REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

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FROM

EASWARI ENGINEERING COLLEGE

In Fulfillment of project in IBM-NALAYATHIRAN 2022

Team Id: PNT2022TMID09601

PROJECT GUIDES

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Faculty Mentor: Dr. K.Johny Elma

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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, analyse 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 system:

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 analysed and to be used for water treatment purpose.

2.2 References:

1. **IoT Based Real-time River Water Quality Monitoring System**

Mohammad Salah UddinChowdury, Talha BinEmran, Science Direct – 2018

This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a microcontroller 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.

2. **Review of Water Quality Monitoring using Internet of Things (IoT)**

Mr. A. P. Roger Rozario, R. Surya IEEE, 2019 .

The quality of the water must be monitored in real-time to ensure its safety and supply. Monitoring water in traditional ways takes longer, which can take up to from 24 to 96 hours to identify contaminants in water supplies, which are more time taking. This project aims at developing a water quality monitoring system using sensors and IoT (Internet of Things). The water quality parameters like temperature, pH, and turbidity are measures using sensors and the water quality index is determined. The measured values from the sensors will be processed using a microcontroller, and alert message will be sent to the user via an android application developed using MIT app inventor in case of any abnormalities.

3. **A Development and Implementation of Water Quality Assessment Monitoring (WQAM) System using the Internet of Things (IoT) in Water Environment**

Muhammad Farhan Johan, S. Abdullah, A. Zanal Saurabh S. Soman, Hamidreza Zareipour , Om Malik JEVA , 23 November 2021 .

This paper presents the development and implementation of Water Quality Assessment and Monitoring (WQAM) system. The system development used Wi-Fi enabled microcontroller to connect with the IoT environment and store the data in the IoT cloud server. The microcontroller used is Arduino UNO that interacts with three types of sensor probes which are pH, turbidity and temperature probe. All the data measurements is transferred using a Wi-Fi module which is ESP8266. The IoT cloud used to utilize the data frame is Thing Speak. This system was implemented on Bandar Pereda Lake and Deraa River in Pulao Pinang with two systems implemented at each location. The sensors were placed on the water surface for more accurate measurements. This system continuously measures the readings of pH, turbidity dan temperature on the lake/river for every 1 hour. Twenty readings were taken for every 1 hour within the first 20 minutes with 1 minute interval and the readings were stored in the IoT cloud server.

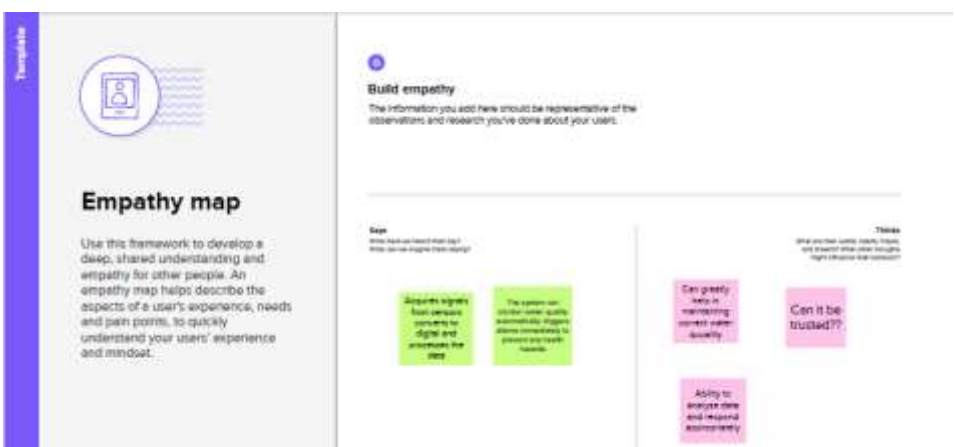
2.3 Problem Statement:

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.



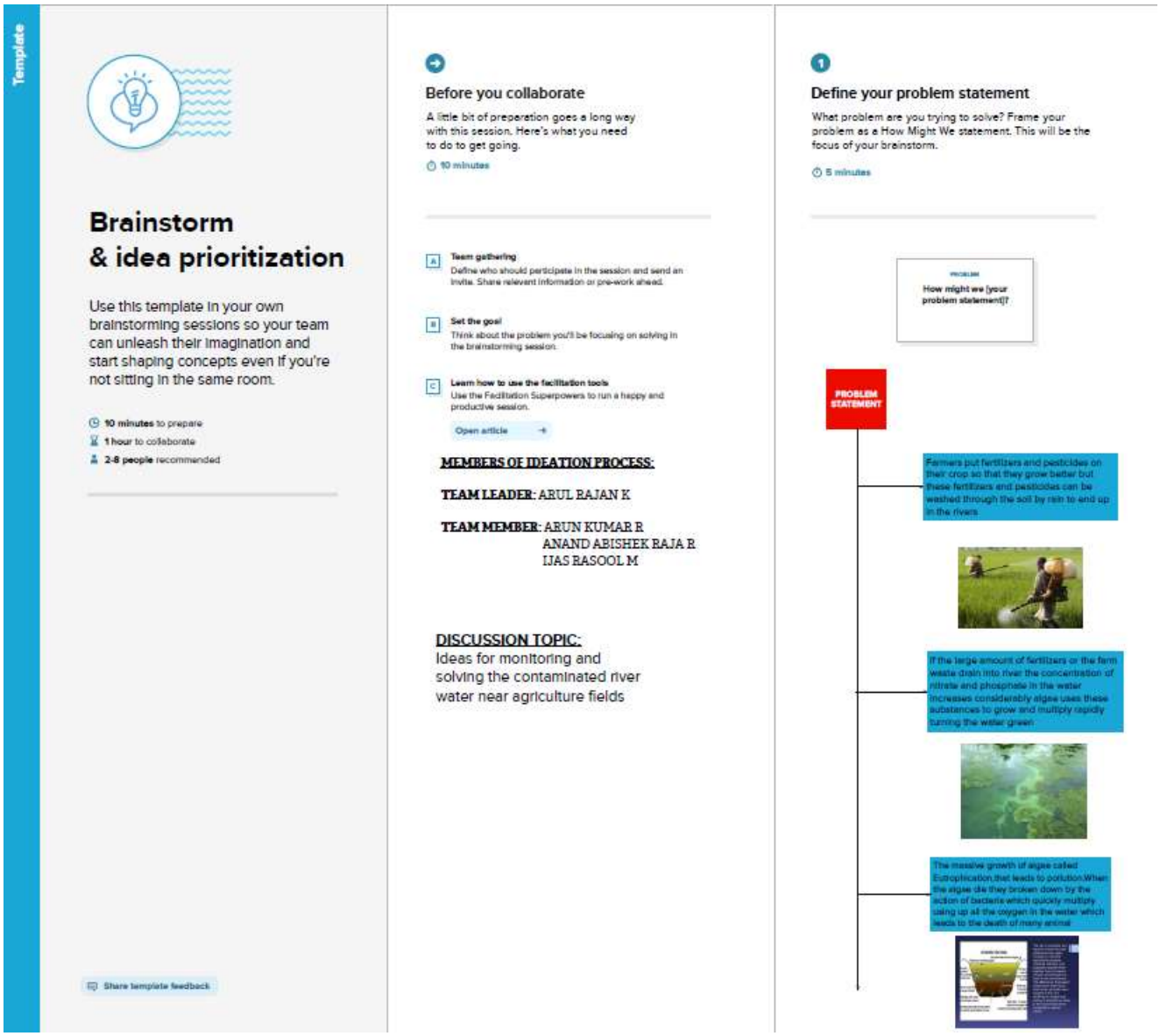
Reference:h ps://app.mural.co/invita on/mural/ibm0082/1666797743994?sender=uf93f4fc8b3ed9d16cc620908&key=535a741b-def9-48d5-92b8-e0850fa6f1e6

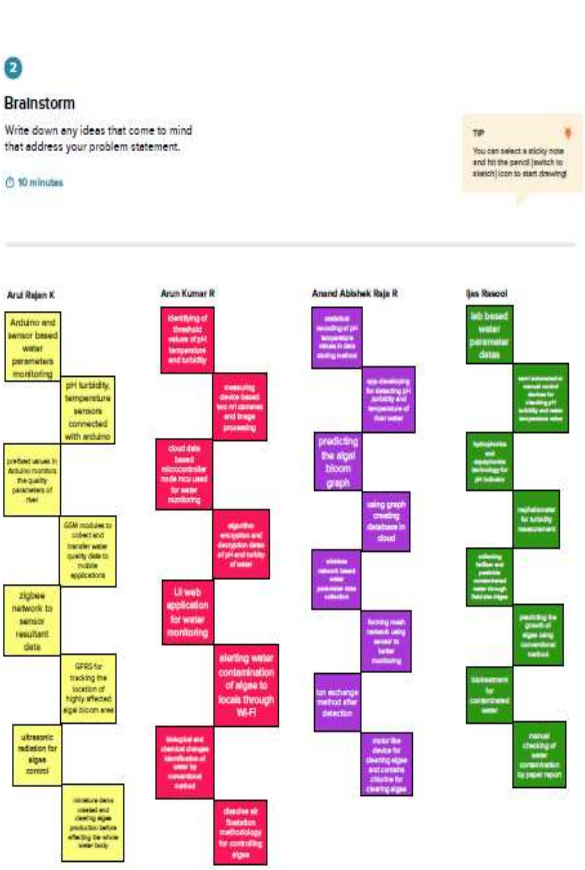
3.2 Ideation & Brainstorming:

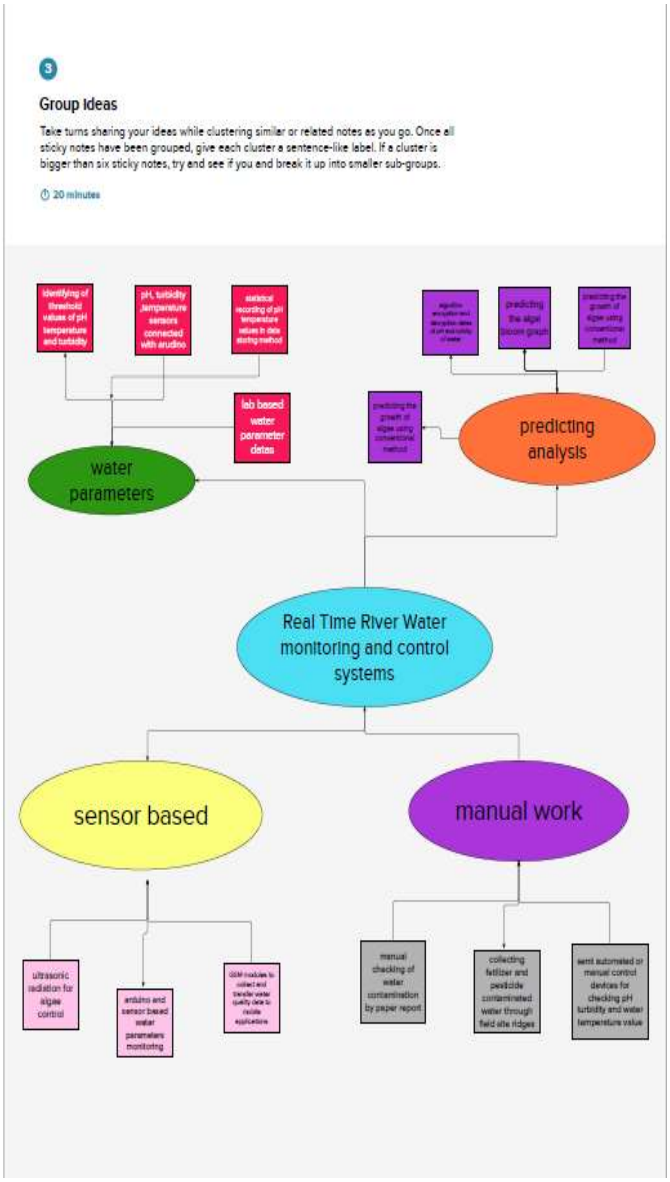
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, 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=uf93f4fc8b3ed9d16cc620908&key=d4906cd4-138e-40f9-a546-ea061cc6c665




2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
TIP
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!
Arul Rajan K
Arduino and sensor based water parameters monitoring
pH turbidity, temperature sensors connected with arduino
GSM modules to collect and transfer water quality data to mobile applications
zigbee network to sensor resultant data
GPRS for tracking the location of highly effected algal bloom area
ultrasonic radiation for algae control
Arun Kumar R
identifying of threshold values of pH temperature and turbidity
UI web application for water monitoring
alerting water contamination of algae to locals through Wi-Fi
dissolve air flotation methodology for controlling algae
Anand Abishek Raja R
predicting the algal bloom graph
using graph creating database in cloud
ion exchange method after detection
Ijas Rasool
lab based water parameter datas
manual checking of water contamination by paper report

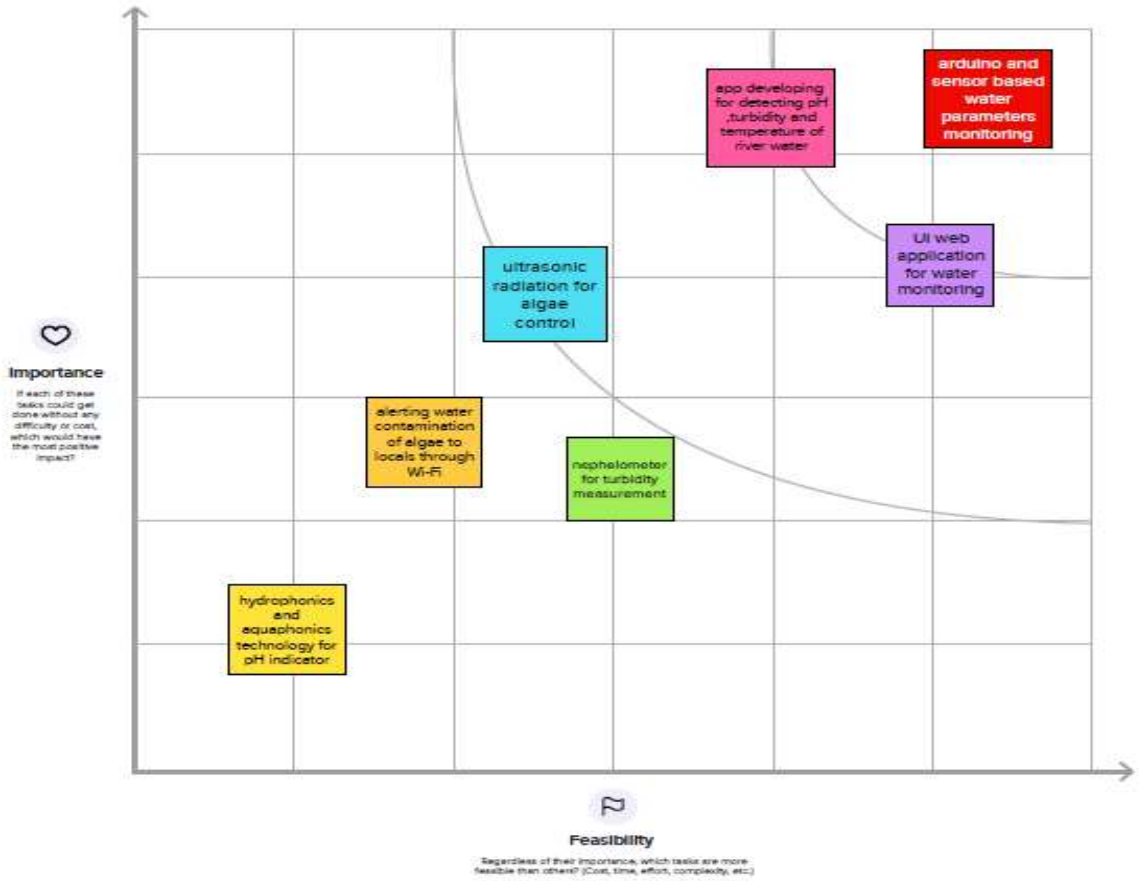

3
Group Ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.
20 minutes
identifying of threshold values of pH temperature and turbidity
pH, turbidity ,temperature sensors connected with arduino
predicting the algal bloom graph
lab based water parameter datas
predicting analysis
water parameters
Real Time River Water monitoring and control systems
sensor based
manual work
ultrasonic radiation for algae control
arduino and sensor based water parameters monitoring
manual checking of water contamination by paper report
collecting fertilizer and pesticide contaminated water through field site ridges

4

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



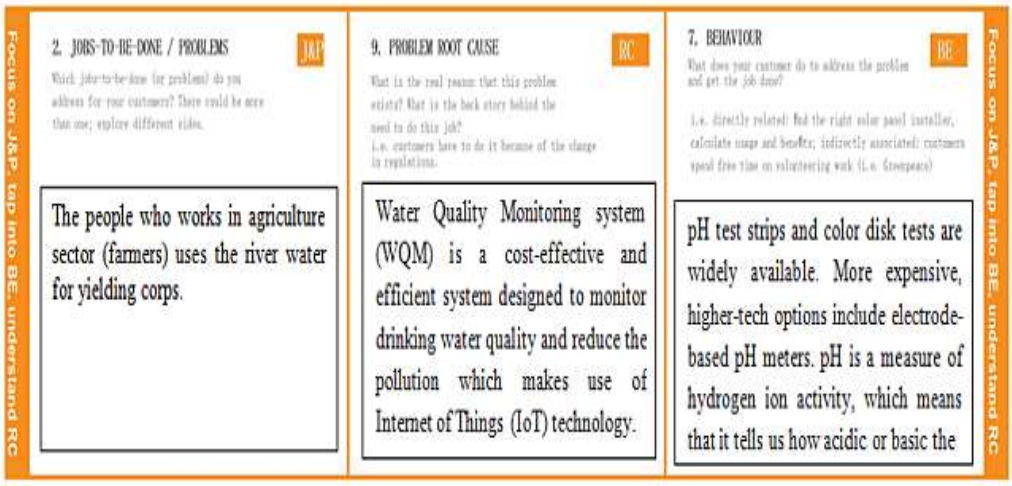
3.3 Proposed Solution:

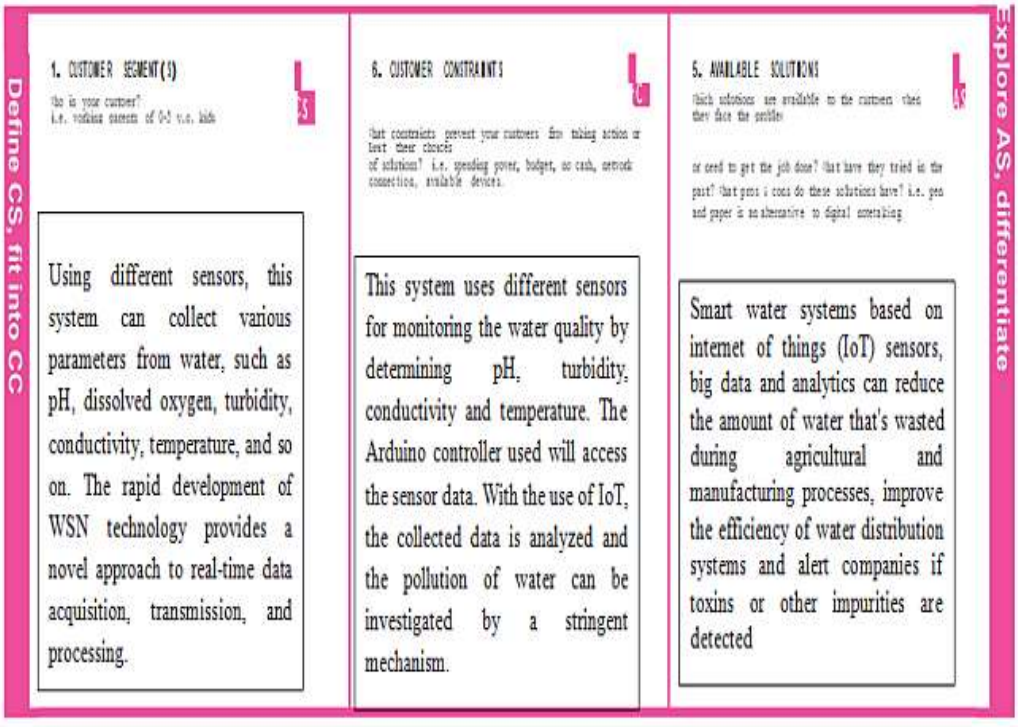
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Massive growth of algae called eutrophication leads to pollution(monitoring and controlling the quality of river water).
2.	Idea / Solution description	Detecting the dust particles , PH level of water, Dissolved oxygen and temperature to be monitored and altering the authorities if water quality is not good.

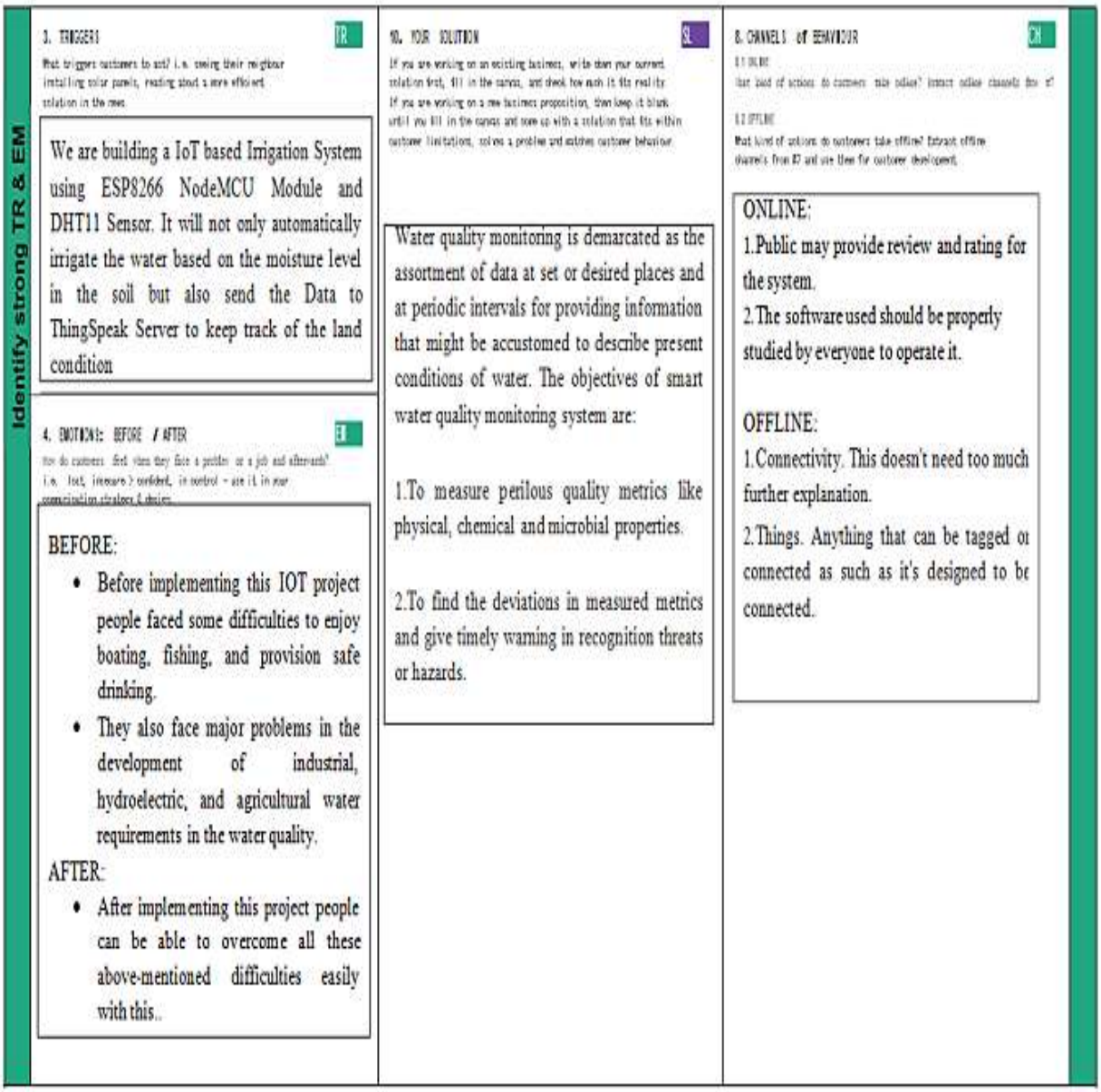
3.	Novelty / Uniqueness	River water quality can be monitored by web application. Quality parameter will track continuously with standard measurements.
4.	Social Impact / Customer Satisfaction	Localities will not get suffered by poor quality of water by alerting them when the water quality is not good.
5.	Business Model (Revenue Model)	Water quality monitoring system by aeron systems for industrial water treatment plant, river bodies, aqua forming ,digital loggers.

6.	Scalability of the Solution	Measuring of real time values and continuous monitoring helps 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 product mobile UI
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:*

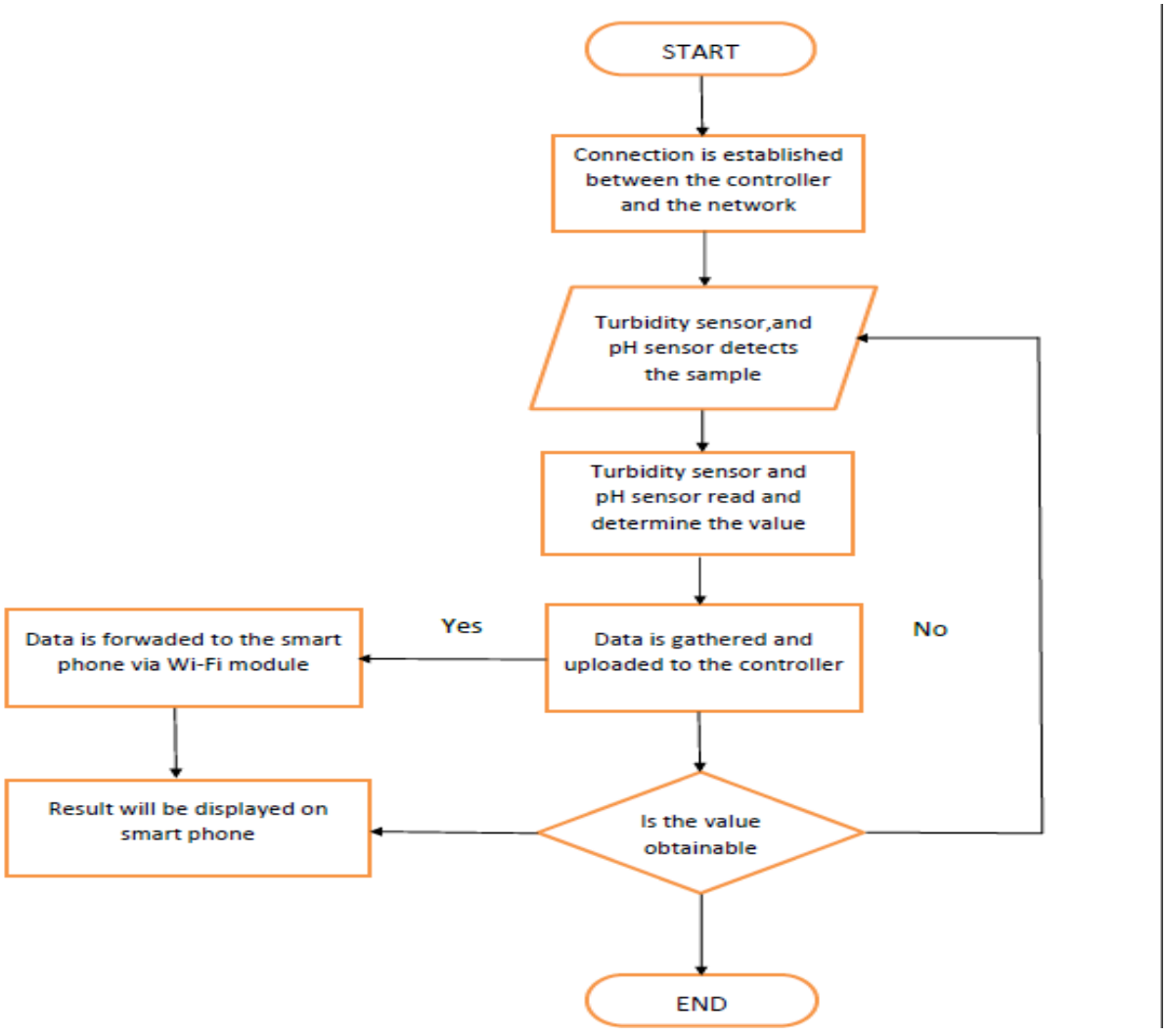
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Monitors the flow and quality of ground water, and invites gates surface- and ground-water interactions.
NFR-2	**Security**	The data and information on are secured in the application on by using the application on firewall.
NFR-3	**Reliability**	The Real me 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.



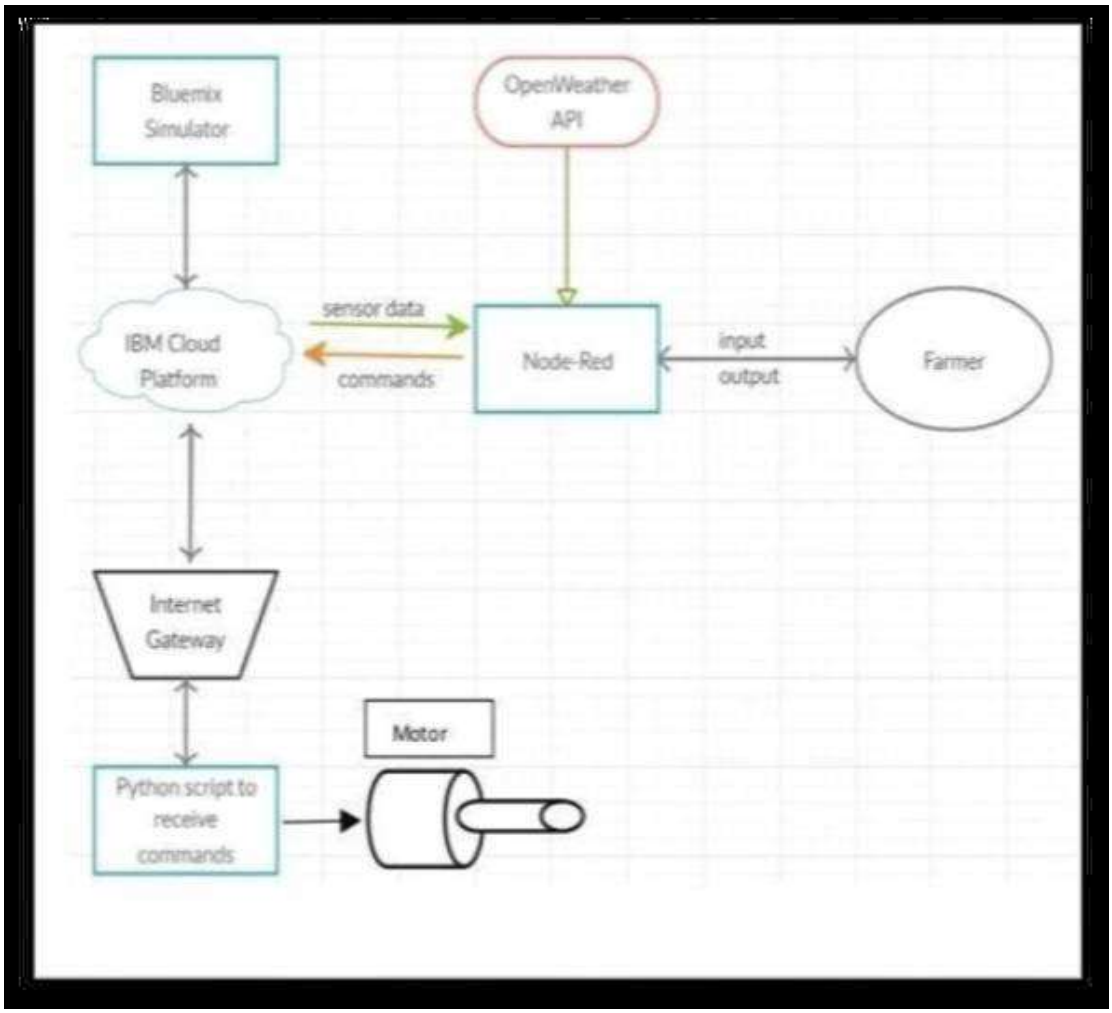
5.2 SOLUTION AND TECHNICAL ARCHITECTURE

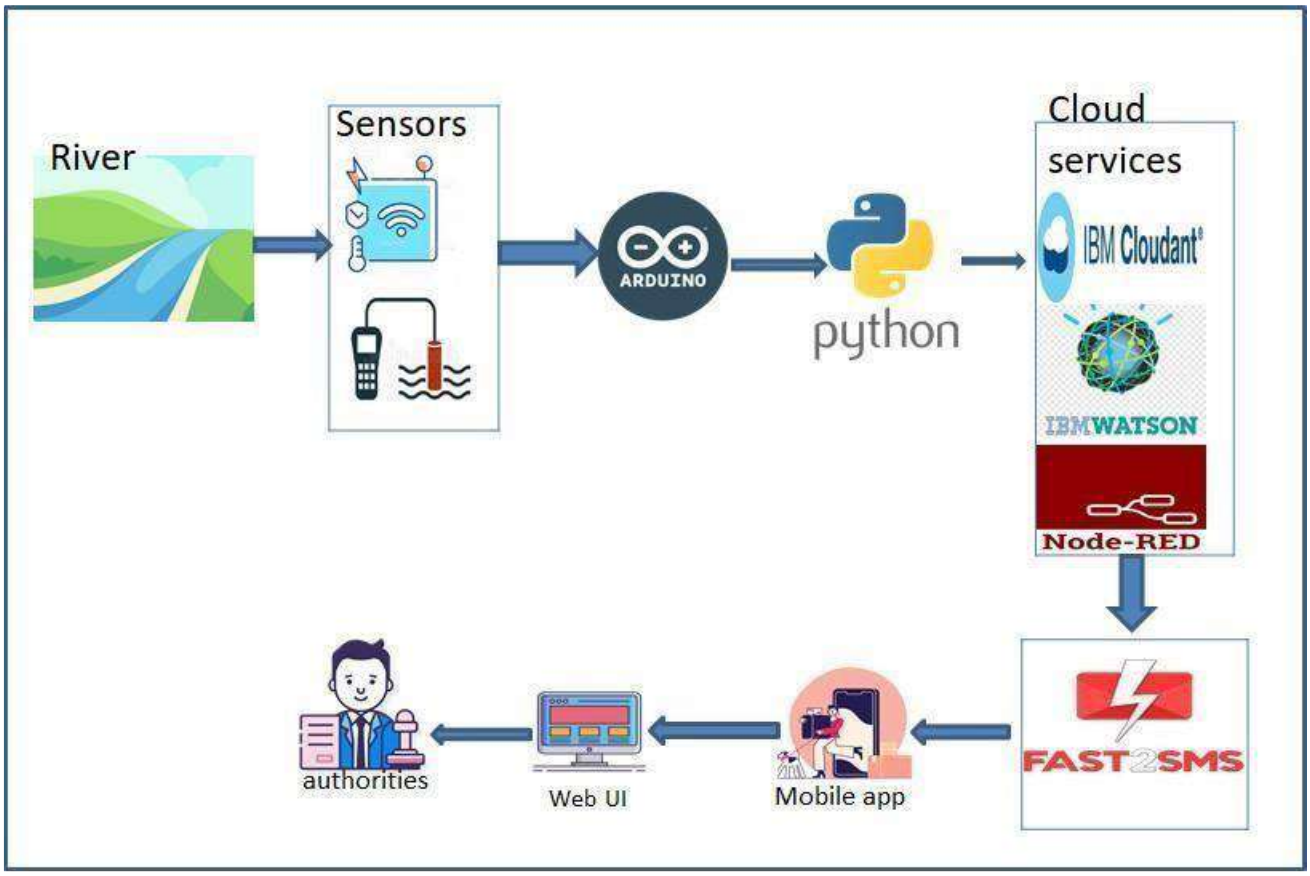
Summary

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.


Bluemix
Simulator
OpenWeather
API
IBM Cloud
Platform
sensor data
commands
Node-Red
input
output
Farmer
Internet
Gateway
Motor
Python script to
receive
commands



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

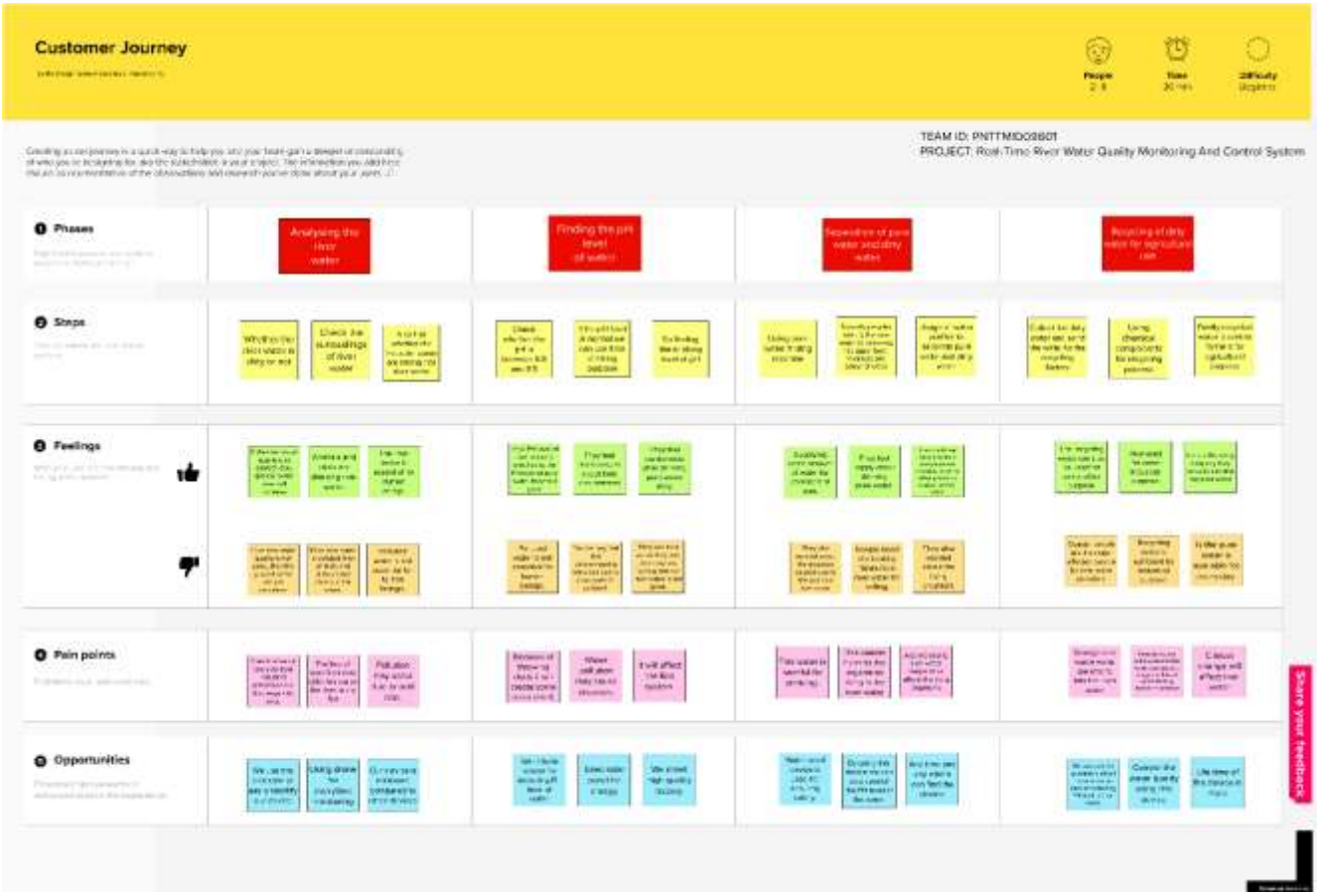
Application Characteristics:

S.No	Characteristics	Description	Technology
1.	PH level Monitoring	The PH level of river water can be monitored via placing sensors in rivers.	PH-sensor
2.	Air Quality Monitoring	The clarity and purity of river 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	I can receive confirmation email & click confirm	High	Sprint-1

			registered for the application			
		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	ADMIN1	As a Admin, Update must be done at each step and take care of any errors	Heavy Monitoring 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.	26 SEPTEMBER 2022
Empathy Map	Prepared Empathy Map Canvas to combine thoughts and pains, gains of the project with all team members .	28 SEPTEMBER 2022
Ideation	Brainstorming session is conducted with all team members to list out	11 OCTOBER 2022

	all the ideas and prioritize the top 3 ideas.	
Proposed Solution	Prepared the proposed solution on document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution , etc.	21 OCTOBER 2022
Problem Solution Fit	Prepared problem - solution fit document.	30 OCTOBER 2022

6.2 SPRINT DELIVERY SCHEDULE

6.3 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 by entering my email, password, and confirming my password.	2	High	Arul Rajan K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Ijas Rasool M
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Anandhaabishekraja R
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Arun Kumar R

Sprint-1	Login	USN-5	As a user, I can log into the application by Entering email & password	1	High	Ijas Rasool M

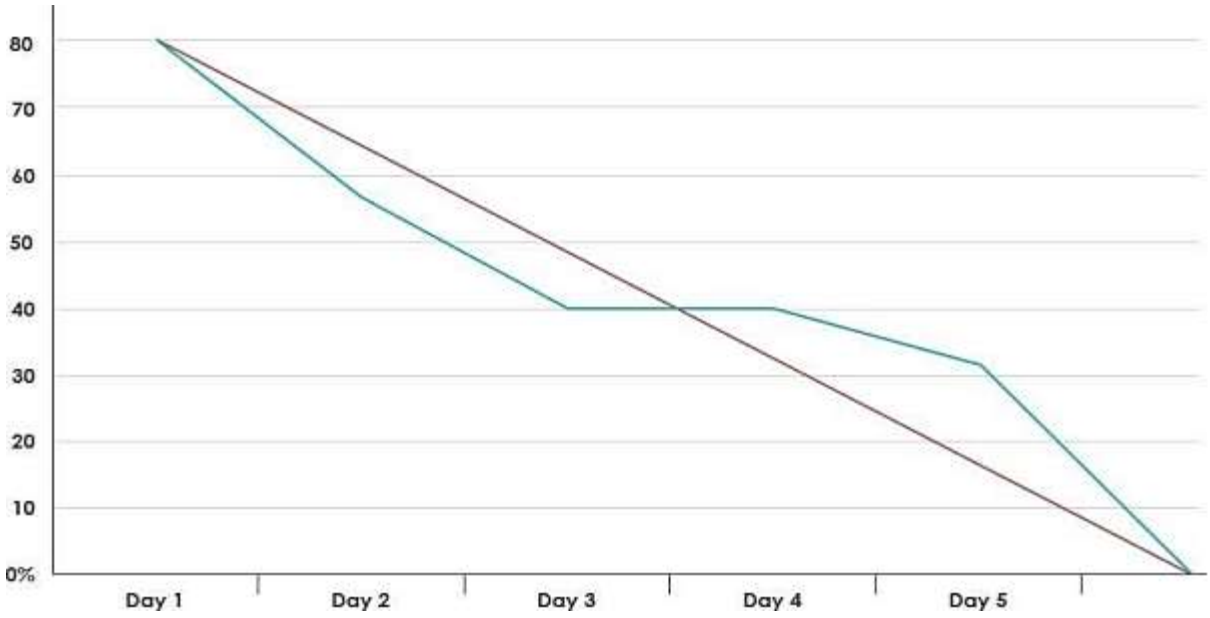
Project Tracker, Velocity & Burndown Charts

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	49	06 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	07 Nov 2022

Velocity:

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

Burndown Chart:

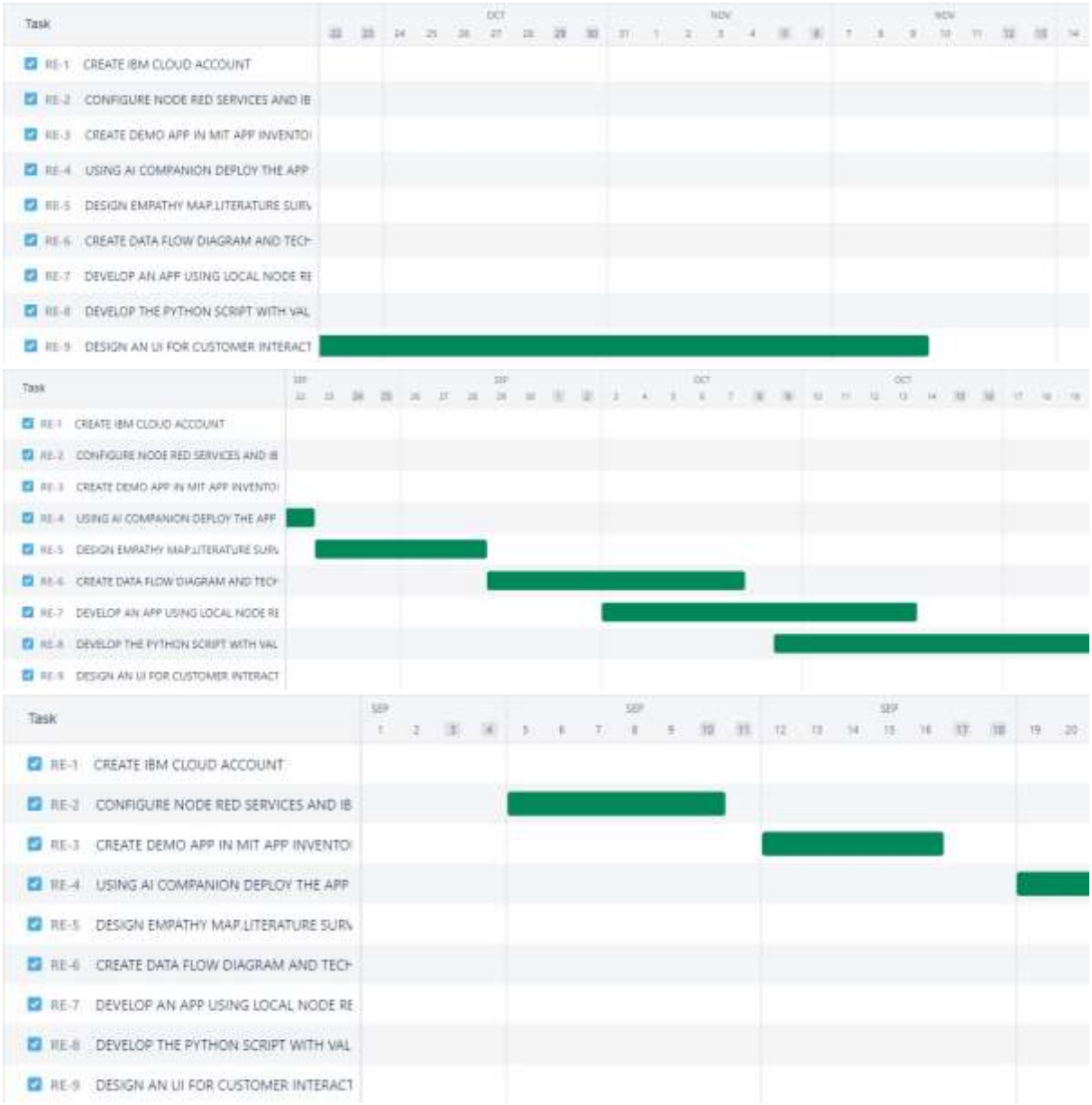


6.3 REPORT FROM JIRA

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:

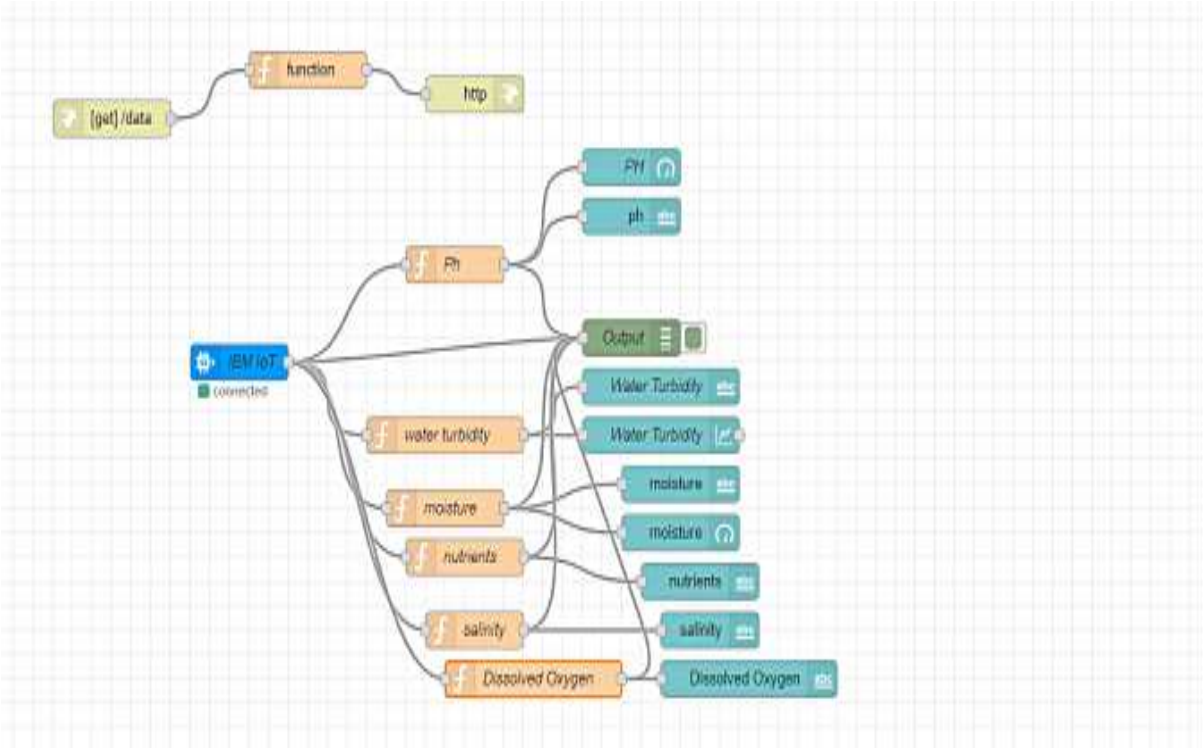
Key	Summary	Status	Category
RE-1	CREATE IBM CLOUD ACCOUNT	DONE	PREREQUISITE
RE-2	CONFIGURE NODE RED SERVICES AND IBM WATSON IOT PLA...	DONE	PREREQUISITE
RE-3	CREATE DEMO APP IN MIT APP INVENTOR 2.	DONE	MOBILE APPLICATION
RE-4	USING AI COMPANION DEPLOY THE APP IN MOBILE	DONE	DEPLOYMENT AND TESTING
RE-5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

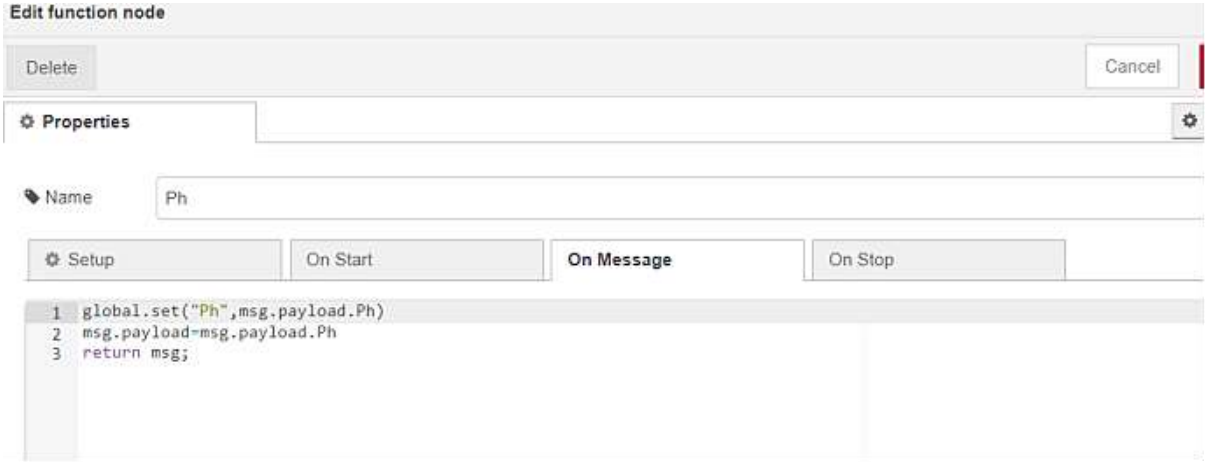
ISSUES :

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

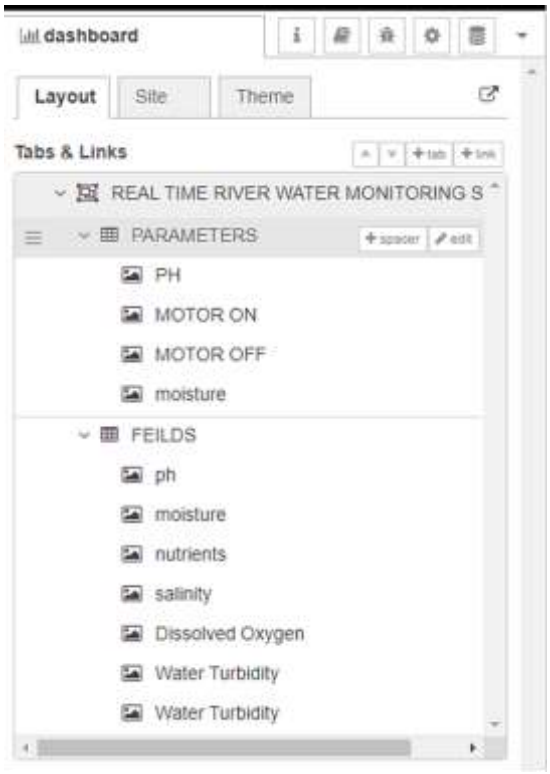
7.CODING AND SOLUTIONING

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).

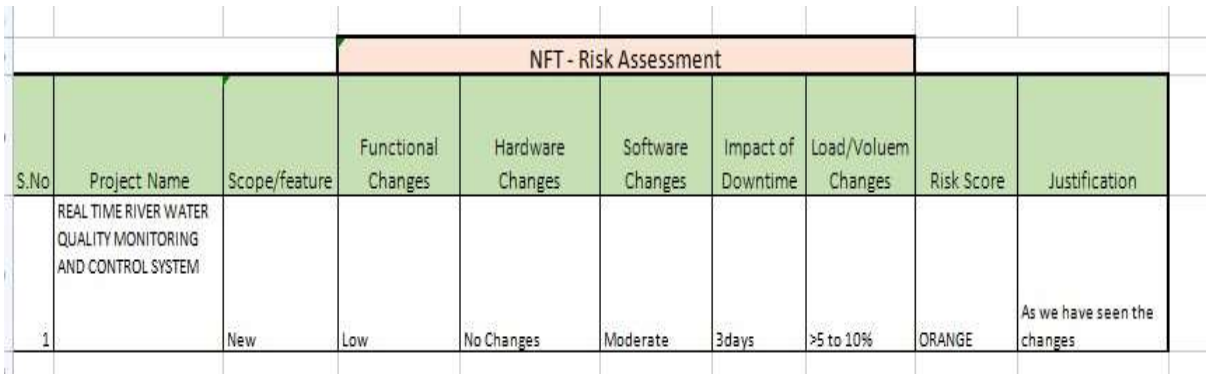
2. Defect Analysis

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 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

```
#program to publish data in ibm watson iot platform import time
import sys import Sms 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

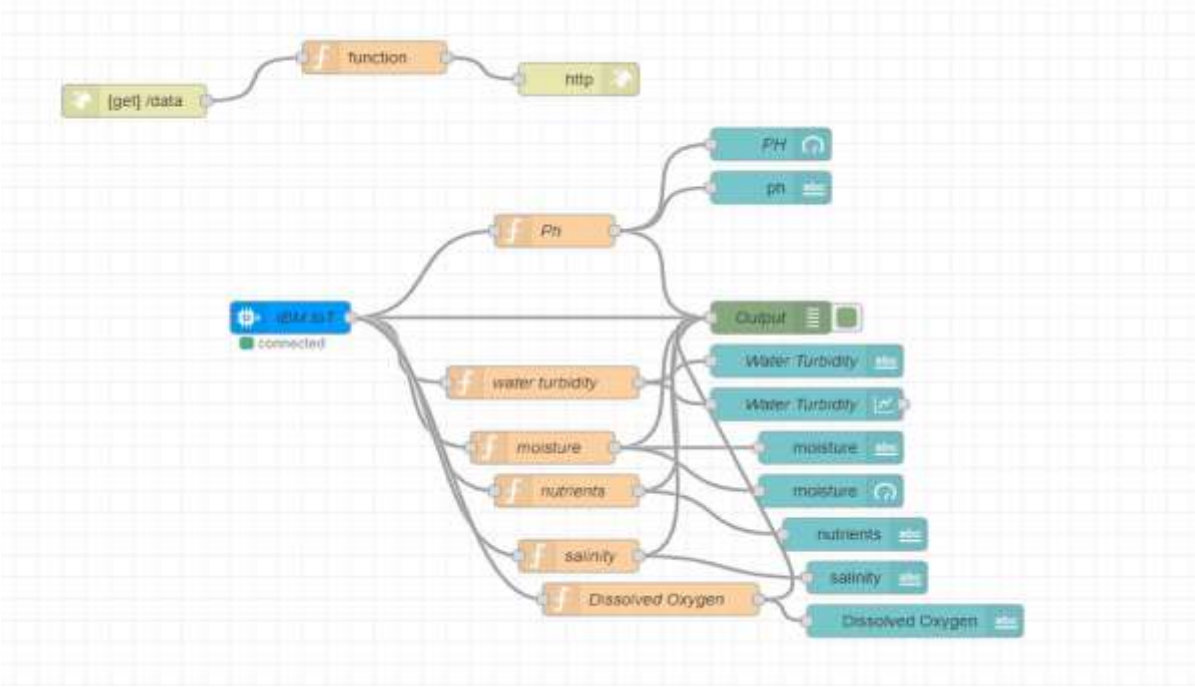
```
Quality of River water is measured and its correct
Published Ph = 6 WaterTurbidity = 80 % salinity = 652 DissolvedO2 = 123 conductivity = 306
Quality of River water is measured and its correct
Published Ph = 8 WaterTurbidity = 57 % salinity = 579 DissolvedO2 = 121 conductivity = 459
Quality of River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

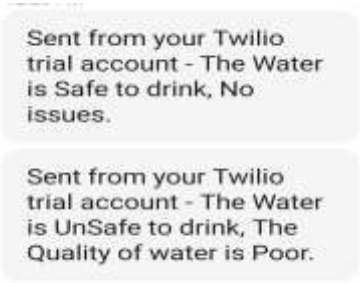
Identity | Device Information | Recent Events | State | Logs

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



sms alert:(Twilio Sms Messaging Services):



PYTHON CODE FOR SMS(Sms.py):

```
from twilio.rest import Client import Keys
client = Client(Keys.account_sid,
Keys.auth_token) message =
client.messages.create(
   body="The Water is UnSafe to drink, The Quality of water is Poor.",
```

```
    from_=Keys.twilio_number,
    to=Keys.my_phone_number
)
print(message.body)
```

HTML CODE:

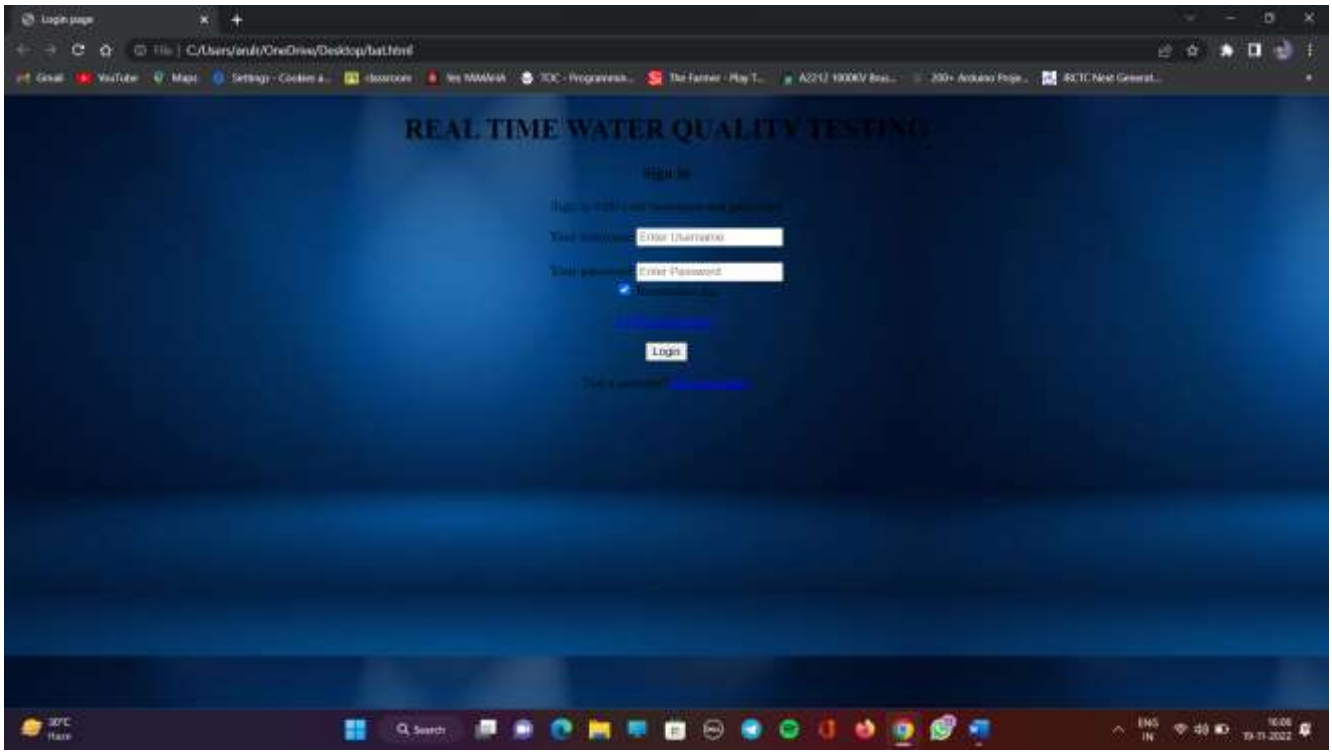
```
<!DOCTYPE html>
<html lang="en">
<head>
    <style>
    h1 {text-align: center;}
    p {text-align: center;}
    div {text-align: center;}
    body {
      background-image:  url("https://thumbs.dreamstime.com/b/clear-transparent-light-bluewater-pool-texture-background-150961732.jpg");
      background-color: #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>
```

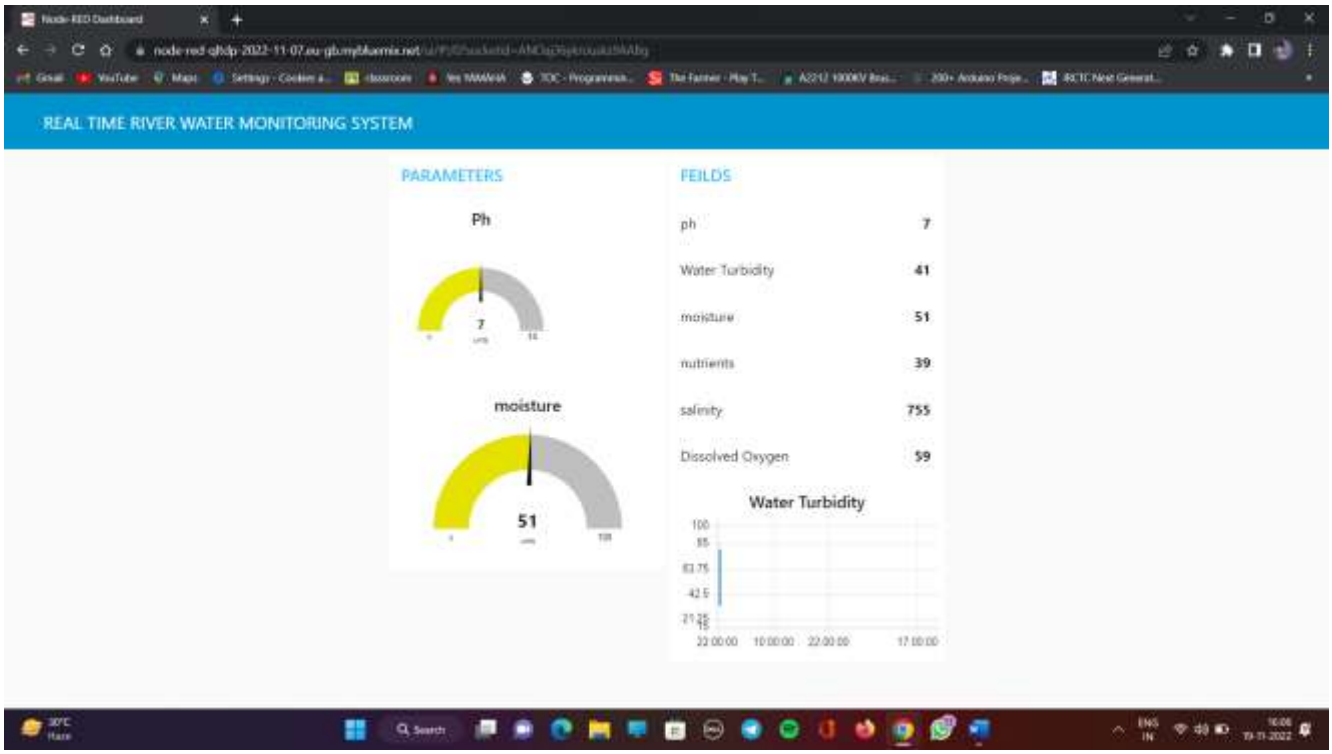
```
  <h1>Login Page</h1>
  <form action="">
    <!-- Headings for the form -->
    <div class="headingsContainer">
      <h3>Sign in</h3>
      <p>Sign in with your username and password</p>
    </div>
<!--    Main
container
for          all
inputs -->
    <div class="mainContainer">
      <!-- Username -->
      <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
7
moisture
51
FEILDS
ph 7
Water Turbidity 41
moisture 51
nutrients 39
salinity 755
Dissolved Oxygen 59
Water Turbidity

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-24320-1659941520

PROJECT DEMO LINK:

1. **https://node-red-qltdp-2022-11-07.eugb.mybluemix.net/ui/#!/0?socketid=WzX3XVVK_oZjhjBAAAAl**

2. **https://possible-wheat-booth.glitch.me/**

1. **https://youtu.be/P3dszB9o95c**