REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Submitted by

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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

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

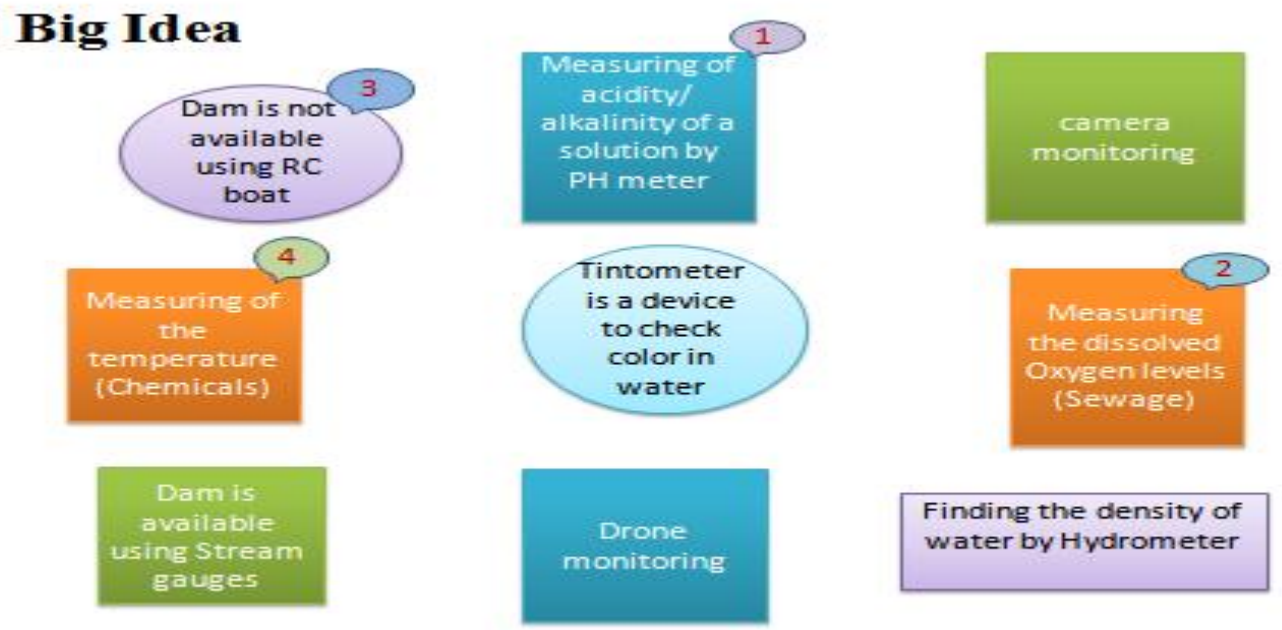
IDEATION AND PROPOSED SOLUTION

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.

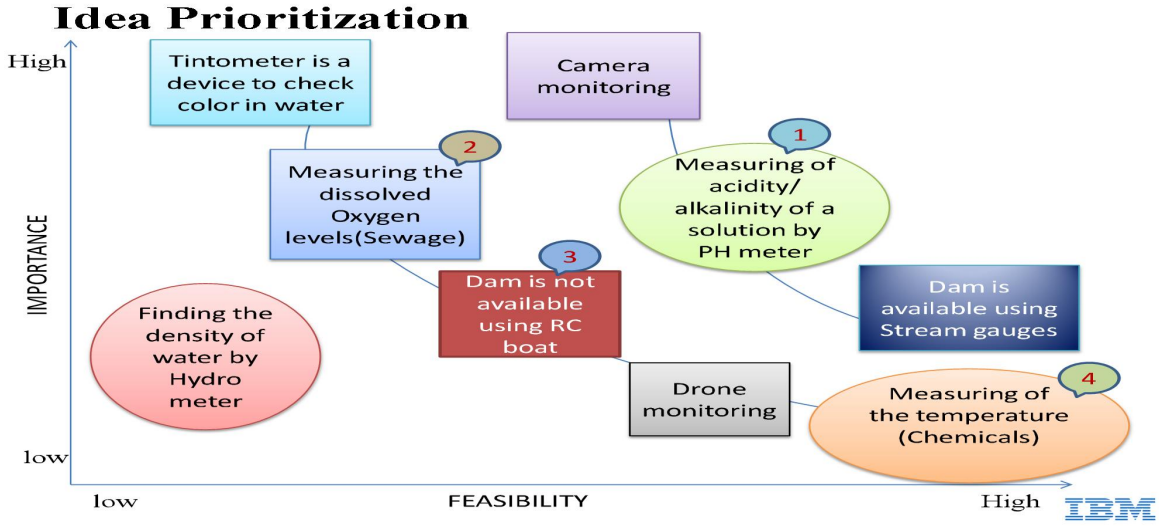
3.2 Big Ideas

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

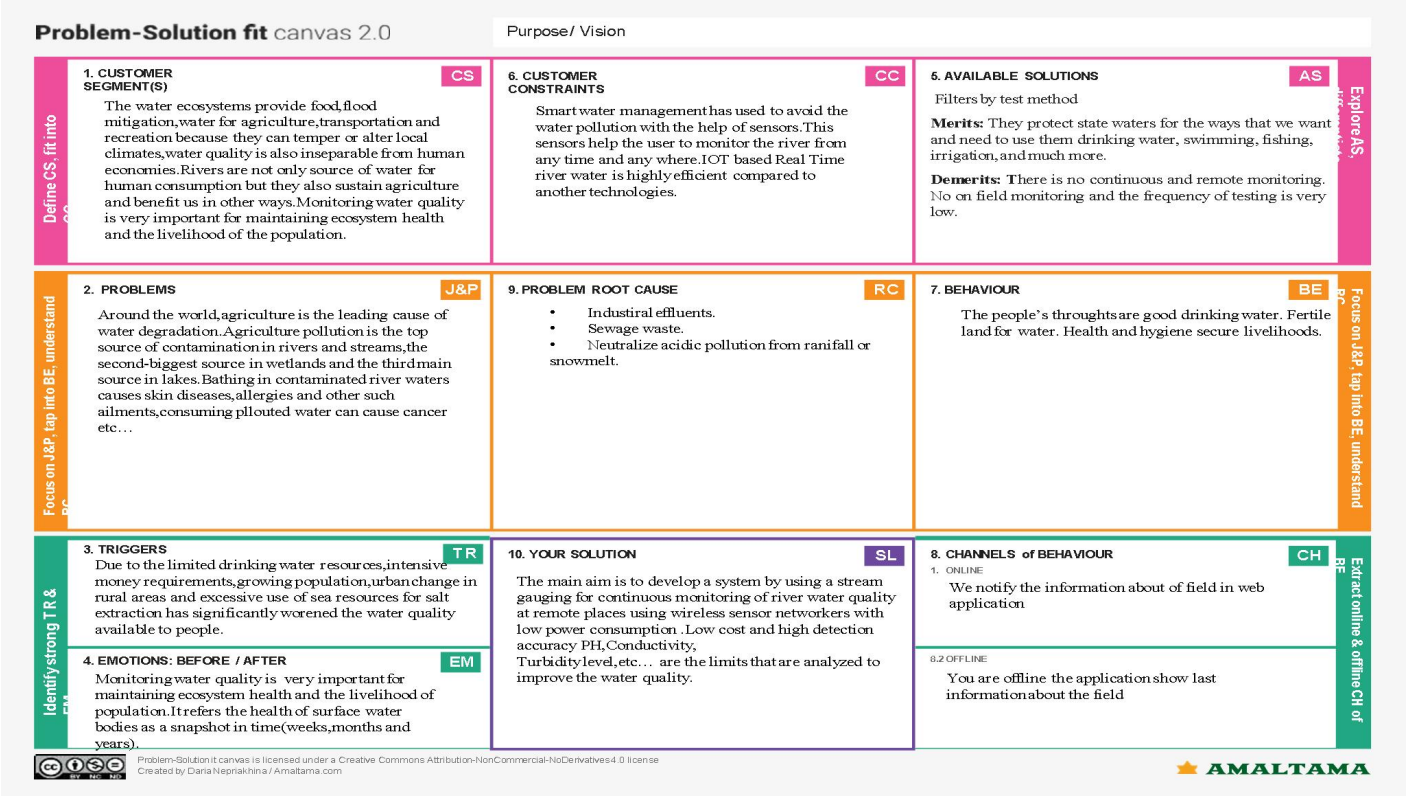


3 Idea Prioritization

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.	**Problem Statement (Problem to be solved)**	IOT Based Real Time River Water QualityMonitoring and Control System.
2.	**Idea / Solution description**	1.To measure water paramrters such as PH,disloved 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 bywireless channel. 3.To send SMS to an authorized person.
3.	**Novelty / Uniqueness**	1.If the water is contaminated, it aware sensor send the alert message to the nearbycontrol room. 2.Sometimes employee is not there messagehas been sent to his mobile.

4.	**Social Impact / Customer Satisfaction**	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.	**Business Model (Revenue Model)**	**1.**Through Advertisment we can sell ourproject to the public sector. 2.We can give advertisement through thesocial media 3.Purity water is most important in world 4.To provide this information in advertisement is useful for socity.
6.	**Scalability of the Solution**	**IOT Sensor, Camera Drone monitoring& assessment of the water purity.** 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's land will be affected. Using this project we can avoid it. The health issues also avoid it.

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.

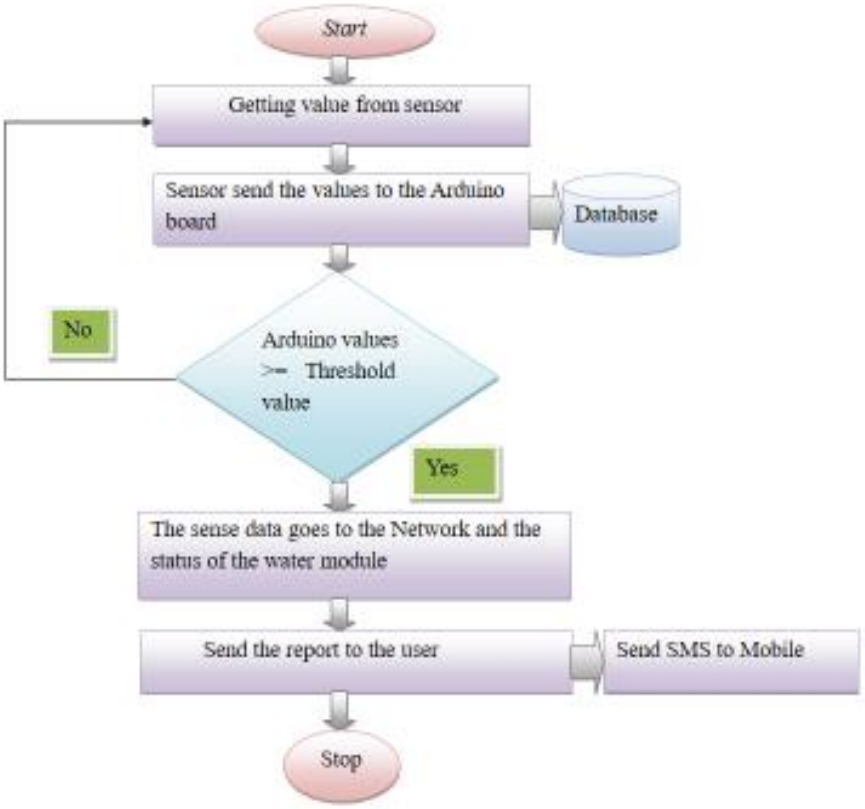
4.2 Non-Functional Requirements

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

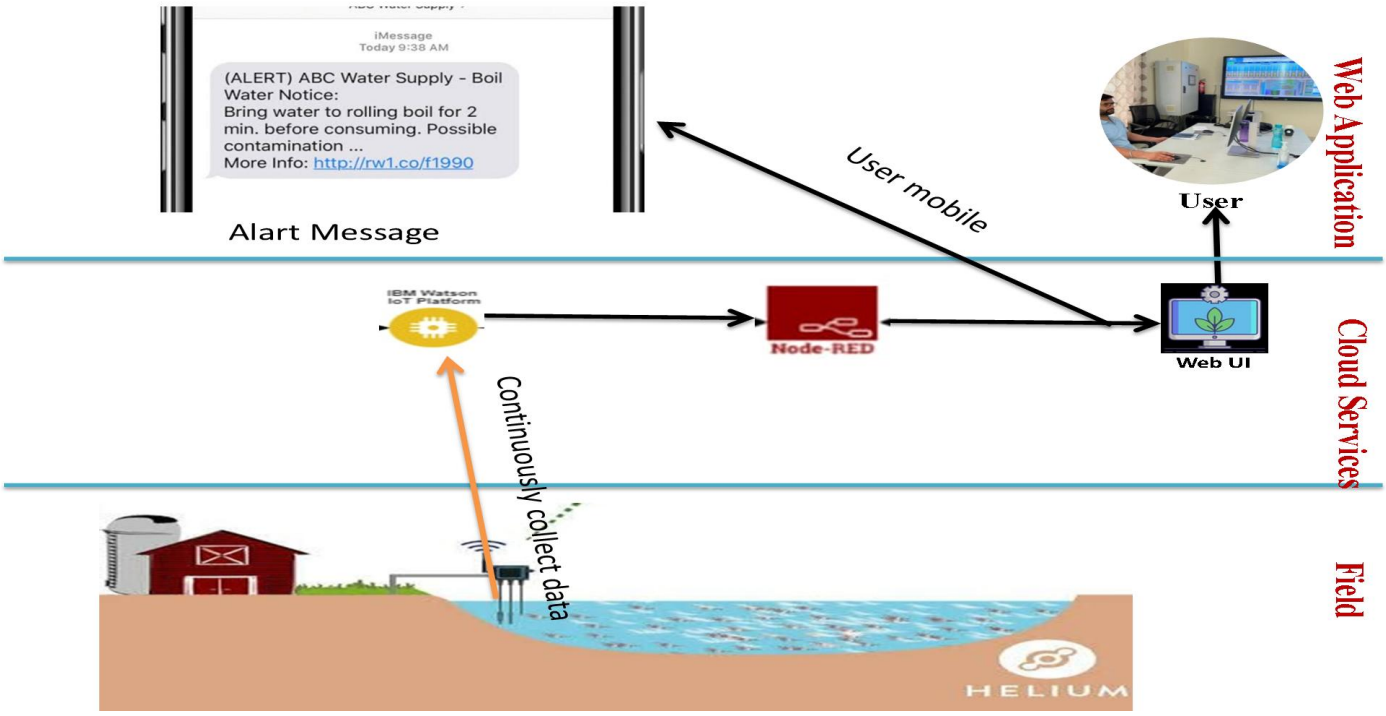
CHAPTER-5

PROJECT DESIGN

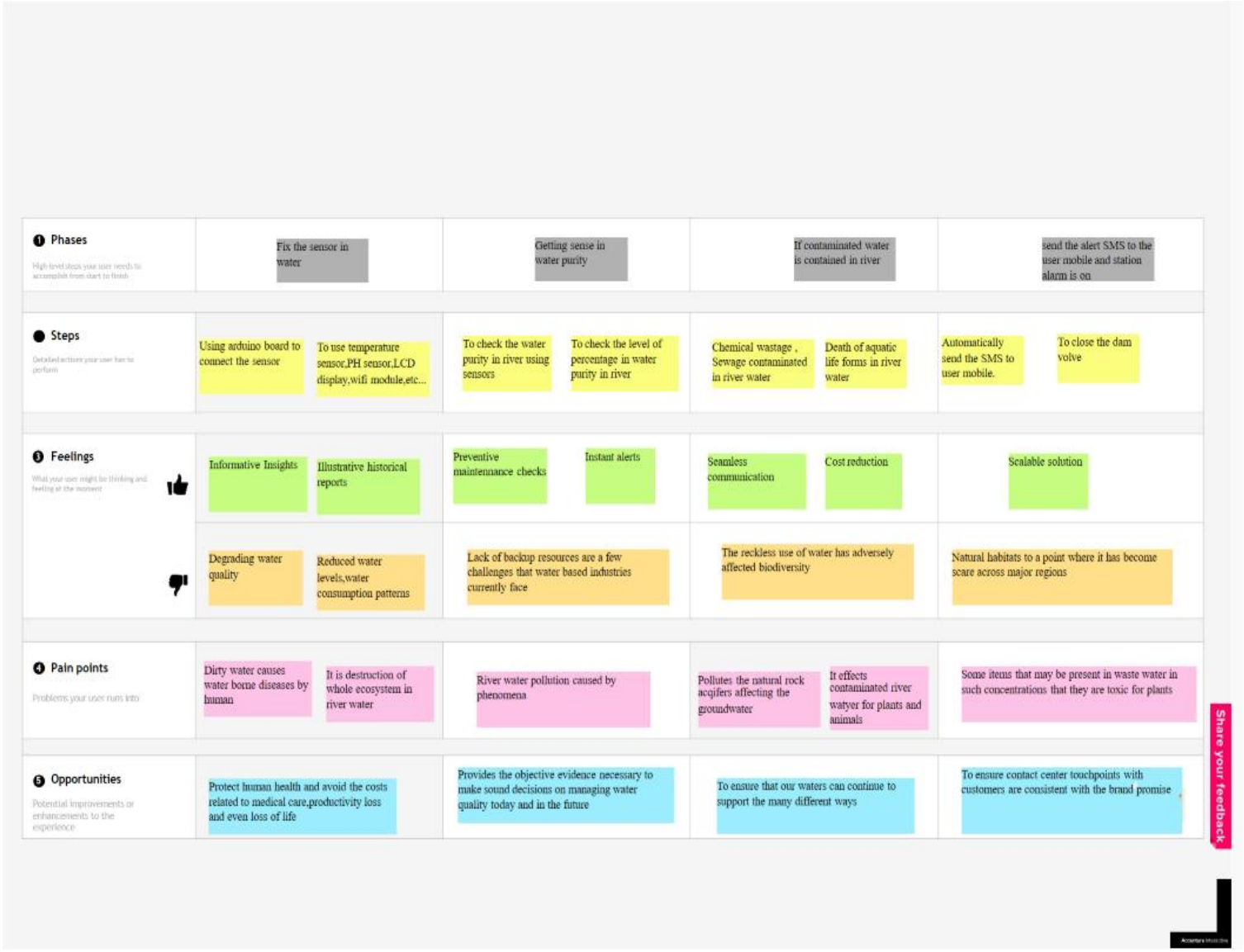
5.1 Data Flow Diagram



5.2 Solution Architecture



5.3 Customer Journey Map



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

CHAPTER-7

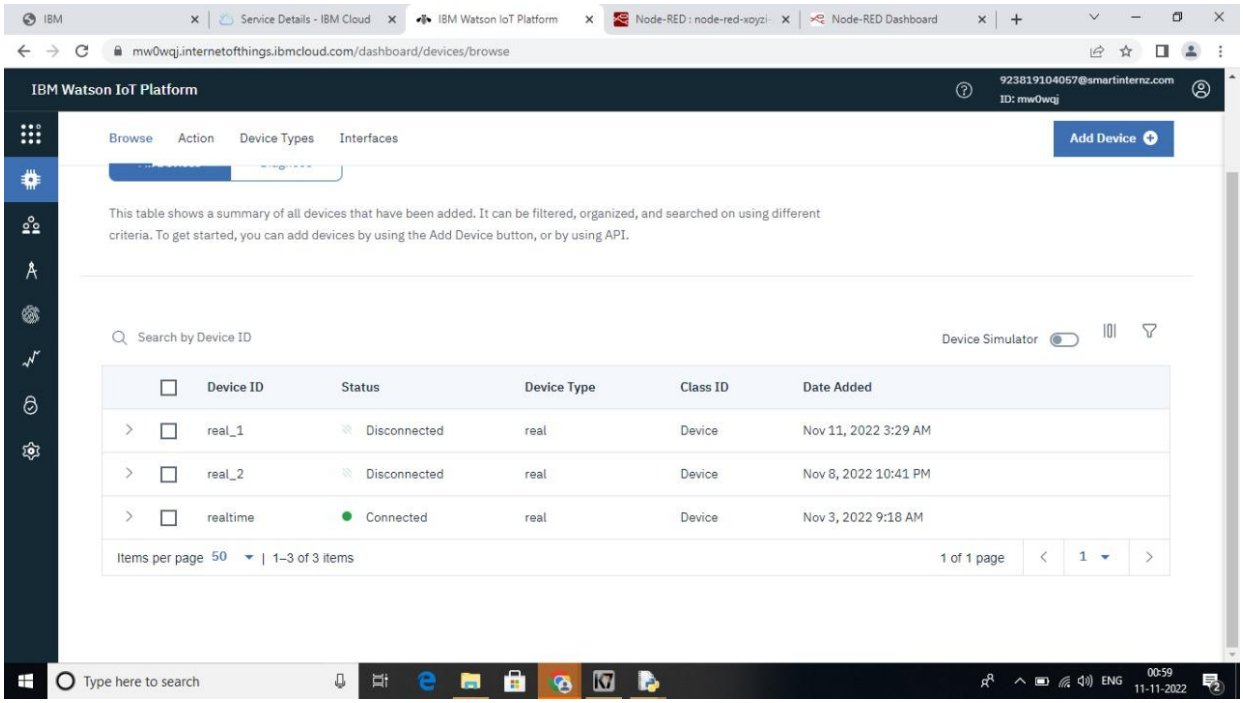
CODING AND SOLUTION

7.1 Feature

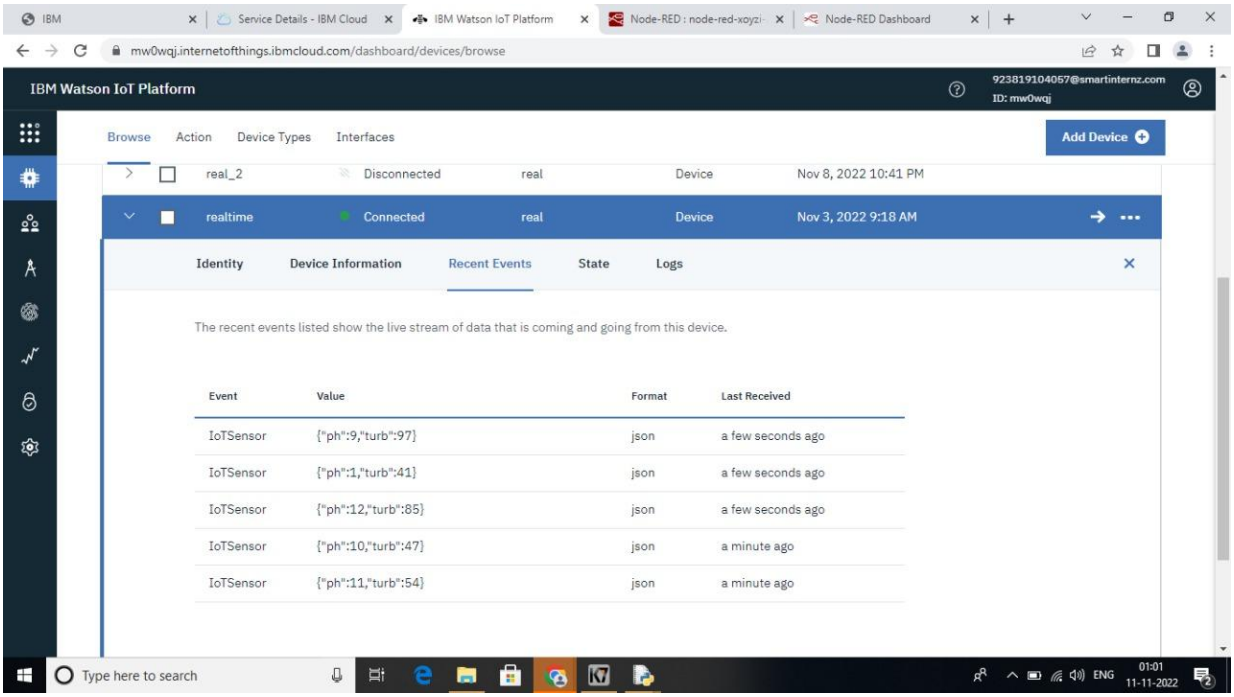
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "mw0wqj"
deviceType = "real"
deviceId = "realtime"
authMethod = "token"
authToken = "vasuki123"
# Initialize GPIO
def myCommandCallback(cmd):
print("Command 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 IoTF")
        time.sleep(5)

        deviceCli.commandCallback = myCommandCallback

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

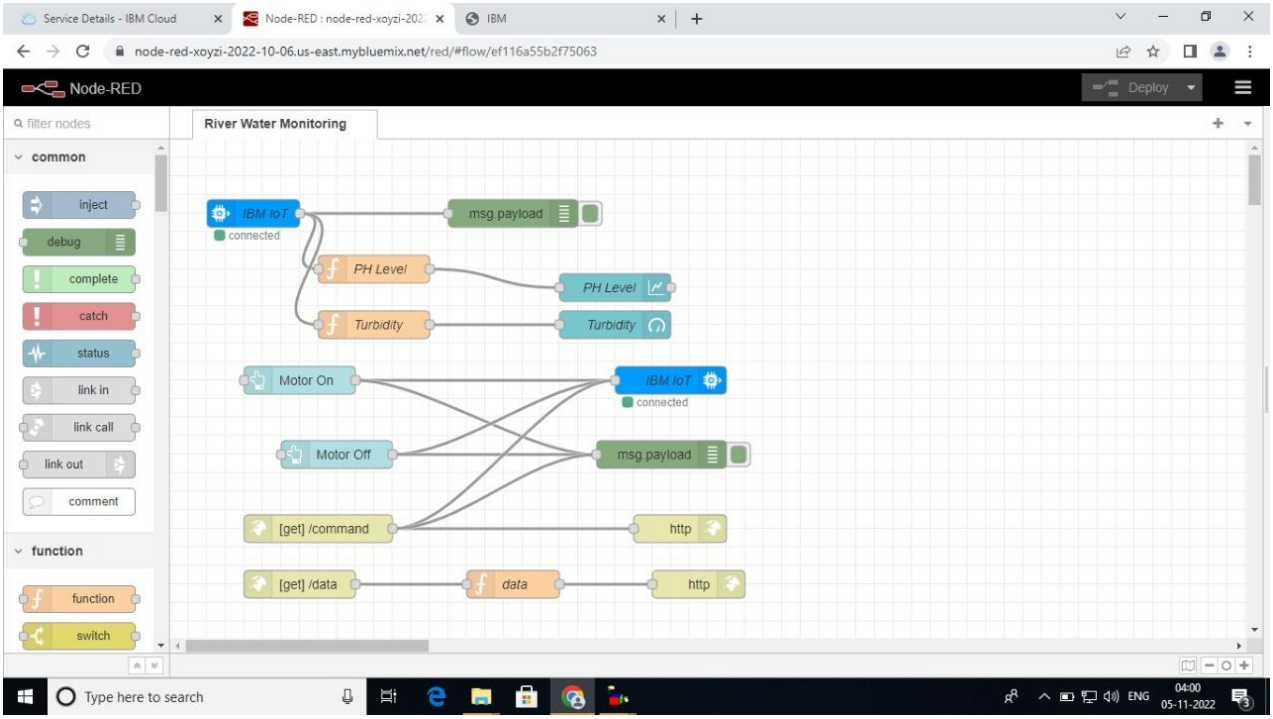
Device Details:



Recent Events:

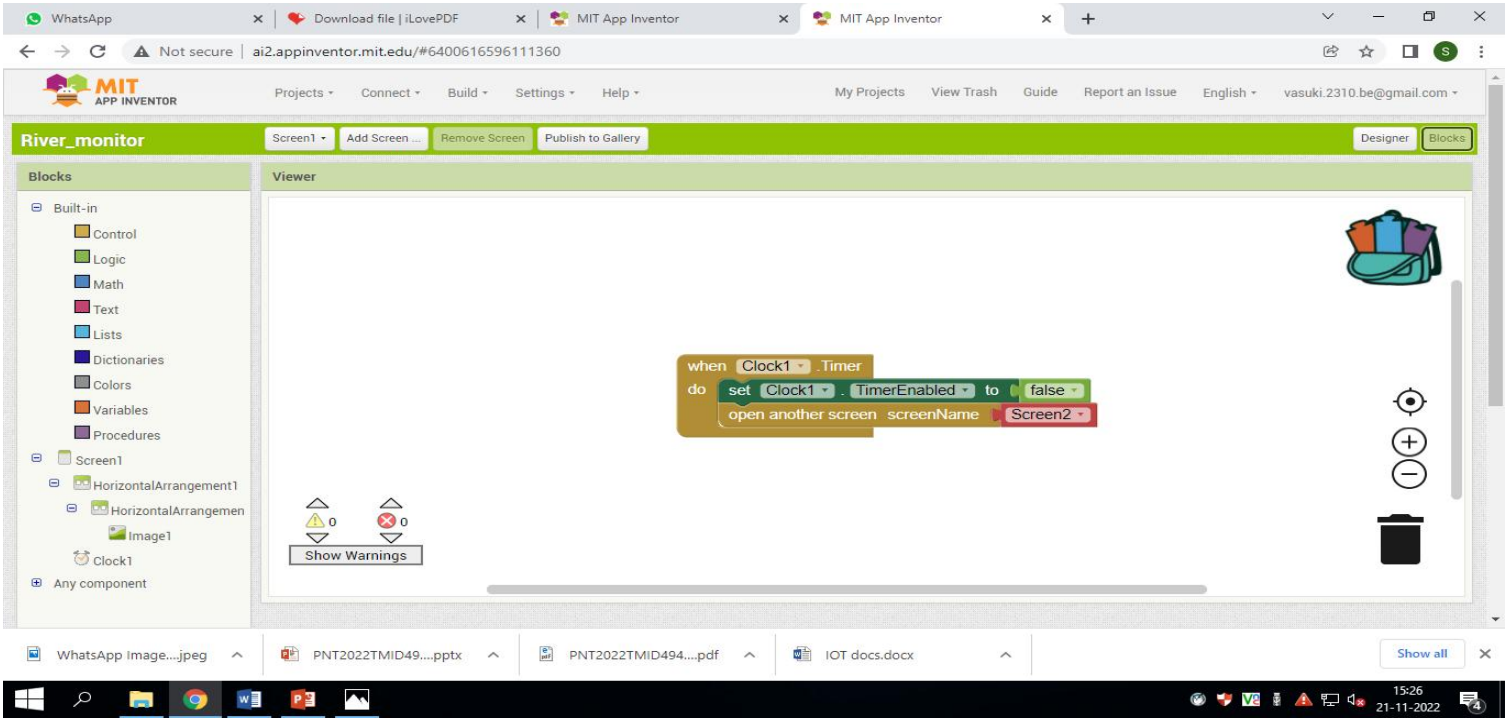


Node-Red Connection and Dashboard Design:

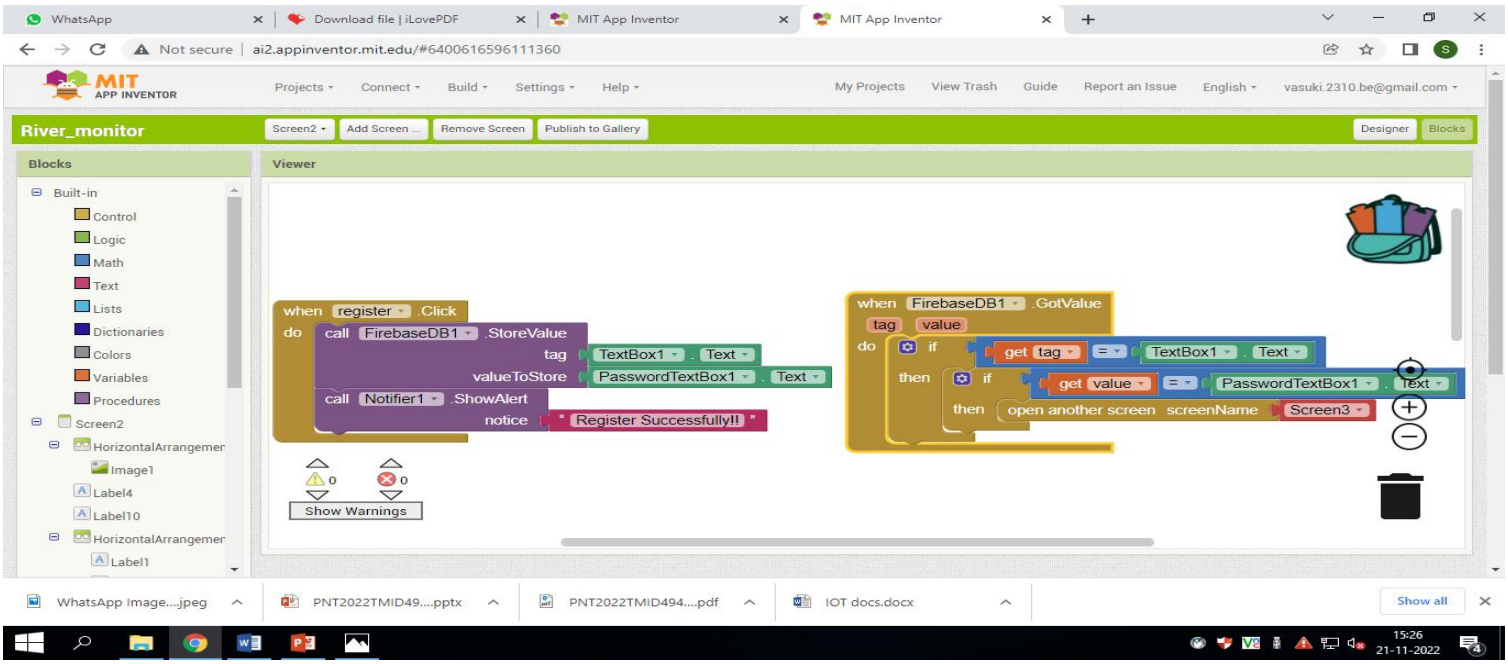


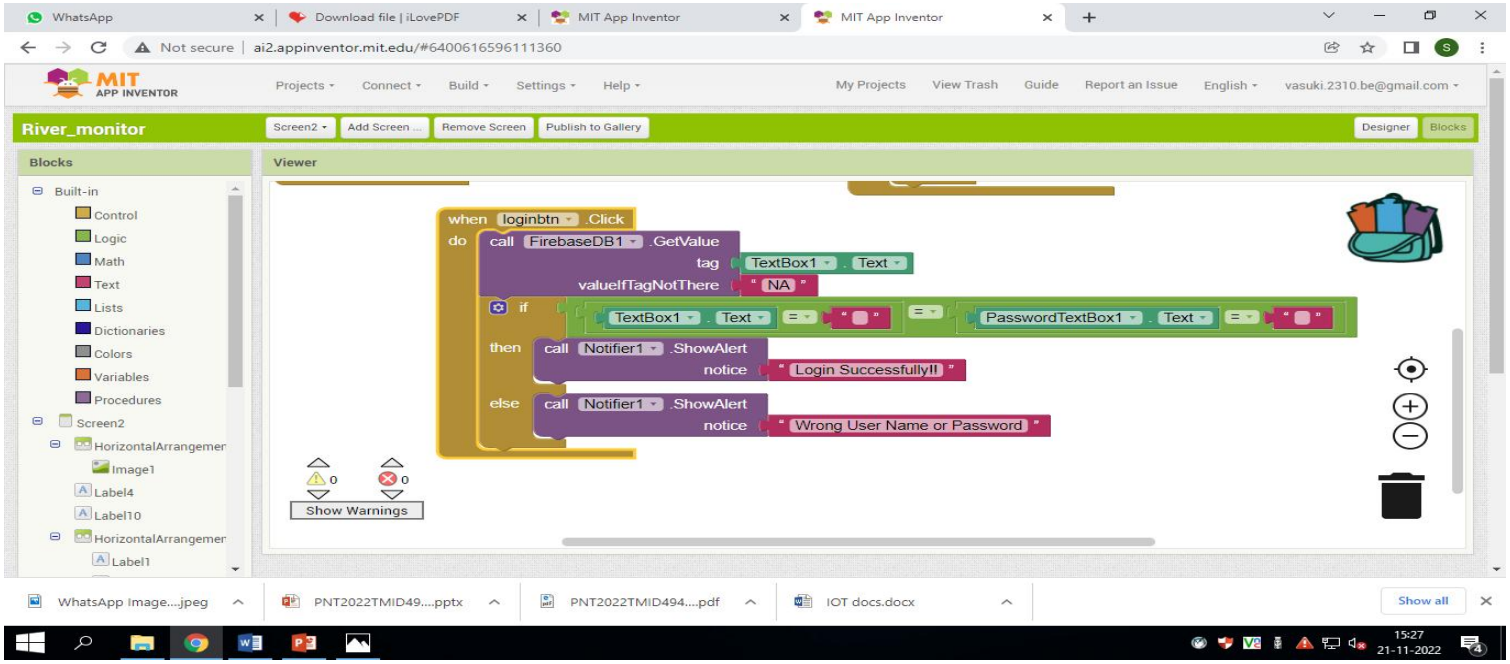
Mobile App code

Screen 1



Screen2

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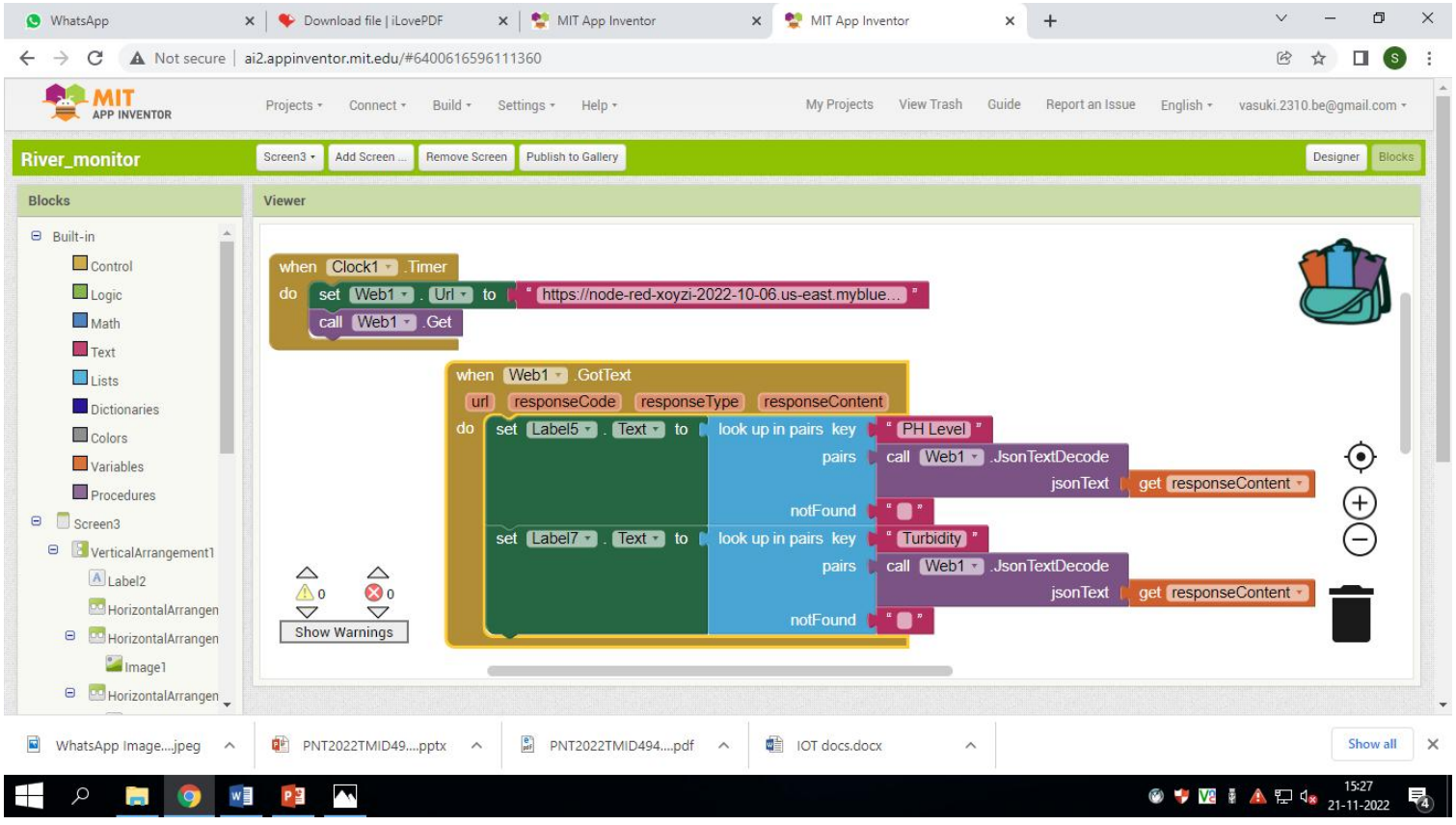
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
vasuki.2310.be@gmail.com
River_monitor
Screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen2
HorizontalArrangemer
Image1
Label4
Label10
HorizontalArrangemer
Label1
when loginbtn .Click
do call FirebaseDB1 .GetValue
tag TextBox1 . Text
valueIfTagNotThere " NA "
if TextBox1 . Text = " " = PasswordTextBox1 . Text = " "
then call Notifier1 .ShowAlert
notice " Login Successfully!! "
else call Notifier1 .ShowAlert
notice " Wrong User Name or Password "
Show Warnings
WhatsApp Image....jpeg
PNT2022TMID49....pptx
PNT2022TMID494....pdf
IOT docs.docx
Show all
15:27
21-11-2022

Screen3


WhatsApp
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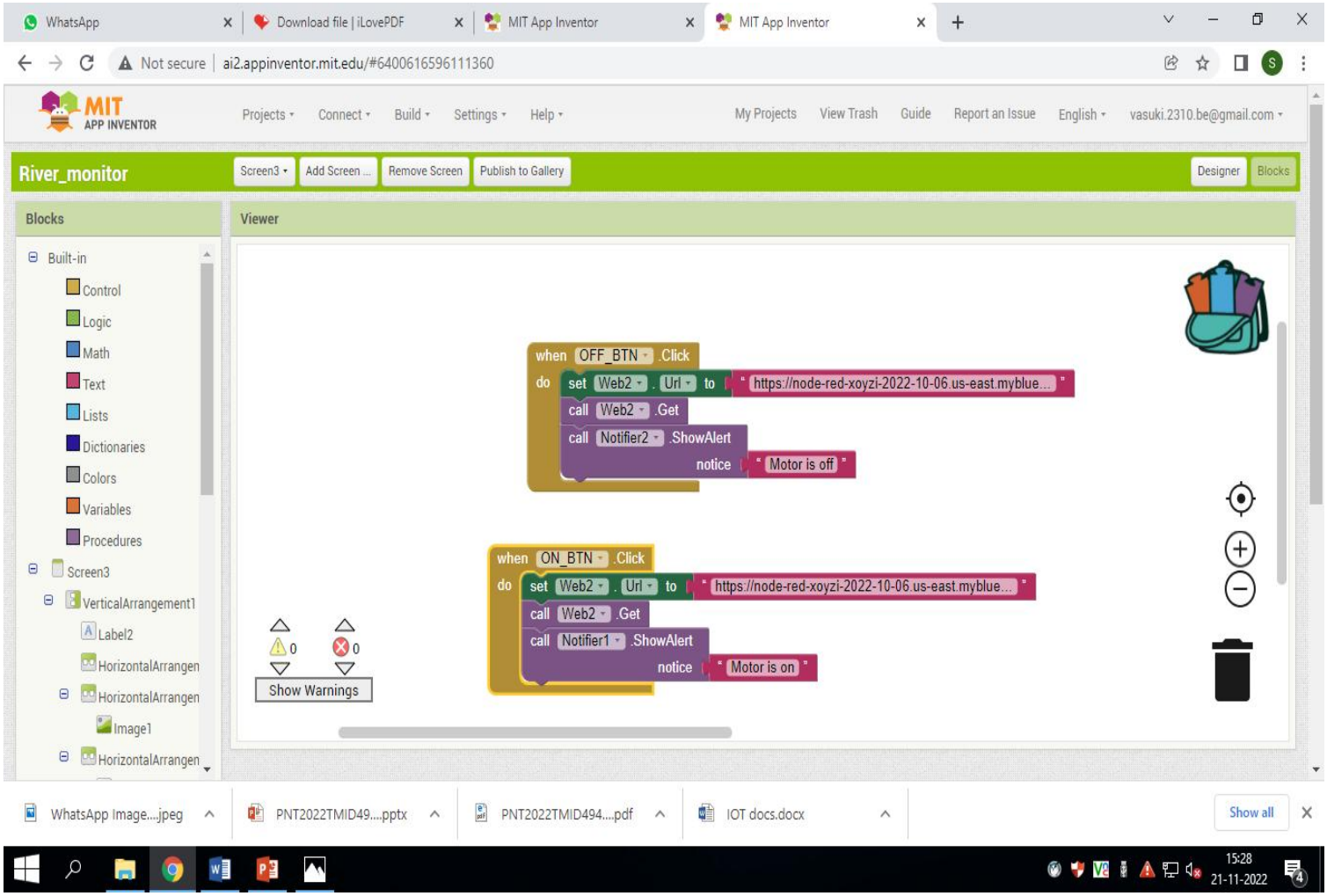
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
vasuki.2310.be@gmail.com
River_monitor
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
VerticalArrangement1
Label2
HorizontalArrangen
HorizontalArrangen
Image1
HorizontalArrangen
when Clock1 .Timer
do set Web1 . Url to " https://node-red-xoyzi-2022-10-06.us-east.myblue... "
call Web1 .Get
when Web1 .GotText
url responseCode responseType responseContent
do set Label5 . Text to look up in pairs key " PH Level "
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound " "
set Label7 . Text to look up in pairs key " Turbidity "
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound " "
Show Warnings
WhatsApp Image....jpeg
PNT2022TMID49....pptx
PNT2022TMID494....pdf
IOT docs.docx
Show all
15:27
21-11-2022


WhatsApp
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Projects
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River_monitor
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
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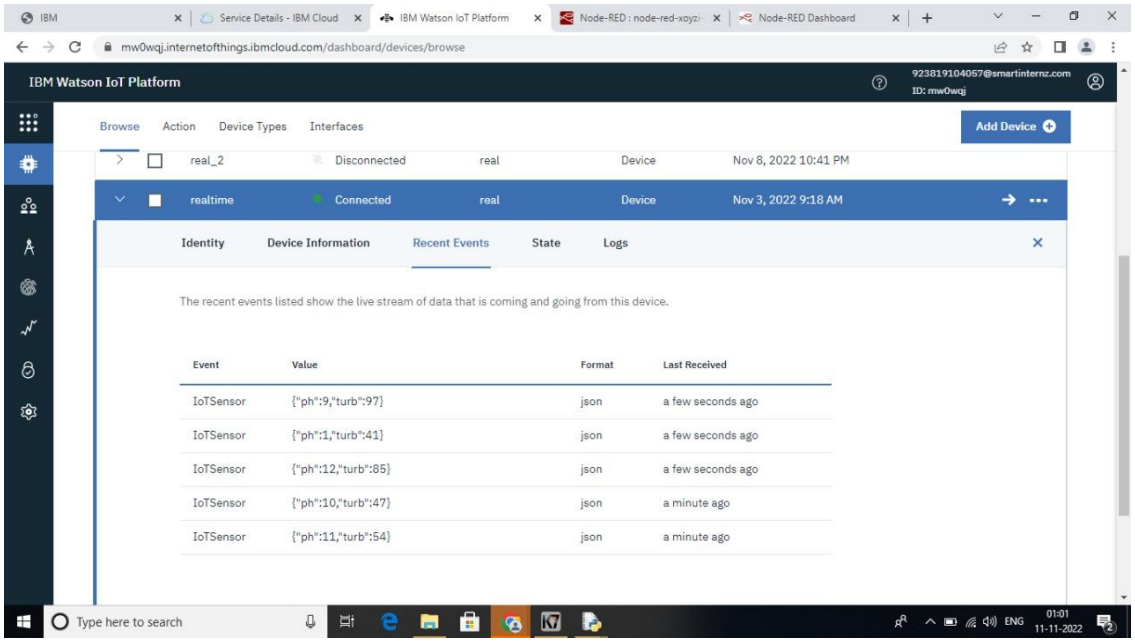
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
VerticalArrangement1
Label2
HorizontalArrangen
HorizontalArrangen
Image1
HorizontalArrangen
when OFF_BTN .Click
do set Web2 . Url to " https://node-red-xoyzi-2022-10-06.us-east.myblue... "
call Web2 .Get
call Notifier2 .ShowAlert
notice " Motor is off "
when ON_BTN .Click
do set Web2 . Url to " https://node-red-xoyzi-2022-10-06.us-east.myblue... "
call Web2 .Get
call Notifier1 .ShowAlert
notice " Motor is on "
0
0
Show Warnings
WhatsApp Image....jpeg
PNT2022TMID49....pptx
PNT2022TMID494....pdf
IOT docs.docx
Show all
15:28
21-11-2022

Test cases


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
real_2
Disconnected
real
Device
Nov 8, 2022 10:41 PM
realtime
Connected
real
Device
Nov 3, 2022 9:18 AM
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
IoTSensor
{"ph":9,"turb":97}
json
a few seconds ago
IoTSensor
{"ph":1,"turb":41}
json
a few seconds ago
IoTSensor
{"ph":12,"turb":85}
json
a few seconds ago
IoTSensor
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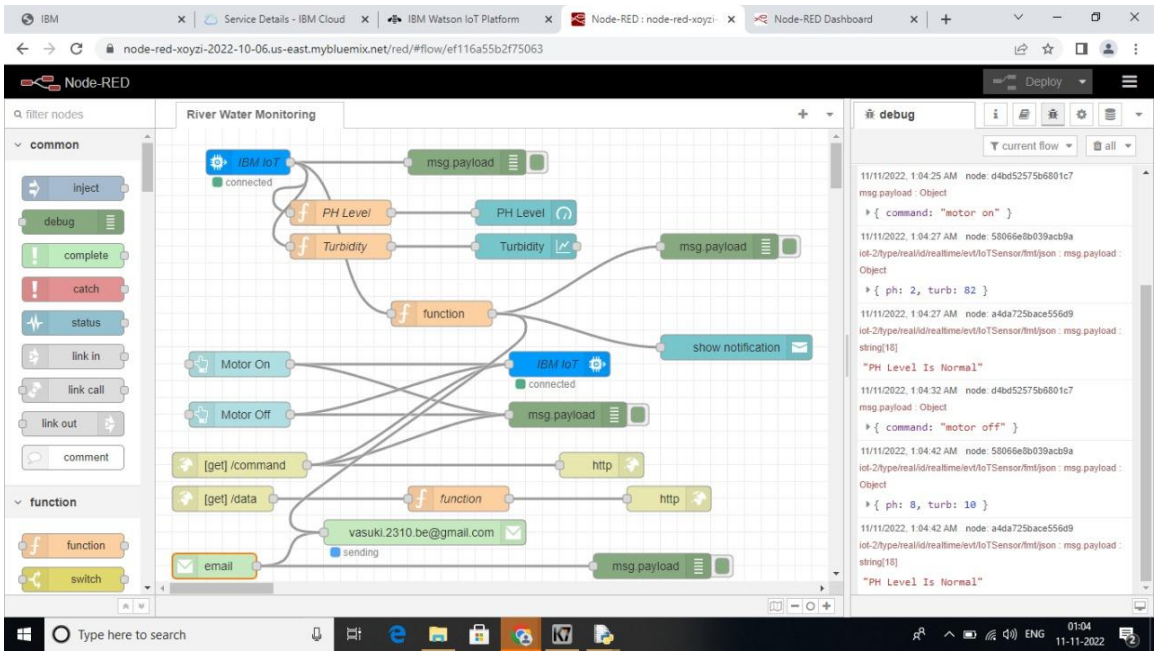
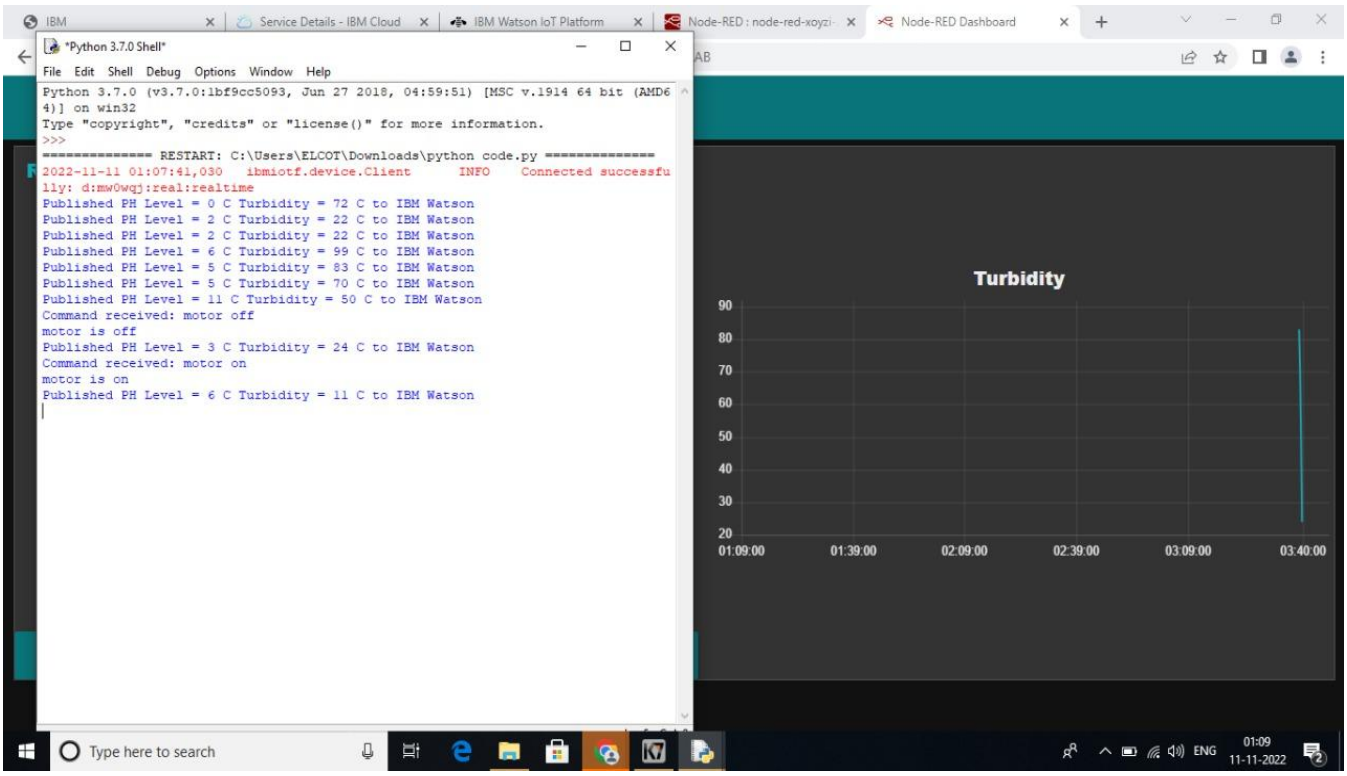
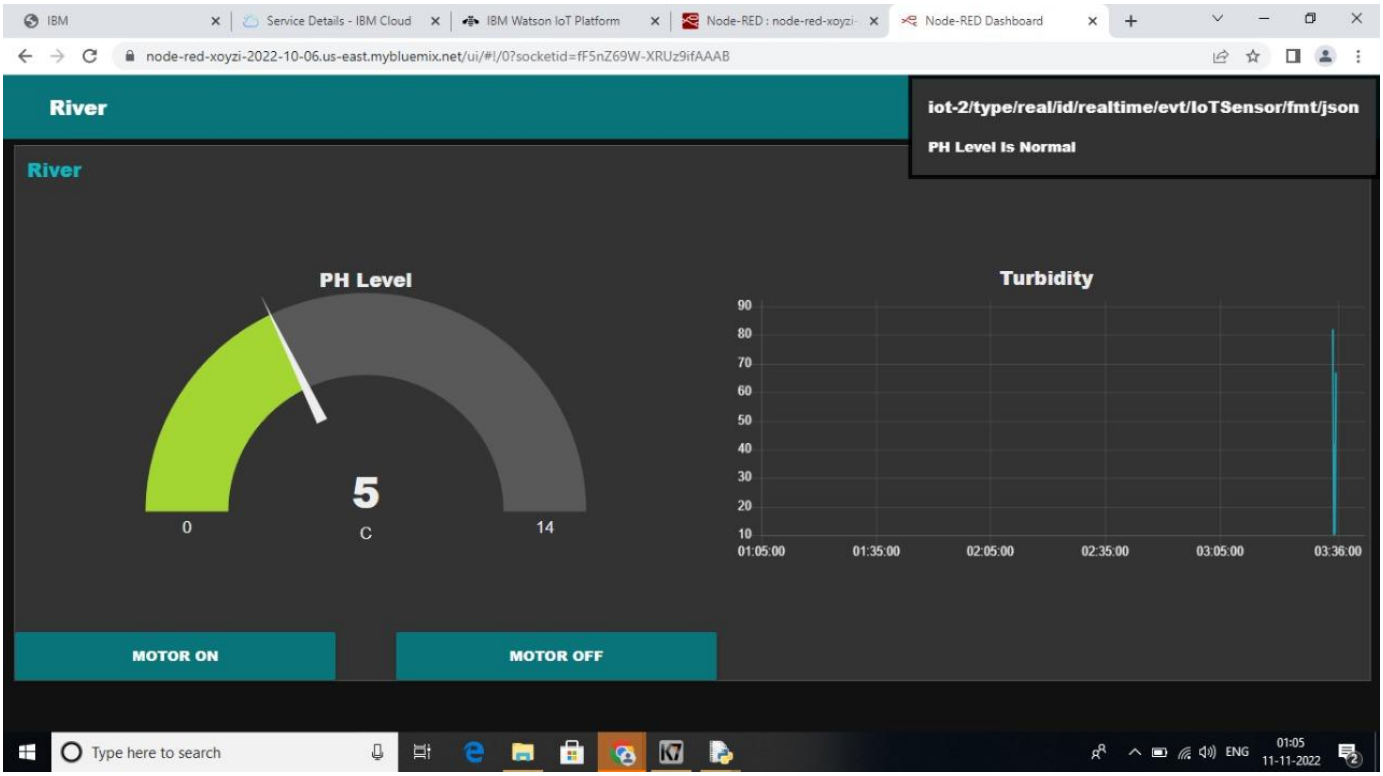
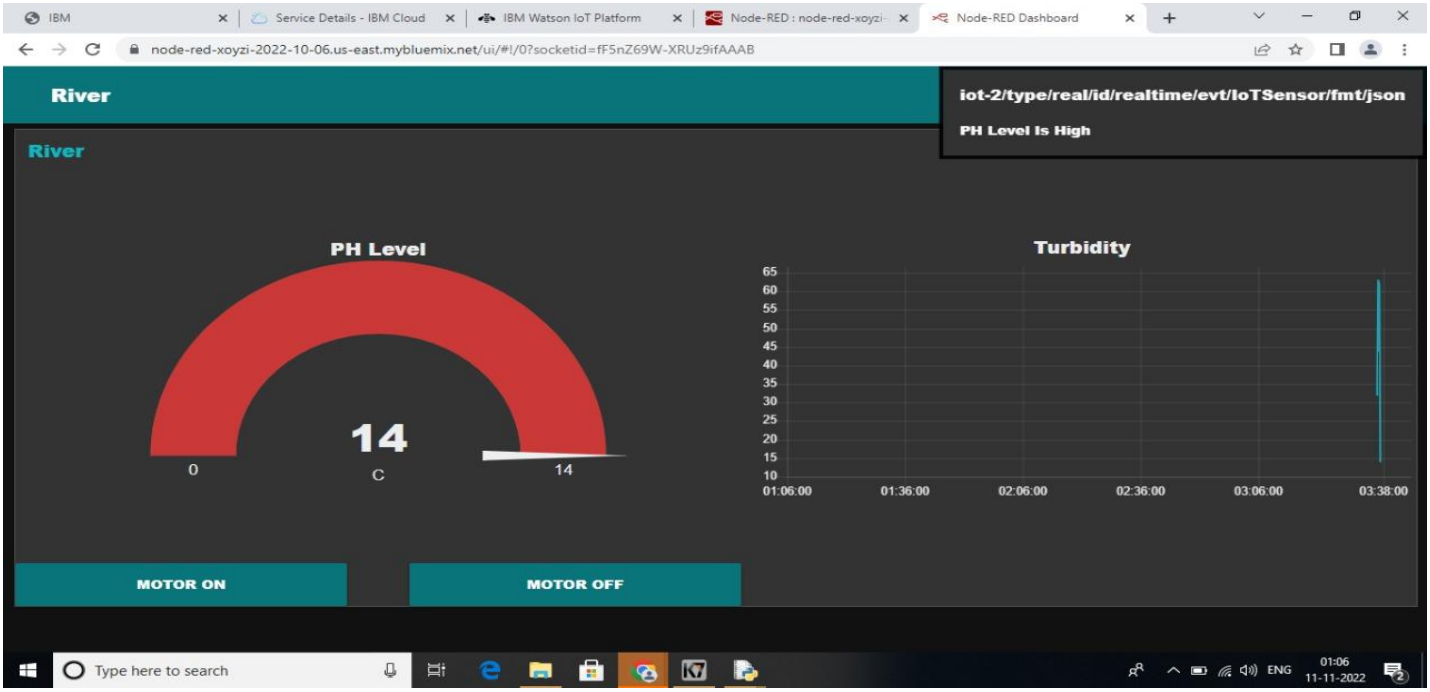
json
a minute ago
IoTSensor
{"ph":11,"turb":54}
json
a minute ago


Node-RED
River Water Monitoring
Deploy
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
IBM IoT
connected
msg.payload
PH Level
PH Level
Turbidity
Turbidity
msg.payload
function
show notification
Motor On
IBM IoT
connected
Motor Off
msg.payload
[get] /command
http
[get] /data
function
http
vasuki.2310.be@gmail.com
sending
email
msg.payload
11/11/2022, 1:04:25 AM node: d4bd52575b6801c7
msg.payload : Object
{ command: "motor on" }
11/11/2022, 1:04:27 AM node: 58066e8b039acb9a
iot-2/type/real/id/realtime/evt/IoTSensor/fmt/json : msg.payload : Object
{ ph: 2, turb: 82 }
11/11/2022, 1:04:27 AM node: a4da725bace556d9
iot-2/type/real/id/realtime/evt/IoTSensor/fmt/json : msg.payload : string[18]
"PH Level Is Normal"
11/11/2022, 1:04:32 AM node: d4bd52575b6801c7
msg.payload : Object
{ command: "motor off" }
11/11/2022, 1:04:42 AM node: 58066e8b039acb9a
iot-2/type/real/id/realtime/evt/IoTSensor/fmt/json : msg.payload : Object
{ ph: 8, turb: 10 }
11/11/2022, 1:04:42 AM node: a4da725bace556d9
iot-2/type/real/id/realtime/evt/IoTSensor/fmt/json : msg.payload : string[18]
"PH Level Is Normal"


IBM
Service Details - IBM Cloud
IBM Watson IoT Platform
Node-RED : node-red-xoyzi
Node-RED Dashboard
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\Users\ELCOT\Downloads\python code.py ==========
2022-11-11 01:07:41,030 ibmiotf.device.Client INFO Connected successfully: d:mw0wqj:real:realtime
Published PH Level = 0 C Turbidity = 72 C to IBM Watson
Published PH Level = 2 C Turbidity = 22 C to IBM Watson
Published PH Level = 2 C Turbidity = 22 C to IBM Watson
Published PH Level = 6 C Turbidity = 99 C to IBM Watson
Published PH Level = 5 C Turbidity = 83 C to IBM Watson
Published PH Level = 5 C Turbidity = 70 C to IBM Watson
Published PH Level = 11 C Turbidity = 50 C to IBM Watson
Command received: motor off
motor is off
Published PH Level = 3 C Turbidity = 24 C to IBM Watson
Command received: motor on
motor is on
Published PH Level = 6 C Turbidity = 11 C to IBM Watson
Turbidity
90
80
70
60
50
40
30
20
01:09:00
01:39:00
02:09:00
02:39:00
03:09:00
03:40:00
Type here to search
ENG
01:09
11-11-2022


IBM
Service Details - IBM Cloud
IBM Watson IoT Platform
Node-RED : node-red-xoyzi
Node-RED Dashboard
node-red-xoyzi-2022-10-06.us-east.mybluemix.net/ui/#!/0?socketid=fF5nZ69W-XRUz9ifAAAB
River
iot-2/type/real/id/realtime/evt/IoTSensor/fmt/json
PH Level Is Normal
River
PH Level
5
C
0
14
Turbidity
90
80
70
60
50
40
30
20
10
01:05:00
01:35:00
02:05:00
02:35:00
03:05:00
03:36:00
MOTOR ON
MOTOR OFF
Type here to search
ENG
01:05
11-11-2022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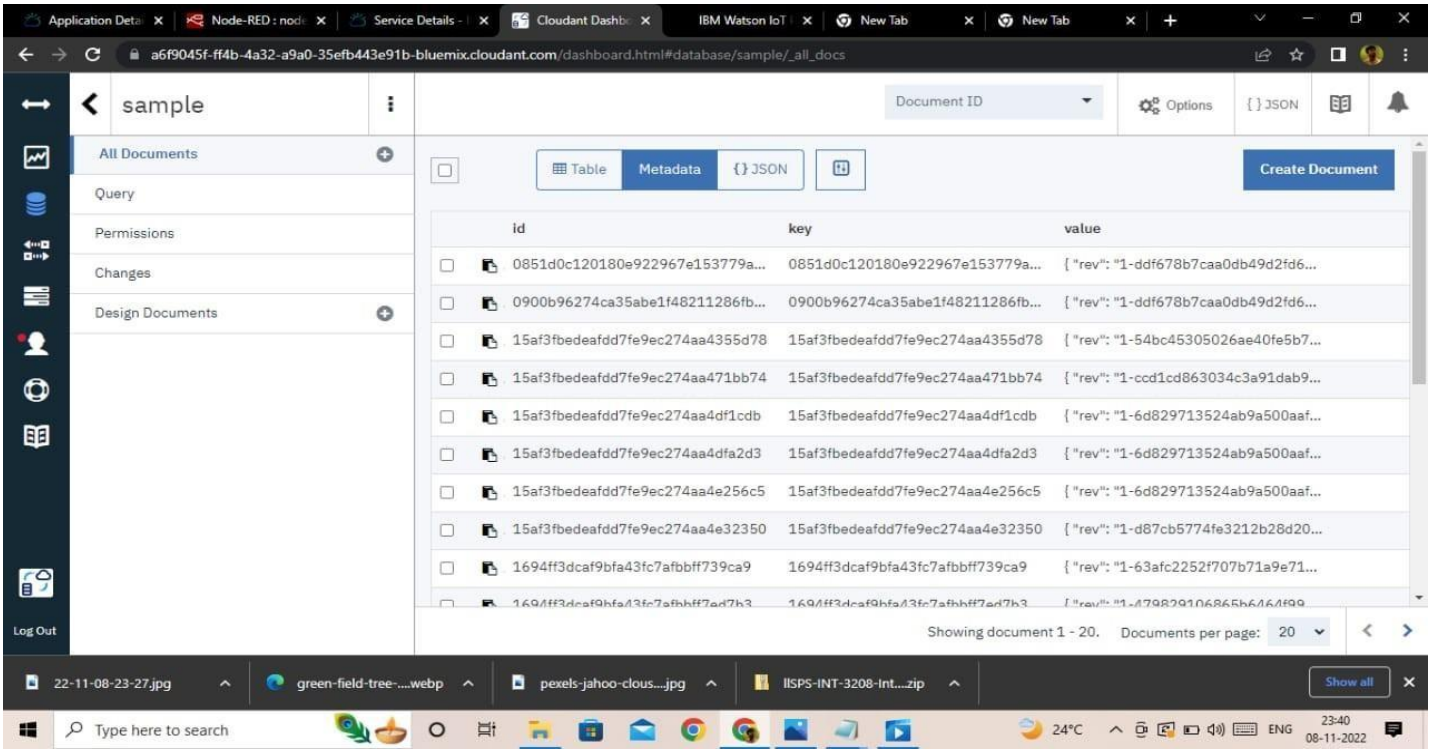
PH Level Is High
PH Level
14
0
C
14
Turbidity
65
60
55
50
45
40
35
30
25
20
15
10
01:06:00
01:36:00
02:06:00
02:36:00
03:06:00
03:38:00
MOTOR ON
MOTOR OFF
Type here to search
ENG
01:06
11-11-2022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Permissions
Changes
Design Documents
Log Out
Document ID
Options
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Table
Metadata
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pexels-jahoo-clous....jpg
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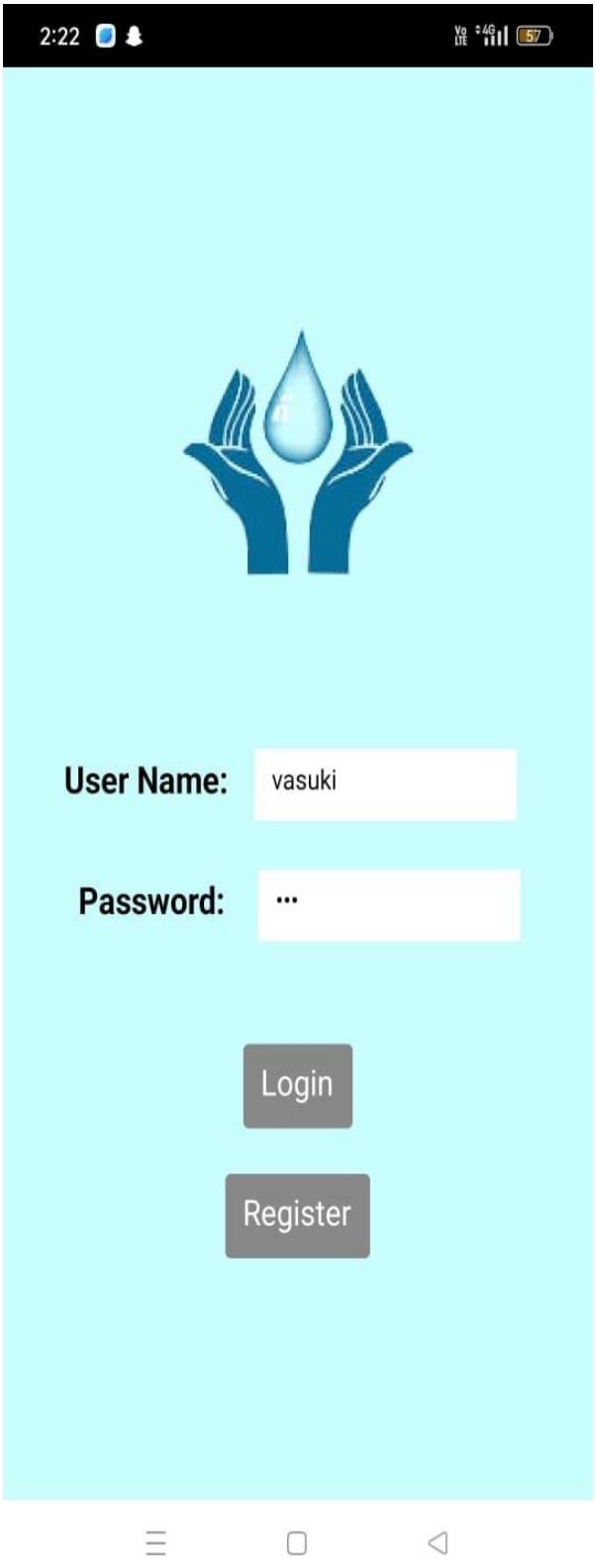
Show all
Type here to search
24°C
ENG
23:40
08-11-2022

Mobile App

Register & Login Page

Logo



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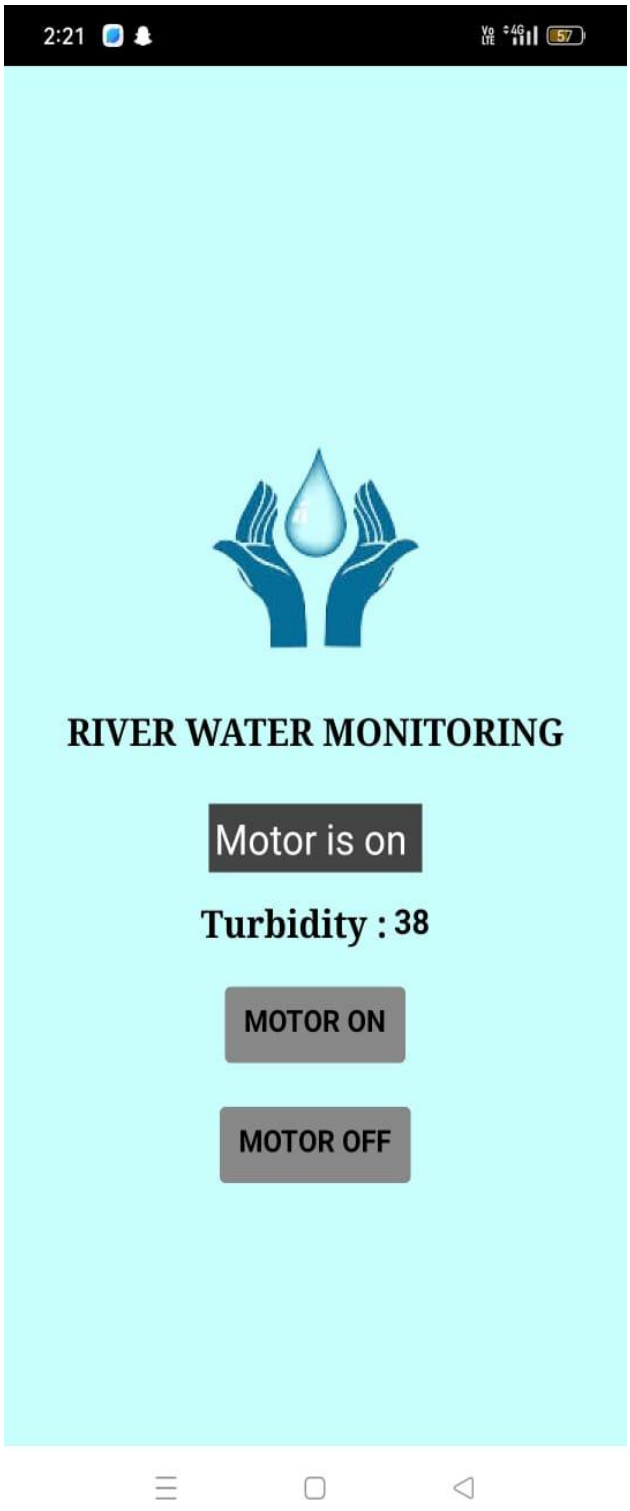
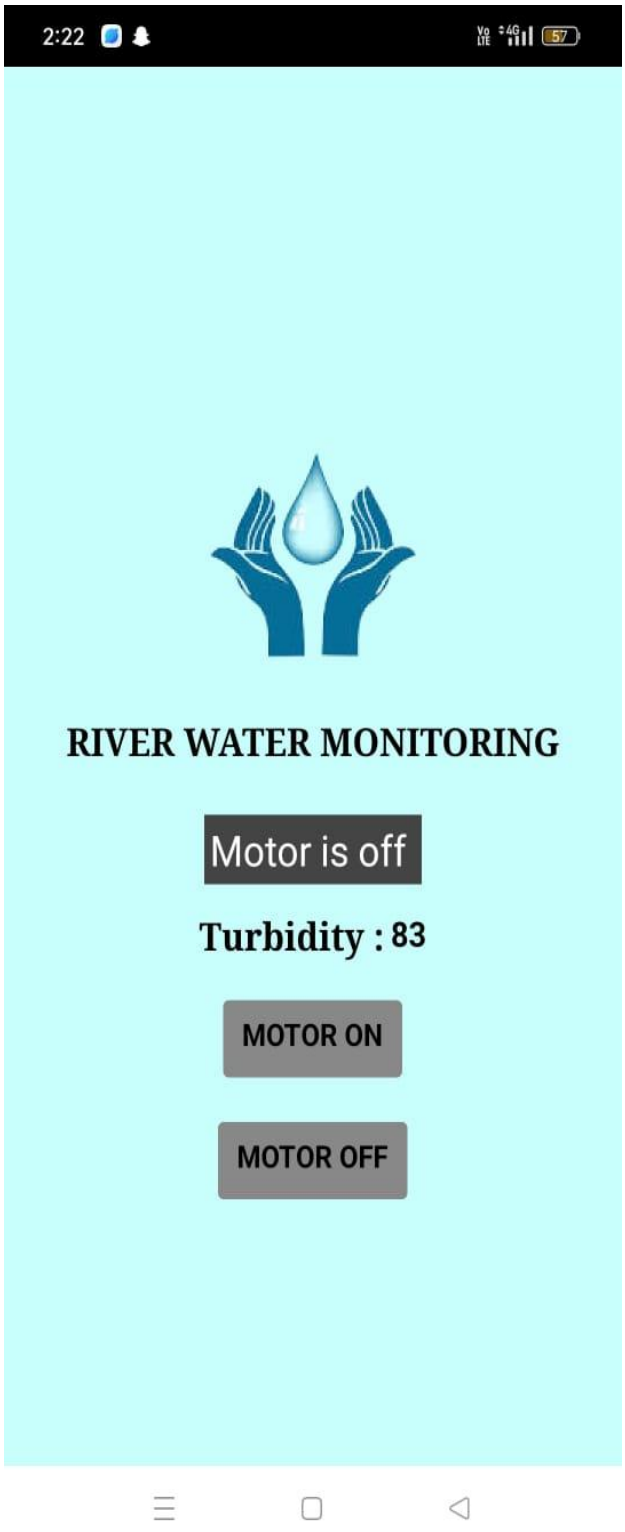
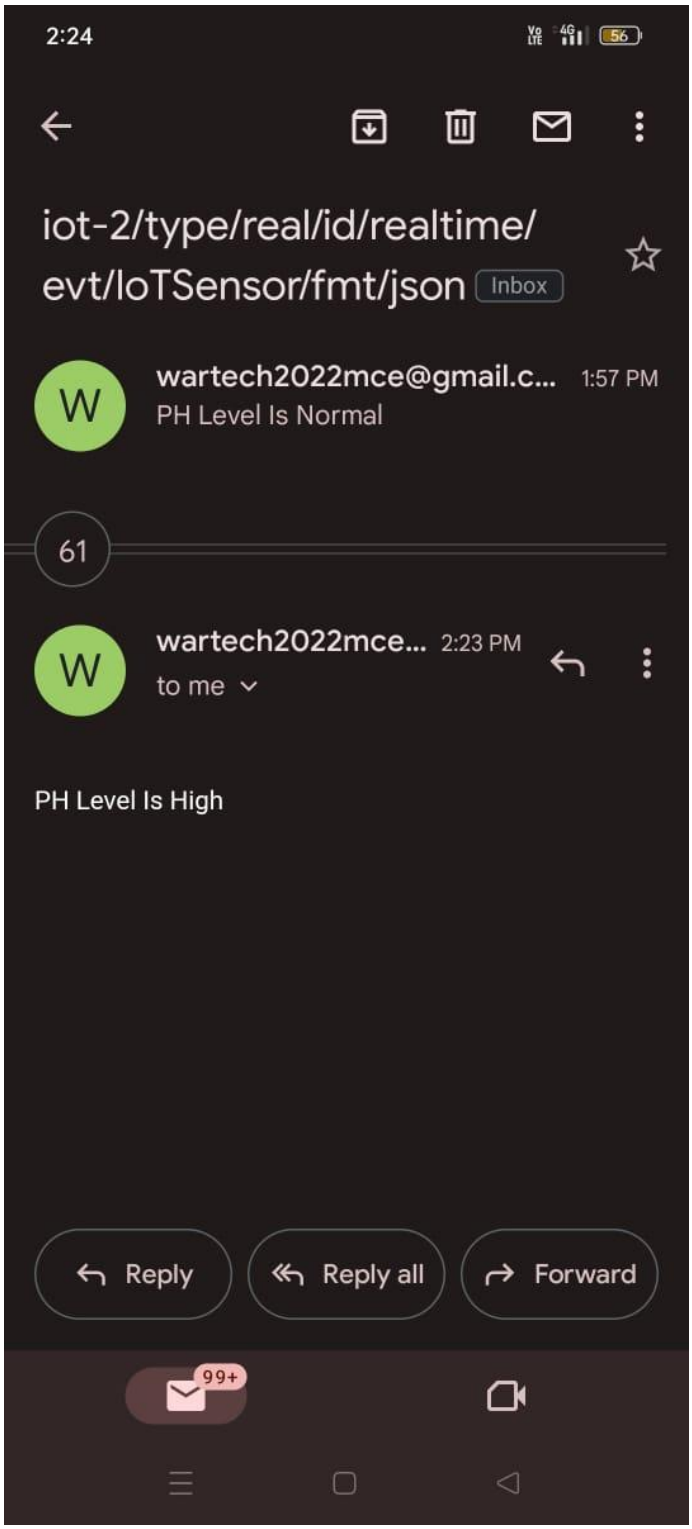

2:21
RIVER WATER MONITORING
Motor is on
Turbidity : 38
MOTOR ON
MOTOR OFF


2:22
RIVER WATER MONITORING
Motor is off
Turbidity : 83
MOTOR ON
MOTOR OFF

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 beging used in the project	https://cloud.ibm.com/login	Pass	Results Verified	Padmavathi M
TC_002	Configure the IBM cloud services which are being used in completing this project	https://cloud.ibm.com/login	Pass	Results Verified	Ramya T
TC_003	IBM Watson IOT platform acts as the mediator to connect the web wep application to IOT devices,so create the IBM Waston IOT platform	https://mw0wqj.internetofthings.ibmcloud.com/dashboard/devices/browse password: Testing123	Pass	Results Verified	Arachana devi A
TC_004	In order to connect the IOT device ti the IBM cloud create in the IBM Waston 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	https://node-red-xoyzi-2022-10-06.us-east.mybluemix.net/ui/#!/0?socketid=QjV_ZOUpoZ_IP5BWAAAF	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	ww.python.org/downloads/release/pyth	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 datas 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 guage equpiment 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 : http://bit.ly/3i5Ou7P