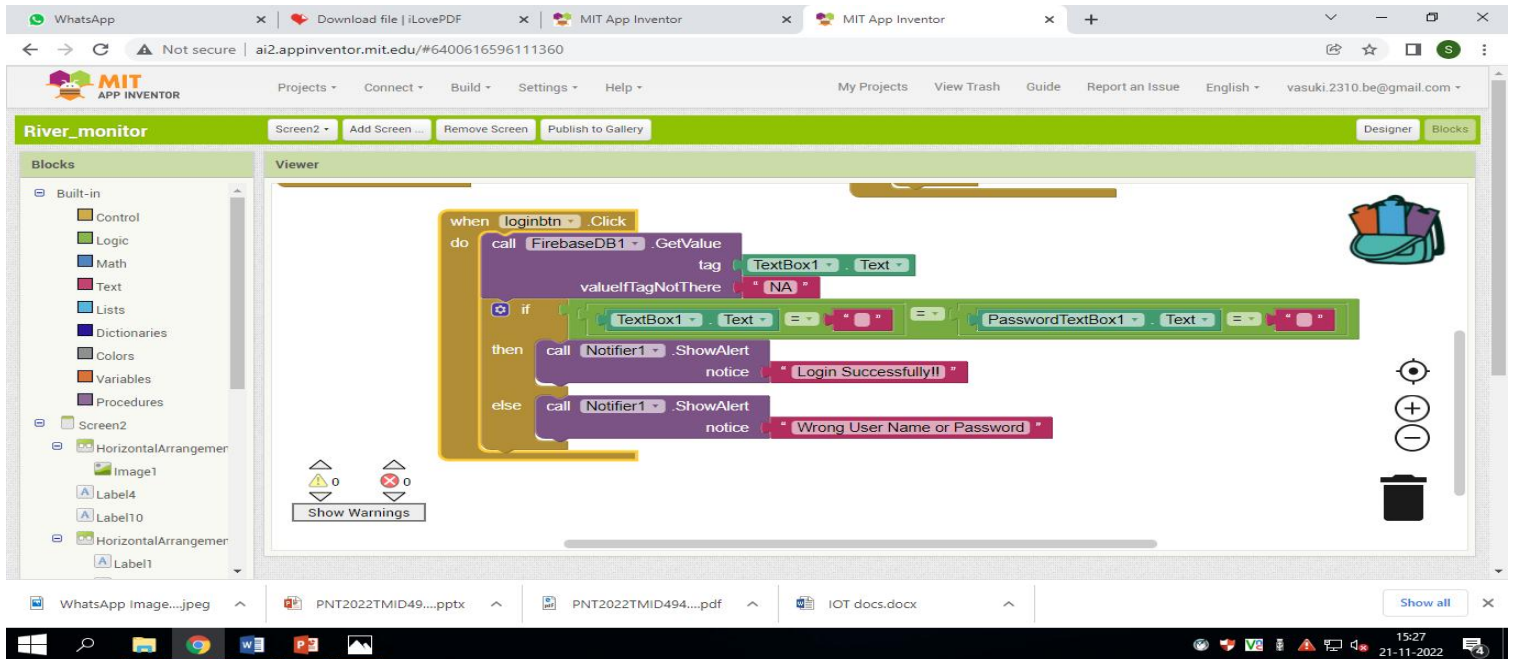
# Mobile App code

## Screen 1

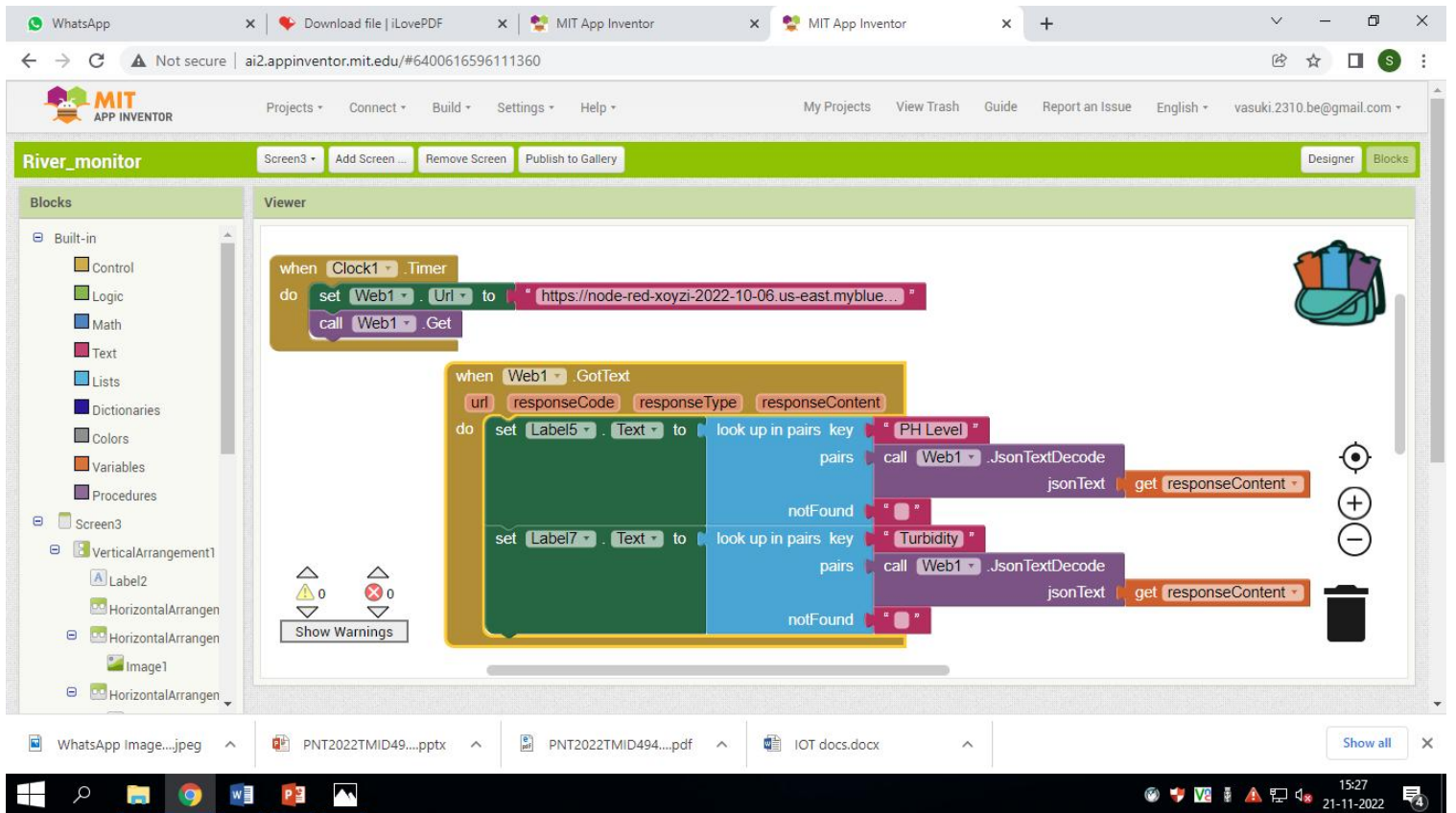


## Screen2





### Screen3





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Not secure | ai2.appinventor.mit.edu/#6400616596111360

MIT APP INVENTOR Projects Connect Build Settings Help My Projects View Trash Guide Report an Issue English vasuki.2310.be@gmail.com

River\_monitor Screen3 Add Screen ... Remove Screen Publish to Gallery Designer Blocks

Blocks

- Built-in
  - Control
  - Logic
  - Math
  - Text
  - Lists
  - Dictionaries
  - Colors
  - Variables
  - Procedures
- Screen3
  - VerticalArrangement1
    - Label2
    - HorizontalArrangen
  - HorizontalArrangen
  - Image1
  - HorizontalArrangen

Viewer

when OFF\_BTN.Click do

- set Web2.Uri to https://node-red-xoyzi-2022-10-06-us-east.myblue...
- call Web2.Get
- call Notifier2.ShowAlert notice Motor is off

when ON\_BTN.Click do

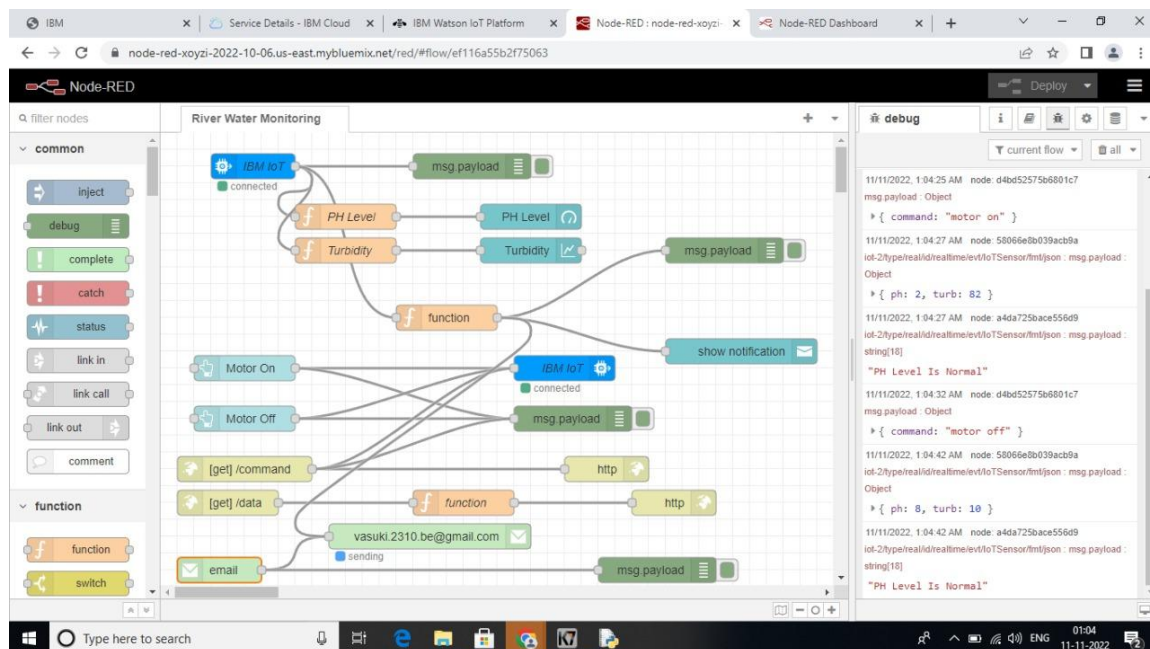
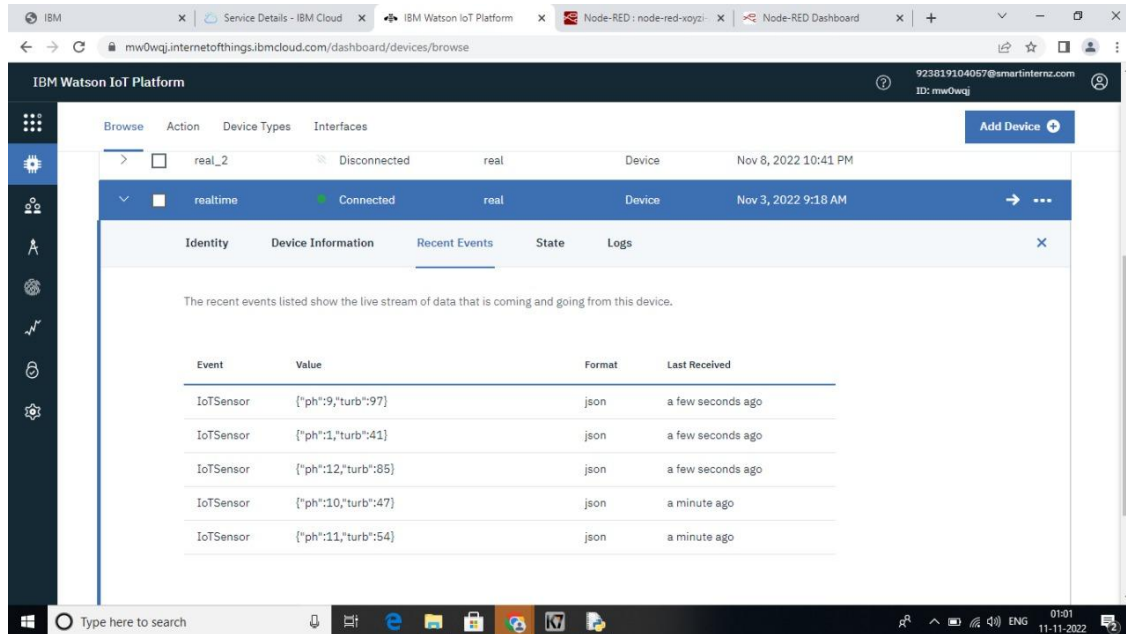
- set Web2.Uri to https://node-red-xoyzi-2022-10-06-us-east.myblue...
- call Web2.Get
- call Notifier1.ShowAlert notice Motor is on

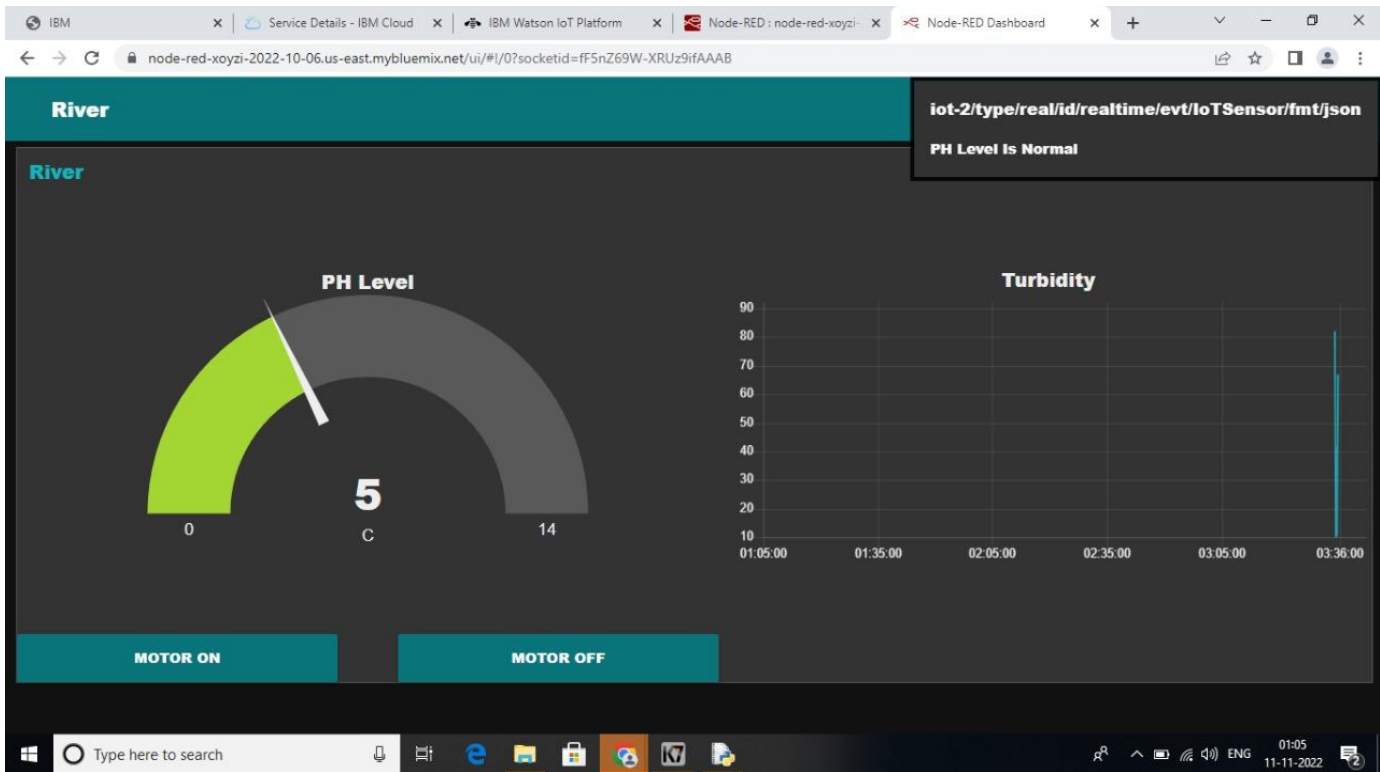
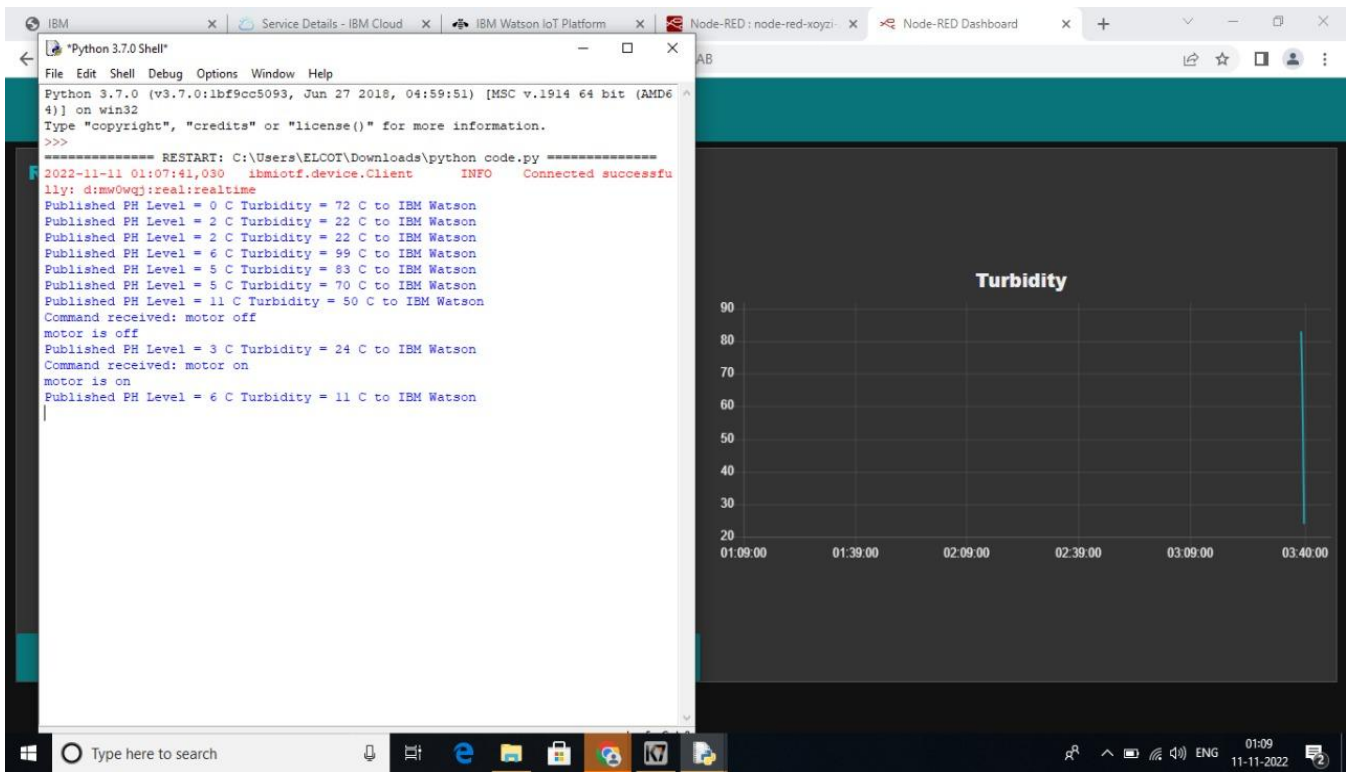
Show Warnings

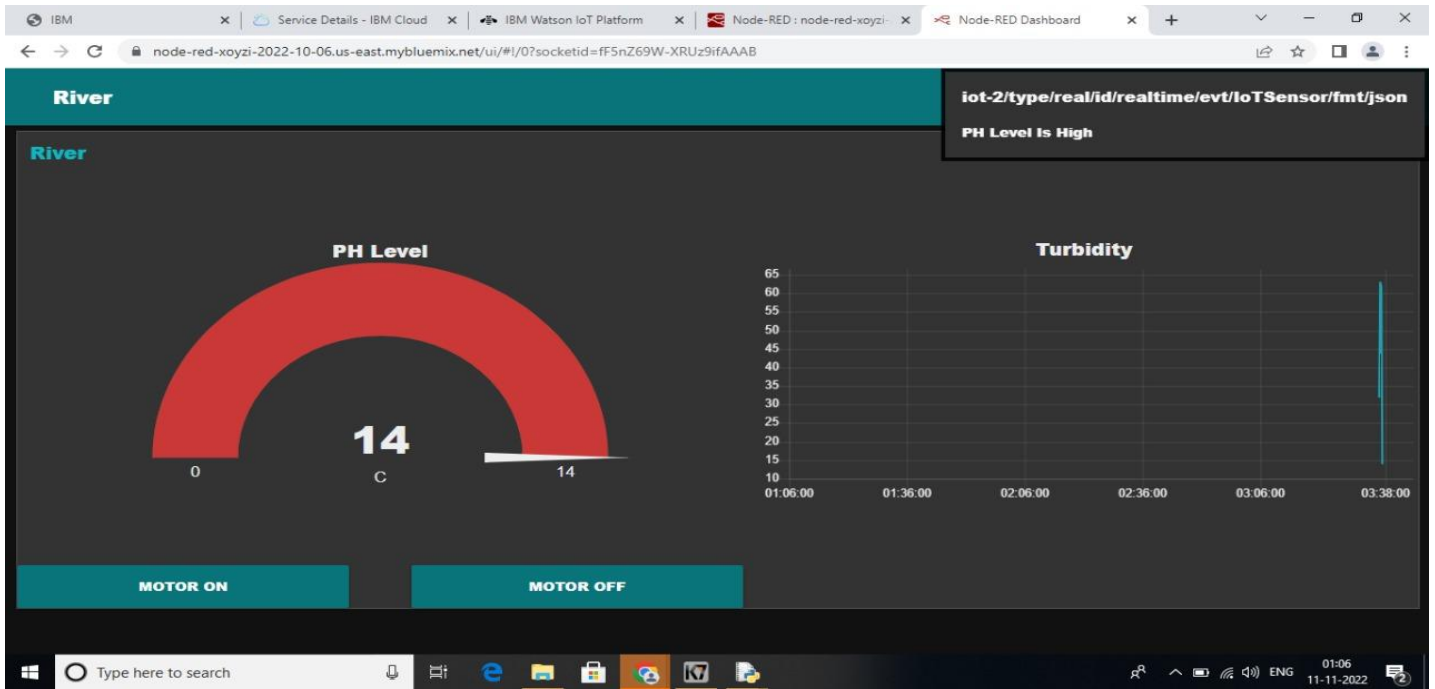
WhatsApp Image....jpeg PNT2022TMID49....pptx PNT2022TMID494....pdf IOT docs.docx Show all x

15:28 21-11-2022

## Test cases







Application Details Node-RED : node-red-xoyzi- Service Details - Cloudant Dashboard IBM Watson IoT New Tab New Tab

a6f9045f-ff4b-4a32-a9a0-35efb443e91b-bluemix.cloudant.com/dashboard.html#database/sample/\_all\_docs

sample

Document ID Options JSON

All Documents Query Permissions Changes Design Documents

Create Document

	id	key	value
<input type="checkbox"/>	0851d0c120180e922967e153779a...	0851d0c120180e922967e153779a...	{"rev": "1-ddf678b7caa0db49d2fd6..."}
<input type="checkbox"/>	0900b96274ca35abe1f48211286fb...	0900b96274ca35abe1f48211286fb...	{"rev": "1-ddf678b7caa0db49d2fd6..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa4355d78	15af3fbdeafdd7fe9ec274aa4355d78	{"rev": "1-54bc45305026ae40fe5b7..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa471bb74	15af3fbdeafdd7fe9ec274aa471bb74	{"rev": "1-ccd1cd863034c3a91dab9..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa4df1cdb	15af3fbdeafdd7fe9ec274aa4df1cdb	{"rev": "1-6d829713524ab9a500aaf..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa4dfa2d3	15af3fbdeafdd7fe9ec274aa4dfa2d3	{"rev": "1-6d829713524ab9a500aaf..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa4e256c5	15af3fbdeafdd7fe9ec274aa4e256c5	{"rev": "1-6d829713524ab9a500aaf..."}
<input type="checkbox"/>	15af3fbdeafdd7fe9ec274aa4e32350	15af3fbdeafdd7fe9ec274aa4e32350	{"rev": "1-d87cb5774fe3212b28d20..."}
<input type="checkbox"/>	1694ff3dc9f9bfa43fc7afbbff739ca9	1694ff3dc9f9bfa43fc7afbbff739ca9	{"rev": "1-63afc2252f707b71a9e71..."}
<input type="checkbox"/>	1694ff3dc9f9bfa43fc7afbbff739ca9	1694ff3dc9f9bfa43fc7afbbff739ca9	...

Showing document 1 - 20. Documents per page: 20

22-11-08-23-27.jpg green-field-tree-...webp pexels-jahoo-clous...jpg IISPS-INT-3208-Int...zip

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24°C 23:40 08-11-2022



## Mobile App

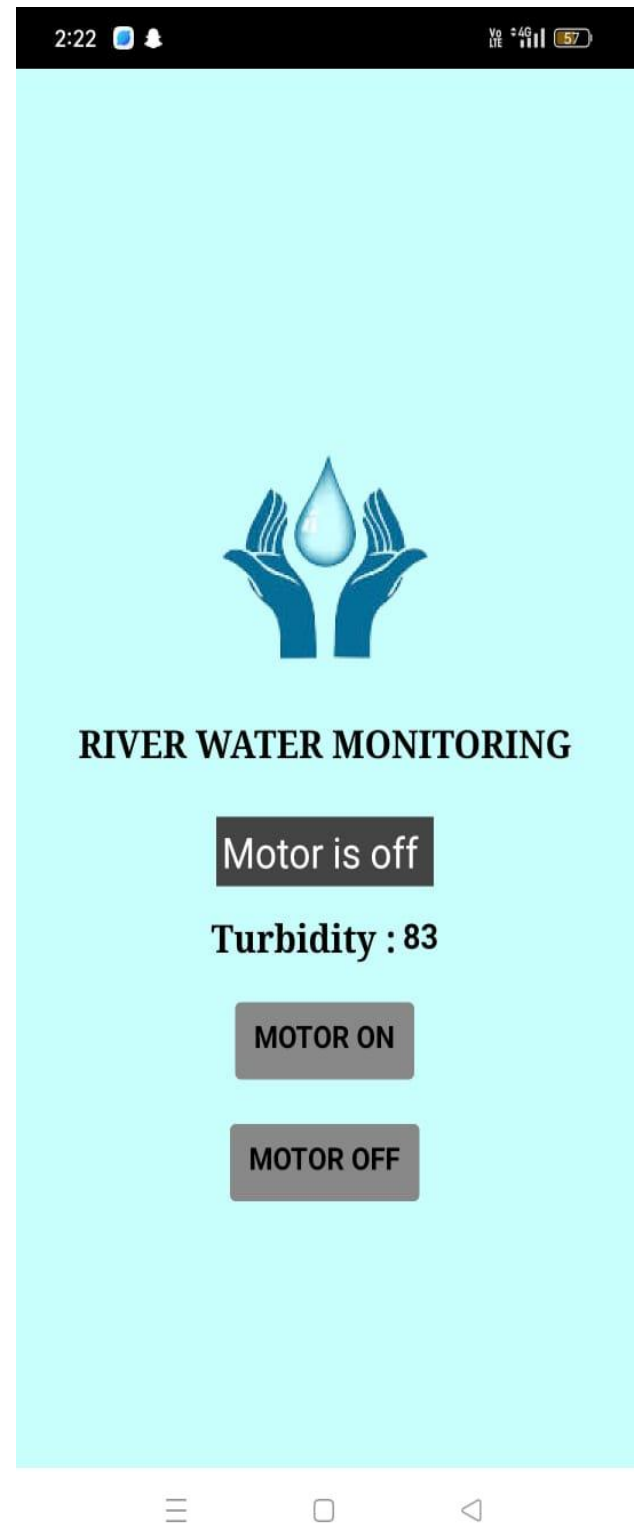
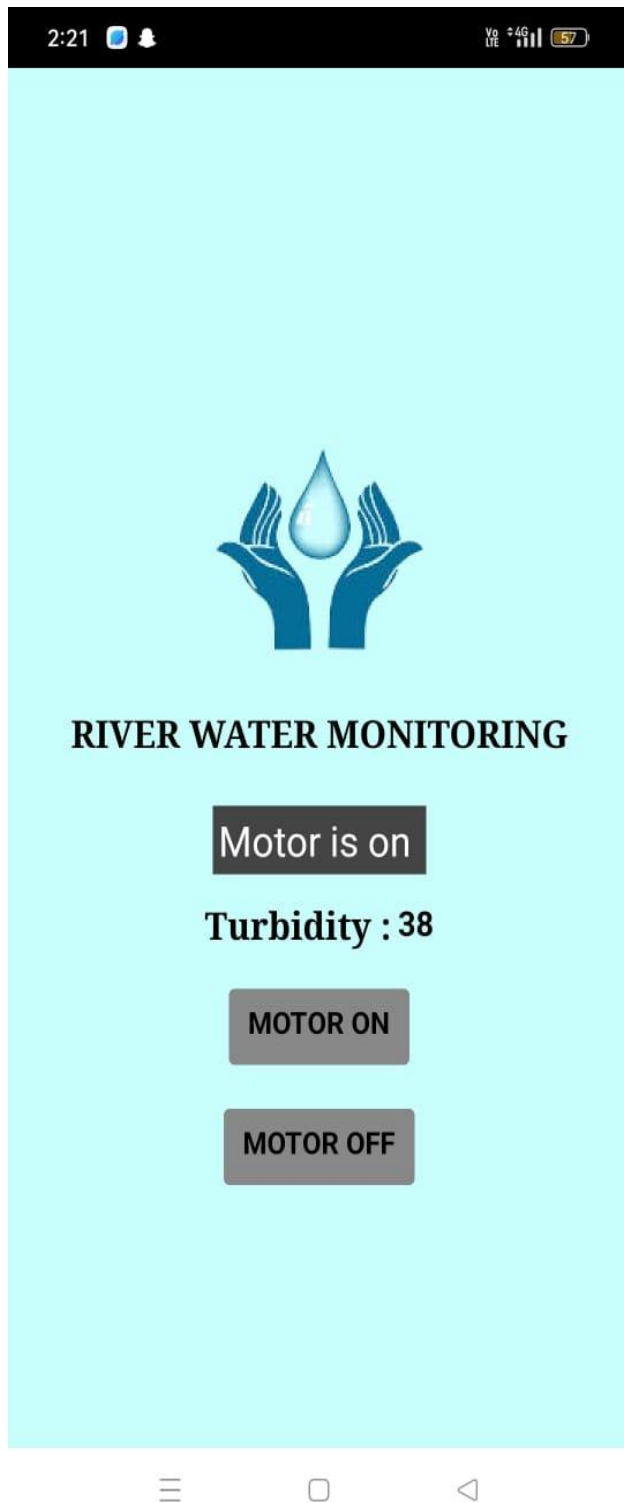
### Logo



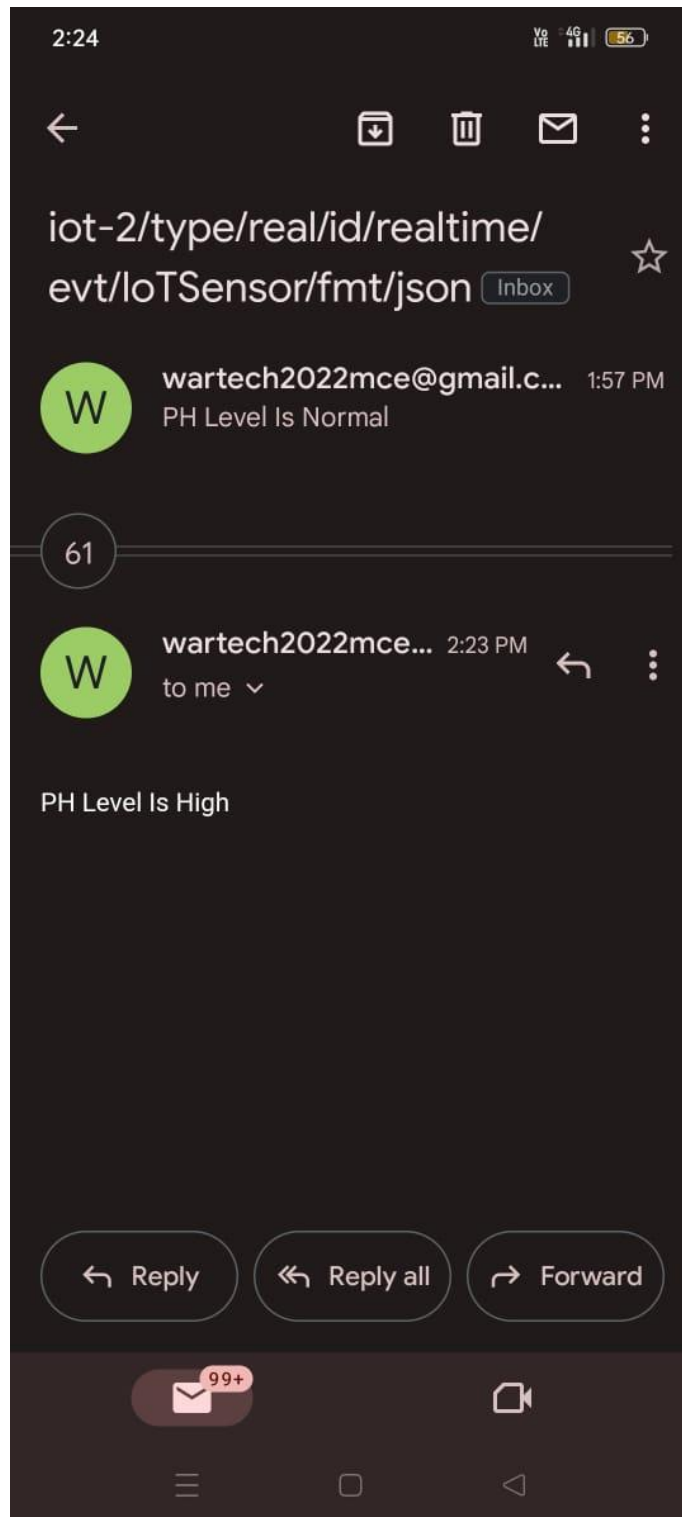
## Register & Login Page

The image shows a mobile app interface for a registration and login page. The background is a solid light blue. At the top, there is a black status bar with white text and icons for time (2:22), notifications, and battery level (57%). Below the status bar, centered, is the app's logo: two hands holding a water droplet. Further down, there are two input fields. The first is labeled 'User Name:' and contains the text 'vasuki'. The second is labeled 'Password:' and contains three dots '...'. Below these fields are two buttons: a 'Login' button and a 'Register' button, both with a dark grey background and white text. At the bottom of the screen, there is a black navigation bar with three white icons: a hamburger menu, a square, and a back arrow.

## Content



## Alert Message in User



## CHAPTER-8

### TESTING

#### 8.1 Test cases

Test case ID	Test Scenario	Test Data	Status	Comments	Executed by
TC_001	Create the IBM cloud services which are being used in the project	<a href="https://cloud.ibm.com/login">https://cloud.ibm.com/login</a>	Pass	Results Verified	Padmavathi M
TC_002	Configure the IBM cloud services which are being used in completing this project	<a href="https://cloud.ibm.com/login">https://cloud.ibm.com/login</a>	Pass	Results Verified	Ramya T
TC_003	IBM Watson IOT platform acts as the mediator to connect the web application to IOT devices,so create the IBM Watson IOT platform	<a href="https://mw0wqj.internetofthings.ibmcloud.com/dashboard/devices/browse">https://mw0wqj.internetofthings.ibmcloud.com/dashboard/devices/browse</a> password: Testing123	Pass	Results Verified	Arachana devi A
TC_004	In order to connect the IOT device to the IBM cloud create in the IBM Watson IOT platform	PH value and Turbidity sensor values are generated randomly in simulation	Pass	Results Verified	Vasuki P
TC_005	Create a node-red services and also node red dashboard	<a href="https://node-red-xoyzi-2022-10-06.us-east.mybluemix.net/ui/#/0?socketid=QjV_ZOUpoZ_IP5BWAAAF">https://node-red-xoyzi-2022-10-06.us-east.mybluemix.net/ui/#/0?socketid=QjV_ZOUpoZ_IP5BWAAAF</a>	Pass	Results Verified	Nithya B
TC_006	Creating a mobile app for user controlling	Values of sensors and button for motor ON/OFF is displayed	Pass	Results Verified	Vasuki P
TC_007	Publish random sensor data such as PH value and Turbidity to the IBM IOT platform	<a href="https://www.python.org/downloads/release/python-3810/">www.python.org/downloads/release/python-3810/</a>	Pass	Results Verified	Ramya T

## 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 River Water Quality Monitoring and Control System] project at the time of therelease toUser Acceptance Testing (UAT).

### 2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how

they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	7	3	6	5	21
Duplicate	4	0	3	0	7
External	1	2	0	1	4
Fixed	14	1	3	8	26
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	4	2	0	6
Totals	26	11	18	19	67

### 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	5	0	0	5
Client Application	30	0	0	30
Security	2	0	0	2
Outsource Shipping	1	0	0	1
Exception Reporting	7	0	0	7
Final Report Output	9	0	0	9
Version Control	1	0	0	1

## **CHAPTER-9**

### **RESULTS**

#### **9.1 Performance Metrics**

1. Requirement Identification
  - a. Functional Requirements
  - b. Non Functional Requirements
2. Implementation result
  - a. System Implementation results
  - b. Results of web application
  - c. Result of mobile application
3. Resource utilization results
  - a. Foreground activities results
  - b. Memory usage
  - c. Energy usage
4. Background activities result

## **CHAPTER-10**

### **ADVANTAGES & DISADVANTAGES**

#### **ADVANTAGE:**

- Remote location
- More accurate results
- Sensor based water quality testing has many advantages such as **accurate, high sensitivity, good selectivity, speed, fast response, low cost** etc.

#### **DISADVANTAGE:**

- Equipment costs are high
- Operation and maintenance costs are greater
- Loss of Independent water



## **CHAPTER-11**

### **CONCLUSION**

In this project we proposed a method for efficient water monitoring ecosystem. With the application of IOT the data can be stored and retrieved from anywhere. In this proposed work, the sensor part is limited only for monitoring of river water. Hence in future it can be automated river water monitoring and the system can be enhanced with security of ecosystem in under video surveillance which prevents it from obtrude intrusion.

## **CHAPTER-12**

### **FUTURE SCOPE**

In the current project we have implemented the project that can protect and maintain the river water. In this project the controller monitor and then control the river water remotely. In future we can add or update few more things to this project. We can create few more models of the same project so that the controller can have information of a entire. We can update the this project by using stream gauge. It will be a one time investment. We can add stream gauge equipment to this project. We can use GSM technology to this project so that the controller can get the information directly to his home through SMS. This helps the controller to get information if there is a internet issues.

## CHAPTER-13

### APPENDIX

Github : <https://github.com/IBM-EPBL/IBM-Project-18924-1659691323>

Demo Link :

<https://drive.google.com/file/d/1wHouGQfF3iiwF9YqoGj9tRWpTApgCJbW/view?usp=drivesdk>