REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

NALAIYA THIRAN PROJECT BASED LEARNING

On

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

TEAM ID: PNT2022TMID48692

A PROJECT REPORT

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ABSTRACT

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 system consists of several sensors which is used to measure physical and chemical parameters of the water. The main components of Wireless Sensor Network (WSN) include a microcontroller 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.

Now a day's Internet of things (IoT) is an innovative technological phenomenon. It is shaping today's world and is used in different fields for collecting, monitoring and analysis of data from remote locations. IoT integrated network if everywhere starting from smart cities, smart power grids, and smart supply chain to smart wearable. Though IoT is still under applied in the field of environment it has huge potential. It can be applied to detect forest fire and early earthquake, reduce air population, monitor snow level, prevent landslide, and avalanche etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system. Water quality monitoring has gained more interest among researchers in this twenty-first century. Numerous works are either done or ongoing in this topic focusing on various aspects of it. 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.

CONTENTS

1.INTRODUCTION

1.1 Project Overview

The River water that are contaminating on the regular basics that are not notified by the people for they become unnoticed with the cause of the effects and spread of harmful diseases that come from usage of these water bodies, the problem solution has been proposed to predict such events that cause the further contamination of river water bodies in that particular regions, we try to predict those water bodies by using cloud services to alert the end user for immediate measurements to be taken by the authorized people

Monitoring provides the objective evidence necessary to make sound decisions on managing water quality today and in the future. Water-quality monitoring is used to alert us to current, ongoing, and emerging problems; to determine compliance with drinking water standards, and to protect other beneficial uses of water.

1.2 Purpose

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.

- River water quality can be monitored by the web application.
- Can be able to know if there are any dust particles present in the water.
- The PH level of the water can be monitored.
- Water turbidity can be monitored.
- Alerting the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.

2.LITERATURE SURVEY

2.1 Existing Problem

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. This problem proposes a sensor-based water quality monitoring system. The uniqueness of our project is to obtain the water monitoring system with high frequency, high mobility, and low powered.

2.2 References

TITLE	AUTHOR	OBJECTIVE
Real-time water quality monitoring through Internet of Things and ANOVA-based analysis: a case study on river Krishna	Prasad M Pujar Harish H Raviraj M Uma kant P	In this paper it has emphasized on the IOT based water quality monitoring system by the statistical analysis where one way and two way analysis of variance (ANOVA)
Sensor based water quality monitoring system	Paul B	causes and effects of water pollution is presented, and comprehensive review of different methods of water quality monitoring and an efficient IoT based method for water quality monitoring has been discussed.
The real time monitoring of water quality in IoT environment	Vijayakumar N Ramya R	The design and development of the real time monitoring of the water quality parameters in IoT environment is presented using water quality parameter sensors, Raspberry PI B+ core controller and an IoT module (USR WIFI 232)

Design and Development of RealTime Water Quality Monitoring System	Meghana M Kiran Kumar B M Divya Kiran Ravikant Verma	This paper presents a system that is developed to measure the parameters of water such as turbidity dissolved solvents PH and temperature. The sensors are interfaced with Arduino UNO and raspberry Pi for data processing and transmission. This data is transmitted through Wi - Fi to the remote place

2.3 Problem Statement Definition

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	I am 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 fertilizers 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 technique s and survival.
PS-2	I am villager who suffers from impure water issues.	I'm trying to take an initiative of consuming pure river water that prevent major and minor	But I can't achieve due to that I can't find proper method than manual practices or	Because of poisonous state of water, we are unable to use it efficiently because it creates	It makes me frustrated and makes me answerable for the health and Risk factors that the villagers take.

		health issues in people.	can’t find an apt product.	major and minor health issues to villagers.	

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

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.

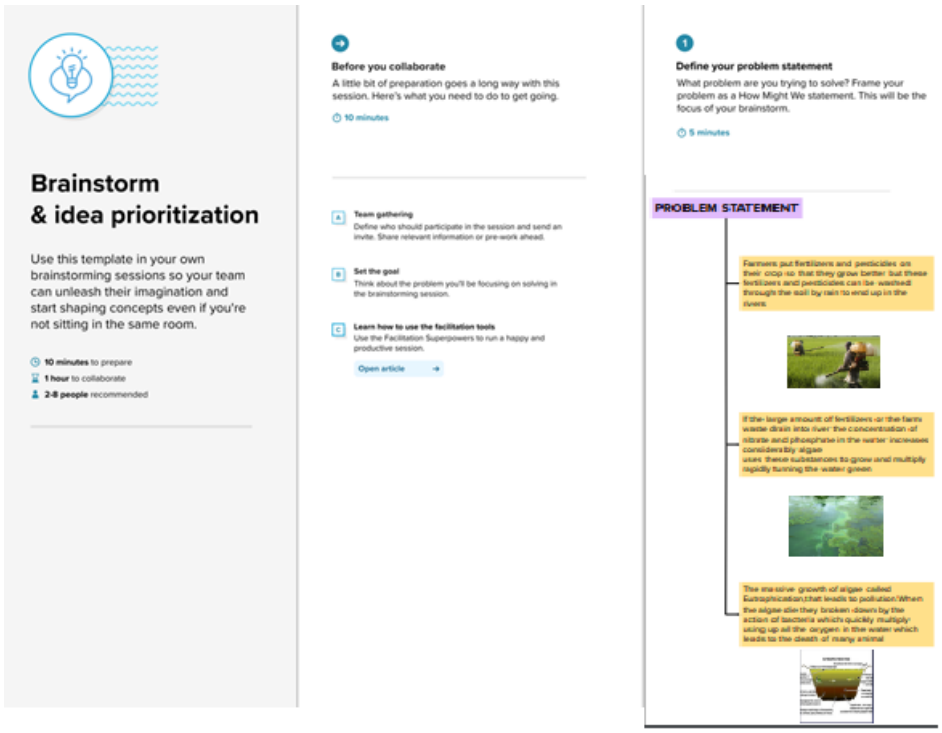
3.2 Ideation & Brainstorming

Brainstorm & Idea Prioritization Template:

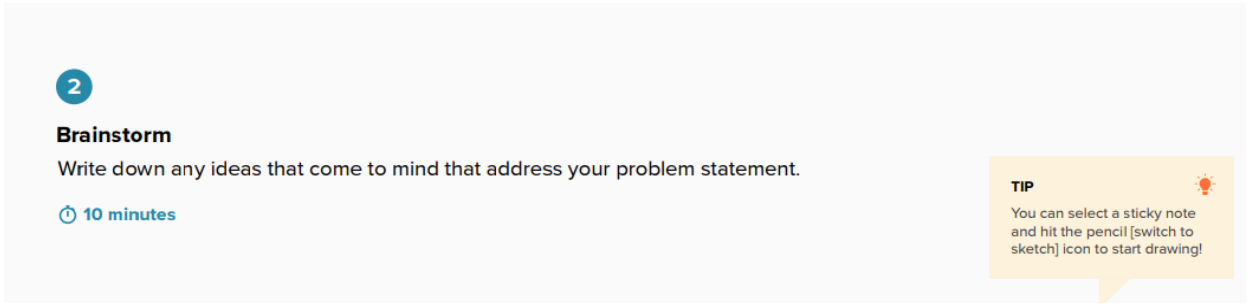
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate,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

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



Nandha Kumar G

Each data needs to be in different measures to analyze the quality	Prediction can also be taken from the historical dataset	Keep the data design
The proposed prediction system will iteratively test the model with training and testing datasets	Data modeling to use the past dataset to inform the future effort	The data mining techniques will be used for applying the classification method for water quality application

Nalinashree N

The data distribution in the testing data should not affect the training data set.	Various techniques can be included to predict the quality within the application.	Use a minimal number of parameters with cheap sensors to predict water quality
Using supervised learning algorithm, water quality class can be predicted	Cross-validation can used to evaluate method for reducing scales of overfitting and increasing accuracy of the model	Variable importance analysis can increase the accuracies of the models

Renuga Devi N

Vikram S

Massive dataset and strong correlation between parameters will make the best prediction.

Accurate model can be selected based on the outcome in the model evaluation

Network structure selection method is proposed to identify the corelated input parameters

The size of training datasets should not be less than the number of training parameters required in the model.

Stratified sampling strategy is used to mitigate the uneven distribution of training and testing dataset

The timeline of the measurements must be recorded

A method like neuro-fuzzy interference system can be implemented which is capable of integrating linear and non-linear relationships in dataset.

Evaluating the effect of substantial nutrient loads on overall water quality

Some of the variables can be eliminated due to the meaningless analysis

Parameters like temperature, turbidity, pH and dissolved solids can be used

Feature selection helps to simplify the procedure and reduce computational cost of analysis

The variable importance measure must be weighted sums of the absolute regression coefficients.

3

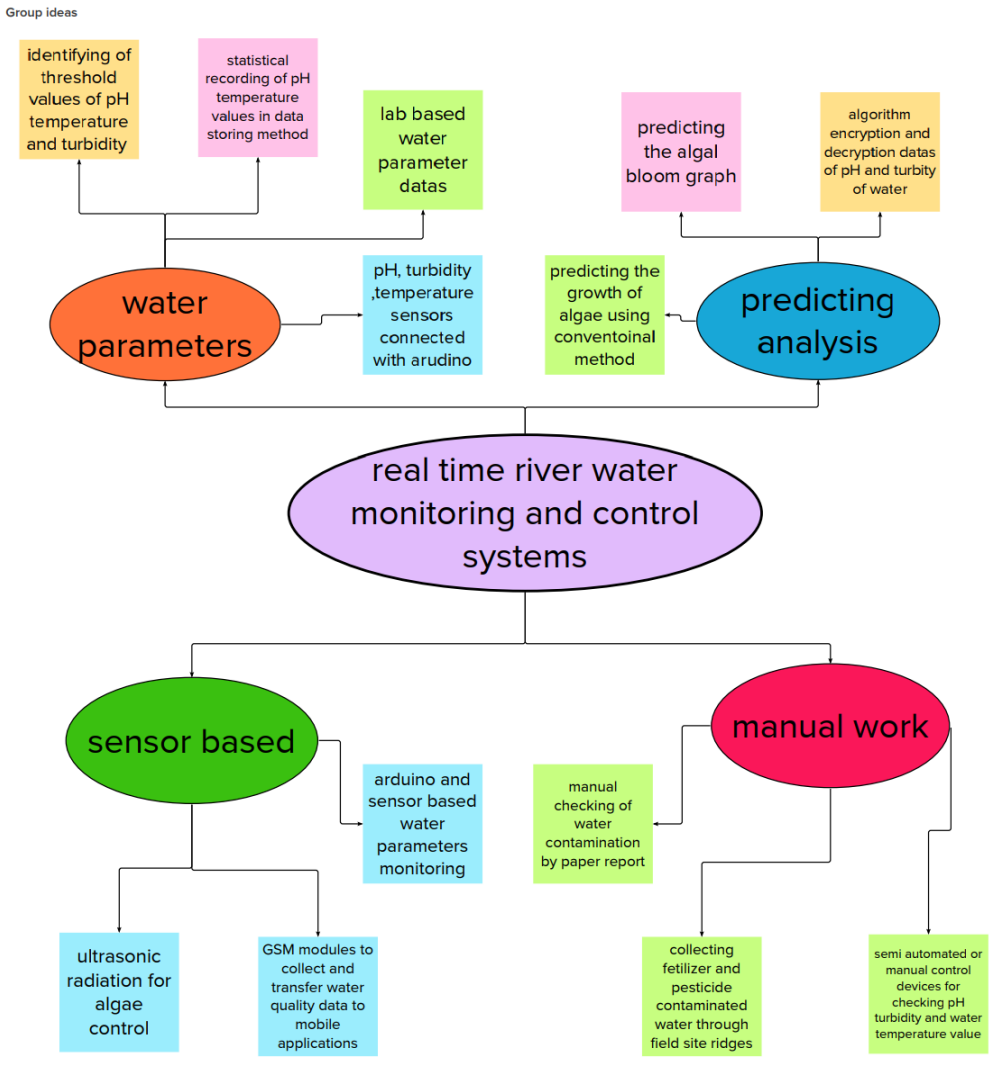
Group ideas

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

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.



Step-3: Idea Prioritization

4

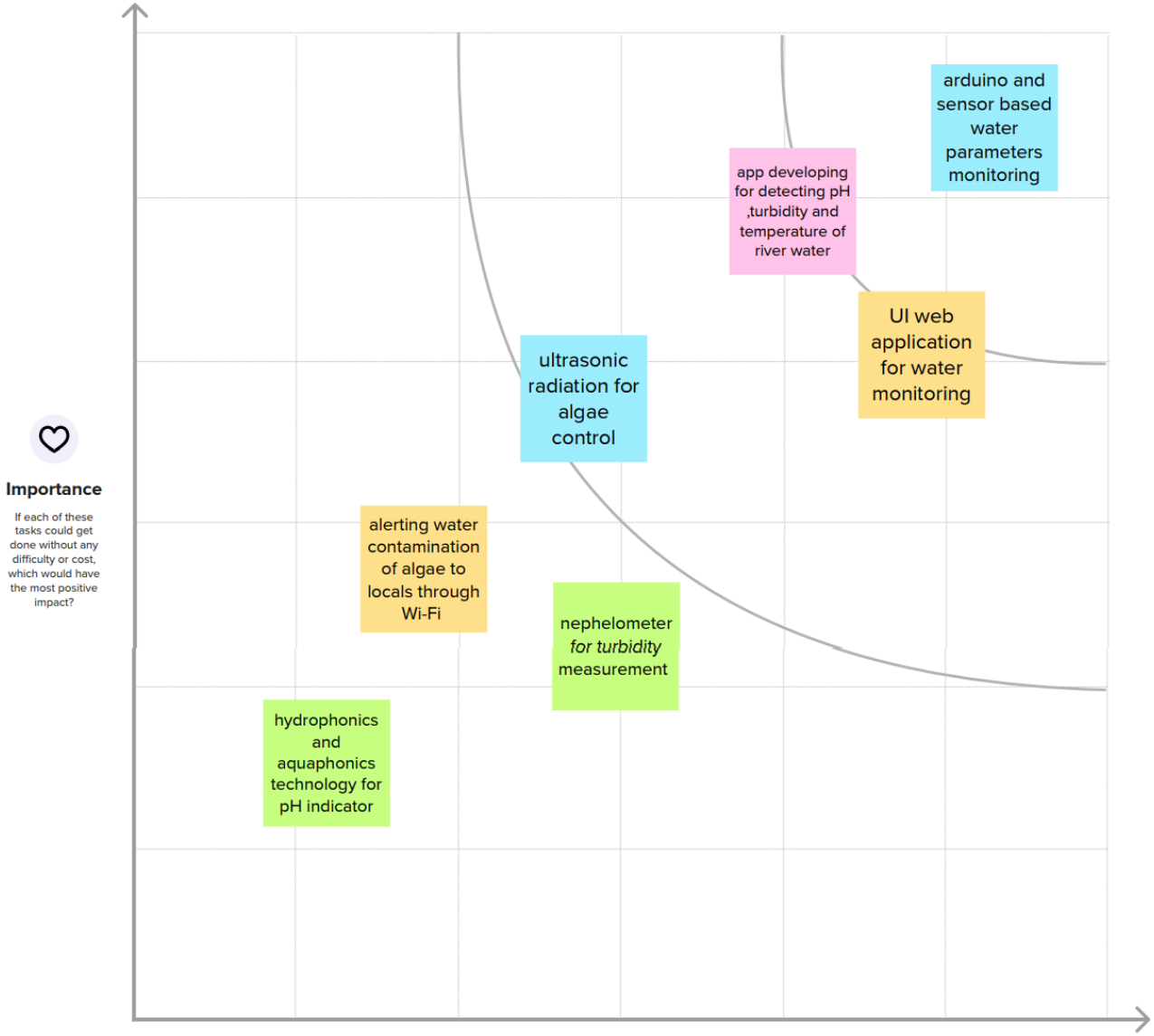
Prioritize

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

TIP

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



Importance

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

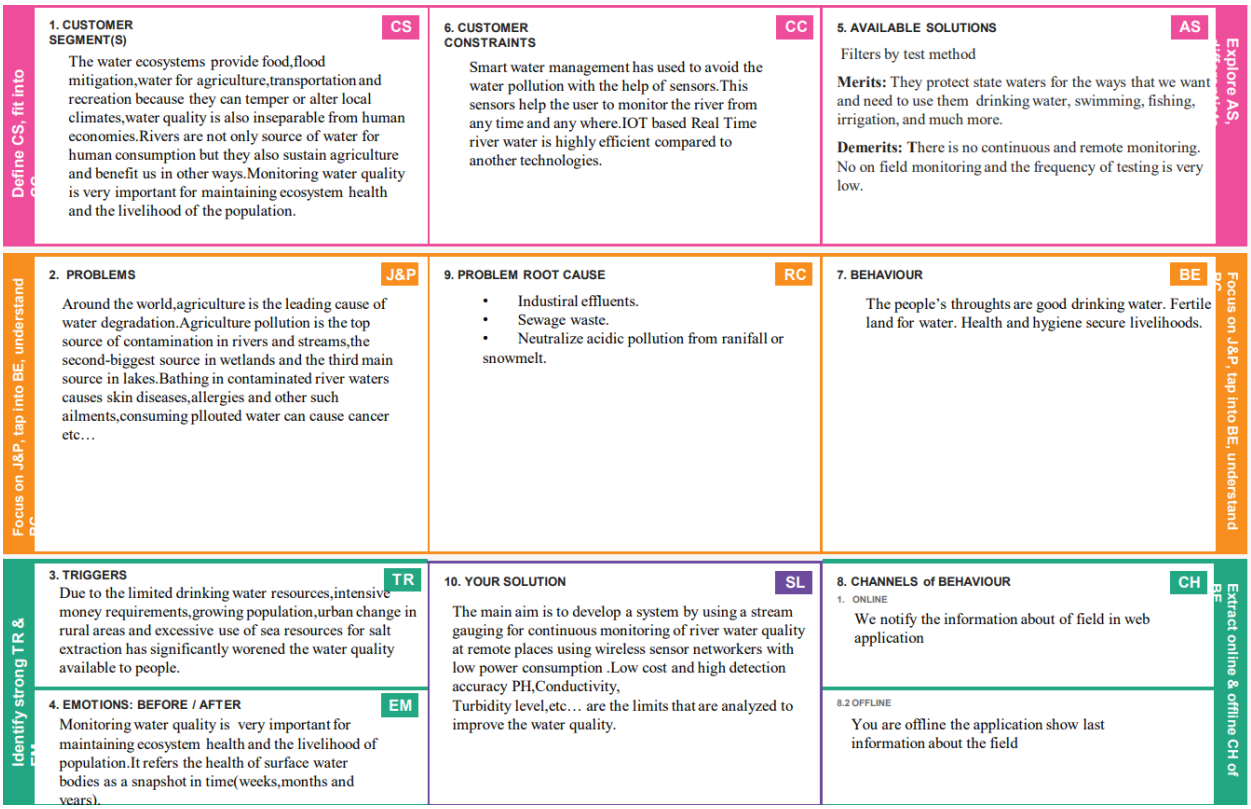
Feasibility

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

3.3 Proposed Solution

S.No.	Parameter	Description
1. .	Problem Statement (Problem to be solved)	Monitoring and controlling the quality of the river water
2.	Idea / Solution description	1.To measure water parameters such as Ph, dissolved oxygen, turbidity, conductivity etc. Using available sensors at a remote place. 2.To assemble data from various sensor nodes and send it to the base station by wireless channel. 3.To send SMS to an authorized person.
3.	Novelty / Uniqueness	Arduino And Sensor Based Water Parameters Monitoring which identifies biological and chemical changes in water
4.	Social Impact / Customer Satisfaction	Localities will not suffered by poor quality of water by alerting them when the water quality is not good.
5.	Business Model (Revenue Model)	The monitoring system could be sold in the market for the purpose of testing water quality.
6.	Scalability of the Solution	The model could be scaled according to size of the water body about to be tested

3.4 Problem Solution fit



4.REQUIREMENT ANALYSIS

4.1 Functional requirement

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

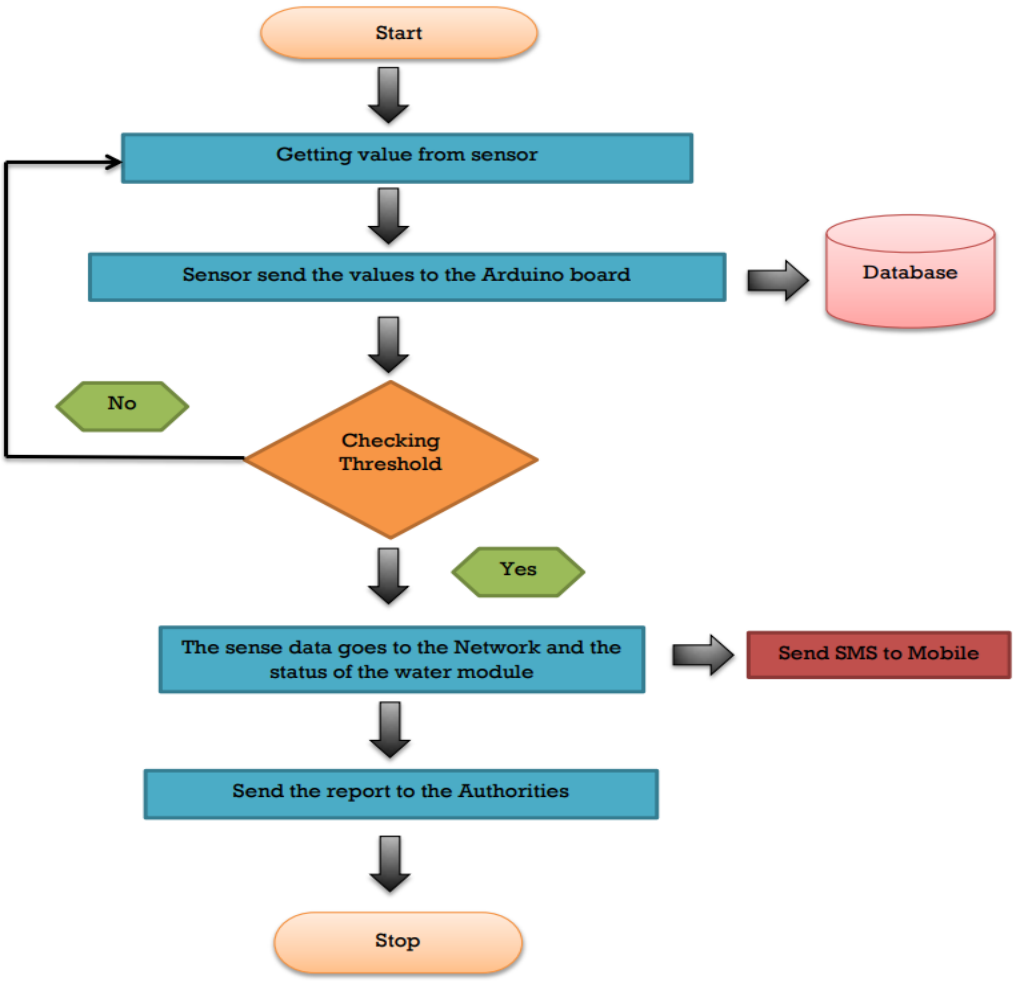
4.2 Non-Functional requirements

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

NFR No.	Non-Functional Requirement	Description
1)	**Usability**	The Final data should be easily understandable .
2)	**Security**	The model designed in a secured manner in order to maintain the privacy
3)	**Reliability**	Even if there is a firmware issues (failures) the last updated Data's are stored in a Default manner.
4)	**Performance**	High quality sensors are used to ease the customers work.
5)	**Availability**	The model designed in such a way that are available, usable and can be modified anytime.
6)	**Scalability**	The System are Scaled according to the size of the water body (varies)

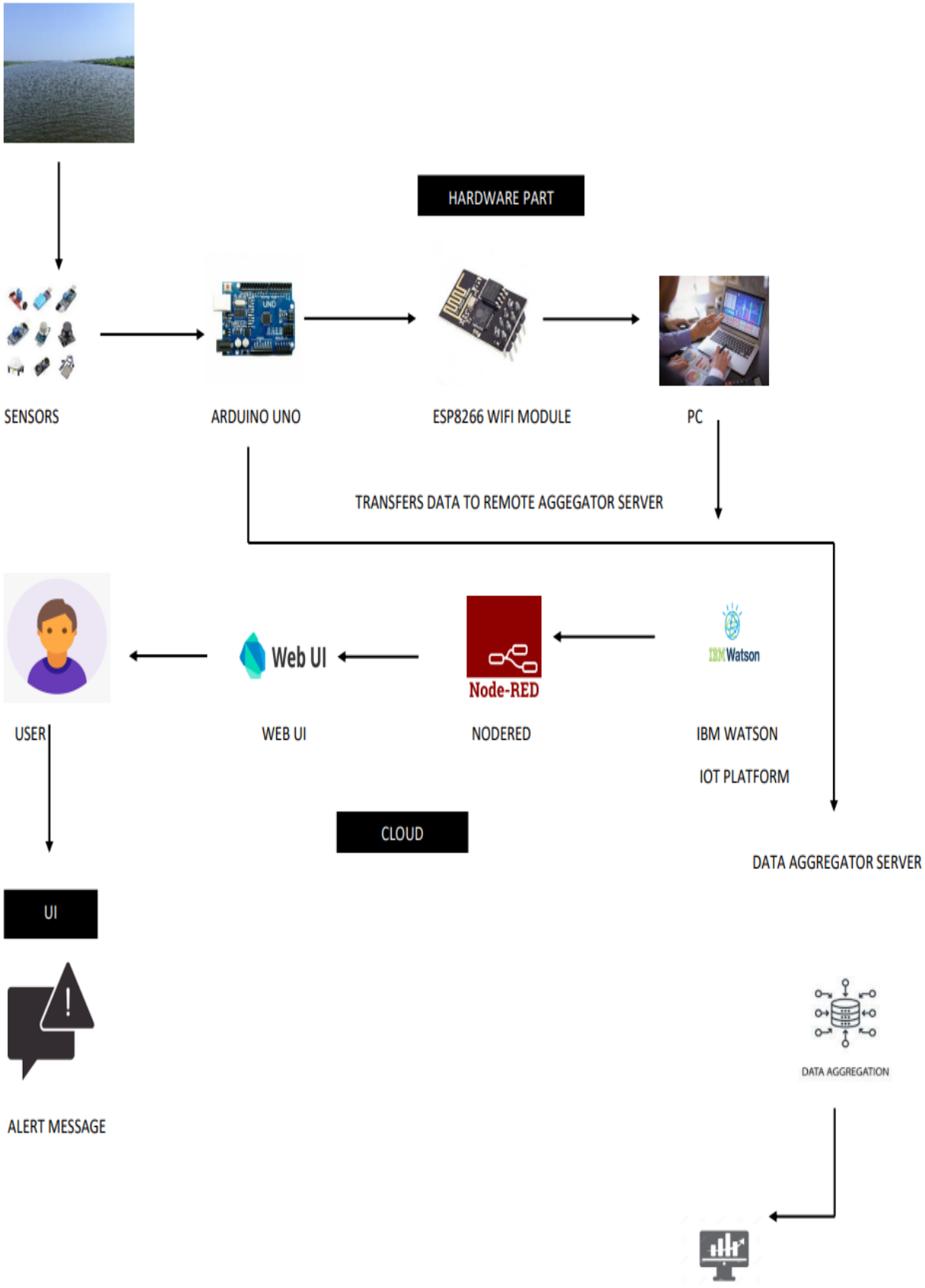
5.PROJECT DESIGN

5.1 Data Flow Diagrams

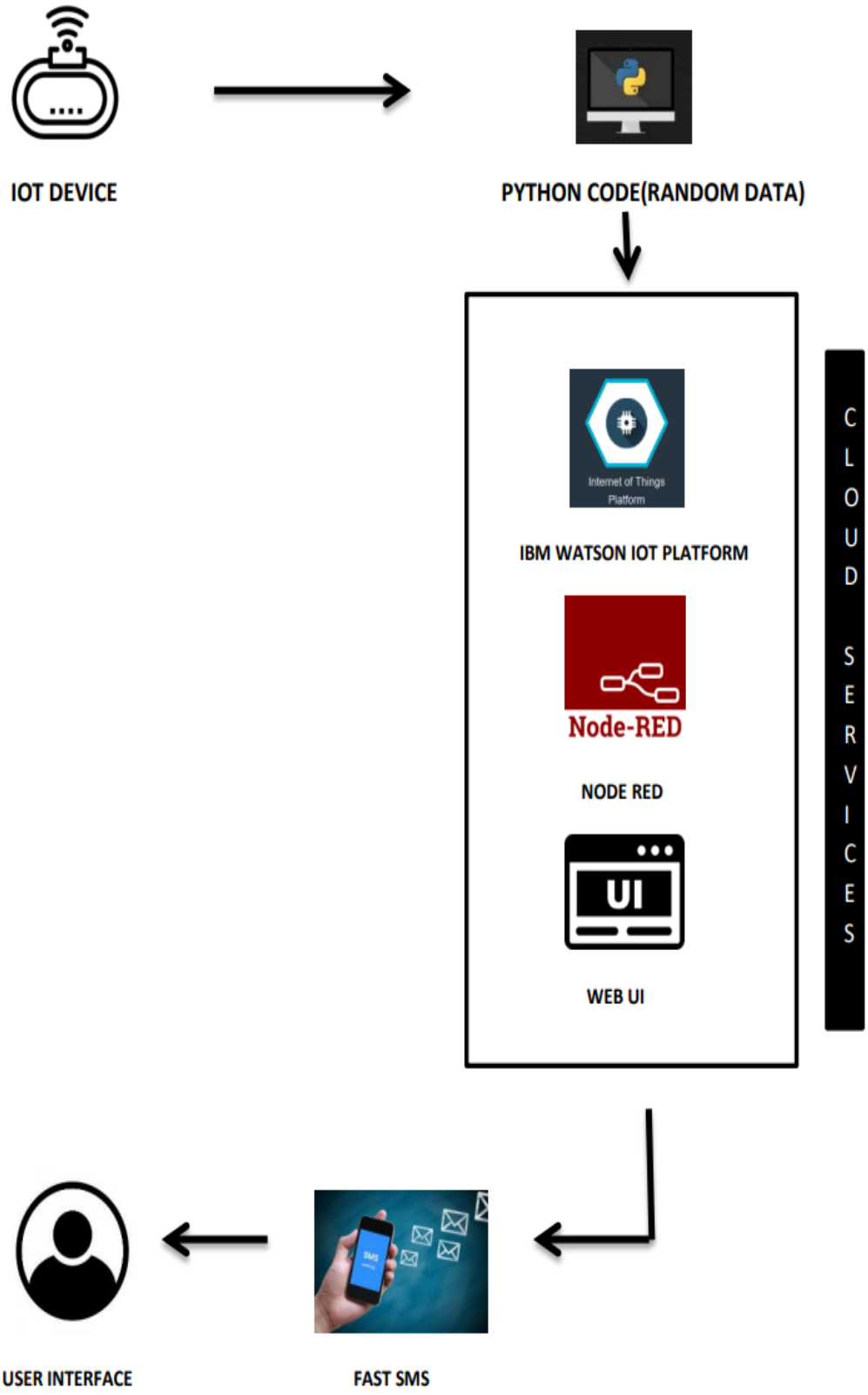


5.2 Solution & Technical Architecture

Solution Architecture



Technology Architecture



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Sensor & Control System	Detection of temperature, pH, Salinity, BOD, COD	USN-1	Detects the control signals and sends to the edge computing device	Saves the measured value	High	Sprint-1
	Calculation	USN-2	Edge Computing calculations are processed	Process only valid information	High	Sprint-1
	Store of results	USN-3	Connecting Cloud IBM	Process of Results	Low	Sprint-2
	Connecting Cloud	USN-4	Generating Cloud computation of the original data	Calculate the results and process from cloud to edge	Medium	Sprint-2
	Alert the end user	USN-5	Alert the End User using alarm and notifications	Alert notifications	High	Sprint-2
Mobile Application	Transport of data	USN-2	Transport of Data from Edge to Cloud , cloud to Edge , or Cloud to Mobile Drive	Transport of data	High	Sprint-3
	Alert messages	USN-2	Alert the end user	Notify the end user	High	Sprint-4
	Statistics	USN-4	Generation of River Statistics in Particular region	Result analysis	Low	Sprint-4
Administrator	Alert messages	USN-5	Alert the results of the end-target	Alarm system	High	Sprint-3
	Statistics	USN-5	Know the current status of every river body	Cloud fetch of data	High	Sprint-2
	Summary Statistics	USN-5	Provide a detailed summary of the results	Statistical Current data	Medium	Sprint-4

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming My password.	2	High	NANDHA KUMAR G, NALINASHREE N
	Registration via Facebook	USN-3	As a user, I can register for the application through Facebook	2	Low	
	Registration via Mail ID	USN-4	As a user, I can register for the application through Gmail	2	Medium	
Sprint-2	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	
	IBM Cloud service Access		Get access to IBM cloud services.	2	High	
Sprint-3	Create the IBM Watson IoT and device Settings	USN-6	To create the IBM Watson IoT Platform and integrate the microcontroller with it, to send the sensed data on Cloud	2	High	RENUGA DEVI N
	Create a node red service	USN-7	To create a node red service to integrate the IBM Watson along with the Web UI	2	Medium	VIKRAM S
	Create a Web UI	USN-8	To create a Web UI, to access the data from the cloud And display all parameters.	2	Medium	NALINASHREE N
	To develop a Python code	USN-9	Create a python code to sense the physical quantity And store data.	2	Medium	NANDHA KUMAR G
	Publish Data to cloud.	USN-10	Publish Data that is sensed by the microcontroller to the Cloud	3	High	VIKRAM S
Sprint-4	Fast-SMS Service	USN-11	Use Fast SMS to send alert messages once the parameters like pH, Turbidity and temperature goes beyond the threshold	3	High	NANDHA KUMAR G, NALINASHREE N, RENUGA DEVI N
	Testing	USN-12	Testing of project and final deliverables	3	Medium	

6.2 Sprint Delivery Schedule

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	7 Days	24 Oct 2022	01 Nov 2022	20	01 Nov 2022
Sprint-2	20	5 Days	02 Nov 2022	07 Nov 2022	20	07 Nov 2022
Sprint-3	20	10 Days	08 Nov 2022	18 Nov 2022	20	18 Nov 2022
Sprint-4	20	9 Days	19 Nov 2022	28 Nov 2022	20	28 Nov 2022

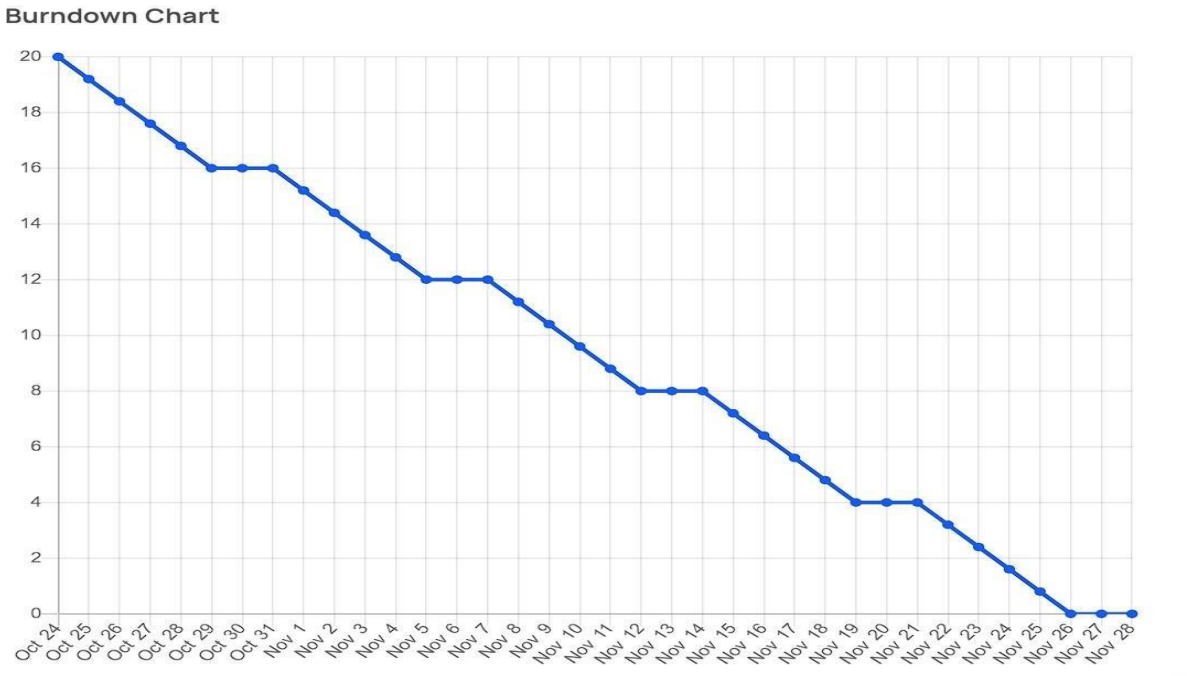
Velocity:

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

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

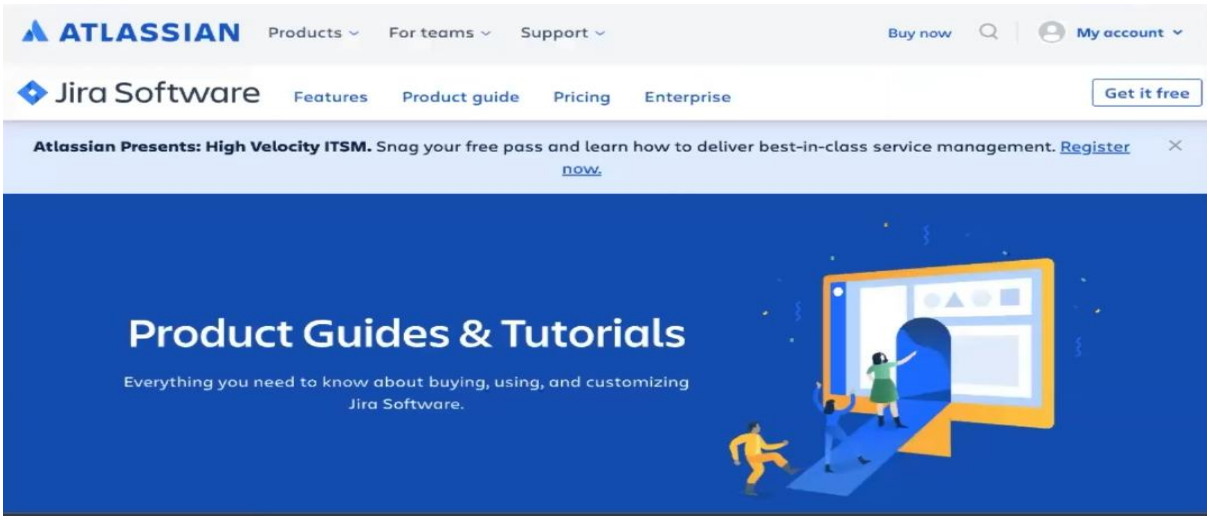
Burndown Chart:

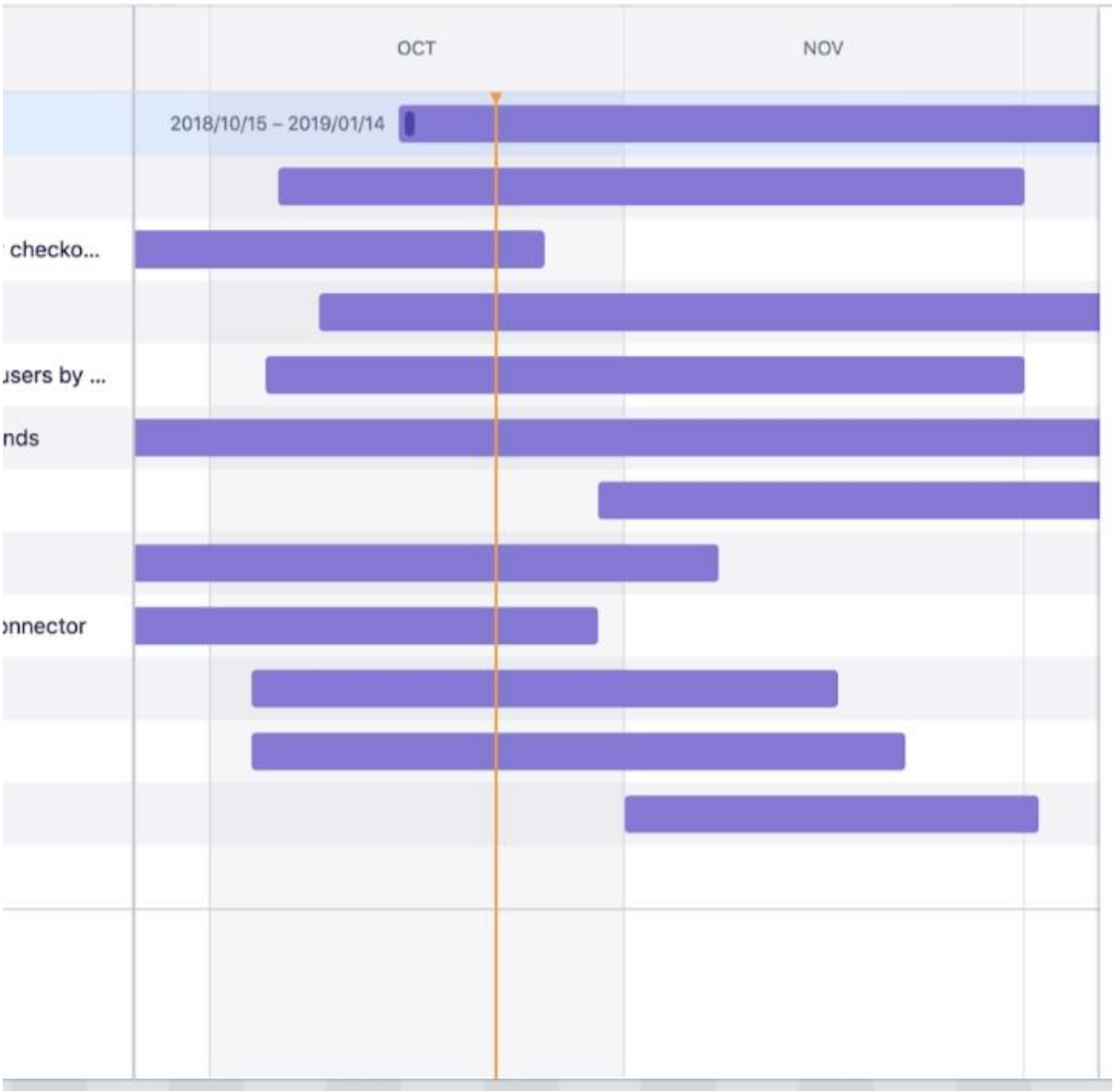
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



SI. NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1.	Understanding the project requirement	Assign the team members and create a repository in the GitHub Assign the task to each member and teachhow to use and open and class the GitHub and IBM career education	1 WEEK
2.	Starting of projectz	Advise students to attend classes of IBM portals, create and develop a rough diagram based on project description and gather information on IOT and IBM projects and team leaders assign tasks to each member of the project	1 WEEK
3.	Attend class	Team members and team lead must watch and learnfrom classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project.	4 WEEKS
4.	Budget and scope of project	Budget and analyze the use of IOT in the project and discuss with team for budget prediction to predict the favorability for the customer to buy.	1 WEEK

6.3 Reports from JIRA





7.CODING & SOLUTIONING

7.1 Feature 1

```
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "jj64y3",
```

```
        "typeId": "Nodered",
        "deviceId":"12345"
    },
    "auth": {
        "token": "123456789"
    }
}
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform:%s"% cmd.data['command'])
    m=cmd.data['command']
    if(m=='motoron'):
        print("Motor is turned ON")
    elif(m=='motoroff'):
        print("Motor is turned OFF")
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
while True:
    ph=random.randint(0,14)
    turb=random.randint(0,10)
    myData={'ph':ph, 'turbidity':turb}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully:", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

python code.py - C:\Users\nandh\Downloads\python code.py (3.7.4)

File Edit Format Run Options Window Help

```
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "jj64y3",
        "typeId": "Nodered",
        "deviceId":"12345"
    },
    "auth": {
        "token": "123456789"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform:%s"% cmd.data['command'])
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    ph=random.randint(0,14)
    turb=random.randint(0,10)
    myData={'ph':ph, 'turbidity':turb}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
    print("Published data Successfully:", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

```
============== RESTART: C:\Users\nandh\Downloads\python code.py ==============
2022-11-13 10:00:40,024   wiotp.sdk.device.client.DeviceClient  INFO    Connecte
d successfully: d:jj64y3:Nodered:12345
Published data Successfully: {'ph': 9, 'turbidity': 2}
Published data Successfully: {'ph': 9, 'turbidity': 1}
Published data Successfully: {'ph': 9, 'turbidity': 0}
Published data Successfully: {'ph': 4, 'turbidity': 7}
Published data Successfully: {'ph': 3, 'turbidity': 5}
Published data Successfully: {'ph': 1, 'turbidity': 8}
Published data Successfully: {'ph': 9, 'turbidity': 3}
Published data Successfully: {'ph': 9, 'turbidity': 1}
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Published data Successfully: {'ph': 0, 'turbidity': 5}
Published data Successfully: {'ph': 12, 'turbidity': 8}
Published data Successfully: {'ph': 10, 'turbidity': 5}
Published data Successfully: {'ph': 9, 'turbidity': 9}
Published data Successfully: {'ph': 5, 'turbidity': 8}
```
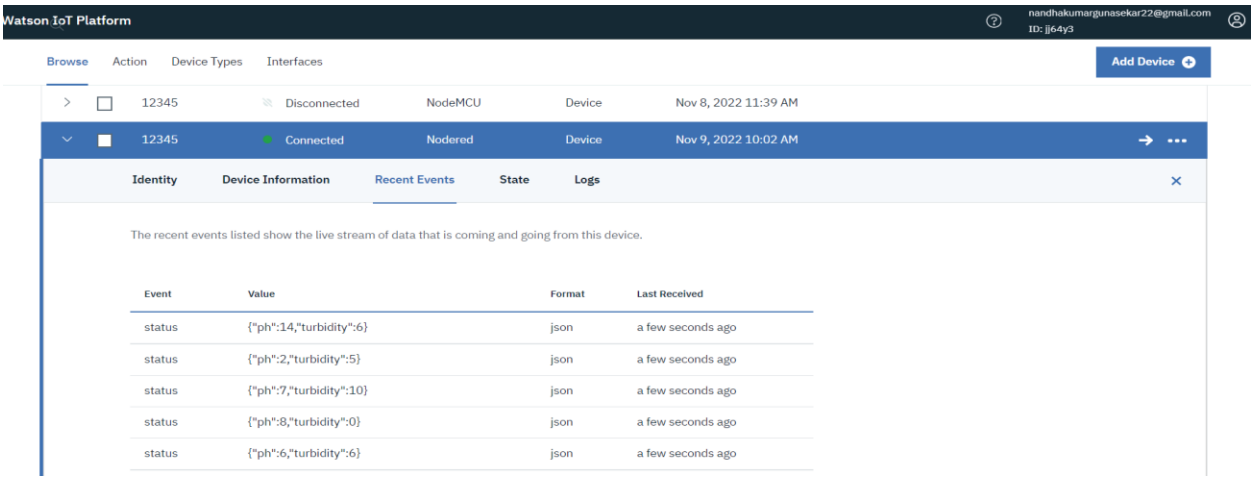
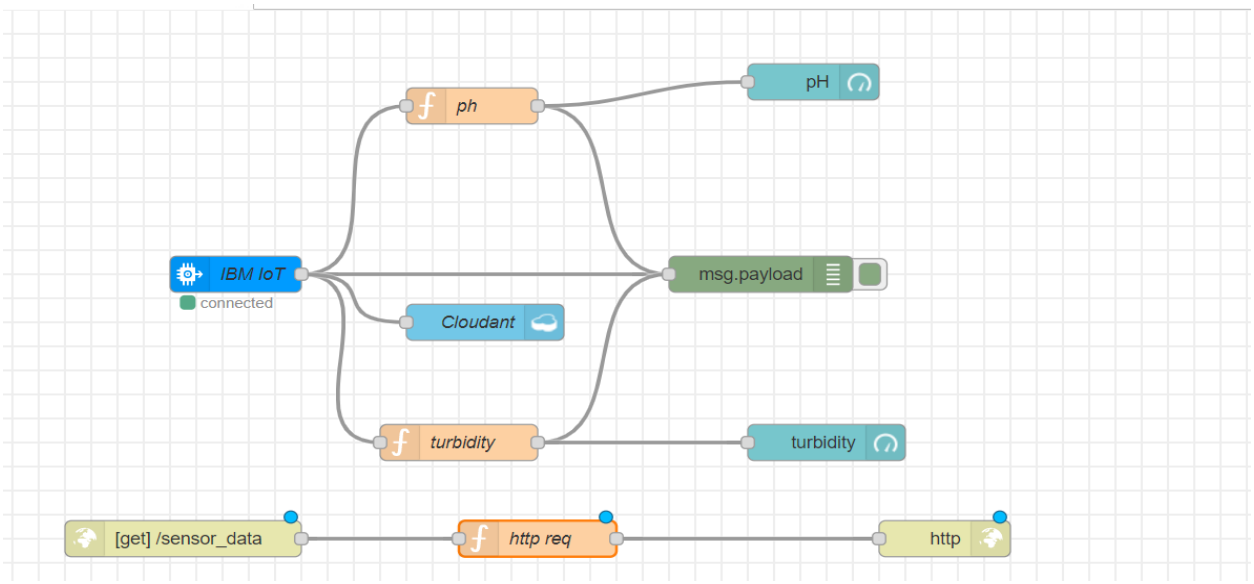
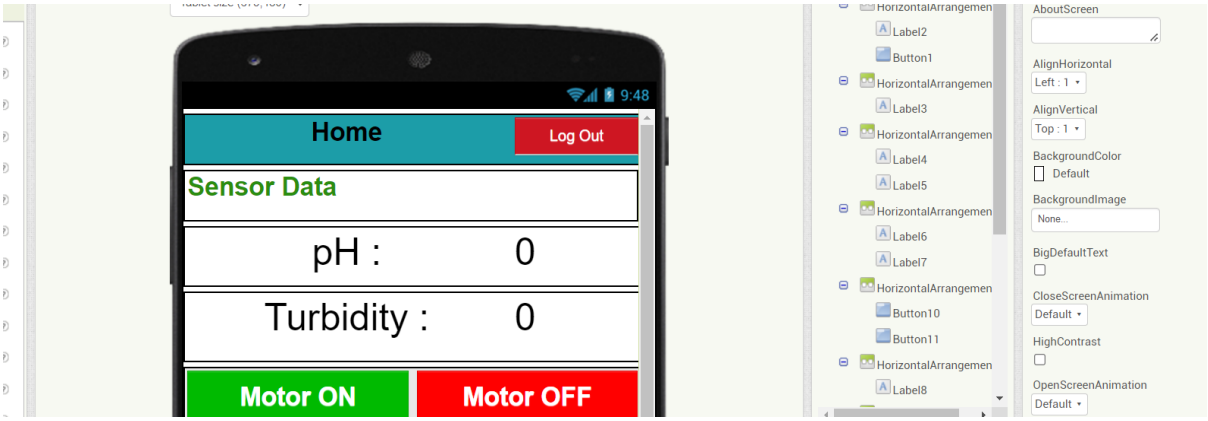
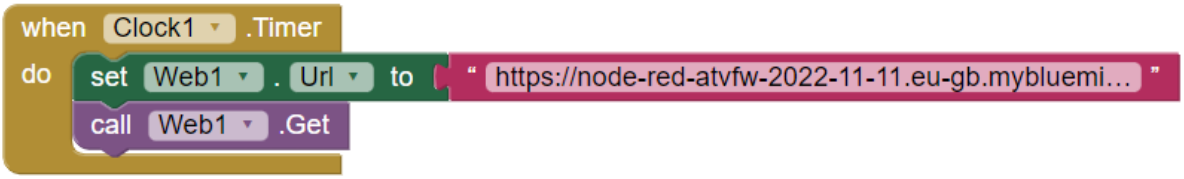
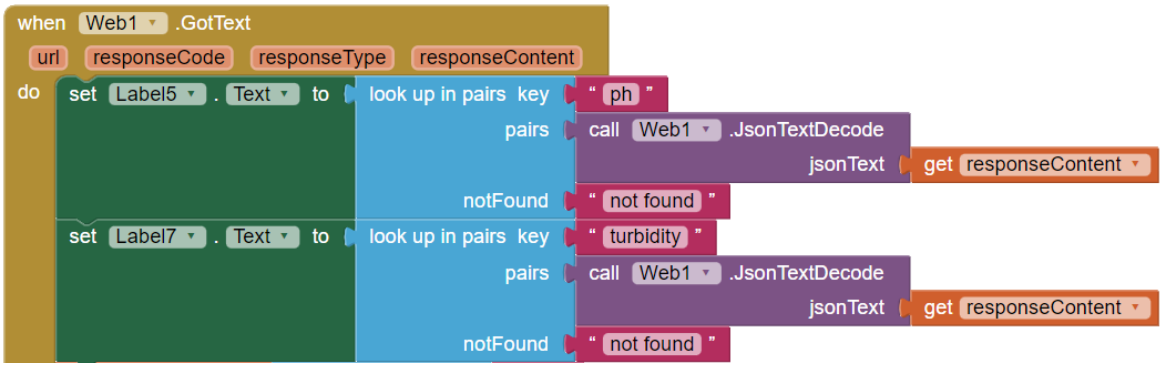


Watson IoT Platform
nandhakumargunasekar22@gmail.com
ID: jj64y3
Browse
Action
Device Types
Interfaces
Add Device
12345 Disconnected NodeMCU Device Nov 8, 2022 11:39 AM
12345 Connected Nodered Device Nov 9, 2022 10:02 AM
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event Value Format Last Received
status {"ph":14,"turbidity":6} json a few seconds ago
status {"ph":2,"turbidity":5} json a few seconds ago
status {"ph":7,"turbidity":10} json a few seconds ago
status {"ph":8,"turbidity":0} json a few seconds ago
status {"ph":6,"turbidity":6} json a few seconds ago

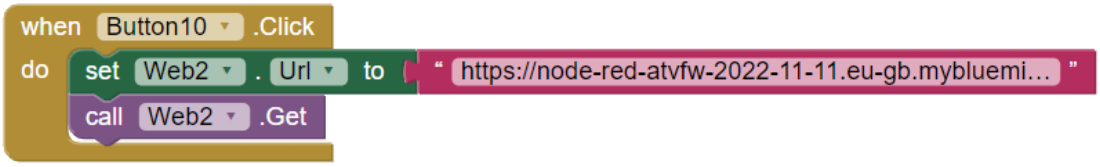
7.2 Feature 2

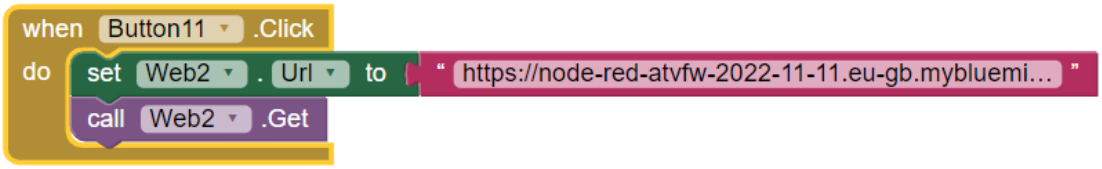

ph
pH
IBM IoT
connected
msg.payload
Cloudant
turbidity
turbidity
[get] /sensor_data
http req
http

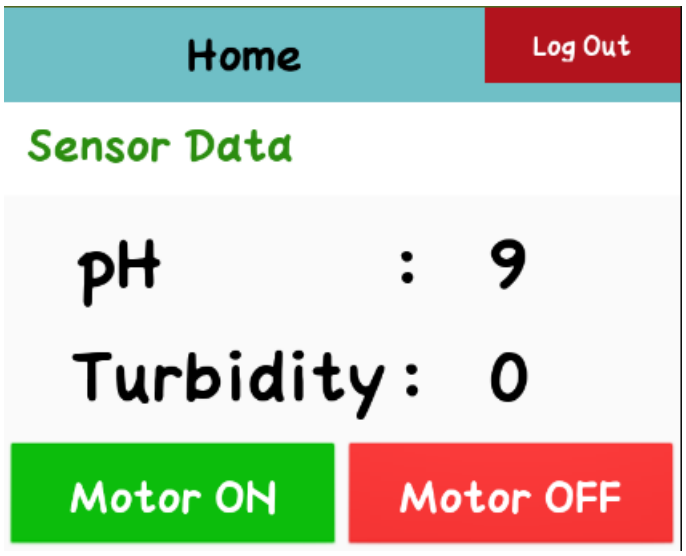

9:48
Home
Log Out
Sensor Data
pH : 0
Turbidity : 0
Motor ON
Motor OFF
Label2
Button1
Label3
Label4
Label5
Label6
Label7
Button10
Button11
Label8
AboutScreen
AlignHorizontal
Left : 1
AlignVertical
Top : 1
BackgroundColor
Default
BackgroundImage
None...
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default


when Clock1 .Timer
do set Web1 . Url to " https://node-red-atvfw-2022-11-11.eu-gb.mybluemi… "
call Web1 .Get


when Web1 .GotText
url responseCode responseType responseContent
do set Label5 . Text to look up in pairs key " ph "
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound " not found "
set Label7 . Text to look up in pairs key " turbidity "
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound " not found "


when Button10 .Click
do set Web2 . Url to " https://node-red-atvfw-2022-11-11.eu-gb.mybluemi… "
call Web2 .Get


when Button11 .Click
do set Web2 . Url to " https://node-red-atvfw-2022-11-11.eu-gb.mybluemi… "
call Web2 .Get


Home
Log Out
Sensor Data
pH : 9
Turbidity : 0
Motor ON
Motor OFF

8.TESTING

8.1 Test Cases

Test Scenarios

1 Verify user is able to see login page
2 Verify user is able to login to application or not?
3 Verify user is able to login from their Google account
4 Verify user is able to Change their Google account
5 Verify login page elements

Home Page

1 Verify user is able to see the Data values from IBM Cloud
2 Verify user is able to see the Control buttons in the Home page
3 Verify user is able to click on the motor buttons
4 Verify user is able to click on the Motor ON button and we can view command in the Python
5 Verify user is able to click on the Motor OFF button and we can view command in the Python

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
LoginPage_TC_OO1	Functional	Login Page	Verify user is able to see the Login Page when they click on the App		1.Open App 2.We can able to see the Login Page		Login page will popup	Working as expected	Pass
LoginPage_TC_OO2	UI	Login Page	Verify the UI elements in Login		1.Open app 2.Verify login page will popup with below UI elements: a.Username textbox b.password text box c.Login button d.Sign In with Google button		Application should show below UI elements: a.Username textbox b.password text box c.Login button d.Sign In with Google button	Working as expected	Pass

LoginPage_TC_OO3	Functional	Login Page	Verify user is able to log into application with Valid credentials		1.Open app 2.Enter Valid username in Username text box 4.Enter Valid password in password text box 5.Click on login button	Username: test password: test	er should vigate to the mepage	Working as expected	Pass
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Open app 2.Enter Invalid username in Username text box 4.Enter Invalid password in password text box 5.Click on login button	Username: demo password: TEST	Application alert voice message as "LOGIN UNSUCCESSFULL"	Working as expected	Pass
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with their Google Account		1.Open app 2.Click on Sign In with Google button 3.Choose their Google Account		User should navigate to the homepage	Working as expected	Pass
HomePage_TC_OO1	UI	Home page	Verify the UI elements in Homepage		1.Verify Homepage will popup with below UI elements: a.Logout button b.pH label and value c.Turbidity label and value d.Motor ON and Motor OFF buttons		Application should show below UI elements: a.Logout button b.pH label and value c.Turbidity label and value d.Motor ON and Motor OFF buttons	Working as expected	Pass
HomePage_TC_OO2	Functional	Home page	Verify user able to view the data from the IBM Cloud		1.Verify Homepage will popup with a. pH value b.Turbidity value		Application should show pH and turbidity value	Working as expected	Pass

HomePage_TC_OO3	Functional	Home page	Verify user able to click on the Logout button		Click on logout button		User should navigate to the homepage	Working as expected	Pass
HomePage_TC_OO4	Functional	Home page	Verify user able to click on the Motor ON button		Click on MotorON button		User should Turn ON the motor from the Application	Working as expected	Pass
HomePage_TC_OO5	Functional	Home page	Verify user able to click on the Motor OFF button		Click on MotorOFF button		User should Turn OFF the motor from the Application	Working as expected	Pass

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 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	5	8	3	2	18
Duplicate	2	0	3	0	5
External	2	2	1	1	6
Fixed	9	2	3	10	24
Not Reproduced	0	0	1	0	1
Skipped	0	0	2	1	3
Won't Fix	0	4	2	1	7
Totals	18	16	15	15	64

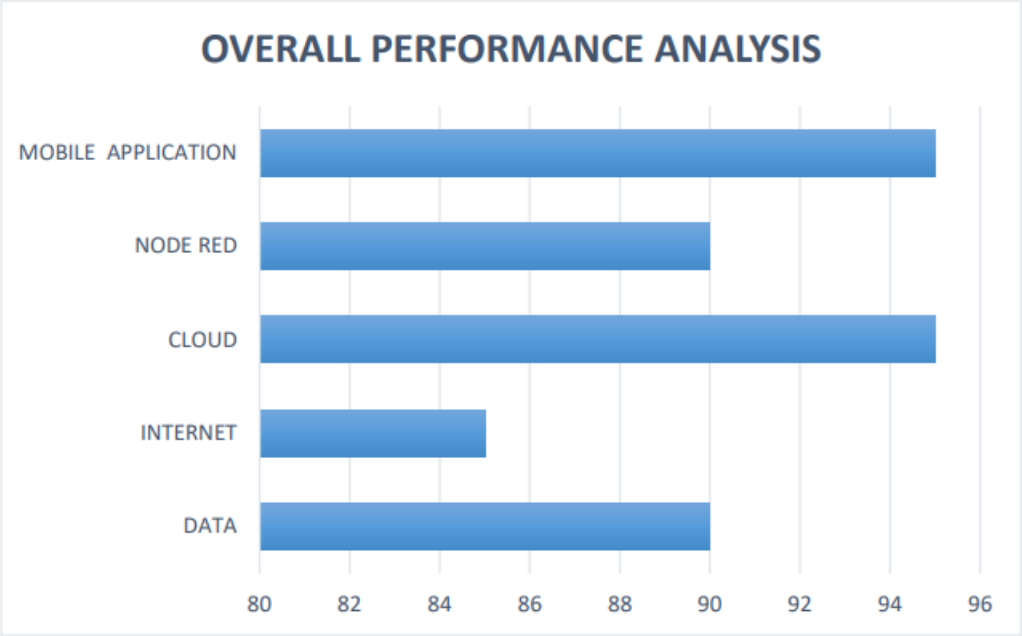
3. Test Case Analysis

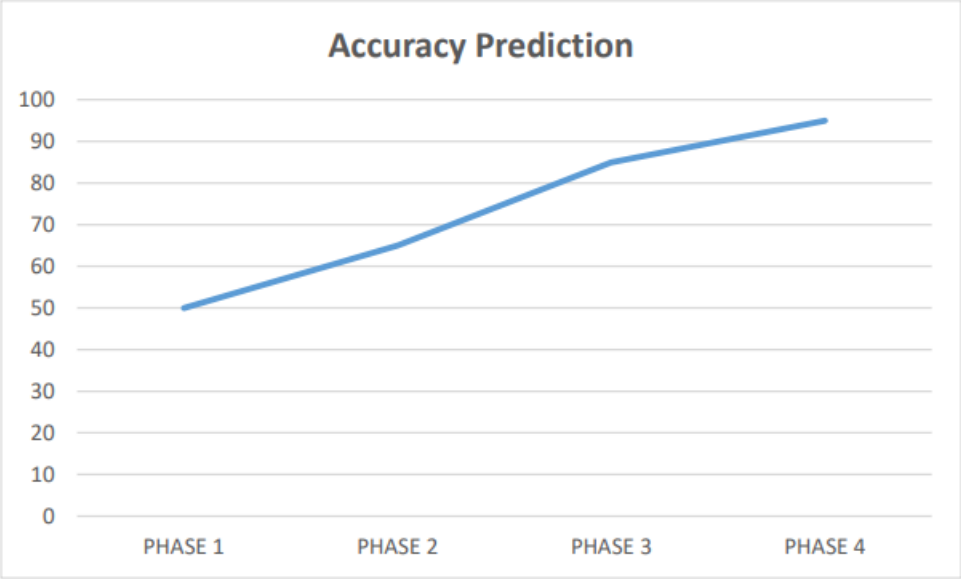
This report shows the number of test cases that have passed, failed, and untested

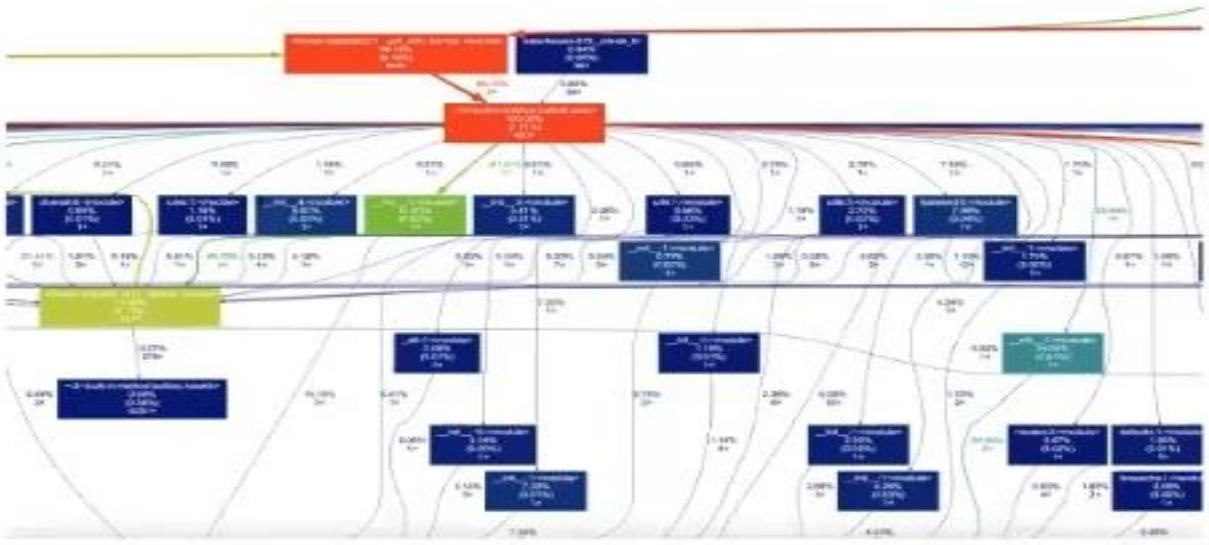
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	30	0	0	30
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	11	0	0	11
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9.RESULTS

9.1 Performance Metrics







10.ADVANTAGES & DISADVANTAGES

Advantages

- Contamination over the particular region could be known
- Live access & monitor of water bodies from the remote location.
- User Friendly
- Efficient, Accurate Results help earlier precautions

- Instantaneous data
- Accuracy of measurements
- Remote Accessibility

Disadvantages

- Sensors which measures the reading is costly
- Implementation at all regions and maintenance is required frequently
- Sometimes signaling, data transmission is challenging in highly remote regions

11. CONCLUSION

The Prediction of river water quality predicts the amount of dissolved chemical substances that a normal water that flows through that region in excess of any amount of the predicted or calculated values it throws an alert alarm which immediately alerts the target officials to take immediate actions.

End user is notified immediately using the services by the cloud which responds at instant of time so that premeasures can be built by stopping the water flow and rectifying the problem that caused so that it may not affect the next phases or regions of the river that flow through the path. Thus producing accurate results at instant of time will achieve the goal that is required for estimated problem.

12. FUTURE SCOPE

This application will be most useful for any user can view the statistics of any river across anywhere and know the current water flow and it's quality by using the mobile application which at current stage is in development phase will be a huge requirement of cloud database, but will enhance each user to be brought notified by pollutant causing agents around the river bodies.

The application is further extended to predict the accurate region that is contaminated by referencing the previous states of the water quality and also it

predicts which is the starting point of the occurrence of the quality of water is discriminated. This method helps people to ideate to look at exact location and stop that issue permanently so that it does not occur any more.

13. APPENDIX

Source Code

```
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "jj64y3",
        "typeId": "Nodered",
        "deviceId":"12345"
    },
    "auth": {
        "token": "123456789"
    }
}
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform:%s"% cmd.data['command'])
    m=cmd.data['command']
    if(m=='motoron'):
        print("Motor is turned ON")
    elif(m=='motoroff'):
        print("Motor is turned OFF")
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
while True:
    ph=random.randint(0,14)
```

```
    turb=random.randint(0,10)
    myData={'ph':ph, 'turbidity':turb}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully:", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

Github link :

https://github.com/IBM-EPBL/IBM-Project-39637-1660472677

Project Demo Link:

https://drive.google.com/file/d/1WvxKMzqRnrTflmfRnqCzqUcgSnp5AMBX/view?usp=sharing