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

Team Id: PNT2022TMID12298

PROJECT GUIDES

Industry Mentor: Bharadwaj

Faculty Mentor: Aravind P

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1.INTRODUCTION

1.1 Project Overview:

River Water quality monitoring System

River water which is used as drinking water is a very precious commodity for all human beings. The system consists of several sensors which are used for measuring physical and chemical parameters of water. The parameters such as temperature, pH, and dissolved oxygen of the water can be measured. Using this system a person can detect pollutants from a water body from anywhere in the world. Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a micro-controller for processing the system, communication system for inter and intra node communication and several sensors Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology Data collected at the IBM cloud Server and verify them to trigger the actions to be performed.

1.2 Purpose:

Water quality refers to chemical, physical biological and radio logical characteristics of water. It is a measure of the condition of water relative to the necessities of one or more bio-tic species and or to any human need or purposes .Water quality monitoring is defined as a sampling and analysis of the water in lake, stream, ocean and river and conditions of the water body. Smart water quality monitoring is a process of real-time monitoring and the analysis of water to identify changes in parameters based on the physical, chemical and biological characteristics.Monitoring water quality is clearly important: in our seas, our rivers, on the surface and in our ports, for both companies and the public. It enables us to assess how they are changing, analyze trends and to inform plans and strategies that improve water quality and ensures that water meets its designated use.There are several indicators determining water quality. These include dissolved oxygen, turbidity, bio indicators, nitrates, pH scale and water temperature.Monitoring water quality helps to

identify specific pollutants, a certain chemical, and the source of the pollution.There are many sources of water pollution: wastewater from sewage seeping into the water supply; agricultural practices (e.g., the use of pesticides and fertilizer); oil pollution, river and marine dumping, port, shipping and industrial activity. Monitoring water quality and a water quality assessment regularly provides a source of data identify immediate issues – and their source.

- Identifying trends, short and long-term, in water quality.
- Data collected over a period of time will show trends, for example identifying increasing concentrations of nitrogen pollution in a river or an inland waterway. The total data will then help to identify key water quality parameters.
- Environmental planning methods: water pollution prevention and management.
- Collecting, interpreting and using data is essential for the development of a sound and effective water quality strategy. The absence of real-time data will however hamper the development of strategies and limit the impact on pollution control. Using digital systems and programs for data collection and management is a solution to this challenge.
- Monitoring water quality is a global issue and concern: on land and at sea. Within the European Union, the European Green Deal sets out goals for restoring biological biodiversity and reducing water pollution, as well as publishing various directives to ensure standards of water quality. Individual nation states, for example France, have also clear regulatory frameworks requiring the effective monitoring of water quality. In the United States, the Environmental Protection Agency (EPA) enforces regulations to address water pollution in each state. Across the world, countries increasingly understand the importance of effective water quality monitoring parameters and methods.

2.LITERATURE SURVEY

2.1 Existing problem:

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. 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).

2.3 Problem Statement:

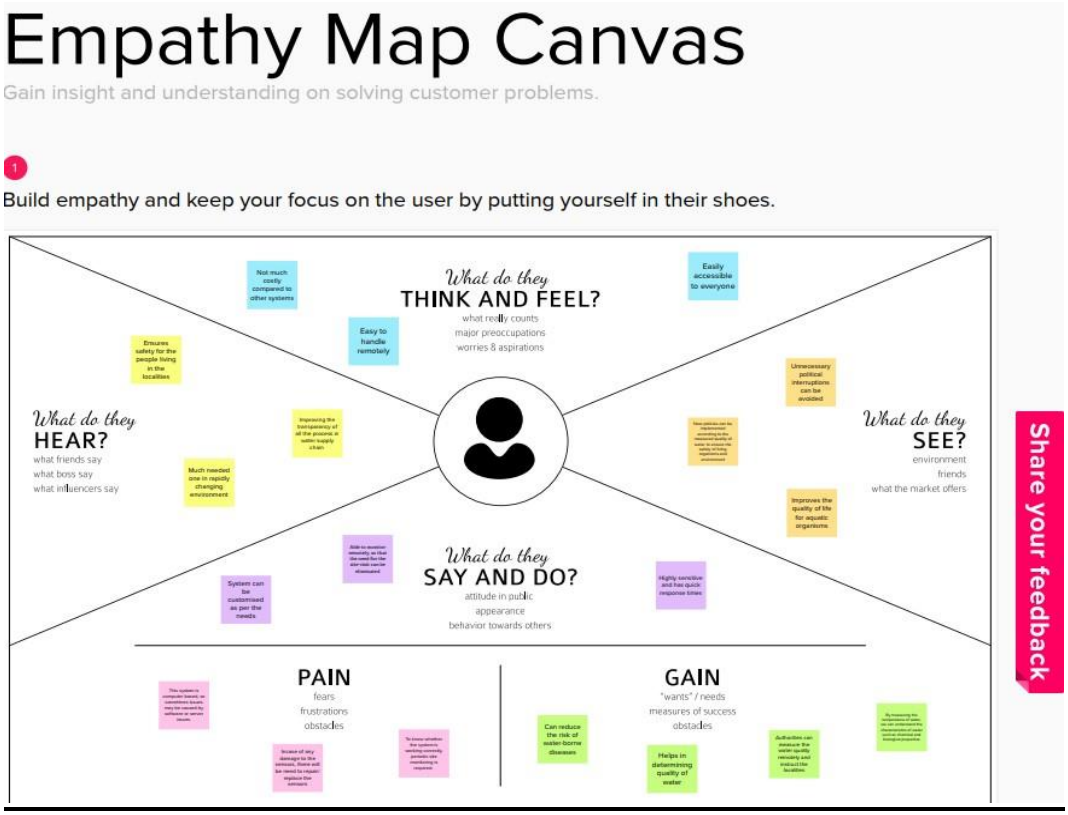
Due to the fast growing urbanization supply of safe drinking water is a challenge for the every city authority. Water can be polluted any time. • So the water we reserved in the water tank at our roof top or basement in our society or apartment may not be safe. Still in India most of the people use simple 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 helps teams better understand their users.Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming:

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

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

Template

Brainstorm & idea prioritization

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

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

Share template feedback

Need some inspiration?

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

Open example →

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.

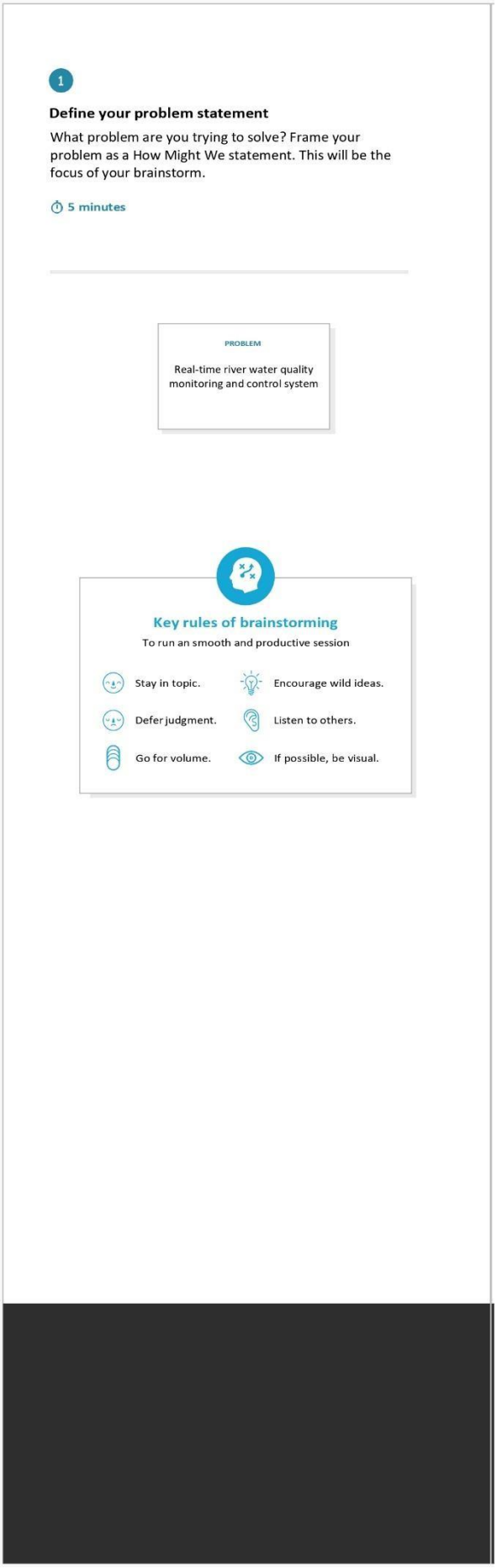
10 minutes

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

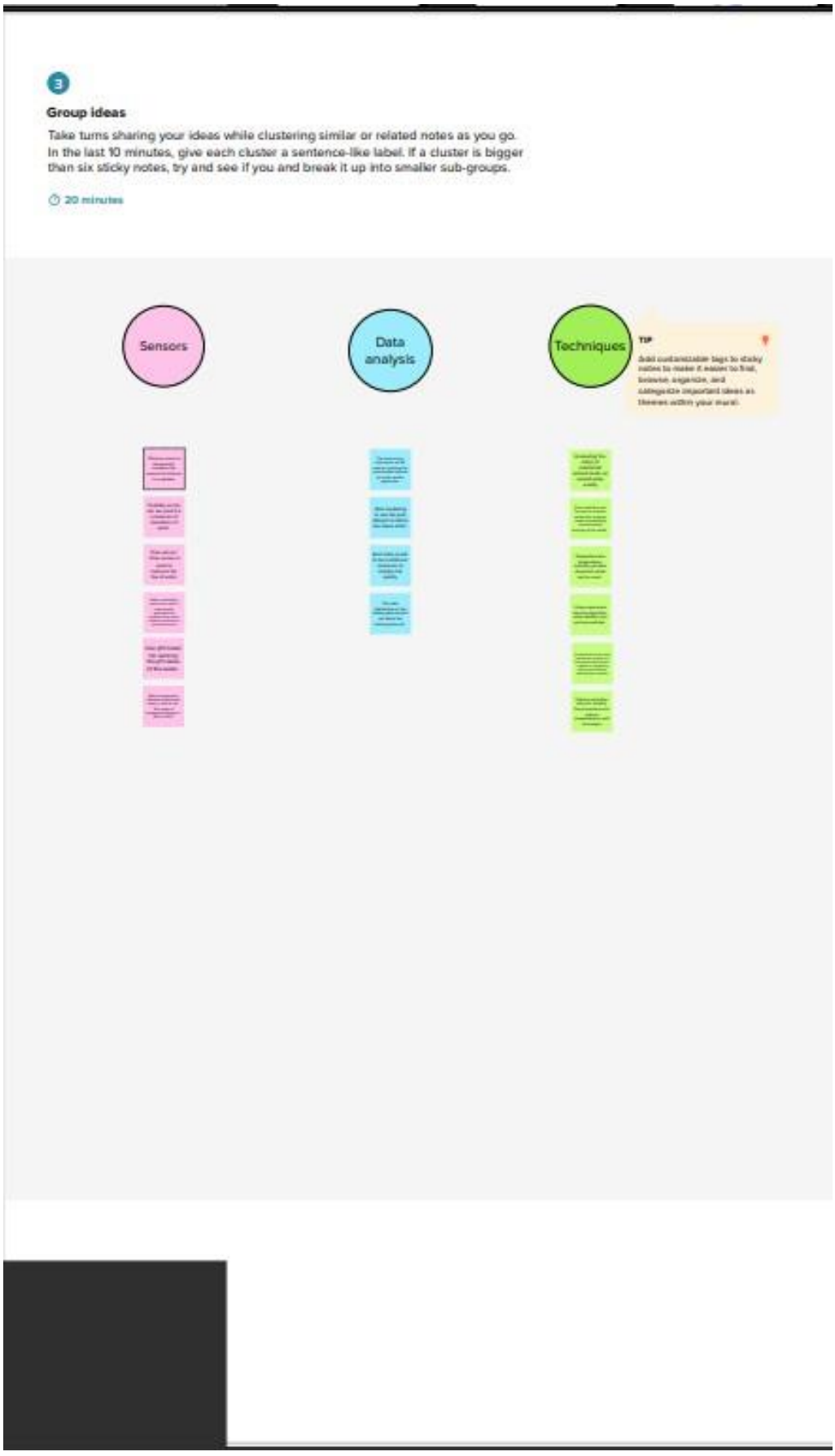
Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

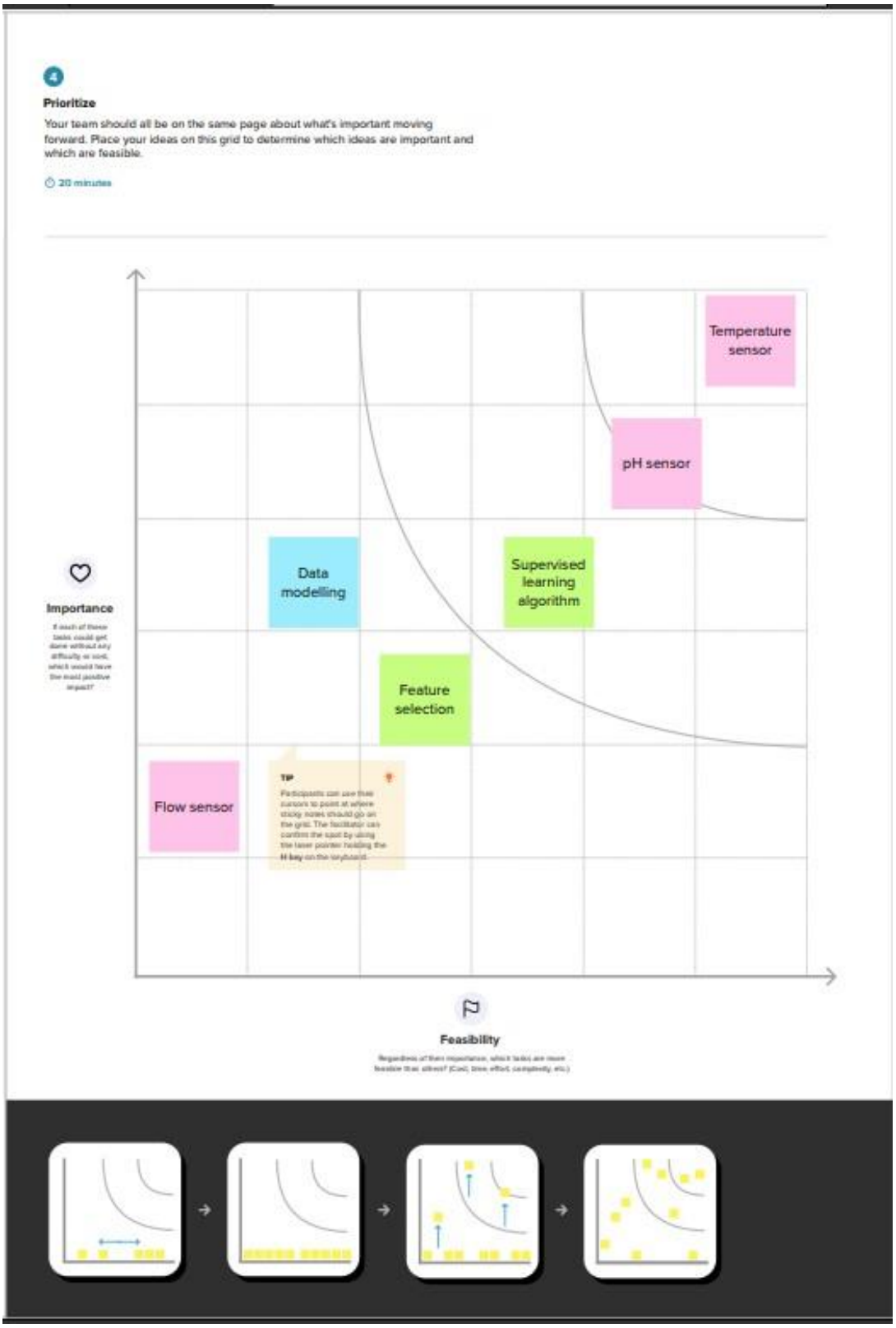
Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →


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
M.NERANJAN PRAKASH
B.SARAVANAN
A.VENGADESH PERUMAL
arduino and sensor based water parameters monitoring
pH, turbidity ,temperature sensors connected with arudino
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
identifying of threshold values of pH temperature and turbidity
measuring device based two nri cameras and image processing
cloud data based microcontroller node mcu used for water monitoring
algorithm encryption and decryption datas of pH and turbity of water
UI web application for water monitoring
alerting water contamination of algae to locals through Wi-Fi
biological and chemical changes identification of water by conventional method
dissolve air floatation methodology for controlling algae
statistical recording of pH temperature values in data storing method
app developing for detecting pH ,turbidity and temperature of river water
predicting the algal bloom graph
using graph creating database in cloud
wireless network based water parameter data collection
forming mesh network using sensor to better monitoring
ion exchange method after detection
motor like device for cleaning algae and contains chlorine for clearing algae
lab based water parameter datas
semi automated or manual control devices for checking pH turbidity and water temperature value
hydrophonics and aquaphonics technology for pH indicator
nephelometer for turbidity measurement
collecting fetilizer and pesticide contaminated water through field site ridges
predicting the growth of algae using conventoinal method
biotreatment for contaminated water
manual checking of water contamination by paper report


3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.
20 minutes
Sensors
Data analysis
Techniques
TIP


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
Temperature sensor
pH sensor
Data modelling
Supervised learning algorithm
Feature selection
Flow sensor
TIP
Importance
Feasibility

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

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

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

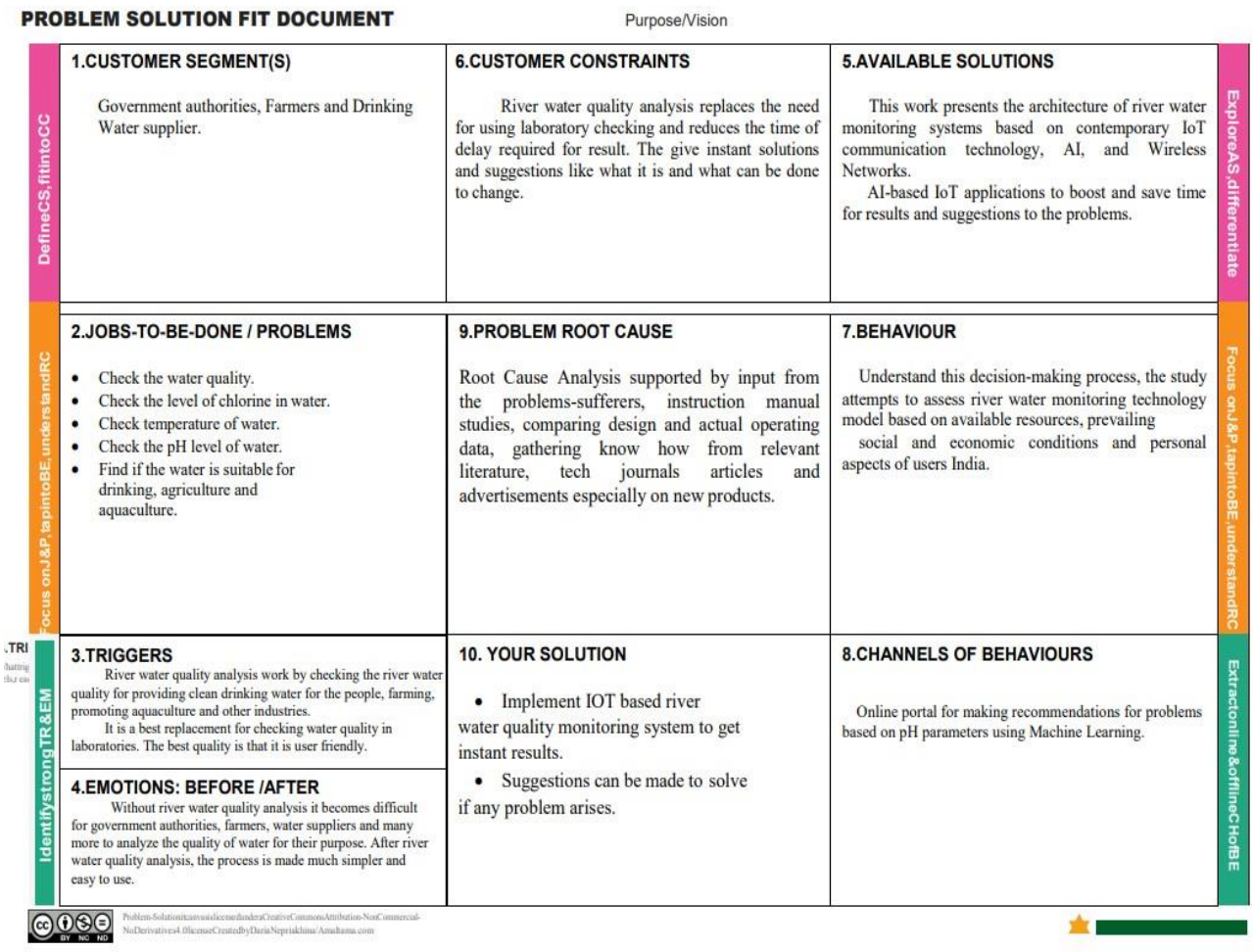
Share template feedback

3.3 Proposed Solution:

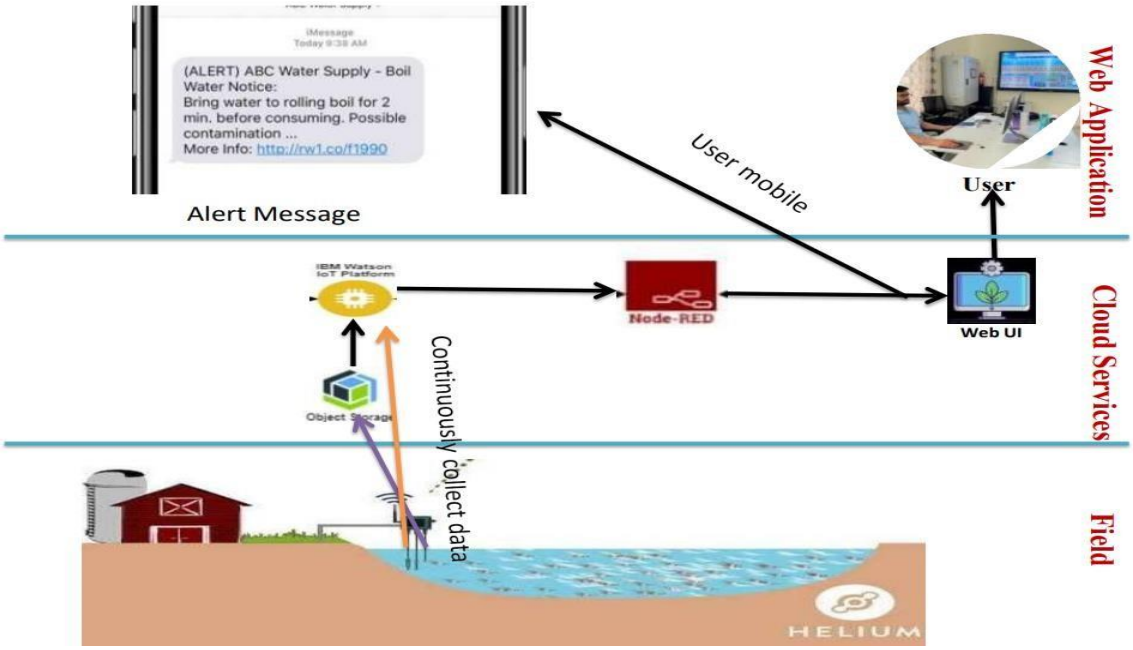
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Most of the water is affected by the industrial wastes containing chemicals, medical wastes and by washing vehicles the engine oil is mix with the river water.
2.	Idea / Solution description	* To measure various chemical and physical properties of water like pH, temperature and particle density of water using sensors. * Dispose the industrial waste, toxic chemicals and medical waste properly.
3.	Novelty / Uniqueness	* If the acquired value is above the threshold value automated warning SMS will be sent to the agent. * The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility and low powered.
4.	Social Impact / Customer Satisfaction	* Everyday peoples and animals will drink only the pure water. * The risk of water-borne diseases can be reduced. * Good environment surrounding the river. * The good quality river water is mainly used for farmers.
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	* Water quality data with a high spatial and temporal resolution for thousands of lakes at a time. * 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.

3.4 PROBLEM SOLUTION:



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 befollowed by the users.

4.2 *Non-functional Requirements:*

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

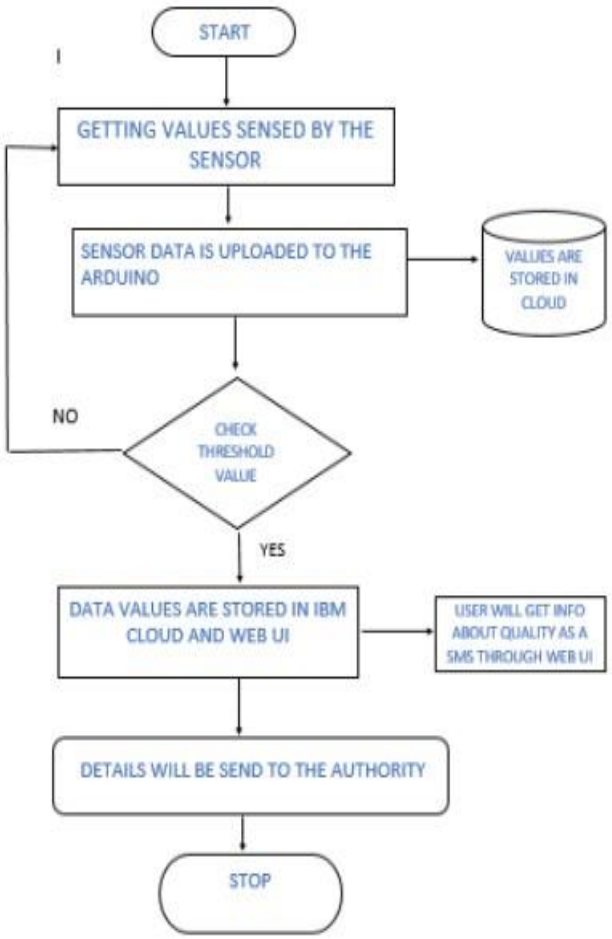
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The Final data should be easily understandable.
NFR-2	**Security**	The model are designed in a safe and secured manner inorder to maintain the privacy.
NFR-3	**Reliability**	Even if there is any firmware issues (failures) thelast updated 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

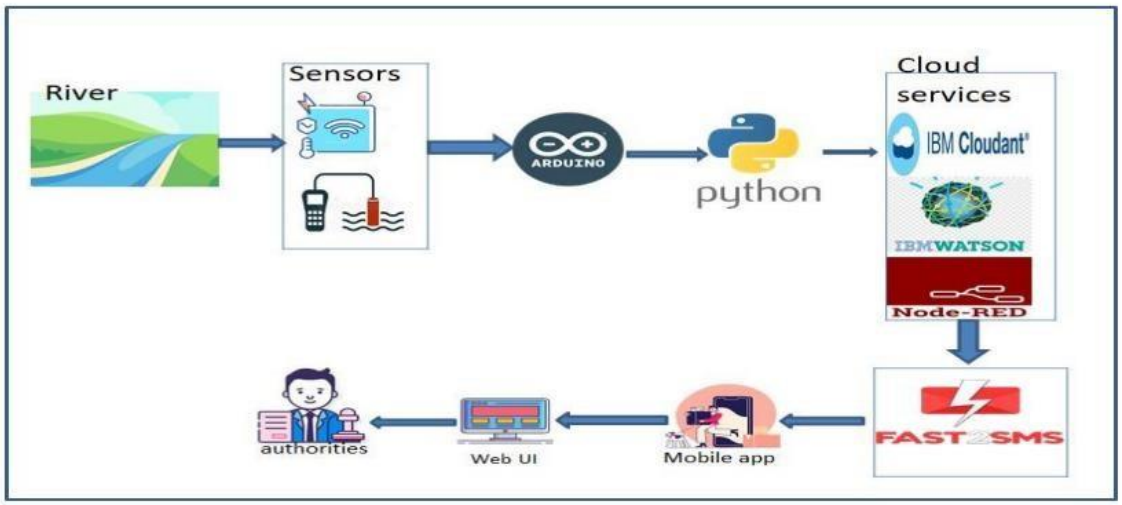
Components & Technologies:

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

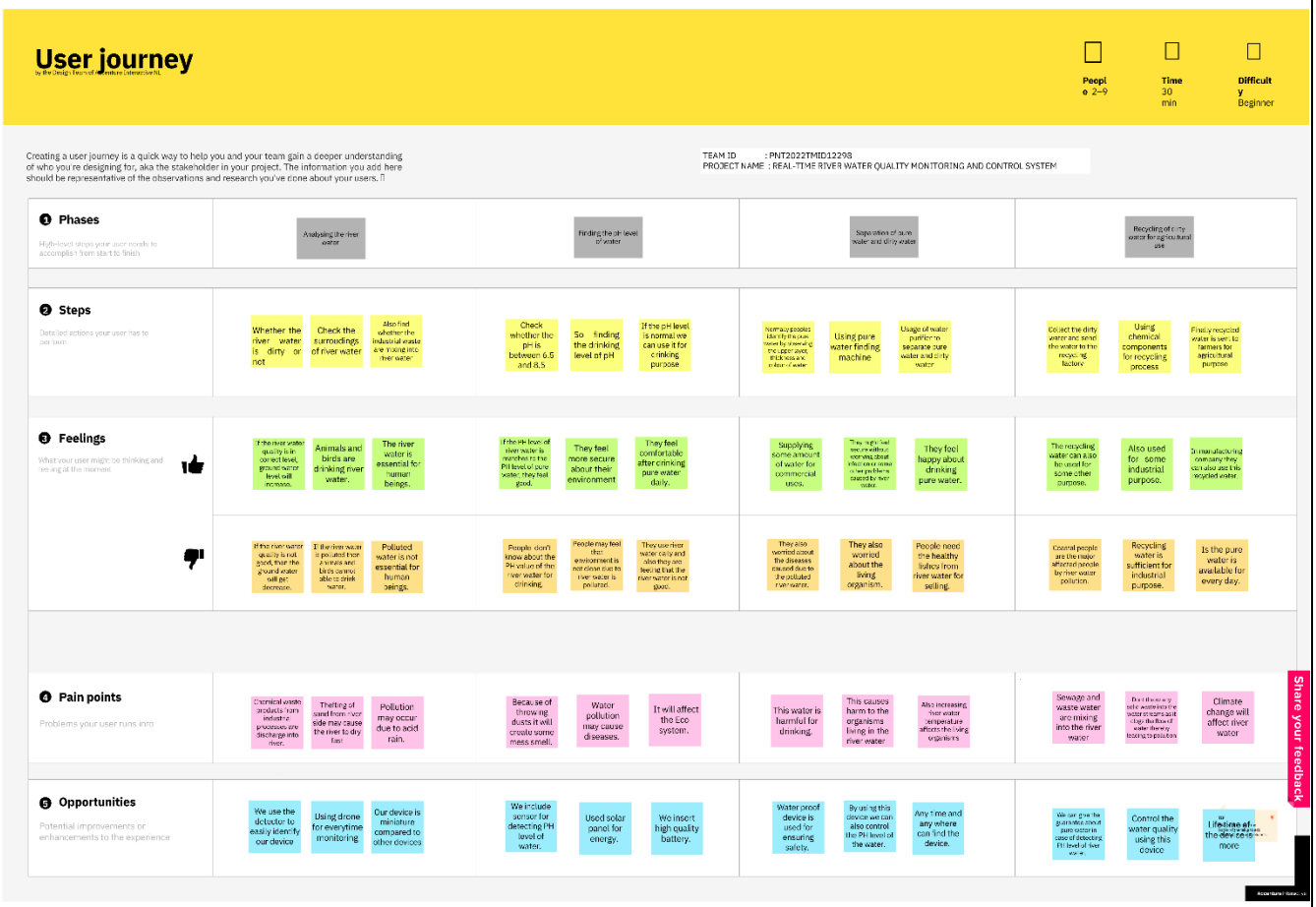
Technical Architecture:



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
	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 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



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 confirmingmy 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

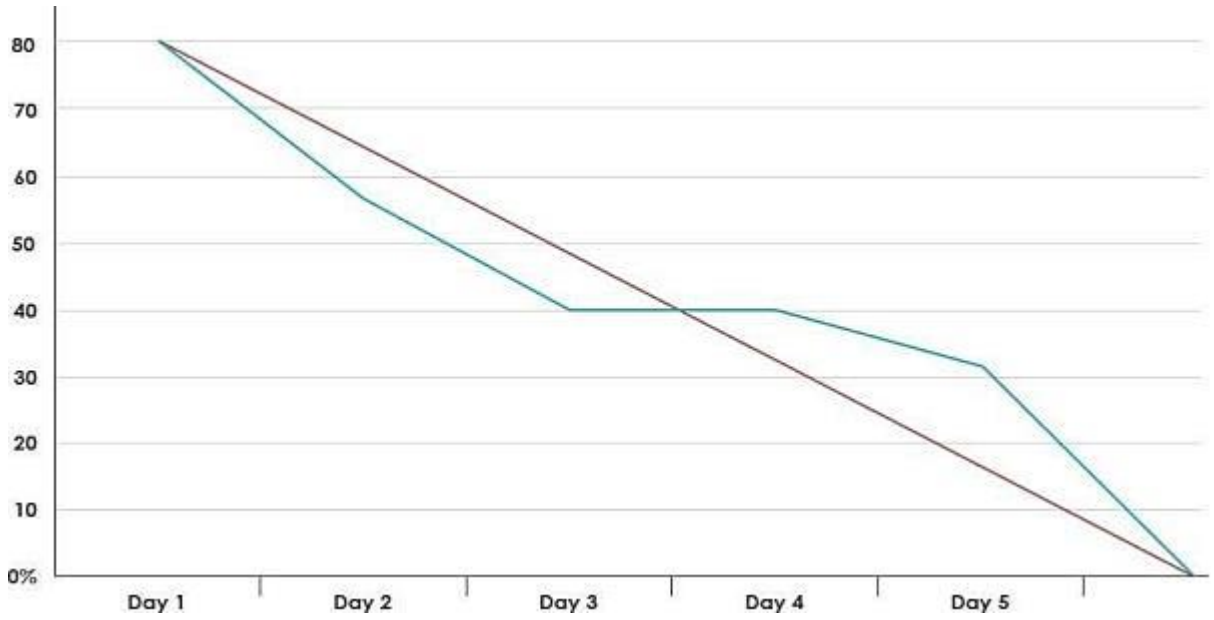
Project Tracker, Velocity & Burndown Charts (4 Marks):

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

Velocity:

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

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

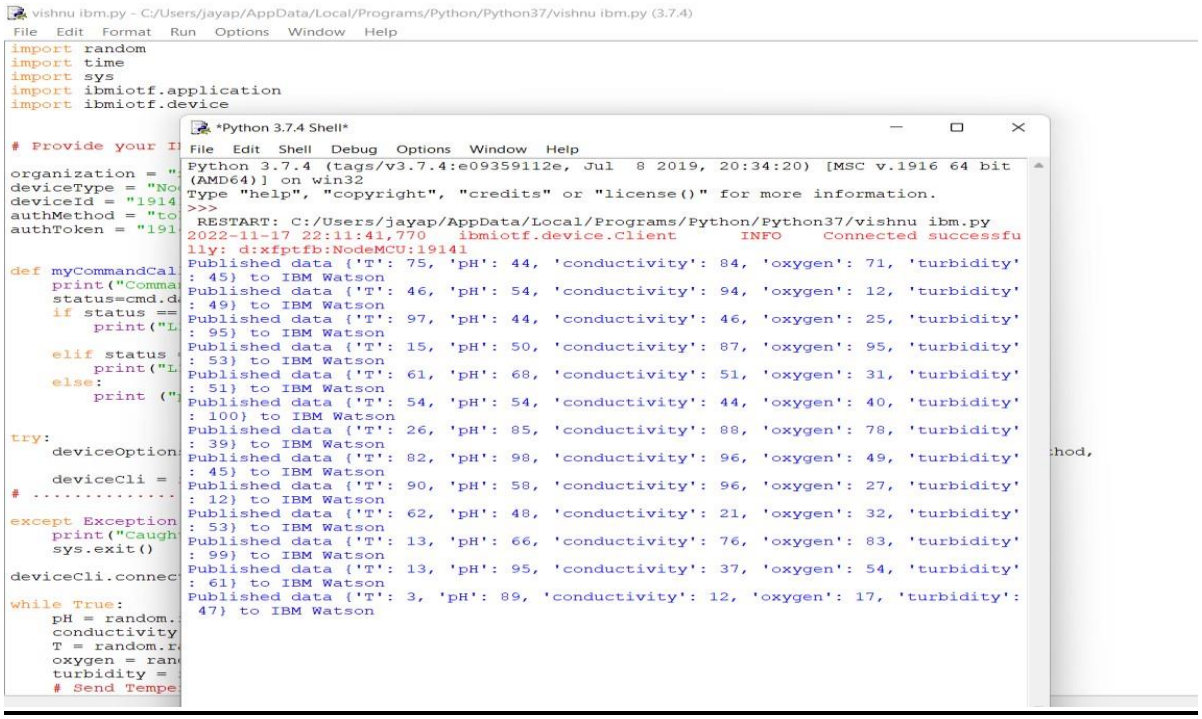
```
import random
import time
import sys
import ibmiotf.application
import ibmiotf.device


# Provide your IBM Watson Device Credentials

organization = "xfptfb"  # repalce it with organization ID
deviceType = "NodeMCU"  # replace it with device type
deviceId = "19141"  # repalce with device id
authMethod = "use-token-auth"
authToken = "1914137383010209"  # repalce with token


def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status == 'lighton':
        print("LIGHT ON")
    elif status == 'lightoff':
        print("LIGHT OFF")
    else:
        print ("please send proper command")


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

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

deviceCli.connect()

while True:
    pH = random.randint(0,100)
```

IBM PROJECT.py - C:\Users\Jeevitha K\IBM PROJECT.py (3.11.0)

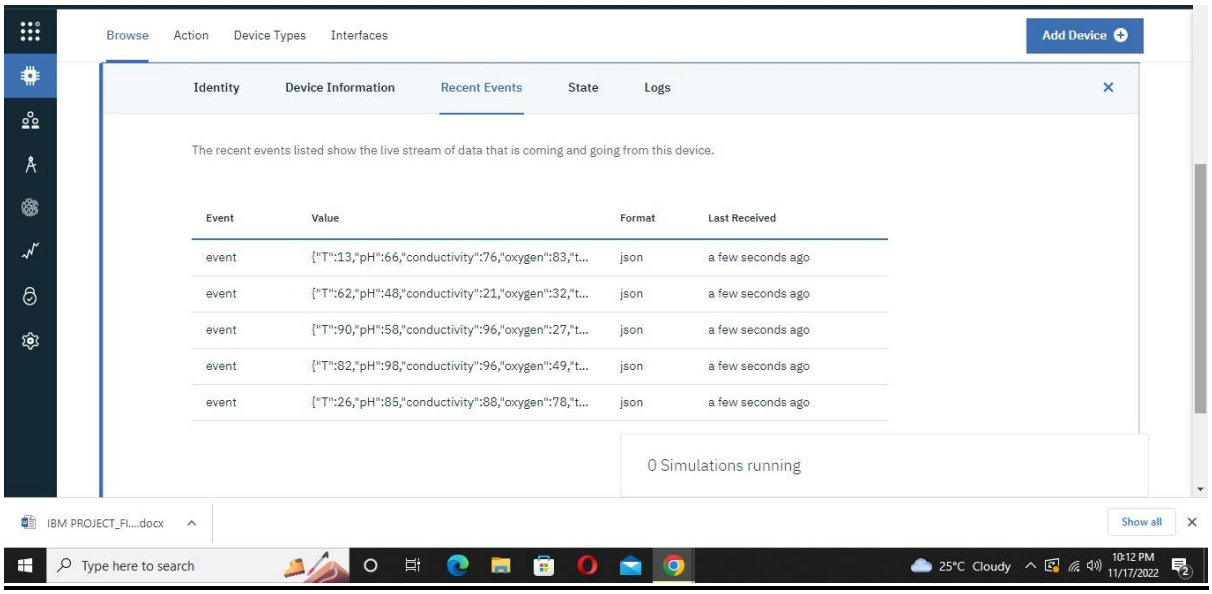
File Edit Format Run Options Window Help

```
        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
```

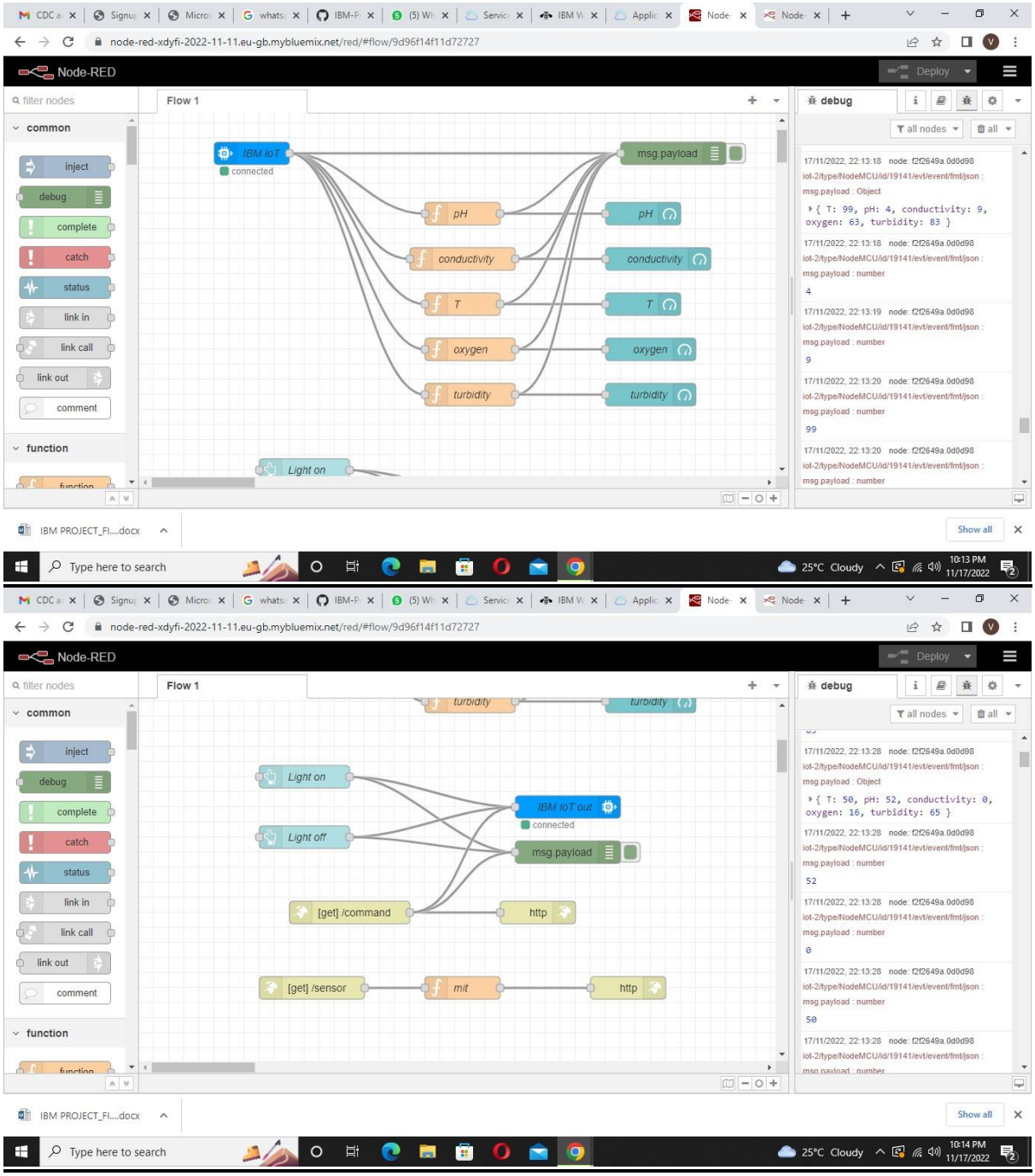
OUTPUT:



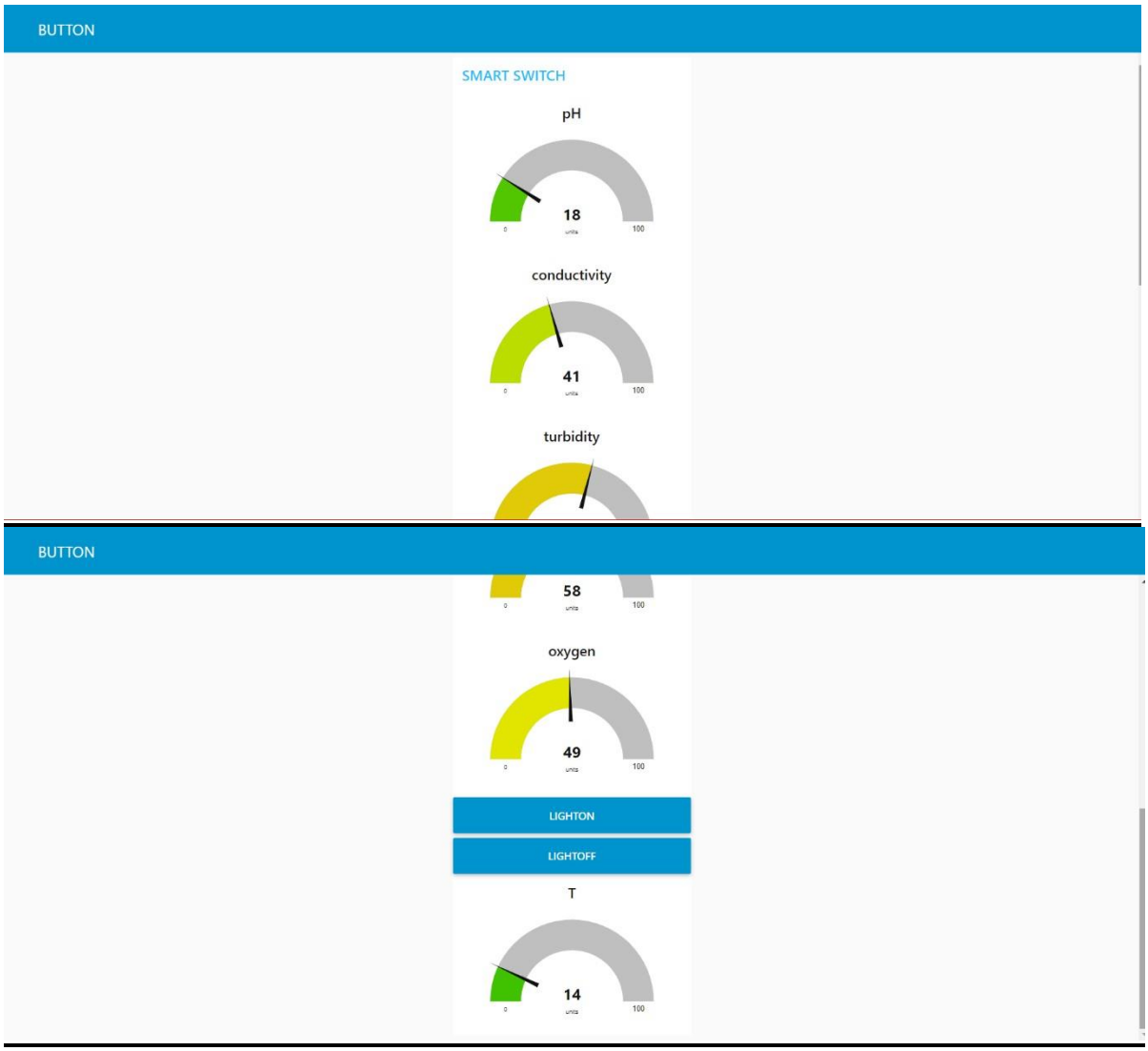
7.2 Publishing datas to IBM Watson:



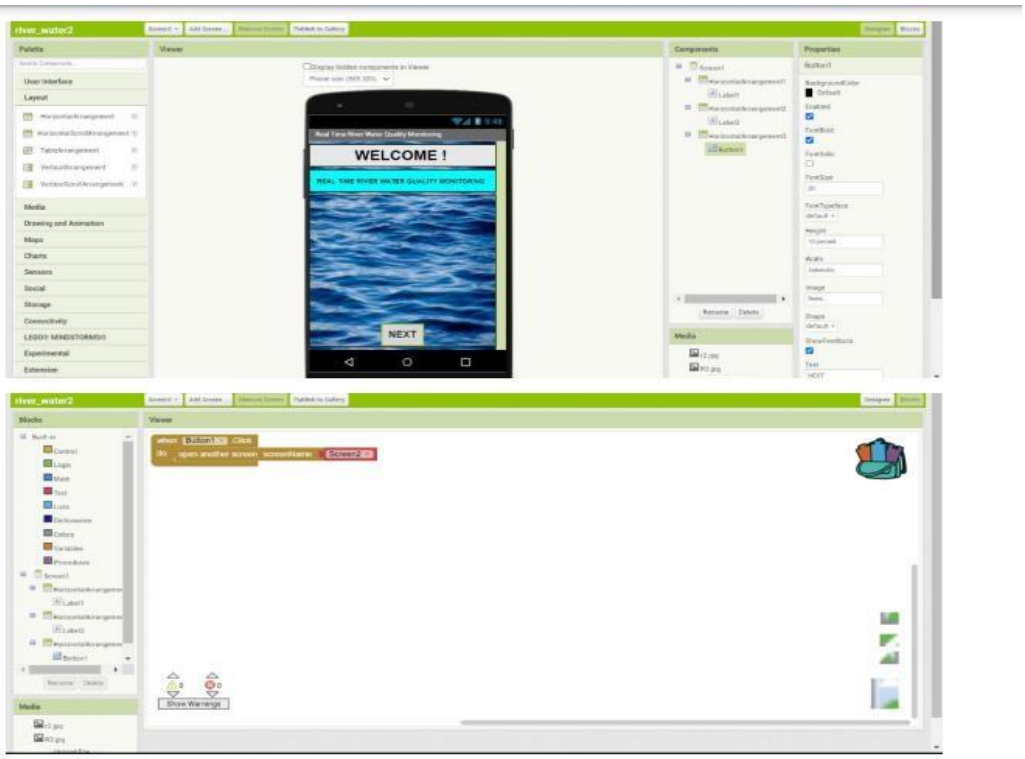
7.3 Pushing datas from IBM Watson to Node-RED:



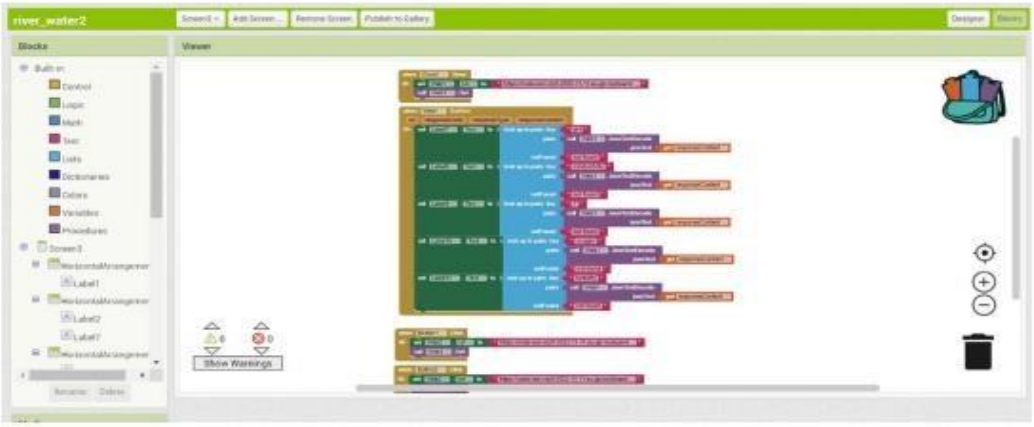
Node-RED dashboard:



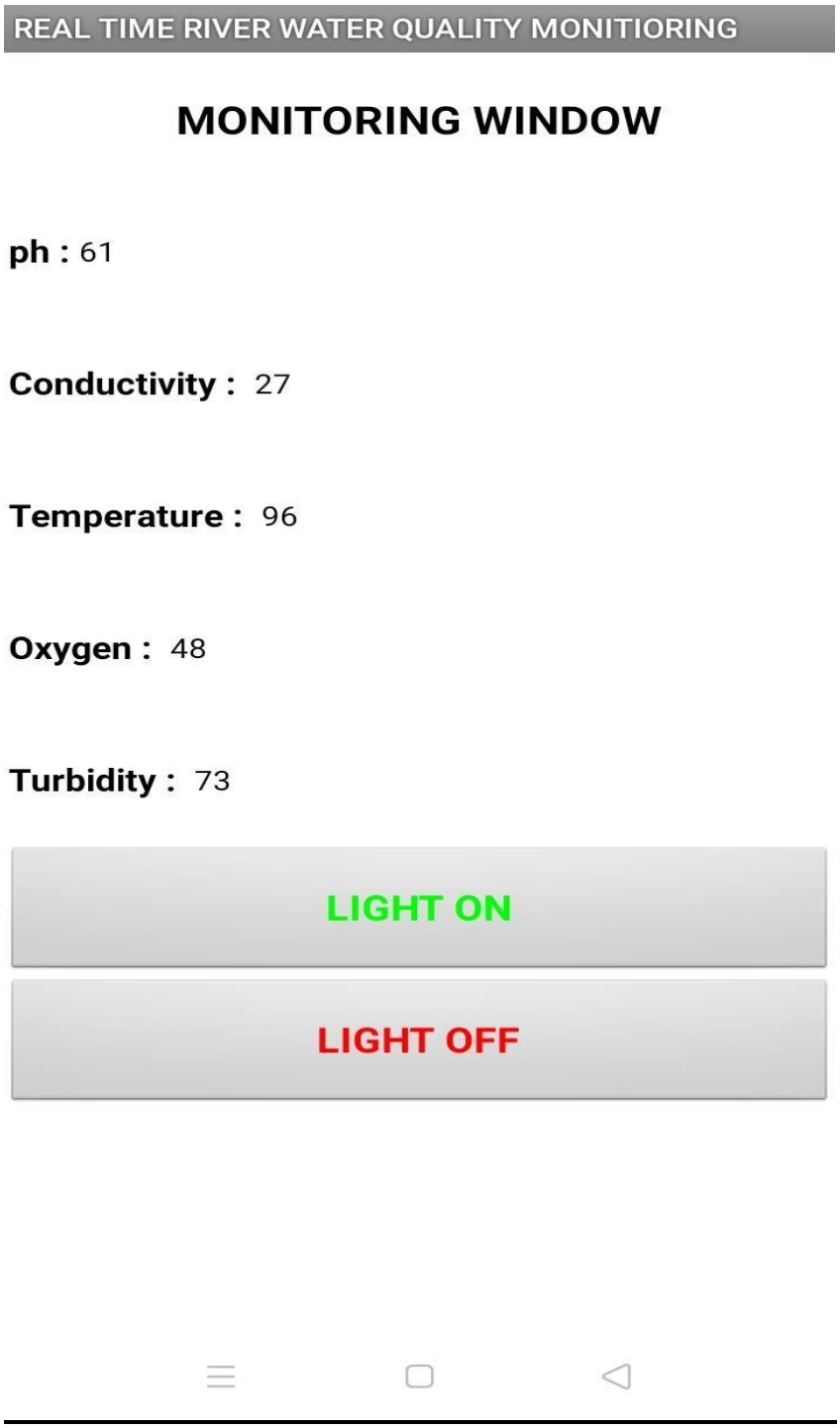
7.4 Mit-app inventor:




river_water2
Palette
Viewer
Components
MONITORING WINDOW
ph :
Conductivity :
Temperature :
Oxygen :
Turbidity :
LIGHT ON
LIGHT OFF


river_water2
Blocks
Viewer
Show Warnings

OUTPUT:


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

13. APPENDIX:

13.1 GIT-HUB LINK:

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

13.2 PROJECT DEMO LINK:

https://youtu.be/KX1ccgUlez4