HINDUSTHAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai, Accredited with "A" Grade by NAAC) Valley Campus, Pollachi Main Road, Coimbatore 641 032.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REPORT ON

HX 8001 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

(Naalaiya Thiran Program)

PROJECT TITLE

IOT-REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

TEAM ID: PNT2022TMID10555

TEAM MEMBERS

1. VIJAY.A(TEAM LEAD)
2. VEERA SEKAR.P
3. VARSHA.S
4. VIGNESH.M

MENTOR

Mrs.S.RAMYA

EVALUATOR

Mrs.KAVITHA

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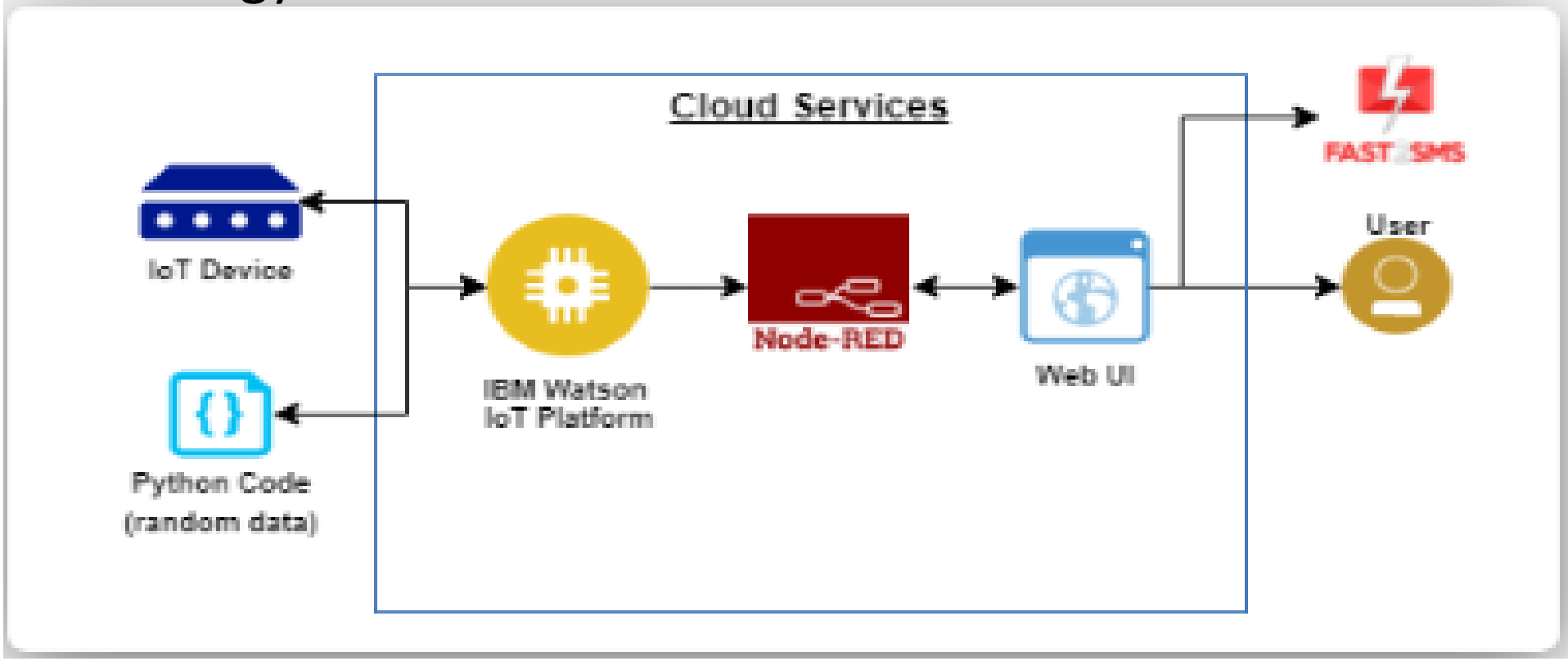
1.Introduction:

1.1)project overview:

Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology.Data collected at the apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models,Belief Rule Based (BRB) system and is also compared with standard values. Also it assures low cost efficent water quality monitoring and control over river water.Since its battery operated,it is much safer for the locality and people to use the river water that has low rate of electrical shocks as the batteryis completely insulated and rechargable so that the system is continuous.By using this product people can predict ,analyse the hardness of water and also the factors like temperatureand turbidity of water for having a safe drinking and water with better consistancy for house hold purposes.Since water is an essential compound in our daily basis intake of it in an healthy manner is provided by our cost efficient quality monitoring and control system which is market affordable and greatly life saving factor for people using river water. The environment around consists of five key elements e.g., soil, water, climate, natural vegetation, and landforms. Among these water is the utmost crucial element for human life. It is also vital for the persistence of other living habitats. Whether it is used for drinking, domestic use, and food production or recreational purposes, safe and readily available water is the need for public health . So it is highly imperative for us to maintain water quality balance. Otherwise, it would severely damage the health of the humans and at the same time affect the ecological balance among other species ..

Water pollution is a foremost global problem which needs ongoing evaluation and adaptation of water resource directorial principle at the levels of international down to individual wells. It has been studied that water pollution is the leading cause of mortalities and diseases worldwide.The records show that more than 14,000 people die daily worldwide due to water pollution The key theme of all the projects was to develop an efficient, cost-effective, real-time water quality monitoring system which will integrate wireless sensor network and internet of things.In this research, we monitor the physical and chemical parameters of water bodies inside Chittagong city by using an IoT based sensor network.

Technology architecture:



1.2)PURPOSE:

The purpose of creating this river water quality monitoring and control system is to facilitate the poor and other living organisms and people those who use river water as their resource.this system will create an impression as an efficient propuct among thousands and milions of users due to its accuracy and advance water quality analysis and solution gathering step .it also sends an messages via fast sms system which itself is an helping hand for people to take immediate and necessary steps for water purification.the data of water quality analysis and WSN product function is always available for people in the cloud as data is stream along with time continuous mnitoring system.

2.)Literature Survey:

2.1)Exixsting problem:

we reviewed out different existing system developed by researchers. Different authors have proposed distinguished models to check water quality by analyzing the parameters such as temperature,pH and conductivity, and so on. By considering all these points, we designed a smart water monitoring system which can perform all these monitoring functions. Stephen Brosnan investigated a WSN to collect real time water quality parameters (WQP). Quio Tie-Zhn, developed online water quality monitoring system based on GPRS/GSM [15]. The information was sent by means of GPRS network, which helped to check remotely the WQP. Kamal Alameh presented web based WSN for monitoring water pollution using ZigBee and WiMAX networks. The system collected, processed measured data from sensors, and directed through ZigBee gateway to the web server by means of WiMAX network to monitor quality of water from large distances in real time. Dong He developed WQM system based on WSN [14]. The remote sensor was based on ZigBee network. WSN tested WQP and sent data to Internet using GPRS. With the help of Web, information was gathered at remote server. Vijayakumar et al., designed a low cost system design for real time water quality monitoring in IoT utilizes sensors to check many important physical and chemical parameters of water [16]. The parameters such as turbidity, temperature, pH, dissolved oxygen conductivity of water can be measured. In our project, we proposed a water quality monitoring system based on IoT.

2.2)References:

IoT Based Real-time River Water Quality Monitoring System

Mohammad Salah UddinChowdury, Talha BinEmran, SubhasishGhosh, AbhijitPathak, Mohd. ManjurAlam, NurulAbsar KarlAndersson

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 apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models, Belief Rule Based (BRB) system and is also compared with standard values. If the acquired value is above the threshold value automated warning SMS alert 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. Therefore, our proposed system will immensely help Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water.

Real-Time Water Quality Monitoring System

Jyotirmaya Ijaradar, Subhasish Chatterjee

The need for effective and efficient monitoring, evaluation and control of water quality in residential area has become more demanding in this era of urbanization, pollution and population growth. Ensuring safe water supply of drinking water is big challenge for modern civilization. Traditional methods that rely on collecting water samples, testing and analyses in water laboratories are not only costly but also lack capability for real-time data capture, analyses and fast dissemination of information to relevant stakeholders for making timely andinformed decisions. In this paper, a real time water quality monitoring system prototype developed for water quality monitoring in Residential home is presented. The development was preceded by evaluation of prevailing environment including availability of cellular network coverage at the site of operation. The system consists of a Raspberry Pi, Analog to Digital Converter, Water quality measurement sensors. It detects water temperature, dissolved oxygen, pH, and electrical conductivity in real-time and disseminates the information in graphical and tabular formats to relevant stakeholders through a web-based portal and mobile phone platforms. The experimental results show that the system has great prospect and can be used to operate in real world environment for optimum control and protection of water resources by providing key actors with relevant and timely information to facilitate quick action taking.

River Water Quality Robot Embedded with Real-Time Monitoring System: Design and Implementation

Mohd Amirul Aizad M. Shahrani; Safaa Najah Saud Al-Humairi; Nurul Shahira Mohammad Puad; Muhammad Asyraf Zulkipli

New sensor capabilities and implementations are being developed by wireless communication. For environmental applications, recent developments in sensor networking are essential. The Things Internet (IoT) allows links between different devices to share and collect data. In addition to automation,IoT expands its capabilities by using Industry 4.0 to resolve environmental concerns. Since water is one of the fundamental requirements of human survival and life underwater, some mechanism is necessary to occasionally control water quality. This paper proposed an autonomous robot occupied with real-time multisensory (pH, temperature, voltage and garbage level) for better water quality. The data were recorded using sensors and transmitted via Wi-Fi to a designed MIT inventor mobile application and stored in the cloud to monitor the water quality. The river water robot is also attached to a selfpower generator using a solar cell and wind turbines. Based on the obtained results, it was found that the pH of the tested river water in the range of 2-4.6,which considered to be highly acidic. In conclusion, the designed robot has shown significant functionality in the real-time receiving and transmitted data with no human interfering required.

2.2 REFERENCES:

1. To conduct this project the following tools have been used :

- Python
- Pandas (Library) : http://pandas.pydata.org/
- Numpy (Library) : http://www.numpy.org/

2. The techniques used to visualize and preprocess the data has been inspired from the book “Data Mining Concepts and Technique”.

3. The Machine Learning part has been greatly inspired by the Machine Learning course teached by Andrew Ng of Coursera (https://www.coursera.org/course/ml) and the book “An introduction to Statistical Learning”.

4. Stock Price Prediction Using LSTM on Indian Share Market by Achyut Ghosh, Soumik Bose1, GiridharMaji, Narayan C. Debnath, Soumya Sen

5. S. Selvin, R. Vinayakumar, E. A. Gopalkrishnan, V. K. Menon and K. P. Soman - Stock price predictionusing LSTM, RNN and CNN-sliding window model - 2017.

6. Murtaza Roondiwala, Harshal Patel, Shraddha Varma, “Predicting Stock Prices Using LSTM” in Undergraduate Engineering Students, Department of Information Technology, Mumbai University, 2015.

7. Xiongwen Pang, Yanqiang Zhou, Pan Wang, Weiwei Lin, “An innovative neural network approach for stock market prediction”, 2018

2.3)Define the Problem Statements

Date	22 September 2022
Team id	PNT2022TMID10555
Project name	Project- **Real-Time River Water Quality Monitoring and Control System**
Maximum Marks	2 Mks

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	I'm an villager who suffers from impure water issues.	I'm trying to take an initiative of consuming pure river water that Prevent major and minor Health issues in people.	But i can't achive due to that i can't find Proper method than Manual practices or can't find an apt product.	Because Of poisonous state of water we are unable to use it efficiently because it Creates major and minor Health issues to villagers.	It makes Me frustrated And answerable for the health and Risk factors that the villagers take.
PS-2	I'm an farmer	I'm developing food and Forage crops.	But often Get disappointed due to chemical imbalance in the water Supply from river.	Since use Of fertizliers Itself produce necessary growth in crops the untreated river water Creates decay of crops which goes to waste.	It makes me to feel The clueless about my Farming techniques and survival.

3.)IDEATION AND PROPOSED SOLUTION:

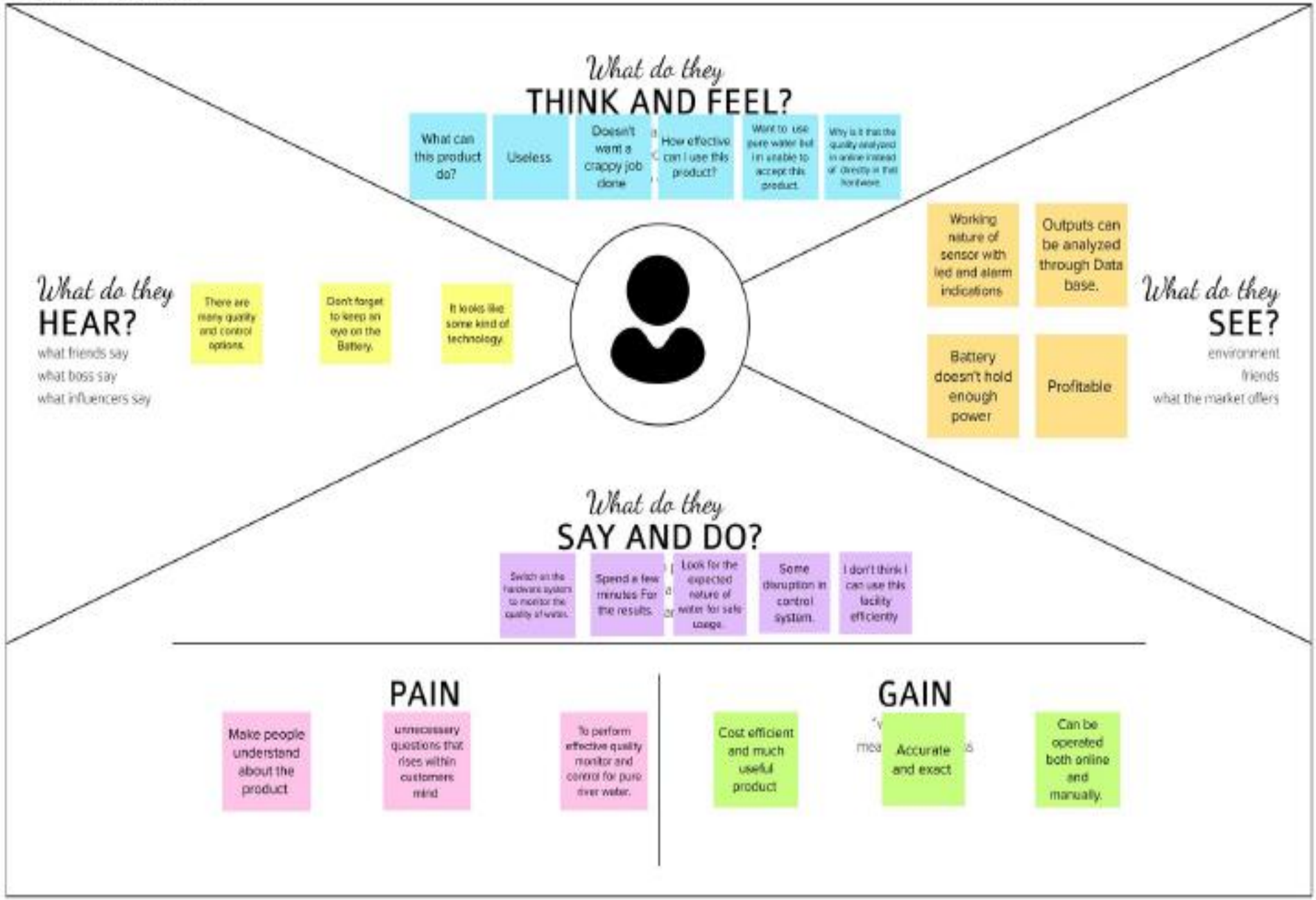
3.1)EMPATHY MAP CANVAS:

Date	**22 September,2022**
Team ID	PNT022TMID10555
Project Name	Project - Real-Time River Water Quality Monitoring and Control System
Maximum Marks	4 Marks

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.

Getting started



3.2)Ideation & Brainstroms:

Date	30 September 2022
Team ID	PNT2022TMID10555
Project name	Project- **Real-Time River WaterQuality Monitoring and ControlSystem**
Maximum Marks	2 Mks

Brainstorm & Idea Prioritization :

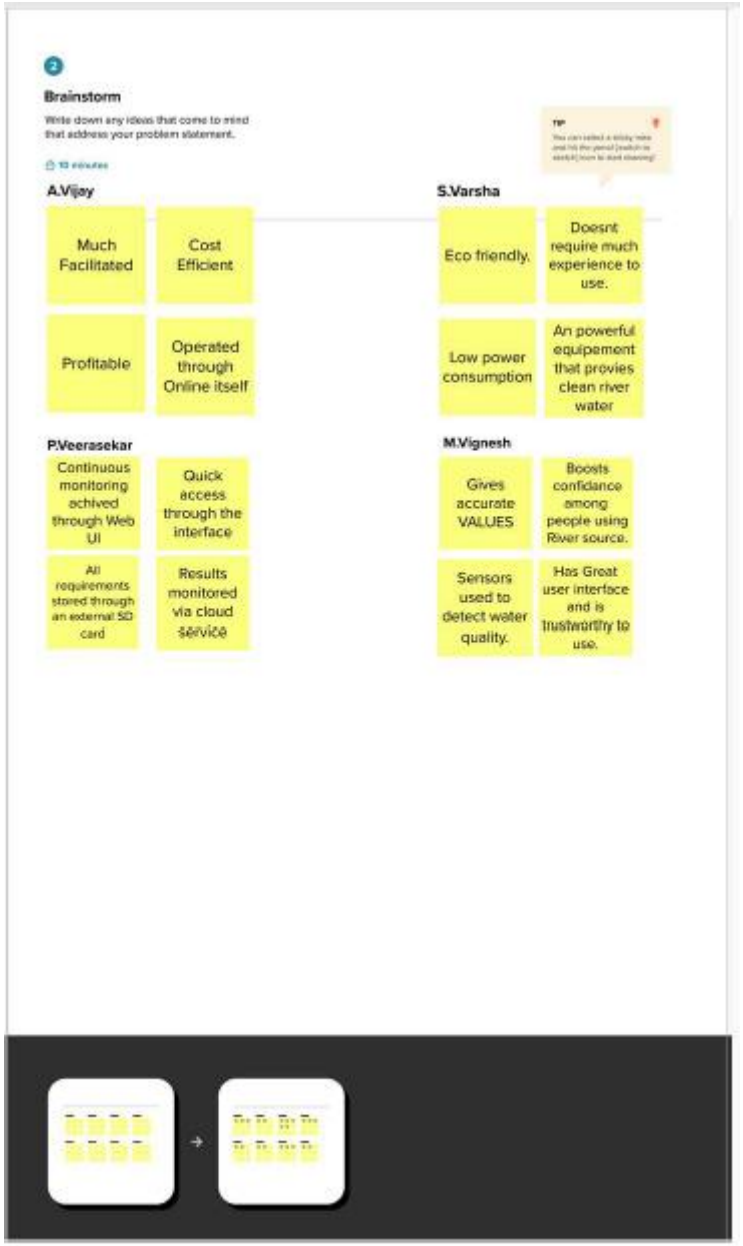
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate,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

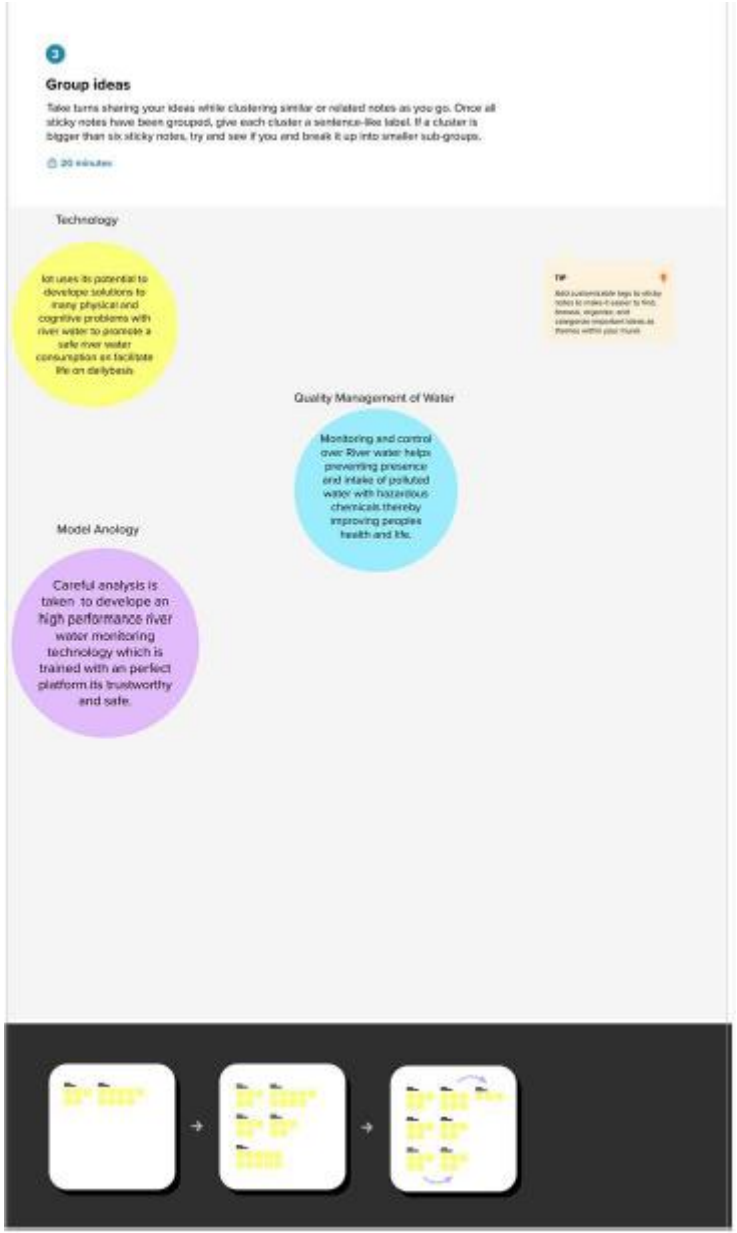
Before you collaborate:

Define Problem Statement:

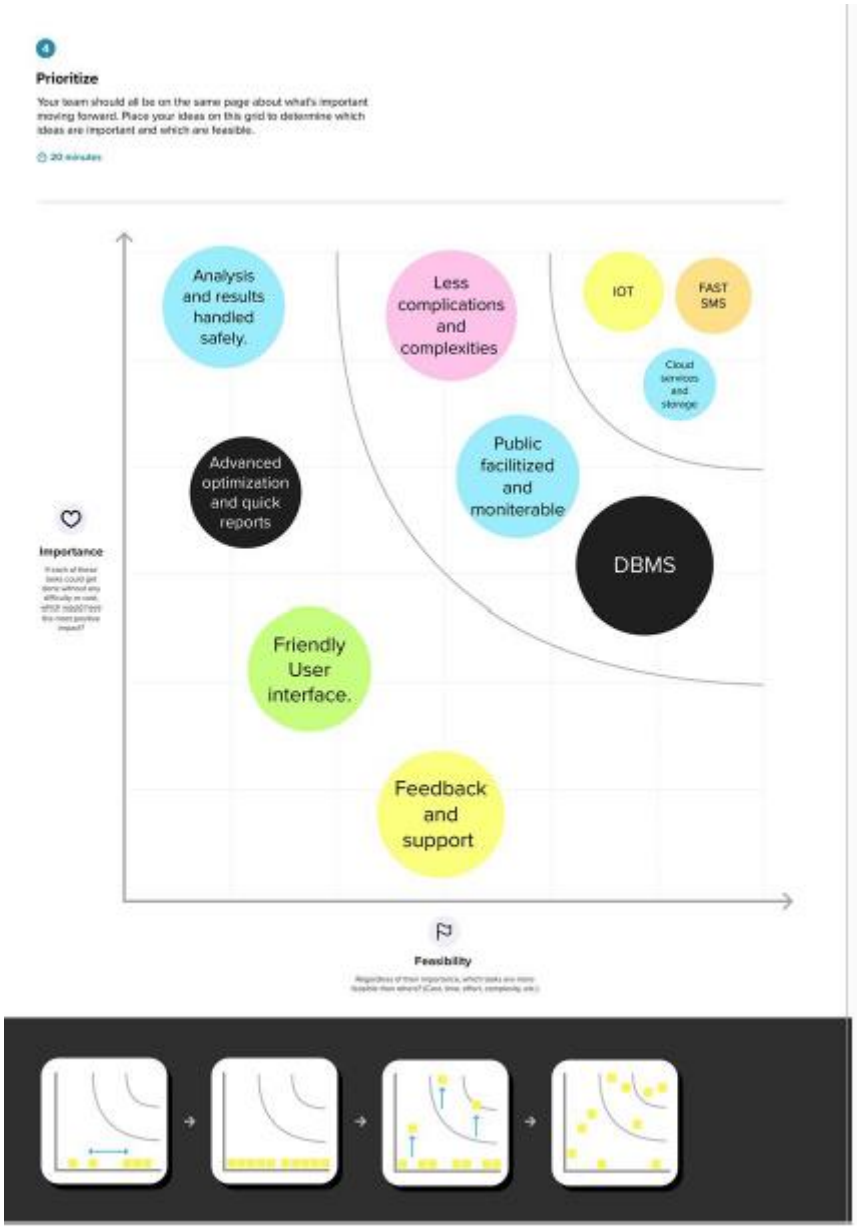
Brainstromz:



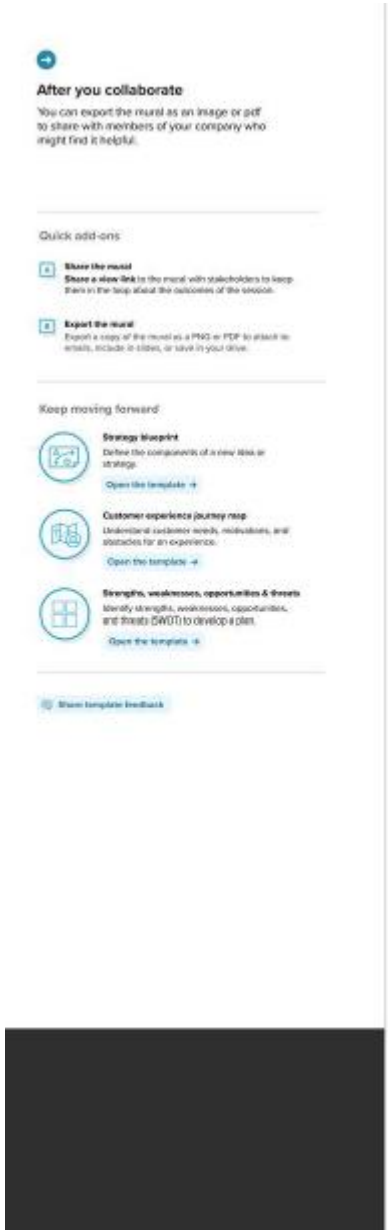
Group Ideas:


3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.
20 minutes
Technology
lot uses its potential to develope solutions to many physical and cognitive problems with river water to promote a safe river water consumption an facilitate life on dailybasis
TIP
Quality Management of Water
Monitoring and control over River water helps preventing presence and intake of polluted water with hazardous chemicals thereby improving peoples health and life.
Model Anology
Careful analysis is taken to develope an high performance river water monitoring technology which is trained with an perfect platform its trustworthy and safe.

Prioritization:



After you collaborate:



3.3)Proposed Solution:

Date	15 october 2022
Team ID	PNT2022TMID10555
Project Name	Project - Real Time River Water Quality Monitoring And Control System
Maximum Marks	2 Mks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	Often people and other living organisms are suffered due to unavailability of pure usable water.Due to this health hazards and other infections are spreaded among people.In order to secure them it is necessary to develop an system to handle the quality of water.This can also help the people to have an idea on drinkable water
2	Idea / Solution description	● So to start this we just need to know or have an idea on the chemical composition of water or simply the nature of water ● Based on timely taken analysis we can find the nature of water . ● Use an random location on taking the amount of chemicals and impurities present in water
3	Novelty / Uniqueness	● This system developed is useful and creates an ease of pure water consumption for natives as well as other beings. ● People can predict the quality of water by the help of this system

4	Social Impact / Customer Satisfaction	● This helps the people to save time and energy as they can get pureriver water with ease ● Building an effective system that can be create as a product for best water quality and control system.
5	Business Model (Revenue Model)	● Many other parts of the world and rural parts of the village are expecting this technology that can greatly facilitate the river water management system.
6	Scalability of the Solution	● when we predict and control the quality of water it can save people from further health damage and save people time to get purified drinking and usable river water.

3.4)Problem – Solution Fit Template:

Date	20 october 2022
Team ID	PNT2022TMID10555
Project Name	Real Time River Water Quality Monitoring And Control System
Maximum Marks	2 Mks

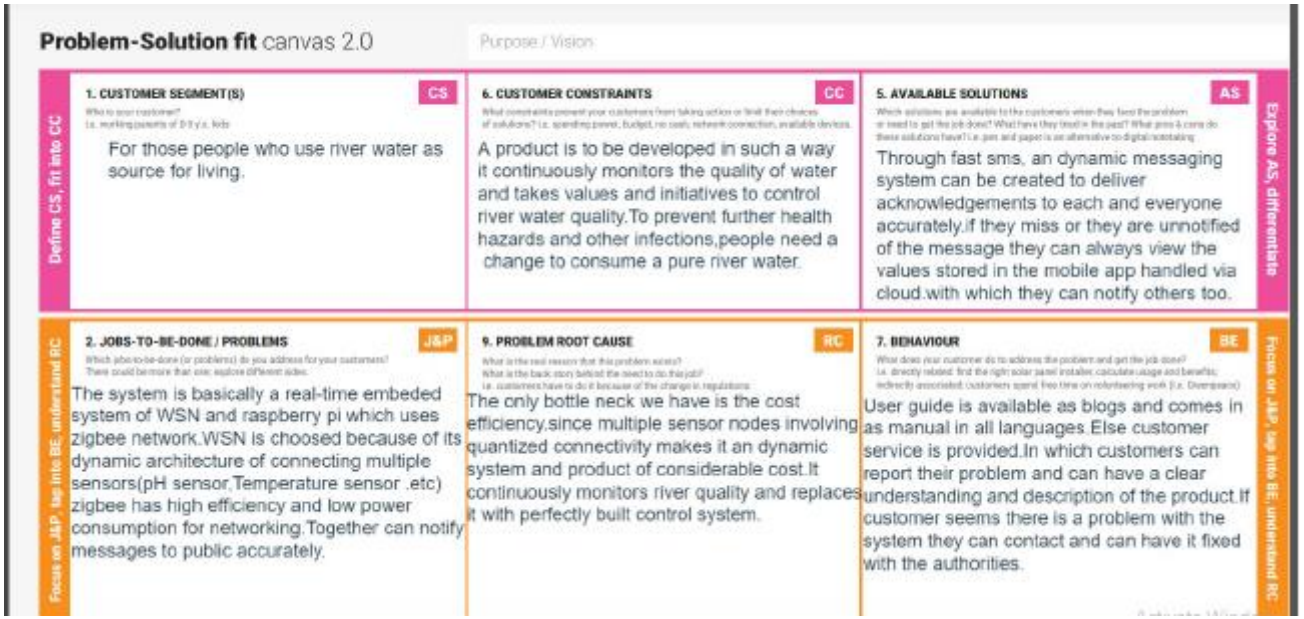
Problem – Solution Fit Template:

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why

Purpose:

- ❑ Solve complex problems in a way that fits the state of your customers.
- ❑ Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- ❑ Sharpen your communication and marketing strategy with the right triggers and messaging.

❑ Increase touch-points with your company by finding the right problem behavior fit and
building trust by solving frequent annoyances, or urgent or costly problems.
❑ Understand the existing situation in order to improve it for your target group



4.)REQUIREMENT ANALYSIS:

4.1)FUNCTIONAL REQUIREMENTS:

Date	19 October2022
Team id	PNT2022TMID10555
Project name	Project- Real time river water quality monitoring and Control system
Maximum MARKS	4 MKS

FunctionalRequirements:

Following are the functional requirements of the proposed solution

FRNo.	Functional Requirement(Epic)	Sub Requirement(Story/Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Hydroxilic level detection	To detect the presence of hydroxilic acid and pH test is imminent. So a pH sensor is used to detect the pH value Of river water,periodically
FR-4	Dust presence in water	To detect the dust presence in water we need to analyze It with a parameter called turbidity. For that we use Turbidity sensor
FR-5	Reaction turbine generator	For energy production for system to have self produced Power methods as well as to Clean the most pollutants Of river waters such as bacteria,we use reaction turbine generator as Rivers come under low head.

4.)REQUIREMENT ANALYSIS:

4.2)NON-FUNCTIONAL REQUIREMENTS:

Date	19 October2022
Team id	PNT2022TMID10555
Project name	Project- Real time river water quality monitoring and Control system
Maximum MARKS	4 MKS

Non-FunctionalRequirements:

Following are the non-functional requirements of the proposed solution

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	Time continuous monitoring and quality control Produced by the system,more effective and less complexities
NFR-2	Security	Data encryptions at front end and back end is applied To the Android application.Proxy servers can't Disrupt or hack as sufficient protective measures Taken at architecture level of app itself.
NFR-3	Reliability	A safe and secure system,that assures living aspects For all beings from aquatic to land species.System Has embarked efficiency in energy management and Data management. A trustworthy and profitable System that constructed with advanced data Analytics procedure that can provide a

NFR-4	**Performance**	As the different technological block scan itself Define and system based on ecofriendly and Innovative product facilitating people's life on daily basis. Chances of entropy is less due to high end engineering(Careful executing of Architectural Design and pretty planned process models.)
NFR-5	Availability	Customer service available for 24/7,query handled Via high end Ui via agency.Also monitoring,analysing And streaming of sensed parameters,values are Handled by cloud services which can beviewed via mobileapp.

NFR-6	**Scalability**	High accuracy due to preset architectural design Gives it a product of high scalability.also the product Is developed just to meet up with customer score constraints.the system can be developed based on people's innovative ideas as this product is scalable For later upgrades and versions,as well for other Products based on it.
NFR-7	Stability	Stability is perfectly explained as a highly stable System based on greater power management Strategies and definite design.
NFR-8	Efficiency	Low Power consumption and High performance.

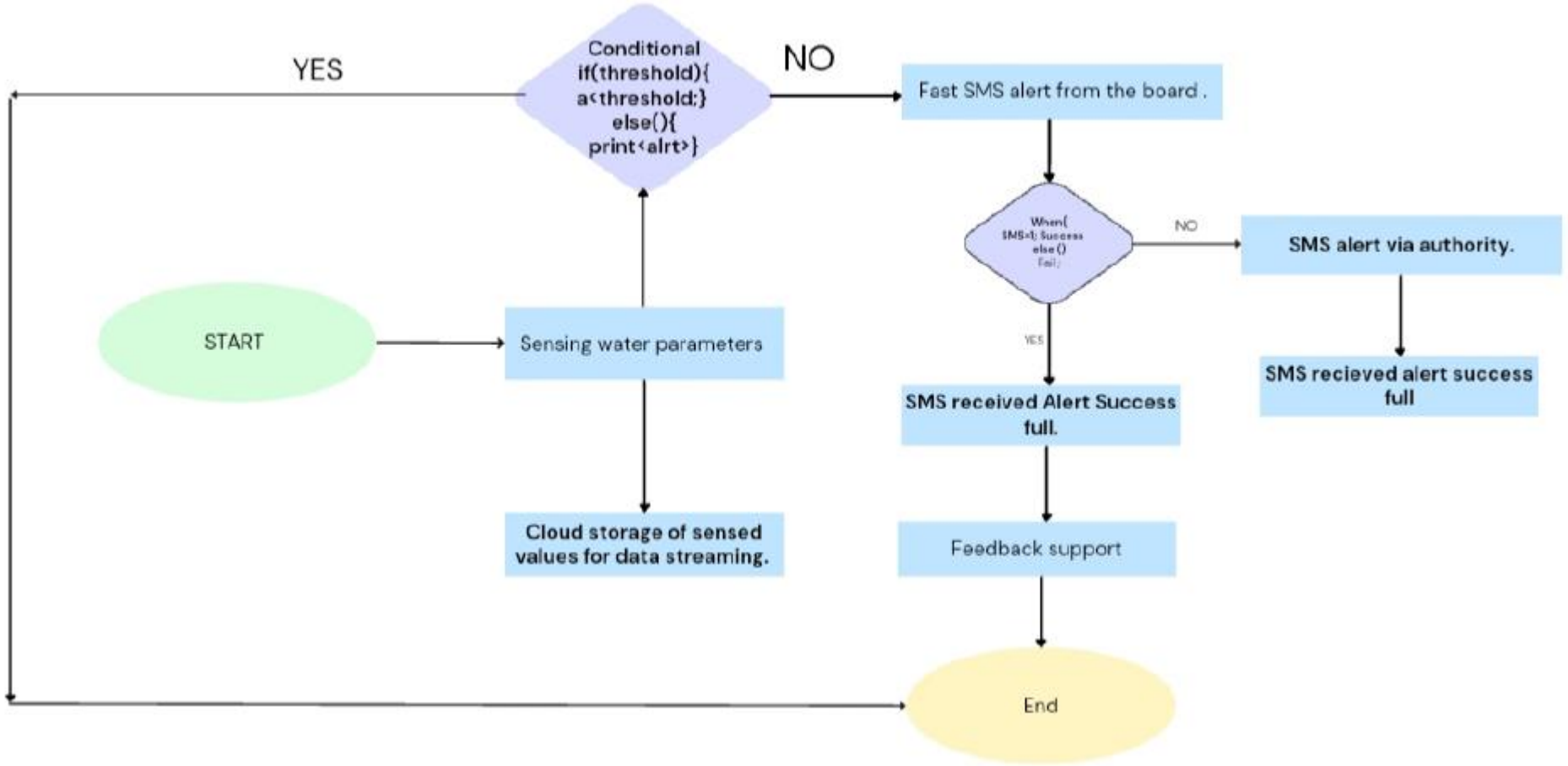
5.)**Project Design**

5.1)Data Flow Diagram & User Stories

Date	
Team ID	PNT2022TMID10555
Project name	Project - Real time river water monitoring and control system
Maximum marks	4 Marks

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.


Conditional
if(threshold){
a<threshold;}
else(){
print<alrt>}
YES
NO
Fast SMS alert from the board .
When(
SMS=1; Success
else()
fail;
NO
SMS alert via authority.
SMS recieved alert success full
YES
SMS received Alert Success full.
START
Sensing water parameters
Cloud storage of sensed values for data streaming.
Feedback support
End

5.2)Solution and technical architecture:

Date	15 October 2022
Team ID	PNT2022TMID10555
Project name	Project-Real Time River Water Quality Monitoring And Control System
Maximum Marks	2 mks

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges

the gap between business problems and technology solutions. Its goals are to:

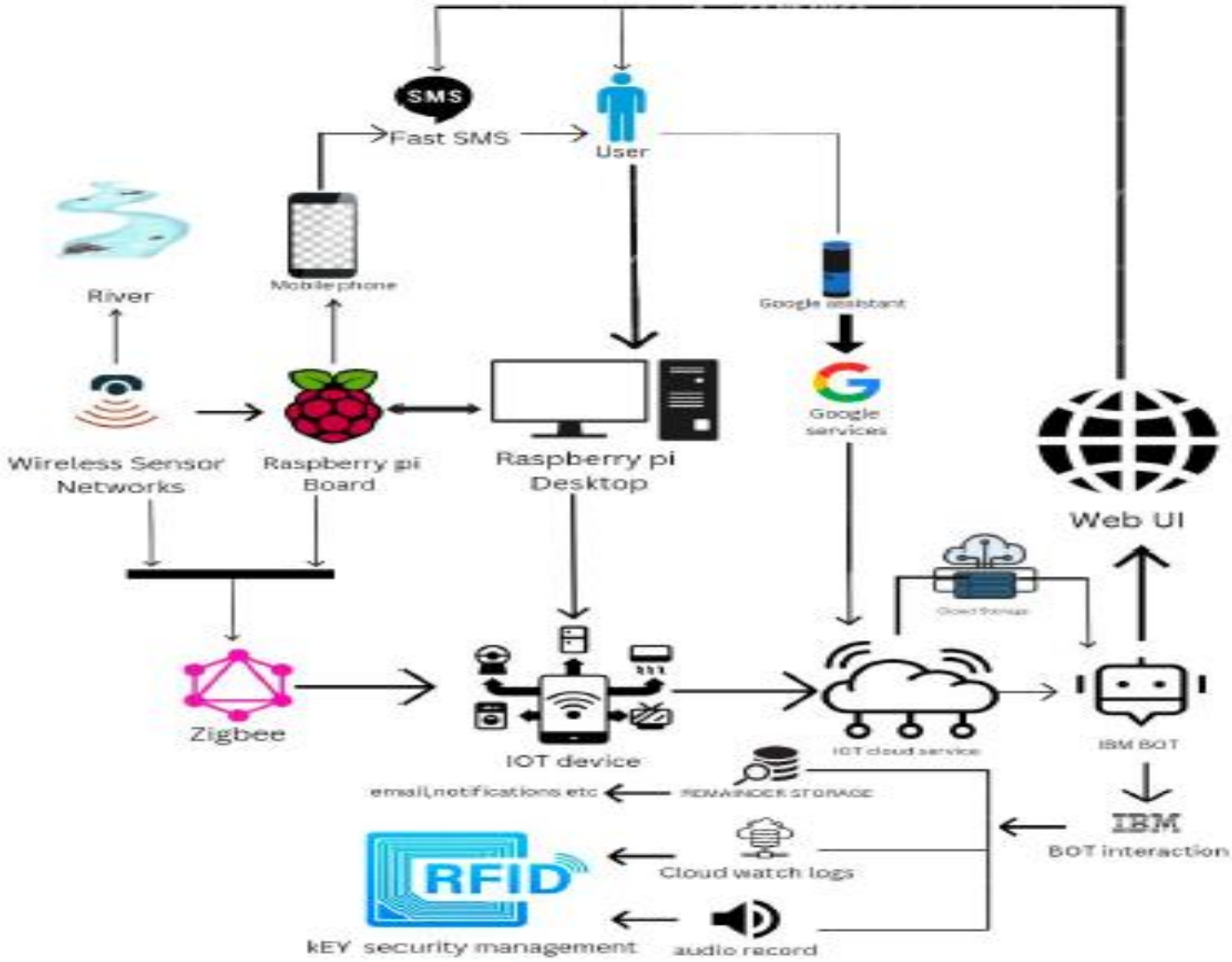
- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the

• Define features, development phases, and solution requirements.

• Provide specifications according to which the solution is defined, managed,

and delivered.

Solution Architecture Diagram:

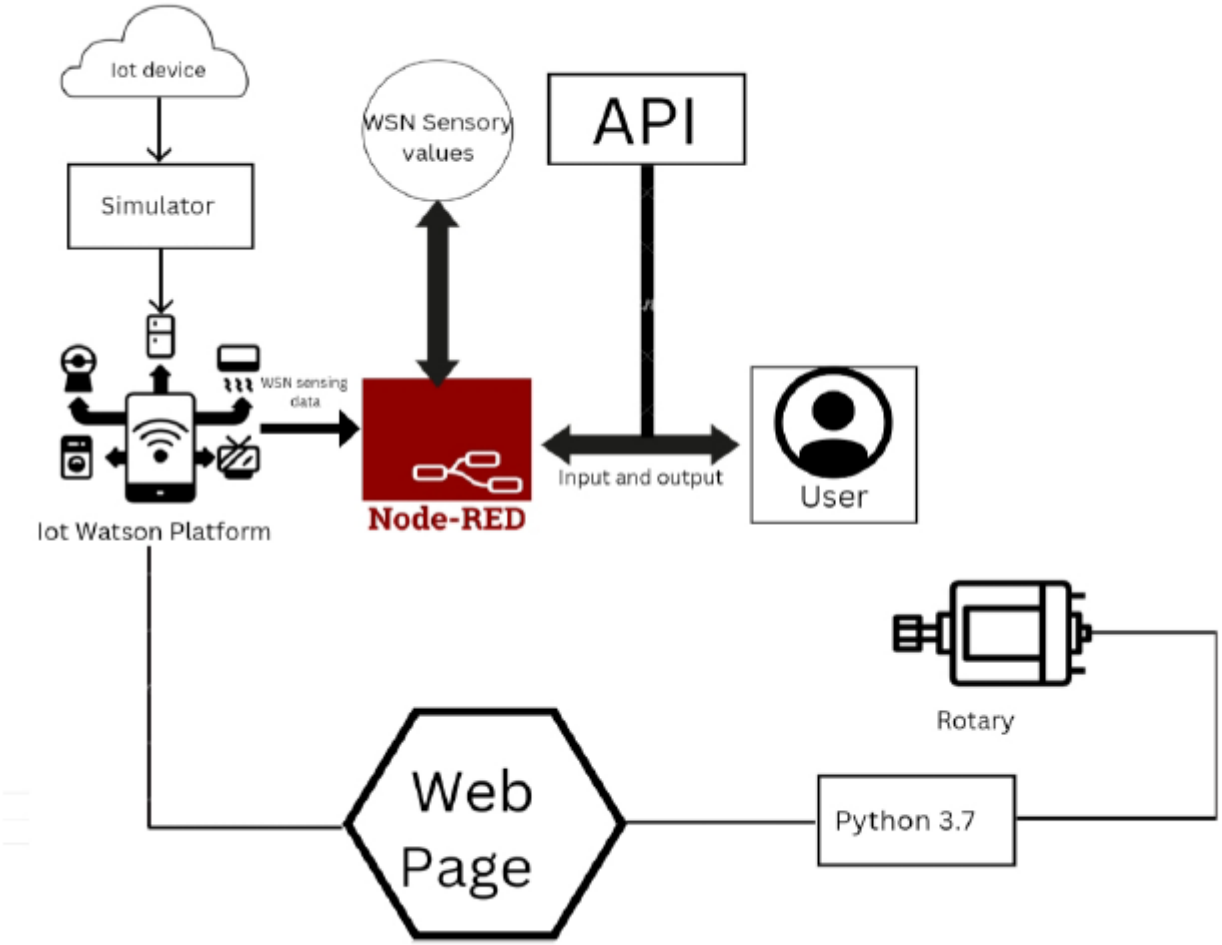

SMS
Fast SMS
User
River
Mobile phone
Google assistant
Wireless Sensor Networks
Raspberry pi Board
Raspberry pi Desktop
Google services
Web UI
Zigbee
IOT device
IOT cloud service
IBM BOT
email,notifications etc
RFID
Cloud watch logs
BOT interaction
kEY security management
audio record

Technology architecture:

Date	18 October 2022
Team ID	PNT2022TMID10555
Project Name	Project -Real time river water quality monitoring and control system
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2


Iot device
Simulator
WSN Sensory values
API
WSN sensing data
Iot Watson Platform
Node-RED
Input and output
User
Rotary
Web Page
Python 3.7

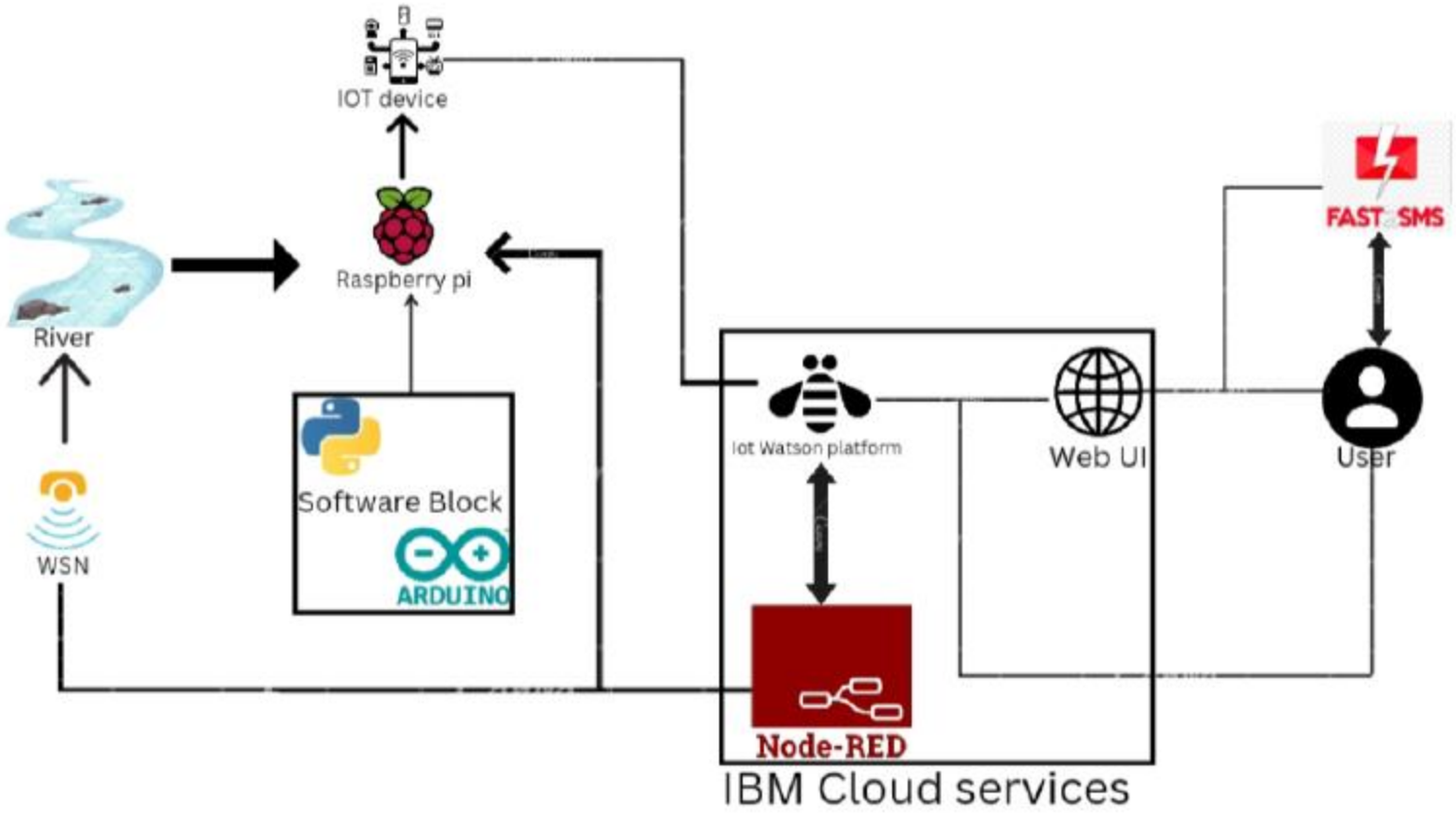

IOT device
Raspberry pi
River
WSN
Software Block
ARDUINO
Iot Watson platform
Web UI
User
FAST SMS
Node-RED
IBM Cloud services

Table-1 : 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, JavaScript / Angular Js / React Js 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.

Table-2: Application Characteristics:

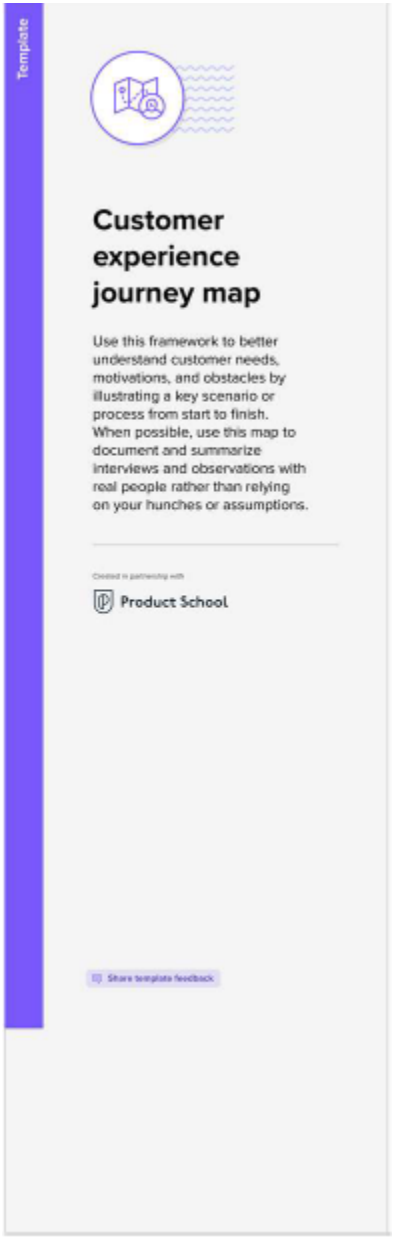
S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable 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

5)Project Design:

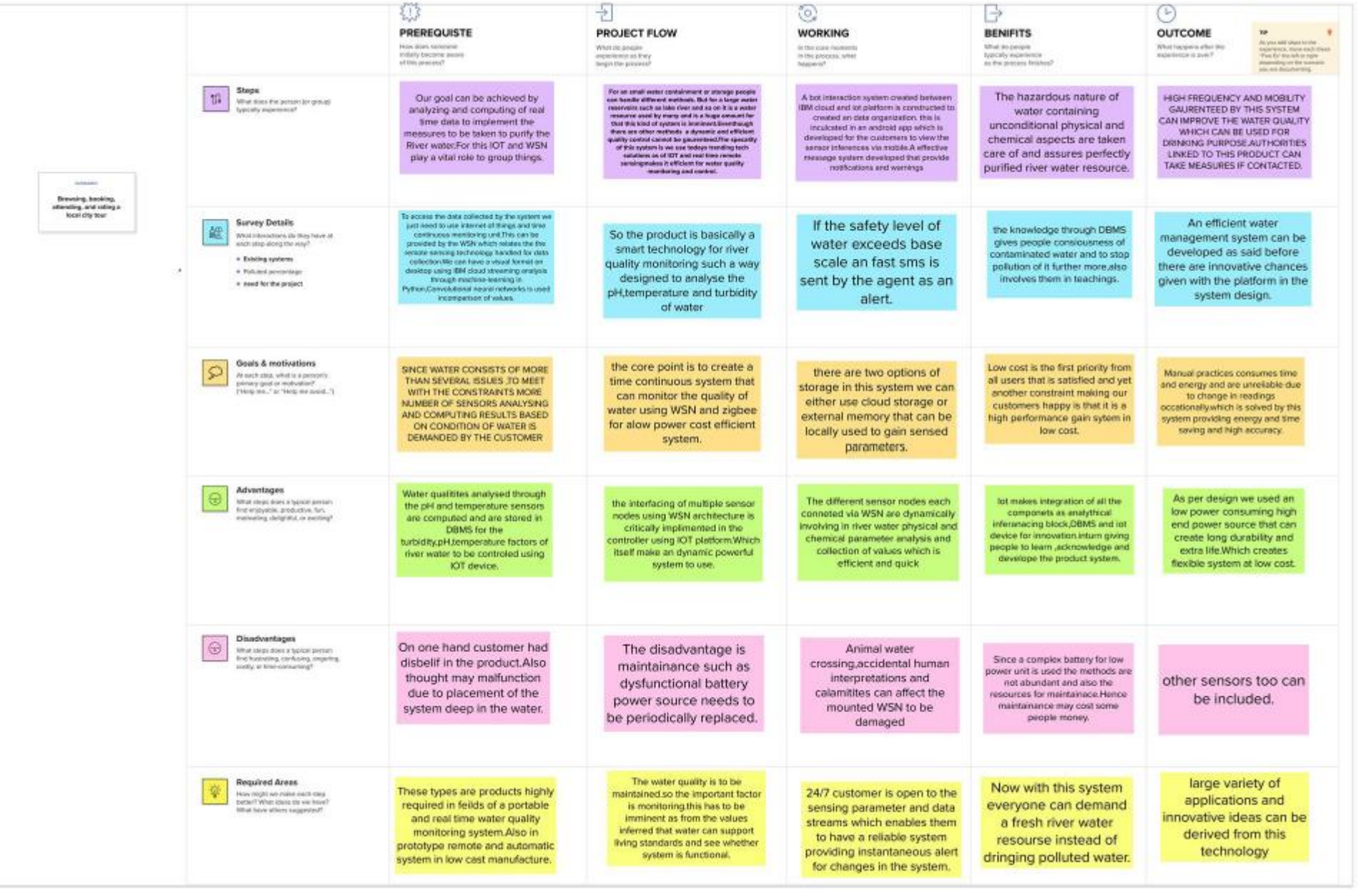
5.3)User stories:

date	20 october 2022
Team id	PNT2022TMID10555
Project name	REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM
Maximum marks	2 MKS

Customer experience journey map:



Customer journey :



5.3)User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through mail	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive login credentials	High	Sprint-1
	interface	USN-6	As a User, I prefer an comparable user interface(UI),that can provide quick switch speed and is user friendly.	I can access it with ease	Medium	Sprint-1
Customer (Web user)	Dashboard	WUSN-1	As a Web user, it is necessary for me to infer the quality of water by personally assure the physical and chemical parameter of water.for that i need dynamic access to sensing parameters and WSN values such as pH ,dust, turbidity,temperature .	I can be abled to observe the values for quality of water	High	Sprint-1
Customer Care Executive	View manner	CCE-1	As a customer care, I can need data visualization.	I can understand easily via visualization.	High	Sprint-1
	taste	CCE-2	As a customer care,an DBMS linked to this system is preferable for infering about the quality of water(presense of hardness and other salts)	I can easily know the presence of hardness and salts.	High	Sprint-1

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	colour visibility	CCE-3	As a customer care, it's important for me to analyze the turbidity and shade of water(colour)	I can know the colour of water which leads to result about condition of water.	High	Sprint-1
Administrator	tolerance	ADMIN-1	An administrative block must take care of the system applications.	Time continuous monitoring through an administrator	High	Sprint-2

6.)Project planning and scheduling:

6.1)sprint planning and estimation:

Date	21 October 2022
Team ID	PNT2022TMID10555
Project Name	Real-Time River Water Quality Monitoring and Control System
Maximum Marks	4 marks

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1	Understanding the project requirement	The Aim is team members are assigned with tasks for each to be executed as a responsible team lead. Also create repository in the Github, Assign members and teach how to use and open the Github and IBM career education portals .	1 WEEK
2	Starting of project	Advisory of team lead to his team members based on regularly attending training sessions for installing and use of prerequiste .Also necessarily attending the training sessions based on python code,development of android app in mobile app invtr.com and working along NodeRed is ensured by the team lead and acknowledged by team members simultaneously	1 WEEK

3	Attend class	Team members and team lead must watch and learn from classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project.	4 WEEK
4	Budget and scope of project	Budgetary planning process taken up on whole as a team to detect the user compatible price to the buy the product based on budgetary on IOT and component level.	1 WEEK

6.2)Sprint delivery Schedule

Date	26 October 2022
Team ID	PNT2022TMID10555
Project Name	Real-Time River Water Quality Monitoring and Control System
Maximum Marks	8 Marks

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	A.Vijay
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	S.Varsha
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	P.Veerasekar
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	M.Vignesh
Sprint-1	Login	USN-5	As a user, I can log into the application by Entering email & password	1	High	A.Vijay

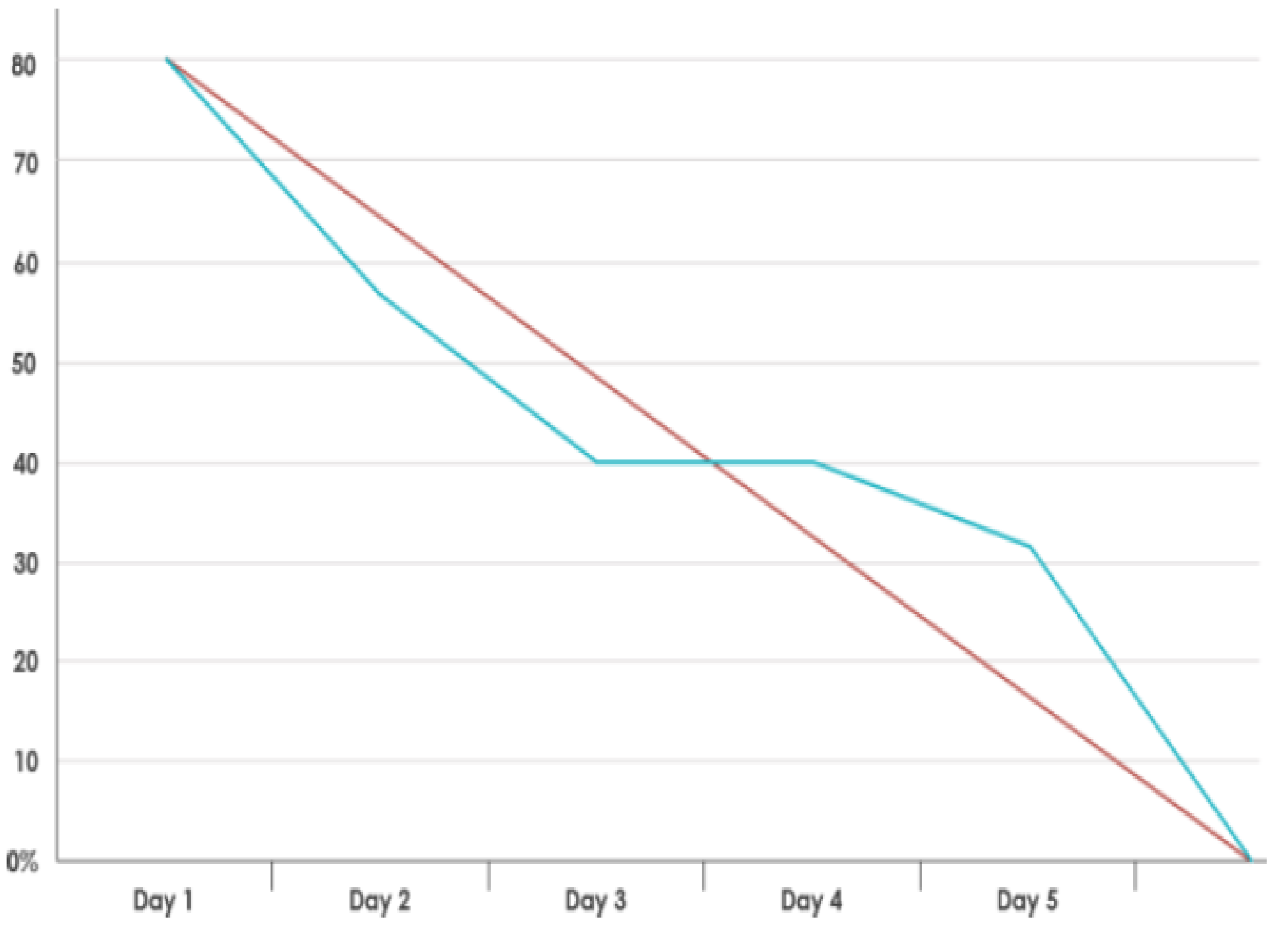
Project Tracker, Velocity & Burndown Chart: (4 Marks)

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:


80
70
60
50
40
30
20
10
0%
Day 1
Day 2
Day 3
Day 4
Day 5

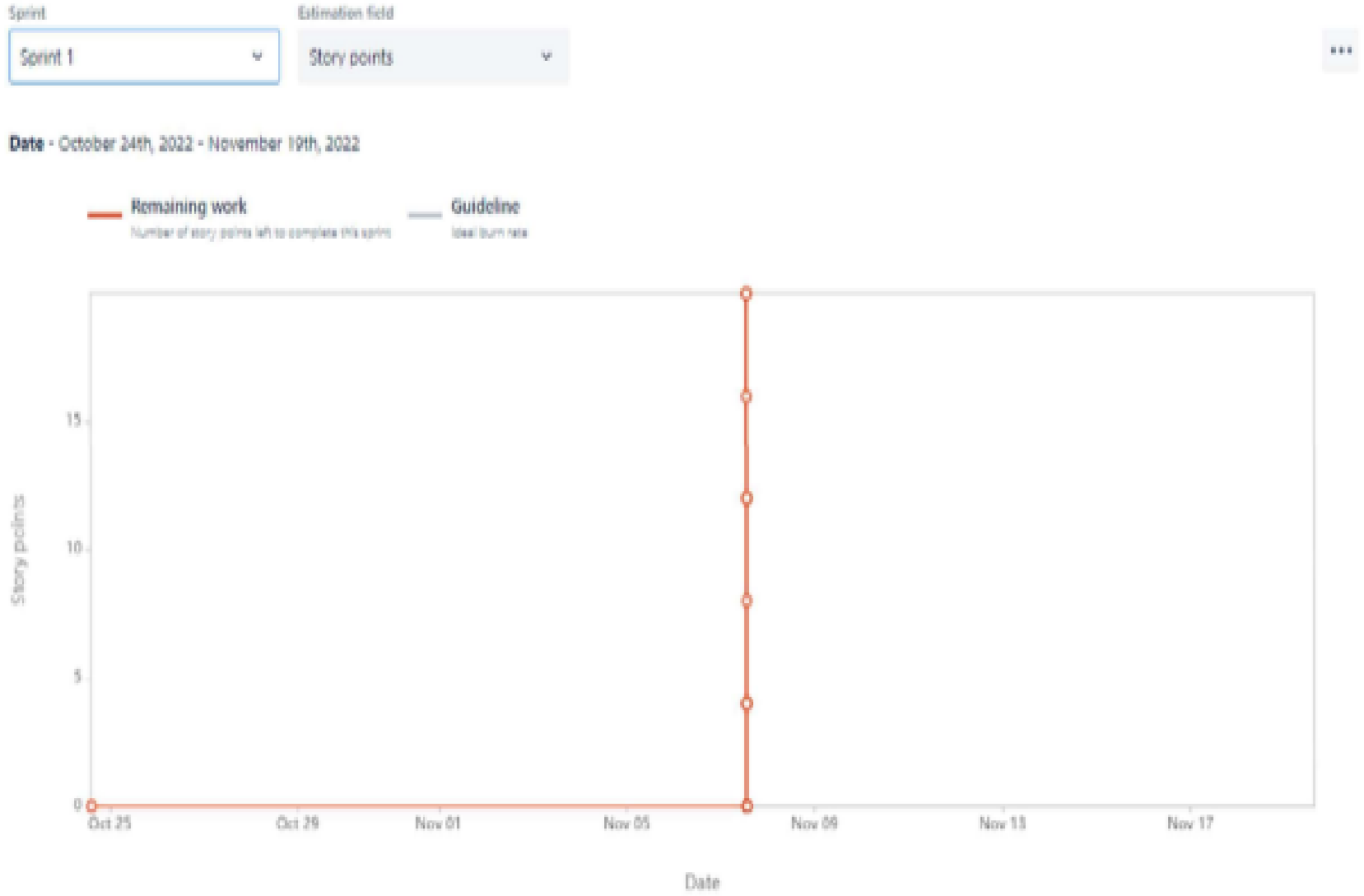
6.3)Reports from JIRA Burn down and burn up diagrams

Date	**3 Nov 2022**
Team id	PNT2022TMID10555
Project	Project- **Real-Time River Water Quality Monitoring and Control System**
Maximum marks	4 Mks

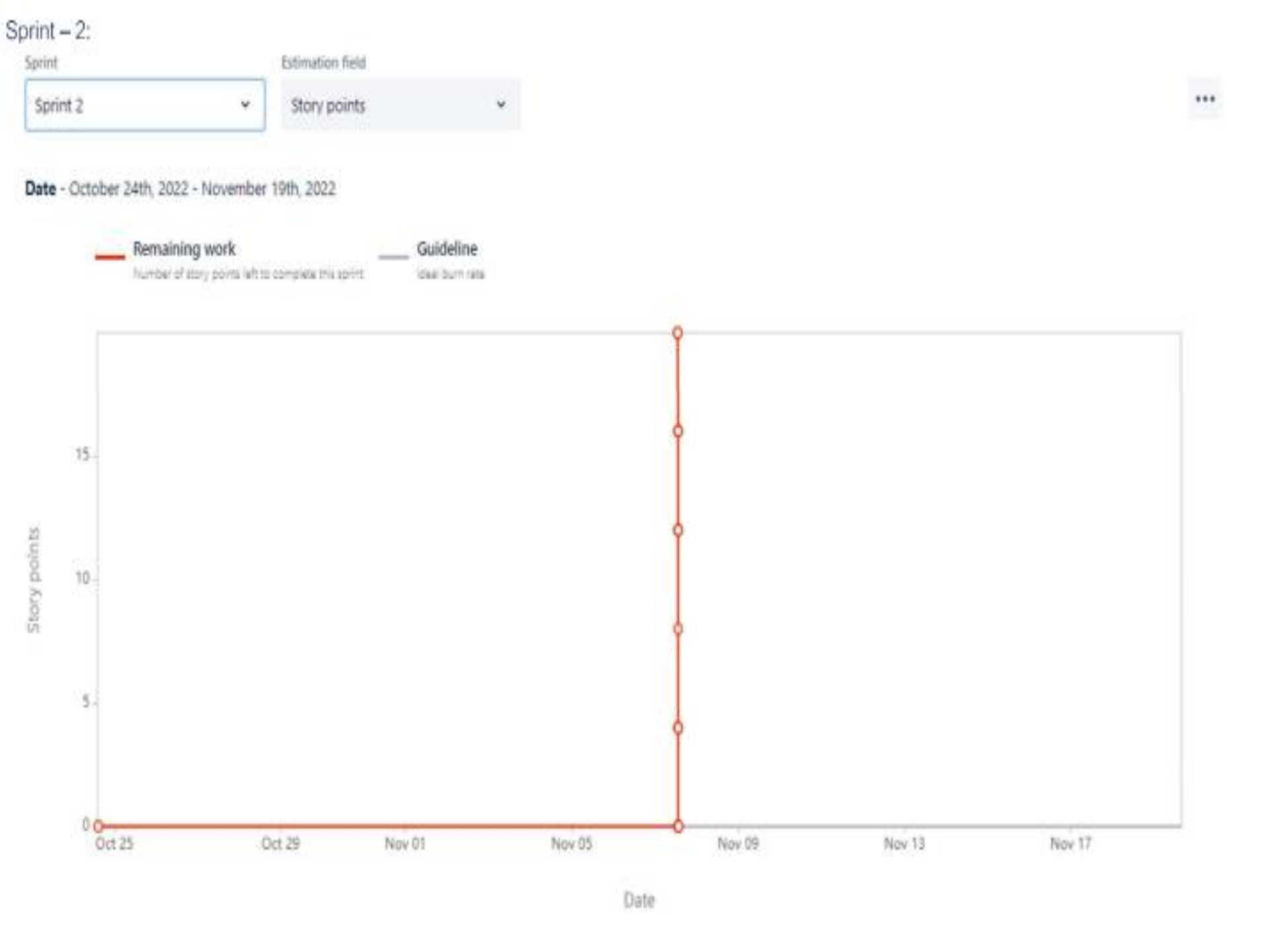
Burndown Chart:

The below burn down chart shows a graphical representation of work left to do versus time for the project Crude Oil Price Prediction. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

Sprint – 1:



Sprint – 2:


Sprint
Sprint 2
Estimation field
Story points
Date - October 24th, 2022 - November 19th, 2022
Remaining work
Number of story points left to complete this sprint
Guideline
Ideal burn rate
Story points
15
10
5
0
Oct 25
Oct 29
Nov 01
Nov 05
Nov 09
Nov 13
Nov 17
Date

Sprint – 3:

Sprint

Sprint 3

Estimation field

Story points

Date - October 24th, 2022 - November 19th, 2022

Sprint-4:

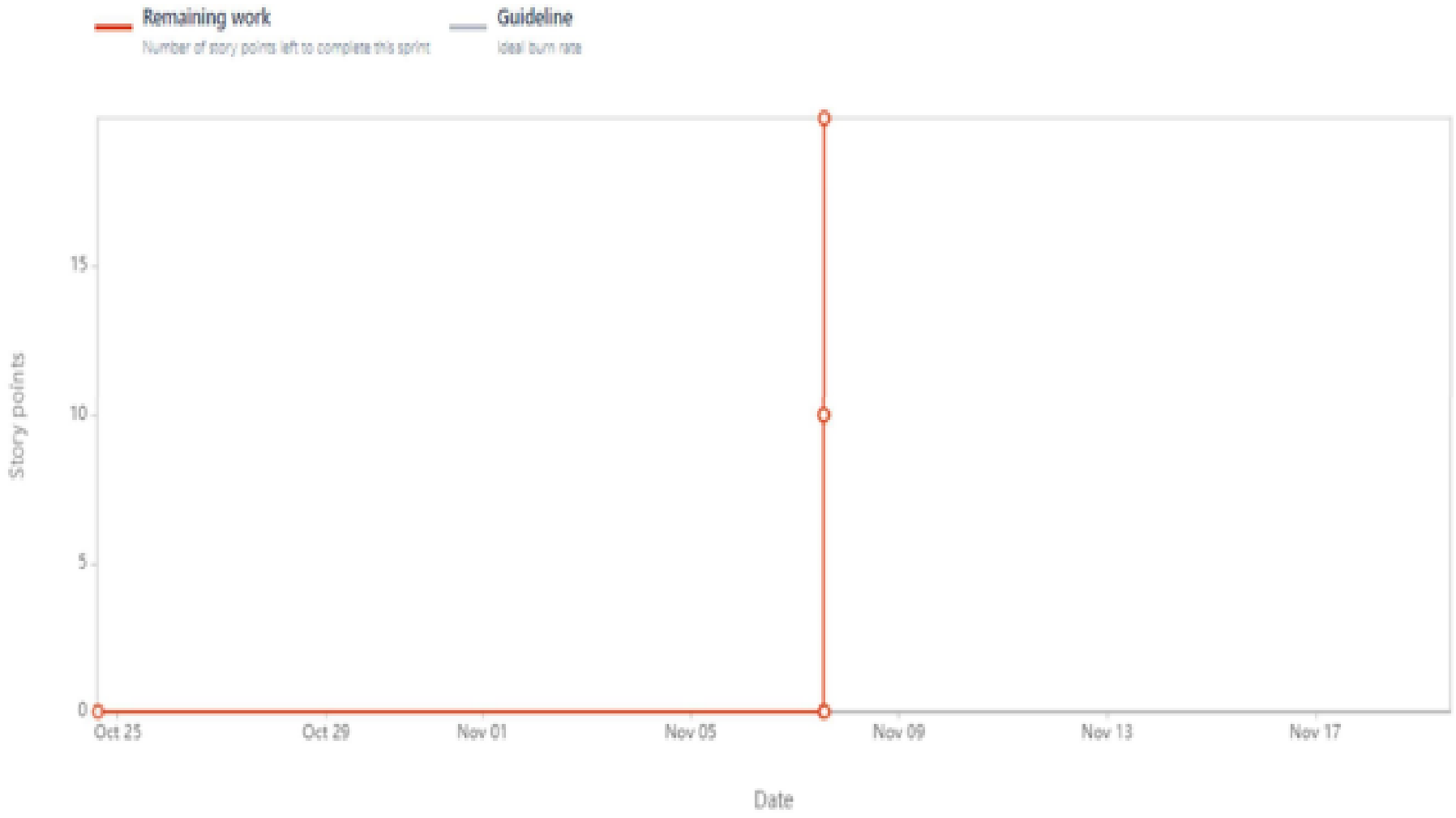
Sprint

Sprint 4

Estimation field

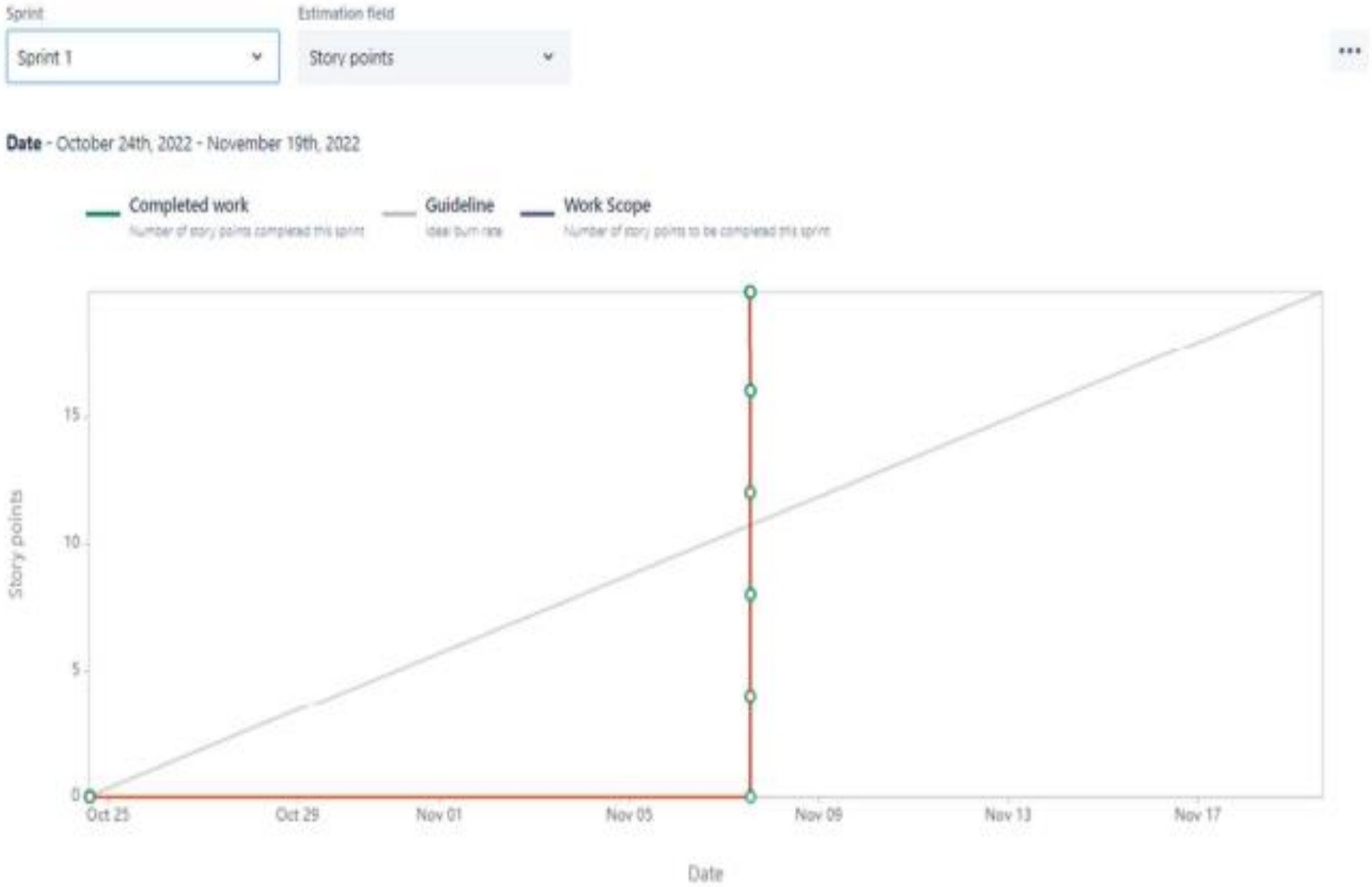
Story points

Date - October 24th, 2022 - November 19th, 2022



Burnup Chart:

Sprint-1:

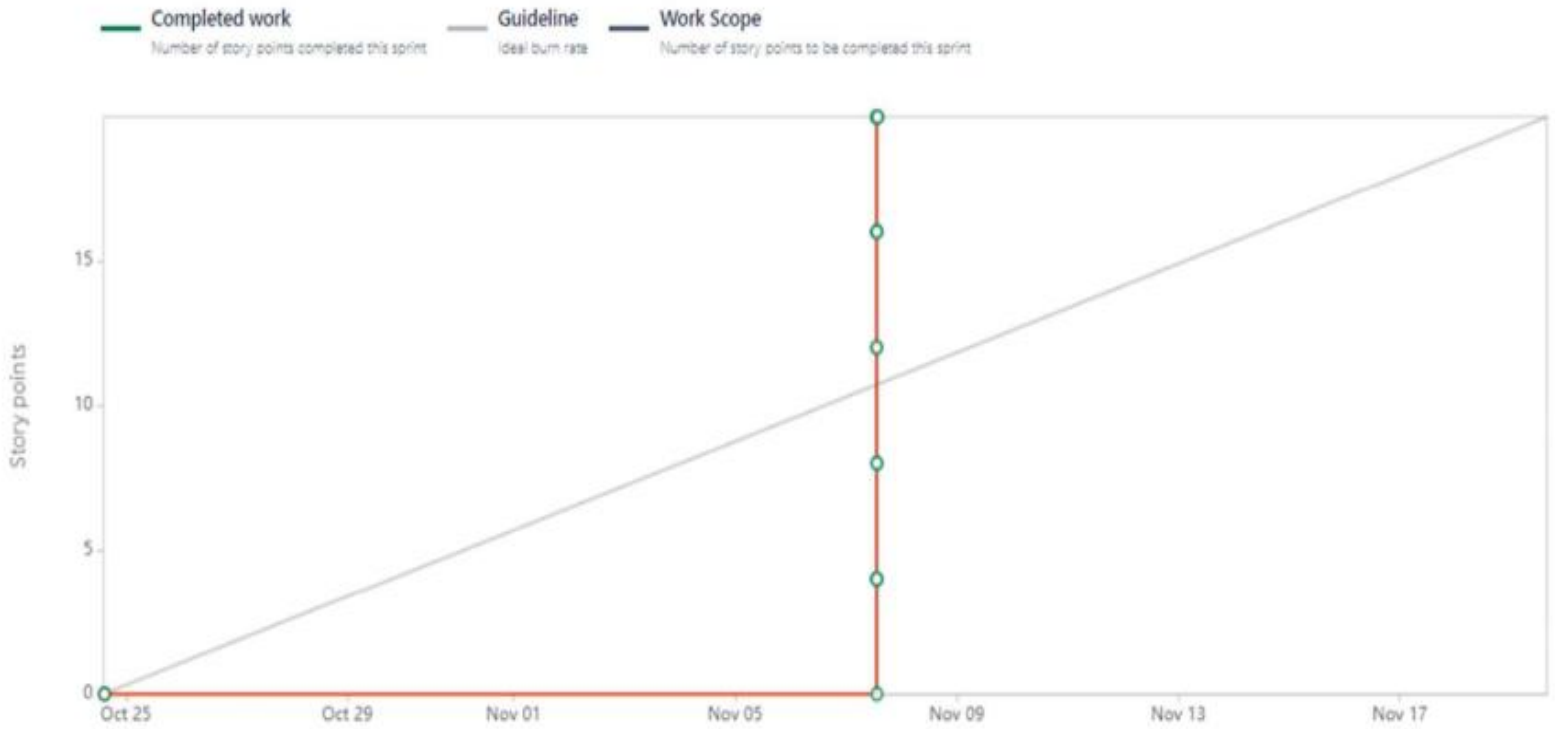


Sprint-2:

Sprint: Sprint 2

Estimation field: Story points

Date - October 24th, 2022 - November 19th, 2022



Sprint-3:

Sprint: Sprint 3

Estimation field: Story points

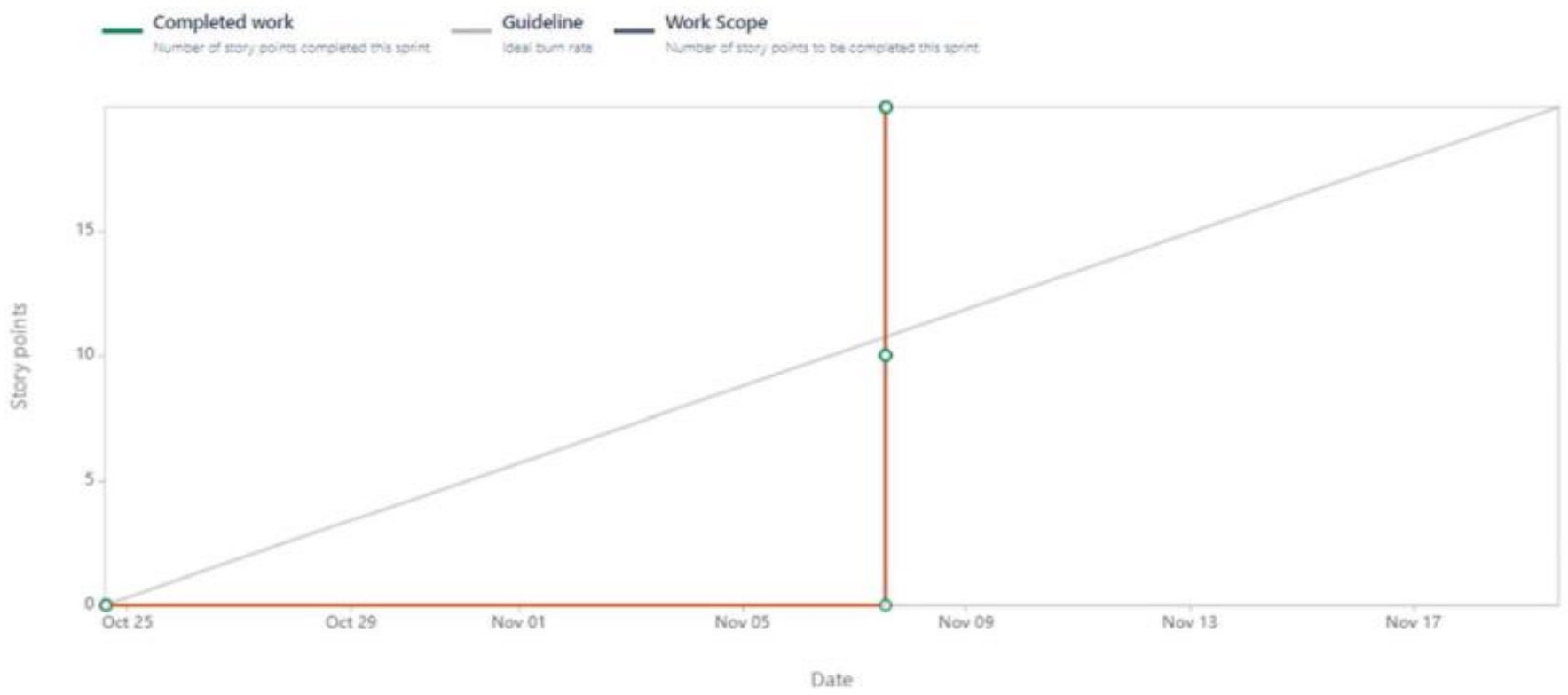
Date - October 24th, 2022 - November 19th, 2022

Sprint-4:

Sprint: Sprint 4

Estimation field: Story points

Date - October 24th, 2022 - November 19th, 2022



7. CODING & SOLUTIONING:

7.1)Feature 1:

```
#include <Arduino.h>
#include <WiFi.h>
#include <WiFiMulti.h>
#include <HTTPClient.h>
#define MY_SERIAL Serial
WiFiMulti wifiMulti;
void setup() {
pinMode(brdled,OUTPUT);
MY_SERIAL.begin(115200);
MY_SERIAL.println();
MY_SERIAL.println();
MY_SERIAL.println();
for(uint8_t t = 4; t > 0; t--) {
MY_SERIAL.printf("[SETUP] WAIT %d...\n", t);
MY_SERIAL.flush();
delay(1000);
}
wifiMulti.addAP("WorkSHop", "inf12345");
wifiMulti.addAP("J-THEORY 3878", "98?J365o");
while (wifiMulti.run()!= WL_CONNECTED) { //Check for the connection
delay(1000);
MY_SERIAL.println("Connecting to WiFi..");
```

```
}
MY_SERIAL.println("WiFi network connected");
//////////////////Setup for the sensors and ads1115/////////////////
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
ads.begin(); // enables the ADC1115
MY_SERIAL.println("Initializing All Sensors.....................");
delay(3000);
}
void loop() {
float mtemp,turb,ph,level; /// variables to hold sensor values(data)
mtemp= mytemp(); // hold temperature data
turb=myturb(); // hold turbidity data
ph=myph(); // hold pH data
level=mylevel(); // hold water level data
// wait for WiFi connection
if((wifiMulti.run() == WL_CONNECTED)) {
digitalWrite(brdled,HIGH);
delay(5000);
digitalWrite(brdled,LOW);
HTTPClient http;
MY_SERIAL.print("[HTTP] begin...\n");
// configure traged server and url
http.begin("https://wqms.herokuapp.com/postData"); //HTTP
//http.begin("http://10.10.64.99:5050/postData"); //HTTP
```

```
//defining a variabble to hold all values from sensors
String ourdata
=String(mtemp)+","+String(turb)+","+String(ph)+","+String(level);
MY_SERIAL.println(ourdata);
MY_SERIAL.print("[HTTP] POST...\n");
// start connection and send HTTP header
http.addHeader("Content-Type","text/plain");
int httpCode = http.POST(ourdata);
// httpCode will be negative on error
if(httpCode > 0) {
// HTTP header has been send and Server response header has been handled
MY_SERIAL.printf("[HTTP] POST... code: %d\n", httpCode);
// file found at server
if(httpCode == HTTP_CODE_OK) {
String payload = http.getString();
MY_SERIAL.println(payload);
}
}
else {
MY_SERIAL.printf("[HTTP] POST... failed, error: %s\n",
http.errorToString(httpCode).c_str());
wifiMulti.run();
if (wifiMulti.run()!= WL_CONNECTED) { //Check for the connection
delay(1000);
wifiMulti.run();
```

```
MY_SERIAL.println("Reconnecting to WiFi..");
}
else {
MY_SERIAL.println("Reconnected");
digitalWrite(brdled,HIGH);
delay(2000);
digitalWrite(brdled,LOW);
}
}
http.end();
}
delay(20000);
}
```

7.2)Feature 2:

```
float myturb(){
int16_t adc1; // we read from the ADC, we have a sixteen bit integer as a result
adc1 = ads.readADC_SingleEnded(1);
float voltage = (adc1 * 0.1875)/1000; //converting analog reading to voltage
(digital value)
senseTurbidity= voltage+1; // converting sensor voltage to 5V
return senseTurbidity;
MY_SERIAL.print("TURBIDITY VALUE: "); //Print the output data to the
serial
```

```
MY_SERIAL.println(senseTurbidity);
MY_SERIAL.print("\n");
delay(1000);
if (senseTurbidity>=3.90 ){
MY_SERIAL.println("\t Water is clear \n");
}
if (senseTurbidity<3.90 && senseTurbidity>=3.30 ){
MY_SERIAL.println("\t Water is normal clear \n");
}
else if(senseTurbidity<3.30)
MY_SERIAL.println("\t Warning. Water is muddy or very cloudy!!!!!!! \n");
}
```

7.3)Feature 3:

```
float myph(){
//////// using the ads1115 for the ph meter
int16_t adc0; // we read from the ADC, we have a sixteen bit integer as a result
adc0 = ads.readADC_SingleEnded(0);
for(int i=0;i<10;i++){
//buf[i]= analogRead(analogpin);
buf[i]= adc0;
delay(100);
}
for(int i=0;i<9;i++){
for(int j=i;j<10;j++){
if(buf[i]>buf[j]){
temp=buf[j];
buf[i]=buf[j];
buf[j]=temp;
}
}
}
avgval=0;
for(int i=2;i<8;i++){avgval+=buf[i]; }
float ads_avg= avgval/6;
float phvol= (ads_avg * 0.1875)/1000;
float phval= -3.7429*phvol + 15.791;
```

```
MY_SERIAL.print("Sensor = ");
MY_SERIAL.println(phval);
MY_SERIAL.print("Voltage = ");
MY_SERIAL.println(phvol);
delay(1000);
if (phval <=1 || phval>13.90){
MY_SERIAL.print("Check the pH meter");
return 13.89 ;
}
return phval;
}
```

8.)Test Case:

8.1)Test cases

Date	13 November,2022
Team ID	PNT2022TMID10555
Project name	project-Real Time River Water Quality Monitoring And Control System
Maximum Marks	4 Mks

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 System] 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	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

Testcase report:

8.2)UAT Testing:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite
LoginPage_TC_001	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	Registration form
LoginPage_TC_002	UI	Home Page	Verify the UI elements in Login/Signup popup	Email
LoginPage_TC_003	Functional	Home page	Verify user is able to log into application with Valid credentials	Facebook
LoginPage_TC_004	Functional	Login page	Verify user is able to log into application with InValid credentials	Gmail
LoginPage_TC_004	Functional	Login page	Verify user is able to log into application with InValid credentials	Bot interaction
LoginPage_TC_005	Functional	Login page	Verify user is able to log into application with InValid credentials	Web interface

Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets
1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://shopenzer.com/	Login/Signup popup should display	Working as expected	Pass	login credentials are simple, but anyways an autologin option is better.
1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	https://shopenzer.com/	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	pass	Steps are not clear to follow
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123	User should navigate to user account homepage	Working as expected	pass	yeah the process and refreshing of home page is good.
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: chalam@gmail password: Testing123	Application should show 'Incorrect email or password ' validation message.	Working as expected	pass	Shows username or password is invalid, can't always remember the credidentials
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123678686786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	pass	difficult to login the page due to many conditions
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam password: Testing123678686786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	pass	correct password or username is to be entered till then it serves invalid credidentials message.Or it is imminent to recreate the password. it's complex and tired.

TC for Automation(Y/N)	BUG ID	Executed By
Yes	BUG-1233	A. Vijay
Yes	BUG-1234	S. Varsha
Yes	BUG-1235	P. veerasekar
Yes	BUG-1236	M. Vignesh
Yes	BUG-1237	A. Vijay
Yes	BUG-1238	S. varsha

9)Results

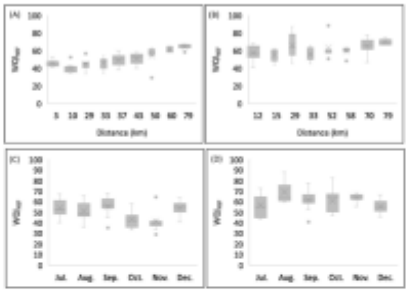
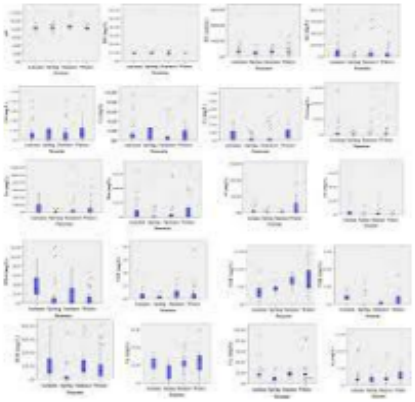
9.1)Performance metrics:

Model Performance Test

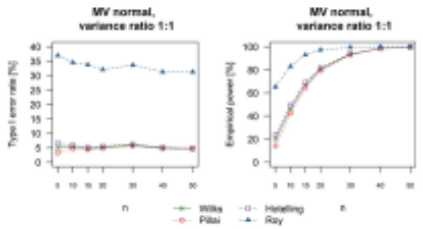
Date	13 November,2022
Team ID	PNT2022TMID10555
Project name	project-Real Time River Water Quality Monitoring And Control System
Maximum Marks	4 Mks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.no	Parameter	Values	Screenshot
1.	Model summary	-Real time river water quality monitoring system is based on iot which is implemented such a way for best product performance.	
2.	Accuracy	Training accuracy- While training the start point may be front end or back end.so there is no disturbance while training as	

		objects,modules and methods are perfectly implemented. Validation accuracy- Risk management is immediate and efficient as risk resources act immediately.its because resources are implemented long before testing of products.		

3.	**Confidence level(only yolo project)**	**Class detected- Yes Confidence score- 90%**	

10)Advantages and disadvantages:

Real-time monitoring of water quality by using IoT integrated Big Data Analytics will immensely help people tobecome conscious against using contaminated water as well as to stop polluting the water. The research is conductedfocusing on monitoring river water quality in real-time. Therefore, IoT integrated big data analytics is appeared tobe a better solution as reliability, scalability, speed, and persistence can be provided. During the project developmentphase an intense comparative analysis of real-time analytics technologies such as Spark streaming analysis throughSpark MLlib, Deep learning neural network models, and Belief Rule Based (BRB) system will be conducted [20-27]. This research would recommend conducting systematic experimentation of the proposed technologies in diversequalities of river water in Bangladesh.Due to the limitation of the budget, we only focus on measuring the quality of river water parameters. Thisproject can be extended into an efficient water management system of a local area. Moreover, other parameterswhich wasn't the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygencan also be quantified. So the additional budget is required for further improvement of the overall system.Author contributionsThis work was carried out in collaboration between all authors. All the authors have accepted responsibility for the entire content of thissubmitted manuscript and approved the submission. MSUC, TBE, SG, AP, MMA, NA, and MSH carried out the study design, performed theexperiments, data collection, data interpretation, and statistical analysis. Authors MSUC, TBE, and AP collected the water samples. Authors SGand AP has arranged the software simulation study. Authors TBE and MSH has arranged the biological study. MSUC, TBE, SG, AP, and MSHdesigned and planned the studies, supervised the experiments. MSH also acted for all correspondences.

11.)Conclusion:

During the project development phase an intense comparative analysis of real-time analytics technologies such as Spark streaming analysis through Spark MLlib, Deep learning neural network models, and Belief Rule Based (BRB) system will be conducted [20- 27]. This research would recommend conducting systematic experimentation of the proposed technologies in diverse qualities of river water in Bangladesh. Due to the limitation of the budget, we only focus on measuring the quality of river water parameters. This project can be extended into an efficient water management system of a local area. Moreover, other parameters which wasn't the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygen can also be quantified. So the additional budget is required for further improvement of the overall system

12.)Future Scope:

Due to the limitation of the budget, we only focus on measuring the quality of river water parameters. Thisproject can be extended into an efficient water management system of a local area. Moreover, other parameterswhich wasn't the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygencan also be quantified. So the additional budget is required for further improvement of the overall system.Author contributionsThis work was carried out in collaboration between all authors. All the authors have accepted responsibility for the entire content of thissubmitted manuscript and approved the submission. MSUC, TBE, SG, AP, MMA, NA, and MSH carried out the study design, performed theexperiments, data collection, data interpretation, and statistical analysis. Authors MSUC, TBE, and AP collected the water samples. Authors SGand AP has arranged the software simulation study. Authors TBE and MSH has arranged the biological study. MSUC, TBE, SG, AP, and MSHdesigned and planned the studies, supervised the experiments. MSH also acted for all correspondences. MSUC, TBE, SG, AP, MMA, NA, andMSH participated in the manuscript draft and has thoroughly checked and revised the manuscript for necessary changes in format, grammar andEnglish standard. KA checked the format, grammar and revised the manuscript. All authors read and agreed the final version of the manuscript.AcknowledgementsThe authors are grateful to both the Department of Computer Science and Engineering and Department of Pharmacy, BGC Trust UniversityBangladesh, Chittagong-4381, Bangladesh, for providing the facilities to conduct this research work.

13.)Appendix:
13.1)Source code:

```
#include <Wire.h>
#include <Adafruit_ADS1015.h>
Adafruit_ADS1115 ads(0x48);
float Voltage = 0.0;
#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 18 // GPIO pin on which the DS18B20 is
connected :D5 on esp12e
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature DS18B20(&oneWire);
// lcd ----- SDA=D2/GPIO4, SCL=D1/GPIO5
#define senseInput //Set to A0 as Analog Read
#define ORG "sovqa3"// IBM ORGANIZATION ID #define DEVICE_TYPE "Iot-Rtrwqmacs"//DEVICE
TYPE MENTIONED IN IOT WATSON PLATFORM #define DEVICE_ID "24681012"//DEVICE ID
MENTIONED IN IOT WATSON PLATEFORM #define TOKEN "12345678"//Token String data3; float
dist; //------------customize the above value------- char server[]=ORG
".messaging.internetofthings.ibmcloud.com";//server name char
publishtopic[]="rtrwqmacs/evt/Data/fmt/json";/*topic name and type of event perform and
format in which data to be send*/ char
subscribetopic[]="rtrwqmacs/cmd/test/fmt/String";/*cmd REPRESENT Command tupe and
COMMAND IS TEST OF FORMAT STRING*/ char authMethod[]="use-token-
auth";//authentication method char token[]=TOKEN; char clientid[]="d:" ORG ":"
```

```
DEVICE_TYPE":" DEVICE_ID;//CLIENT ID //---------------------------------- WiFiClient wifiClient;//
creating an instance for wificlient PubSubClient client(server, 1883 , callback , wifiClient);
int senseRawValue; //Some variable
float senseTurbidity; //Some floating variable
#define analogpin
const int trigPin = 12;
const int echoPin = 13;
// defines variables
long duration;
int distance;
int tankheight=27;
int mydistance;
```

```
int buf[10],temp;
int sensorval=0;
long int avgval;
int brdled =02;
////////////////// for http Client//////////////////
#include <Arduino.h>
#include <WiFi.h>
#include <WiFiMulti.h>
#include <HTTPClient.h>
#define MY_SERIAL Serial
WiFiMulti wifiMulti;
void setup() {
pinMode(brdled,OUTPUT);
MY_SERIAL.begin(115200);
MY_SERIAL.println();
MY_SERIAL.println();
MY_SERIAL.println();
for(uint8_t t = 4; t > 0; t--) {
MY_SERIAL.printf("[SETUP] WAIT %d...\n", t);
MY_SERIAL.flush();
delay(1000);
}
wifiMulti.addAP("WorkSHop", "inf12345");
wifiMulti.addAP("J-THEORY 3878", "98?J365o");
while (wifiMulti.run()!= WL_CONNECTED) { //Check for the connection
```

```
delay(1000);
MY_SERIAL.println("Connecting to WiFi..");
}
MY_SERIAL.println("WiFi network connected");
//////////////////Setup for the sensors and ads1115/////////////////
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
ads.begin(); // enables the ADC1115
MY_SERIAL.println("Initializing All Sensors.....................");
delay(3000);
}
void loop() {
float mtemp,turb,ph,level; /// variables to hold sensor values(data)
mtemp= mytemp(); // hold temperature data
turb=myturb(); // hold turbidity data
ph=myph(); // hold pH data
level=mylevel(); // hold water level data
// wait for WiFi connection
if((wifiMulti.run() == WL_CONNECTED)) {
digitalWrite(brdled,HIGH);
delay(5000);
digitalWrite(brdled,LOW);
HTTPClient http;
MY_SERIAL.print("[HTTP] begin...\n");
// configure traged server and url
```

```
MY_SERIAL.println(distance);
MY_SERIAL.print("Distance: ");
MY_SERIAL.println(distance);
if (distance<=10&& distance>=5){
MY_SERIAL.println("The water level: FULL");
}
else if (distance>10 && distance<=16){
MY_SERIAL.println("The water level: NORMAL");
}
else if (distance>16){
MY_SERIAL.println("The water level: LOW");
}
delay(1000);
}////////////////////// pH Sensor //////////////////////
float myph(){
//////// using the ads1115 for the ph meter
int16_t adc0; // we read from the ADC, we have a sixteen bit integer as a result
adc0 = ads.readADC_SingleEnded(0);
for(int i=0;i<10;i++){
//buf[i]= analogRead(analogpin);
buf[i]= adc0;
delay(100);
}
```

```
http.begin("https://openweathermap.org/appid"); //HTTP
//http.begin(""http://api.openweathermap.org/data/2.5/forecast?id=524901&appid=915c3fc3b
97c6219 9e657fd7ad0c4edf"); //HTTP
//defining a variabble to hold all values from sensors
String ourdata
=String(mtemp)+","+String(turb)+","+String(ph)+","+String(level);
MY_SERIAL.println(ourdata);
MY_SERIAL.print("[HTTP] POST...\n");
// start connection and send HTTP header
http.addHeader("Content-Type","text/plain");
int httpCode = http.POST(ourdata);
// httpCode will be negative on error
if(httpCode > 0) {
// HTTP header has been send and Server response header has been handled
MY_SERIAL.printf("[HTTP] POST... code: %d\n", httpCode);
// file found at server
if(httpCode == HTTP_CODE_OK) {
String payload = http.getString();
MY_SERIAL.println(payload);
}
}
else {
MY_SERIAL.printf("[HTTP] POST... failed, error: %s\n",
http.errorToString(httpCode).c_str());
wifiMulti.run();
```

```
MY_SERIAL.print("TURBIDITY VALUE: "); //Print the output data to the
serial
MY_SERIAL.println(senseTurbidity);
MY_SERIAL.print("\n");
delay(1000);
if (senseTurbidity>=3.90 ){
MY_SERIAL.println("\t Water is clear \n");
}
if (senseTurbidity<3.90 && senseTurbidity>=3.30 ){
MY_SERIAL.println("\t Water is normal clear \n");
}
else if(senseTurbidity<3.30)
MY_SERIAL.println("\t Warning. Water is muddy or very cloudy!!!!!!! \n");
}
//////////////////////Ultrasonic Sensor//////////////////////
float mylevel(){
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
return distance;
```

```
if (wifiMulti.run()!= WL_CONNECTED) { //Check for the connection
delay(1000);
wifiMulti.run();
MY_SERIAL.println("Reconnecting to WiFi..");
}
else {
MY_SERIAL.println("Reconnected");
digitalWrite(brdled,HIGH);
delay(2000);
digitalWrite(brdled,LOW);
}
}
http.end();
}
delay(20000);
}
//////////////////Turbidity Sensor//////////////////////
float myturb(){
int16_t adc1; // we read from the ADC, we have a sixteen bit integer as a result
adc1 = ads.readADC_SingleEnded(1);
float voltage = (adc1 * 0.1875)/1000; //converting analog reading to voltage
(digital value)
senseTurbidity= voltage+1; // converting sensor voltage to 5V
return senseTurbidity;
```

```
for(int i=0;i<9;i++){
for(int j=i;j<10;j++){
if(buf[i]>buf[j]){
temp=buf[j];
buf[i]=buf[j];
buf[j]=temp;
}
}
}
avgval=0;
for(int i=2;i<8;i++){avgval+=buf[i]; }
float ads_avg= avgval/6;
float phvol= (ads_avg * 0.1875)/1000;
float phval= -3.7429*phvol + 15.791;
MY_SERIAL.print("Sensor = ");
MY_SERIAL.println(phval);
MY_SERIAL.print("Voltage = ");
MY_SERIAL.println(phvol);
delay(1000);
if (phval <=1 || phval>13.90){
MY_SERIAL.print("Check the pH meter");
return 13.89 ;
}
return phval;
}
```

```
//////////////////Temperature Sensor/////////////////
float mytemp(){
float temp;
DS18B20.requestTemperatures();
temp=DS18B20.getTempCByIndex(0);
MY_SERIAL.print("Temperature: ");
return temp;
}
```

GIT HUB AND DEMO LINK:

https://github.com/IBM-EPBL/IBM-Project-28034-1660105947.git

https://www.google.com/search?q=river+water+quality+monitoring+system&source=lmns&tbm=vid&bih=657&biw=1366&hl=en&sa=X&ved=2ahUKEwiHoPHj2rf7AhXHi9gFHY9wBL0Q_AUoAnoECAEQAg#fpstate=ive&vld=cid:be1734cc,vid:gU0uSVNi4a0