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 PNT2022TMID06206

PROJECT GUIDES

Industry Mentor: Mr.Bharadwa
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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:

The 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..,)

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.

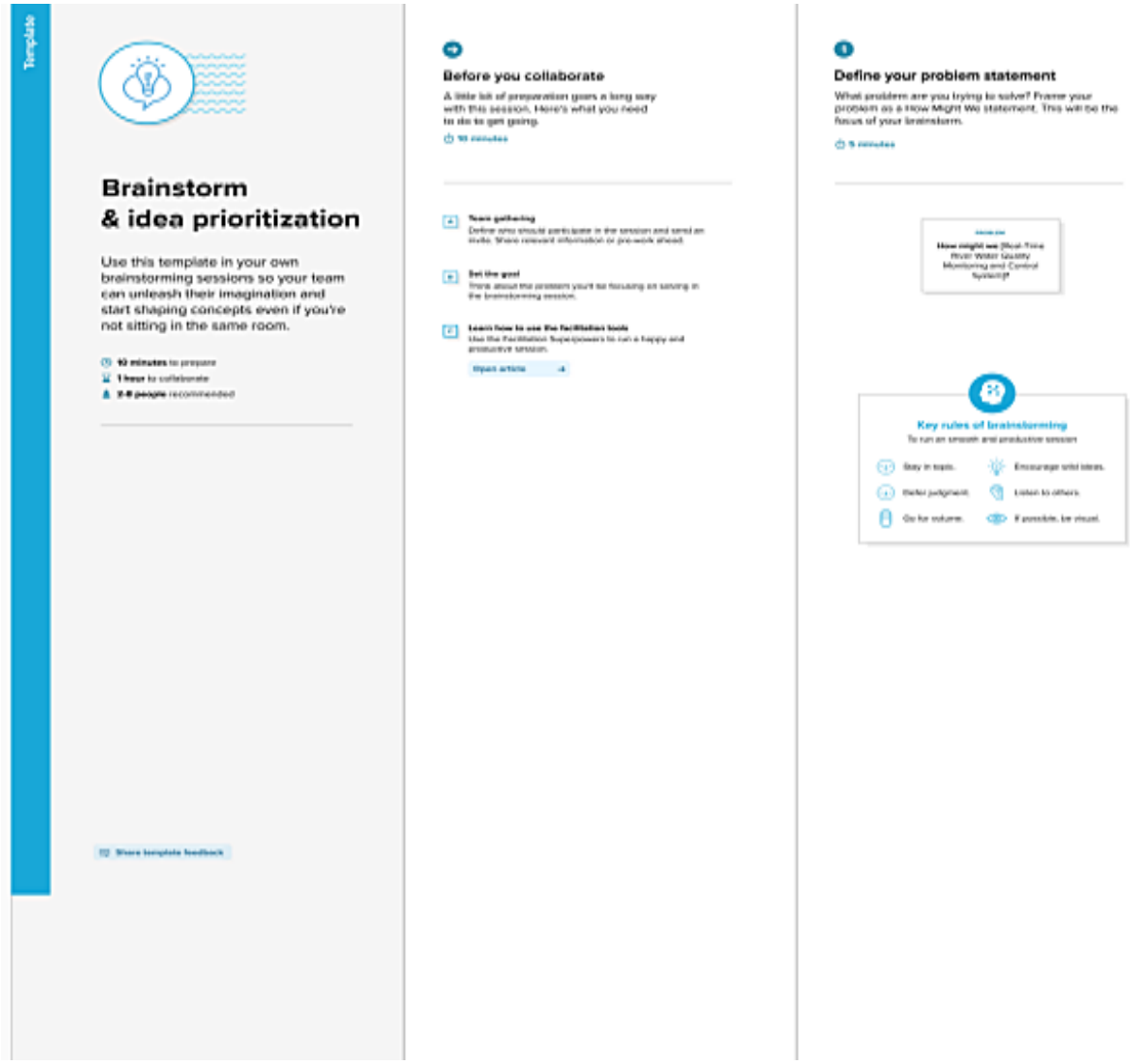
Reference:https://app.mural.co/invitation/mural/ibm0082/1666797743994?sender=uf93f4fc8b3ed9d16cc620908&key=535a741b-def9-48d5-92b8-e0850fa6f1e6

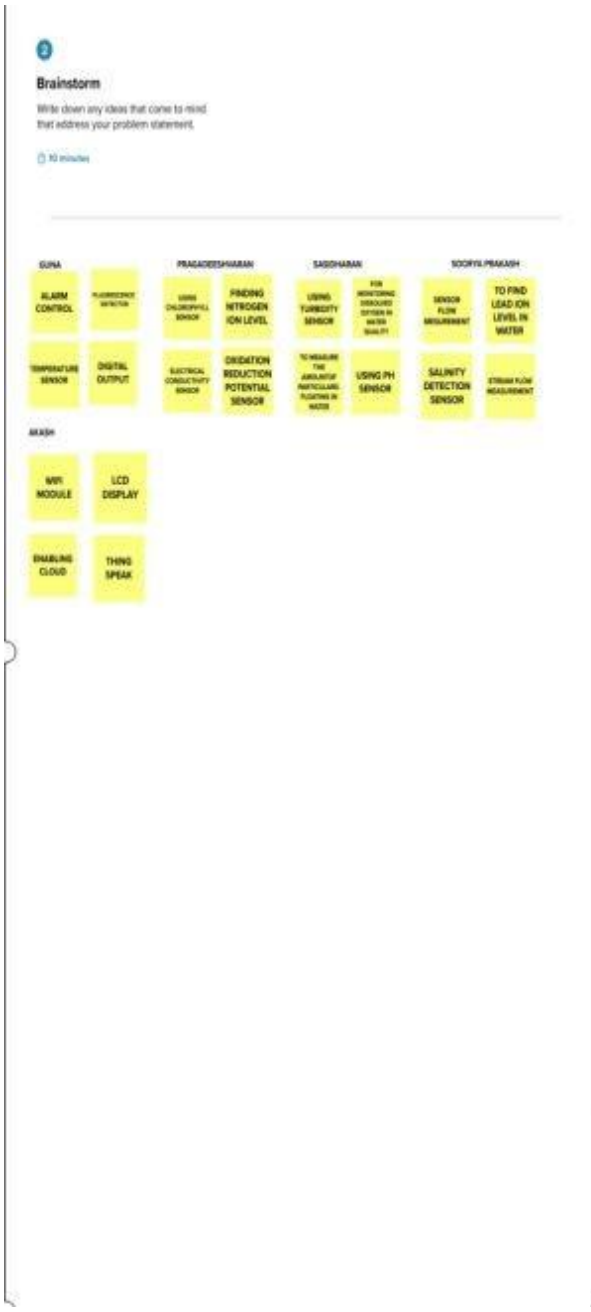
3.2 Ideation & Brainstorming:

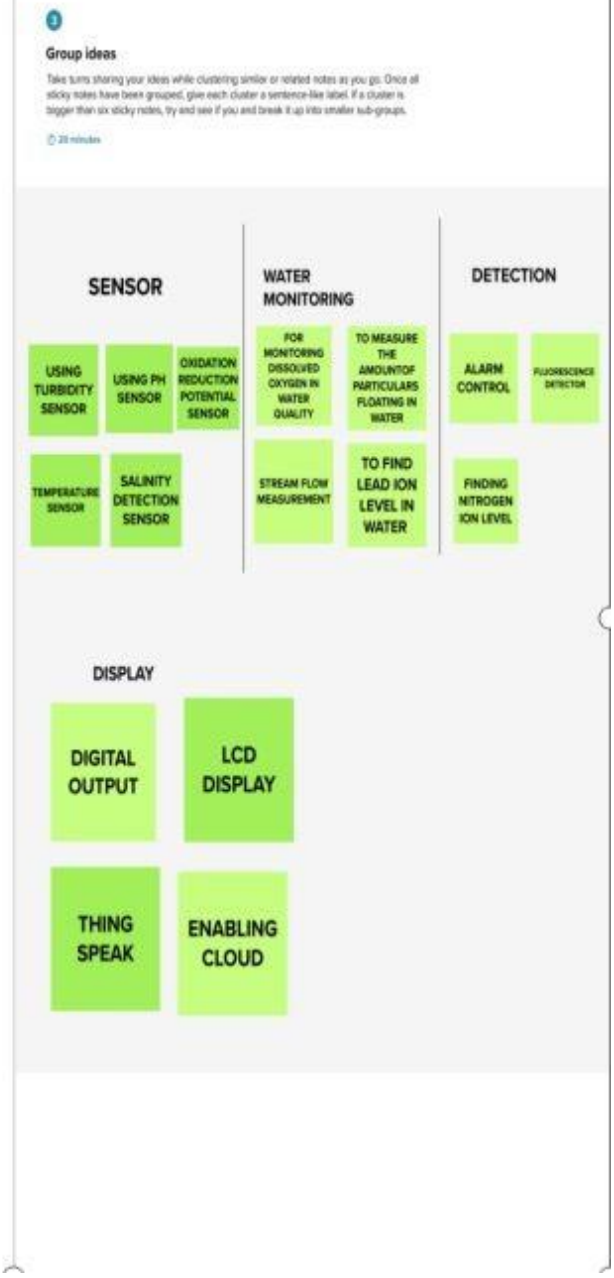
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate,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

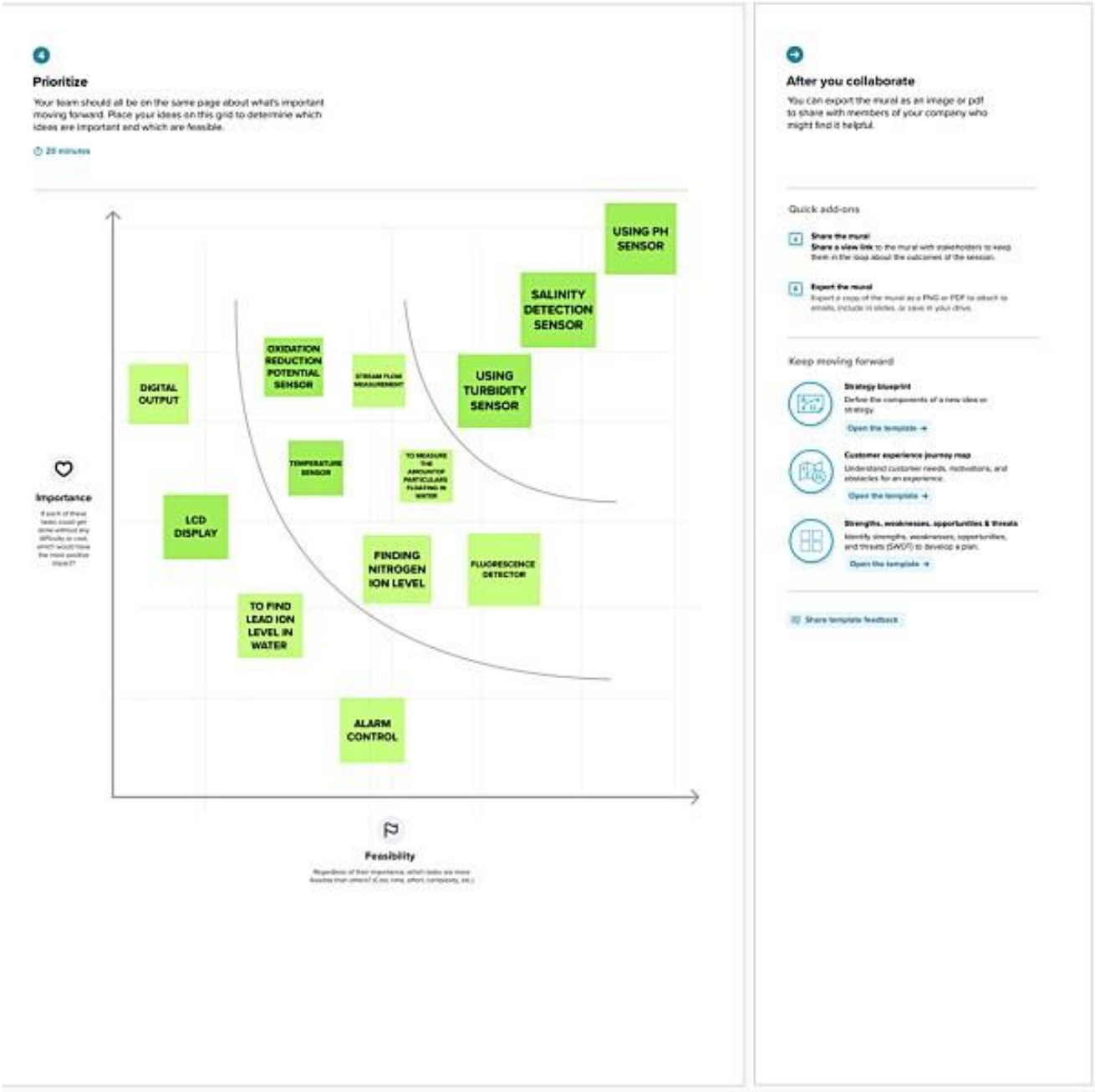
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Reference:https://app.mural.co/invitation/mural/ibmproject1215/1666848258091?sender=uf9 3f4fc8b3ed9d16cc620908&key=d4906cd4-138e-40f9-a546-ea061cc6c665




2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
GUNA
ALARM CONTROL
FLUORESCENCE DETECTOR
TEMPERATURE SENSOR
DIGITAL OUTPUT
PRAGADEESHWARAN
USING CHLOROPHYLL SENSOR
FINDING NITROGEN ION LEVEL
ELECTRICAL CONDUCTIVITY SENSOR
OXIDATION REDUCTION POTENTIAL SENSOR
SASIDHARAN
USING TURBIDITY SENSOR
FOR MONITORING DISSOLVED OXYGEN IN WATER QUALITY
TO MEASURE THE AMOUNTOF PARTICULARS FLOATING IN WATER
USING PH SENSOR
SOORYA PRAKASH
SENSOR FLOW MEASUREMENT
TO FIND LEAD ION LEVEL IN WATER
SALINITY DETECTION SENSOR
STREAM FLOW MEASUREMENT
AKASH
WIFI MODULE
LCD DISPLAY
ENABLING CLOUD
THING SPEAK


3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.
20 minutes
SENSOR
USING TURBIDITY SENSOR
USING PH SENSOR
OXIDATION REDUCTION POTENTIAL SENSOR
TEMPERATURE SENSOR
SALINITY DETECTION SENSOR
WATER MONITORING
FOR MONITORING DISSOLVED OXYGEN IN WATER QUALITY
TO MEASURE THE AMOUNTOF PARTICULARS FLOATING IN WATER
STREAM FLOW MEASUREMENT
TO FIND LEAD ION LEVEL IN WATER
DETECTION
ALARM CONTROL
FLUORESCENCE DETECTOR
FINDING NITROGEN ION LEVEL
DISPLAY
DIGITAL OUTPUT
LCD DISPLAY
THING SPEAK
ENABLING CLOUD

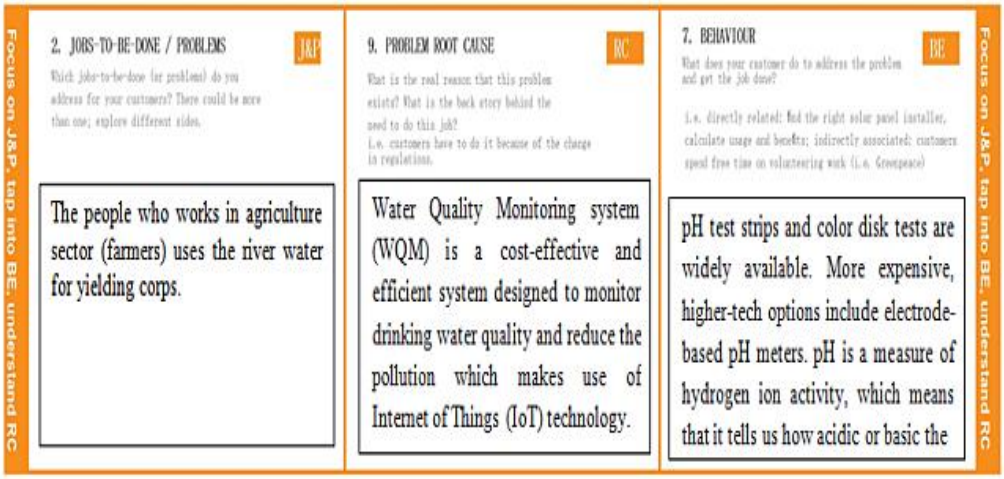

Prioritize
Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.
20 minutes
USING PH SENSOR
SALINITY DETECTION SENSOR
OXIDATION REDUCTION POTENTIAL SENSOR
STREAM FLOW MEASUREMENT
USING TURBIDITY SENSOR
DIGITAL OUTPUT
TEMPERATURE SENSOR
TO MEASURE THE AMOUNT OF PARTICULATES FLOATING IN WATER
LCD DISPLAY
FINDING NITROGEN ION LEVEL
FLUORESCENCE DETECTOR
TO FIND LEAD ION LEVEL IN WATER
ALARM CONTROL
Importance
Feasibility
After you collaborate
You can export the mural as an image or pdf to share with members of your company who might find it helpful.
Quick add-ons
Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.
Keep moving forward
Strategy blueprint
Define the components of a new idea or strategy.
Open the template →
Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →
Share template feedback

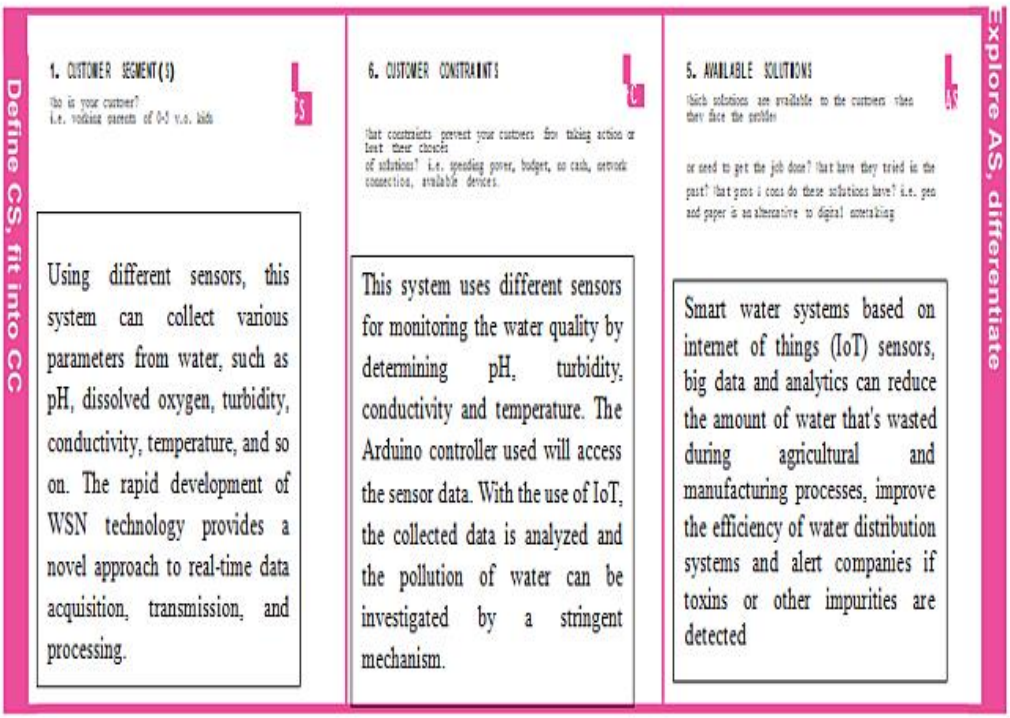
3.3 Proposed Solution:

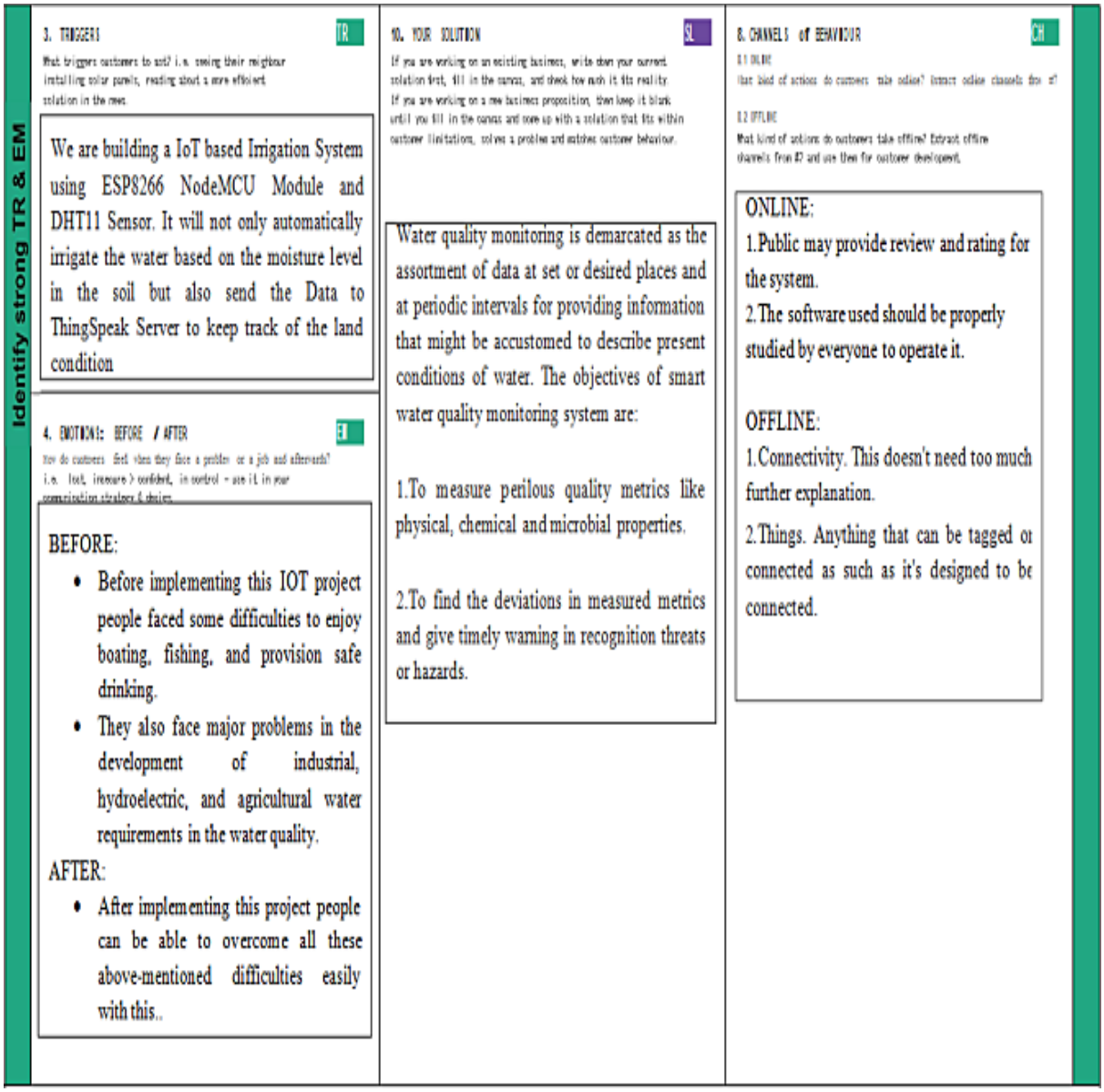
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	IOT Based Real Time River Water Quality Monitoring and Control System
2.	Idea / Solution description	1.To monitor the quality of water using sensors like temperature, potentiometer(pH), turbidity,salinity and so on. 2.Collecting those data and storing it in cloudand perform analyse to check if the water is contaminated or not for drinking. 3.If the water is contaminated an alert is made to the user/ local authority through SMS or can be viewed through web application anytime.
3.	Novelty / Uniqueness	1.Based on the collected data prediction is made whether the water can be used for cultivation of specific crops and suitable for the aquatic animals.
4.	Social Impact / Customer Satisfaction	Algal growth, fertilizers, pesticides cause river pollution which can impact all living beings. Better monitoring and control measures can impact health and vegetation massively.

5.	Business Model (Revenue Model)	Service based product is developed to serve thelocal people to know the quality of water before consuming it or using it for any purpose. This prevents health issues or at most loss of living being.
6.	Scalability of the Solution	Developing the product as both web and mobile application it is portable, and data canbe accessed from anywhere anytime. provide a real-time monitoring and a feasible solution for remote or distant places where water quality laboratory is not present.

3.4 PROBLEM SOLUTION:






Identify strong TR & EM
3. TRIGGERS
TR
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
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
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
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	Arduino(control system)	Sensors are interfaced to Arduino and it collects measurements data periodically from sensors.
FR-2	WSN Sensor	Multiple sensor nodes installed for the detection of pH, temperature, dust particles, turbidity.
FR-3	Software Design Requirements	WSN requires IoT platform which requires Neural Network Model to classify water quality as Good OrBad. IoT integrated big data analytics to store data in cloud and analyze it constantly.
FR-4	LCD/PC/Mobile display	Displays the resulting sensed pH, temperature,turbidity. If ,acquired value > Threshold value, then comment=BAD. If, acquired value < Threshold value, then comment=GOOD.

4.2 Non-functional Requirements:

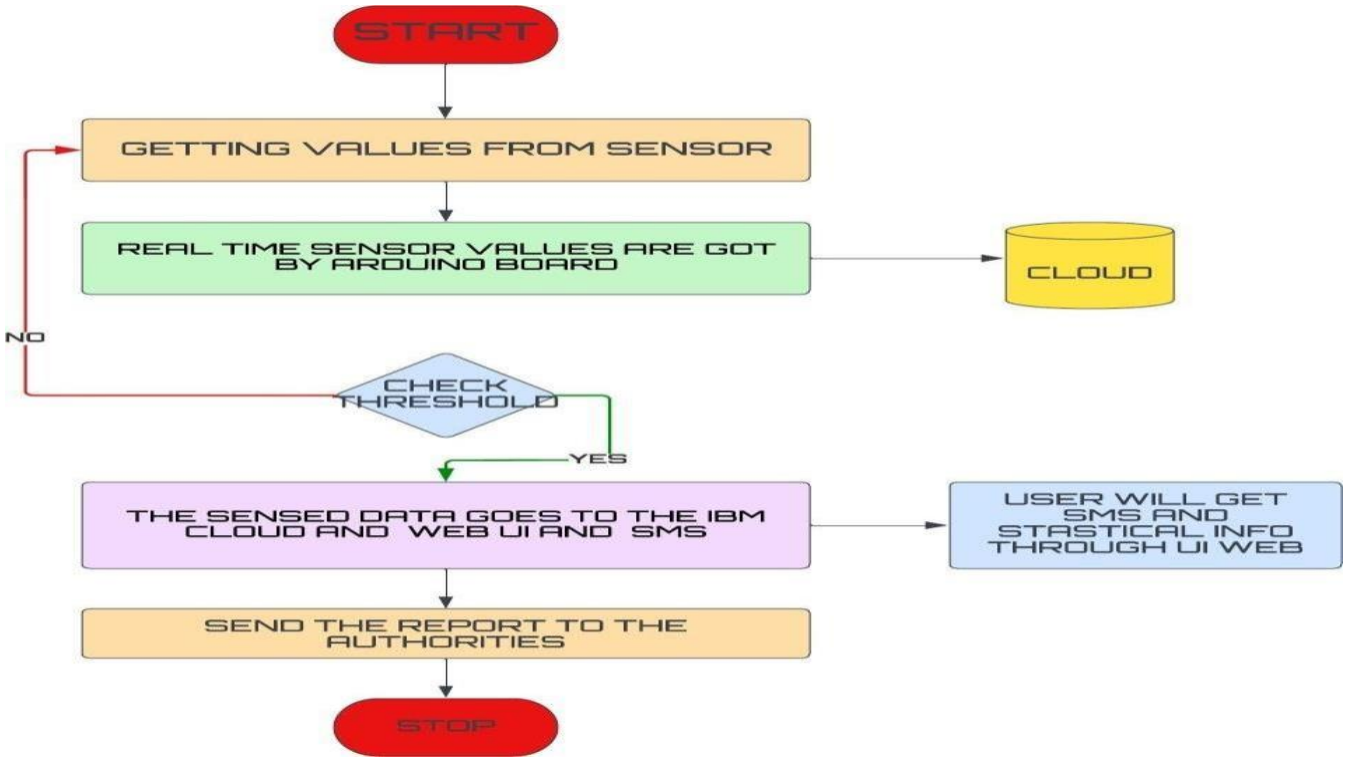
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It is important to monitor water quality to ensure that, it is safe for humans to drink it as well as for wild life and marine life and to understand environmental impacts and to not harm sea life.
NFR-2	**Security**	The IoT networks are incredibly safe and communication speed is also high. The technology comfortably resolves all the issues.
NFR-3	**Reliability**	The water quality and monitoring system is reliable and it's output can be assured. Since standardized hardware components and software designs are used.
NFR-4	**Performance**	Real-time quality of water is executed and alertring the authorities if water quality is not good.
NFR-5	**Availability**	The monitoring system is made available for use at any time with accuracy.
NFR-6	**Scalability**	The system with high frequency, high mobility and low powered and cost-effective.

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 is collected 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	The clarity 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.

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, socia 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	Registration	USN-1	As a user, I can register for the application byentering my email, password, and confirming My password.	2	High	JAWERIYA ,RIZWANA
	Registration via Facebook	USN-3	As a user, I can register for the applicationthrough Facebook	2	Low	
	Registration via Mail ID	USN-4	As a user, I can register for the applicationthrough Gmail	2	Medium	
Sprint-2	Confirmation	USN-2	As a user, I will receive confirmation email once Ihave registered for the application	1	High	
	Login	USN-5	As a user, I can log into the application byentering email & password	1	High	
	IBM Cloud service Access		Get access to IBM cloud services.	2	High	
Sprint-3 and Sprint 4	Create the IBM Watson IoT and device Settings	USN-6	To create the IBM Watson IoT Platform and integrate the microcontroller with it, to send the sensed data onCloud	2	High	THASLIMA , JASHEENA ,GEETHA
	Create a node red service	USN-7	To create a node red service to integrate the IBMWatson along with the Web UI	2	medium	RIZWANA
	Create a Web UI	USN-8	To create a Web UI, to access the data from the cloudAnd display all parameters.	2	Medium	JAWERIYA ,
	To develop a Python code	USN-9	Create a python code to sense the physical quantityAnd store data.	2	Medium	THASLIMA
						JASHEENA
	Publish Data to cloud.	USN-10	Publish Data that is sensed by the microcontroller to theCloud	3	High	GEET HA
	Fast-SMS Service	USN-11	Use Fast SMS to send alert messages once the parameters like pH, Turbidity and temperature goesbeyond the threshold	3	High	JAWERIYA, THASLIMA
	Testing	USN-12	Testing of project and final deliverables	3	Medium	

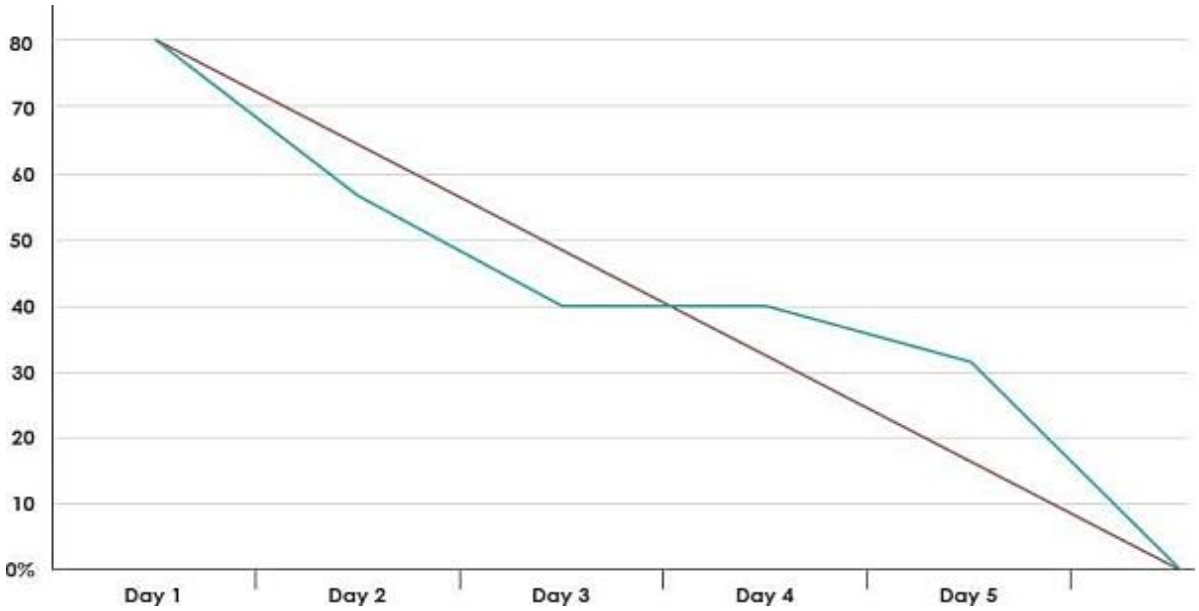
Project Tracker, Velocity & Burndown Charts

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	4 Days	24Oct 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	2 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:

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

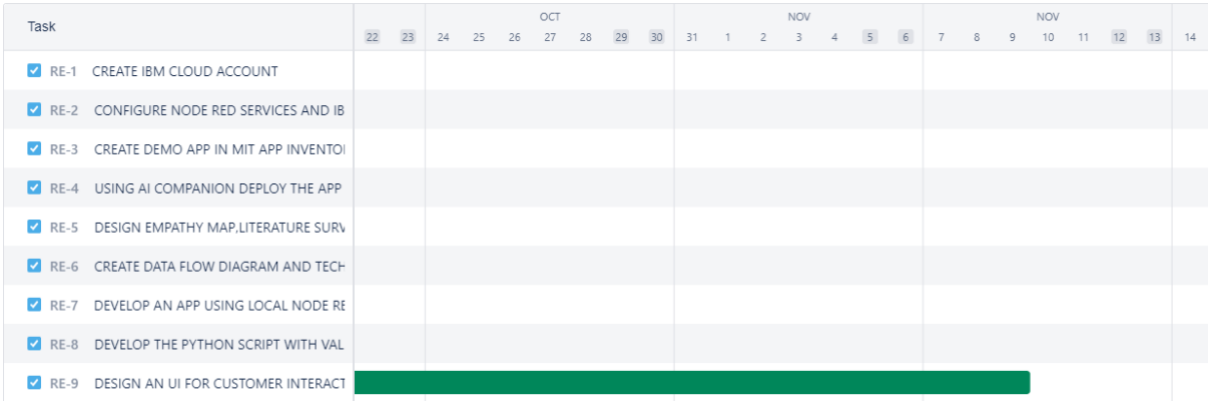
Burndown Chart:

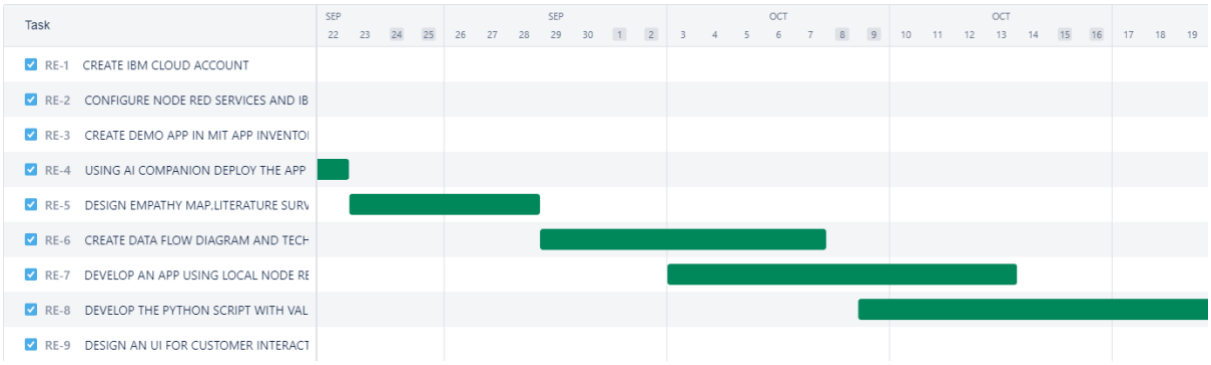


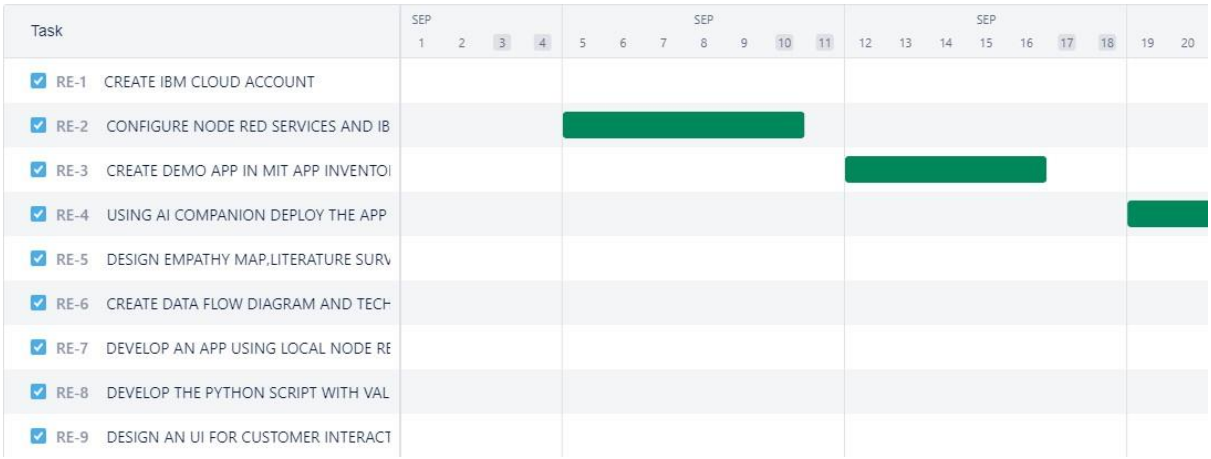
6.3 REPORT FROM JIRA

REFERENCE LINK (JIRA SOFTWARE):
https://ibmprojectrealtimemonitoring.atlassian.net/jira/core/projects/RE/board

TIMELINE CREATED USING JIRA SOFTWARE







https://ibmprojectrealtimemonitoring.atlassian.net/jira/core/projects/RE/list?filter=statusCategory+%3D+Done+AND+statusCategoryChangedDate+%3E%3D+-1w&showDone=true&atlOrigin=eyJpIjoiMmVlZjFiNTA2ODIxNDg0MGFmOGZlMTA2Y2M0Y2VjN2IiLCJwIjoiaiJ9

LISTS IN JIRA:

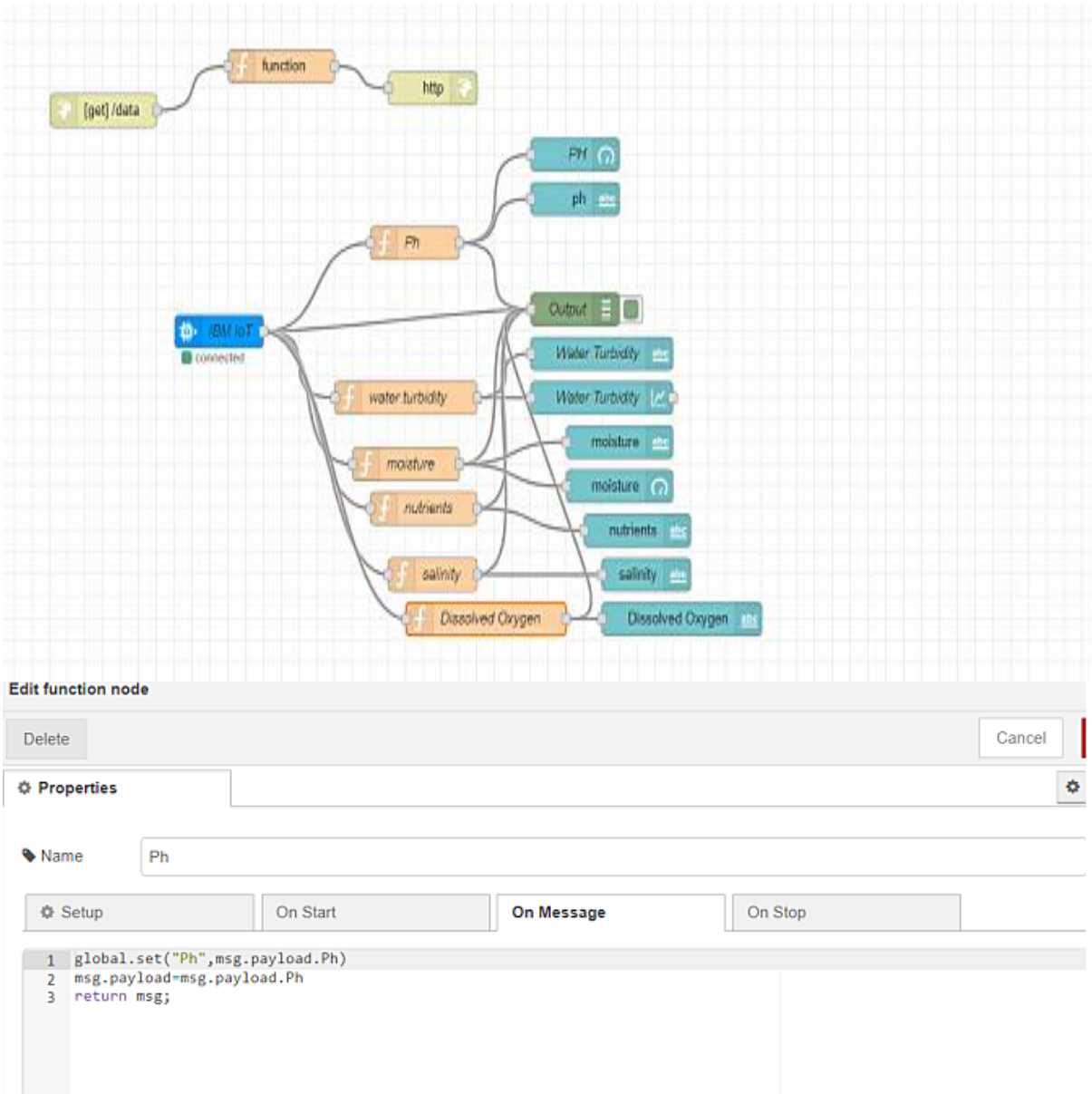
Key	Summary	Status	Category
RE-1	CREATE IBM CLOUD ACCOUNT	DONE	PREREQUISITE
RE-2	CONFIGURE NODE RED SERVICES AND IBM WATSON IOT PLA...	DONE	PREREQUISITE
RE-3	CREATE DEMO APP IN MIT APP INVENTOR 2.	DONE	MOBILE APPLICATION
RE-4	USING AI COMPANION DEPLOY THE APP IN MOBILE	DONE	DEPLOYMENT AND TESTING
RE-5	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 :

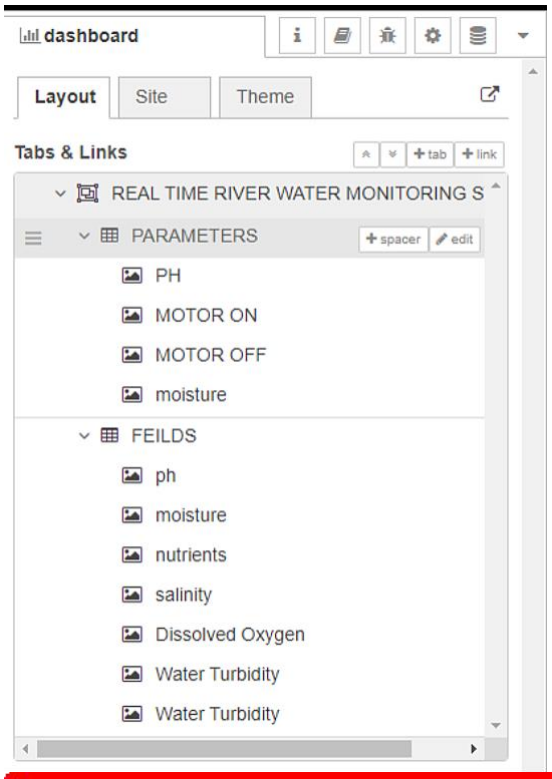
Name	Type	Related Schemes
ERROR IN MSG PAYLOAD EVENTS	Base	• Default Issue Type Scheme
ISSUE IN CONFIGURING NODE RED DASHBOARD	Base	• Default Issue Type Scheme
ERROR 1101 IN MIT APP INVENTOR	Subtask	• Default Issue Type Scheme
URL NOT RESPONDED THE NODE RED DATA URL NOT RESPONDED	Subtask	• Default Issue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

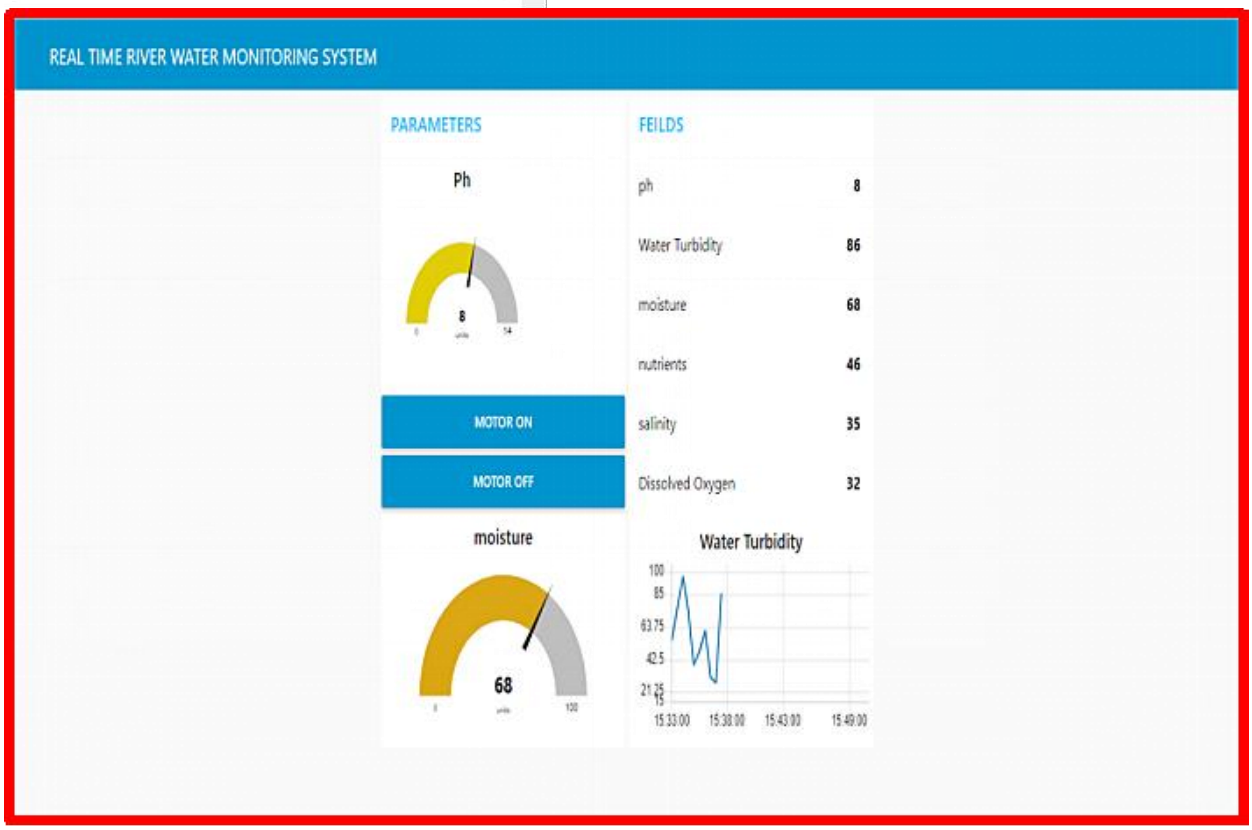
7. CODING AND SOLUTIONING

7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:



Node red Dashboard:





8. TESTING

8.1 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 how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	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 Bluetooth module 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 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.

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':
DissolvedOxygen,'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

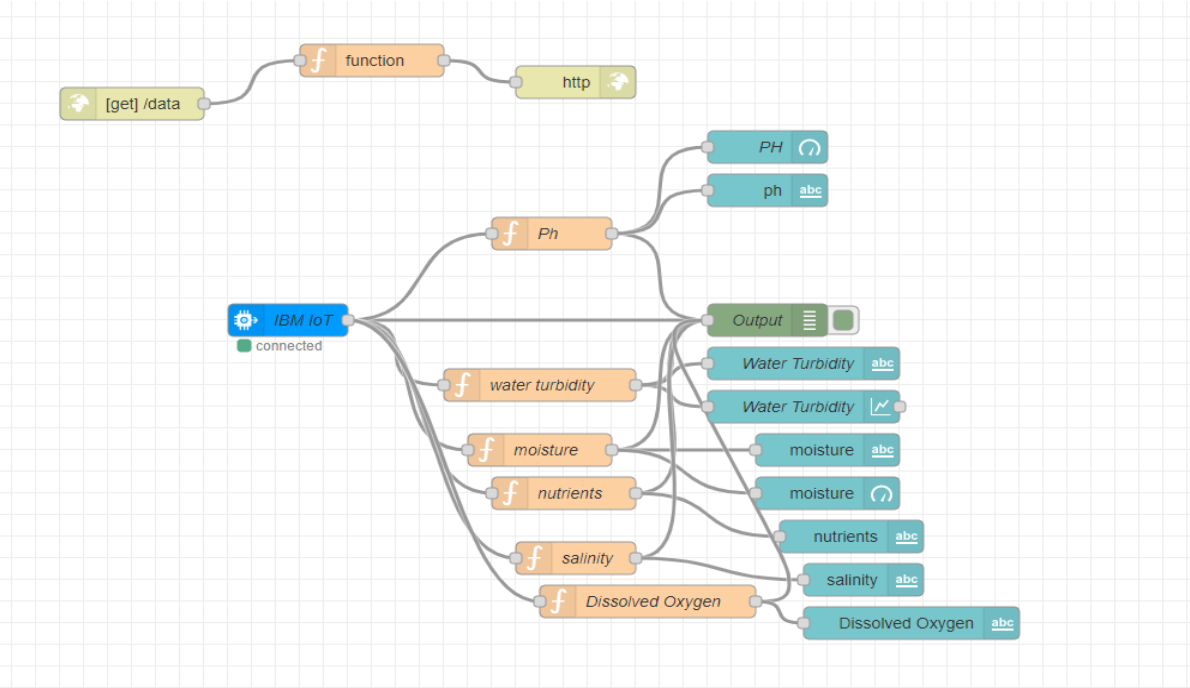
```
Quality of River water is measured and its correct
Published Ph = 6 WaterTurbidity = 80 % salinity = 652 DissolvedO2 = 123 conductivity = 306
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 57 % salinity = 579 DissolvedO2 = 121 conductivity = 459
Quality of River 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

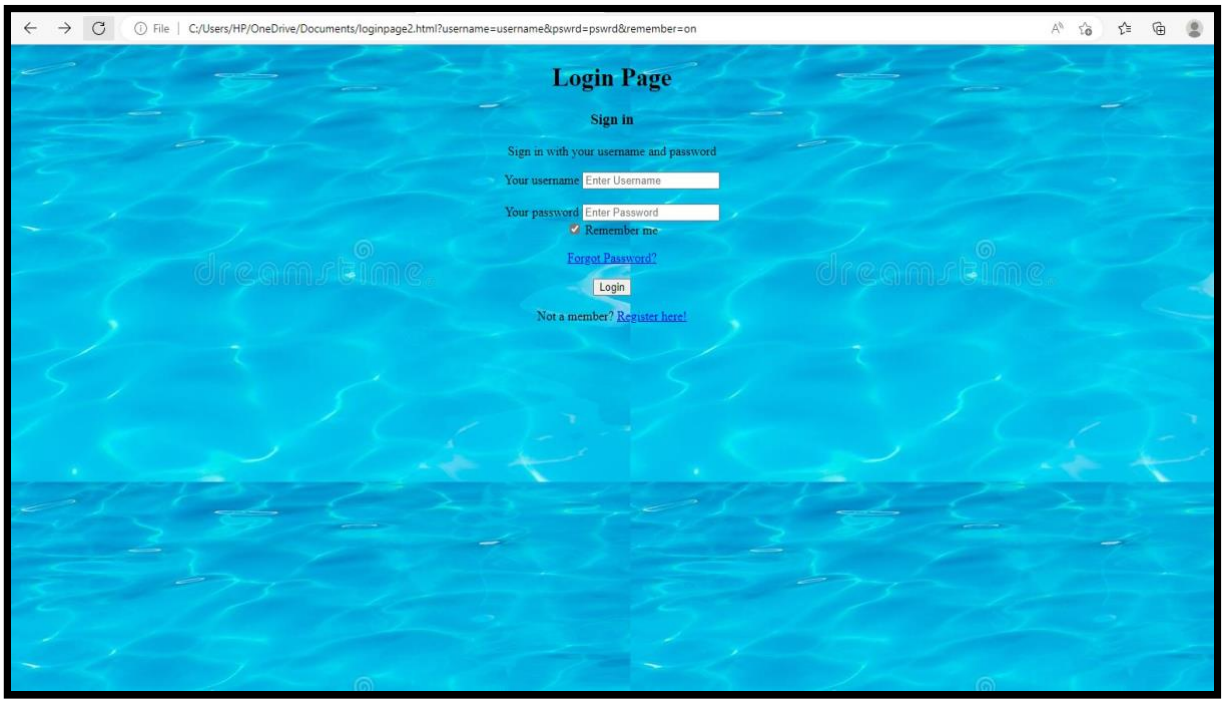


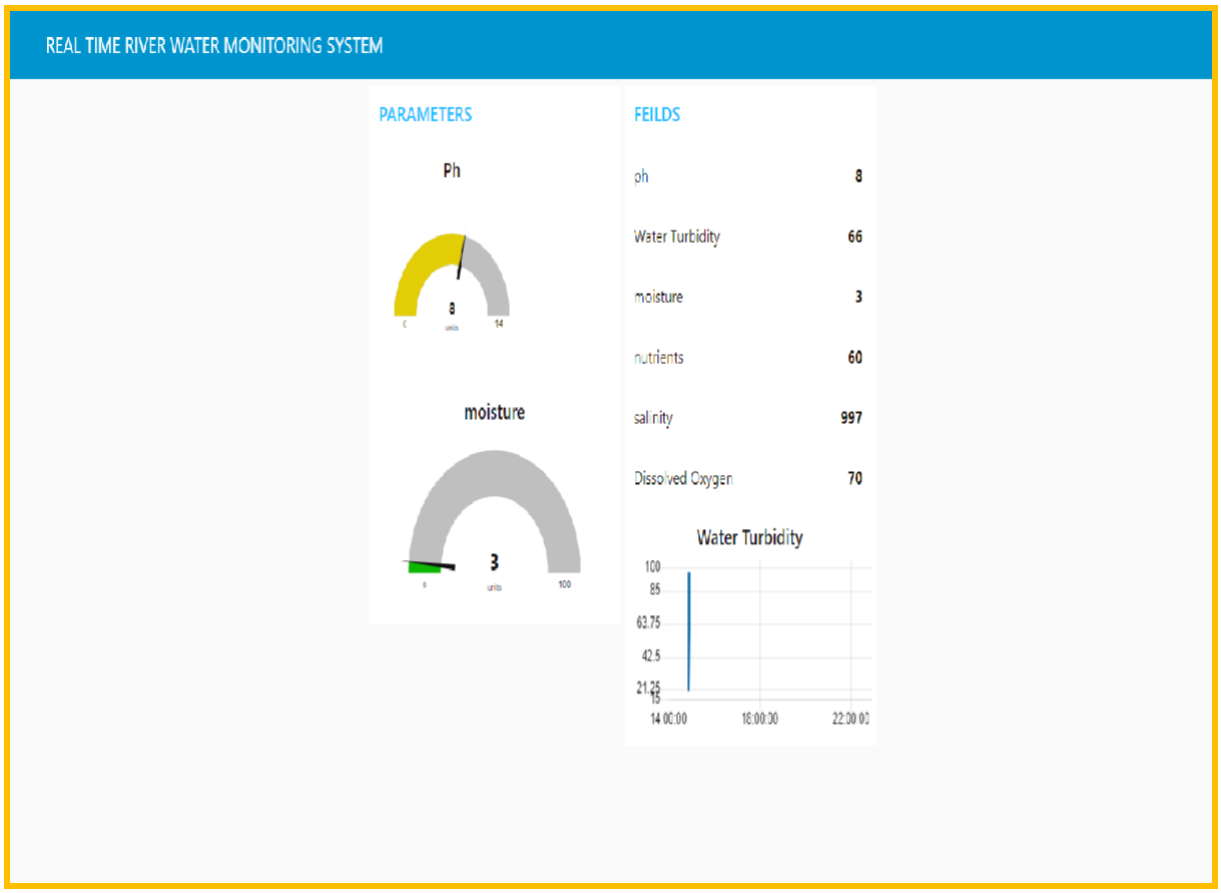
HTML CODE:

```
<!DOCTYPE html>
<html lang="en">
<head>
   <style>
   h1 {text-align: center;}
   p {text-align: center;}
   div {text-align: center;}
   body {
     background-image: url("https://thumbs.dreamstime.com/b/clear-transparent-light-blue-water-pool-texture-background-150961732.jpg");
     background-color: #cccccc;
    }
   </style>
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Login page in HTML</title>
</head>
```

```
<body>


   <h1>Login Page</h1>
   <form action="">
      <!-- Headings for the form -->
      <div class="headingsContainer">
         <h3>Sign in</h3>
         <p>Sign in with your username and password</p>
      </div>


      <!-- Main container for all inputs -->
      <div class="mainContainer">
         <!-- Username -->
         <label for="username">Your username</label>
         <input type="text" placeholder="Enter Username" name="username" required>


         <br><br>


         <!-- Password -->
         <label for="pswrd">Your password</label>
         <input type="password" placeholder="Enter Password" name="pswrd" required>


         <!-- sub container for the checkbox and forgot password link -->
         <div class="subcontainer">
            <label>
              <input type="checkbox" checked="checked" name="remember"> Remember me
            </label>
            <p class="forgotpsd"> <a href="#">Forgot Password?</a></p>
         </div>
         <button type="submit" onclick="window.location.href = 'https://node-red-qltdp-2022-
```

```
11-07.eu-gb.mybluemix.net/ui';">Login</button>

        <!-- Sign up link -->
        <p class="register">Not a member?  <a href="#">Register here!</a></p>

      </div>
    </p>

  </form>
</body>
</html>
```




REAL TIME RIVER WATER MONITORING SYSTEM
PARAMETERS
Ph
8
moisture
3
FEILDS
ph 8
Water Turbidity 66
moisture 3
nutrients 60
salinity 997
Dissolved Oxygen 70
Water Turbidity
100
85
63.75
42.5
21.25
14 00:00
18:00:00

MOBILE APP


WATER QUALITY TEST
Water Turbidity
93
Ph
7
moisture
45
nutrients
49
salinity
36
dissolved O2
44
NEXT PAGE
PUBLIS H

13.2 GIT-HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-5264-1658753298

PROJECT DEMO LINK:

https://youtu.be/4YhgzxLfXb8