PROJECT REPORT

REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

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INDEX

INTRODUCTION

1.1 Project Overview:

River Water quality monitoring System Water is one of the major compounds that profoundly influence ecosystem. But, nowadays it is been exploited heavily due to rapid industrialization, human waste and random use of pesticides and chemical fertilizers in agriculture, which leads to water contamination. Thus, a water monitoring system is necessary to observe the water quality in a large area such as lake, river, and aquaculture. As per the current world situation, Internet of Things (IoT) and remote sensing techniques are used in heterogeneous areas of research for supervising, congregate and analyzing data from the remote locations. In this paper, the suggested system is a minimal price real time water quality monitoring system in IoT environment. This system comprise of numerous sensors for assessing the physical and chemical parameter. The factors of water that can be assessed using these sensors are pH, turbidity, conductivity, dissolved oxygen. Using this system the real time quality of water bodies can be determined and the data uploaded over the Internet are analyzed.

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.Smart water quality Monitoing System [Author: Mr. Kumar K]

2.Real Time Water Quality Monitoring and Management [Author: Deepika gupta]

3.The Monitoring of Water Quality in IOT Environment [Author: Anuadha T]

4.IOT Based Real time River Water Quality Monitoring System [Author: Elsevier B.V]

5.Smart Portable Water Monitoring [Author: Okoli Chinedu David]

6.Intelligent System for Monitoring and Detecting Water Quality [Author: Jamal Mabrouki]

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..,)

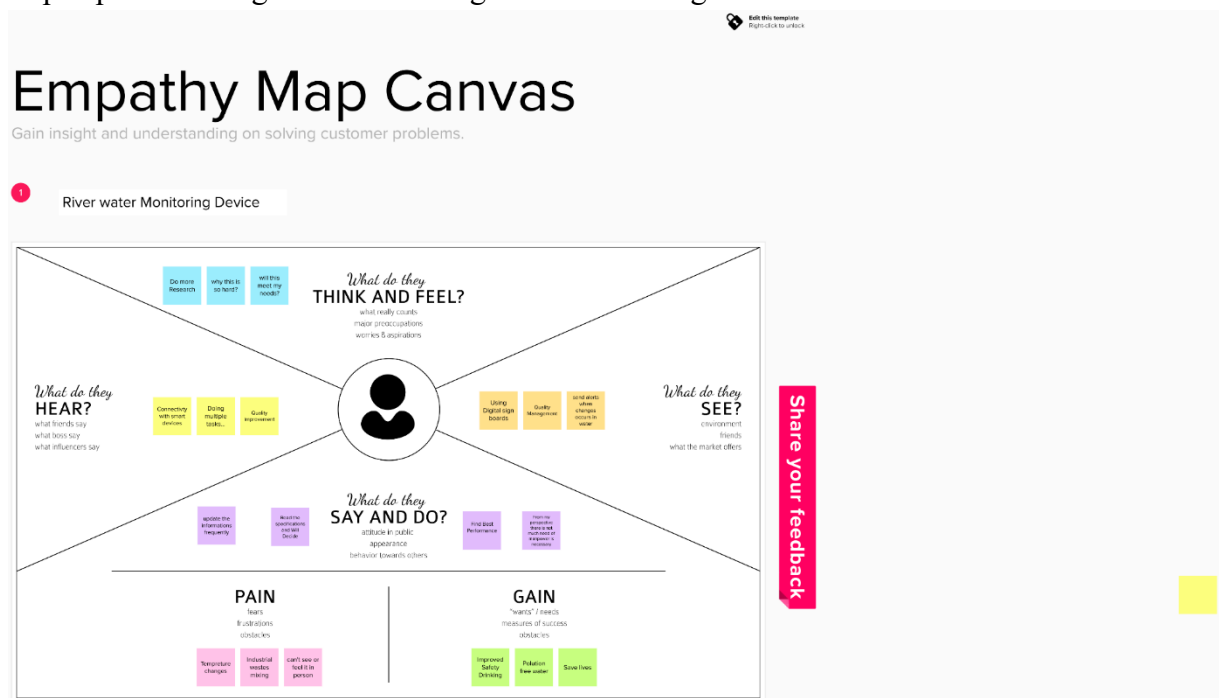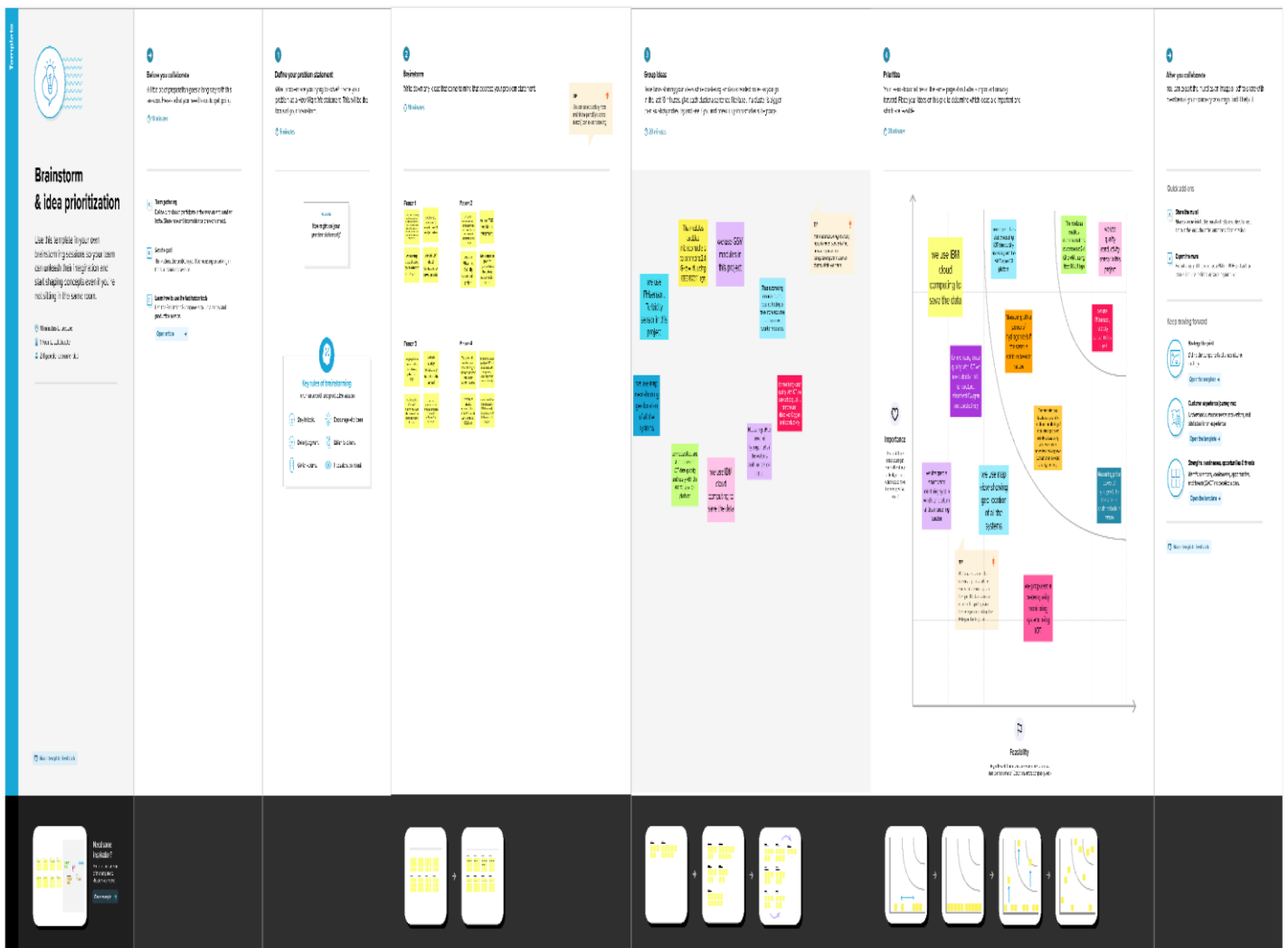| Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	A Farmer	use river water for irrigation	i dont know the quality and level of the water	i dont know how to measure the quality of the water	frustrated
PS-2	An Industrialist	use river water for drinks manufcuring	i dont know the pH level of river water	we can't use water with acidic nature for cool drinks manufacturing	indecisive

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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.

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.

9

3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Pollution of water is one of the main threats in recent times as drinking water is getting contaminated and polluted. The polluted water can cause various diseases to humans and animals, which in turn affects the life cycle of the ecosystem. If water pollution is detected in an early stage, suitable measures can be taken and critical situations can be avoided. To make certain the supply of pure water, the quality of the water should be examined in real-time. Smart solutions for monitoring of water pollution are getting more and more significant these days with innovation in sensors, communication, and Internet of Things (IoT) technology. In this paper, a detailed review of the latest works that were implemented in the arena of smart water pollution monitoring systems is presented. The paper proposes a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly. The developed model is tested with three water samples and the parameters are transmitted to the cloud server for further action.
2.	Idea / Solution description	An assembled Arduino microcontroller is used as the core controller of the system. Once the code is uploaded to the microcontroller, no PC system, keyboard command, monitor is required to operate the system. The system functions automatically and independently according to the code uploaded to the microcontroller. In this system, three sensors are used to measure the essential water parameters. As it was studied from the previous researches, the most essential water parameters needed to be monitored by the average users are water pH level,

		water turbidity (cloudiness) and water temperature which is a measurement of the amount of the water in a container.Therefore, four essential water parameters which are temperature, pH level and turbidity can be measured by this proposed system. Sensors circuits are connected to the microcontroller and the probes of the turbidity, pH, and temperature sensors placed inside the water.A water proof temperature sensor is used to avoid any damage or electrical shock to the system and the user. An ultrasonic sensor is used to measure the level of the water in thecontainer. The ultrasonic sensor is connected in the system such that it will be placed on the top of the water container.The ultrasonic sensor sends electromagnetic waves to the water surface and receives the wave back after touched the water surface. From the time taken to send and receive the wave by the ultrasonic sensor and the velocity of the electromagnetic waves, the distance which shows the water level in the container is calculated by the microcontroller.All sensors read the water quality parameters and send the data to the microcontroller in the form of electrical signals.The microcontroller is programmed such that is will analyze the result and compare it with the standard ranges which are predetermined in the code. If any water parameter crossed the standard limit, the alarm system will turn on.In case of any abnormality in a water parameter detected by the microcontroller, the buzzer will buzz to indicate that the water is not proper for use. To show the sensor readings (The water parameters) on the device itself, an LCD (Liquid Crystal Display) screen is used. The LCD screen is connected to the microcontroller, and through the wired connection, it receives the sensor readings from the microcontroller and displays them accordingly.

3.	Novelty / Uniqueness	• To measure various chemical and physical properties of water like pH, temperature and particle density of water using sensors. • Send the data collected to a Raspberry Pi, show the data in display and send it to a cloud based Database using Wired/Wireless Channel. • Trigger alarm when any discrepancies are found in the water quality. • Data visualization and analysis using cloud based visualization tools.
4.	Social Impact / Customer Satisfaction	The main objectives of this research were to assess the level of customer satisfaction on urban water supply services of Southern Region, Ethiopia, and identify major determinants. Quantitative data were collected from 8,413 customers in seventeen towns, using a questionnaire based on the SERVQUAL model. Qualitative data were collected from customers via focus group discussion, and interviews were used with utility employees and officials. The results showed 47% of customers were satisfied with the water supply enterprise services, while 43% were dissatisfied for various reasons. The customer satisfaction score was below the acceptable level for all service quality dimensions, and understanding of customers, communication, and responsiveness were far below the benchmark. The correlation analysis revealed the existence of a monotonic, positive relationship between customers' total satisfaction and service quality dimensions. The proportional odds model indicated that total customer satisfaction was highly dependent on the nine service quality dimensions used in this research.
5.	Business Model (Revenue Model)	• We can sell this technology to the industries and also to the small scale and large scale industries to develop their industrial security and wellness.

		• We can also provide it as a service based to earn money out of it. • For example we may offer our services to the company as a contract for a period of time to make revenue.
6.	Scalability of the Solution	The scalability on this model is high as there are involves more demand on safety and security of workers and the companies too.so, the danger the losses caused are get reduced by this system. And we need lesser man power to work with this kind of activities

3.4 PROBLEM SOLUTION:

Define CS, fit into CL	**1. CUSTOMER SEGMENT(S)** CS Common people and industrialist are our customers because, nowadays every common people need to know the quality of the water theydrink	**6. CUSTOMER LIMITATIONS** CL An exhaustive systematic search was performed on all the indexing databases. The papers were classified based on methodologies. A taxonomy was derived by performing a deep scan on the classified papers. The contributions listed in this survey are exhaustive and lists all the state-of-the-art development in this area.	**5. AVAILABLE SOLUTIONS** AS Accurate measuring of water quality using various sensors, make it available in all remote places	Explore AS, differentiate
Focus on PR, tap into BE, understand RC	**2. PROBLEMS / PAINS** PR This article is the first of a series of three related to the challenges that we faced to detect phishing attacks at scale with constraints on accuracy and performance. In this article, we will describe how—starting mainly from the email stream—we identify suspicious links and then fetch the content from the associated webpages.In the next article, we will describe how suspicious webpages are analyzed and assessed in real-time,with a focus on Supervised Learning techniques.	**9. PROBLEM ROOT / CAUSE** RC The water may be contaminated by means of nutrient pollution (Industry), Eutrophication, Algal blooms and so on.	**7. BEHAVIOR** BE Directly related: find better network availability, calculate the quality and quantity of water. Indirectly related: customers spend free time on making awareness of the system to others	Focus on PR, tap into BE, understand RC
Identify strong TR & EM	**3. TRIGGERS TO ACT** TR I have found the following four psychological triggers that ecommerce platforms should adopt to increasecustomer urgency and drive sales:Utilize the personal touch,Encourage loyaltyIncentivize customers. **4. EMOTIONS** EM The output is predicted accurately regarding the contamination of water, so as to avoid consumption of contaminated water by the people	**10. YOUR SOLUTION** SL • We provide a good source to the public and we work based on public review. • The PH level of water isidentified. • Turbidity of water is identified.Conductivity of water is identified and also monitor the presence of chemical substances in water • Monthly report of maintaining the water will bedisplayed.	**8. CHANNELS of BEHAVIOR** CH ONLINE • People and industrialist may provide review and rating for the system. • The software used shouldbe properly studied by everyone to operate it. OFFLINE • Public and industrialist supply funds to develop thesystem and make the system to take a next move. • The hardware setup should be installed properly.	Extract online & offline CH of BE

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 Email Registration through product mobile UI
FR-2	User Confirmation	Confirmation via Email,Confirmation via OTP Confirmation via Message
FR-3	Ph level detection	To monitor the water quality Ph sensor is used and the signals are send to Ardino.
FR-4	Turbidity detection	Turbidity sensor measures the clarity of element or muddiness utter in the water and the signals are send to Arduino.
FR-5	Ultrasonic generator	At regular interval times the waves are generated to clear algae 25%,50%,75%,100%

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 has simple monitoring system and efficient to use.
NFR-2	Security	Mobile application is secured with firewall protection.
NFR-3	Reliability	Real time sensor output values with future predicted data storage. 98% efficient monitoring output. It also gives assurance for aquaculture safety.
NFR-4	Performance	It has greater performance and environmentally safe model.
NFR-5	Availability	In the form of mobile UI 24 x 7 monitoring system.

NFR-6	**Scalability**	Highly Scalable. It is capable to produce a best final output.
NFR-7	**Stability**	The stability is very high
NFR-8	**Efficiency**	It is highly efficient, high mobility and low powered.

5 PROJECT DESIGN

5.1Data 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.
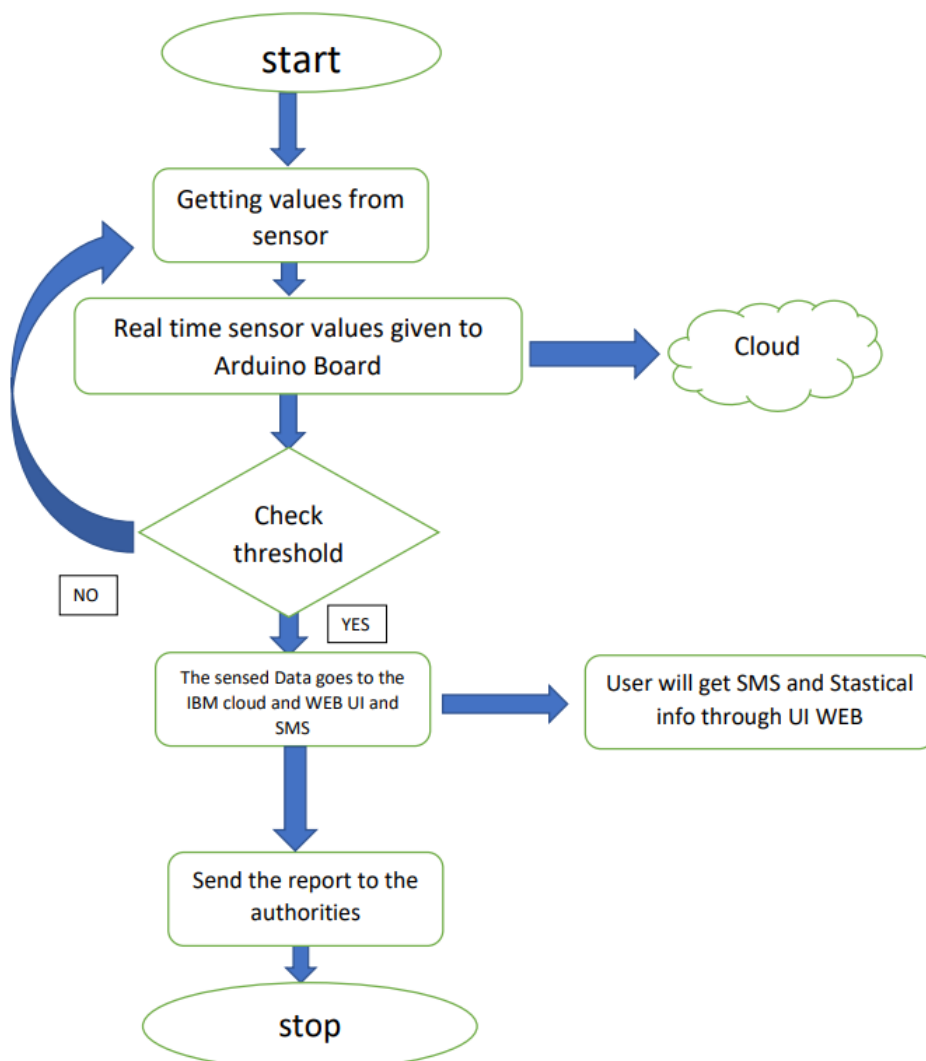
5.2 SOLUTION AND TECHNICAL ARCHITECTURE

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 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	Theclarityandpurity 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.

Use the below template to create product backlog and sprint schedule

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.	3	High	Kiruthika, Reshma, Ranjitha, Sriranjani
Sprint-1	Registration via Facebook	USN-2	As a user, I can register for the application through Facebook	3	High	Kiruthika, Reshma, Sriranjani
Sprint-1	registration via Gmail	USN-3	As a user, I can register for the application through Gmail	2	Medium	Kiruthika, Reshma, Sriranjani
Sprint-2	Confirmation	USN-4	As a user I will receive confirmation email once I have registered for the application	3	High	Kiruthika, Reshma
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	Kiruthika, Reshma,
Sprint-2	IBM cloud service	USN-6	Get access to IBM cloud services	3	High	Kiruthika, Reshma

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Create IBM Watson and device settings	USN-7	To create the IBM Watson IOT platform and Intergrate the microcontroller with it to send sensed data to cloud	3	High	Kiruthika Reshma ranjitha
Sprint-3	Create node red service	USN-8	To create a node red service to integrate the IBM Watson along with Web UI	1	Low	Kiruthika, Reshma, Sriranjani
Sprint-3	Create Web UI	USN-9	To create Web UI to access the data from cloud And display all parameters	3	High	Kiruthika, Reshma, Ranjitha
Sprint-3	To develop a python code	USN-10	Create python code to sense the physical quantity and store data	2	Medium	Kiruthika, Reshma, Ranjitha
Sprint-4	Publish data to cloud	USN-11	Publish data that is sensed by the microcontroller to the cloud	3	High	Kiruthika, Reshma, Sriranjani
Sprint-4	Fast SMS service	USN-12	Use fast SMS to send alert message once the parameters like ph , turbidity and temperature goes beyond the threshold	2	Medium	Kiruthika Reshma
Sprint-4	Testing	USN-13	Testing of project and final deliverables	3	High	Kiruthika Reshma

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	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Date Completed (as on Planned End Date)	Sprint Release (Actual)
Sprint-	10	6 Days	24 Oct 2022	29 Oct 2022	10	29 Oct 2022
1	10	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-	10	6 Days	07 Nov 2022	12 Nov 2022	10	12 Nov 2022
2	10	6 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

Velocity:

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

Burndown Chart:

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies suchas Scrum. However, burn down charts can be applied to any project containing measurable progress over time

Burndown Chart
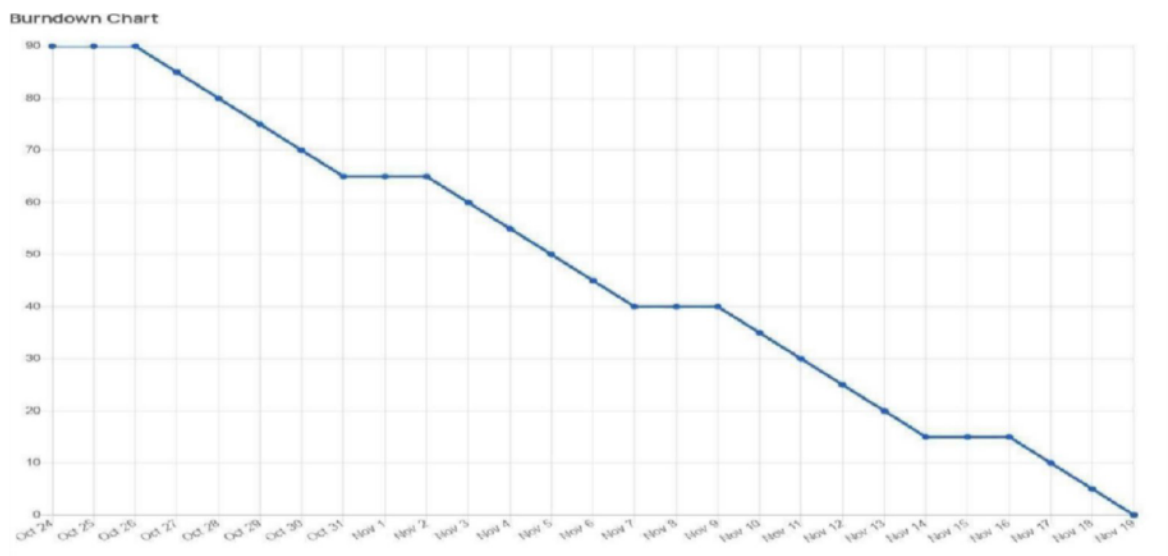
7.CODING AND SOLUTIONING

7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:
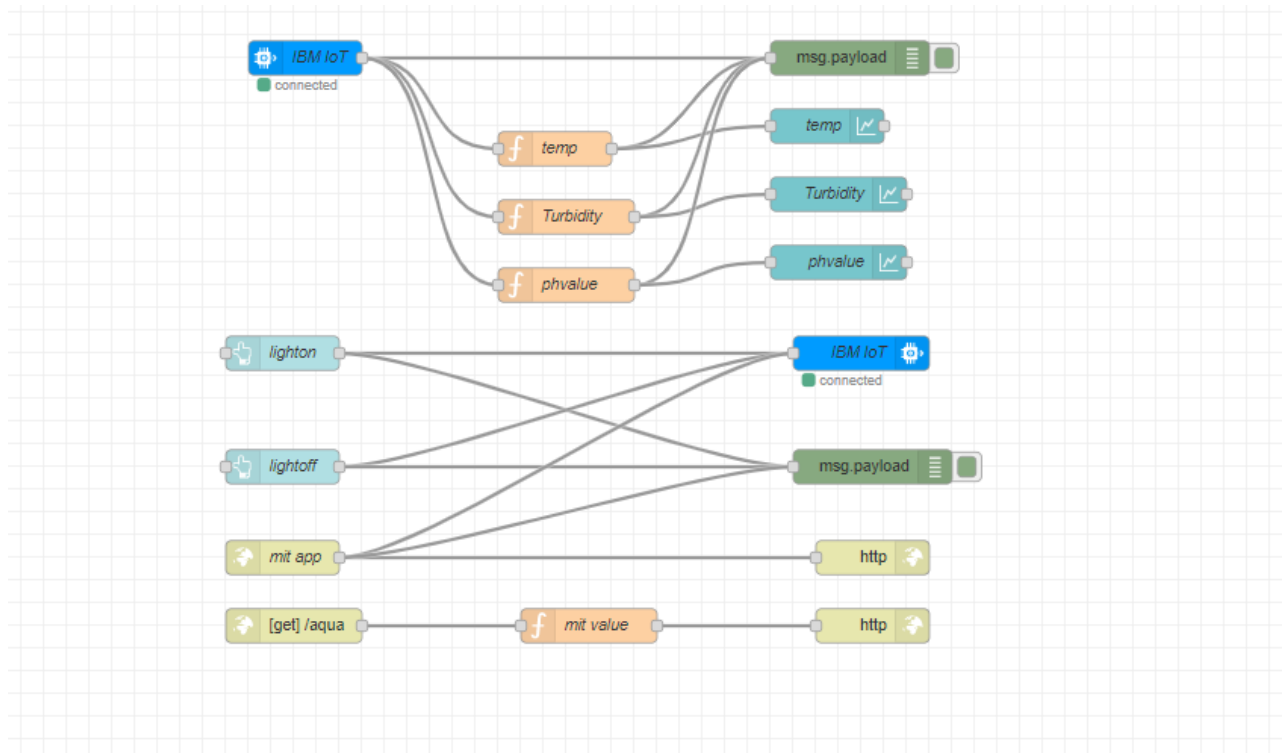
Node red Outputs:

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

Test case id	Feature	Component	Test Scenario	Steps to Execute	Test Data	Actual Result	Status
Login page	Functional	Home page	Verify user is able to see the Given app	1.Download the given APK File 2.Click on download button 3.Verify login popup displayed or not"	APK File	Working as expected	Pass
Login page	Functional	Home page	Verify user is able to see the Login/Signup popup when user open the Aqua Meter	1. Download the given APK File 2.Click on download button 3.Verify login popup displayed or not"	APK File	Working as expected	Pass
Login page	Functional	Home page	Verify the UI elements in Login/Signup popup	1. Download the given APK File 2.Click on download button 3.Verify login popup with below UI elements: A .Username text box A .password text box B .Submit button	APK File	Working as Expected	Pass
Login Page	Functional	Home page	Verify user is able to log into application with Valid credentials	"1 Download the given APK File 2.Click on download button 3.Enter Valid "Given " username in Username text box 4.Enter valid password in password text box 5.Click on Submit button"	Username: Username Password: Password	Working as Expected	Pass
Login Page	Functional	Home page	Verify user is able to see the output	1.output displayed	APKFile	Working as Expected	Pass

9.RESULT

9.1 PERFROMANCE METRICS :

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
				NFT - Risk Assessment					
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

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


#Provide your IBM Watson Device
Credentials
organization = "uo60re"
```

```python
    deviceType = "KIRUTHI"
    deviceId = "1234"
    authMethod = "token"
    authToken = "12345678"


    # Initialize GPIO



    def myCommandCallback(cmd):
        print("Command received: %s" %
cmd.data['command'])
        status=cmd.data['command']
        if status=="lighton":
            print ("led is on")
        else:
            print ("led is off")
        #print(cmd)




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

    except Exception as e:
        print("Caught exception
connecting device: %s" % str(e))
        sys.exit()
```

```python
    # Connect and send a datapoint
"hello" with value "world" into the cloud
as an event of type "greeting" 10 times
    deviceCli.connect()

    while True:
        #Get Sensor Data from DHT11

        temp=random.randint(60,100)

Turbidity=random.randint(0,100)
        phvalue=random.randint(2,14)

        data = { 'temp' : temp,
'Turbidity': Turbidity,'phvalue': phvalue}
        #print data
        def myOnPublishCallback():
            print ("Published temp = %s
'C" % temp, "Turbidity = %s %%" %
Turbidity,"phvalue = %s %%" % phvalue,
"to IBM Watson")

        success =
deviceCli.publishEvent("IoTSensor",
"json", data, qos=0,
on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to
IoTF")
        time.sleep(10)

        deviceCli.commandCallback =
myCommandCallback
```

29

Disconnect the device and

application from the cloud

deviceCli.disconnect()

OUTPUT

MOBILE APP:

13.2 GIT-HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-44803-1660726891

PROJECT DEMO LINK:
1. https://node-red-cwixp-2022-11-15.au-
   syd.mybluemix.net/red/#flow/8e0119092bed0c6e

2. https://youtu.be/m92WyLjxO5A