REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

A PROJECT REPORT

Submitted by

S.ABIRAMI
D.SRINIVASAN
S.SOWMIYA
E.SARANISRI

FROM

UNIVERSITY COLLEGE OF ENGINEERING KANCHIPURAM

In fulfillment of project in IBM-NALAYATHIRAN 2022

Team Id: ***PNT2022TMID40434***

INDEX

1. INTRODUCTION

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.

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

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.

References:

1. K.S. Adu-Manu, C. Tapparello, W. Heinzelman, F.A. Katsriku, J.-D. Abdulai

Water quality monitoring using wireless sensor networks: Current trends and future research directions ACM Transactions on Sensor Networks (TOSN) (2017).

2. S. Thombre, R.U. Islam, K. Andersson, M.S. Hossain

IP based Wireless Sensor Networks : performance Analysis using Simulations and Experiments. Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, 7 (2016).

3. Rushikesh Kshirsagar, R.Mudhalwadkar, Saish Kalaskar

Design and Development of IoT Based Water Quality Measurement System. The idea about low-cost IOT based portable approach for water quality measurements system. Because of its low-cost approach, everyone can afford to use it to determine quality of water(2019).

4. N. Vijayakumar, R. Ramya

The real time monitoring of water quality in IoT environment. The parameters such as temperature, PH, turbidity, conductivity, dissolved oxygen of the water can be measured. The measured values from the sensors can be processed by the core controller. The raspberry PI B+ model can be used as a core controller (2015).

5. M.Chitra, D. Sadhihskumar, R. Aravindh, M. Murali, R. Vaittilingame

IoT based Water Flood Detection and Early Warning System. The collected information (data) from the water level sensor and temperature and humidity sensor passed to Thingview Android application in order to find the flow graph level of the water level in the river and temperature, humidity values and sends SMS to the registered contact mobile numbers (2020).

6. Dr.Geetha

IoT based real time water quality monitoring system using smart sensor

WQM is a cost effective and efficient system designed to monitor drinking water quality with the help of IOT(2020).

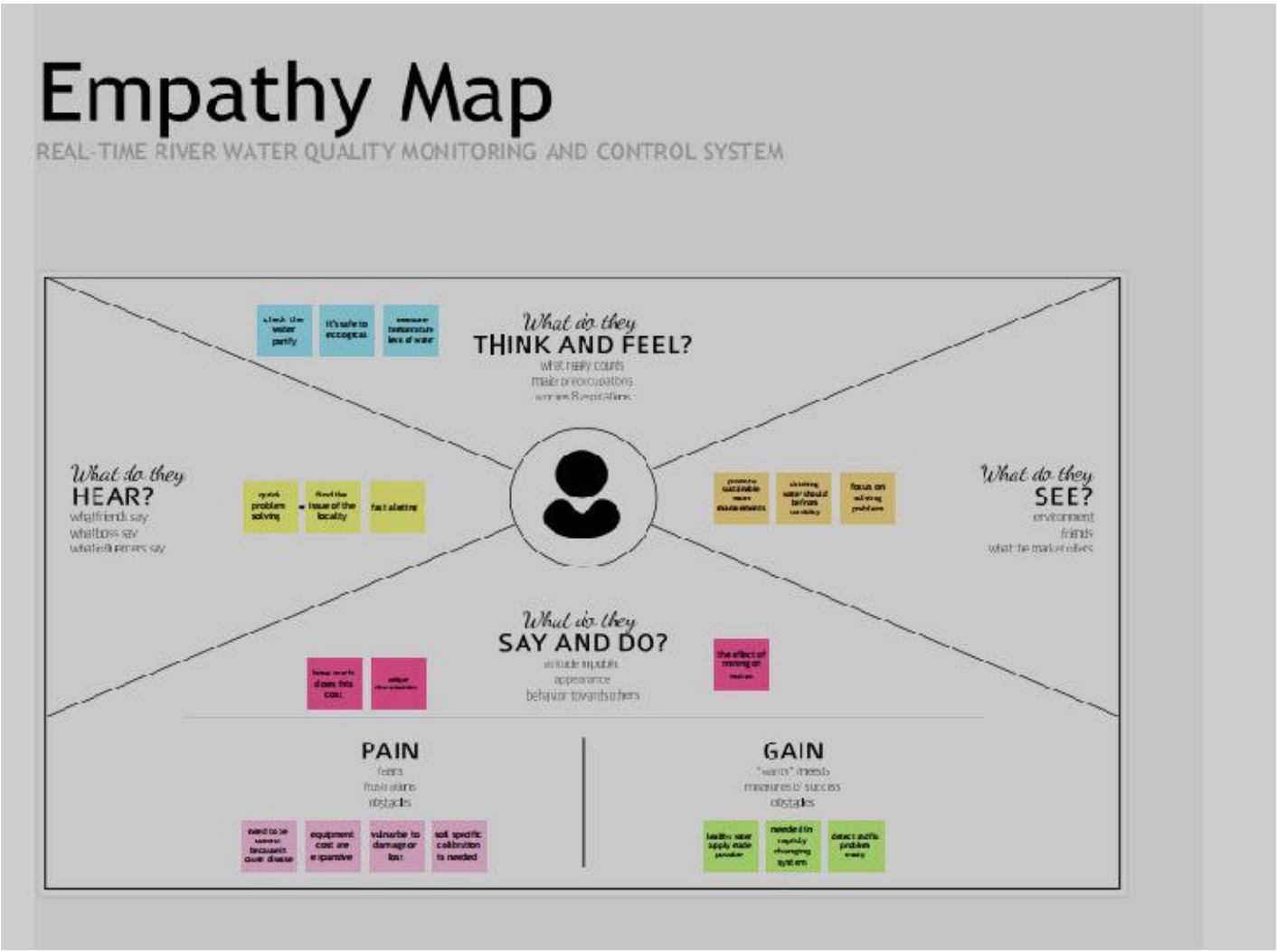
Problem Statement:

The reduce the river water pollution and to monitor the parameters of river water and control measures can impact vegetation,health. The Real time analysis of Indicators of River water(Ph,salinity,nutrients,etc..,)

IDEATION & PROPOSED SOLUTION

Empathy Map Canvas:

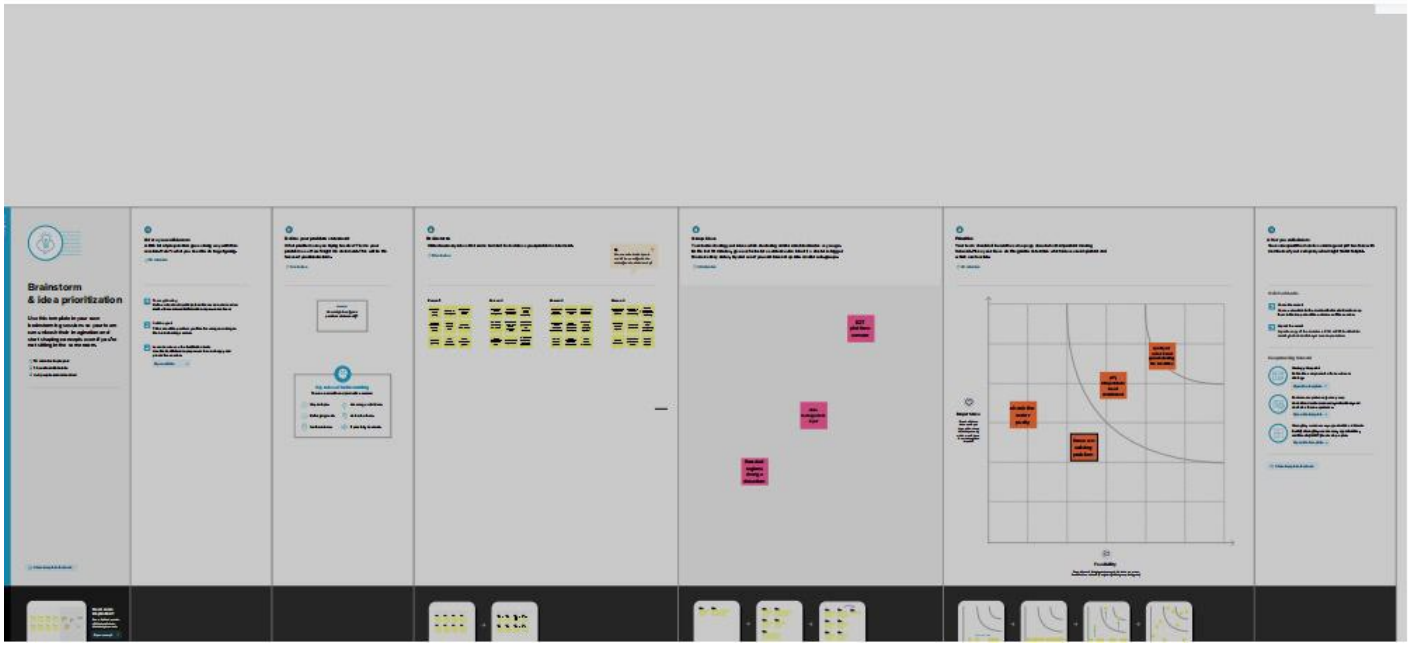
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



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.



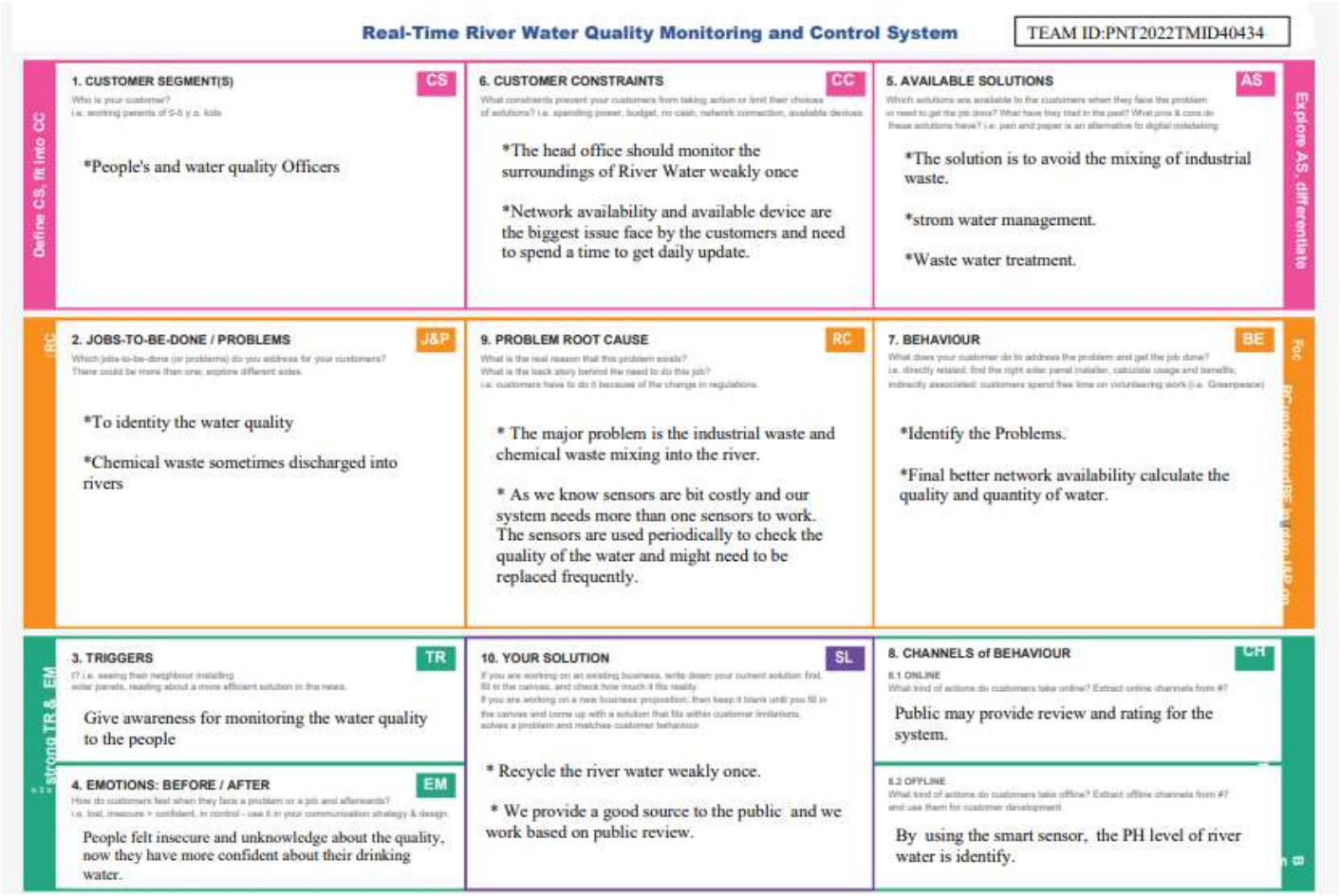
Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	IOT based Real Time Rever Water Quality Monitoring and Control Systems . The system consists of several sensors which is used to measure physical and chemical parameters of the water. real Time data access can be done by using remote monitoring and Internet of Things(IOT) technology
2.	Idea / Solution description	* To measure water parameters like PH, dissolved oxygen, Turbidity, Conductivity etc. Using available sensors at a remote place. * Data collected apart site can be displayed in a visual format on a sensor PC with the help of IOT compared with standard values. If the acquired value is above the threshold value automated warming SMS alert will be sent to the base station.
3.	Novelty / Uniqueness	The Uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high system with high frequency, high mobility, and low powered.

4.	Social Impact / Customer Satisfaction	More than 50% kinds of diseases are caused by drinking water quality and 80% of diseases and 50% of child deaths are relate to poor drinking water, agriculture

5.	Business Model (Revenue Model)	* We can give advertisement through the social media. * purity Water is most important in world. * To provide this information in advertisement is useful for society
6.	Scalability of the Solution	* IOT sensor, Thermal Sensor, IR sensor, 8 assessment of the water purity. * We can use it for agriculture and drinking water. Thus the human begins, goals and cros infected should be avoided by this project by using this water the farmer's land will be affected. Using this project we can avoid it. The health issues also avoid

PROBLEM SOLUTION:



4 REQUIREMENT ANALYSIS

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 Mobile no Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	View current status of river water	View river water quality in the website
FR-4	Reporting issue	User can report the issue in the website.
FR-5	Feedback	User can feedback their thoughts in the website

Non-functional Requirements:

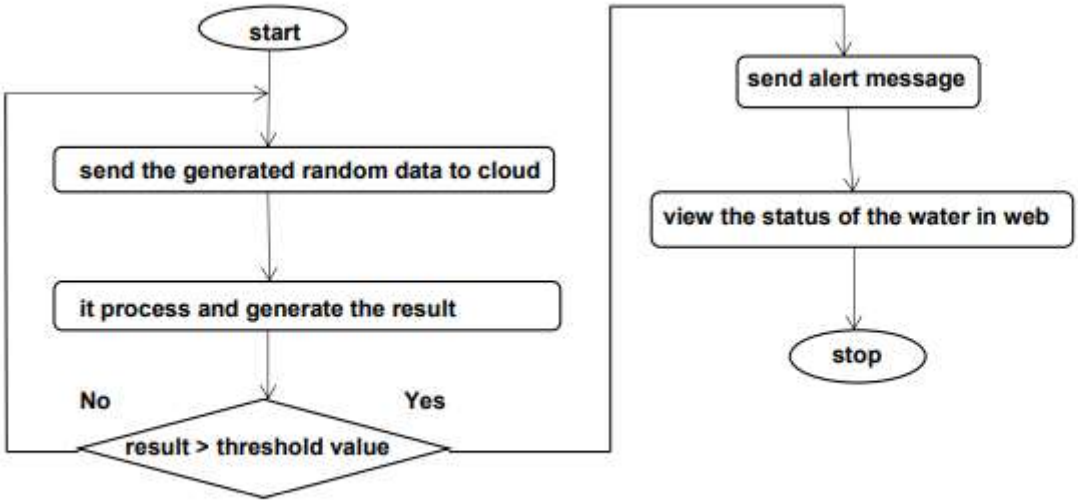
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	the website should be user friendly and easy to use
NFR-2	**Security**	Strong firewall used to protect the user password and data
NFR-3	**Reliability**	Both the hardware and software work without failure while processing
NFR-4	**Performance**	The performance of system has higher efficiency and environmental friendly.
NFR-5	**Availability**	The request should be accept in a few second and allow user to use
NFR-6	**Scalability**	It should be available for the user whenever they need
NFR-7	**Stability**	It should work without negative issue and maintain website traffic

5 PROJECT DESIGN

Data Flow Diagrams:

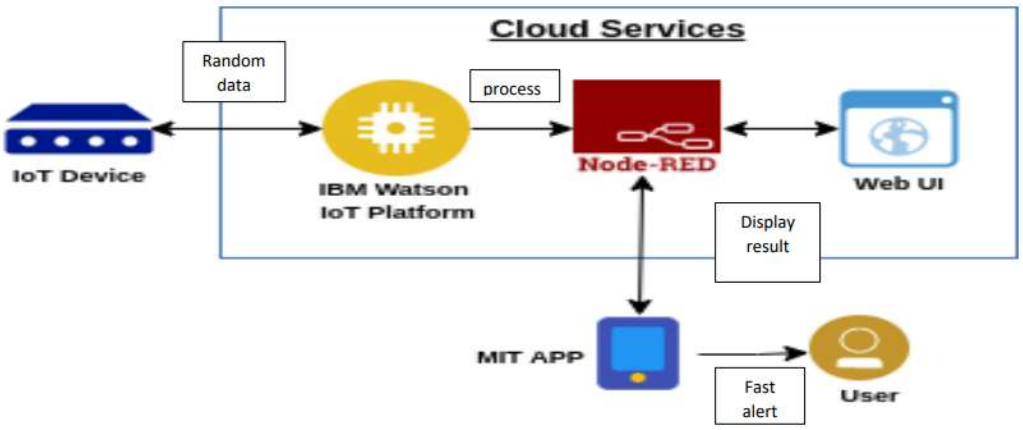
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



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.



.

Components Technologies& Application Characteristics:

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI, Mobile App	IBM Watson, Node-RED,MIT APP
2.	Application Logic-1	For a process in the application generate random data	Python , IBM Watson
3.	Database	Data Type, Configurations etc.	MySQLetc.
4.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
5.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
6.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	open-source frameworks used for the project	Node-RED,MIT APP
2.	Security Implementations	Strong firewall used to protect user password and data	MIT APP , WEB UI
3.	Scalable Architecture	It should work without negative issue and maintain website traffic	Node-RED(WEB UI,MIT APP)
4.	Availability	It should be available for the user whenever they need	Node-RED(WEB UI,MIT APP)
5.	Performance	The request should be accept in a few second and allow user to use	Node-RED(WEB UI,MIT APP)

User Stories

Use the below template to list all the user stories for the product.

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,Web user)	Registration	USN-1	Registration through Mobile no Registration through Gmail	I can access my account / dashboard	High	Sprint-1
	Confirmation	USN-2	Confirmation via OTP Confirmation via Email	I can receive confirmation email & otp click confirm	High	Sprint-1
	Login	USN-3	As a user can log into the application by entering email & password	I can sign in access the dashboard	High	Sprint-1
	View status of river water	USN-4	As a user can view quality of the water	Can see the current status of water	High	Sprint-1
	Reporting issue and feedback	USN-5	User can report the issue and feedback in the website	can report the issue and feedback their thoughts	High	Sprint-2
	Sign out	USN-6	User can sign out successfully	User can sign out after their queries	High	Sprint -1

6. PROJECT PLANNING AND SCHEDULING

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 DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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, we must register for the applicationby entering my email, password, and confirming my password.	2	High	Abirami.S Sowmiya.S
Sprint-1		USN-2	As a user, we must register for an IBM cloud account , IoT platform ,RED node service and uncertain DB.	1	High	Srinivasan.D Sarani Sri.E
Sprint-2		USN-3	As a user, we develop a python script to publish random sensor data.	2	Low	Srinivasan.D Sowmiya.S
Sprint-3		USN-4	As a user, a web UI should be created in Node-RED using dashboard nodes available in it.	2	Medium	Abirami.S Saranisri.E
Sprint-4	Login	USN-5	As a user, In this milestone you are expected to get started with the ideation and project process.	1	High	Abirami.S Srinivasan.D

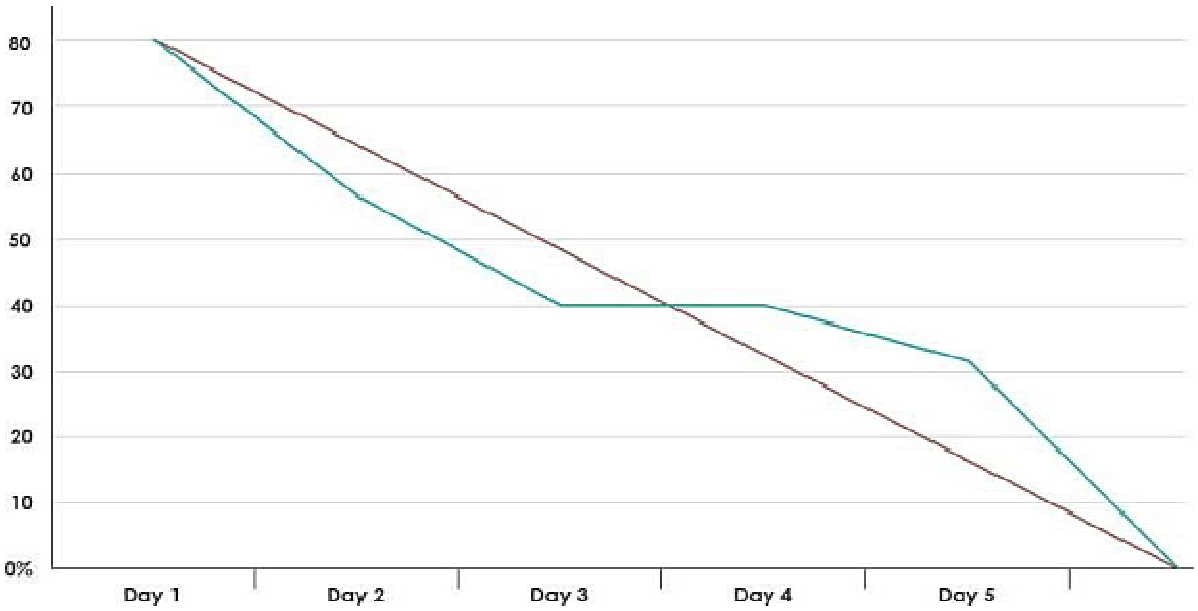
Project Tracker, Velocity & Burndown Charts

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (ason Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	27 Oct 2022
Sprint-2	20	6 Days	28 Oct 2022	04 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	03 Nov 2022	10 Nov 2022	49	04 Nov 2022
Sprint-4	20	6 Days	08 Nov 2022	15 Nov 2022	50	09 Nov 2022

Velocity:

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

Burndown Chart:



RESULT

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

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.

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.