REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

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FROM

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (AUTONOMOUS)

In fulfillment of project in IBM-NALAYATHIRAN 2022

Team Id: PNT2022TMID23797

PROJECT GUIDES

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1.INTRODUCTION

1.1.PROJECT OVERVIEW:

For all people, river water that is utilised for drinking is a very valuable resource. Multiple sensors make up the system, which is used to measure the physical and chemical characteristics of water. It is possible to measure the water's characteristics, including its temperature, pH, and dissolved oxygen. Anyone in the world can use this technology to find pollution in a body of water. The current technique for monitoring water quality is manual, has a tedious process, and takes a long time. In this study, a sensor-based system for monitoring water quality is proposed. A microcontroller for system processing, a communication system for inter and intra node communication, and a number of sensors are the core elements of a wireless sensor network (WSN). Remote monitoring and Internet of Things (IoT) technology can be used to access real-time data. Data gathered at the IBM cloud server are verified before being used to launch operations.

1.1. PURPOSE:

Chemical, physical, biological, and radiological aspects of water are referred to as its quality. It measures how well the water is functioning in relation to the needs of one or more biological species and/or any human needs or goals. Monitoring the state of a water body as well as sampling and analysing the water in a lake, stream, ocean, or river falls within the definition of water quality. Real-time monitoring and analysis of water are used in smart water quality monitoring to spot changes in parameters based on their physical, chemical, and biological properties. Clearly, it is crucial to keep an eye on the water quality in our seas, our rivers for businesses and the general people, both above ground and at our ports.

It enables us to evaluate how they are altering, examine patterns, and inform plans and strategies that enhance the quality of water and guarantee that water is used for its intended purpose. Water quality is determined by a number of factors. These consist of pH scale, water temperature, dissolved oxygen, turbidity, bio

indicators, and nitrates. Monitoring the quality of the water makes it easier to pinpoint particular contaminants, a particular chemical, and the source of the contamination. Agricultural activities (such as the use of pesticides and fertilizer), oil pollution, river and marine dumping, port, shipping, and industrial activity are a few of the numerous sources of water pollution. Other sources include sewage effluent and agricultural practices. Regular water quality assessments and monitoring help to identify problems as they arise and the data behind them.

- Data collection, interpretation, and use are crucial for creating a good and practical water quality strategy. However, the creation of plans will be hampered and the influence on pollution management would be constrained in the lack of real-time data. The answer to this problem is to collect and handle data using digital systems and programs.
- On land and at sea, monitoring water quality is a problem and a concern on a global scale. The European Green Deal publishes many directives to establish standards of water quality and lays forth objectives for restoring biological variety and lowering water pollution within the European Union. Additionally, distinct legislative frameworks in each nation state, such as France, mandate effective water quality monitoring.
- The Environmental Protection Agency (EPA) in the US enforces laws to combat water contamination in every state. Countries all around the world are becoming more aware of the significance of efficient water quality monitoring metrics and techniques.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Competition for water resources is anticipated to increase as a result of population expansion, urbanisation, and climate change, with an impact on agriculture and river water in particular. Water will be suitable for swimming pools, monitoring compound spillage identification in rivers, and potable water use. It contains independent hubs that collaborate with the cloud to maintain water control. The parameters affecting the quality of river-water need to be analysed and used for water treatment purposes because river water needs to be treated before it can be used in agricultural fields.

2.2 REFERENCES:

[1] B. Chen, Y. Song, T. Jiang, Z. Chen, B. Huang, and B. Xu, **"Real-time estimation of population exposure to PM2.5 using mobile- and station-based big data,"** Int J Environ Res Public Health, vol. 15, Mar 23 2018.

[2] B. Paul, **"Sensor based water quality monitoring system,"** BRAC University, 2018.

[3] K. Andersson and M. S. Hossain, **"Smart Risk Assessment Systems using Belief-rule-based DSS and WSN Technologies",** in 2014 4th International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace and Electronic Systems, VITAE 2014 : Co-located with Global Wireless Summit, Aalborg, Denmark 11-14 May 2014, 2014.

[4] S. Thombre, R. U. Islam, K. Andersson, and M. S. Hossain, **"IP based Wireless Sensor Networks : performance Analysis using Simulations and Experiments",** J ournal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, vol. 7, no. 3, pp. 53–76, 2016.

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Computer Communications Workshops (INFOCOM WKSHPS) : 6th IEEE INFOCOM International Workshop on Mobility Management in the Networks of the Future World, 2015, pp. 133–137.

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[7] M. Z. Abedin, A. S. Chowdhury, M. S. Hossain, K. Andersson, and R. Karim, **"An Interoperable IP based WSN for Smart Irrigation Systems"**, presented at the 14th Annual IEEE Consumer Communications & Networking Conference, Las Vegas, 8-11 January 2017, 2017.

[8] M. Z. Abedin, S. Paul, S. Akhter, K. N. E. A. Siddiquee, M. S. Hossain, and K. Andersson, **"Selection of Energy Efficient Routing Protocol for Irrigation Enabled by Wireless Sensor Networks"**, in Proceedings of 2017 IEEE 42nd Conference on Local Computer Networks Workshops, 2017, pp. 75–81.

[9] R. Ul Islam, K. Andersson, and M. S. Hossain, **"Heterogeneous Wireless Sensor Networks Using CoAP and SMS to Predict Natural Disasters"**, in Proceeding of the 2017 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS) : The 8th IEEE INFOCOM International Workshop on

Mobility Management in the Networks of the Future World (MobiWorld'17), 2017, pp. 30–35.

[10] K. N. E. A. Siddiquee, F. F. Khan, K. Andersson, and M. S. Hossain**, "Optimal Dynamic Routing Protocols for Agro-Sensor Communication in MANETs"**, in Proceedings of the 14th Annual IEEE Consumer Communications & Networking Conference, Las Vegas, 8-11 January 2017.

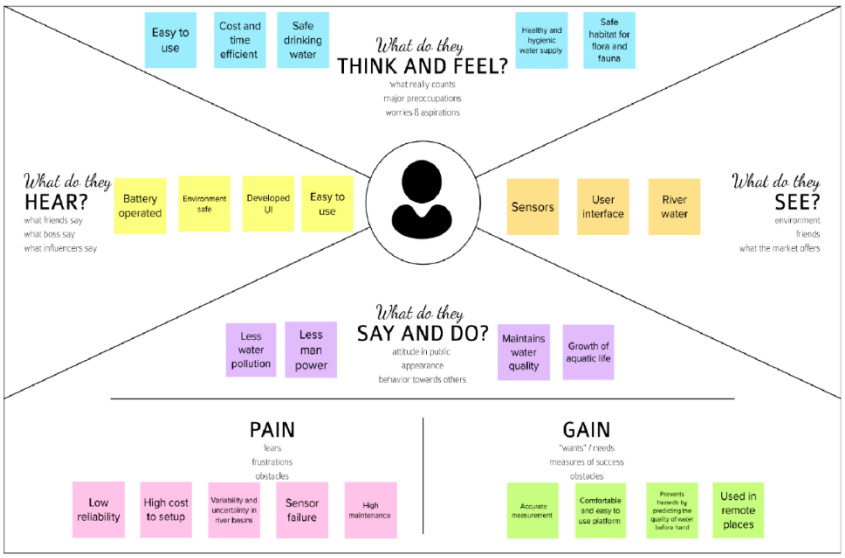
2.3 PROBLEM STATEMENT DEFINITION:

Vegetation and health may be impacted by control efforts to reduce river water pollution and monitor its properties. The Real-time study of River Water Indicators (Ph,temperature,turbidity,etc..,)

3.IDEATION & PROPOSED SOLUTION

3.1.EMPATHY MAP CANVAS:

An empathy map is a straightforward, simple-to-understand picture that summarises information about a user's actions and views. It is a helpful tool that enables teams to comprehend their users more fully. It's important to comprehend both the actual issue and the individual who is experiencing it in order to develop a workable solution. Participants learn to think about situations from the user's perspective, including goals and problems, through the exercise of constructing the map.



Reference:
https://app.mural.co/t/ibmproject03356/m/ibmproject03356/1666334837786/d712caafe65eb155446f32d545a3b96773f502ed?sender=u95165d403918b035b1630115

3.2 . IDEATION & BRAINSTORMING:

During a brainstorming session, everyone on a team is encouraged to engage in the process of original thought that results in problem solving. Volume over quality is prioritised, unconventional ideas are welcomed and developed upon, and everyone is urged to participate in order to produce a wealth of original solutions.Utilize this template for your team's brainstorming meetings so they may use their imaginations and begin developing concepts even if they are not in the same room as you.

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

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.

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

Open article

REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

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

OUR AIM IS TO MONITOR THE QUALITY OF RIVER WATER AND TAKE NECESSARY STEPS TO PREVENT THE AGENTS WHICH DEGRADE THE QUALITY. THE WATER IS MOSTLY AFFECTED BY INDUSTRIAL POLLUTION. THE PROBLEM CAN BE SOLVED BY REDUCING THE pH VALUE BY USING SMART SENSOR

Key rules of brainstorming

To run an smooth and productive session

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

Need some inspiration?

See a finished version of this template to kickstart your work.

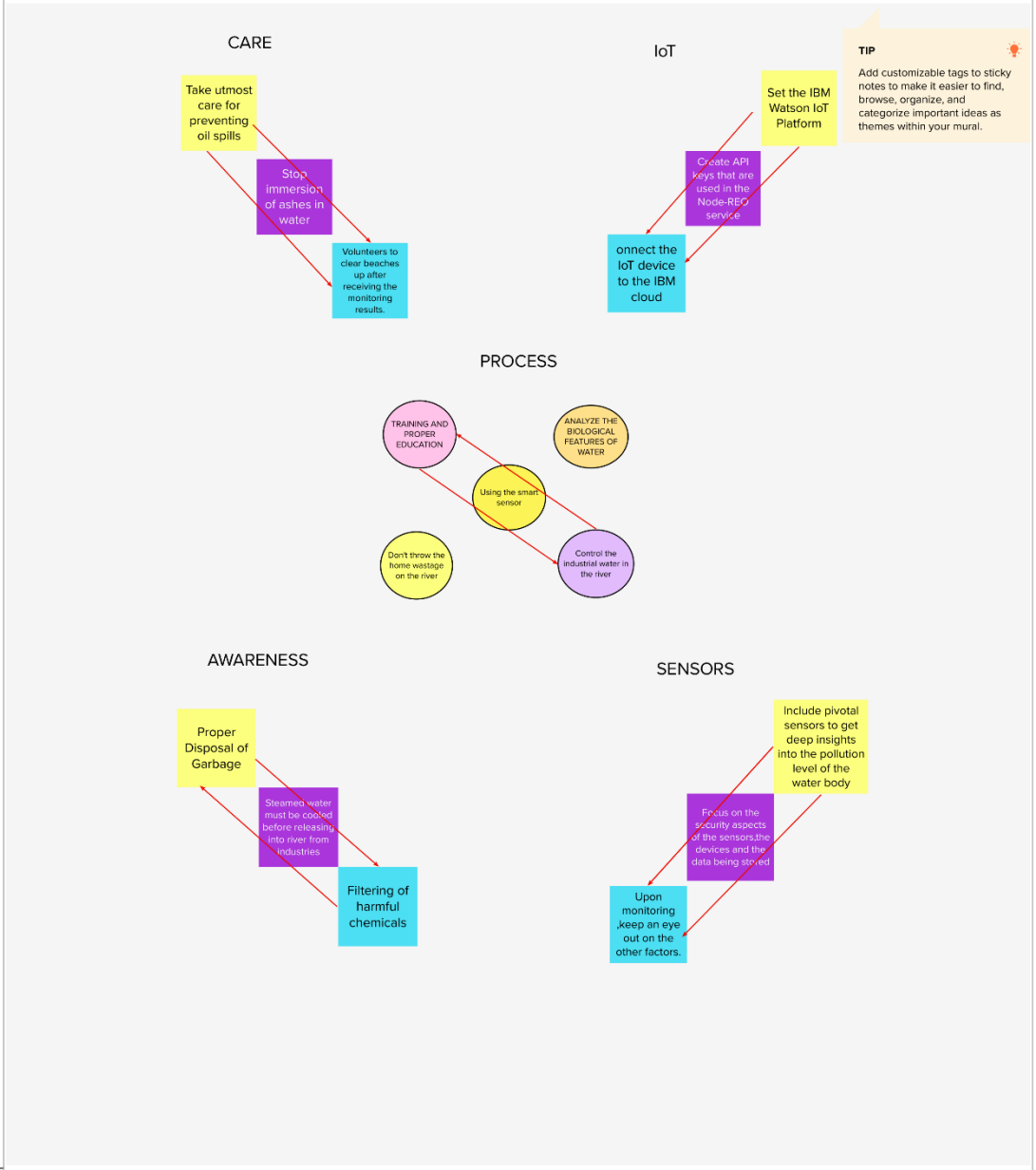
Open example

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

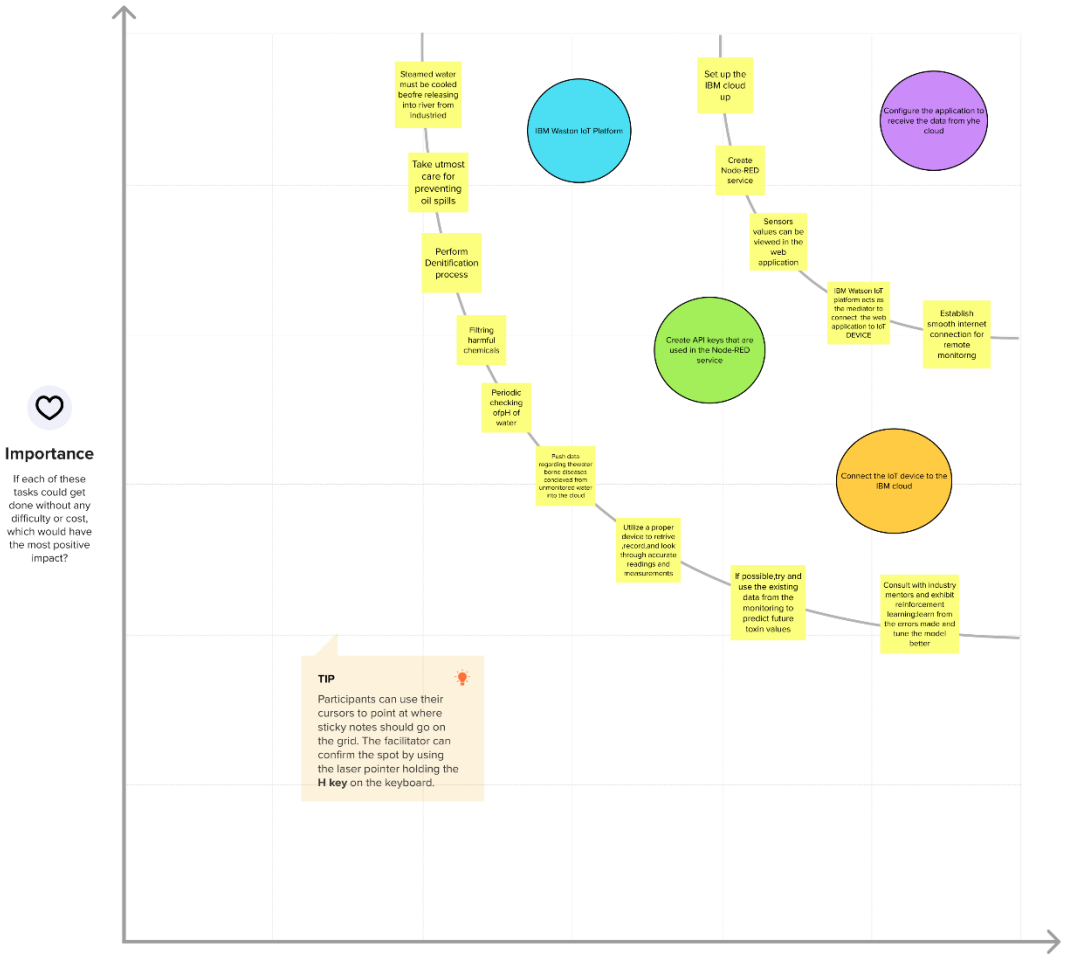


4

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



Importance

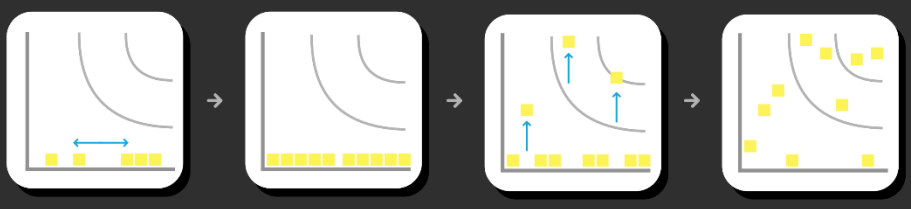
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)



3.3 PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	IOT Based Real Time River Water Quality Monitoring and Control System
2.	Idea / Solution description	1. To monitor the quality of water using sensors like temperature, potentiometer(pH), turbidity, salinity and so on. 2. Collecting those data and storing it in cloud and perform analyse to check if the water is contaminated or not for drinking. 3. If the water is contaminated an alert is made to the user/ local authority through SMS or can be viewed through web application anytime.
3.	Novelty / Uniqueness	1. Based on the collected data prediction is made whether the water can be used for cultivation of specific crops and suitable for the aquatic animals.
4.	Social Impact / Customer Satisfaction	Algal growth, fertilizers, pesticides cause river pollution which can impact all living beings. Better monitoring and control measures can impact health and vegetation massively.
5.	Business Model (Revenue Model)	Service based product is developed to serve the local people to know the quality of water before consuming it or using it for any purpose. This prevents health issues or at most loss of living being.
6.	Scalability of the Solution	Developing the product as both web and mobile application it is portable, and data can be accessed from anywhere anytime. provide a real-time monitoring and a feasible solution for remote or distant places where water quality laboratory is not present.

3.4.PROBLEM SOLUTION:

Real Time Water Quality Management and Control System **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMID23797

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Common people are our customers because, nowadays every common people need to know the quality of the water they drink and basically, we are targeting the people whose age is above 18 years because they clearly know about the technologies we applied.

6. CUSTOMER CONSTRAINTS CC

Network availability and available device are the biggest issue face by the customers and need to spend a time to get daily update, it may high budget for some people. The resources in terms of financial as well as manpower are inadequate.

5. AVAILABLE SOLUTIONS

- The temperature of water can be monitored.
- The PH level of water is identified.
- Amount of oxygen dissolved in water.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEM J&P

In society people had to know the Quality of water, in conventional method it is impossible to inform people, and this leads to many problems like disease. Here we apply new technologies and trends to aware people. This project helps more graduate to work with it.

9. PROBLEM ROOT CAUSE RC

The reason for the arrival of this project is to keep and monitor the water used for multiple purpose especially for drinking purpose. We took this project to make the biggest change in society and breakthe myth of utilization of technologies.

7. BEHAVIOUR 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 J&P, tap into BE,

4.REQUIREMENT ANALYSIS

4.1.FUNCTIONAL REQUIREMENT

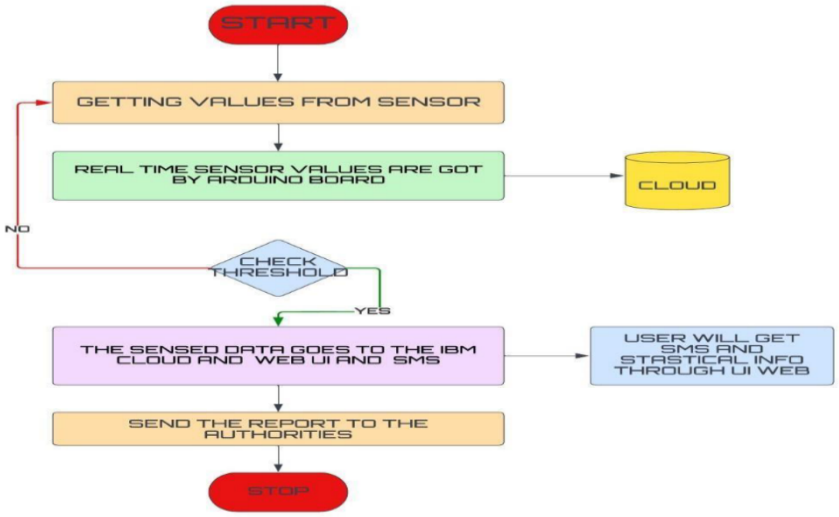
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Login	Confirmation through verified password
FR-2	View Water Details	View current water details in website View traditional water eligibility in website
FR-3	Logout	Logs out the user successfully

4.2 NON FUNCTIONAL REQUIREMENT:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Load time for user interface screens shall not be more than 2 seconds.
NFR-2	**Security**	User account is password protected Account creation done only after email verification
NFR-3	**Reliability**	Users can access their account 98% of the time without failure
NFR-4	**Performance**	Load time for user interface screens shall not be more than 2 seconds. Login info verified within 10 seconds.
NFR-5	**Availability**	Maximum down time will be about 4 hours
NFR-6	**Scalability**	System can handle about 1000 users at any given time

5.PROJECT DESIGN

5.1.DATA FLOW DIAGRAM:



5.2.SOLUTION AND TECHNICAL ARCHITECTURE

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Example - Solution Architecture Diagram:

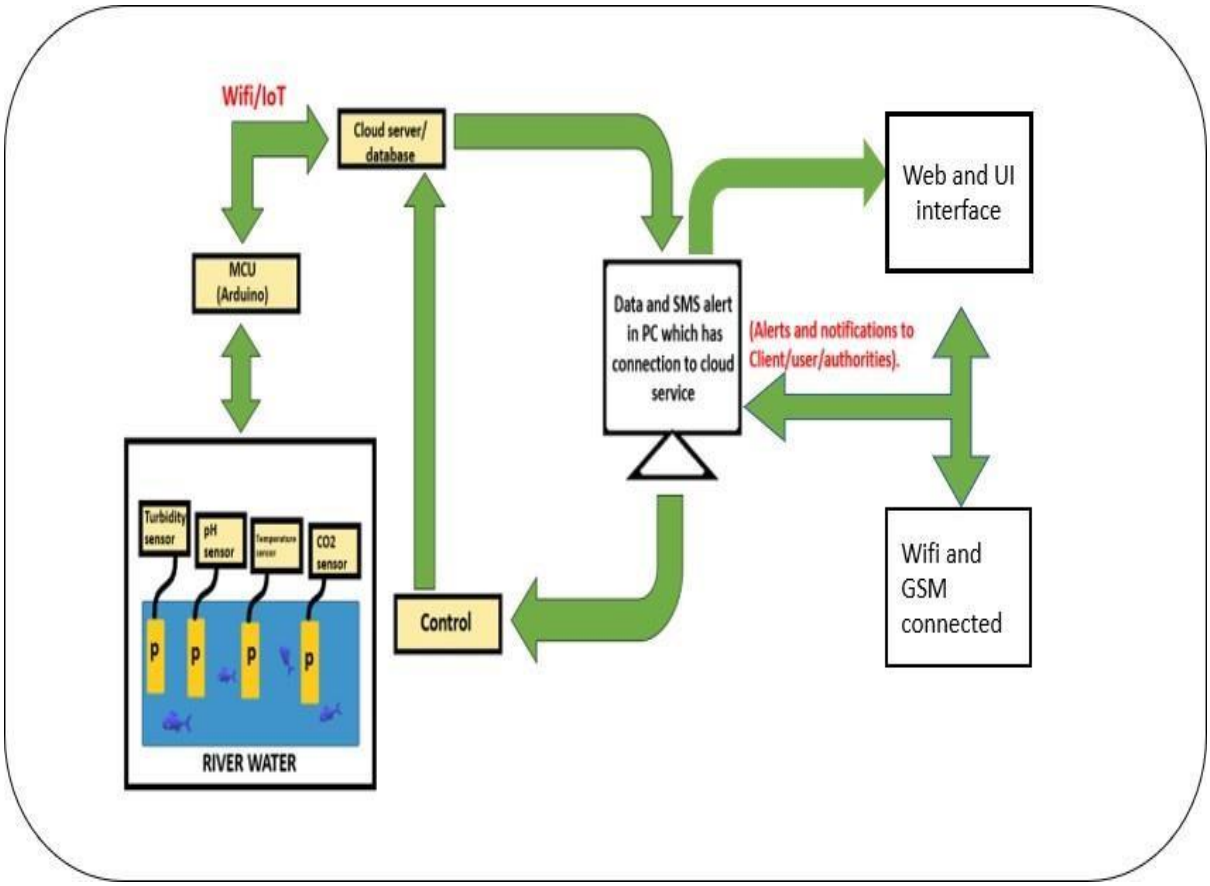


Figure 1: Architecture of IoT based river water control system

5.3 USER STORIES

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 email, password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application	I can receive e confirmation email & click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Google	I can register & access the dashboard with Google	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through the mail.	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email, password & captcha	I can receive login credentials.	High	Sprint-1
	Interface	USN-6	As a user, the interface should be user-friendly manner	I can able to access easily.	Medium	Sprint-1
Customer (Web user)	dashboard	USN-7	As a user, I can access the specific info(ph value, temp, humidity, quality).	I can able to know the quality of the water.	High	Sprint-1
Customer (input)	View manner	USN-8	As a user, I can view data in visual representation manner(graph)	I can easily understand by visuals.	High	Sprint-1
	Taste	USN-9	As a user , I can able to view the quality(salty) of the water	I can easily know whether i is salty or not	High	Sprint-1
	Color visibility	USN-10	As a user , I can able predict the water color	I can easily know the condition by color	High	Sprint-1
Administrator	Risk tolerant	USN-11	An administrator who Is handling the system should update and take care of the application.	Admin should monitor the records properly.	Medium	Sprint-2

6.PROJECT PLANNING & SCHEDULING

6.1.SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

TITLE	DESCRIPTION	DATE
Literature Survey & Informatio nGathering	By gathering material from technical papers and web browsing, a literature review on the chosen project is conducted.	06 OCTOBER 2022
Empathy Map	Empathy Map Canvas prepared to integrate feelings and benefits of the project with all team members.	08 OCTOBER 2022
Ideation	All team members participate in a brainstorming session to list all of the ideas and rank the top three.	09 OCTOBER 2022
Proposed Solution	created a document outlining the proposed solution, which covers topics like innovation, idea viability, business model, social impact, scalability of solution, etc.	15 OCTOBER 2022
Problem Solution Fit	Prepared problem - solution fit document.	21 OCTOBER 2022

6.2. SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Devadharshini, Badmapriya, Boomikadevi, Elakkiya
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Devadharshini, Badmapriya, Boomikadevi, Elakkiya
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Devadharshini, Badmapriya, Boomikadevi, Elakkiya
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Devadharshini, Badmapriya, Boomikadevi, Elakkiya
Sprint -2	User interface experience	USN-6	As a user I need a proper user interface for the project which was contain the graphical representation of received data from the sensors	2	High	Devadharshini, Badmapriya, Elakkiya.
Sprint -2		USN-7	As a user, I can create a IBM cloud account for the data base which should able to store the data and gather the data from the sensors	1	Medium	Badmapriya, Boomikadevi, Elakkiya
Sprint -2		USN-8	As I a user I can create node-red app for providing commands to the sensors in the IBM cloud	2	Medium	Devadharshini, Badmapriya, Boomikadevi
Sprint -2		USN-9	As a user, I can create IOT Watson assistant for converting the sensors data to the digital data	2	Low	Devadharshini, Boomikadevi,
Sprint -2		USN-10	As a user, I can create a fast to SMS app For providing alert the user which consuming water was not have the quality of consumable	1	High	Badmapriya, Elakkiya
Sprint -2		USN-11	As I a user, I can make cloudant data base in the IBM cloud for storing the data from the sensors for future references	2	High	Boomikadevi, Elakkiya
Sprint -3	App interface creation	USN-12	As I a user, I can use the MIT APP INVERTER for creating the user interface which contains interface between of IBM cloud	1	Medium	Badmapriya, Boomikadevi, Elakkiya
Sprint -3		USN-13	As I am a user, I can create a dashboard which was containing graphical representing the sensors measurements	1	Medium	Devadharshini, Badmapriya, Elakkiya

Sprint -3		USN-14	As I am a user, I can save or delete the previous measurements which was contain the sensor measurements	2	High	Devadharshini, Badmapriya,
Sprint -3		USN-15	As I am a user, I need the devices was properly insulated and the devices was must be a water resistant	2	High	Devadharshini, Elakkiya
Sprint -3		USN-16	As I am a user, I can create the devices which was implemented in the project should be	1	Low	Devadharshini, Boomikadevi,
			maintain properly with the particular interval of time			
Sprint -3		USN-17	As I am a user, I need a simultaneous data collecting data from the sensors and also save the received data to the cloudant /cloud dashboard	2	Low	Devadharshini, Badmapriya, Boomikadevi,
Sprint -3		USN-18	As a user, I can manage the devices which was implemented in the project	1	High	Devadharshini, Boomikadevi, Elakkiya.
Sprint -3	User development	USN-19	As a admin, I can manage all the devices and find the drawbacks and also rectify that	1	High	Devadharshini, Elakkiya
Sprint -3		USN-20	As a admin, I can manage the devices which was not working not properly I should replace that device	1	Medium	Badmapriya, Elakkiya
Sprint -3		USN-21	As a admin, I can monitor the devices which was sending the correct data or not	1	Low	Devadharshini, Boomikadevi,
Sprint -3		USN-22	As a admin, I can make changes in the user interface which was able to understand the measurements was easily understandable by user/industry person	2	High	Badmapriya, Boomikadevi,
Sprint -4	User command centre	USN-23	As a admin, I can create the command option in the user interface and able to perform the devices based on the commands	2	High	Devadharshini. Boomikadevi, Elakkiya
Sprint -4		USN-24	As a user, I can give the command to the device which was already able understand the command and also perform the function which was mention in the command	2	Medium	Devadharshini, Boomikadevi, Elakkiya
Sprint -4		USN-25	As a user, I can need user interface was always be an eco-friendly which was designed in the user interface	2	Medium	Devadharshini, Badmapriya,
Sprint -4		USN-26	As a user, I need a user interface which was contains HTTP command format and also should contain the web page interface	1	High	Badmapriya, Boomikadevi,
Sprint -4		USN-27	As a user, I can make the measurements was also capable to know the web interface	1	Low	Devadharshini Boomikadevi, Elakkiya.
Sprint -4		USN-28	As a user, I need a proper statement of the measurements of the data and also	1	Low	Devadharshini, Badmapriya, Elakkiya

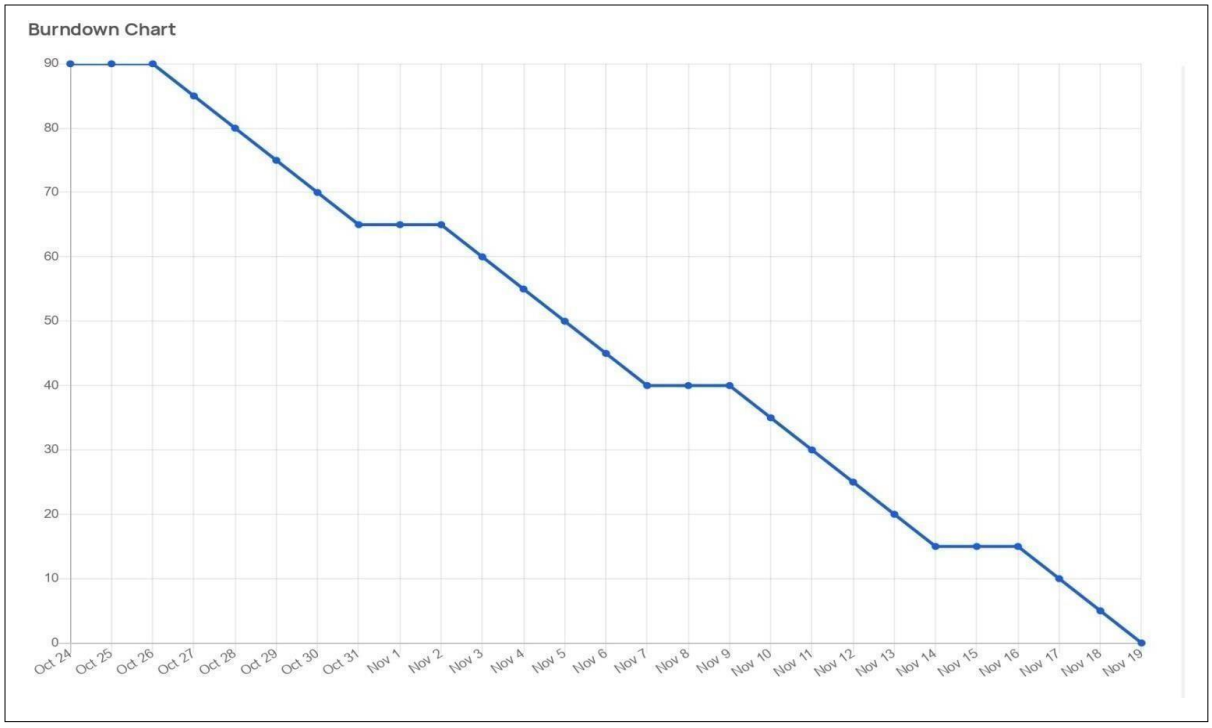
Project Tracker, Velocity & Burndown Charts

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	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit(story points per day)

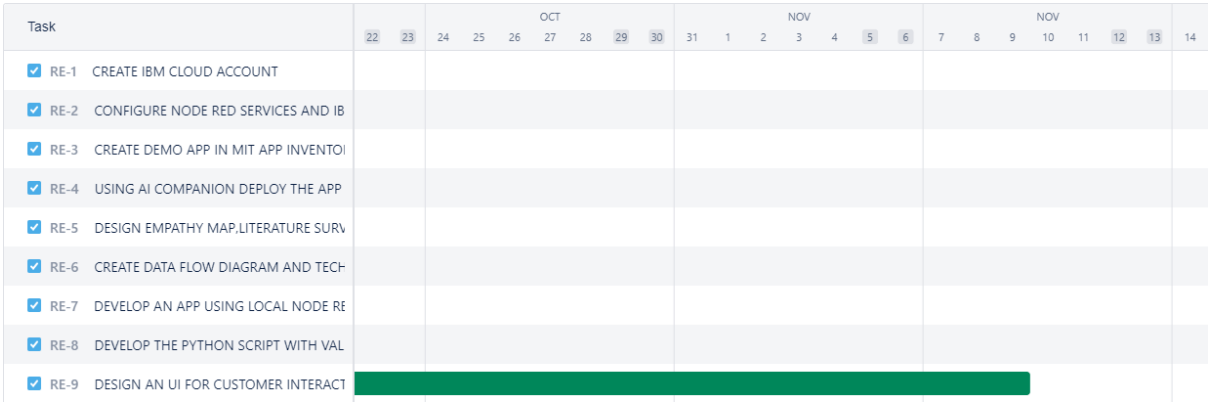
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

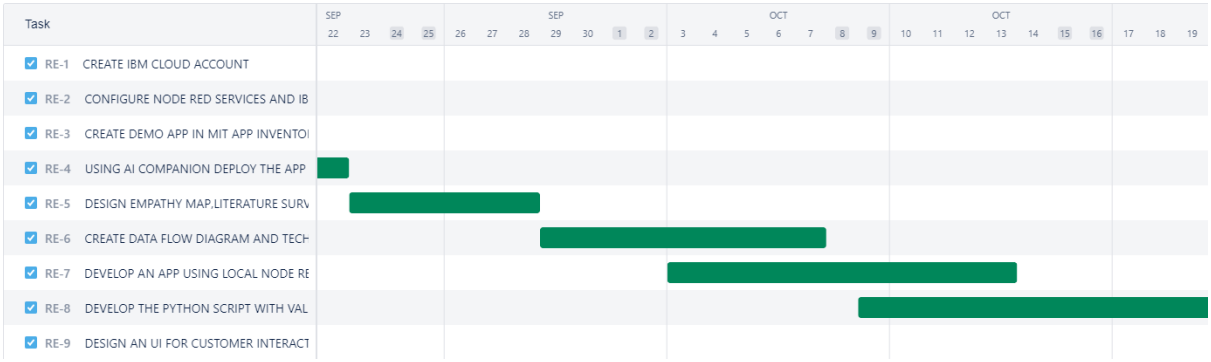


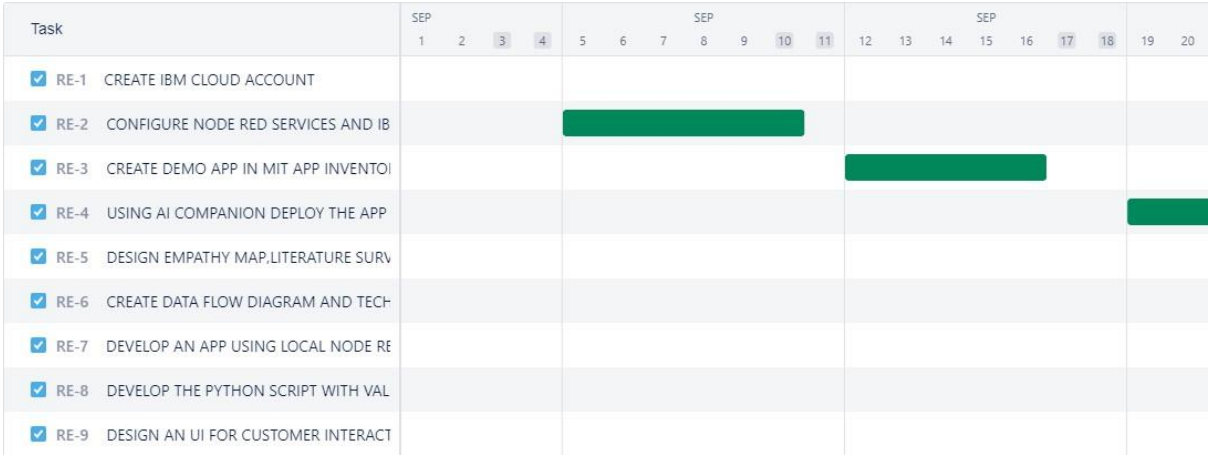
6.3.REPORT FROM JIRA

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

TIMELINE CREATED USING JIRA SOFTWARE







LISTS IN JIRA:

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

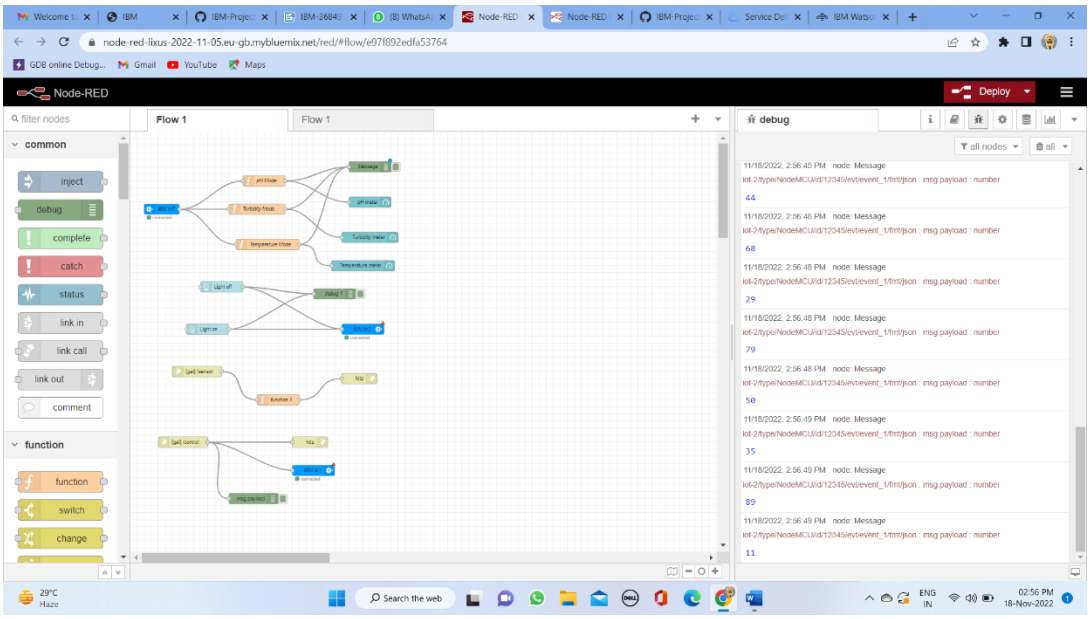
ISSUES :

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

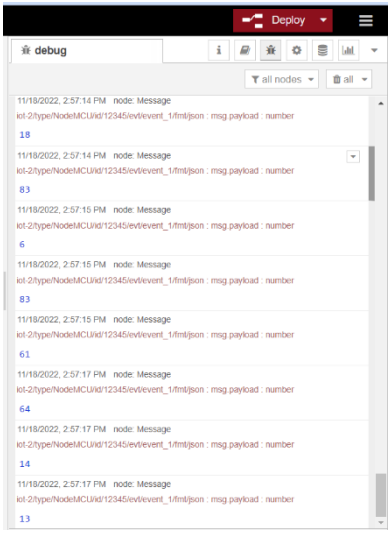
7.CODING AND SOLUTION

7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD:

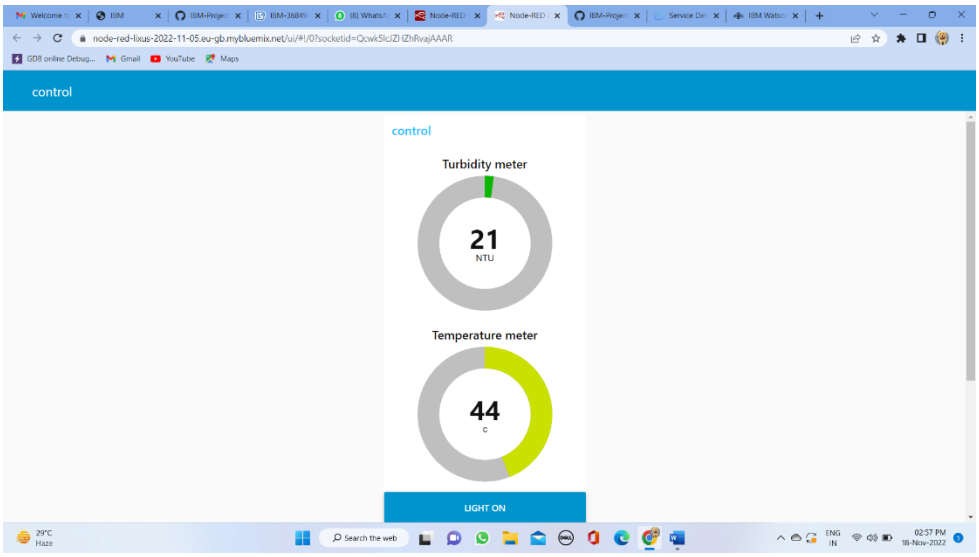
FLOW DIAGRAM:

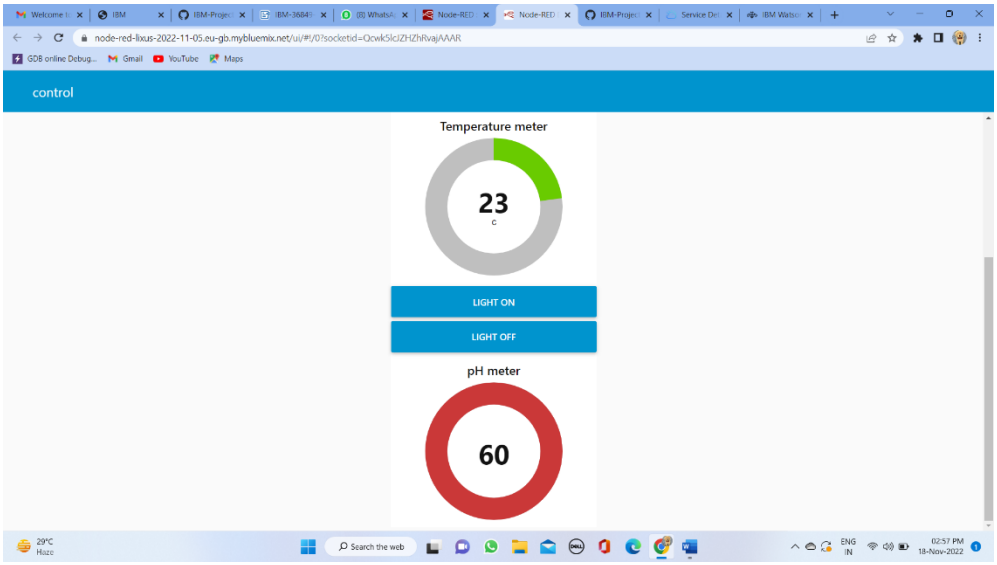


NODE RED OUTPUT:



NODE RED UI OUTPUT ANALYSIS:





8.TESTING

8.1Test 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

8.2.1.PURPOSE OF DOCUMENTS

This document serves as a quick reference for the REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEMS.

8.2.2.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 WITHTHE 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 THEAPP
ERROR	3-5%	REAL-TIME DELAY MAY OCCUR

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Increase water quality and stop acidification and other natural and chemical pollution from contaminating water supplies. Companies use sensors and IoT technology for real-time monitoring and control of water quality in order to enhance and maintain it.
- Boost the effectiveness of water systems such water reservoirs, treatment facilities, distribution mains, and wastewater recycling facilities. Using IoT and data solutions for asset management, businesses can incorporate predictive maintenance, keep track of crucial variables like water pressure, temperature, flow, etc., and prevent equipment breakdown and downtime.
- Practice consumption monitoring via IoT-based water management systems. It helps to optimize and keep under control the usage of water resources at different levels — households, communities, countries and the whole planet.
- This water monitoring, cleaning, and control procedure is automated, which eliminates the need for manual work and saves time and money.
- The system's automation improves the effectiveness and efficiency of the control and monitoring processes. Remote control of the system is possible thanks to real-time mobile monitoring made possible by the Bluetooth module and Arduino interface on the PLC.

DISADVANTAGES:

- The cost of analysis is very high
- It is challenging to collect water samples from every part of the water body
- The lab testing and analysis take some time; as a result, the results do not match real-time water quality measurement due to measurement delay.
- The method is time-consuming because manual data collection is labor-intensive and time-consuming from various locations around the water body.

11.CONCLUSIONS

Real-time quality control of Water from the reserve tank of the house and colony uses a Raspberry Pi, an existing Cloud system, and temperature, turbidity, and PH sensors. The system is low-cost, does not require staff to be on duty, and can automatically monitor water quality. It also immediately triggers alarms to prevent any health hazards. As a result, the system is probably more efficient, practical, and quick. The system is very adaptable. Other water quality parameters can only be monitored using this system by changing the relevant sensors and software programs. The process is easy. Water scarcity is one of the key problems the world is currently facing. Water pollution is yet another. These two may be caused by rising populations, urbanisation that has reached a saturation point, and massive industrialization. The proposed system can be put into place with the addition of basic parameter checking and expanded with the addition of other aspects related to water quality. These types of quality monitoring systems will aid society in achieving a more secure future because continuous monitoring greatly reduces water pollution. Implementation will be much simpler if there are few features.

In order to achieve this, sensor devices must be placed in the environment for data collection and processing. We can make the environment more realistic by placing sensor devices there, allowing the environment to communicate with other things across a network. The user will then have access to the gathered data and the analysis' findings over Wi-Fi.

12.FUTURE SCOPE

Our usage of water detecting sensors provides a special benefit. It is quicker to monitor polluted levels than with a manual method, and it alerts the affected rate of water pollution instantly. Rural residents who live close to the river will be delighted with our suggestion. Monitoring water pollution in a certain location will be helpful. Consequently, this mechanism shields users from water pollution. It will be used in farming to examine the PH level, temperature, and quality of the water. This project will have a positive social impact on farmers as well. This project can be scaled up to include more diverse types of sensors. The relay can be interfaced to allow us to regulate the water supply. We can use it as a revenue model as well. Additionally, this technology might be used in a number of industrial procedures. To monitor data on computers, the system can be modified to suit the needs of the user and implemented in conjunction with lab view.

13.APPENDIX

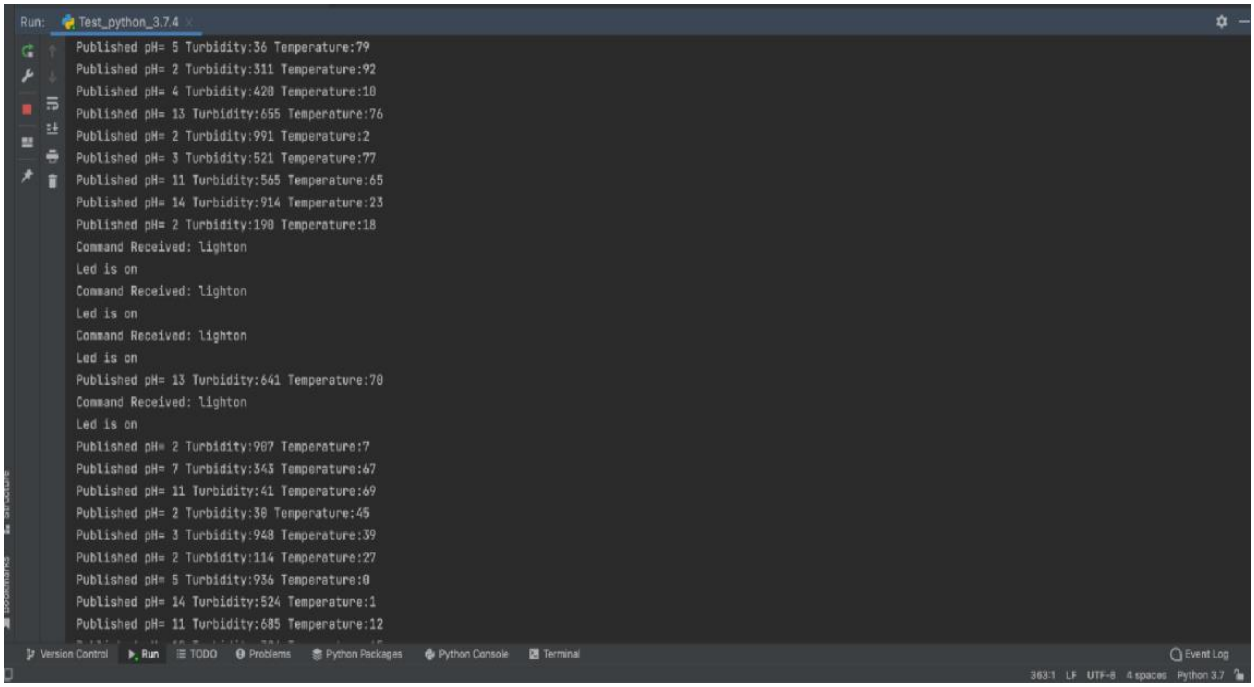
13.1.SOURCE CODE:

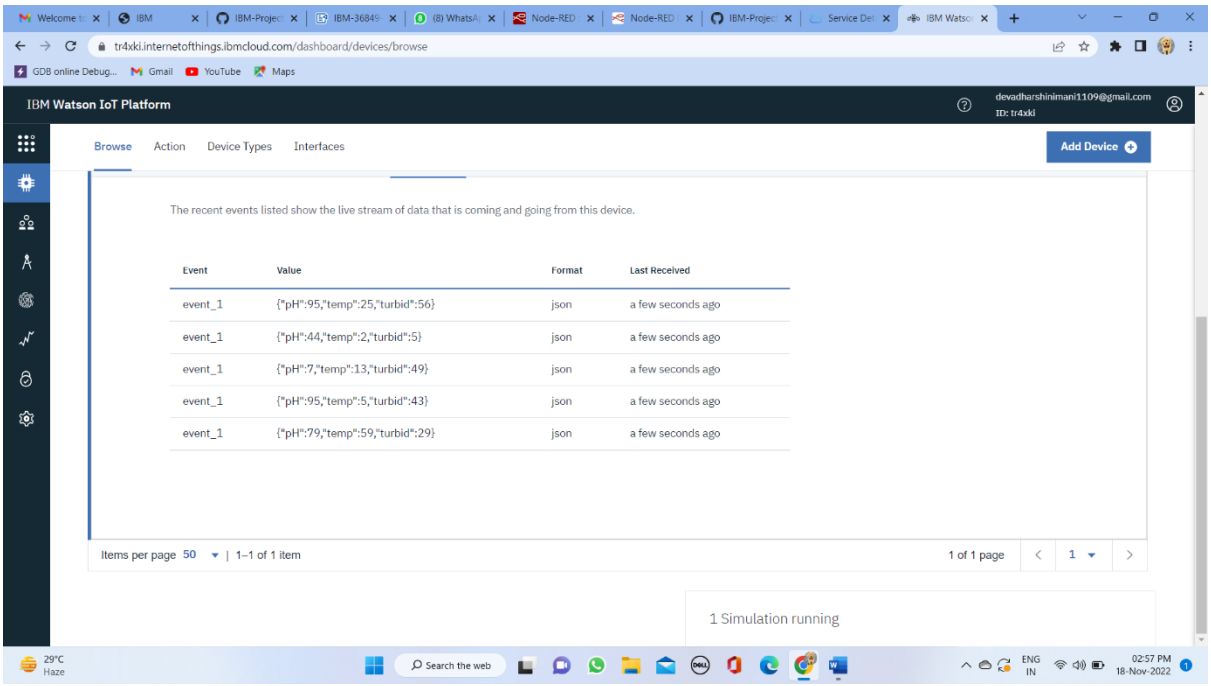
PYTHON CODE TO PUBLISH DATA

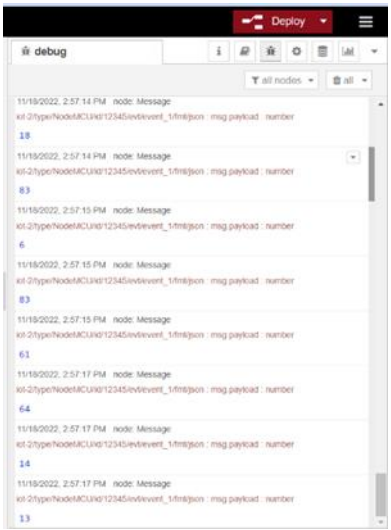
```
import ibmiotf.application
import ibmiotf.device
import time
import random
import sys
from twilio.rest import Client
import keys
Client = Client(keys.account_sid, keys.auth_token)

organization = "lwkiec"
deviceType = "NodeMCU"
deviceId = "12345"
authMethod = "token"
authToken = "12345"


pH = random.randint(1, 14) turbidity
= random.randint(1, 1000)
temperature = random.randint(0, 100)


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

deviceCli.connect()

while True:

    pH = random.randint(1, 14)
```

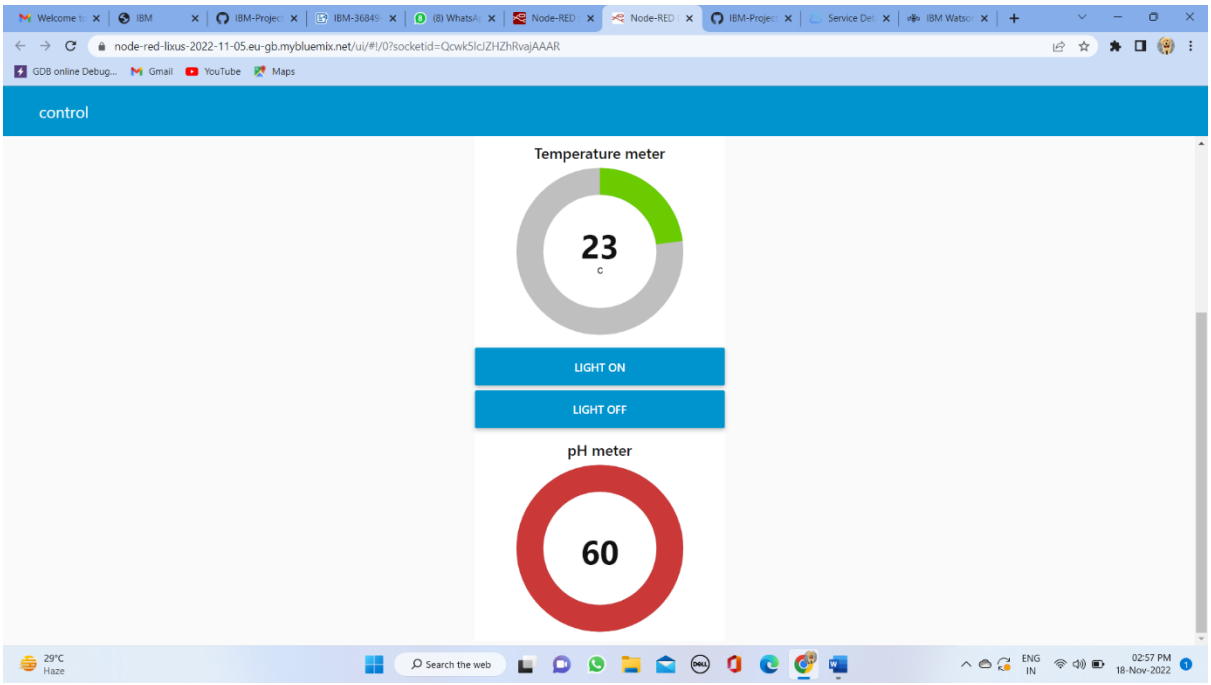
```
    turbidity = random.randint(1, 1000)
    temperature = random.randint(0, 100)

    data = {'pH': pH, 'turbid': turbidity, 'temp': temperature}
    def SMS():
       message = Client.messages.create(
          body="ALERT!! THE WATER QUALITY IS DEGRADED",
          from_=keys.twilio_number,
           to = keys.target_number)
       print(message.body)

    if temperature>70 or pH<6 or turbidity>500:
       SMS()

    def myOnPublishCallback():
      print("Published pH= %s" % pH, "Turbidity:%s" % turbidity, "Temperature:%s" %
temperature)


   success = deviceCli.publishEvent("demo", "json", data, qos=0,
on_publish=myOnPublishCallback)
    if not success:
       print("Not Connected to ibmiot")
    time.sleep(5)
   deviceCli.commandCallback =

myCommandCallbackdeviceCli.disconnect()
```

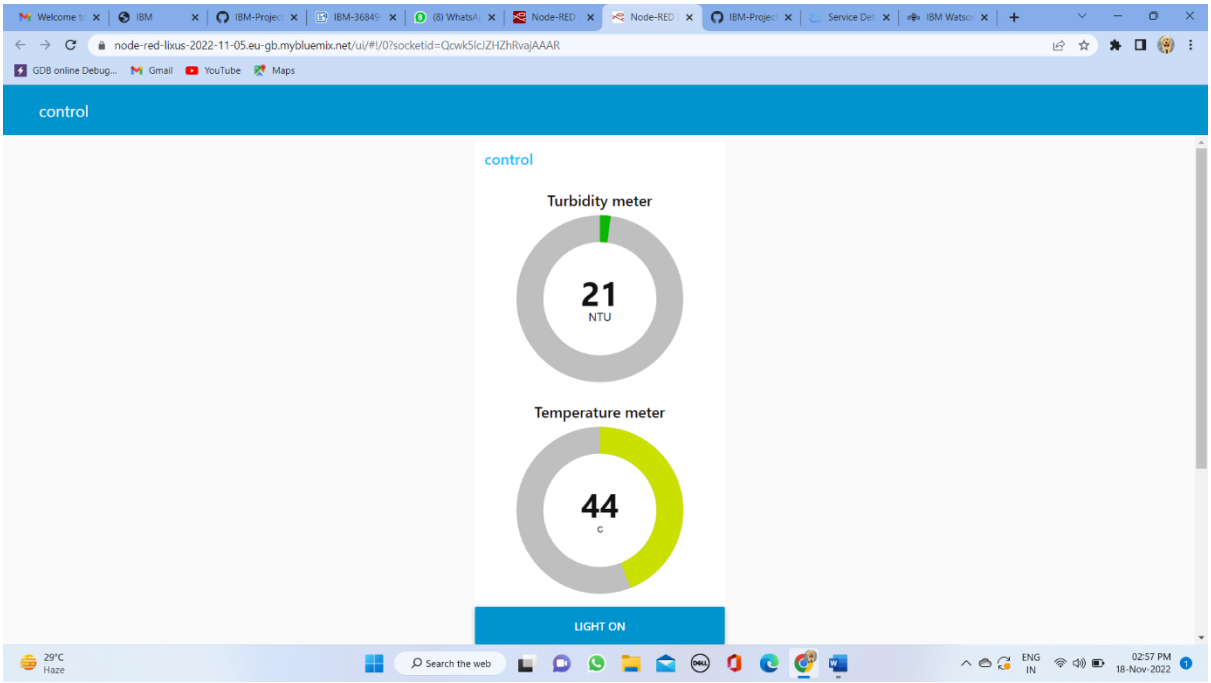
FINAL OUTPUT:

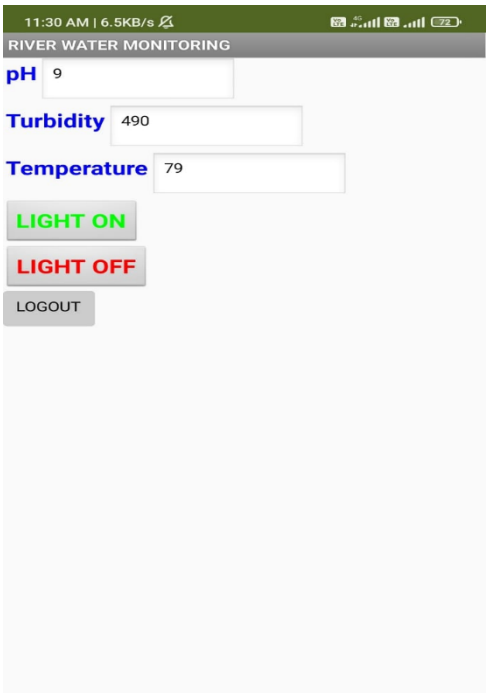



tr4xki.internetofthings.ibmcloud.com/dashboard/devices/browse
IBM Watson IoT Platform
devadharshinimani1109@gmail.com
ID: tr4xki
Browse
Action
Device Types
Interfaces
Add Device
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
Last Received
event_1 {"pH":95,"temp":25,"turbid":56} json a few seconds ago
event_1 {"pH":44,"temp":2,"turbid":5} json a few seconds ago
event_1 {"pH":7,"temp":13,"turbid":49} json a few seconds ago
event_1 {"pH":95,"temp":5,"turbid":43} json a few seconds ago
event_1 {"pH":79,"temp":59,"turbid":29} json a few seconds ago
Items per page 50 | 1–1 of 1 item
1 of 1 page
1
1 Simulation running
29°C Haze
Search the web
ENG IN
02:57 PM 18-Nov-2022


Deploy
debug
all nodes
all
11/18/2022, 2:57:14 PM node: Message
18
11/18/2022, 2:57:14 PM node: Message
83
11/18/2022, 2:57:15 PM node: Message
6
11/18/2022, 2:57:15 PM node: Message
83
11/18/2022, 2:57:15 PM node: Message
61
11/18/2022, 2:57:17 PM node: Message
64
11/18/2022, 2:57:17 PM node: Message
14
11/18/2022, 2:57:17 PM node: Message
13


control
Temperature meter
23
c
LIGHT ON
LIGHT OFF
pH meter
60


control
control
Turbidity meter
21
NTU
Temperature meter
44
c
LIGHT ON



13.2.GITHUB AND DEMO LINK

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-36849-1660298272

PROJECT DEMO LINK:

https://github.com/IBM-EPBL/IBM-Project-36849-1660298272/tree/main/FINAL%20DELIVERABLES/DEMONSTRATION%20VIDEO