REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

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In fulfillment of project in IBM-NALAYATHIRAN 2022
Team Id:PNT2022TMID20521

PROJECT GUIDES

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1. INTRODUCTION

1.1 Project Overview:

River Water quality monitoring System

River water which is used as drinking water is a very precious commodity for all human beings. The system consists of several sensors which are used for measuring physical and chemical parameters of water. The parameters such as temperature, pH, and dissolved oxygen of the water can be measured. Using this system, a person can detect pollutants froma water body from anywhere in the world. Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming This paper proposes asensor- based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a micro-controller for processing the system, communication systemfor inter and intra node communication and several sensors Real-time data access can be doneby using remote monitoring and Internet of Things (IoT) technology Data collected at the IBM cloud Server and verify them to trigger the actions to be performed.

1.2 Purpose:

Water quality refers to chemical, physical biological and radio logical characteristics of water. It is a measure of the condition of water relative to the necessities of one or more bio-tic species and or to any human need or purposes. Water quality monitoring is defined asa sampling and analysis of the water in lake, stream, ocean and river and conditions of the water body. Smart water quality monitoring is a process of real-time monitoring and the analysis of water to identify changes in parameters based on the physical, chemical and biological characteristics. Monitoring water quality is clearly important: in our seas, our

rivers, on the surface and in our ports, for both companies and the public. It enables us to assess how they are changing, analyze trends and to inform plans and strategies that improve water quality and ensures that water meets its designated use. There are several indicators determining water quality. These include dissolved oxygen, turbidity, bio indicators, nitrates, pH scale and water temperature. Monitoring water quality helps to identify specific pollutants, a certain chemical, and the source of the pollution. There are many sources of water pollution: wastewater from sewage seeping into the water supply; agricultural practices (e.g., the use of pesticides and fertilizer); oil pollution, river and marine dumping, port, shipping and industrial activity. Monitoring water quality and a water quality assessment regularly provides a source of data identify immediate issues – and their source.

- Identifying trends, short and long-term, in water quality.
- Data collected over a period of time will show trends, for example identifying increasing concentrations of nitrogen pollution in a river or an inland waterway. The total data will then help to identify key water quality parameters.
- Environmental planning methods: water pollution prevention and management.
- Collecting, interpreting, and using data is essential for the development of a sound and effective water quality strategy. The absence of real-time data will however hamper the development of strategies and limit the impact on pollution control. Using digital systems and programs for data collection and management is a solution to this challenge.
- Monitoring water quality is a global issue and concern: on land and at sea. Within the European Union, the European Green Deal sets out goals for restoring biological biodiversity and reducing water pollution, as well as publishing various directives to ensure standards of water quality. Individual nation states, for example France, have also clear regulatory frameworks requiring the effective monitoring of water quality. In the United States, the Environmental Protection Agency (EPA) enforces regulationsto address water pollution in each state. Across the world, countries increasingly understand the importance of effective water quality monitoring parameters and methods.

2. LITERATURE SURVEY

2.1 Existing Problem:

Due to population growth, urbanization, and climatic change ,competition for water resources is expected to increase, with a particular impact on agriculture, river water. Water will be suitableness to potable water monitoring compound spillage identification done rivers, remote estimation for swimming pools. It holds self-sufficient hubs that unite with the cloud to ongoing water control. The river water needed to be treated before it is used in agriculture fields, hence the parameters affecting the quality of river-water need to be analyzed and to be used for water treatment purpose.

2.2 References:

Dr.Geetha [1] :IoT based real time water quality monitoring system using smart sensor. WQM is a cost effective and efficient system designed to monitor drinking water quality with the help of IOT(2020).

Natasha Markovic [2]: this research paper focuses on Sensor Web for River Water Pollution Monitoring and Alert System Sensor Web has provided infrastructure for collecting and processing data from distributed and heterogeneous sensors. This set of technologies has found various implementations, especially in the area of environmental monitoring. The Sensor Web architecture for crisis management, described in this paper, provides active monitoring of measuring parameters and timely responses in cases of environmental disasters. The River Water Management and Alert System built on this architecture enable access, control, and management of river water pollution.

K. A. UnnikrishnaMenon [3]: This research paper focuses on Wireless Sensor Network for River Water Quality Monitoring in India This paper introduces a river water quality monitoring system based on wireless sensor network which helps in continuous and remote monitoring of the water quality data in India. The wireless sensor node in the system is designed for monitoring the pH of water, which is one of the main parameters that affect the quality of water. Wireless sensor Network which aids in River Water Quality Monitoring. This paper also proposes a novel technique for the design of a water quality sensor node which can be used for monitoring the pH of water.

Aswinkumar [4]: This research paper focuses on Detection on water pollution and water management using smart sensors iot. To ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. This system consists some sensors. Which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry piusing Zigbee protocol. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time.

Leonid Stoimenovet [5]: this research paper focuses on Sensor Web for River Water Pollution Monitoring and Alert System Sensor Web has provided infrastructure for collecting and processing data from distributed and heterogeneous sensors. This set of technologies has found various implementations, especially in the area of environmental monitoring. The Sensor Web architecture for crisis management, described in this paper, provides active monitoring of measuring parameters and timely responses in cases of environmental disasters. The River Water Management and Alert System built on this architecture enable access, control, and management of river water pollution.

Maneesha V. Ramehet [6]: This research paper focuses on Wireless Sensor Network for River Water Quality Monitoring in India This paper introduces a river water quality monitoring system based on wireless sensor network which helps in continuous and remote monitoring of the water quality data in India. The wireless sensor node in the system is designed for monitoring the pH of water, which is one of the main parameters that affect the quality of water. Wireless sensor Network which aids in River Water Quality Monitoring. This paper also proposes a novel technique for the design of a water quality sensor node which can be used for monitoring the pH of water.

2.3 Problem Statement:

Due to the fast-growing urbanization supply of safe drinking water is a challenge for every city authority. Water can be polluted any time.

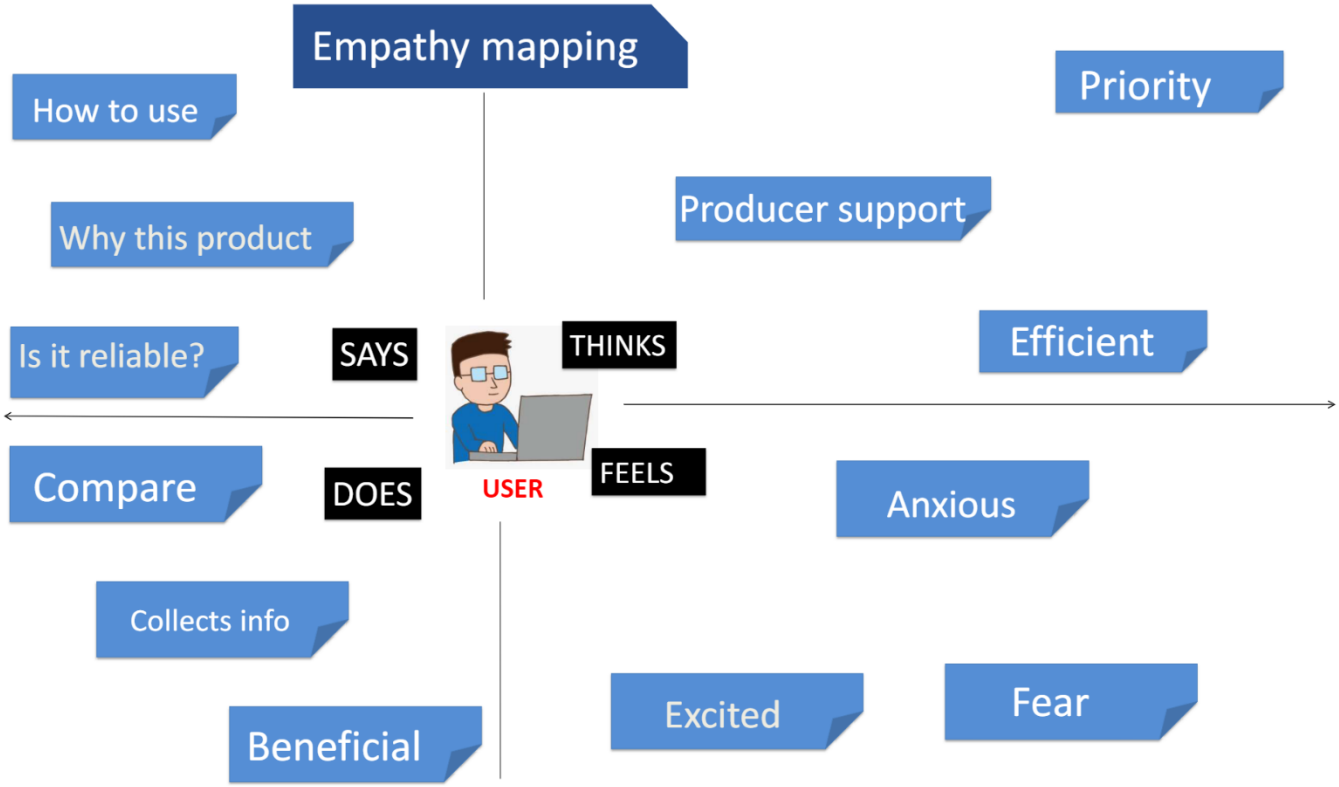
- So, the water we reserved in the water tank at our roof top or basement in our society or apartment may not be safe. Still in India most of the people use simple water purifier that is not enough to get surety of pure water. The traditional water quality monitoring system has certain drawbacks.
- Sometimes the water has dangerous particles or chemical mixed and general-purpose water purifier cannot purify that. It relies on collecting of water samples, testing and analyses in laboratories and it's impossible to check the quality of water manually in every time.
- It results in more cost, more man power and more time. Also, it lacks capability for real- time data collections. So, an automatic real-time monitoring system is required to monitor the health of the water reserved in our water tank of the society or apartment.

So it can warn us automatically if there is any problem with the reserved water. And we can check the quality of the water anytime and from anywhere. By keeping this mind, wedesigned this system especially for residential areas.

3. IDEATION & PROPOSED SOLUTION

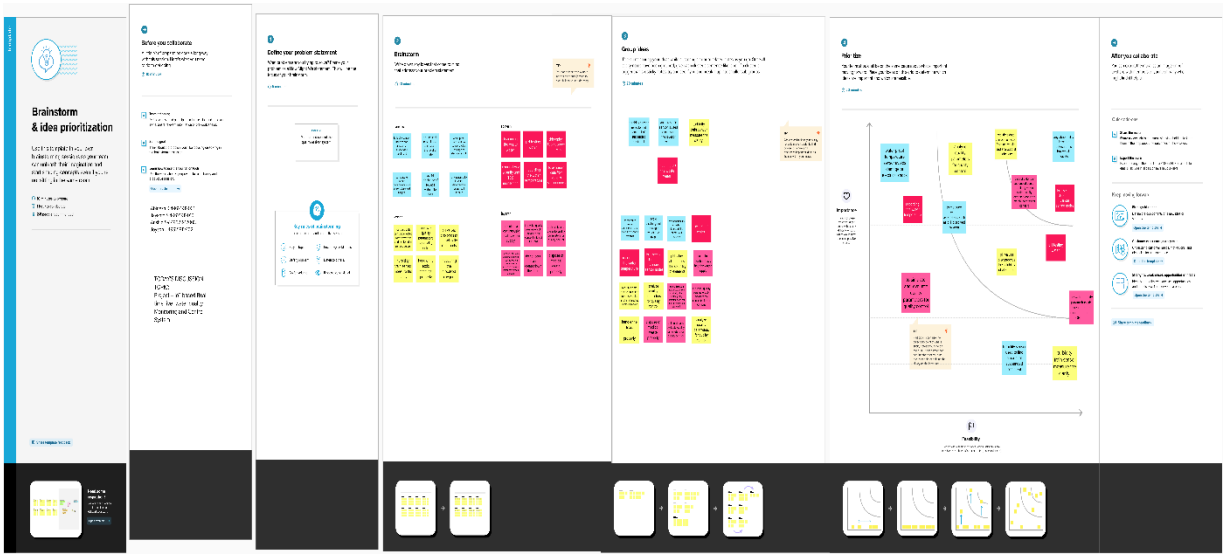
3.1 Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solution



Use this template in your own brainstorming sessions so your team can unleash theirimagination and start shaping concepts even if you're not sitting in the same room.

Brainstorming combines a relaxd, informal approach to problem solving with lateral thinking. It encourages people to come up with thoughts and ideas that can, at first, seem a bit crazy. Some of these ideas can be crafted into original, creative solutions to a problem, while others can spark even more ideas. This helps to get people unstuck by "jolting" them out of their normal ways of thinking.

Therefore, during brainstorming sessions, people should avoid criticizing or rewarding ideas. You're trying to open up possibilities and break down incorrect assumptions about the problem's limits. Judgment and analysis at this stage stunts idea generation and limit creativity.

Evaluate ideas at the end of the session – this is the time to explore solutions further, using conventional

3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Due to population growth, urbanization, and climatic change, competition for water resources is expected to increase, with a particular impact on agriculture, river water.
2.	Idea / Solution description	To monitor the water supply we implement IoT (Internet of Things) setup, for river water quality monitoring systems periodically checks, dust particles, temperature and PH level by sensors and notifies for public when the water quality varies.
3.	Novelty / Uniqueness	We use water detection sensor has unique advantage. It consumes less time to monitor than a manual method for checking polluted levels, and notifies immediately to reduce affected rate of pollution in water.
4.	Social Impact / Customer Satisfaction	People who are living in rural areas near to the river will be very satisfied with our idea. It will be useful to monitorwater pollution in specific area. So this system prevent people from water pollution. It will be used for farmingpurpose to check quality water, temperature and PH level. Our Impact of this project is also create a social satisfaction for farmers too.

5.	Business Model (Revenue Model)	It costs low compared to another model. Our real time quality monitoring model has sensors easily helps to monitor and predict the affected water scale easily in farming, drinking water, aquaculture, and other industries. It notifies by sending directly to the corporation and they can further notify the people to aware immediately. Quick actions can be taken. With the help of efficient use of mobile network, IoT and continuous monitoring it will be revolutionized model.
6.	Scalability of the Solution	Checking the river water quality for providing clean drinking water for the people, farming, promoting aquaculture, and other industries. It is the best replacement for checking water quality in laboratories and it is user-friendly. If we add more advanced sensors in future it can be used to monitor multiple levels in water. It will show continuous real time values in maintaining the quality of water.

3.4 PROBLEM SOLUTION:

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 Registration through Linkedin
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Ultrasonic generator	Periodically the waves are generated to destroy algae in the range of 25%,50%,100%
FR-4	Ph level detection	To observe the water quality, Ph sensor is used and the signals are conveyed to the Arduino.
FR-5	Turbidity detection	Turbidity sensor measures the purity of element or marshy utter in the water and the signals are delivered to Arduino

4.2 Non-functional Requirements:

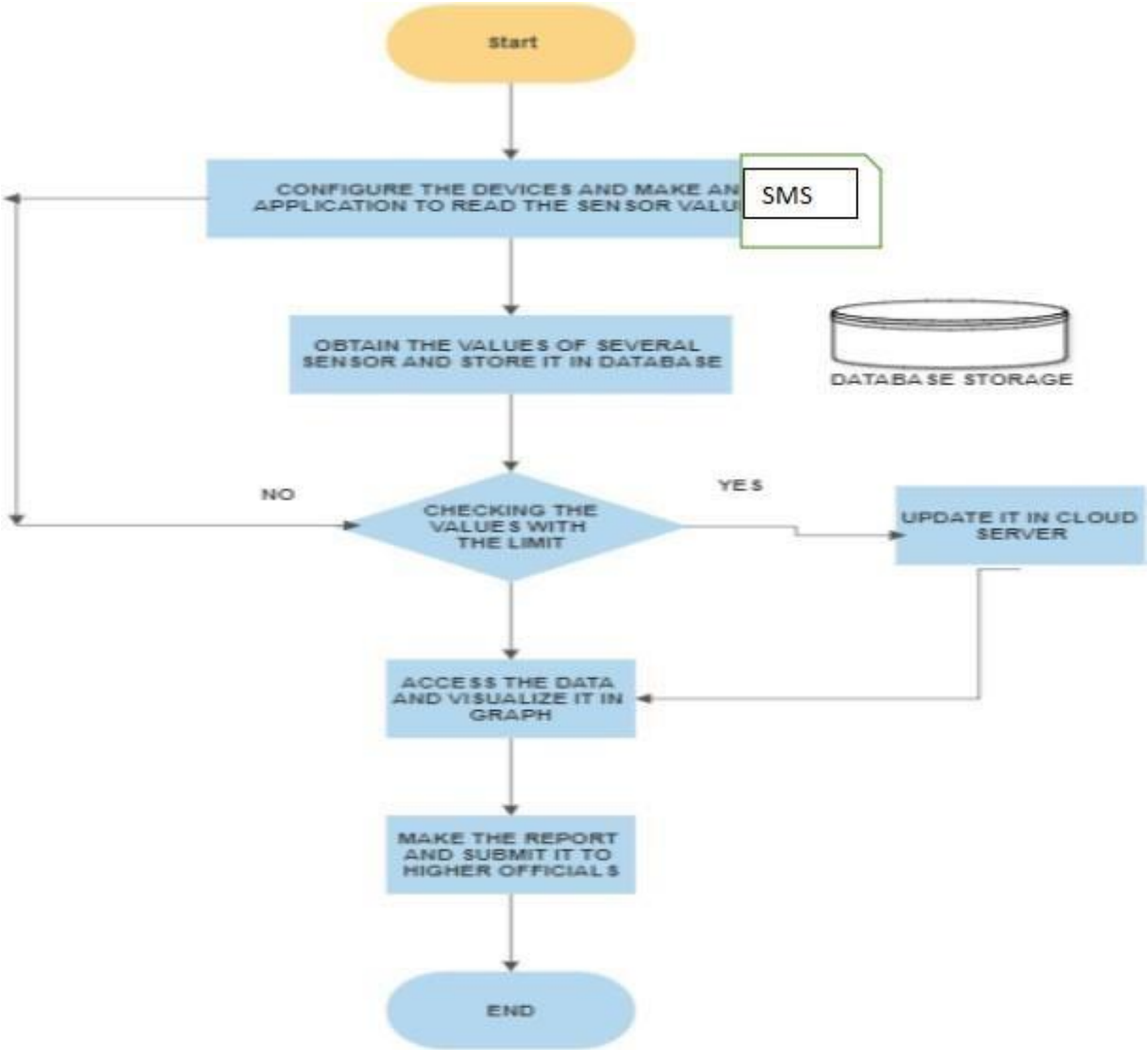
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Monitors the flow and quality of ground water, and investigates surface-and ground-water interactions.
NFR-2	**Security**	The data and information are secured in the application by using the applicationfirewall.
NFR-3	**Reliability**	The Real time sensor output values with future predicted data storage with outputefficiency of 98%. It also gives certainty for aquaculture safety.
NFR-4	**Performance**	The performance of system has higher efficiency and environmentally friendly.
NFR-5	**Availability**	It is available in the form of mobile UI 24 x 7 monitoring system.
NFR-6	**Scalability**	The system has high scalability. Able to be changed in size or scale to give the bestoutput.
NFR-7	**Stability**	The ability of the system to bring itself back to its stable configuration. The stability ishigh.
NFR-8	**Efficiency**	The monitoring system is highly efficient, high mobility with consumption ofpower.

5 PROJECT DESIGN

5.1 Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solution And Technical Architecture

Summary

This code pattern explains how to build an IOT based river water monitoring

and controlling system with some predefined values.

Flow

- Feed the data received from the Sensor unit which are placed in the river sides.
- The collected data will be displayed in the Web page to the user.
- Then the collected data is sent to the data base, where the collected data and the predefined data are checked and monitored.
- If any data exceed the predefined data, then the control signal will send to the Admin.
- The collected data will be stored in the IBM cloud storage. Later the data will be controlled by the admin via Web UI

Components & Technologies:

S.No	Component	Description	Technology
1.	Sensor Data	The data iscollected form the various sensor placed in the river sides.	ESP32Wifi module Raspberry Pie.
2.	Database for Storage	The data/info need to be stored for accessing it in future	MySQL-Oracle
3.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
4.	Cloud Database	Database Service on Cloud	IBM cloud
5.	Data Storage	File storage requirements	IBM Block Storage

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	PH level Monitoring	The PH level of river water can be monitoredvia placing sensors in rivers.	PH-sensor
2.	Air Quality Monitoring	Theclarity and purity ofriver water can be monitored	Surface Mount Sensor
3.	Temperature Monitoring	The temperature of river water can be monitored	Temperature sensor
4.	Water Treatment	can be used as both a safety device in the water purification process as carbon dioxide, methane, and carbon monoxide are some of the key gases produced during the treatment process	NDIR gas sensors
4.	Soil Condition Monitoring	Soil condition monitoring sensors allow farmers to collect data about rainfall, temperature, and other metrics over time to track trends and predict irrigation needs.	Acoustic sensor

5.3 User Stories

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

	Publish Data to cloud.	USN-10	Publish Data that is sensed by themicrocontroller to the Cloud	3	High	Anshio SV Joyson J
Sprint-4	Fast-SMS Service	USN-11	Use Fast SMS to send alert messagesonce the parameters like pH, Turbidity andtemperature goes beyond the threshold	3	High	Abinesh K Jayanth S Anshio SV Joyson J
	Testing	USN-12	Testing of project and finaldeliverables	3	Mediu m	

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & SCHEDULING:

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project is done by gathering information about related details on technical papers and web browsing.	06 OCTOBER 2022
Empathy Map	Prepared Empathy Map Canvas to combine thoughts and pains, gains of the project with all team members.	08 OCTOBER 2022
Ideation	Brainstorming session is conducted with all team members to list out all the ideas and prioritize the top 3 ideas.	09 OCTOBER 2022
Proposed Solution	Prepared the proposed solution document, which includes the novelty, feasibility of idea business model, social impact scalability of solution, etc.	28 OCTOBER 2022
Problem Solution Fit	Prepared problem - solution fit document.	30 OCTOBER 2022

6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

SI. NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1.	Understanding theproject requirement	Assign the team members and create a repository in the GitHub. Assign the task to each member and teachhow to use and open and class the GitHub and IBM career education	1 WEEK
2.	Starting of project	Advise students to attend classes of IBM portals, create and develop a rough diagram based on project description and gather information on IOT and IBM projects and team leaders assign tasks to each member of the project	1 WEEK
3.	Attend class	Team members and team lead must watch and learnfrom classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project.	4 WEEKS
4.	Budget and scope of project	Budget and analyze the use of IOT in the project and discuss with team for budget prediction to predict the favorability for the customer to buy.	1 WEEK

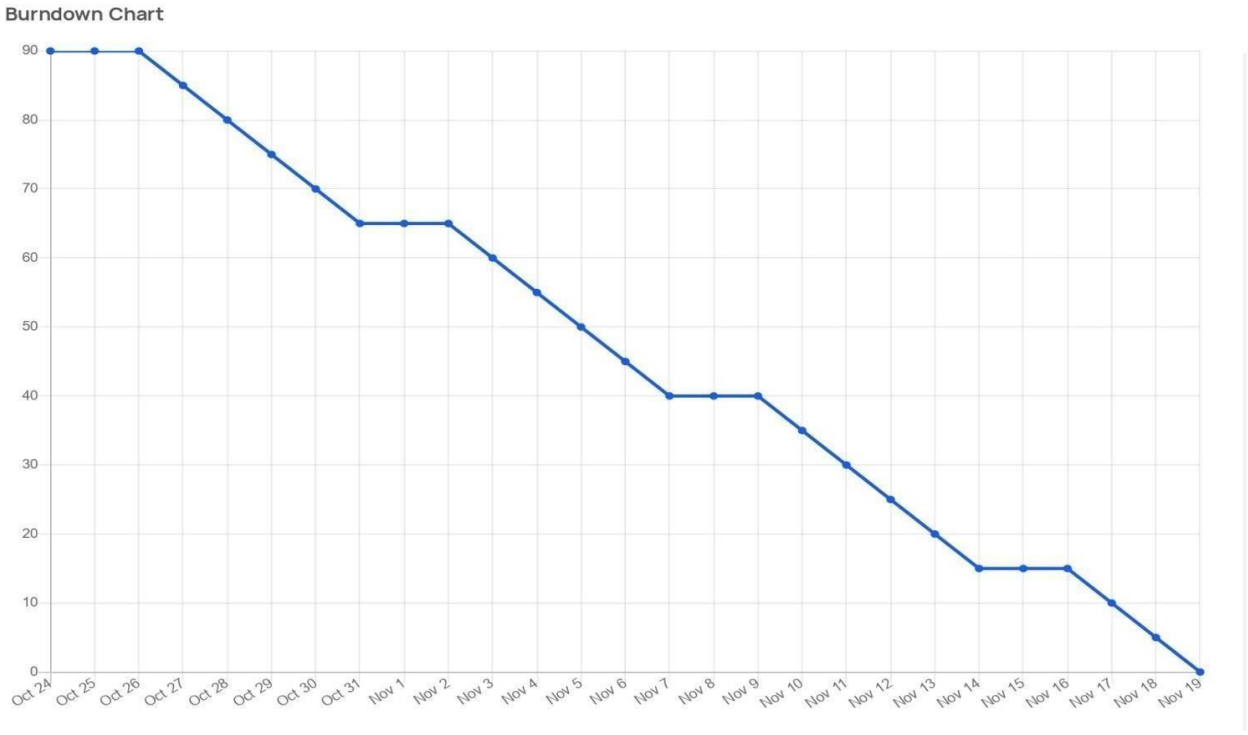
Project Tracker, Velocity & Burndown Charts

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint EndDate (Planned)	Story Points Completed (as on Planned EndDate)	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

Velocity:

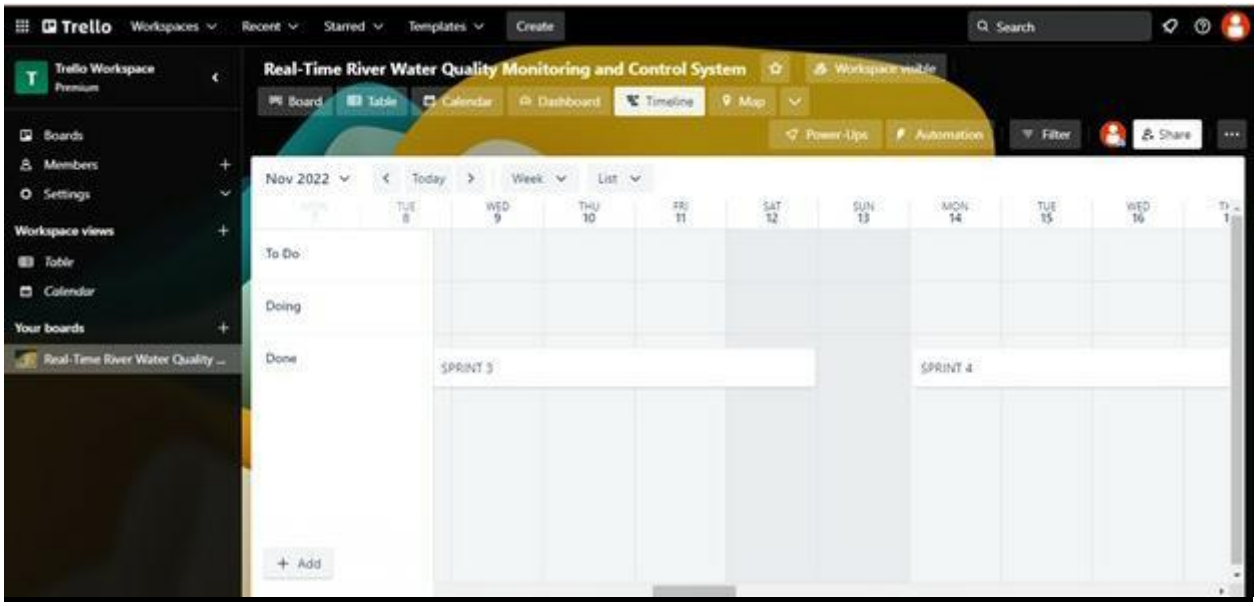
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

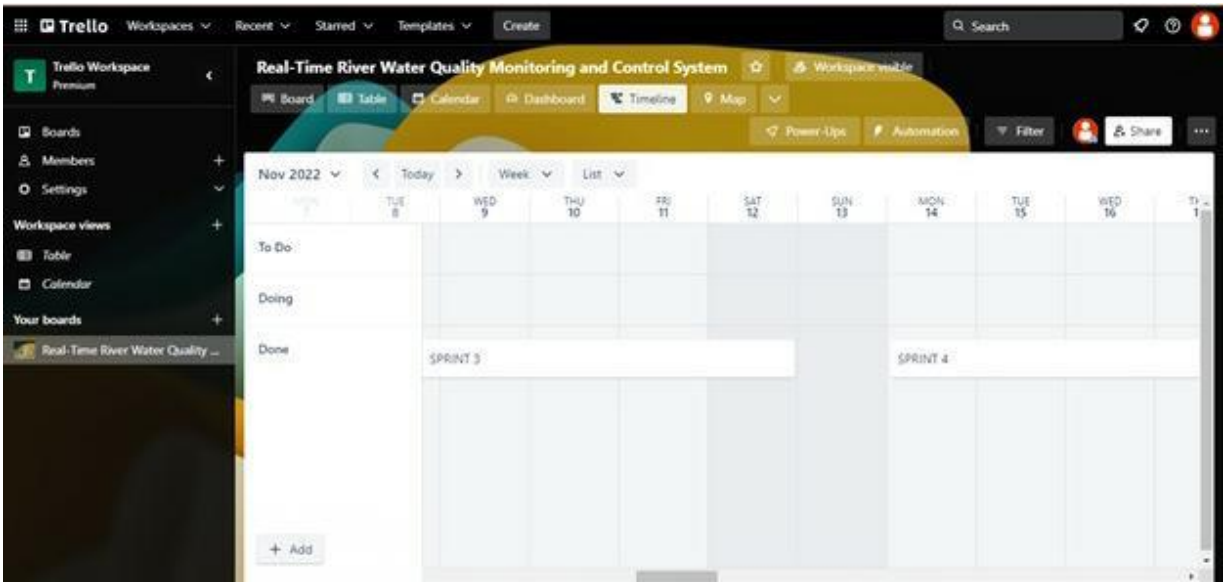
Burndown Chart:



6.3 REPORT FROM JIRA

TIMELINE CREATED USING JIRA SOFTWARE



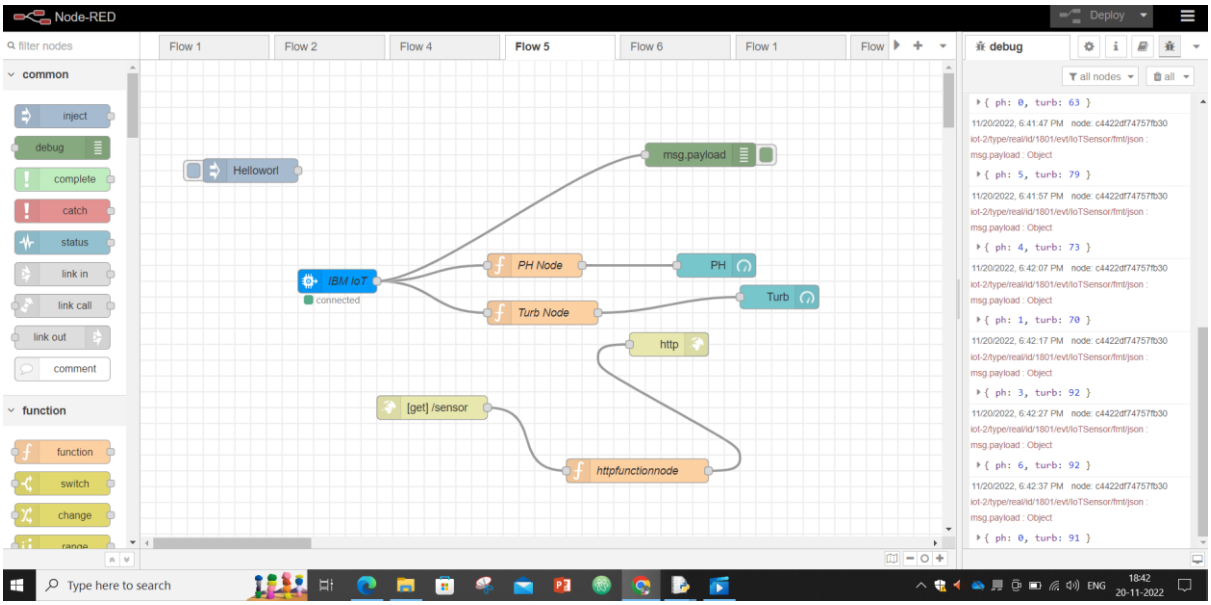


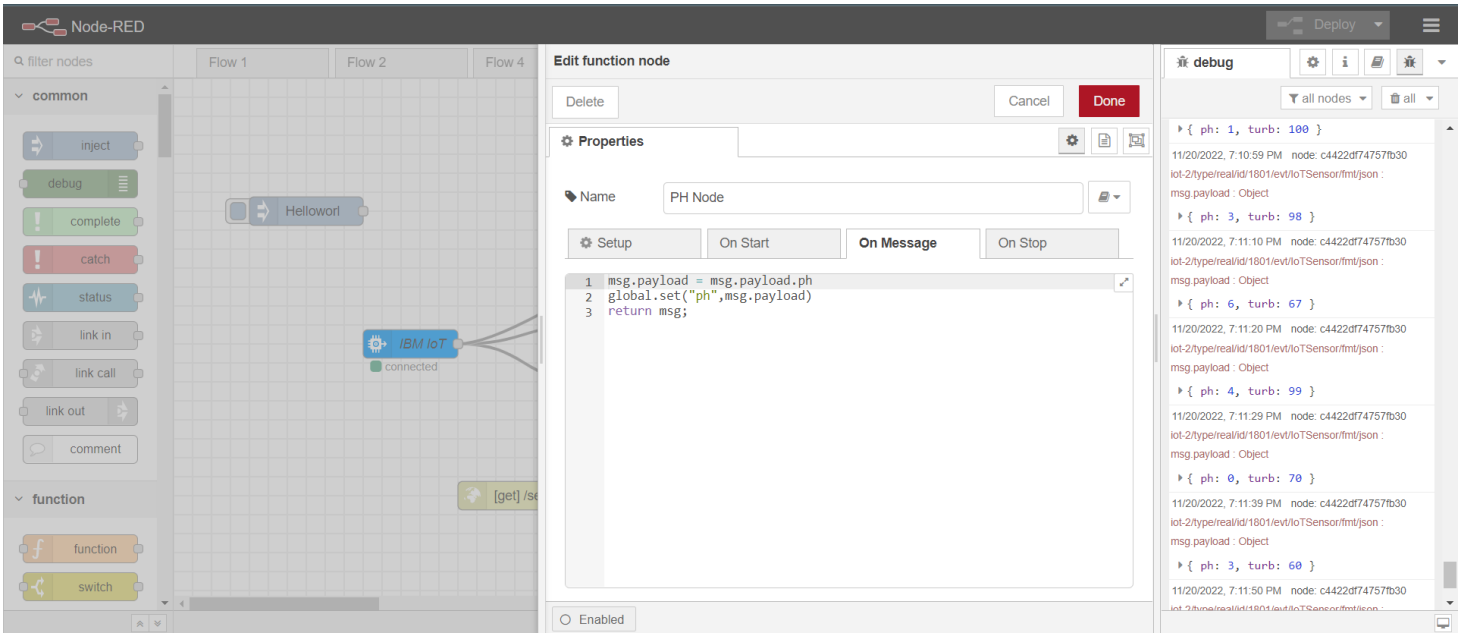
ISSUES:

Name	Type	Related Schemes
ERROR IN MSG PAYLOAD EVENTS	Base	• Default Issue Type Scheme
ISSUE IN CONFIGURING NODE RED DASHBOARD	Base	• Default Issue Type Scheme
ERROR 1101 IN MIT APP INVENTOR	Subtask	• Default Issue Type Scheme
URL NOT RESPONDED THE NODE RED DATA URL NOT RESPONDED	Subtask	• Default Issue Type Scheme

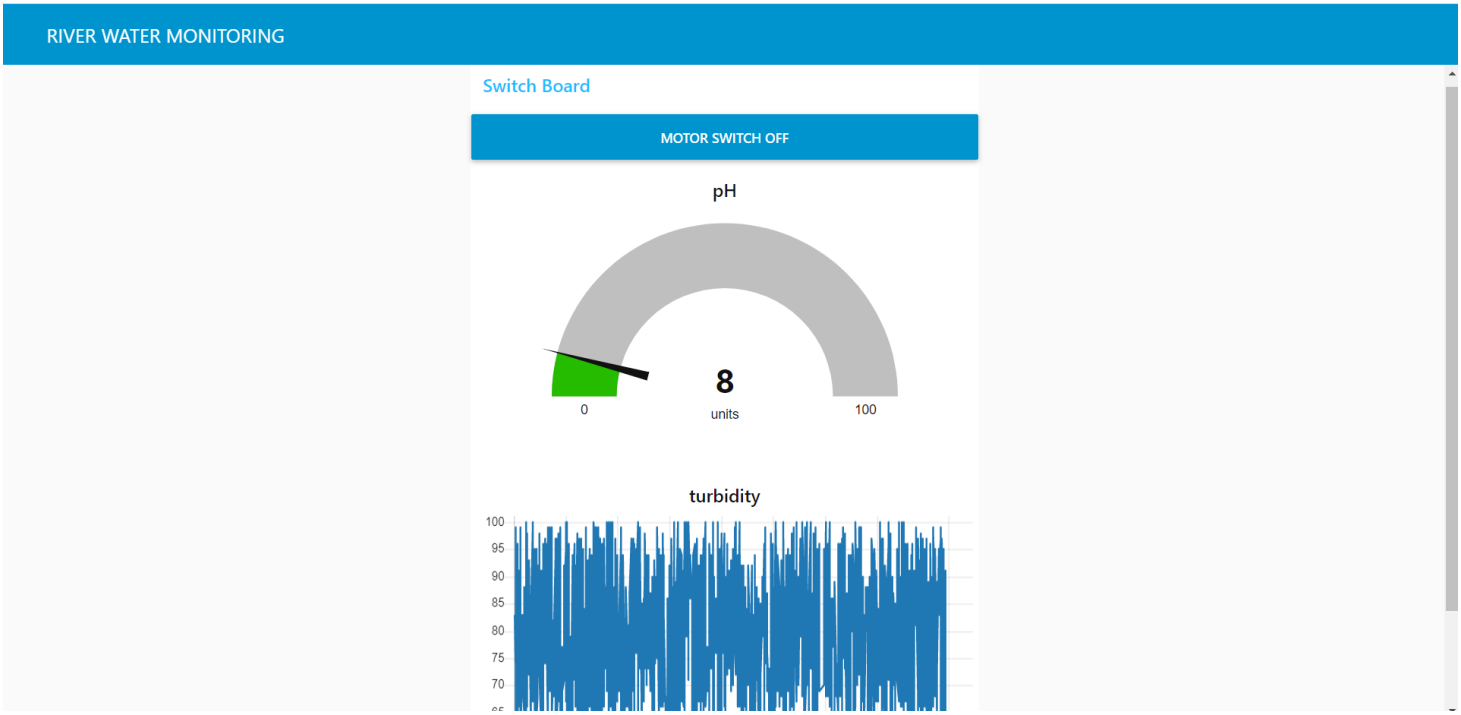
7. CODING AND SOLUTIONING

7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:





Node red Dashboard:



8. TESTING

8.1 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	15	0	0	15
Client Application	45	0	0	45
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	10	0	0	10
Final Report Output	4	0	0	4
Version Control	3	0	0	3

8.2 USER ACCEPTANCE TESTING:

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 SYSTEMS project at the time of the release to User Acceptance Testing (UAT).

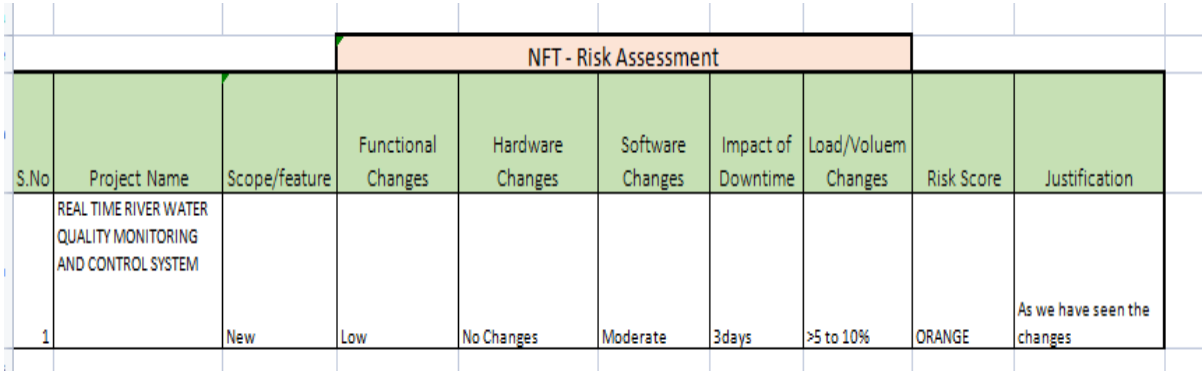
2. Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity3	Severity 4	Subtotal
By Design	9	5	4	3	21
Duplicate	2	0	2	0	4
External	3	4	1	2	10
Fixed	10	1	5	17	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	2	3
Won't Fix	0	3	3	1	7
Totals	24	13	17	25	79

9. RESULT

9.1 PERFROMANCE METRICS:



			NFT - Risk Assessment						
S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM	New	Low	No Changes	Moderate	3days	>5 to 10%	ORANGE	As we have seen the changes

PERFORMANCE TABLE

PARAMETER	PERFORMANCE	DESCRIPTION
ADMIN TESTING	95%-100%	THE TESTING DONE BEFORE IT IS DEPLOYED AS AN APP
CUSTOMER SATISFACTION	75-85%	THE CUSTOMER NEED TO BE SATISFIED WITH THE MOBILE APPLICATION
USER INTERFACE	65-85%	THE APP CAN USED BY ANYONE.(EASE OF ACCESS)
SEVER RESPONSE	50-75%	url - response
DATA VALIDATION WITH NO. OF TEST CASE	60-80% (15-30 TESTCASE)	VALID DATA FROM THE APP
ERROR	3-5%	REAL-TIME DELAY MAY OCCUR

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- The prototype developed for 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 Bluetoothmodule allows remote controlling of the system.

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 do not reflect real time water quality measurement due to delay in measurement.
- The process is time consuming due to slow process of manual datacollection from different locations of the water body.
- The method is prone to human errors of various forms.

11. CONCLUSION

Thus, our project is used to Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can monitorwater quality automatically, and it is low in cost and does not require people on duty. So, the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters.

The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value. By keeping the embedded devices in the environment for monitoring enables self-protection (i.e., smart environment) to the environment. To implementthis need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e., it can interact with other objects through the network.

Then the collected data and analysis results will be available to the end user through the Wi-Fi.

12. FUTURE SCOPE

We use water detection sensor has unique advantage. It consumes less time to monitor than a manual method for checking polluted levels, and notifies immediately to reduce affected rate of pollution in water. People who are living in rural areas near to the river will be very satisfied with our idea. It will be useful to monitor water pollution in specific area. So, this system prevents people from water pollution. It will be used for farming purpose to check quality water, temperature, and PH level. Our Impact of this project is also creating a social satisfaction for farmers too. The scalability of this project gives the addition of more different type of sensors. By interfacing the relay we can control the supply of water. We can also implement as a revenue model. 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.

13. APPENDIX

13.1 SOURCE CODE:

PYTHON CODE TO PUBLISH DATA

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = "kpglcf"
deviceType = "real"
deviceId = "1801"
authMethod = "token"
authToken = "Jayantha"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    elif status == "motoroff":
        print ("motor is off")
    else :
        print ("please send proper command")

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(0,7)

    turb=random.randint(60,100)


    data = { 'ph' : ph, 'turb': turb }

    #print data

    def myOnPublishCallback():

        print ("Published PH Level = %s C" % ph, "Turbidity = %s %%" % 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(10)


    deviceCli.commandCallback = myCommandCallback


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

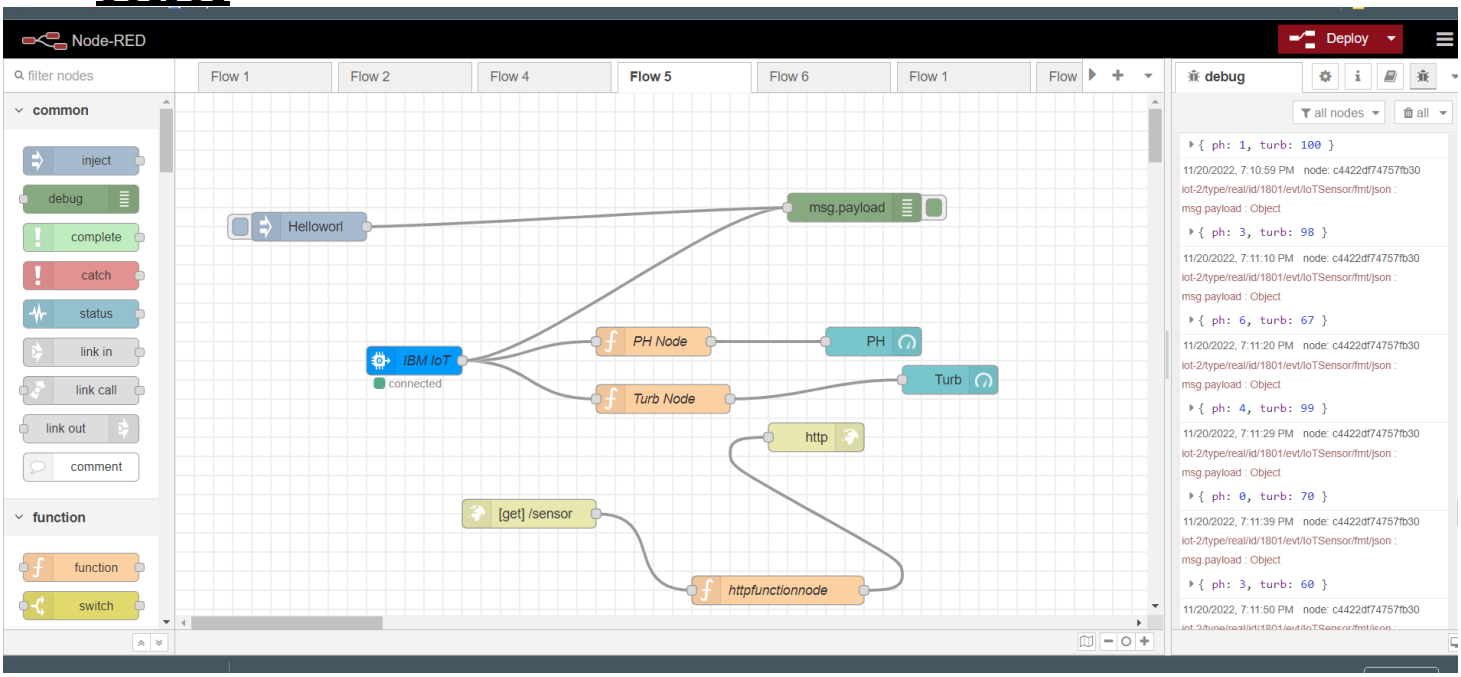
Wokwi Code:

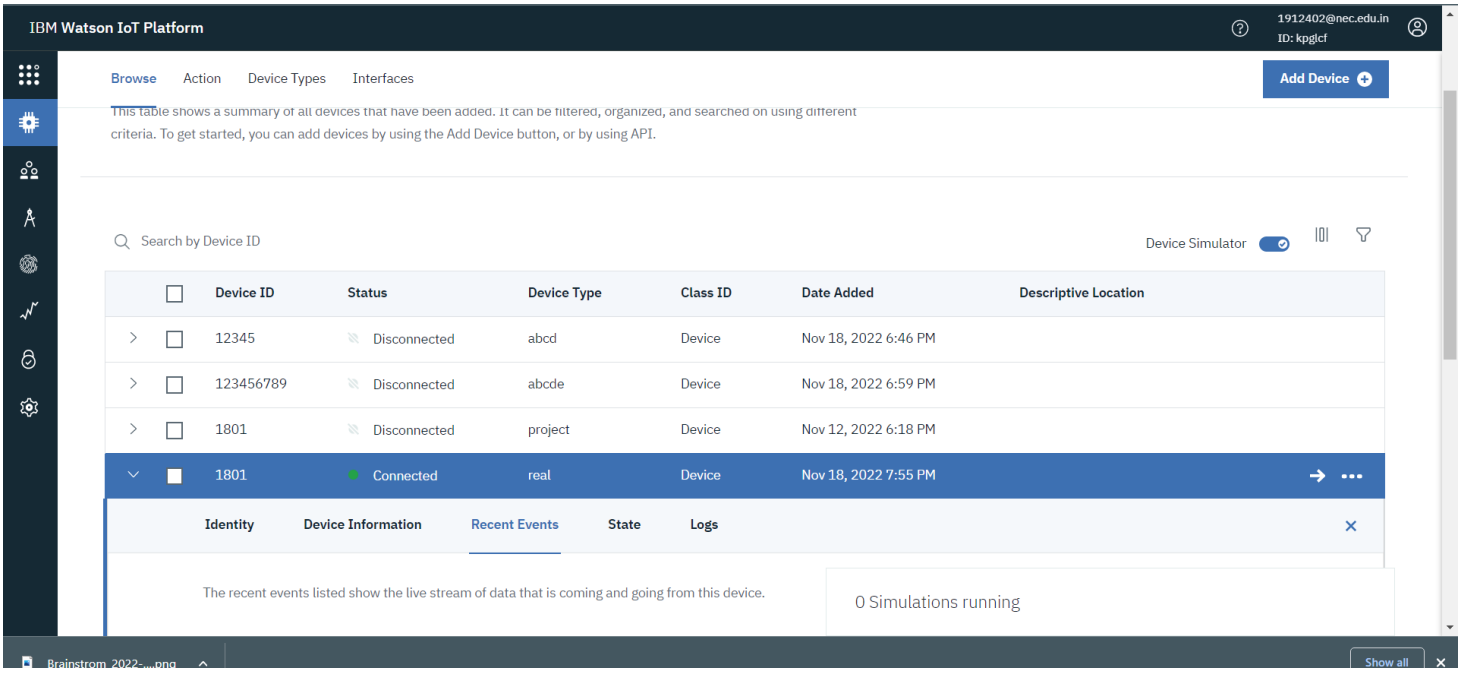
```
#include <WiFi.h>
#include <PubSubClient.h>
void callback(char* subscribetopic, byte* payload, unsigned int
payloadLength);
//-------credentials of IBM Accounts------
#define ORG "kotoq5"//IBM ORGANITION ID
#define DEVICE_TYPE "ESP32"//Device type mentioned in ibm watson IOT
Platform
#define DEVICE_ID "1801"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN " Jayantha" //Token
String data3;
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/Data/fmt/json";
char subscribetopic[] = "iot-2/cmd/test/fmt/String";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
WiFiClient wifiClient;
PubSubClient client(server, 1883, callback ,wifiClient);
const int trigPin = 5;
const int echoPin = 18;
#define SOUND_SPEED 0.034
long duration;
float distance;
void setup() {
Serial.begin(115200);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
wificonnect();
mqttconnect();
}
```

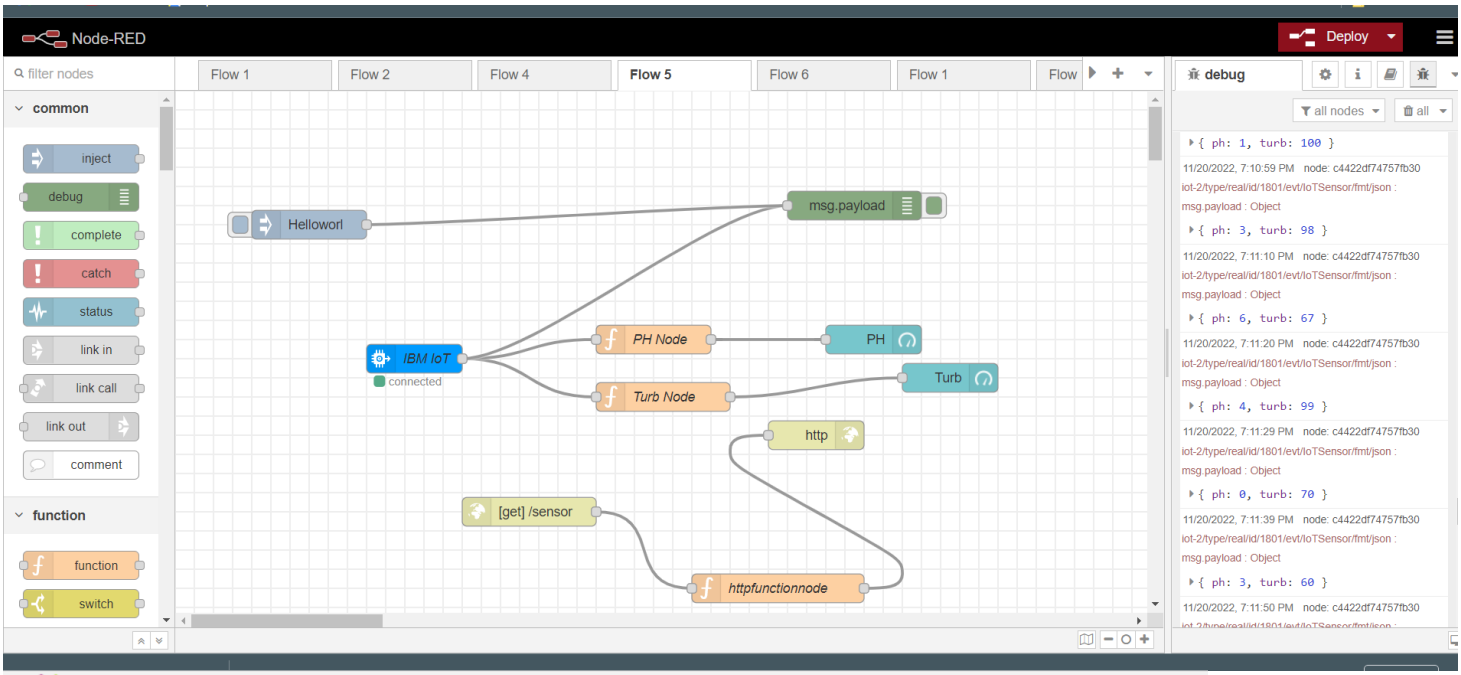
```
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration * SOUND_SPEED/2;
Serial.print("Distance (cm): ");
Serial.println(distance);
if(distance<100)
{
Serial.println("ALERT!!");
delay(1000);
PublishData(distance);
delay(1000);
if (!client.loop()) {
mqttconnect();
}
}
delay(1000);
}
void PublishData(float dist) {
mqttconnect();
String payload = "{\"Distance\":";
payload += dist;
payload += ",\"ALERT!!\":""\"Distance less than 100cms\"";
payload += "}";
Serial.print("Sending payload: ");
Serial.println(payload);
if (client.publish(publishTopic, (char*) payload.c_str())) {
Serial.println("Publish ok");
} else {
Serial.println("Publish failed");
}
}
void mqttconnect() {
if (!client.connected()) {
Serial.print("Reconnecting client to ");
Serial.println(server);
```

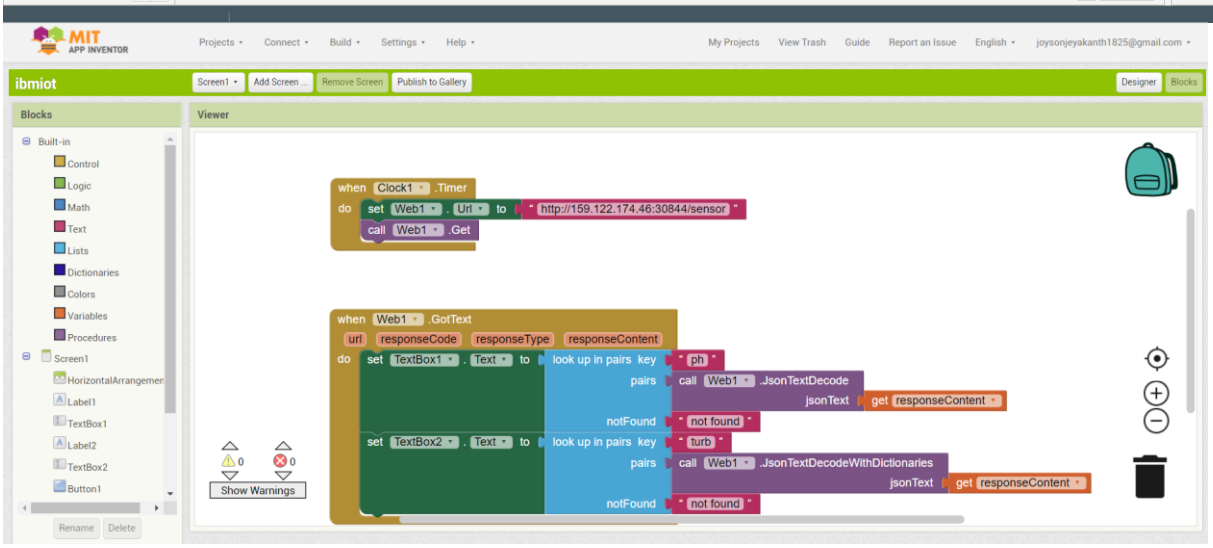
```
while (!!!client.connect(clientId, authMethod, token)) {
Serial.print(".");
delay(500);
}
initManagedDevice();
Serial.println();
}
}
void wificonnect()
{
Serial.println();
Serial.print("Connecting to ");
WiFi.begin("Wokwi-GUEST", "", 6);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
}
void initManagedDevice() {
if (client.subscribe(subscribetopic)) {
Serial.println((subscribetopic));
Serial.println("subscribe to cmd OK");
} else {
Serial.println("subscribe to cmd FAILED");
}
}
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{
Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic);
for (int i = 0; i < payloadLength; i++) {
//Serial.print((char)payload[i]);
data3 += (char)payload[i];
}
Serial.println("data: "+ data3);
data3="";
}
```

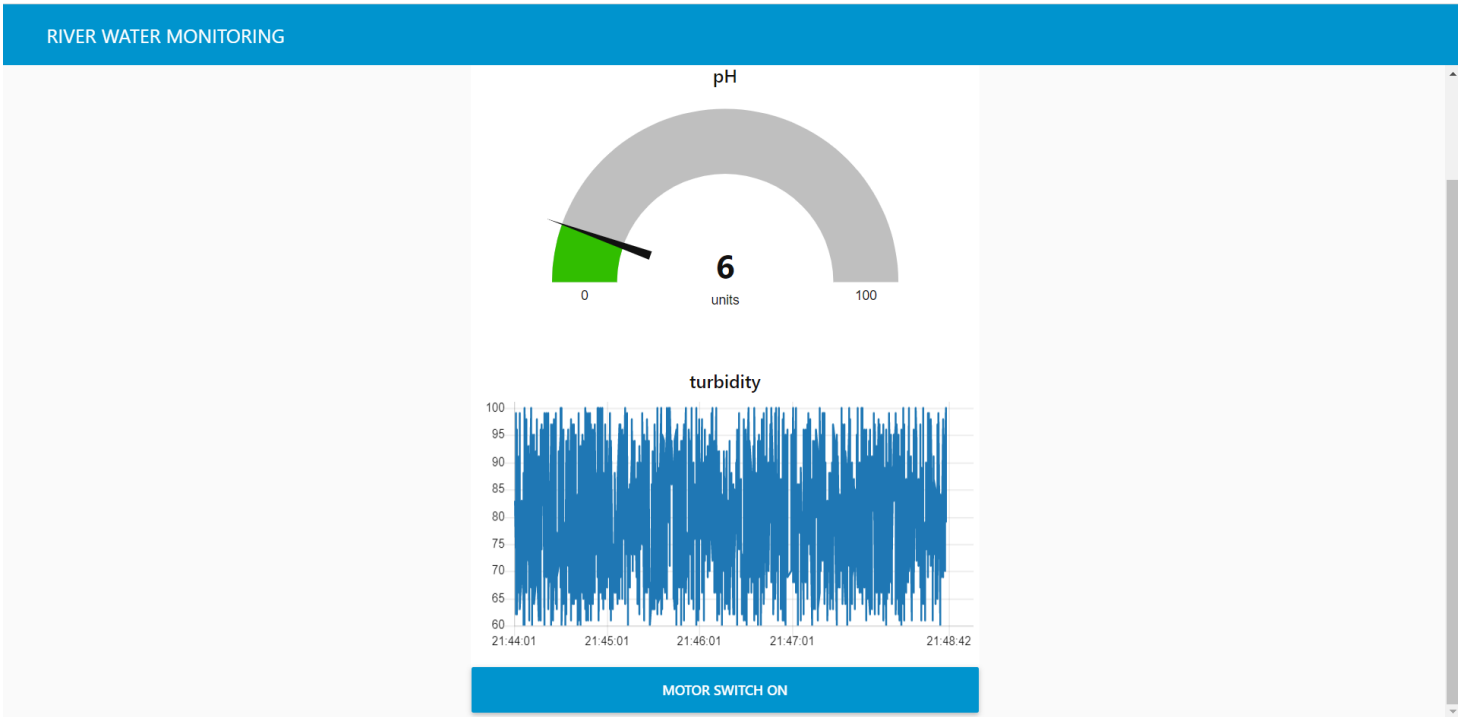
OUTPUT

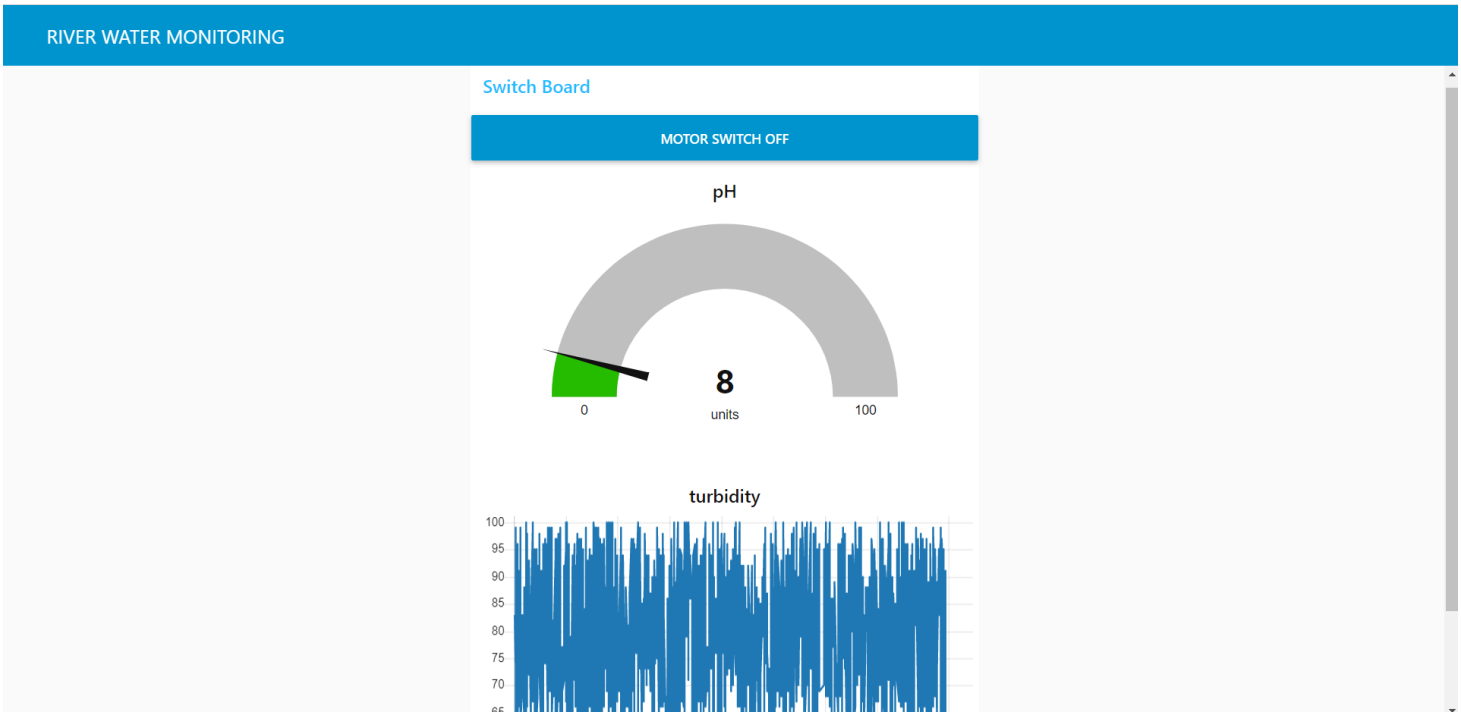

Node-RED
Deploy
filter nodes
Flow 1
Flow 2
Flow 4
Flow 5
Flow 6
Flow 1
Flow
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
Helloworl
msg.payload
IBM IoT
connected
PH Node
PH
Turb Node
Turb
http
[get] /sensor
httpfunctionnode
debug
all nodes
all
{ ph: 1, turb: 100 }
11/20/2022, 7:10:59 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 3, turb: 98 }
11/20/2022, 7:11:10 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 6, turb: 67 }
11/20/2022, 7:11:20 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 4, turb: 99 }
11/20/2022, 7:11:29 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 0, turb: 70 }
11/20/2022, 7:11:39 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 3, turb: 60 }
11/20/2022, 7:11:50 PM node: c4422df74757fb30


IBM Watson IoT Platform
1912402@nec.edu.in
ID: kpglcf
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
Descriptive Location
12345 Disconnected abcd Device Nov 18, 2022 6:46 PM
123456789 Disconnected abcde Device Nov 18, 2022 6:59 PM
1801 Disconnected project Device Nov 12, 2022 6:18 PM
1801 Connected real Device Nov 18, 2022 7:55 PM
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.
0 Simulations running
Show all

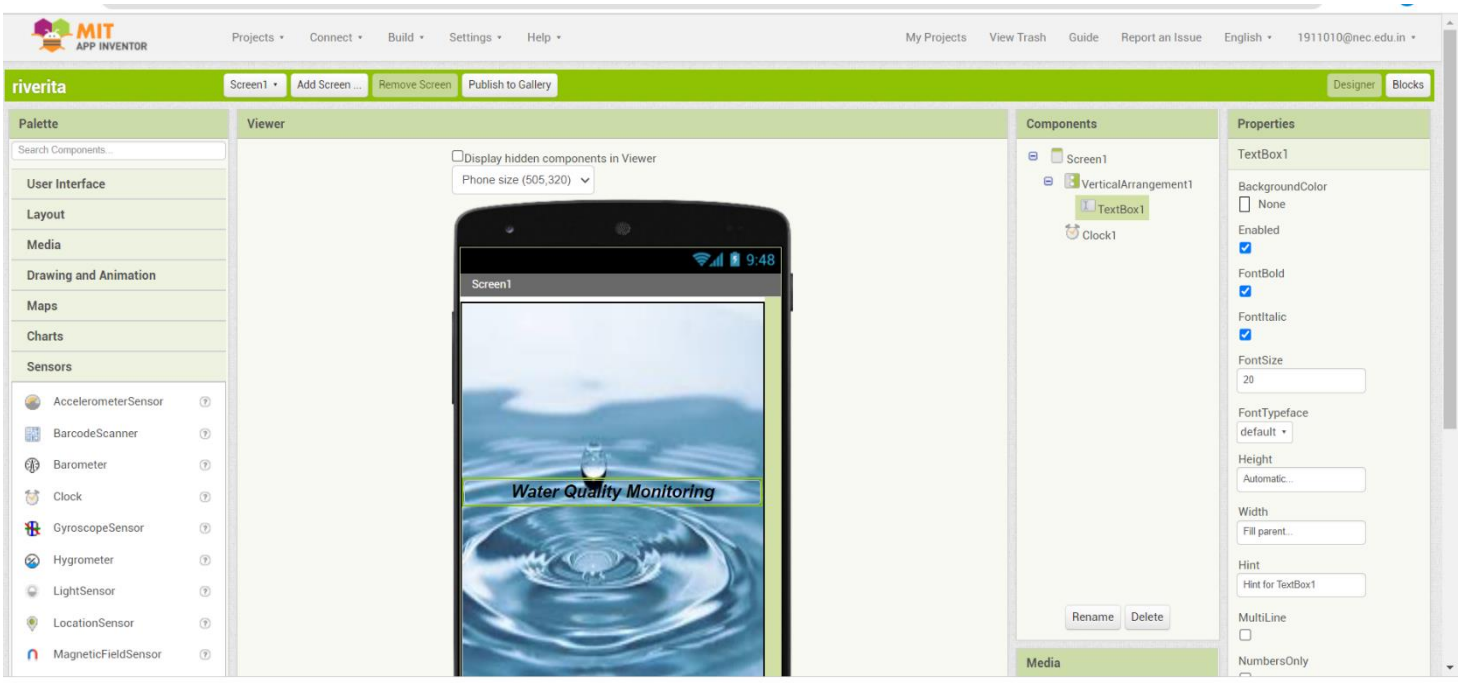

Node-RED
Deploy
filter nodes
Flow 1
Flow 2
Flow 4
Flow 5
Flow 6
Flow 1
Flow
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
Helloworl
msg.payload
IBM IoT
connected
PH Node
PH
Turb Node
Turb
http
[get] /sensor
httpfunctionnode
debug
all nodes
all
{ ph: 1, turb: 100 }
11/20/2022, 7:10:59 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 3, turb: 98 }
11/20/2022, 7:11:10 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 6, turb: 67 }
11/20/2022, 7:11:20 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 4, turb: 99 }
11/20/2022, 7:11:29 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 0, turb: 70 }
11/20/2022, 7:11:39 PM node: c4422df74757fb30
iot-2/type/real/id/1801/evt/IoTSensor/fmt/json :
msg.payload : Object
{ ph: 3, turb: 60 }
11/20/2022, 7:11:50 PM node: c4422df74757fb30


MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
joysonjeyakanth1825@gmail.com
ibmiot
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
HorizontalArrangemen
Label1
TextBox1
Label2
TextBox2
Button1
Rename
Delete
Viewer
when Clock1 .Timer
do set Web1 . Url to " http://159.122.174.46:30844/sensor "
call Web1 .Get
when Web1 .GotText
url responseCode responseType responseContent
do set TextBox1 . Text to look up in pairs key " ph "
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound " not found "
set TextBox2 . Text to look up in pairs key " turb "
pairs call Web1 .JsonTextDecodeWithDictionaries
jsonText get responseContent
notFound " not found "
Show Warnings


RIVER WATER MONITORING
pH
6
units
0
100
turbidity
100
95
90
85
80
75
70
65
60
21:44:01
21:45:01
21:46:01
21:47:01
21:48:42
MOTOR SWITCH ON


RIVER WATER MONITORING
Switch Board
MOTOR SWITCH OFF
pH
8
units
0
100
turbidity
100
95
90
85
80
75
70

MOBILE APP


MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
1911010@nec.edu.in
riverita
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Layout
Media
Drawing and Animation
Maps
Charts
Sensors
AccelerometerSensor
BarcodeScanner
Barometer
Clock
GyroscopeSensor
Hygrometer
LightSensor
LocationSensor
MagneticFieldSensor
Viewer
Display hidden components in Viewer
Phone size (505,320)
9:48
Screen1
Water Quality Monitoring
Components
Screen1
VerticalArrangement1
TextBox1
Clock1
Rename
Delete
Media
Properties
TextBox1
BackgroundColor
None
Enabled
FontBold
FontItalic
FontSize
20
FontTypeface
default
Height
Automatic...
Width
Fill parent...
Hint
Hint for TextBox1
MultiLine
NumbersOnly

APPENDIX:

13.2 GIT-HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-24784-1659948832

13.3PROJECT DEMO LINK:

https://www.youtube.com/watch?v=8wQwXj9D1a4