

REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

Category: INTERNET OF THINGS

PROJECT REPORT

Submitted by

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FROM

KAMARAJ COLLEGE OF ENGINEERING TECHNOLOGY, MADURAI-01

In fulfillment of project in IBM-NALAIYATHIRAN 2022

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PROJECT GUIDES

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INDEX

1.INTRODUCTION

1.1 Project Overview

1.2 Purpose

2.LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

3.5 Solution Architecture

4.REQUIREMENT ANALYSIS

4.1 Functional requirement

4.2 Non-Functional requirements

5.PROJECT DESIGN

5.1 Data Flow Diagrams

5.2 Technology Stack

5.3 User Stories

5.4 Customer Journey

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

6.2 Sprint Delivery Schedule

7.CODING & SOLUTIONING

7.1 Python Script

7.2 Publishing datas to IBM Watson

7.3 Pushing datas from IBM Watson to Node-RED

8.TESTING

8.1 Test Cases

8.2 User Acceptance Testing

9.RESULTS

9.1 Performance Metrics

10.ADVANTAGES & DISADVANTAGES

11.CONCLUSION

12.FUTURE SCOPE

13.APPENDIX

13.1 GitHub Link

13.2 Project Demo Link

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:

TITLE	TECHNOLOGY	ADVANTAGES	DRAWBACKS
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
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.
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.

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
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.
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.

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.
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.
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.
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. M.Chitra, D. Sadhihskumar, R. Aravindh, M. Murali, R. Vaithilingame

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).

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.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

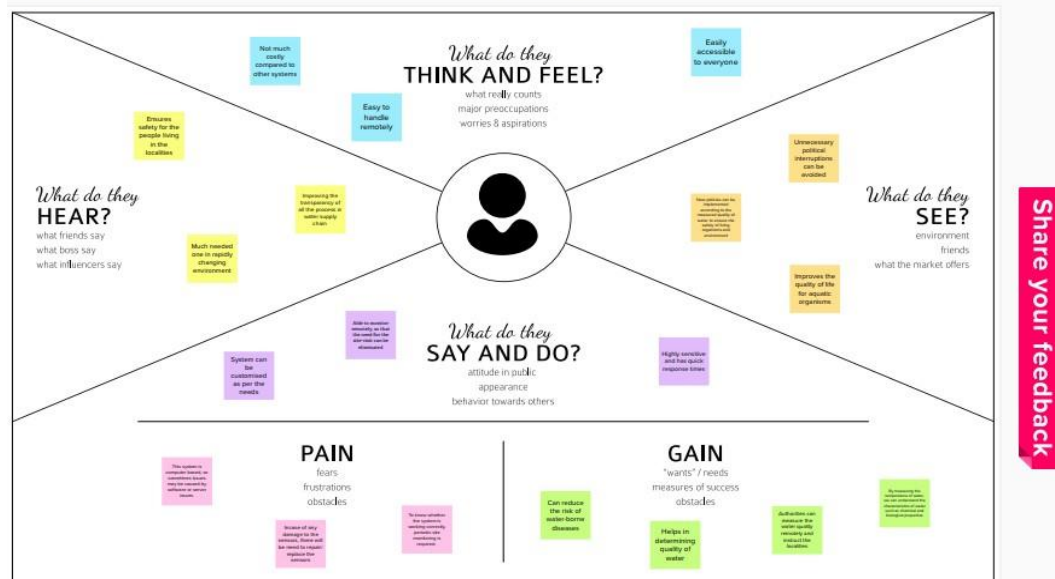
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise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

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.



3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.



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](#) →



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](#) →

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.



Encourage wild ideas.



Defer judgment.



Listen to others.



Go for volume.



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

P.AUNGILAS
SOWBAN PRAJAH

arduino and
sensor based
water
parameters
monitoring

pH, turbidity
,temperature
sensors
connected
with arduino

prefixed values in
Arduino monitors
the quality
parameters of
river

GSM modules to
collect and
transfer water
quality data to
mobile
applications

GPRS for
tracking the
location of
highly affected
algal bloom area

zigbee
network to
sensor
resultant data

ultrasonic
radiation for
algae
control

miniature dams
created and
clearing algae
production before
affecting the whole
water body

M.NERANJAN
PRAKASH

identifying of
threshold
values of pH
temperature
and turbidity

cloud data
based
microcontroller
node mcu used
for water
monitoring

UI web
application
for water
monitoring

biological and
chemical changes
identification of
water by
conventional
method

dissolve air
floatation
methodology
for controlling
algae

measuring
device based
two nri cameras
and image
processing

algorithm
encryption and
decryption datas
of pH and turbity
of water

alerting water
contamination
of algae to
locals through
Wi-Fi

B.SARAVANAN

statistical
recording of pH
temperature
values in data
storing method

predicting
the algal
bloom graph

wireless
network based
water
parameter data
collection

ion exchange
method after
detection

motor like
device for
cleaning algae
and contains
chlorine for
clearing algae

app developing
for detecting pH
,turbidity and
temperature of
river water

using graph
creating
database in
cloud

forming mesh
network using
sensor to
better
monitoring

motor like
device for
cleaning algae
and contains
chlorine for
clearing algae

A.VENGADESH
PERUMAL

lab based
water
parameter
datas

hydroponics
and
aquaponics
technology for
pH indicator

collecting
fertilizer and
pesticide
contaminated
water through
field site ridges

biotreatment
for
contaminated
water

manual
checking of
water
contamination
by paper report

semi automated or
manual control
devices for
checking pH
turbidity and water
temperature value

nephelometer
for turbidity
measurement

predicting the
growth of
algae using
conventional
method

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 can break it up into smaller sub-groups.

🕒 20 minutes



Temperature sensors
can be used to monitor
the temperature of a
system.

Pressure sensors
can be used to monitor
the pressure of a system.

Flow sensors
can be used to monitor
the flow of a liquid or gas.

Position sensors
can be used to monitor
the position of a moving
object.

Proximity sensors
can be used to monitor
the distance between
two objects.

Image sensors
can be used to monitor
the visual environment.



Data analysis
can be used to
extract information
from raw data.

Data analysis
can be used to
identify patterns in
data.

Data analysis
can be used to
predict future trends.

Data analysis
can be used to
optimize system performance.



TIP
Add customizable tags to sticky
notes to make it easier to find,
archive, organize, and
categorize important ideas as
they arise within your mind.

Machine learning
can be used to
analyze large amounts
of data.

Deep learning
can be used to
analyze complex data
sets.

Reinforcement learning
can be used to
teach a system to
perform a task.

Generative models
can be used to
create new data.

Transfer learning
can be used to
transfer knowledge
from one task to
another.

Domain adaptation
can be used to
adapt a model to
a new domain.

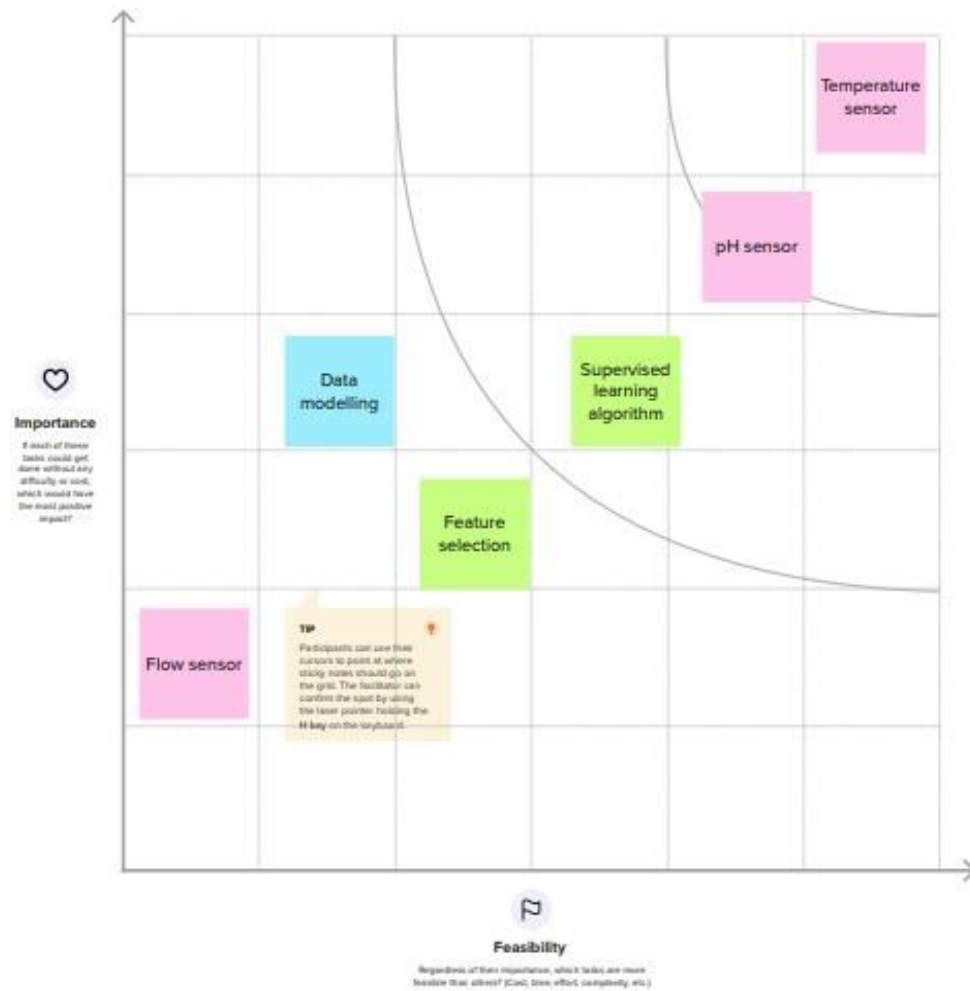
Active learning
can be used to
select the most
informative data points.

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





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



Share the mural

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



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](#)

3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Most of the water is affected by the industrial wastes containing chemicals, medical wastes and by washing vehicles the engine oil is mix with the river water.
2.	Idea / Solution description	<p>* To measure various chemical and physical properties of water like pH, temperature and particle density of water using sensors.</p> <p>* Dispose the industrial waste, toxic chemicals and medical waste properly.</p>
3.	Novelty / Uniqueness	<p>* If the acquired value is above the threshold value automated warning SMS will be sent to the agent.</p> <p>* The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility and low powered.</p>
4.	Social Impact / Customer Satisfaction	<p>* Everyday peoples and animals will drink only the pure water.</p> <p>* The risk of water-borne diseases can be reduced.</p> <p>* Good environment surrounding the river. * The good quality river water is mainly used for farmers.</p>
5.	Business Model (Revenue Model)	By using this system we can find the quality of water because river water is the basic raw material for food and beverage industries.

6.	Scalability of the Solution	<p>* Water quality data with a high spatial and temporal resolution for thousands of lakes at a time.</p> <p>* It supports the evaluation of environmental problems and potential health risks through the analysis of changes in water quality and the detection of harmful algal blooms.</p>
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3.4 PROBLEM SOLUTION:

PROBLEM SOLUTION FIT DOCUMENT

Purpose/Vision

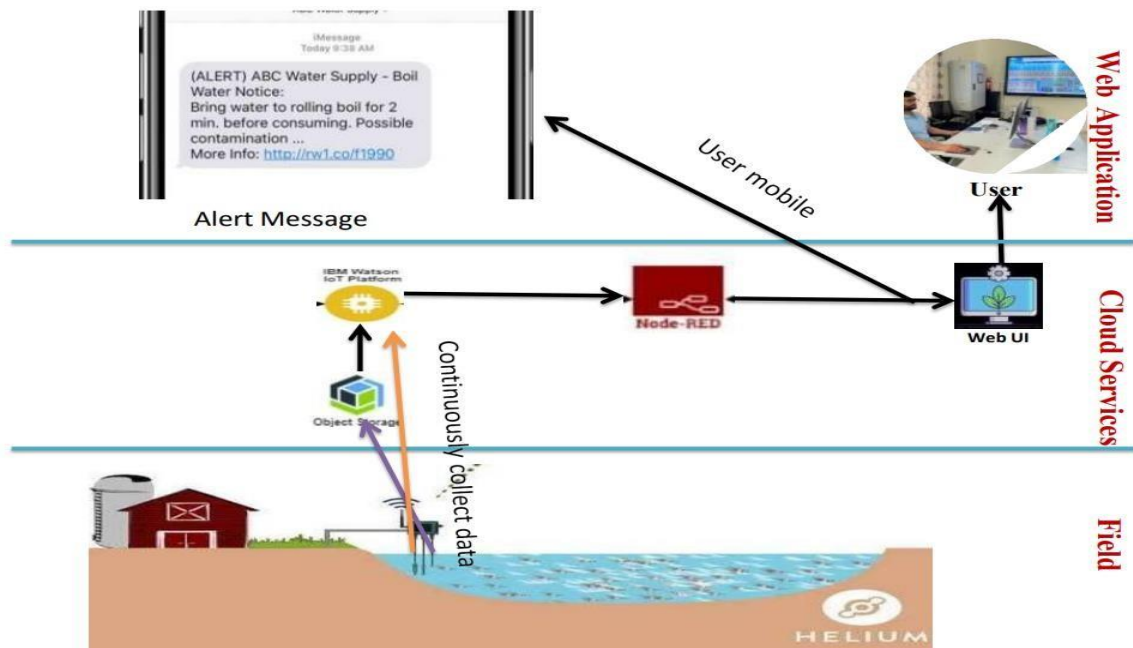
DefineCS, fitintoCC	1.CUSTOMER SEGMENT(S) Government authorities, Farmers and Drinking Water supplier.	6.CUSTOMER CONSTRAINTS River water quality analysis replaces the need for using laboratory checking and reduces the time of delay required for result. The give instant solutions and suggestions like 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
	2.JOBS-TO-BE-DONE / PROBLEMS <ul style="list-style-type: none">• Check the water quality.• Check the level of chlorine in water.• Check temperature of water.• Check the pH level of water.• Find if the water is suitable for drinking, agriculture and 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, fitintoBE, understandRC	3.TRIGGERS River water quality analysis work by checking the river water quality for providing clean drinking water for the people, farming, promoting aquaculture and other industries. It is a best replacement for checking water quality in laboratories. The best quality is that it is user friendly.	10. YOUR SOLUTION <ul style="list-style-type: none">• Implement IOT based river water quality monitoring system to get instant results.• Suggestions can be made to solve if any problem arises.	8.CHANNELS OF BEHAVIOURS Online portal for making recommendations for problems based on pH parameters using Machine Learning.	Focus on J&P, fitintoBE, understandRC
	4.EMOTIONS: BEFORE /AFTER Without river water quality analysis it becomes difficult for government authorities, farmers, water suppliers 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.			
Identifystrong TR&EM				Extractionline&offlineC-Home



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3.5 SOLUTION ARCHITECTURE:



4. REQUIREMENT ANALYSIS

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Users Authorization levels	Complete mapping are shown in a hierarchical manner in order to show only the specific Data.
FR-2	Historical Data	The datas collected are stored in the cloud from the starting stage till updation is completed.
FR-3	User Authentication	The credentials is accessible only to the authorized users to access the model.
FR-4	Users rules and laws	There are some specific guidelines and procedures which has to be followed by the users.

4.2 Non-functional Requirements:

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

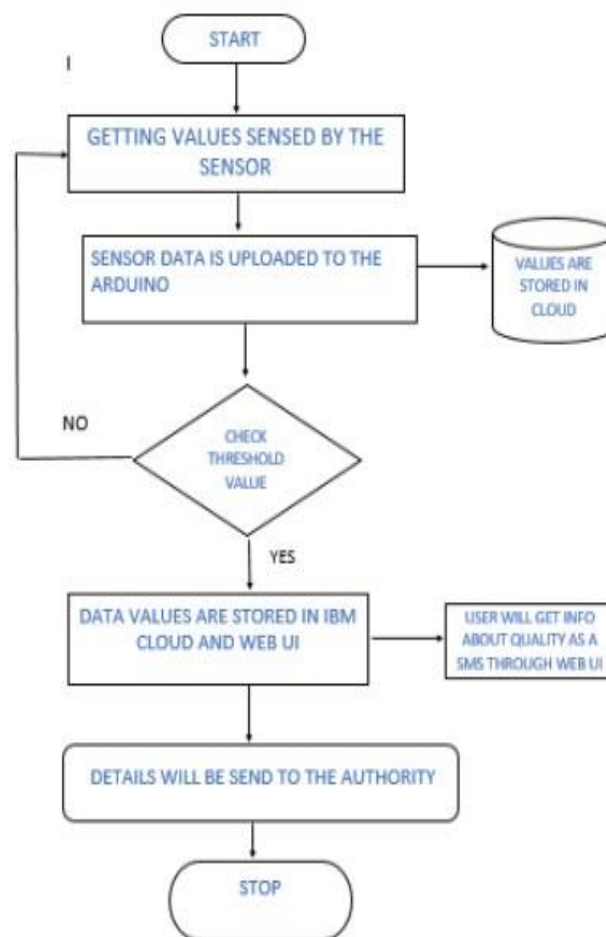
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The Final data should be easily understandable.
NFR-2	Security	The model are designed in a safe and secured manner in order to maintain the privacy.
NFR-3	Reliability	Even if there is any firmware issues (failures) the last updated datas are stored in a default manner.
NFR-4	Performance	High quality sensors are used to provide accurate datas.

NFR-5	Availability	The model is designed in such a way that are available,usable,accesible and can be modified anytime.
NFR-6	Scalability	The system is scaled according to the size of The river(water bodies)
NFR-7	Stability	The ability of the system to bring itself back to its stable configuration. The stability is high.
NFR-8	Efficiency	The monitoring system is highly efficient,high mobility with consumption of power.

5. PROJECT DESIGN

5.1 Data Flow Diagrams:

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



5.2 Technology Stack

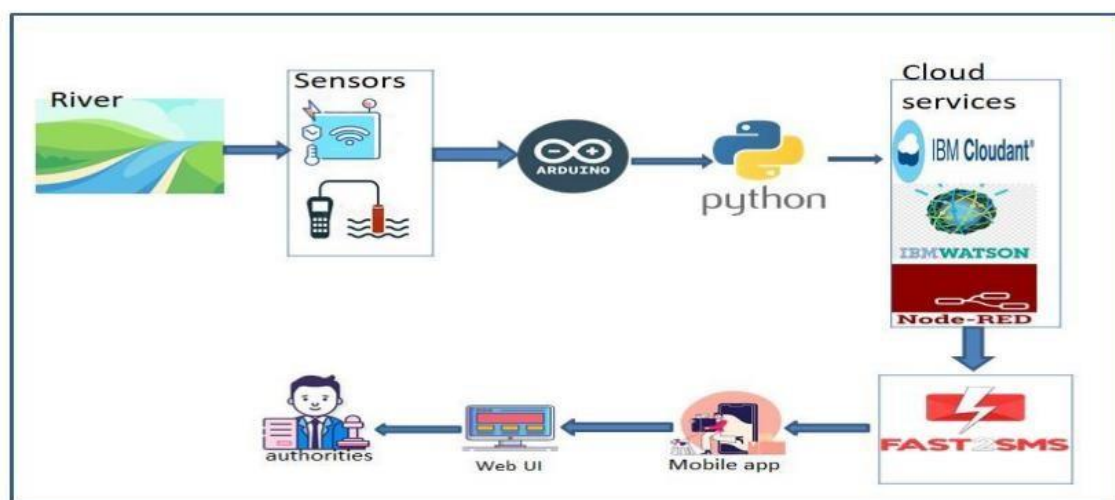
Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, Node-Red ,Cloud,etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

Technical Architecture:



5.3 User Stories

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
Customer (Web user)	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
	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
	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 it 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

User journey

















































by the design team of the system

People 2-9
Time 30 min
Difficulty Beginner

Creating a user journey is a quick way to help you and your team gain a deeper understanding of who you're designing for, aka the stakeholder in your project. The information you add here should be representative of the observations and research you've done about your users. ⚡

TEAM ID : PNT2022TMD12298

PROJECT NAME : REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

<h3>1 Phases</h3> <p>High-level steps your user needs to accomplish from start to finish</p>	Analysing the river water			Finding the pH level of water		Separation of pure water and dirty water		Recycling of dirty water for agricultural use				
<h3>2 Steps</h3> <p>Data-led actions your user has to perform</p>	Whether the river water is dirty or not	Check the surroundings of river water	Also find whether the industrial waste is toxic into river water	Check whether the pH is between 6.5 and 8.5	So finding the drinking level of pH	If the pH level is normal we can use it for drinking purpose	Normal products like fish is used for medical purpose, the paper and plastic is used for other purpose	Using pure water finding machine	Usage of water purifier to separate pure water and dirty water	Collect the dirty water and send the water to the recycling factory	Using chemical components for recycling process	Finally recycled water is sent to farmers for agricultural purpose
<h3>3 Feelings</h3> <p>What your user might be thinking and feeling at the moment</p>	 If the river water quality is in correct level, government level will increase.	 Animals and birds are drinking river water.	 The river water is essential for human beings.	 If the level of river water is higher than the level, they feel good.	 They feel more secure about their environment	 They feel comfortable after drinking pure water daily.	 Supplying some amount of water for commercial uses.	 The right level of water is used for drinking purpose.	 They feel happy about drinking pure water.	 The recycled water can also be used for some other purpose.	 Also used for some industrial purpose.	 Manufacturing company they use water and the recycled water
	 If the river water quality is not good then the government will get decrease.	 If the river water is polluted then birds can't able to drink water.	 Polluted water is not essential for human beings.	 People don't know about the pollution of the river water for drinking.	 People may feel that environment is not clean due to the polluted water.	 The river water may cause diseases and they may feel that the river water is not good.	 They also worried about the diseases caused due to the polluted river water.	 They also worried about the living organisms.	 People need the healthy fishes from the river water for selling.	 Control people are the major polluted water by their water pollution.	 Recycling water is sufficient for industrial purpose.	 Is the pure water is available for every day.
<h3>4 Pain points</h3> <p>Problems your user runs into</p>	 Chemical waste products from industrial processes are discharged into the river.	 Threatening of sandstone river side may cause the river to dry fast.	 Pollution may occur due to acid rain.	 Because of throwing dusts it will create some mess and smell.	 Water pollution may cause diseases.	 It will affect the Eco system.	 This water is harmful for drinking.	 This causes harm to the organisms living in the river water.	 Also increasing river water temperature affects the living organisms.	 Sewage and waste water are making into the river major.	 It is a very big problem for the water resources and the health of the water body.	 Climate change will affect river water.
<h3>5 Opportunities</h3> <p>Potential improvements or enhancements to the experience</p>	 We use the detector to easily identify our device.	 Using drone for everything monitoring.	 Our device is miniature compared to other devices	 We include sensor for detecting pH level of water.	 Used solar panel for energy.	 We insert high quality battery.	 Water proof device is used for ensuring safety.	 By using this device we can also control the pH level of the water.	 Any time and any where can find the device.	 We use give the government more pure water and decrease the level of water.	 Control the water quality using this device.	 We use the device to control the water quality using this device.

Share your feedback

Share your feedback

Feedback form

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING & SCHEDULING:

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project is done by gathering information about related details on technical papers and web browsing.	06 OCTOBER 2022
Empathy Map	Prepared Empathy Map Canvas to combine thoughts and pains, gains of the project with all team members .	08 OCTOBER 2022
Ideation	Brainstorming session is conducted with all team members to list out all the ideas and prioritise the top 3 ideas.	09 OCTOBER 2022
Proposed Solution	Prepared the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	28 OCTOBER 2022
Problem Solution Fit	Prepared problem - solution fit document.	30 OCTOBER 2022

6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation

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, I can register for the application by entering my email, password, and confirming my password.	2	High	P Aungilas Sowban Prajah
Sprint-1	User Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	Medium	A Vengadesh perumal
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	2	High	M Neranjan Prakash
Sprint-2	Interface Sensor	USN-1	A sensor interface is a bridge between a device and any attached sensor. The interface takes data collected by the sensor and outputs it to the attached device.	2	High	B Saravanan M Neranjan Prakash

Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	P Aungilas Sowban Prajah M Neranjan Prakash B Saravanan A Vengadesh Perumal
Sprint-4	Web Application	USN-1	As a user, I will show the current Information of the River water.	1	Medium	M Neranjan Prakash P Aungilas Sowban Prajah

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Project Tracker, Velocity & Burndown Charts

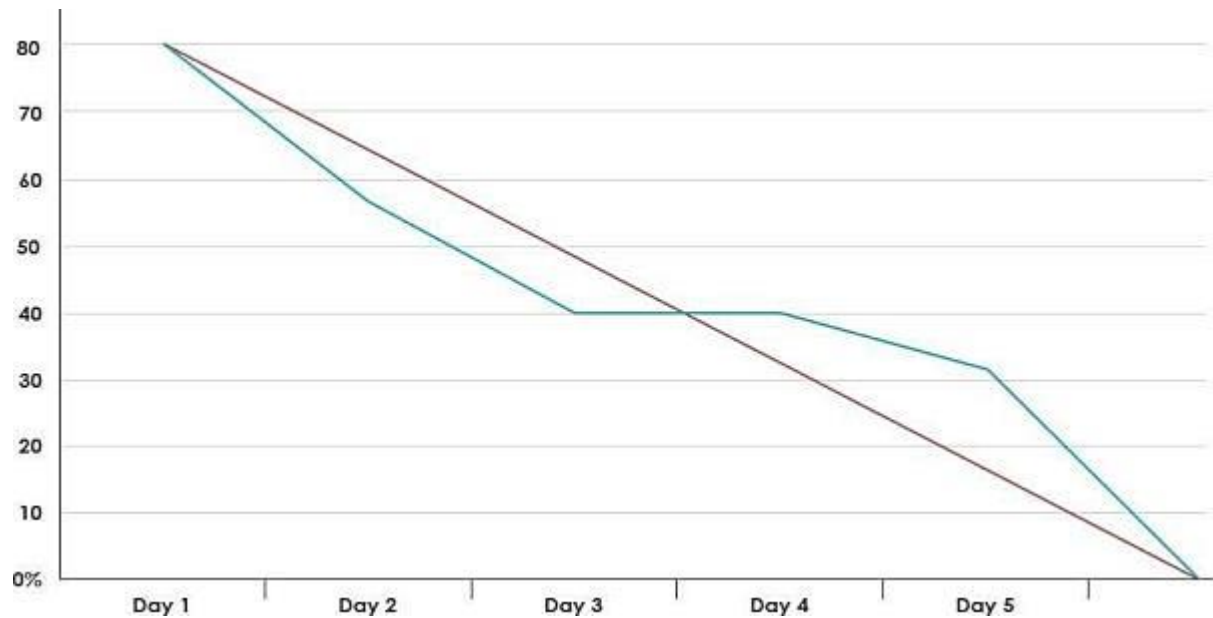
Project Tracker, Velocity & Burndown Charts (4 Marks):

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

Velocity:

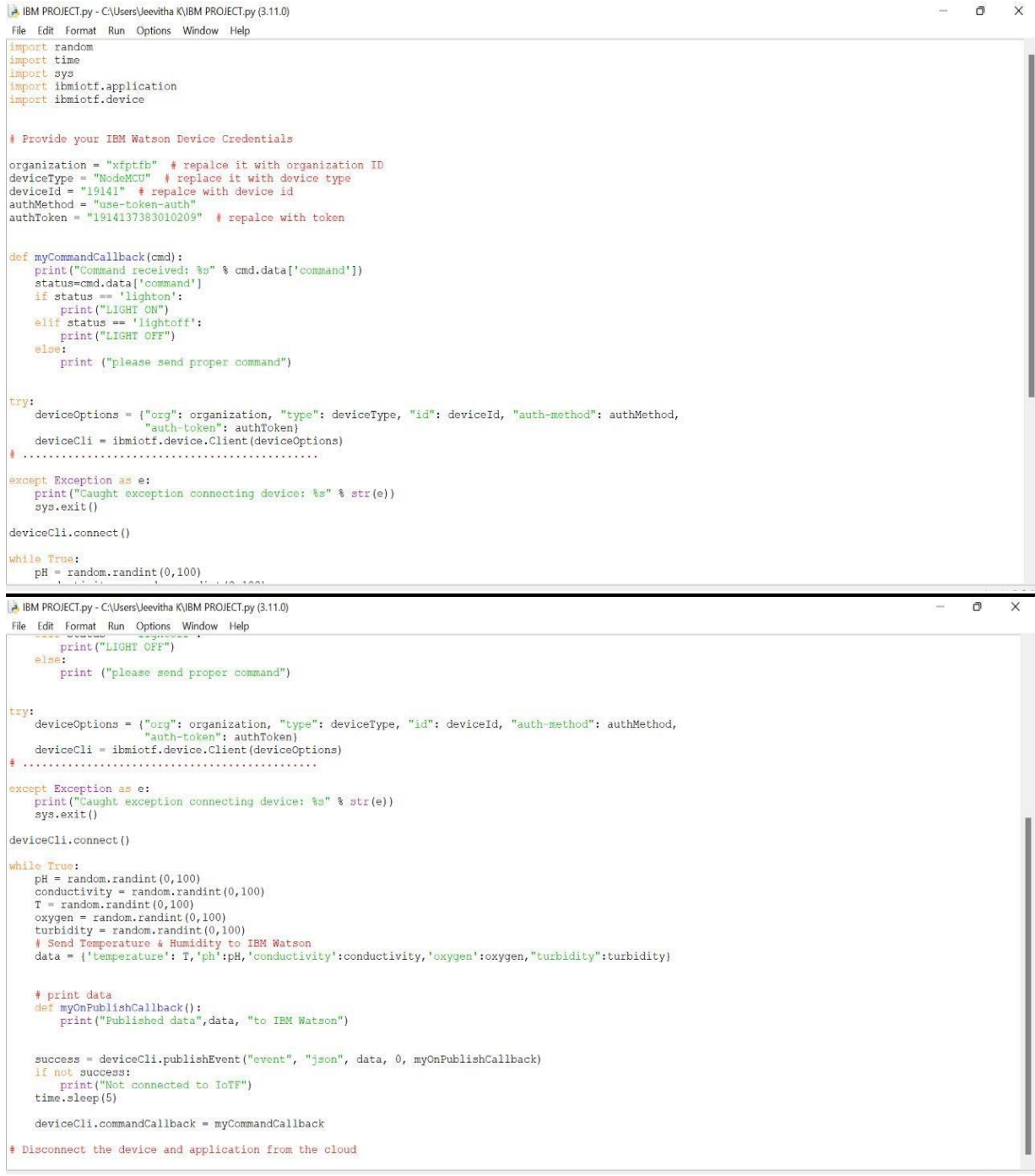
$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

Burndown Chart:



7.CODING AND SOLUTIONING

7.1 Python Script:



```

IBM PROJECT.py - C:\Users\Jeevitha K\IBM PROJECT.py (3.11.0)
File Edit Format Run Options Window Help

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

# Provide your IBM Watson Device Credentials

organization = "xtpftfb" # replace it with organization ID
deviceType = "NodeMCU" # replace it with device type
deviceId = "19141" # replace with device id
authMethod = "use-token-auth"
authToken = "1914137383010209" # replace 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 = {'temperature': 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:

```

vishnu_ibm.py - C:/Users/jayap/AppData/Local/Programs/Python/Python37/vishnu_ibm.py (3.7.4)
File Edit Format Run Options Window Help

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

# Provide your IBM Cloud API key and device ID
organization = "
deviceType = "No
deviceId = "1914
authMethod = "to
authToken = "191

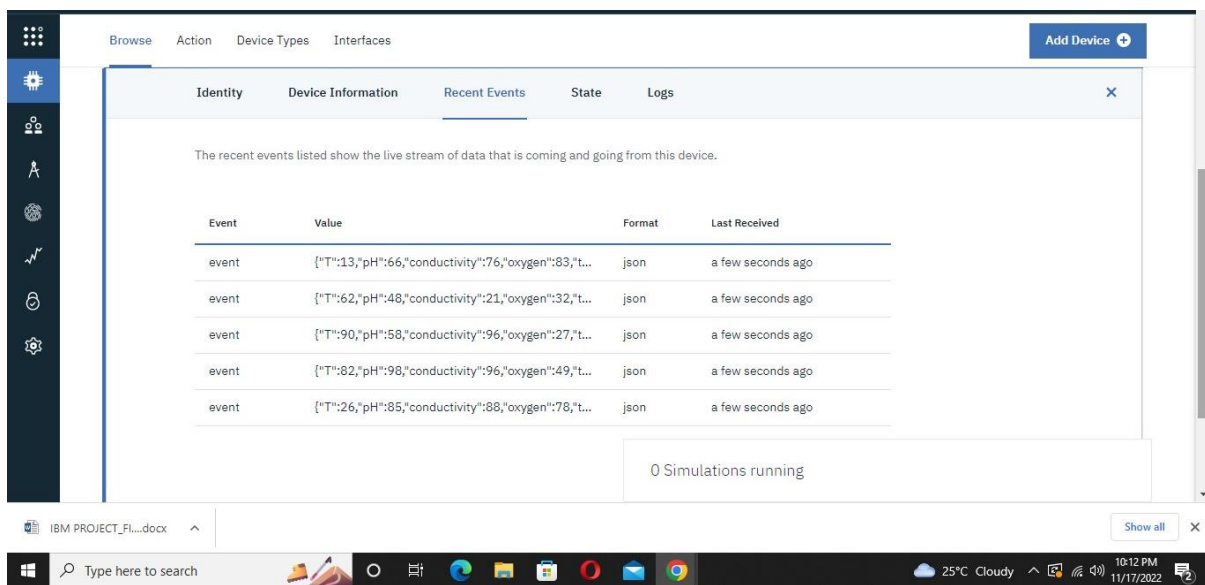
def myCommandCallback(cmd):
    print("Command received: {}".format(cmd))
    status = cmd.split()
    if status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 75, "pH": 44, "conductivity": 84, "oxygen": 71, "turbidity": 45
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 46, "pH": 54, "conductivity": 94, "oxygen": 12, "turbidity": 49
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 97, "pH": 44, "conductivity": 46, "oxygen": 25, "turbidity": 95
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 15, "pH": 50, "conductivity": 87, "oxygen": 95, "turbidity": 53
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 61, "pH": 68, "conductivity": 51, "oxygen": 31, "turbidity": 51
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 54, "pH": 54, "conductivity": 44, "oxygen": 40, "turbidity": 100
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 26, "pH": 85, "conductivity": 88, "oxygen": 78, "turbidity": 39
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 82, "pH": 98, "conductivity": 96, "oxygen": 49, "turbidity": 45
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 90, "pH": 58, "conductivity": 96, "oxygen": 27, "turbidity": 12
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 62, "pH": 48, "conductivity": 21, "oxygen": 32, "turbidity": 53
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 13, "pH": 66, "conductivity": 76, "oxygen": 83, "turbidity": 99
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "status":
        print("Getting status from IBM Watson")
        data = {
            "T": 13, "pH": 95, "conductivity": 37, "oxygen": 54, "turbidity": 61
        }
        ibmiotf.device.publish(deviceId, data)
    elif status == "publish":
        print("Publishing data to IBM Watson")
        data = {
            "T": 3, "pH": 89, "conductivity": 12, "oxygen": 17, "turbidity": 47
        }
        ibmiotf.device.publish(deviceId, data)

try:
    deviceOptions = {
        "org": organization,
        "type": deviceType,
        "id": deviceId,
        "method": authMethod,
        "token": authToken
    }
    device = ibmiotf.device.Device(deviceOptions)
    device.connect()
    deviceCli = ibmiotf.device.Client(device)
    deviceCli.connect()
except Exception as e:
    print("Caught exception: {}".format(e))
    sys.exit()

while True:
    pH = random.random() * 14
    conductivity = random.random() * 100
    T = random.random() * 100
    oxygen = random.random() * 100
    turbidity = random.random() * 100
    # Send Temperature
    deviceCli.publish("publish", data)
    time.sleep(1)

```

7.2 Publishing datas to IBM Watson:



7.3 Pushing data from IBM Watson to Node-RED:

The image displays two screenshots of the Node-RED web interface, showing a data flow from IBM Watson IoT to various sensors and actuators.

Top Screenshot: The interface shows a flow named "Flow 1". The flow starts with an "IBM IoT" node (connected) which branches into five parallel paths. Each path contains a function node (labeled "pH", "conductivity", "T", "oxygen", and "turbidity") followed by a corresponding output node (labeled "pH", "conductivity", "T", "oxygen", and "turbidity"). All five paths converge into a single "msg.payload" node. The debug console on the right shows the following data:

```

17/11/2022, 22:13:18 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : Object
{ T: 99, pH: 4, conductivity: 9,
oxygen: 63, turbidity: 83 }

17/11/2022, 22:13:18 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
4

17/11/2022, 22:13:19 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
9

17/11/2022, 22:13:20 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
99

17/11/2022, 22:13:20 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number

```

Bottom Screenshot: The interface shows a flow named "Flow 1". The flow starts with a "Light on" node and a "Light off" node. Both nodes connect to an "IBM IoT" node (connected). The "Light on" node also connects to a "msg.payload" node. The "Light off" node connects to a "msg.payload" node. The "IBM IoT" node connects to a "[get] /command" node, which then connects to an "http" node. The "[get] /sensor" node connects to a "mit" node, which then connects to an "http" node. The debug console on the right shows the following data:

```

17/11/2022, 22:13:28 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : Object
{ T: 50, pH: 52, conductivity: 0,
oxygen: 16, turbidity: 65 }

17/11/2022, 22:13:28 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
52

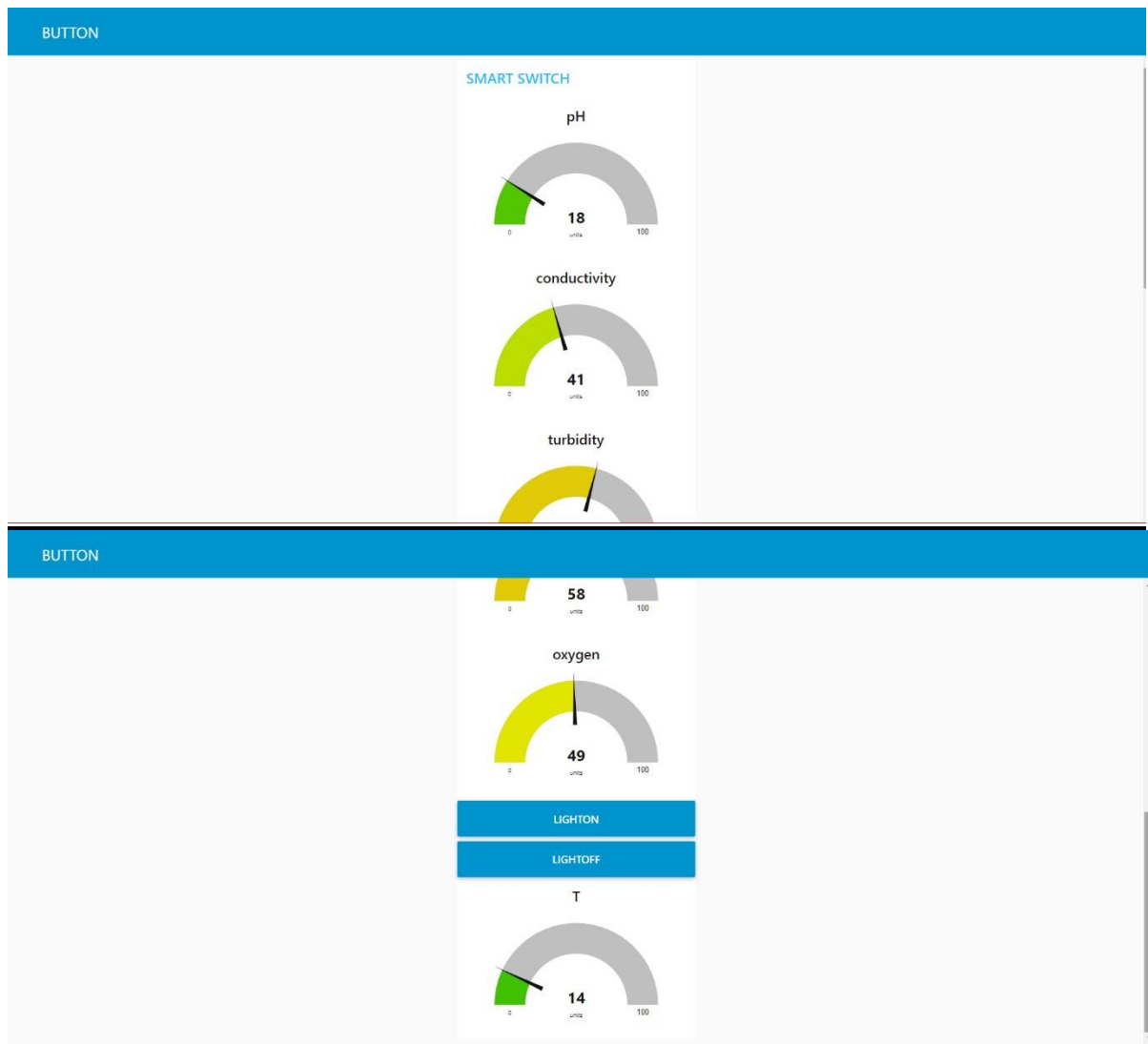
17/11/2022, 22:13:28 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
0

17/11/2022, 22:13:28 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number
50

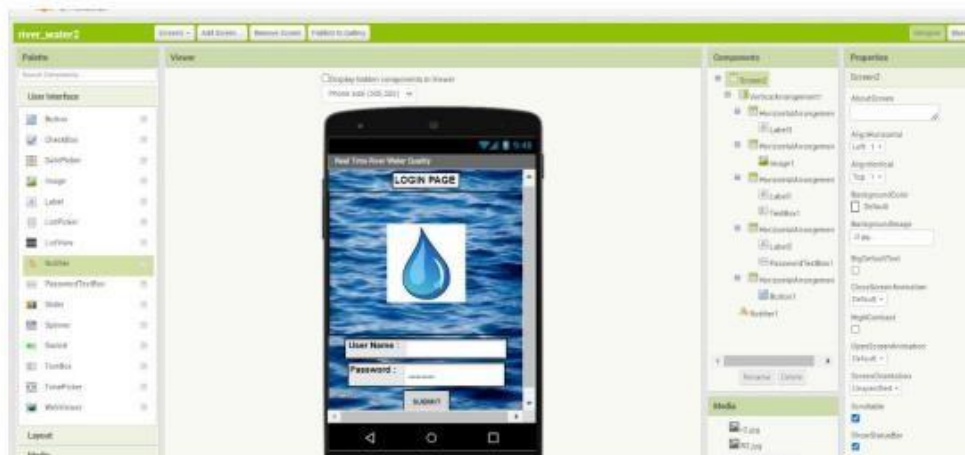
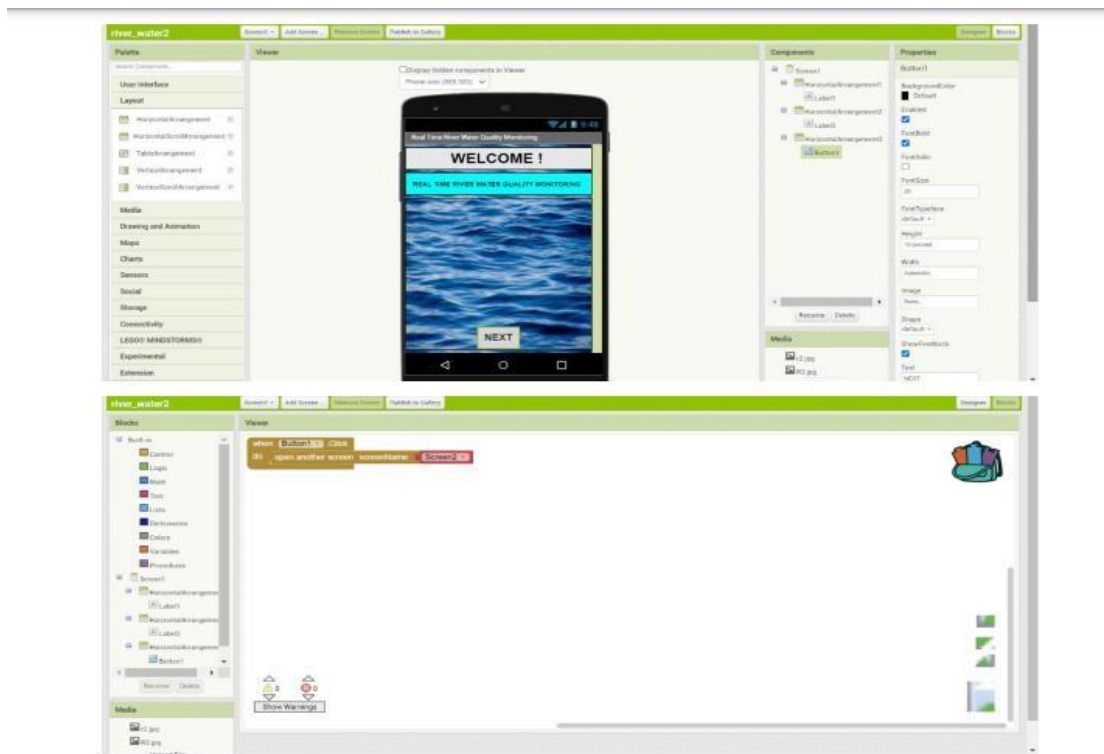
17/11/2022, 22:13:28 node: c2c649a-0d0d98
iot-2/typeNodeMCU/Id/19141/ev/event/tmt/json :
msg.payload : number

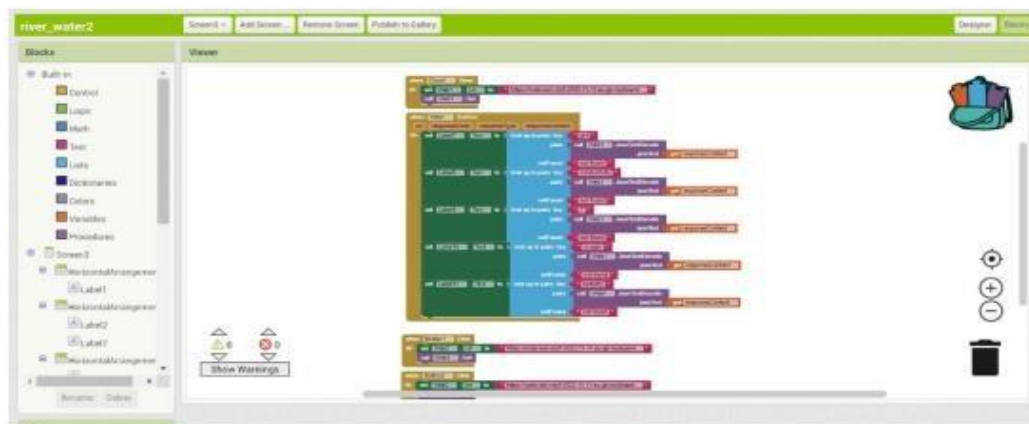
```

Node-RED dashboard:



7.4 Mit-app inventor:





OUTPUT:

REAL TIME RIVER WATER QUALITY MONITORING

MONITORING WINDOW

ph : 61

Conductivity : 27

Temperature : 96

Oxygen : 48

Turbidity : 73

LIGHT ON

LIGHT OFF



8.TESTING

8.1 TEST CASES:

- We want to check the water condition whether drinkable or not based on data received.
- If the water conditions are normal and drinkable water nothing needs to be done.
- If the water conditions are not normal, water is polluted or spoiled and needs to be changed and alert the people.

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

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 scalability of this project gives the addition of more different type of sensors. By interfacing the relay we can control the supply of water. We can also implement as a revenue model. This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

13. APPENDIX:

13.1 GIT-HUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-13174-1659513009>

13.2 PROJECT DEMO LINK:

<https://youtu.be/KX1ccgUlez4>