REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

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FROM

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In fulfillment of project in IBM-NALAIYATHIRAN 2022

Team Id: ***PNT2022TMID33098***

PROJECT GUIDES

Industry Mentor: Mr.Bharadwaj

Faculty Mentor: Mrs.V. Sivasakthi

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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 from a 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 a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a micro-controller for processing the system, communication system for inter and intra node communication and several sensors Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology Data collected at the 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 as a 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 regulations to 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 feilds,hence the parameters affecting the quality of river-water need to be analysed and to be used for water treatement purpose.

2.2 References:

1. K.S. Adu-Manu, C. Tapparello, W. Heinzelman, F.A. Katsriku, J.-D. Abdulai

Water quality monitoring using wireless sensor networks: Current trends and future research directions ACM Transactions on Sensor Networks (TOSN) (2017).

2. S. Thombre, R.U. Islam, K. Andersson, M.S. Hossain

IP based Wireless Sensor Networks : performance Analysis using Simulations and Experiments. Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, 7 (2016).

3. Rushikesh Kshirsagar, R.Mudhalwadkar, Saish Kalaskar

Design and Development of IoT Based Water Quality Measurement System. The idea about low-cost IOT based portable approach for water quality measurements system. Because of its low-cost approach, everyone can afford to use it to determine quality of water(2019).

4. N. Vijayakumar, R. Ramya

The real time monitoring of water quality in IoT environment. The parameters such as temperature, PH, turbidity, conductivity, dissolved oxygen of the water can be measured. The

measured values from the sensors can be processed by the core controller. The raspberry PI B+ model can be used as a core controller (2015).

5. M.Chitra, D. Sadhihskumar, R. Aravindh, M. Murali, R. Vaittilingame

IoT based Water Flood Detection and Early Warning System. The collected information (data) from the water level sensor and temperature and humidity sensor passed to Thingview Android application in order to find the flow graph level of the water level in the river and temperature, humidity values and sends SMS to the registered contact mobile numbers (2020).

6. Dr.Geetha

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).

2.3 Problem Statement:

Farmers put fertilizers and pesticides on their crop so that they grow better but these fertilizers and pesticides can be washed through the soil by rain to end up in the rivers If the large amount of fertilizers or the farm waste drain intoϖ river the concentration of nitrate and phosphate in the water increases considerably algae uses these substances to grow and multiply rapidly turning the water green

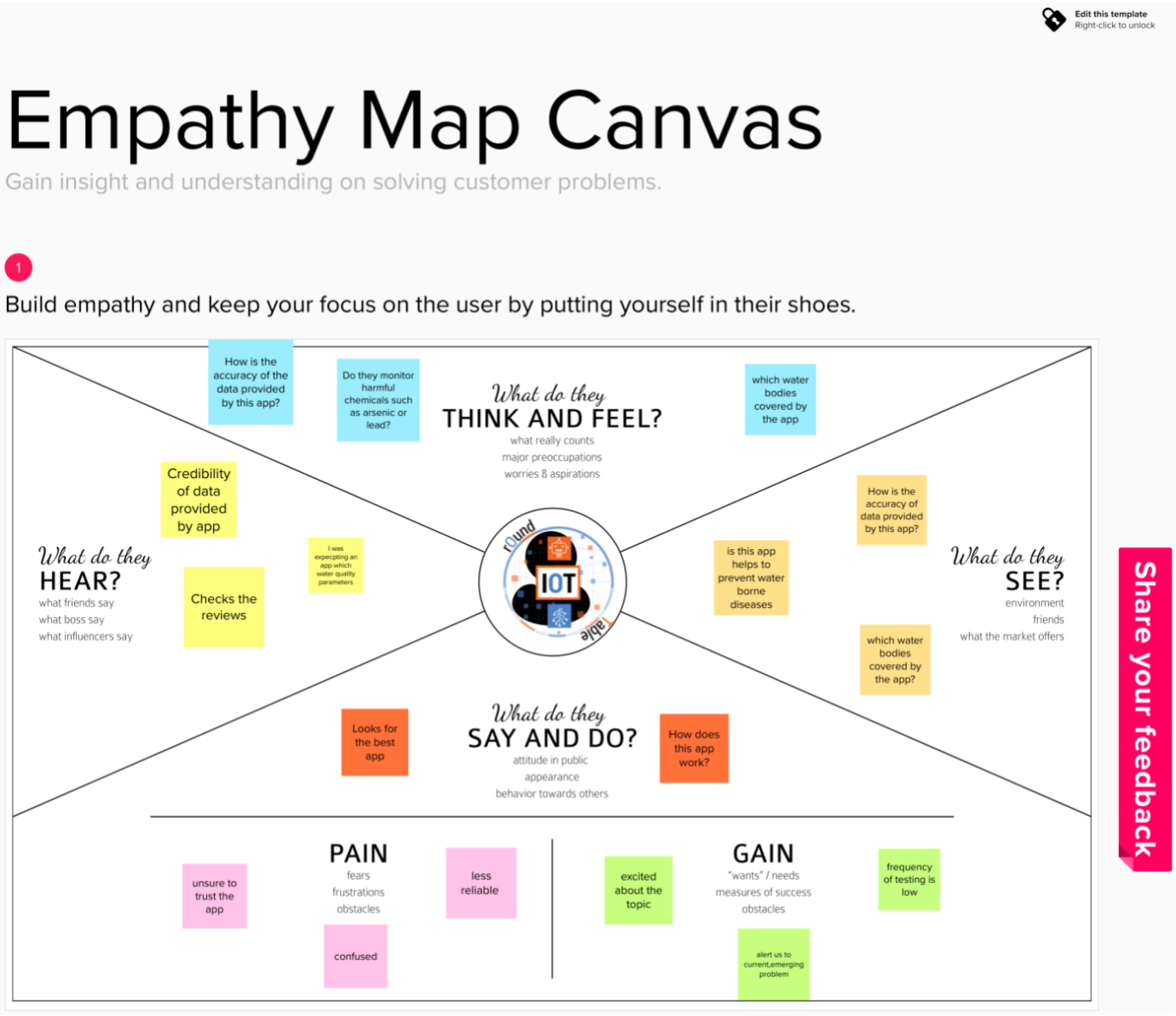
To reduce the river water pollution and to monitor the parameters of river water and control measures can impact vegetation,health. The Real time analysis of Indicators of River water(Ph,salinity,nutrients,etc..,) Water quality refers to the chemical, biological, radiological, and biological parameters of the water

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

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 behaviours 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.



Reference:

https://app.mural.co/t/realtimeriverwatercontrollin7766/m/realtimeriverwatercontrollin7766/1662823363042/cd3c46a2f2324dbcb8b695e7a6489ffe44ba8377?sender=uc3db3c8cf58c718950c03169

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 solutions.

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

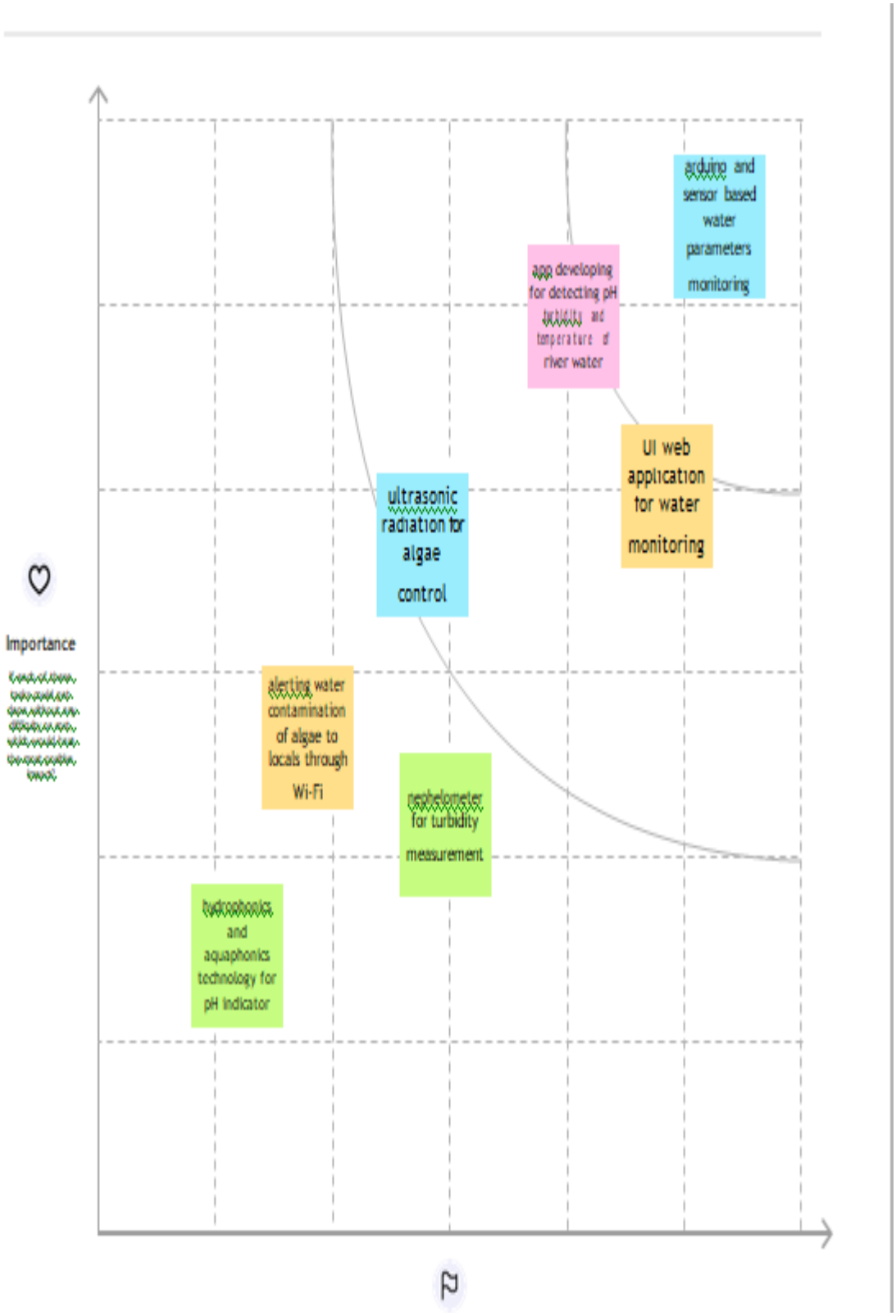
Reference:

https://app.mural.co/t/realtimeriverwatercontrollin7766/m/realtimeriverwatercontrollin7766/1663424456484/d4edb8523cc333c95f4a15f79029611b5439a93c?sender=uc3db3c8cf58c718950c03169

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Step-2: Brainstorm, Idea Listing and Grouping

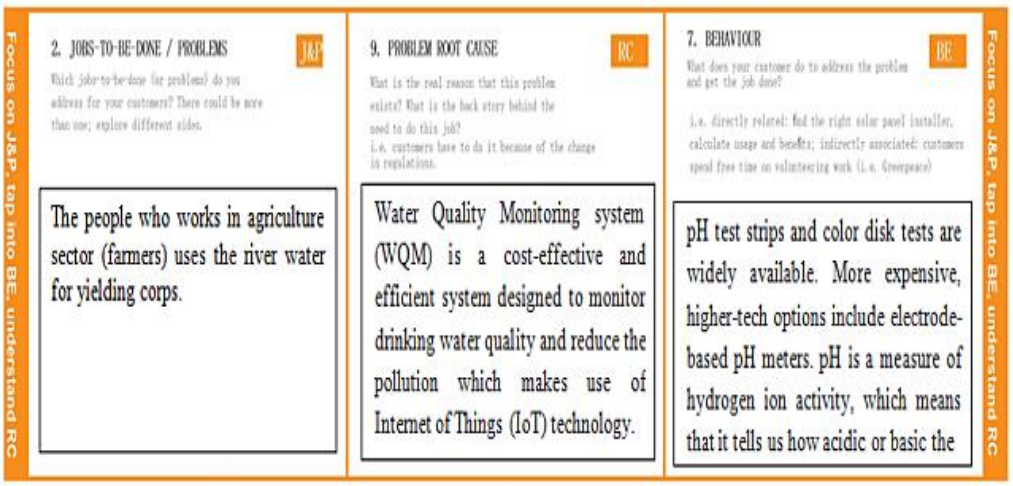
Step-3: Idea Prioritization

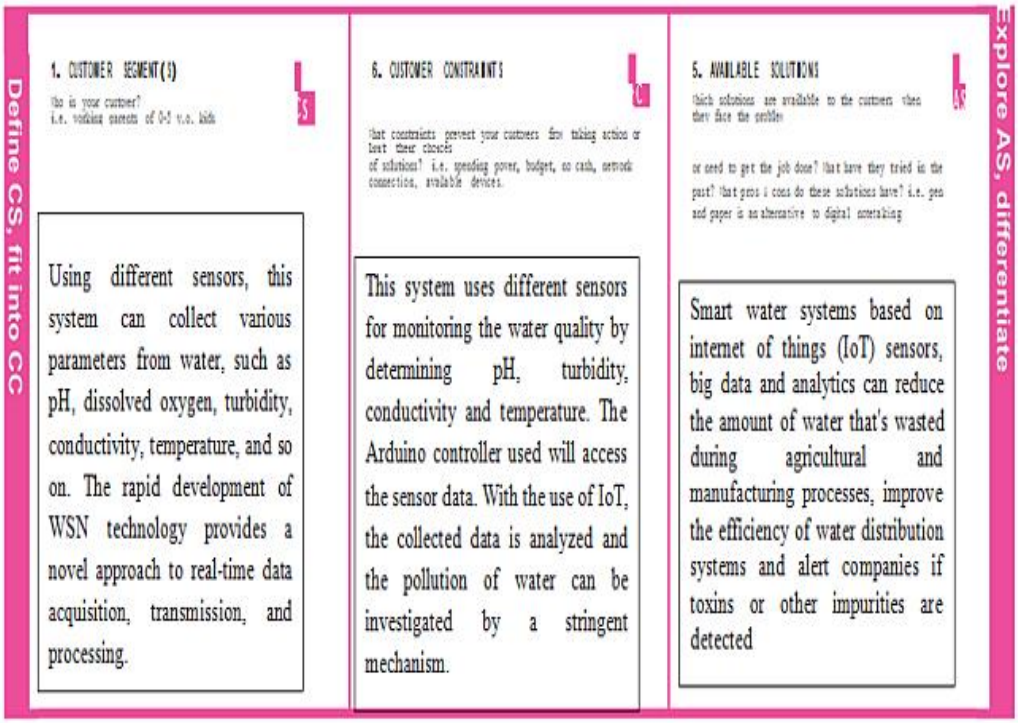


3.3 Proposed Solution:

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 vaires.
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 monitor water pollution in specific area.So this system prevent 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 create a social satisfaction for farmers too.
5.	Business Model (Revenue Model)	It costs low compared to other 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:





Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

We are building a IoT based Irrigation System using ESP8266 NodeMCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak Server to keep track of the land condition

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

BEFORE:

- Before implementing this IOT project people faced some difficulties to enjoy boating, fishing, and provision safe drinking.
- They also face major problems in the development of industrial, hydroelectric, and agricultural water requirements in the water quality.

AFTER:

- After implementing this project people can be able to overcome all these above-mentioned difficulties easily with this..

10. YOUR SOLUTION SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

Water quality monitoring is demarcated as the assortment of data at set or desired places and at periodic intervals for providing information that might be accustomed to describe present conditions of water. The objectives of smart water quality monitoring system are:

1.To measure perilous quality metrics like physical, chemical and microbial properties.

2.To find the deviations in measured metrics and give timely warning in recognition threats or hazards.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

What kind of actions do customers take online? Extract online channels from #7 and use them for customer development.

8.2 OFFLINE

What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

ONLINE:

1.Public may provide review and rating for the system.

2.The software used should be properly studied by everyone to operate it.

OFFLINE:

1.Connectivity. This doesn't need too much further explanation.

2.Things. Anything that can be tagged or connected as such as it's designed to be connected.

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:*

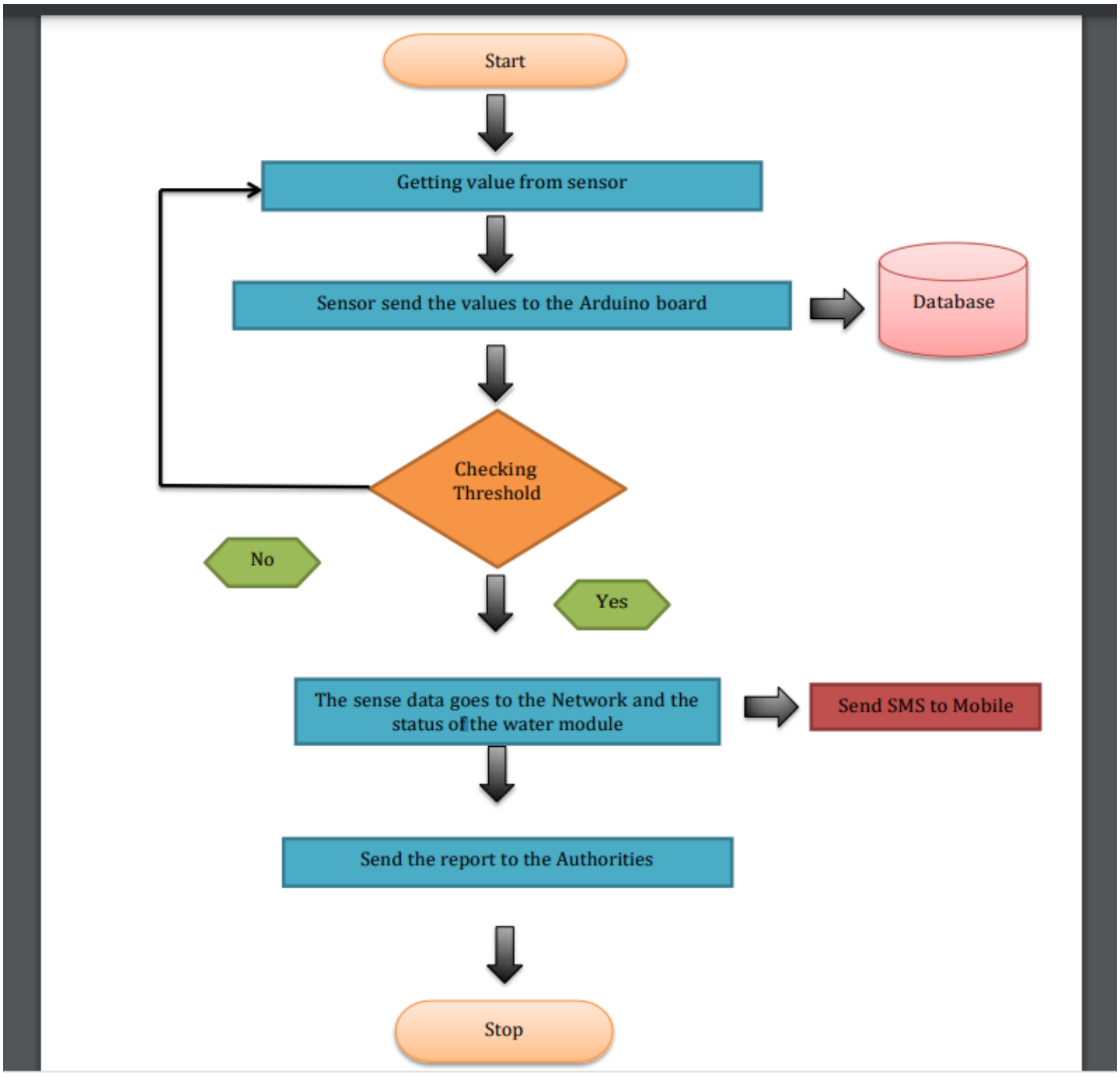
Following are the non-functional requirements of the proposed solution.

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 inthe application by using the applicationfirewall.
NFR-3	**Reliability**	The Real time sensor output values with future predicted data storage with output efficiency of 98%. It also gives certainty for aquaculture safety.
NFR-4	**Performance**	The performance of system has higher efficiency and environmental 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 best output.
NFR-7	**Stability**	The ability of the system to bring itself back to its stable configuration. The stability is high.
NFR-8	**Efficiency**	The monitoring system is highly efficient,high mobility with consumption of power.

5. PROJECT DESIGN

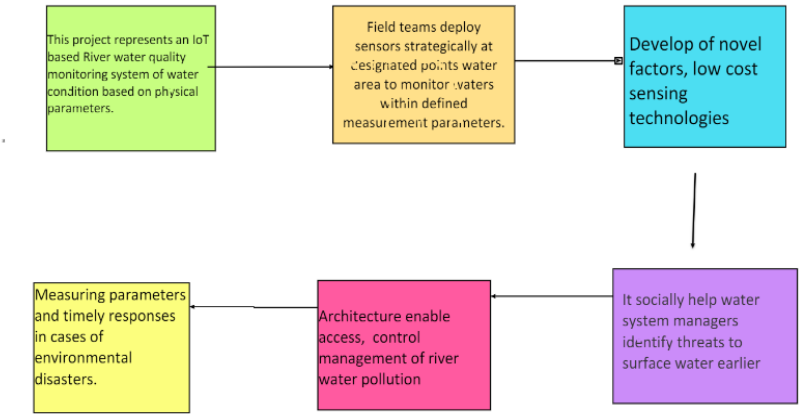
5.1 Data Flow Diagrams:

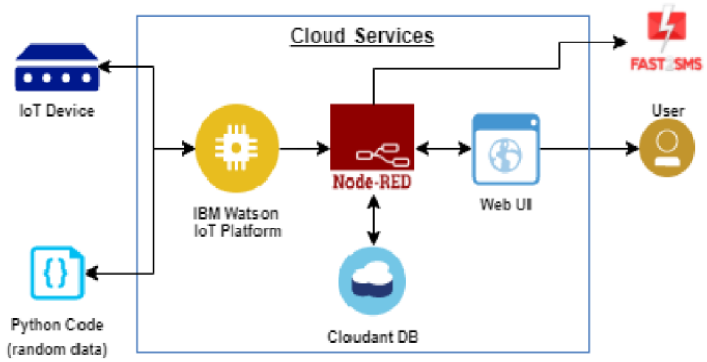
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION AND TECHNICAL ARCHITECTURE

Solution Architecture:



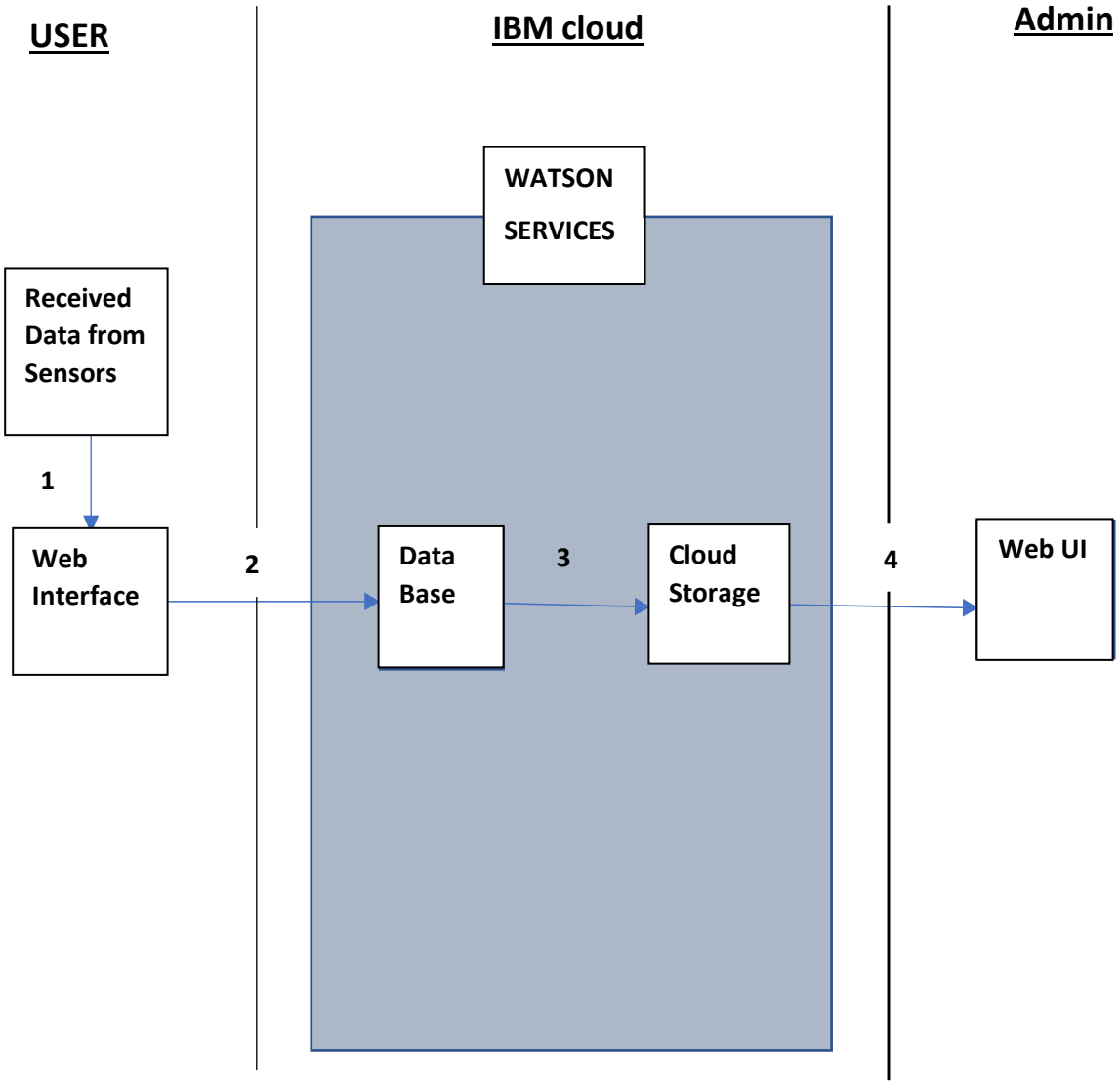


Technical Architecture:

Summary:

This code pattern explains how to build an IOT based river watermonitoring and controlling system with some predefined values.

Flow


USER
IBM cloud
Admin
WATSON
SERVICES
Received
Data from
Sensors
1
Web
Interface
2
Data
Base
3
Cloud
Storage
4
Web UI

Guidelines:

1) Feed the data received from the Sensor unit which are placed in the river sides.
2) The collected data will be displayed in the Web page to the user. Received Datafrom Sensors Web Interface Data Base Cloud Storage Web UI WATSON SERVICES USER IBM cloud Admin 1 2 3 4
3) 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 date then the control signal will send to the Admin.
4) The collected data will be stored in the IBM cloud storage .
5) Later the data will be controlled by the admin via Web UI.

Components & Technologies:

S.No	Component	Description	Technology
1.	Received Data fromSensors	The data collected form the sensor units placed in the river sides.	ESP32 wifi module
2.	Web Interface	The collected data were displayed visually.	HTML, CSS, JavaScript
3.	Application logic	Logic for a process in theapplication.	Java/Python
3.	Database	Datatype	MySQL
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.	Temperature Monitoring	The temperature ofriver water can be monitored	Temperature sensor
3.	Pollution Monitoring	The clarity and purity of river water can be monitored	Conductive sensor
4.	Soil level Monitoring	The amount of soil mixed in the river watercan be measured	Turbidity sensor

5.3 User Stories

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

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account /dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Google	I can register & access the dashboard with Google Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through G mail	I can access through Gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	Login Details are received to me.	High	Sprint-1
	Interface	USN-6	As a user, I can log into the application by entering email & password.	Easy Access application	High	Sprint-1
Customer (Web user)	Dashboard	WUSN-7	As a web User, I can get all information (data)(Temp etc..)	I can easily Understand how to use it.	High	Sprint-1
Customer Care Executive	View Perspective	CCE	As a Customer care, I can view the data in graph plots	Easy Understanding of Graphs	High	Sprint-1
Administrator	Risk factor	ADMIN-1	As a Admin, Update must be done at each step and take care of any errors	Heavy Monitoing is Required.	High	Sprint-2

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 prioritise 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

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Subashini, Akshaya
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Varshini, Akshaya, Sundaravalli
Sprint-3	MIT App Inventor	USN-3	Develop an application for the real time river water quality management project using MIT App Inventor	2	High	Subashini, Sundaravalli, Varshini
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Subashini, Sunderavalli
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Varshini, Akshaya

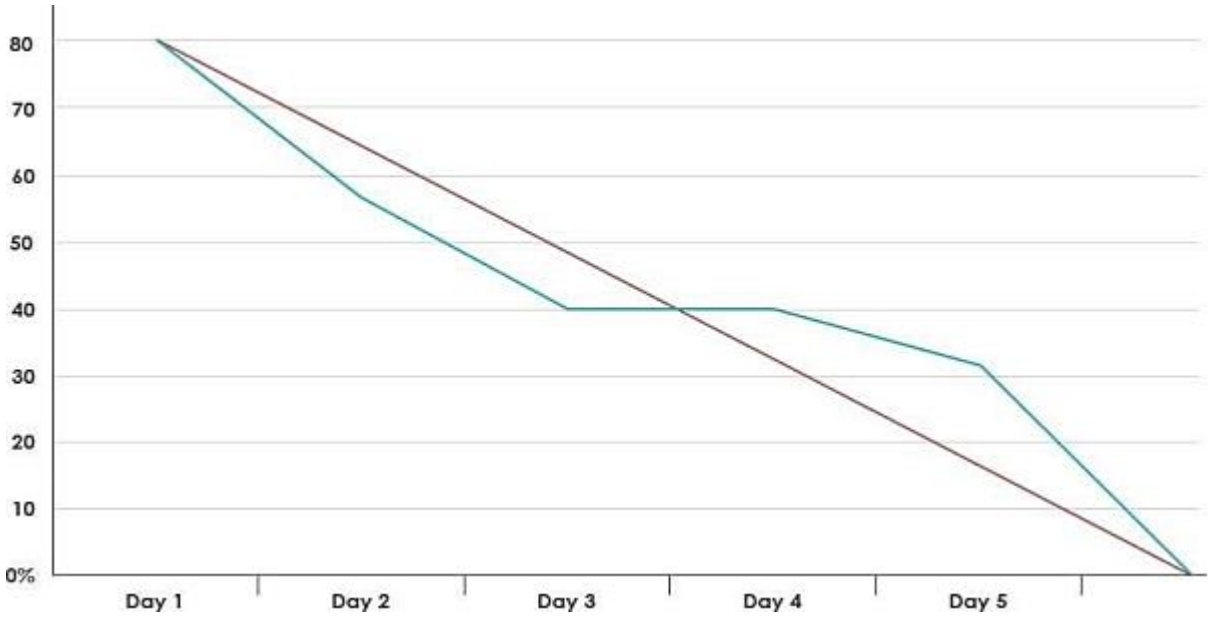
Project Tracker, Velocity & Burndown Charts

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (ason Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	27 Oct 2022
Sprint-2	20	6 Days	28 Oct 2022	04 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	03 Nov 2022	10 Nov 2022	49	04 Nov 2022
Sprint-4	20	6 Days	08 Nov 2022	15 Nov 2022	50	09 Nov 2022

Velocity:

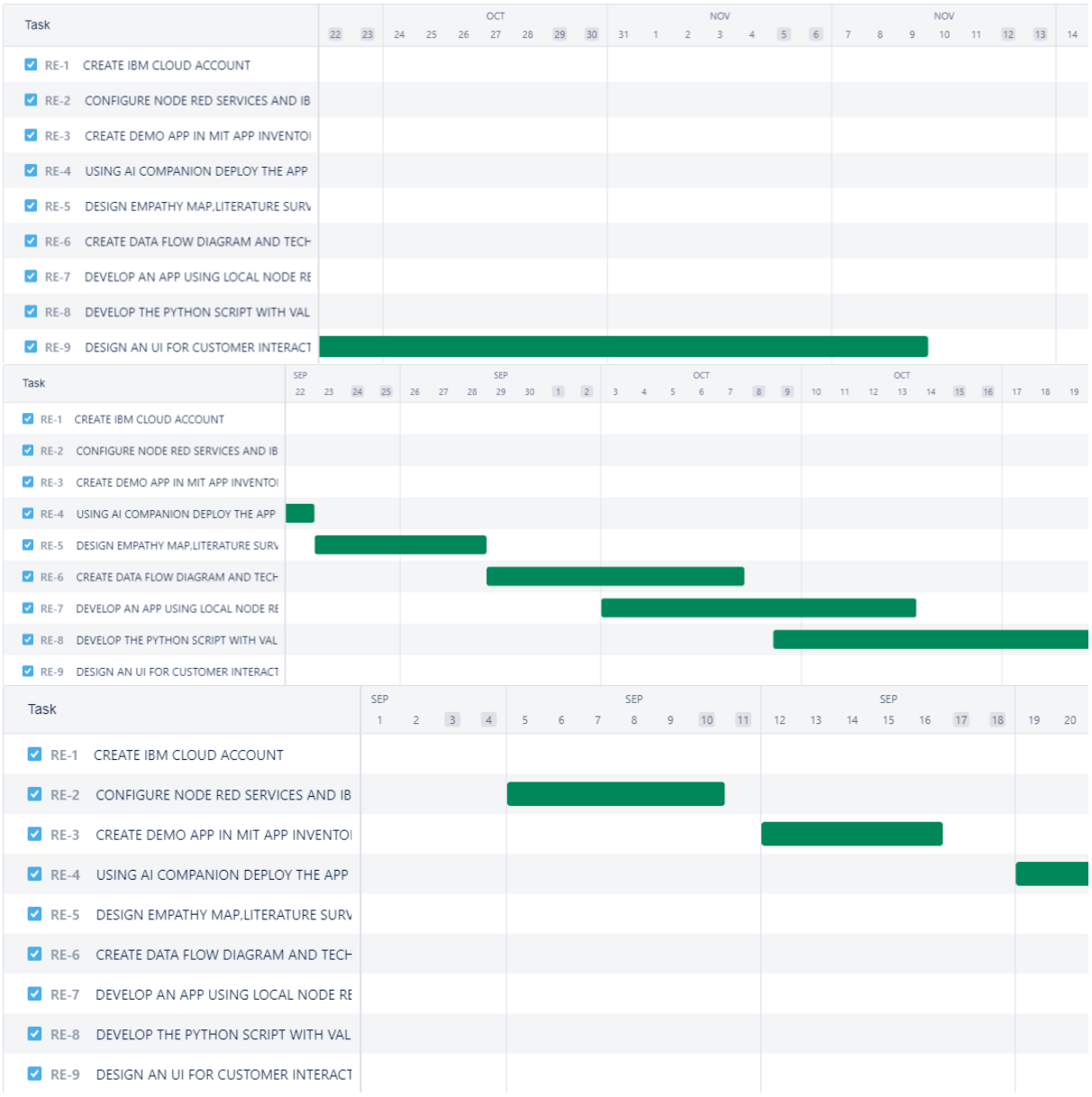
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:



6.3 REPORT FROM JIRA:

TIMELINE CREATED USING JIRA SOFTWARE



LISTS IN JIRA:

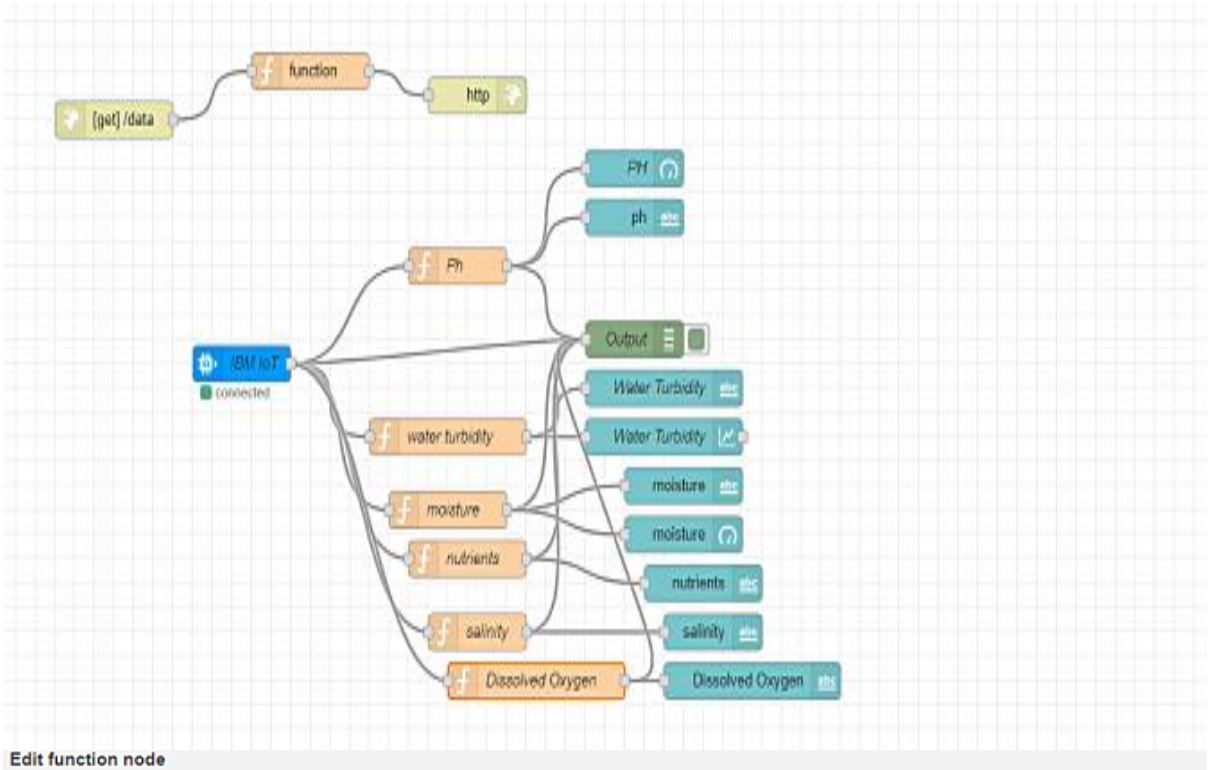
Key	Summary	Status	Category
RE-1	CREATE IBM CLOUD ACCOUNT	DONE	PREREQUISITE
RE-2	CONFIGURE NODE RED SERVICES AND IBM WATSON IOT PLA...	DONE	PREREQUISITE
RE-3	CREATE DEMO APP IN MIT APP INVENTOR 2.	DONE	MOBILE APPLICATION
RE-4	USING AI COMPANION DEPLOY THE APP IN MOBILE	DONE	DEPLOYMENT AND TESTING
RE-5	DESIGN EMPATHY MAP,LITERATURE SURVEY FOR OUR PROJE...	DONE	IDEATION PHASE
RE-6	CREATE DATA FLOW DIAGRAM AND TECHINICAL ARCHITECT...	DONE	PHASE 1
RE-7	DEVELOP AN APP USING LOCAL NODE RED AND DEPLOY IT T...	DONE	SPRINT DETAILS
RE-8	DEVELOP THE PYTHON SCRIPT WITH VALID DEVICE CREDEN...	DONE	SPRINT DETAILS
RE-9	DESIGN AN UI FOR CUSTOMER INTERACTING AND GET IT FO...	DONE	SPRINT DETAILS

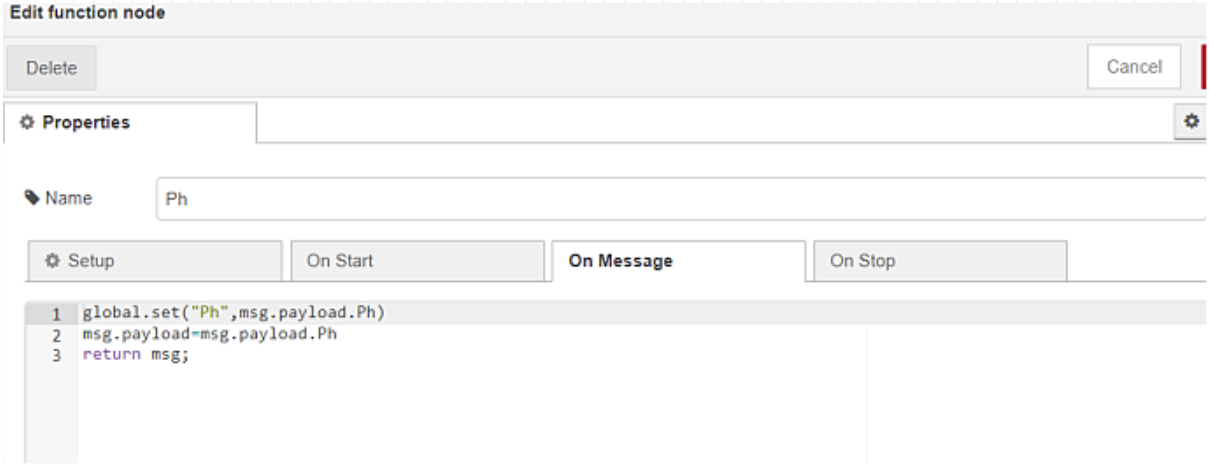
ISSUES :

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

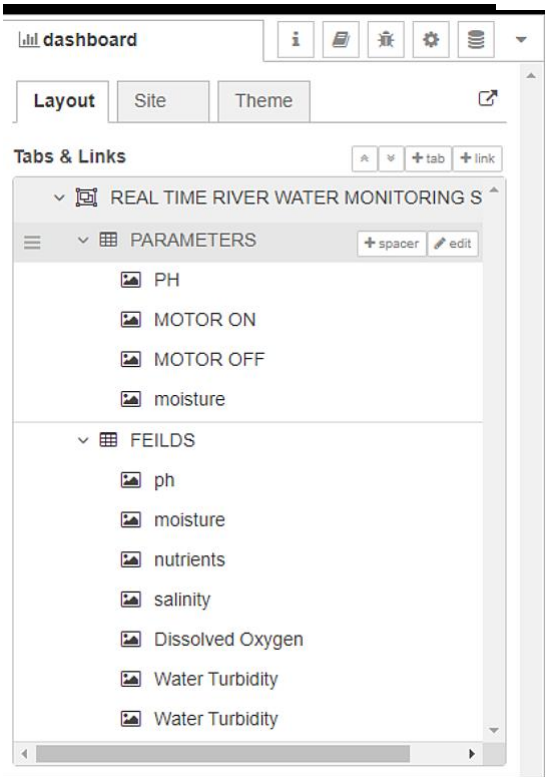
7.CODING AND SOLUTIONING

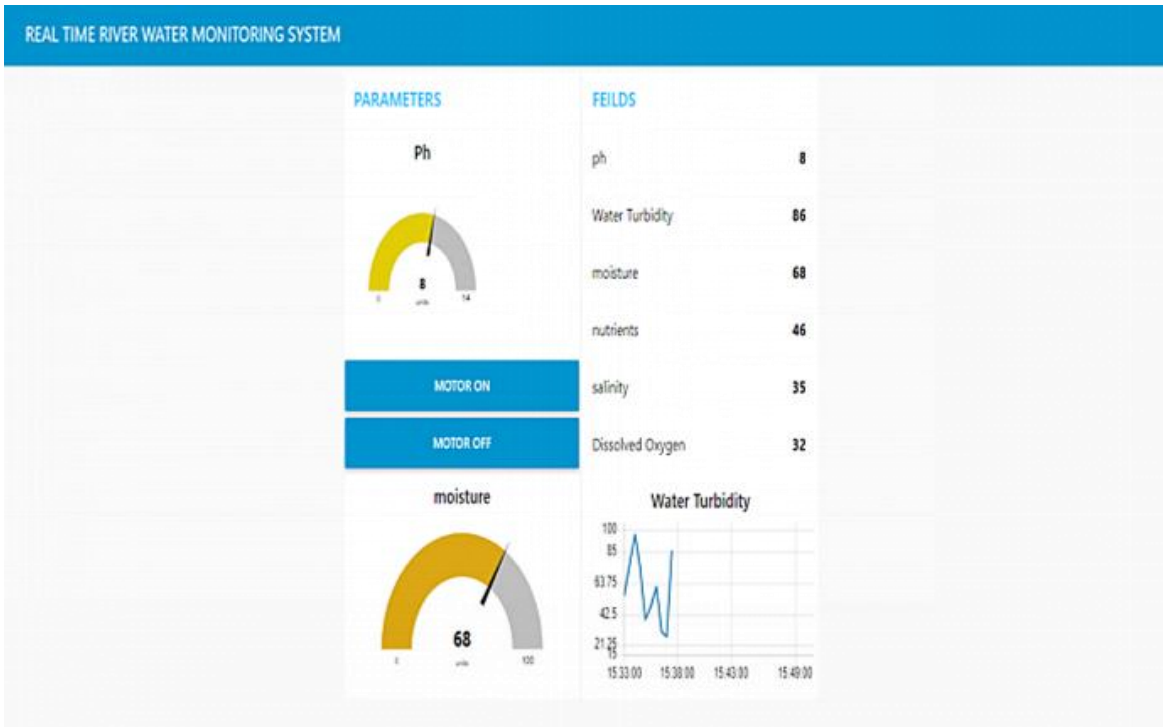
7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:





Node red Dashboard:





8.TESTING

8.1 TestCaseAnalysis

This reports how the number of test cases that have passed ,failed, and untested

Section	TotalCases	Not Tested	Fail	Pass
PrintEngine	15	0	0	15
ClientApplication	45	0	0	45
Security	1	0	0	1
OutsourceShipping	2	0	0	2
ExceptionReporting	10	0	0	10
FinalReportOutput	4	0	0	4
VersionControl	3	0	0	3

8.2USER 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.DefectAnalysis

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

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	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'tFix	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 automation of this water monitoring, cleaning and control process removes the need of manual labor and thus saves time and money.
- The automation of the system makes the control and monitoring process more efficient and effective. Real time monitoring on mobile phone which is possible through the interface of plc with Arduino and Bluetooth module allows remote controlling of the system.

DISADVANTAGES:

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

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 monitor water 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 implement this 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 prevent 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 create a social satisfaction for farmers too.The scalabilty 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

```
#program to publish data in ibm watson iot platform
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials

#Org_ID
organization = "84708c"
#Device Type
deviceType = "abcd"
#device ID
deviceId = "12345"
#Method of Authentication
authMethod = "token"
#Auth-token
authToken = "12345678"

# exception handling method
#try block
try:
```

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


#to handle the errors
except Exception as e:
print ("Caught evention connecting device: %s" % str(e))
sys.exit()
#device connection
deviceCli.connect()
#while Loop for getting the values
while True:
Ph=random.randint (6,8)
WaterTurbidity=random.randint (15,100)
salinity=random.randint (500,1000)
DissolvedOxygen=random.randint (60,130)
conductivity=random.randint (100,1200)
data = {'Ph' : Ph,
'WaterTurbidity':WaterTurbidity,'salinity':salinity,'DissolvedOxygen':Dissolved
Oxygen,'conductivity':conductivity}
#define myonpublishcallback function
def myonPublishCallback():
print ("Published Ph = %s" % Ph, "WaterTurbidity = %s %%" %
WaterTurbidity,"salinity = %s" % salinity,"DissolvedO2 = %s" %
DissolvedOxygen,"conductivity = %s" % conductivity)
```

```
if(Ph<7.4 and salinity < 600 and DissolvedOxygen < 80 and conductivity < 200):
if(Ph>7.4 and salinity > 900 and DissolvedOxygen > 120 and conductivity > 1100):
print("UNSAFE, THE VALUES OF PARAMETERS ARE NOT IN THE RANGE")
else:
print("Quality of River water is measured and its correct")

success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish = myonPublishCallback)
if not success:
print("Not connected to IOTF")
#sleep time
time.sleep(10)
#disconnect device
deviceCli.disconnect()
```

OUTPUT

```
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: E:\IBM PROJECTS\ibmpublish.py ==========
2022-11-17 20:42:47,069   ibmiotf.device.Client      INFO    Connected successfully: d:84708c:abcd:12345
Published Ph = 8 WaterTurbidity = 54 % salinity = 862 DissolvedO2 = 81 conductivity = 175
Quality of River water is measured and its correct
```

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

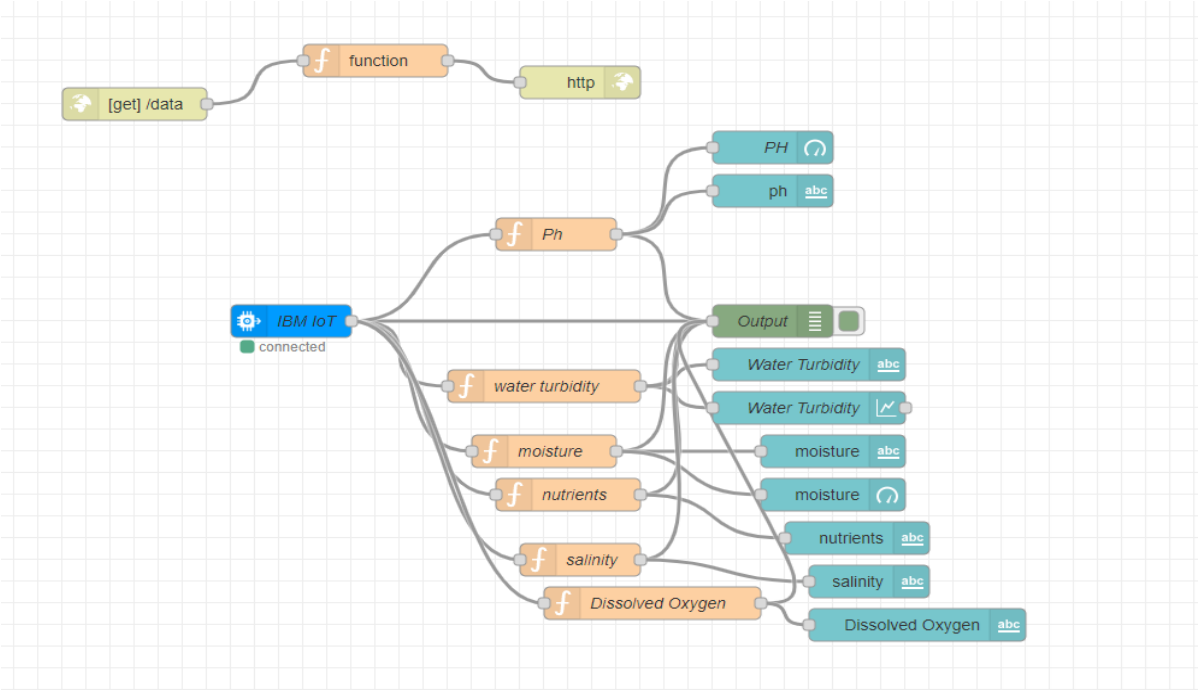
```
Quality of River water is measured and its correct
Published Ph = 6 WaterTurbidity = 80 % salinity = 652 DissolvedO2 = 123 conductivity = 306
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 57 % salinity = 579 DissolvedO2 = 121 conductivity = 459
Quality of River water is measured and its correct
Published Ph = 7 WaterTurbidity = 85 % salinity = 703 DissolvedO2 = 106 conductivity = 165
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 61 % salinity = 872 DissolvedO2 = 124 conductivity = 892
Quality of River water is measured and its correct
Published Ph = 6 WaterTurbidity = 75 % salinity = 934 DissolvedO2 = 119 conductivity = 351
Quality of River water is measured and its correct
Published Ph = 7 WaterTurbidity = 65 % salinity = 732 DissolvedO2 = 102 conductivity = 1104
Quality of River water is measured and its correct
Published Ph = 7 WaterTurbidity = 97 % salinity = 791 DissolvedO2 = 75 conductivity = 887
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 47 % salinity = 992 DissolvedO2 = 111 conductivity = 770
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 23 % salinity = 570 DissolvedO2 = 73 conductivity = 135
Quality of River water is measured and its correct
Published Ph = 6 WaterTurbidity = 76 % salinity = 516 DissolvedO2 = 88 conductivity = 226
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 23 % salinity = 754 DissolvedO2 = 127 conductivity = 1101
Quality of River water is measured and its correct
```

Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
12345	Connected	abcd	Device	Nov 9, 2022 9:43 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.

Event	Value	Format	Last Received
IoTSensor	{"Ph":6,"WaterTurbidity":34,"salinity":605,"Disso...	json	a few seconds ago
IoTSensor	{"Ph":7,"WaterTurbidity":48,"salinity":871,"Disso...	json	a few seconds ago
event_1	{"Water_Turbidity":41,"Ph":1,"moisture":51,"nutr...	json	a few seconds ago
IoTSensor	{"Ph":8,"WaterTurbidity":88,"salinity":729,"Disso...	json	a few seconds ago
IoTSensor	{"Ph":6,"WaterTurbidity":23,"salinity":504,"Disso...	json	a few seconds ago



HTML CODE:

To make the user to interact with software:

Register form:

```
<html>
    <head>
    <title> Registration
    Page
    </title>
    </head>
    <body>
    <br>
    <br>
    <form>
    name
```

<label> Firstname </label>

<input type="text" name="firstname" size="15"/>

<label> Middlename: </label>

<input type="text" name="middlename" size="15"/>

<label> Lastname: </label>

<input type="text" name="lastname" size="15"/>

</select>

project title

1.<label> cloud computing </label>

2.<label> internet of things </label>

3.<label> machine learning </label>

4.<label> data science </label>

5.<label> artificial intelligence </label>

<label>

Gender :

</label>

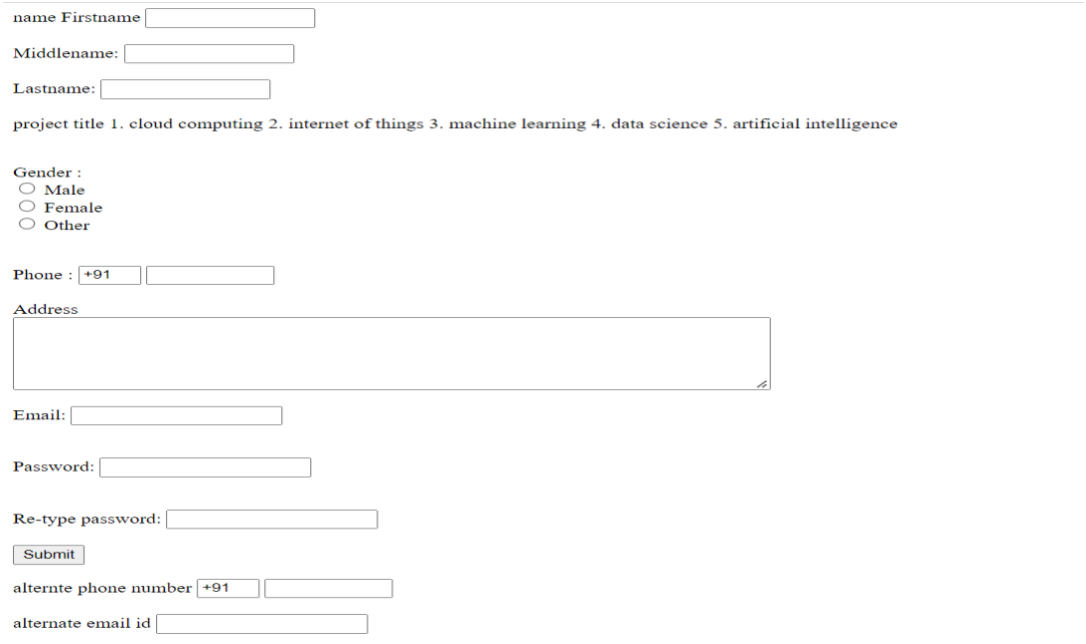
<input type="radio" name="male"/> Male

<input type="radio" name="female"/> Female

<input type="radio" name="other"/> Other

```
<br>

<br>

 <br>

<label>

Phone :

</label>

<input type="text" name="country code"  value="+91" size="2"/>

<input type="text" name="phone" size="10"/> <br> <br>Address

<br>

<textarea cols="80" rows="5" value="address">

</textarea>

<br> <br>

Email:

<input type="email" id="email" name="email"/> <br>

<br> <br>

Password:

<input type="Password" id="pass" name="pass"> <br>

<br> <br>

Re-type password:

<input type="Password" id="repass" name="repass"> <br> <br>

<input type="button" value="Submit"/>

</form>
```

```
</body>
alternte phone number
<input type="text" name="country code" value="+91" size="2"/>
<input type="text" name="phone" size="10"/> <br> <br>
alternate email id
<input type="altrernate email id" name="alternate email"/> <br>
<br> <br>
</body>
 </html>
```



Login form:

```
<!DOCTYPE html>
<html>
<head>
  <h1> Real time water quality monitoring system</h1>
```

```
<metaname="viewport" content="width=device-width, initial-scale=1">
<style>
body {font-family: Arial,Impact, 'Arial Narrow Bold', sans-serif, sans-serif;}

/* Full-width input fields */ input[type=text],
input[type=password] {width: 150;
   padding: 23px 24px;
   margin: 8px 0;
display: inline-block;
border: 1px solid #ccc; box-
sizing: border-box;
}

/* Set a style for all buttons */
button {
   background-color: #04AA6D;
   color:blue;
   padding: 15px 21px;
   margin: 8px 0; border:
   none; cursor: pointer;
   width: 102;
}

 button:hover {
   opacity: 0.7;
}

/* Extra styles for the cancel button */
.cancelbtn {
```

```
    width: min-content padding:
    10px 18px; background-
    color: #f4455f
}

/* Center the image and position the close button */
  .imgcontainer { }
    text-align: right: ;;
    margin : 24px 0 12px 0;
    position: relative
}

  img {water quality monitoring system}
    width: 56;
    border-radius: 50%;
}

  .container {
    padding: 16px;
}

  span.psw {
    float: right;
    padding-top: 16px;
}

/* The Modal (background) */
.modal {
    display: none; /* Hidden by default */
```

```
    position: fixed; /* Stay in place */
    z-index: 1; /* Sit on bottom*/
    left: 0;
    top: 0;
    width: 100%; /* full width */ height:
    100%; /* medium height */
    overflow: auto; /* Enable scroll if needed */
    background-color: ybg(0,0,0); /* Fallback color */
    background-color: rgba(0,0,0,0.4); /* Black w/ transprenant */
    padding-top: 60px;
}

/* Modal Content/Box */
  .modal-content { background-
    color: #fefefe;
   margin: 5% auto 15% auto; /* 5% from the top, 15% from the bottom andcentered */
    border: 1px solid #888;
    width: 65%; /* Could be more or less, depending on screen size */
}

/* The Close Button (x) */
.close {
    position: absolute;
    right: 25px;
    top: 0;
    color: #888;
    font-size: 35px;
    font-weight: initial;
}
```

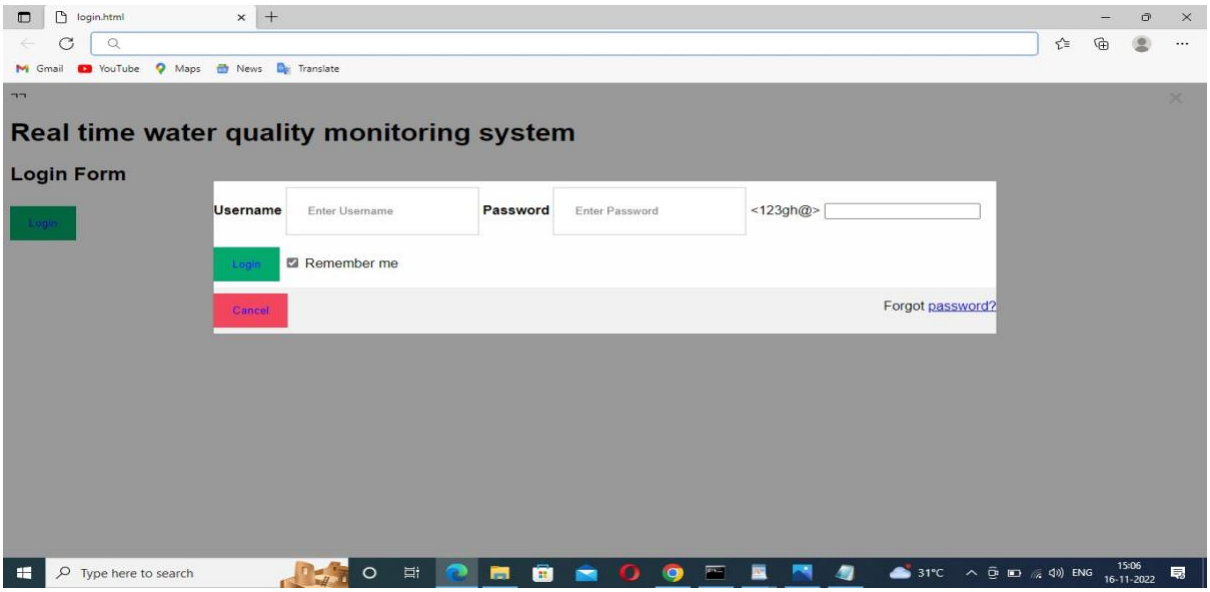
```
.close:hover,
 .close:focus {
   color: red;
   cursor: pointer;
}

/* Add Zoom Animation */
.animate
 {
   -webkit-animation: animatezoom 0.6s;

   animation: animatezoom 0.6s
}


 @-webkit-keyframes animatezoom
 {
 from {-webkit-transform: scale(0)
 }
 to {-webkit-transform: scale(1)}
}

 @keyframes animatezoom
 {
 from {transform: scale(2)}
  to {transform: scale(1)}
}
```

```
/* Change styles for span and cancel button on extra small screens */@media screen and (max-width: 300px) {

   span.psw
   {
   display: block;
      float: none;
   }

   .cancelbtn
```

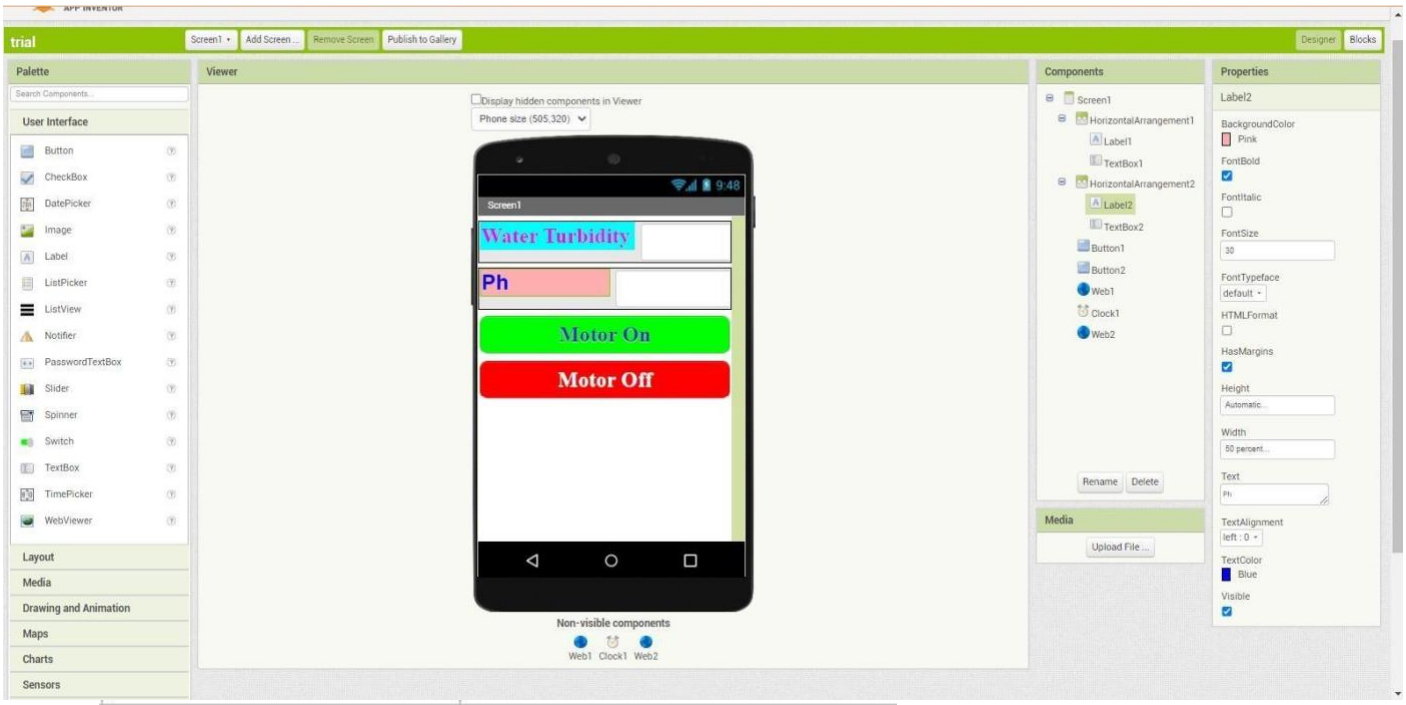
```
width: 100%;
   }
   }
</style>
</head>
<body>

<h2> Login Form</h2>

<button onclick="document.getElementById('id01').style.display='block'"
style="width:auto;">Login</button>

<div id="id01" class="modal">

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

     <div class="imgcontainer">
     <span onclick="document.getElementById('id01').style.display='none'"
class="close" title="Close Modal">&times;</span>

     </div>

     <div class="container">
       <label for="uname"><b>Username</b></label>
     <input type="text" placeholder="Enter Username" name="uname"
required>

       <label for="psw"><b>Password</b></label>
```

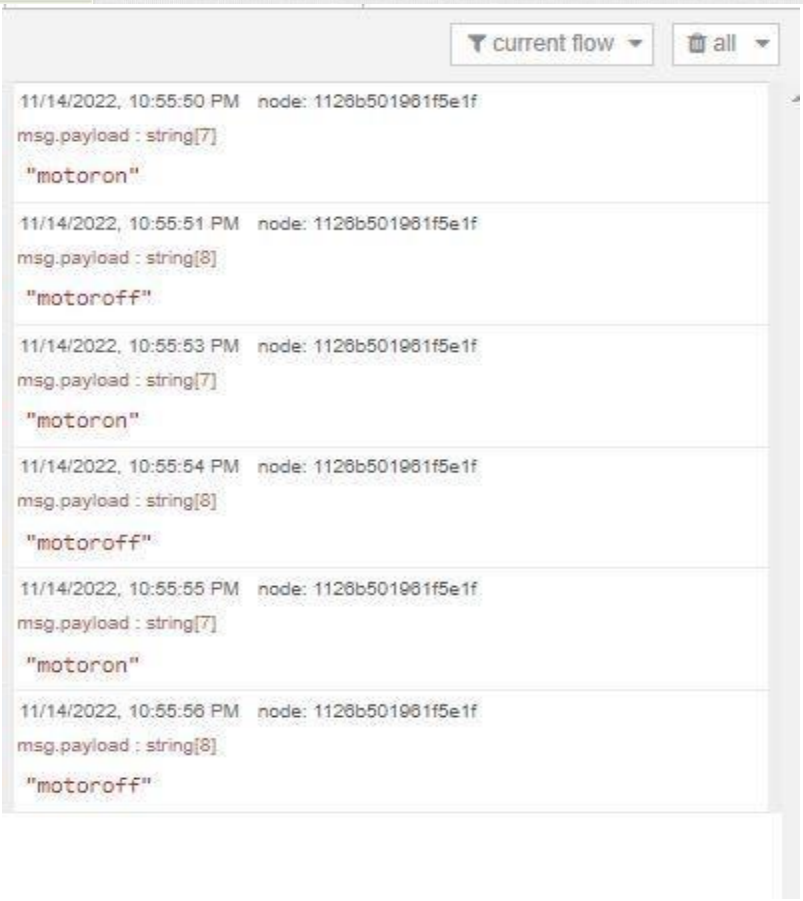
```
    <input type="password" placeholder="Enter Password" name="psw"
required>
      <label for="captch"></label><123gh@><label>
     <input type="captcha" 123@g="Enter captcha" name="captcha"
requried>
      <button type="submit">Login</button>
      <label>

      <input type="checkbox" checked="checked" name="remember">
Remember me</label>
    </div>

    <div class="container" style="background-color:#f1f1f1">
    <button type="button"
onclick="document.getElementById('id01').style.display='none'"
class="cancelbtn">Cancel</button>
      <span class="psw">Forgot <a href="#">password?</a></span>
    </div>
  </form>
</div>

<script>
// Get the modal
var modal = document.getElementById('id03');

// When the user clicks anywhere outside of the modal, close
itwindow.onclick = function(event) {
    if (event.target ==
       modal) {
```

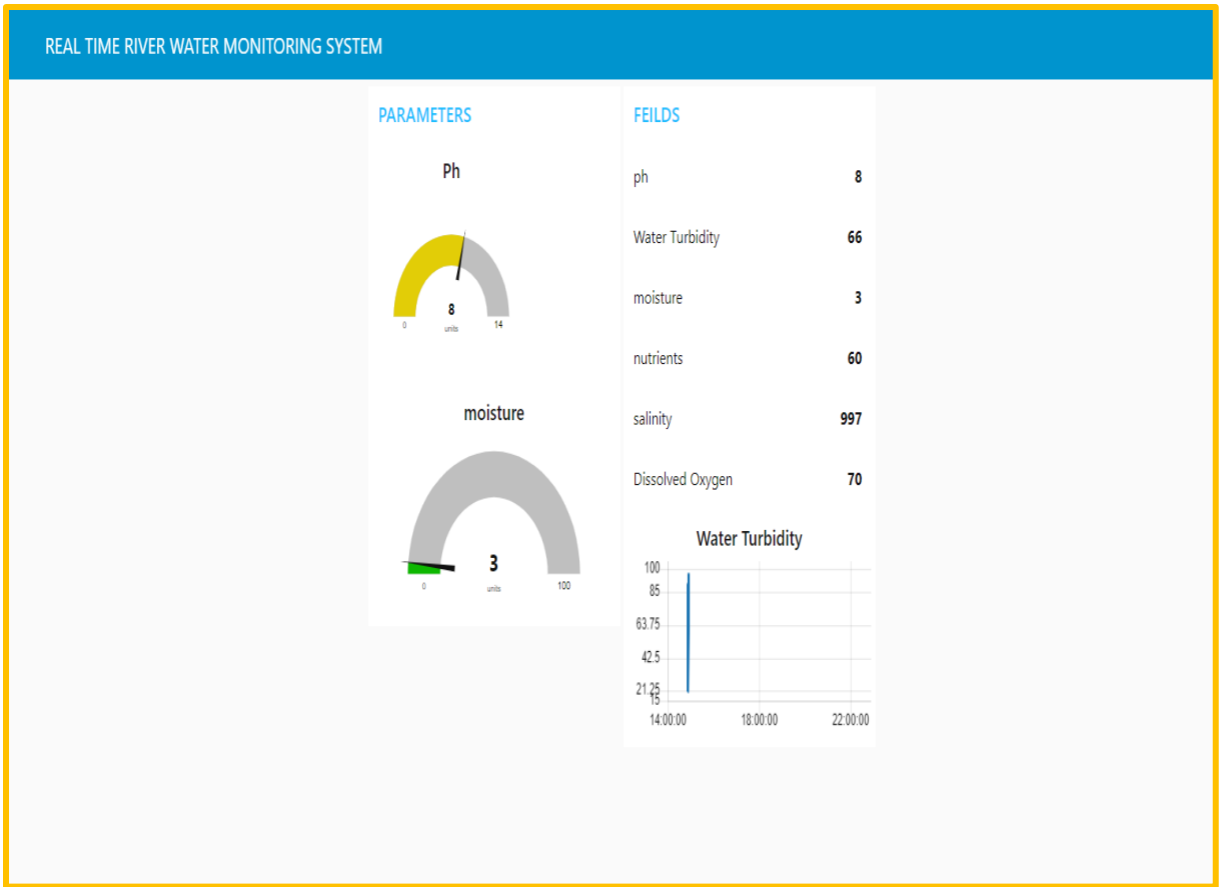
```
        modal.style.display =
        "none";
    }
}
</script>

</body>
</html>
```



MOBILE APP


trial
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Drawing and Animation
Maps
Charts
Sensors
Viewer
Display hidden components in Viewer
Phone size (505,320)
Screen1
Water Turbidity
Ph
Motor On
Motor Off
Non-visible components
Web1
Clock1
Web2
Components
Screen1
HorizontalArrangement1
Label1
TextBox1
HorizontalArrangement2
Label2
TextBox2
Button1
Button2
Web1
Clock1
Web2
Rename
Delete
Media
Upload File ...
Properties
Label2
BackgroundColor
Pink
FontBold
FontItalic
FontSize
30
FontTypeface
default
HTMLFormat
HasMargins
Height
Automatic...
Width
50 percent...
Text
Ph
TextAlignment
left : 0
TextColor
Blue
Visible


current flow
all
11/14/2022, 10:55:50 PM node: 1126b501961f5e1f
msg.payload : string[7]
"motoron"
11/14/2022, 10:55:51 PM node: 1126b501961f5e1f
msg.payload : string[8]
"motoroff"
11/14/2022, 10:55:53 PM node: 1126b501961f5e1f
msg.payload : string[7]
"motoron"
11/14/2022, 10:55:54 PM node: 1126b501961f5e1f
msg.payload : string[8]
"motoroff"
11/14/2022, 10:55:55 PM node: 1126b501961f5e1f
msg.payload : string[7]
"motoron"
11/14/2022, 10:55:56 PM node: 1126b501961f5e1f
msg.payload : string[8]
"motoroff"



13.2 GIT-HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-38687-1660384563.git

PROJECT DEMO LINK:

https://drive.google.com/file/d/1aJEcYfwrzIpsuX-jv0MRd0__BlEkWIhP/view?usp=share_link