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-NALAIYATHIRAN 2022

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PROJECT GUIDES

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COIMBATORE-641 013

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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

S. NO	TITLE	TECHNOLOGY	ADVANTAGES	DRAWBACKS
1	Design And Development Of A Water Quality Monitoring System By Using IOT	This system checks the quality of water in real time through various sensors (one for each parameter ,Ph, Temp, Pollution)and uses with module to transfer the data collected from sensor to smart Phone/Pc	This system consists of multiple sensors to measure a various parameter. It is more accuracy and requires less man power.	This method consumes more time and cost of the system depends on the number of parameter
2	Water Quality Monitoring System Using IOT And Machine Learning	To measure various chemical and physical properties of water like temperature and particle density of water using sensor	Due to automation it will reduce the time to check the parameter. This is economically affordable for common people. Accuracy in measurement. Email alert is sent to user	System hardware need to be handled with care. Only limited user are added to handle the system. Only one person authorized to system able to access it.
3	Real-Time Water Quality Monitoring System	Existing method, the system which are semi-automated or manually controlled device which are handle by the person responsible of monitoring the water quality	Based on the existing water quality monitoring system and scenario of water stay that proposed system is more suitable to monitor the water.	These analysis can be performed by human intervention which are specific period only.
4	Cloud-Based Smart Water Quality Monitoring System Using IOT Sensors And Machine Learning	The advancement of technologies also plays major role to monitor water quality remotely on the large scale. Nikhil implemented the Azure cloud platform based water quality monitoring system using Node MCU microcontroller to collect the data from the sensor in Jason format	First phase we are going to conduct a survey on the recent water monitoring system and in second phase for development of the cloud-based water quality monitoring framework which checks the water nature of groundwater which is overhead	These sensor are deployed inside the tank to read parameters associated with the quality and the level of water inside the water tank
5	IOT Based Real-Time River Water Quality Monitoring System	Environmental consist of five keywords example soil, water, climate, natural vegetation and landforms. It's using different sensor and various parameter from water.	It can detect forest fire, early earthquake, reduce air pollution, monitoring snow level , prevent landslide.	It develop only water quality monitoring system based on GPRS/GSM. It required more cost.

6	River Water Monitoring System Using Internet Of Things To Determine The Location Of River Pollution	This system uses monitoring points like web based application sent the notification when there is a change in parameter and the process the incoming data then do calculation and produce the classification of status	This system uses many sensor for more parameter and is real time encryption decryption flow in this algorithm.	This system connects through so the wifi connectivity Is narrow and consumes more power and less accuracy.
7	Water Quality Monitoring System Using Arduino UNO	In this techniques, we propose a development and extension of real time water computing structure using IOT parameters and through wifi the data been transferred.	This system attach the consistency and possibility of using for real time monitoring the parameters and exclusive and cost efficient	WIFI connectivity is narrow and not more accuracy.
8	Water Quality Monitoring System Using IOT And Machine Learning	To measure various physical and chemical properties of water sensors have using send the data connects is node MCU, since the data and send to cloud based database using wired/wireless channel.	Due to automation is reduce time to check prevention from diseases and more accuracy	System hardware need to be handled with care (as we are using difference sensors and node MCU).Only limited users are added.
9	IOT Technology For Smart Water System	This techniques is one of the conventional methods of analyzing the water quality using IOT technology	This provides high recurs to the data and device used. It also help to treat the waste water	As more techniques are blooming has to improve its techniques and it requires lot of cost.
10	Real- Time River Water Quality Monitoring And Control System	Current water quality monitoring system with a monotonous process and is very time consuming. The Wireless Sensor Network(WSN)include a microcontroller for processing the system.	This system is used to collect the data and can displayed in visual format on the sever Pc with help of spark streaming analysis through Spark MLib.	In these requires more data. Sometimes acquires network problem.

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. 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).

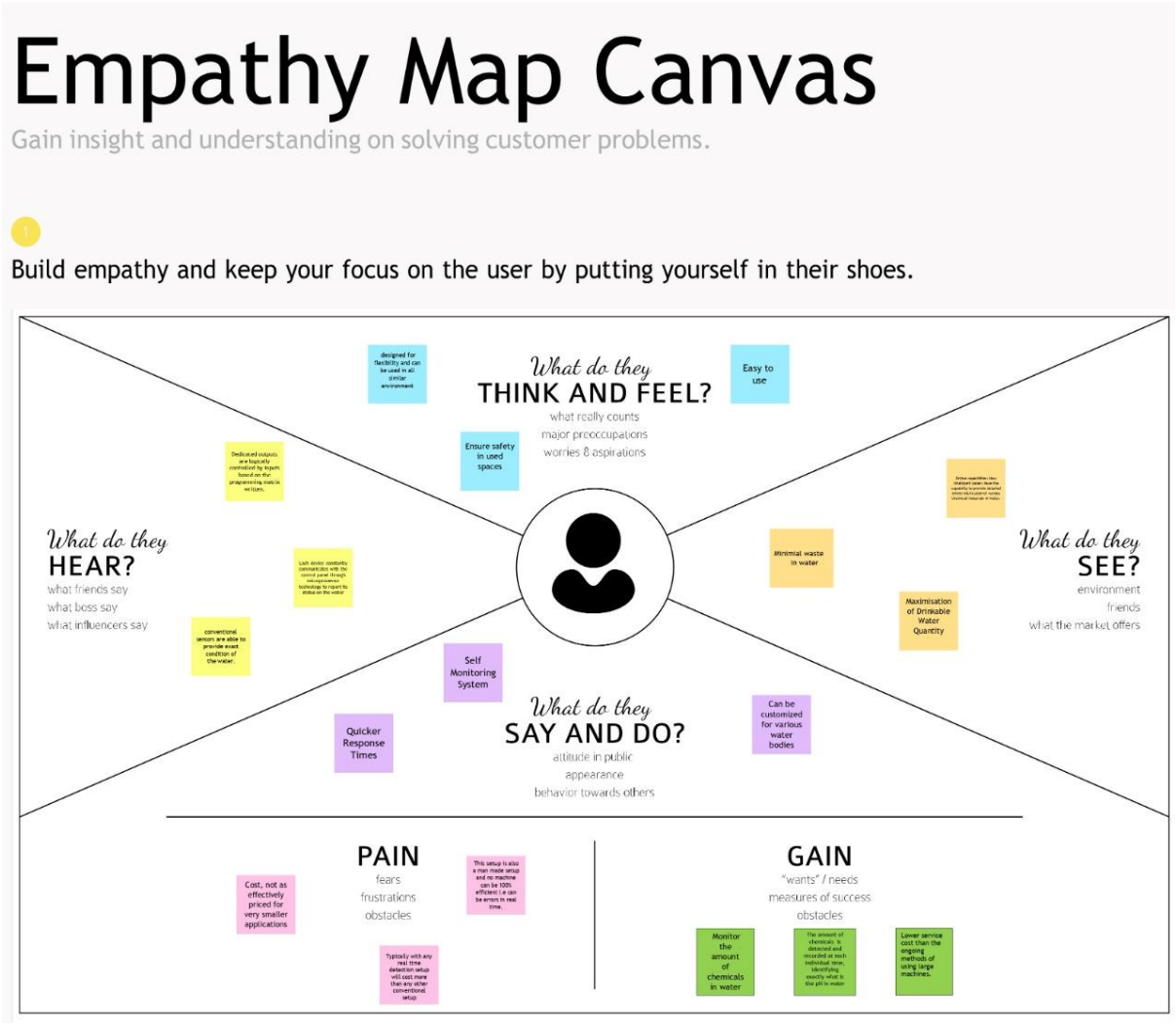
2.3 Problem Statement:

Due to the fast growing urbanization supply of safe drinking water is a challenge for the every city authority. Water can be polluted any time. • So the water we reserved in the water tank at our roof top or basement in our society or apartment may not be safe. Still in India most of the people use simple water purifier that is not enough to get surety of pure water. The traditional water quality monitoring system has certain drawbacks. • Sometimes the water has dangerous particles or chemical mixed and general purpose water purifier cannot purify that. It relies on collecting of water samples, testing and analyses in laboratories and it’s impossible to check the quality of water manually in every time. • It results in more cost, more man power and more time. Also, it lacks capability for real-time data collections. So an automatic real-time monitoring system is required to monitor the health of the water reserved in our water tank of the society or apartment. So it can warn us automatically if there is any problem with the reserved water. And we can check the quality of the water anytime and from anywhere. By keeping this mind we designed this system especially for residential areas.

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 conepts even if you're not sitting in the same room.

Template

Brainstorm & idea prioritization

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.

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

Share template feedback

Need some inspiration?
See a finished version of this template to kickstart your work.

Open example →

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

Real-time river water quality monitoring and control system

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Defer judgment.
- Go for volume.
- Encourage wild ideas.
- Listen to others.
- If possible, be visual.

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!

GOWTHAM R | GOWTHAM S | ARUNVIKRAM AR | ARUNPRASHATH K

Person 5 | Person 6 | Person 7 | Person 8

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

A **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B **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

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

A **Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B **Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.

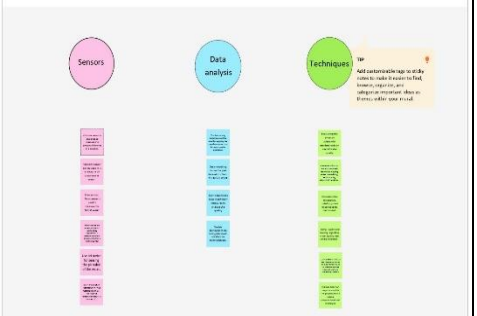
Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

3 Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, 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



3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Due to population growth,urbanization,and climatic change,competition for water resources is expected to increase,with a particular impact on agriculture,river water.
2.	Idea / Solution description	To monitor the water supply we implement IoT (Internet of Things)setup, for river water quality monitoring systems periodically checks,dust particles,temperature and PH level by sensors and notifies for public when the water quality vaires.
3.	Novelty / Uniqueness	We use water detection sensor has unique advantage.It consumes less time to monitor than a manual method for checking polluted levels,and notifies immediately to reduce affected rate of pollution in water.
4.	Social Impact / Customer Satisfaction	People who are living in rural areas near to the river will be very satisfied with our idea.It will be useful to monitor water pollution in specific area.So this system prevent people from water pollution.It will be used for farming purpose to check quality water,temperature and PH level.Our Impact of this project is also create a social satisfaction for farmers too.
5.	Business Model (Revenue Model)	It costs low compared to other model.Our real time quality monitoring model has sensors easily helps to monitor and predict the affected water scale easily in farming, drinking water,aquaculture,and other industries.It notifies by sending directly to the corporation and they can further notify the people to aware immediately.Quick actions can be taken.With the help of efficient use of mobile network,IoT and continuous monitoring it will be revolutionized model.

6.	Scalability of the Solution	Checking the river water quality for providing clean drinking water for the people, farming, promoting aquaculture, and other industries. It is the best replacement for checking water quality in laboratories and it is user-friendly.If we add more advanced sensors in future it can be used to monitor multiple levels in water.It will show continuous real time values in maintaining the quality of water.

3.4 PROBLEM SOLUTION:

PROBLEM SOLUTION FIT DOCUMENT

Purpose/Vision

DefineCS,fitintoCC

1.CUSTOMER SEGMENT(S)

Farmers, Government authorities and Drinking Water supplier

6.CUSTOMER CONSTRAINTS

River water quality analysis replaces the need for using laboratory checking and reduces the time of delay required for result. The give instant solutions and suggestions like what it is and what can be done to change.

5.AVAILABLE SOLUTIONS

This work presents the architecture of river water monitoring systems based on contemporary IoT communication technology, AI, and Wireless Networks.

AI-based IoT applications to boost and save time for results and suggestions to the problems.

ExploreAS,differentiate

Focus on J&P,tapintoBE,understandRC

2.JOBS-TO-BE-DONE / PROBLEMS

- Check the water quality
- Check the level of chlorine in water.
- Check type of water
- Find if the water is suitable for aquaculture

9.PROBLEM ROOT CAUSE

Root Cause Analysis supported by input from the problems-sufferers, instruction manual studies, comparing design and actual operating data, gathering know how from relevant literature, tech journals articles and advertisements especially on new products.

7.BEHAVIOUR

Understand this decision-making process, the study attempts to assess river water monitoring technology model based on available resources, prevailing social and economic conditions and personal aspects of users India.

Focus on J&P,tapintoBE,understandRC

3.TRI

IdentifystrongTR&EM

3.TRIGGERS

River water quality analysis work by providing essential nutrients for the development of farming and other industries.

It is a best replacement for checking water quality in laboratories. The best quality is that it is user friendly.

4.EMOTIONS: BEFORE /AFTER

Without river water quality analysis it was difficult for farmers, industrialists and many more to analyze the quality of water for their purpose. After river water quality analysis, the process is made much simpler and easy to use.

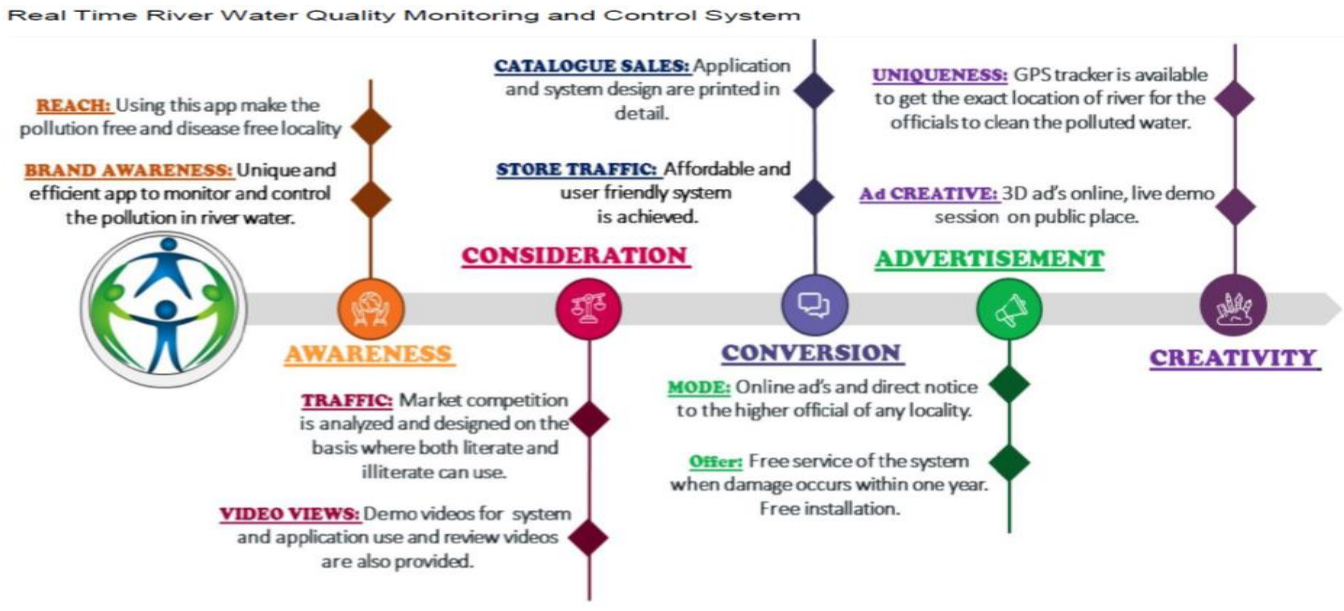
10. YOUR SOLUTION

- Implement IOT based river quality monitoring system to get instant results.
- Suggestions can be made to solve if any problem araises.

8.CHANNELS of BEHAVIOURS

Online portal for making recommendations for problems based on PH parameters using Machine Learning.

ExtractonlineA&offlineChoiBE



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	Users Authorization levels	Complete mapping are given in a hierarchical manner in order to show only the specific Data.
FR-2	Historical Data	The Data are stored in the cloud from the beginningStage till the Updation .
FR-3	User Authentication	The credentials is accessible only to the authorizedusers to access the model.
FR-4	Users rules and laws	There is some specific guidelines which has to be followed by the users.

4.2 *Non-functional Requirements:*

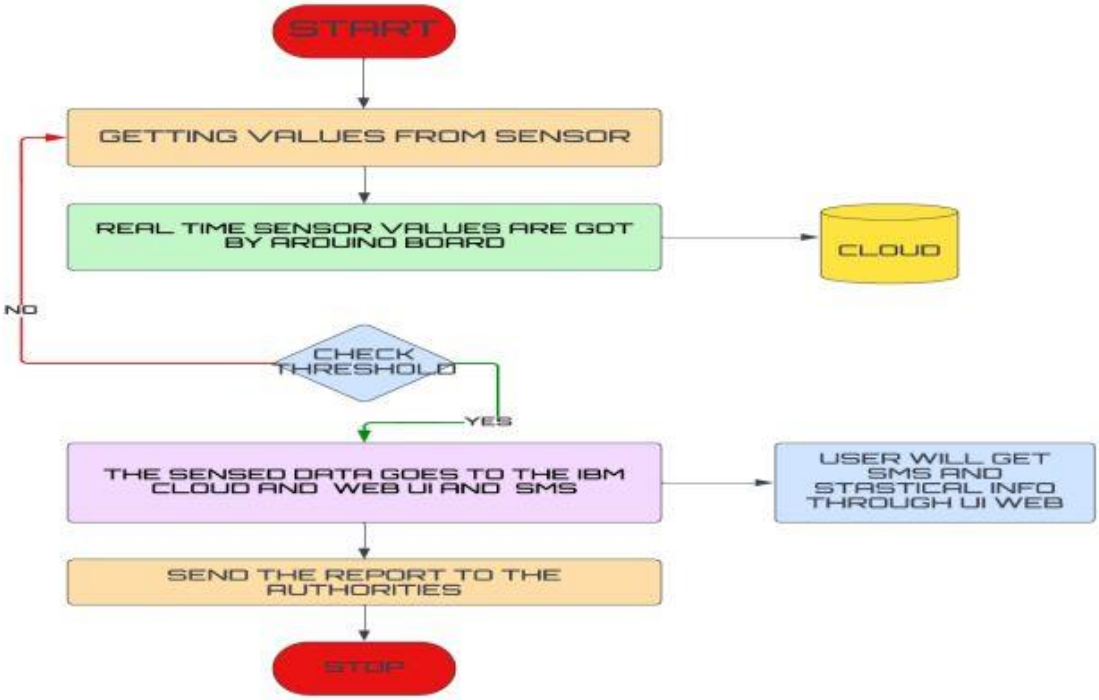
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The Final data should be easily understandable.
NFR-2	**Security**	The model are designed in a secured manner inorder to maintain the privacy
NFR-3	**Reliability**	Even if there is a firmware issues (failures) the last updated Data's are stored in a Defaultmanner.
NFR-4	**Performance**	High quality sensors are used to ease the customer's work.
NFR-5	**Availability**	The model are designed in such a way that are available ,usable and can be modified anytime.
NFR-6	**Scalability**	The System are Scaled according to the size ofthe water body (varies)

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 watermonitoring 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 ofriver 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, social impact, scalability of solution, etc.	28 OCTOBER 2022
Problem Solution Fit	Prepared problem - solution fit document.	30 OCTOBER 2022

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	5
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	5

Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	2
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	3

6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

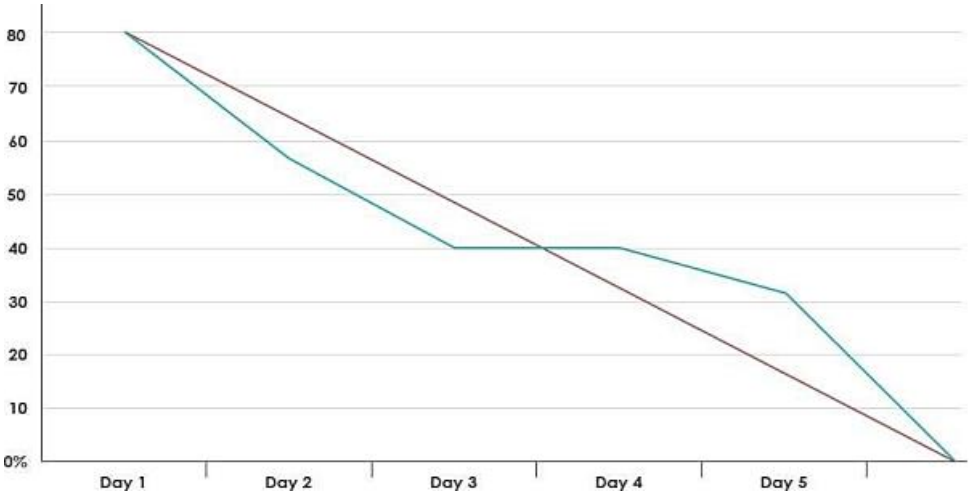
Project Tracker, Velocity & Burndown Charts

Velocity:

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

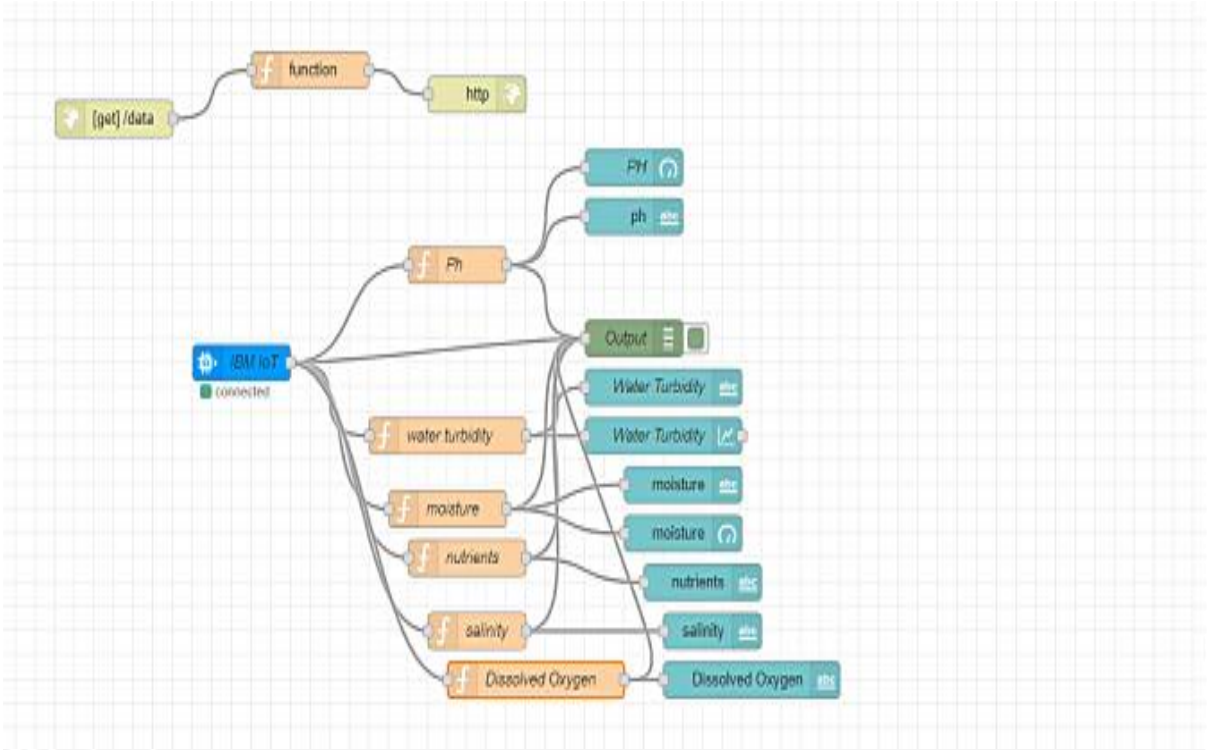
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022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

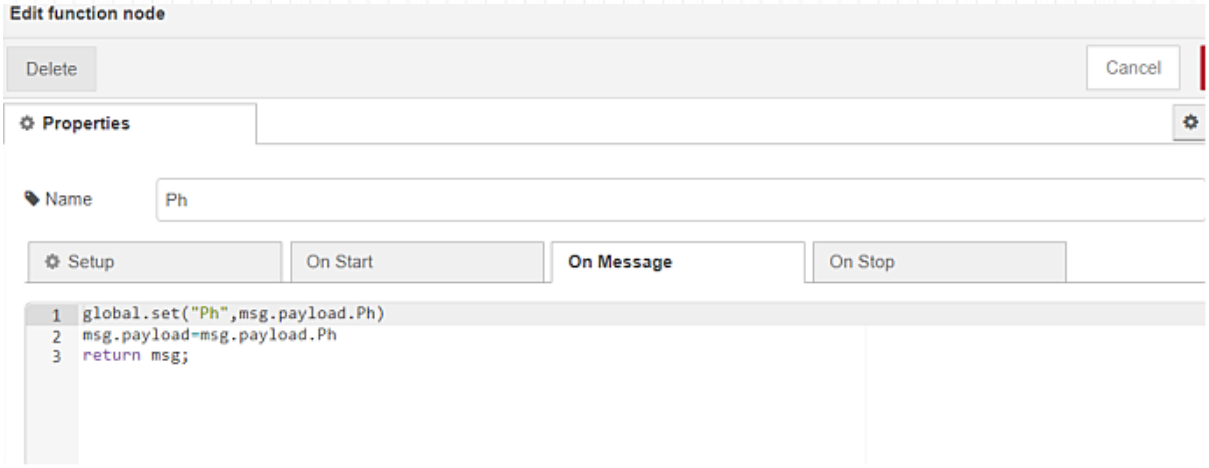
Burndown Chart:



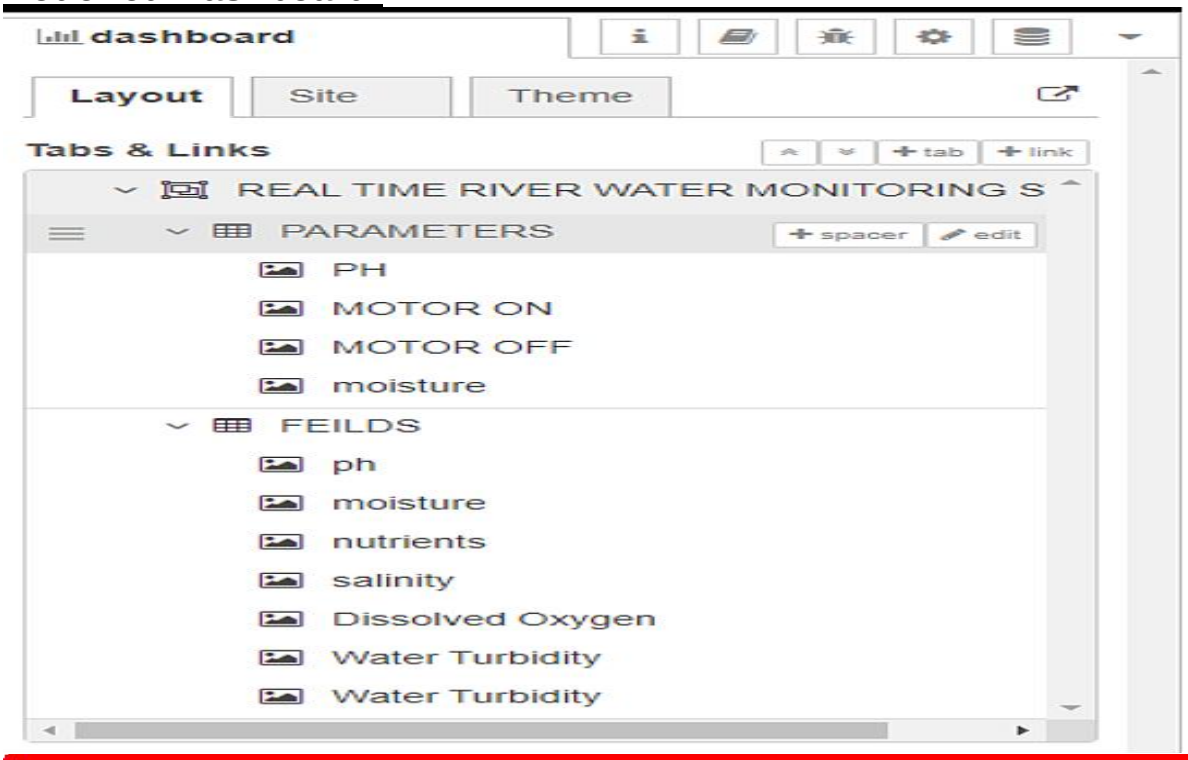
7.CODING AND SOLUTIONING

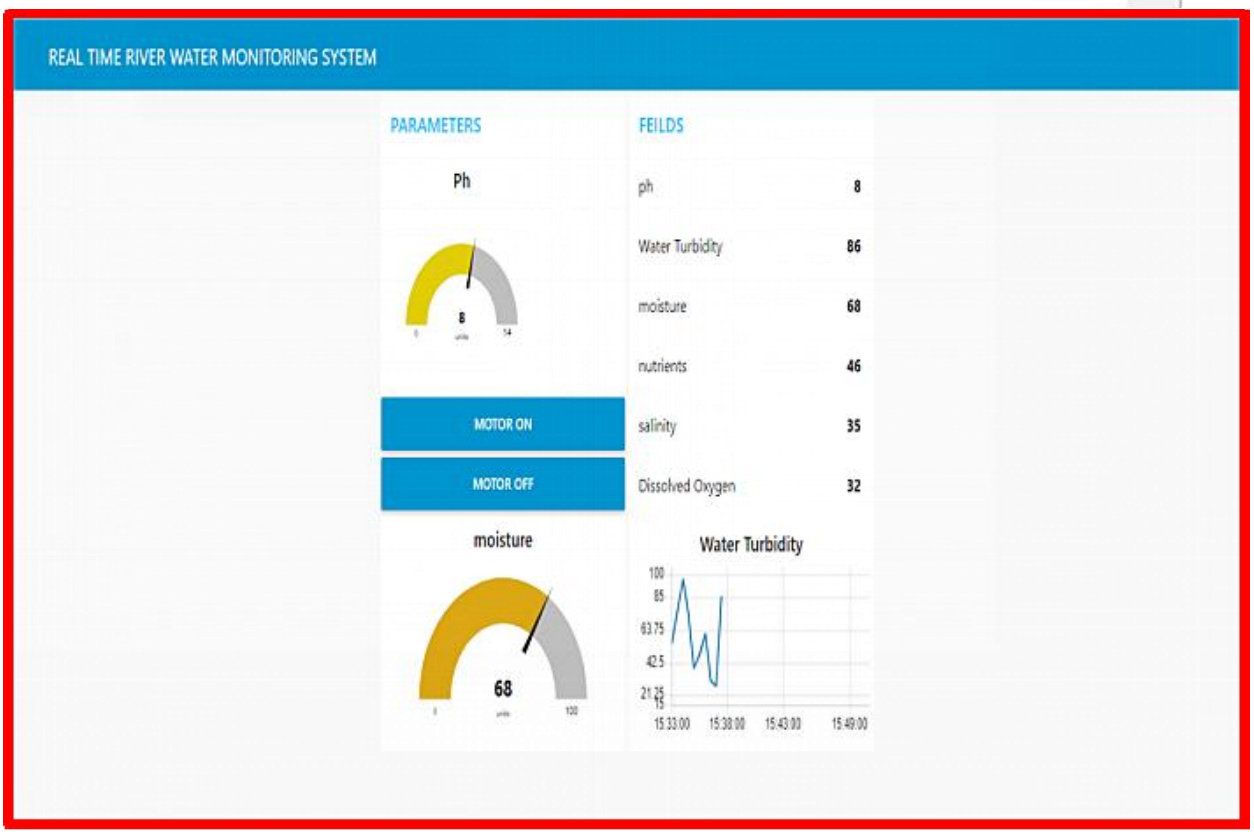
7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:





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.

12.FUTURE SCOPE

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

13.APPENDIX

13.1 SOURCE CODE:

PYTHON CODE TO PUBLISH DATA

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



# Provide your IBM Watson Device Credentials

organization = "nqat1y"  # repalce it with organization ID
deviceType = "NodeMCU"  # replace it with device type
deviceId = "501238"  # repalce with device id
authMethod = "token"
authToken = "10571213"  # repalce with token



def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
```

```
    status=cmd.data['command']
    if status == 'lighton':
        print("LIGHT ON")
    elif status == 'lightoff':
        print("LIGHT OFF")
    else:
        print ("please send proper command")



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

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

deviceCli.connect()

while True:
    pH = random.randint(0,100)
    conductivity = random.randint(0,100)
    T = random.randint(0,100)
    oxygen = random.randint(0,100)
    turbidity = random.randint(0,100)
    # Send Temperature & Humidity to IBM Watson
    data = {'T': T,'pH':pH,'conductivity':conductivity,'oxygen':oxygen,"turbidity":turbidity}



    # print data
    def myOnPublishCallback():
        print("Published data",data, "to IBM Watson")
```

```
    success = deviceCli.publishEvent("event", "json", data, 0, myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(5)

    deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
```

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
```

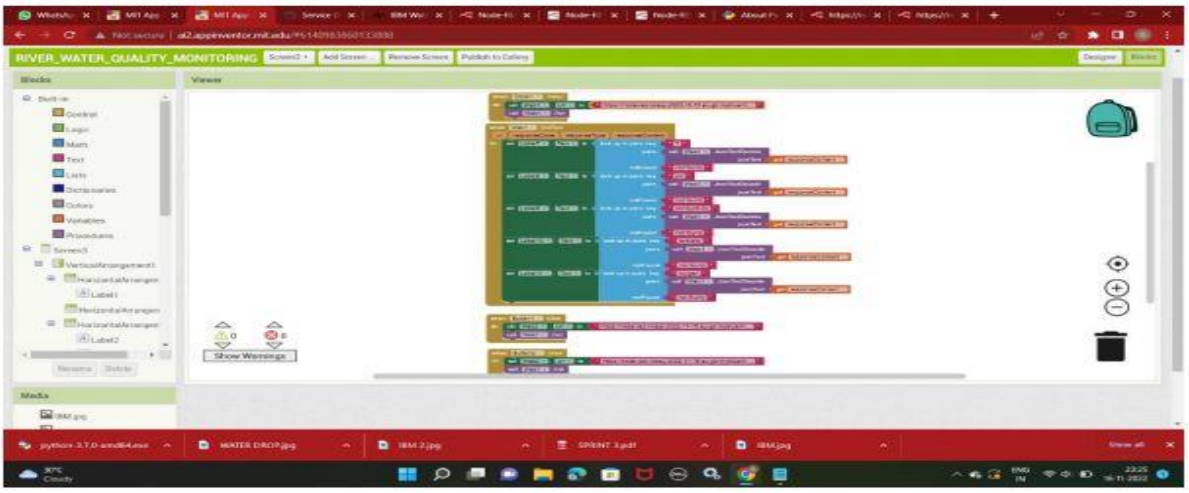
Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
12345	Connected	abcd	Device	Nov 9, 2022 9:43 PM	

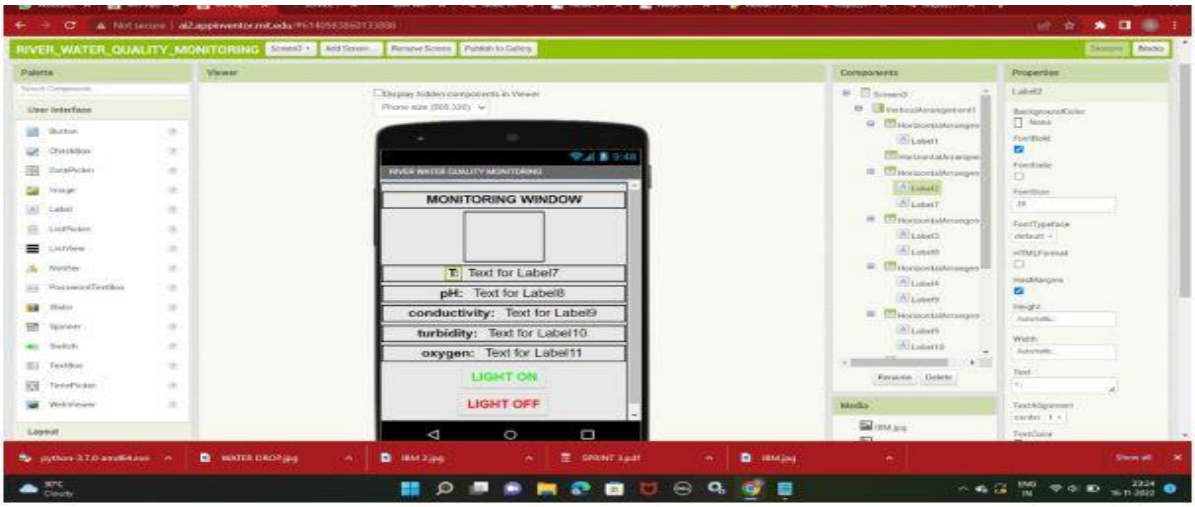
Identity | Device Information | Recent Events | State | Logs

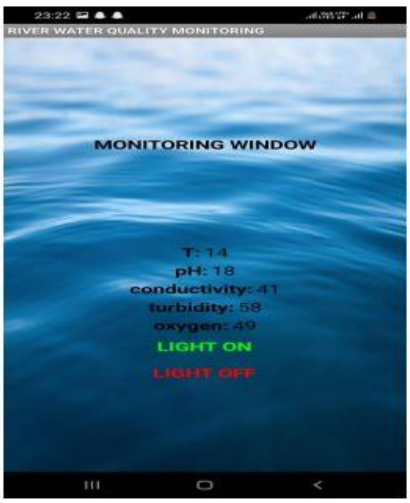
The recent events listed show the live stream of data that is coming and going from this device.

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

MOBILE APP







13.2 GIT-HUB LINK:
https://github.com/IBM-EPBL/IBM-Project-7136-1658848242

YOUTUBE LINK(EXPLANATION VIDEO LINK):
https://youtu.be/OMlxVLz0cO0