Project Report :

REAL TIME RIVER WATER QUALITY MONITORING &CONTROL SYSTEM

TEAM ID:PNT2022TMID47191

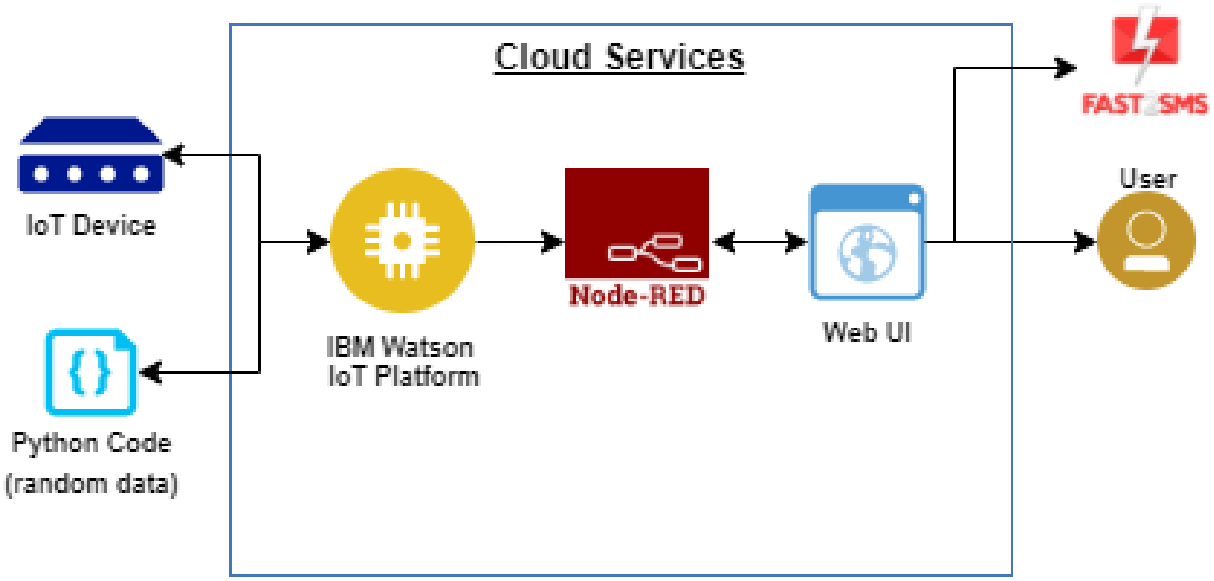
TEAM LEAD:VIGNESHWARAN
MEMBER1:MUKILAN
MEMBER2:GUNAL
MEMBER3:SIVA

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

2.1 LITERATURE SURVEY

Real-Time River Water Quality Monitoring and Control System

Team ID: PNT2022TMID47191

Water Quality Monitoring System Based on IOT

R.vigneshwaran,A.mukilan,M.gunal,G.siva

Research India Publications

Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors is used to measuringphysical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured.

IOT Based Water Monitoring System

ICIATE - 2017

The quality of water varies from place to place, depending on the condition of the source and thetreatment it receives. The traditional method of testing Turbidity, PH & Temperature is to collectsamples manually and then send them to laboratory for analysis. However, it has been unable tomeet the demands of water quality monitoring today. So a set of monitoring of Turbidity, PH & Temperature of Water quality has been developed. The system consists of Turbidity, PH, water level & Temperature sensor, single-chip microcontroller data acquisition module, information transmission module, monitoring center and other accessories. Turbidity, PH & Temperature of water are automatically detected under the control of single chip microcontroller all day. The single chip gets the data, and then processes and analyzes them.The data will be sent to monitoring center and alert the public at the same time using IOT environment. The proposed paper has realized the automation of water quality monitoring intelligence of data analyzing and networking of information transferring.

IoT Based Low Cost System for Monitoring of Water Quality in Real Time

IRJET – 2018

Now a day's water pollution is one of the biggest fears for the green globalization. To prevent the water pollution, first we have to estimate the water parameters like pH, turbidity, temperature and TDS as the variations in the values of these parameters point towards the presence of pollutants. In this paper we design and develop a low cost system for real time monitoring of the water quality in IoT. At present, water parameters are detected by chemical test or laboratory test, where the testing equipments are stationary and samples are provided to testing equipments. Thus the current water quality monitoring system is a manual system with tedious process and is very time consuming. In order to increase the frequency, the testing equipments can be placed in the water resources and detection of pollution can be made remotely. This paper proposes a Sensor-Based Water Quality Monitoring System which is used formeasuring physical and chemical parameters of the water

Communication Systems of Smart Agriculture Based on Wireless Sensor Networks in IoT

As technology develops, major countries have begun to implement the Smart Agriculture system and Internet of Things to facilitate farmers in managing their

agricultural land. This study discusses the communication system of Smart Agriculture based on Internet of Things. Data fromthe sensor will be sent by Wireless Sensor Network to Raspberry Pi and send it to the database server which can then be accessed via the internet using android applications. Android applications can be used to monitor soil pH sensors and moisture.

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.

2.3)Define the Problem Statement

Ideation Phase

Define the Problem Statement

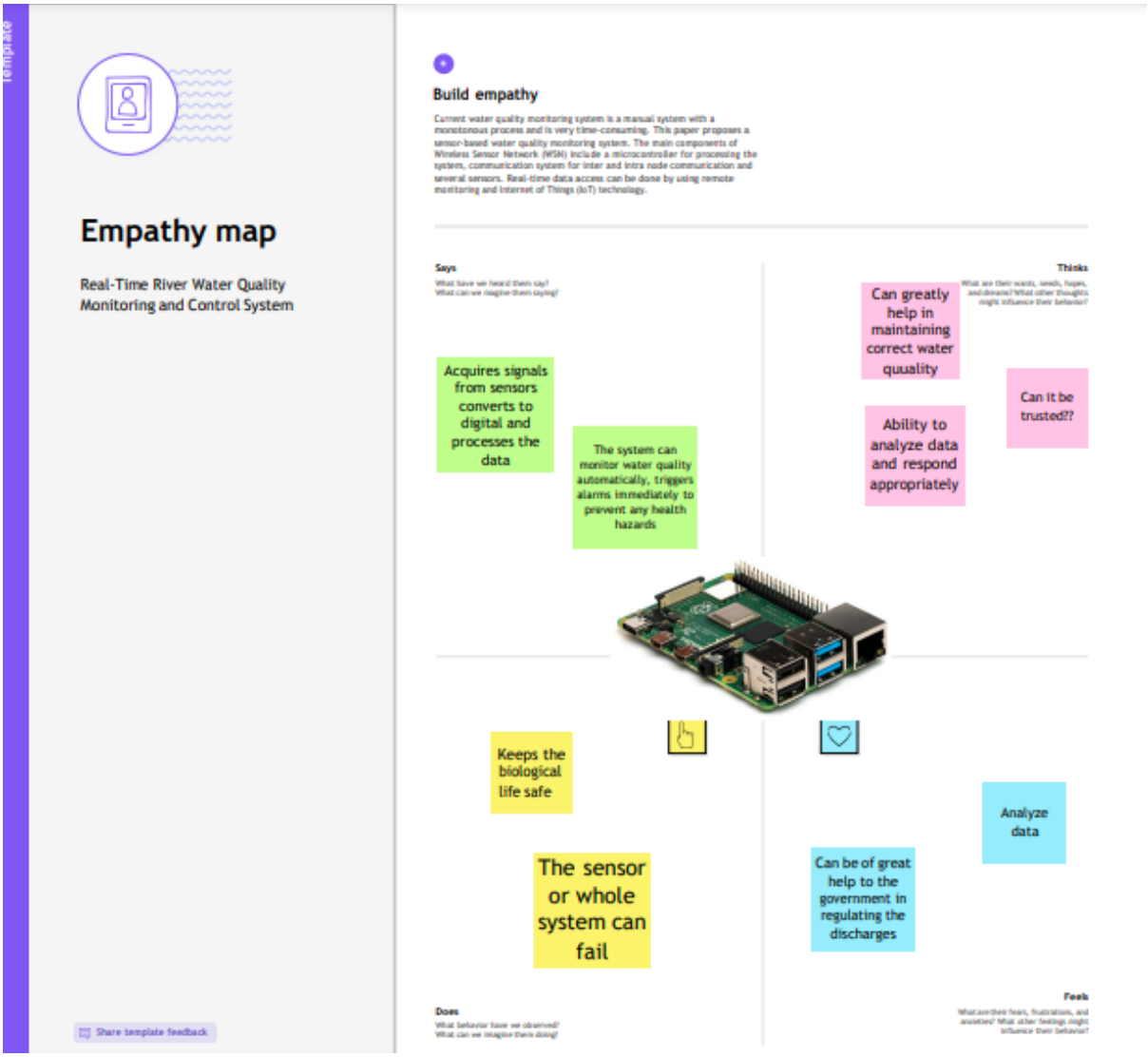
Date	19 September 2022
Team ID	PNT2022TMID47191
Project Name	Project –Real-Time River Water Quality Monitoring and Control System Using IOT
Maximum Marks	2 Marks

I am	Common people living a normal lifeon Earth	Common people living on Earth who consume water in their day-to-day life for different purpose
I'm trying to	Monitor the qualityof the water	Wants to monitor the water consumed everyday whether the water is contaminated or pure, pH,temperature, salinity in it
but	Do not know to monitor the qualityof water	Time consuming process for manual testing
because	Lack of required knowledge	Common people lack knowledge of this type oftesting, sensors etc.
Which makes me feel	Doubted and fearfulof the consumed water	Decline of pure water, increasing viral diseases

3.)IDEATION AND PROPOSED SOLUTION:

3.1)EMPATHY MAP CANVAS:

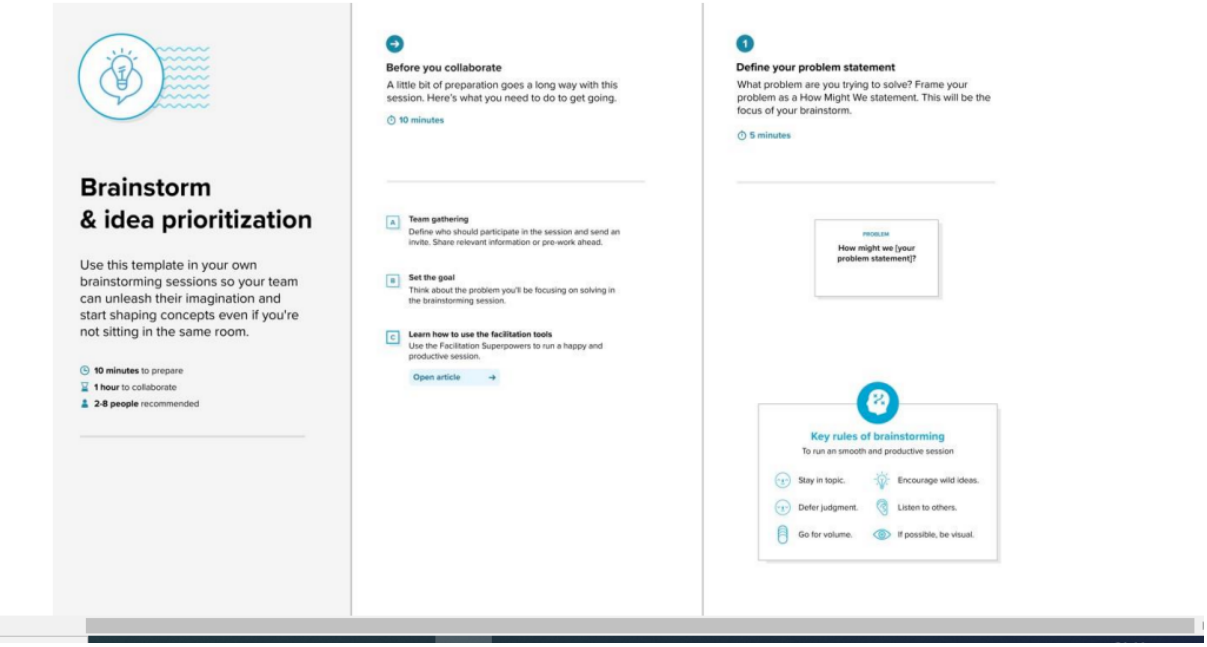
Empathy Map Canvas: An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing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



3.2)Ideation & Brainstroms:

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.



3.3)Proposed Solution:

Project Design Phase-I Proposed Solution Template

Team ID	PNT2022TMID47191
Project Name	Project – Real Time River Water QualityMonitoring and Control System
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	To find the PH level, Temperature and Dustparticles in Water
2.	Idea / Solution description	Monitoring water parameters by using Arduino,Temperature sensor and Ph sensors
3.	Novelty / Uniqueness	If the water quality is not good it will insist thepeople to not drink or use the water as a warning message via mobile app
4.	Social Impact / Customer Satisfaction	People come to know about the quality of waterand it prevent the people from diseases and other health problems
5.	Business Model (Revenue Model)	It help people to become conscious against using contaminated water as well as to stoppolluting the water.
6.	Scalability of the Solution	The process of operating this Model is veryeasy. As it can be operated from using the mobile phone as well

Ideation Phase

Define the Problem Statement

Date	19 September 2022
Team ID	PNT2022TMID47191
Project Name	Project –Real-Time River Water Quality Monitoring and Control System Using IOT
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but	Do not know to monitor the qualityof water	Time consuming process for manual testing
because	Lack of required knowledge	Common people lack knowledge of this type oftesting, sensors etc.
Which makes	Doubted and fearfulof the consumed water	Decline of pure water, increasing viral

me feel		diseases

Project Title: Real-Time River Water Quality Monitoring and Control System

Project Design Phase-I

Team ID: PNT2022TMID47191

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
i.e. working parents of 0-5 y.o. kids

People's and water quality Officers

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices

The head office should monitor the surroundings of River Water weakly once

Network availability and available device are the biggest issue face by the customers and need to spend a time to get daily update.

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

The solution is to avoid the mixing of industrial waste.
Strom water management
Waste water treatment.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

To identity the water quality

Chemical waste sometimes discharged into rivers

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

The major problem is the industrial waste and chemical waste mixing into theriver.

As we know sensors are bit costly and our system needs more than one sensor to work. The sensors are used periodically to check the quality of the water and might need to be replacedfrequently

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

Identify the Problems.

Final better network availability calculate the quality and quantity of water.

Focus on J&P, tap into BE, understand RC

3. TRIGGERS

TR

What triggers customers to act? i.e. seeing their neighbour installing solarpanels, reading about a more efficient solution in the news.

Give awareness for monitoring the water quality to the people

10. YOUR SOLUTION

SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

Recycle the river water weakly once.

We provide a good source to the public and we work basedon public review.

8. CHANNELS of BEHAVIOUR

CH

ONLINE

What kind of actions do customers take online? Extract online channels from #7

OFFLINE

What kind of actions do customers take offline? Extract offline channels from #7 and usethem for customer development.

ONLINE:

Public may provide review and rating for the system.

OFFLINE:

By using the smart sensors, the ph level of the water isidentify.

4. EMOTIONS: BEFORE / AFTER

EM

How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

People felt insecure and acknowledge about the qu now theyhave more confident about their drinking.

Project Design Phase-II

Solution Requirements (Functional & Non-functional)

Team ID	PNT2022TMID47191
Project Name	Real-Time River Water Quality Monitoring and Control System
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Mobile noRegistration through Gmail
FR-2	User Confirmation	Confirmation via OTP Confirmation via Email
FR-3	View current status of river water	View river water quality in the website
FR-4	Reporting issue	User can report the issue in the website

FR-5	Feedback	User can feedback their thoughts in the website
FR-6	Sign out	User can sign out successfully

Non-functional Requirements:

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

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

5.)Project Design

5.1)Data Flow Diagram & User Stories

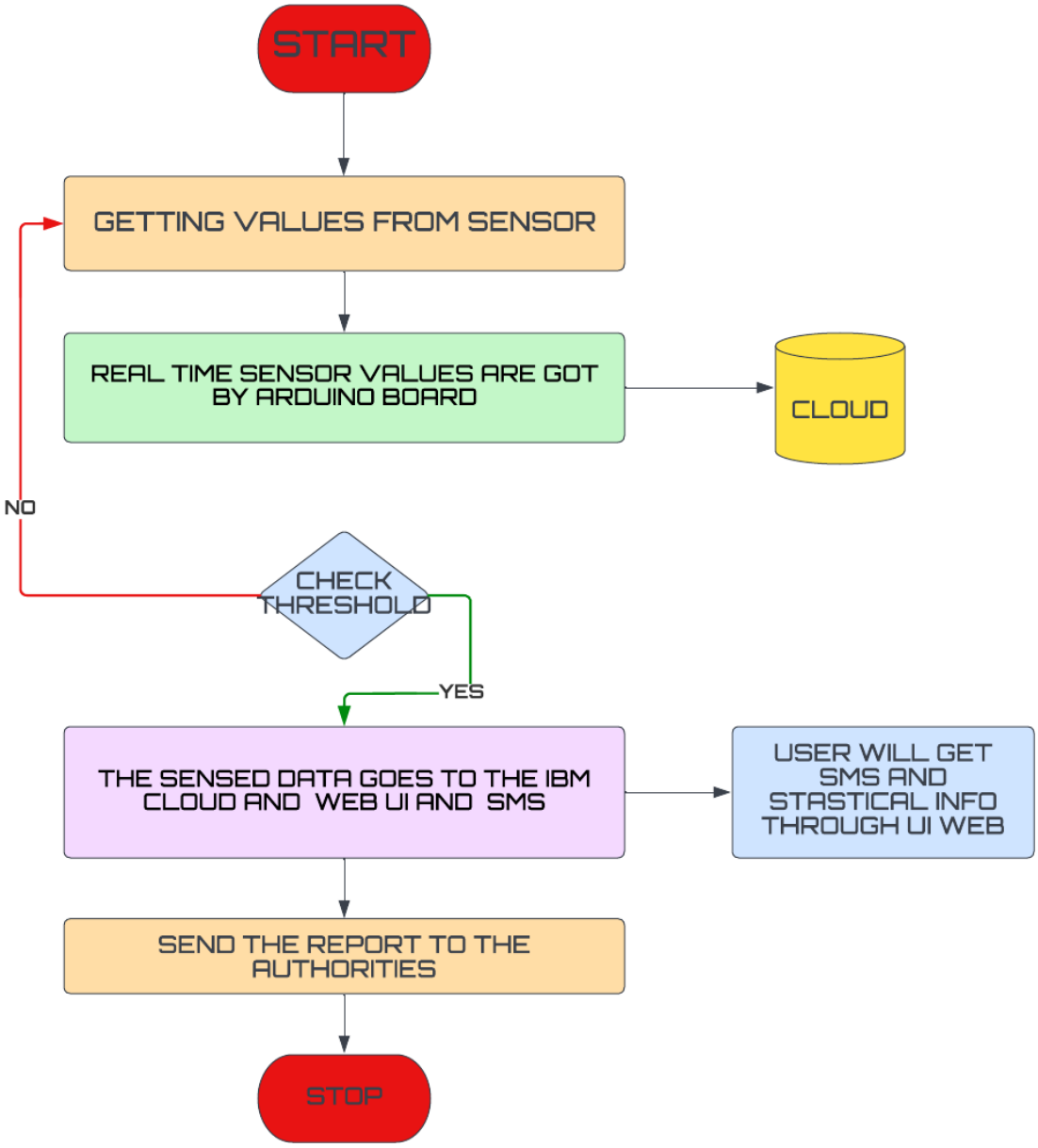
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored

Data Flow Diagram:

Project Design Phase-II

Data Flow Diagram & User Stories

Team ID	PNT2022TMID47191
Project Name	Project - Real time River water quality monitoring and control system


START
GETTING VALUES FROM SENSOR
REAL TIME SENSOR VALUES ARE GOT BY ARDUINO BOARD
CLOUD
NO
CHECK THRESHOLD
YES
THE SENSED DATA GOES TO THE IBM CLOUD AND WEB UI AND SMS
USER WILL GET SMS AND STASTICAL INFO THROUGH UI WEB
SEND THE REPORT TO THE AUTHORITIES
STOP

User Stories

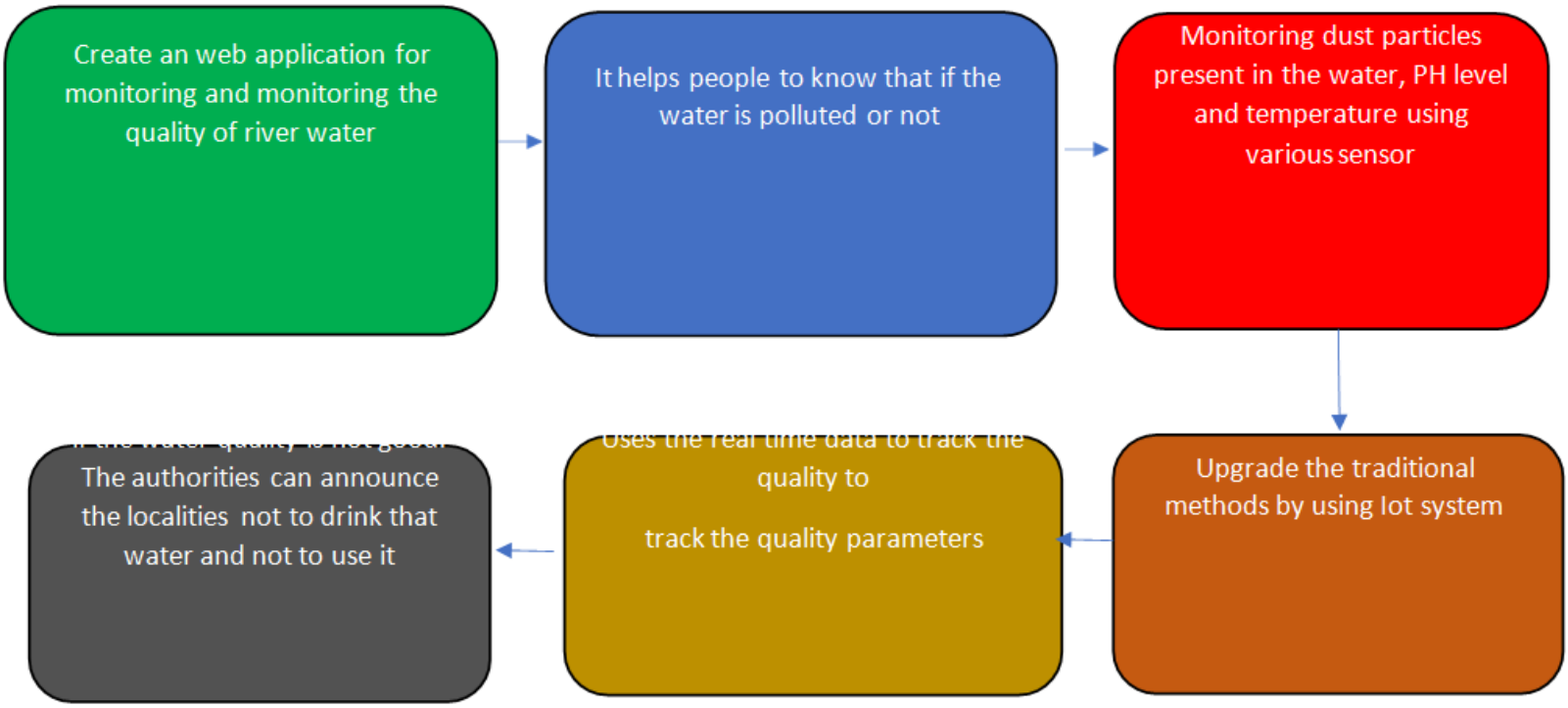
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application byentering email, password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmationemail once I have registered for the application	I can receive e confirmation email &click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Google	I can register & accessthe dashboard with Google	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through the mail.	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email, password & captcha	I can receive login credentials.	High	Sprint-1
	Interface	USN-6	As a user, the interface should be user-friendlymanner	I can able to accesseasily.	Medium	Sprint-1
Customer (Web user)	dashboard	USN-7	As a user, I can access the specific info(phvalue, temp, humidity, quality).	I can able to know thequality of the water.	High	Sprint-1
Customer (input)	View manner	USN-8	As a user, I can view data in visual representation manner(graph)	I can easily understandby visuals.	High	Sprint-1
	Taste	USN-9	As a user , I can able to view the quality(salty) ofthe water	I can easily know whether itis salty or not	High	Sprint-1

	Color visibility	USN-10	As a user , I can able predict the water color	I can easily know the condition by color	High	Sprint-1
Administrator	Risk tolerant	USN-11	An administrator who Is handling the system should update and take care of the application.	Admin should monitor the records properly.	Medium	Sprint-2

5.2)Solution and technical architecture

Project Design Phase-I
Solution architecture

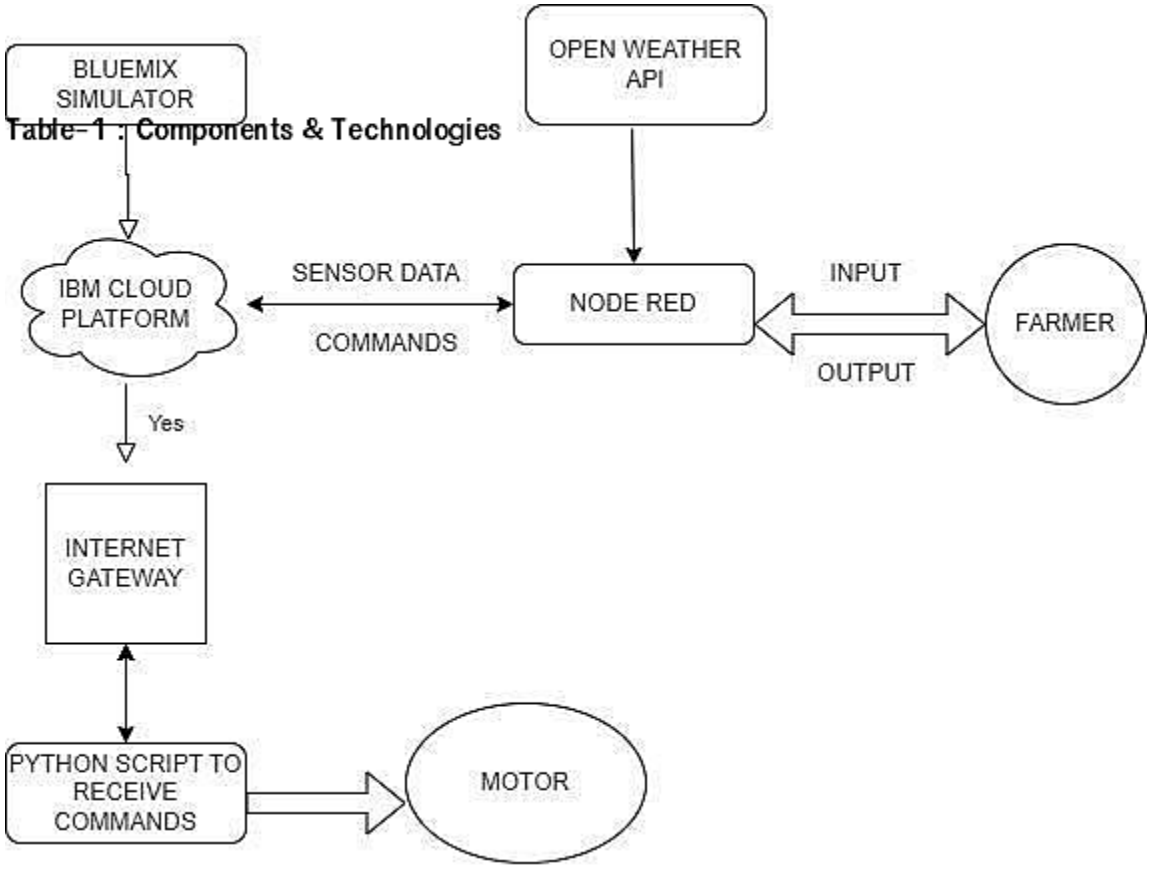
Team ID	PNT2022TMID47191
Project Name	Project – Real Time River Water QualityMonitoring and Control System
Maximum Marks	



Project Design PhaseTechnology stacK

Team ID	PNT2022TMID47191
Project Name	Real-Time river Water Quality Monitoringand Control System
Maximum Marks	4 Marks

TECHNICAL ARCHITECTURE:



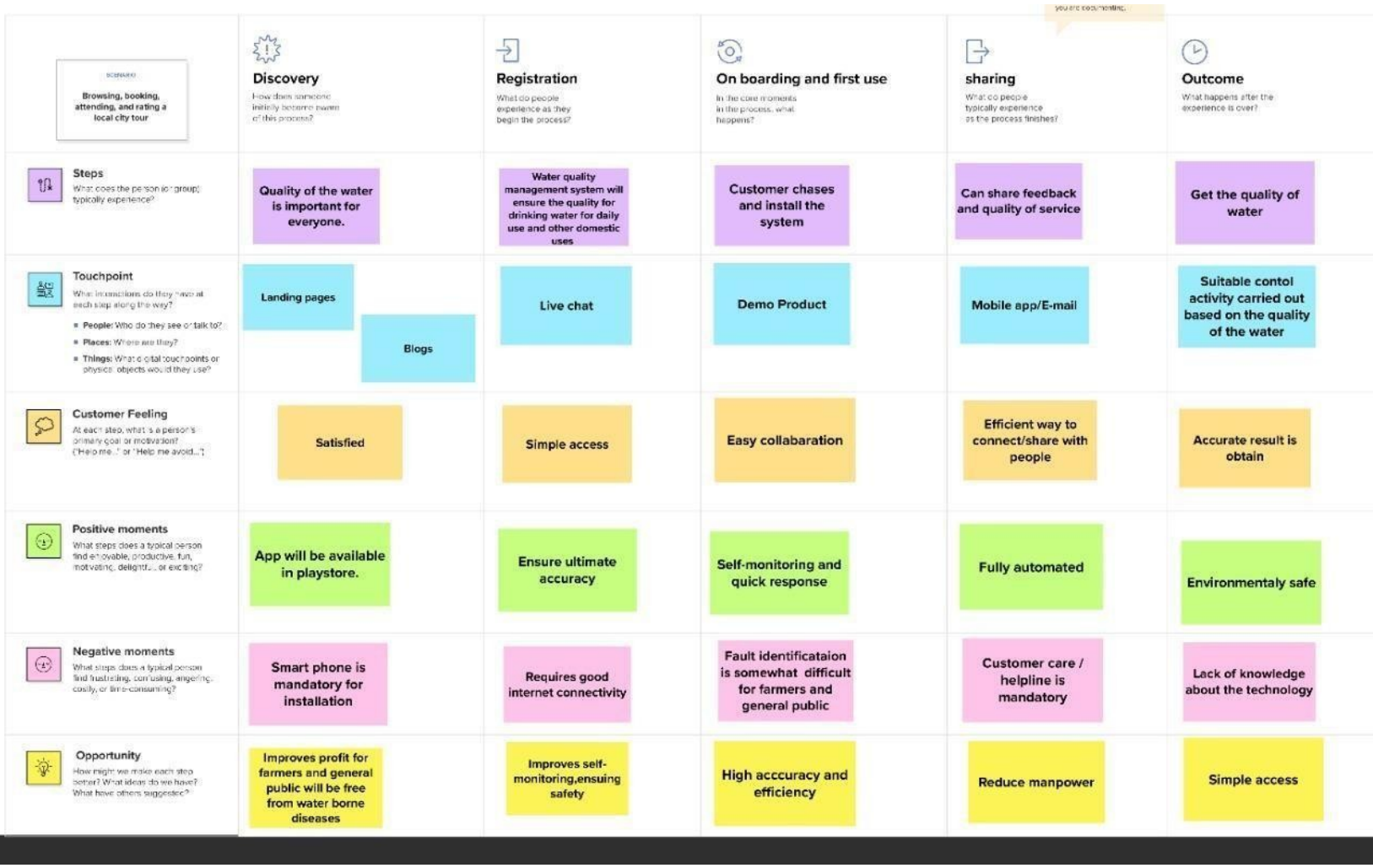
S.No	Component	Description	Technology
1.	User Interface	How user interacts with application	HTML, CSS, Bootstrapping
2.	Applicati onLogic-1	Logic for a process in theapplication	JAVA/PYTHON
3.	Application Logic-2	Logic for a process in theapplication	IBM WATSON STT services
4.	Applicati onLogic-3	Logic for a process in theapplication	BM WATSON Assistant
5.	Database	Data Type, Configurations etc	MySQL,
6.	Cloud Database	Database Service on Cloud	IBM cloud
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 theapplication	IBM Weather API, etc
9.	External API-2	Purpose of External API used in theapplication	Aadhar API, etc
10.	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.	PH level monitoring	The PH level of river water canbe monitored via placing sensors in rivers	PH-sensor
2.	Temperature monitoring	The temperature of river water can be monitored	Temperature sensor
3.	Pollution monitoring	The clarity and purity of river water can be monitored	Conductive sensor
4.	Soil level monitoring	The amount of soil mixed in river water can be measured	Turbidity sensor

5)Project Design:

5.3)User stories



6.)Project planning and scheduling:

6.1)sprint planning and estimation

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning,)

Team ID	PNT2022TMID47191
Project Name	Project – Real time river water quality monitoring and control system

Sprint Schedule

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirmingmy password.	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-1	Registration viaFacebook	USN-2	As a user, I can register for the applicationthrough Facebook	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-1	registration via Gmail	USN-3	As a user, I can register for the applicationthrough Gmail	Medium	, VIGNESH WARAN MUKILAN GUNAL SIVA

Sprint-2	Confirmation	USN-4	As a user I will receive confirmation email once Ihave registered for the application	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-2	Login	USN-5	As a user, I can log into the application byentering email & password	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-2	IBM cloud service	USN-6	Get access to IBM cloud services	High	VIGNESH WARAN MUKILAN GUNAL SIVA

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Priority**	**Team Members**
Sprint-3	Create IBM Watsonand device settings	USN-7	To create the IBM Watson IOT platform and Intergrate the microcontroller with it to send sensed data to cloud	High	VIGNESH WARAN MUKILAN GUNAL SIVA

Sprint-3	Create node redservice	USN-8	To create a node red service to integrate theIBM Watson along with Web UI	Low	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-3	Create Web UI	USN-9	To create Web UI to access the data from cloudAnd display all parameters	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-3	To develop a pythoncode	USN-10	Create python code to sense the physicalquantity and store data	Medium	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-4	Publish data to cloud	USN-11	Publish data that is send to thecloud	High	VIGNESH WARAN MUKILAN GUNAL SIVA
Sprint-4	Fast SMS service	USN-12	Use fast SMS to send alert message once the parameters like ph , turbidity and temperature goes beyond the threshold	Medium	VIGNESH WARAN MUKILAN GUNAL SIVA

Sprint-4	Testing	USN-13	Testing of project and final deliverables	High	VIGNESH WARAN MUKILAN GUNAL SIVA

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

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:

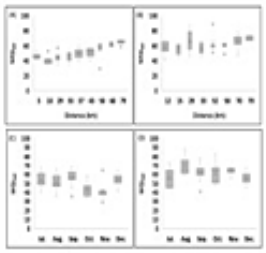
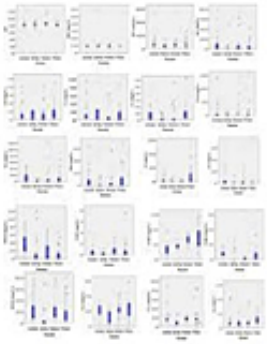
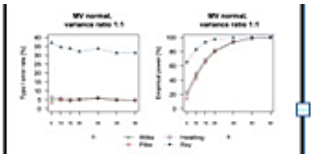
UAT TESTING

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.

Results

9.1)Performance

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

1. **Advantages and disadvantages:**

Real-time monitoring of water qualityby using IoT integrated Big Data

Analyticswill 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 qualityin 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 streaminganalysis throughSpark MLlib, Deep learningneural 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 riverwater parameters. Thisproject can be extended into an efficient water management systemof alocal 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. AuthorsMSUC, 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 diversequalities of river water in Bangladesh. Due to the limitation of the budget,we only focuson 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'tthe scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygen can also be quantified. So the additional budget is requiredfor further improvement ofthe overallsystem

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 workwas 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. Allauthors 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 thefacilities to conductthis research work.

13.)Appendix:

13.1)Source code:

```
#include <Wire.h>
#include
<Adafruit_ADS10
15.h>
Adafruit_ADS11
15 ads(0x48);
float Voltage =
0.0;
#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 18 // GPIO pin on which
the DS18B20 isconnected :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"//DEVICETYPE MENTIONED IN IOT WATSONPLATFORM #define DEVICE_ID "24681012"//DEVICEID
MENTIONED IN IOT WATSONPLATEFORM #define TOKEN"12345678"//Token String data3; floatdist; //----------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
analog
pincon
st int
trigPin
= 12;
const

```
int
echoP
in = 13;
//
defi
nes
vari
abl
es
long
dur
atio
n;
int distance;
int
tan
kh
eig
ht=
27;
int
my
dist
anc
e;

i
nt
b
```

uf
[1
0]
,t
e
m
p;
i
nt
se
ns
or
va
l=
0;
lo
n
g i
nt
av
gv
al;
i
nt
br
dl
e
d
=

```
2;
////////////////// for http
Client//////////////////#include
<Arduino.h>
#include
<WiFi.h>
#include
<WiFiMult
i.h>
#include
<HTTPClie
nt.h>
#defineM
Y_SERIAL
Serial
WiFiMulti
wifiMulti;
void
setup(){
pinMode(br
dled,OUTPU
T);
MY_SERIAL.
begin(11520
0);
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
_SE
RIA
L.fl
ush
();
del
ay(
100
0);
}
wifiMulti.addAP("WorkSHop",
"inf12345"); wifiMulti.addAP("J-
THEORY 3878", "98?J365o");
while (wifiMulti.run()!= WL_CONNECTED) { //Checkfor the connection

delay(1000);
MY_SERIAL.println("Connec
ting to WiFi..");
}
MY_SERIAL.println("WiFi network connected");
//////////////////Setup for the sensorsand
```

```
ads1115/////////////////pinMode(trigPin, OUTPUT); //
Sets the trigPin as an Output pinMode(echoPin, INPUT);
// Sets theechoPin as an Input
ads.begin(); // enablesthe ADC1115
MY_SERIAL.println("Initializing All
Sensors.....
... ");delay(3000);
}
void loop() {
float mtemp,turb,ph,level; /// variables to hold sensorvalues(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(500
0);
digitalWrit
e(brdled,L
OW);
HTTPClie
```

```
nt http;
MY_SERIAL.print("[HTTP] begin. \n");
// configure traged server and url

MY_SERIAL.prin
tln(distance);
MY_SERIAL.prin
t("Distance:
");MY_SERIAL.p
rintln(distance);
if (distance<=10&& distance>=5){
MY_SERIAL.println("The waterlevel: FULL");
}
else if (distance>10 &&
distance<=16){MY_SERIAL.println
("The water level: NORMAL");
}
else if (distance>16){
MY_SERIAL.println("The waterlevel: LOW");
}
delay(1000);
}////////////////////// pH Sensor ///////////////////////
float myph(){
//////// using the ads1115for the ph meter
int16_t adc0;// we read from the ADC, we have a sixteen bit integer
as a resultadc0 = ads.readADC_SingleEnded(0);
for(int i=0;i<10;i++){
```

```
//buf[i]= analogRead(analogpin);
b
uf
[i
]=
a
d
c
0;
d
el
a
y(
1
0
0
);
}

http.begin("https://openweathermap.org/appid"); //HTTP
//http.begin(""http://api.openweathermap.org/data/2.5/forecast?id=524901&app
id=915c3fc3b
97c6219 9e657fd7ad0c4edf"); //HTTP
//defining a variabble to hold all values
from sensorsStringourdata
=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);
// httpCodewill be
negativeon 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.printl
n(payload);
}
}
else {
MY_SERIAL.printf("[HTTP]
POST...failed, error: %s\n",
http.errorToString(httpCode).c_str());
wifiMulti.run();

MY_SERIAL.print("TURBIDITY VALUE: "); //Printthe output
data to theserial
```

```
MY_SERIAL.println(s
enseTurbidity);
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 normalclear \n");
}
else if(senseTurbidity<3.30)
MY_SERIAL.println("\t Warning. Water is muddy or very cloudy!!!!!!! \n");
}
//////////////////////Ultrasonic
Sensor//////////////////////floatmylevel(){
// Clears the
trigPindigitalWrite(t
rigPin, LOW);
delayMicroseconds(
2);
digitalWrite(trigPin,
HIGH);
delayMicroseconds(
10);
digitalWrite(trigPin,
LOW); duration =
pulseIn(echoPin,
```

```
HIGH);return
distance;

if (wifiMulti.run()!= WL_CONNECTED) { //Checkfor the
connectiondelay(1000);
wifiMulti.run();
MY_SERIAL.println("Reconnecting to WiFi..");
}
else {
MY_SERIAL.println("
Reconnected");
digitalWrite(brdled,
HIGH); delay(2000);
digitalWrite(brdled,L
OW);
}
}
http.end();
}
delay(20000);
}
//////////////////Turbidity Sensor////////////////////
float myturb(){
int16_t adc1;// we read from the ADC, we have a sixteen bit integer
as a resultadc1 = ads.readADC_SingleEnded(1);
float voltage= (adc1 * 0.1875)/1000; //converting analog reading to voltage
(digital value)
```

```
senseTurbidity= voltage+1; // converting
sensorvoltage to 5Vreturn senseTurbidity;

for(i
nt
i=0;i
<9;i
++){
for(i
nt
j=i;j
<10;
j++){
if(bu
f[i]>
buf[j
]){
tem
p=b
uf[j
];
buf[i
]=bu
f[j];
buf[j
]=te
mp;
}
}
```

```
}
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("Sens
or = ");
MY_SERIAL.println(phv
al);
MY_SERIAL.print("Volt
age = ");
MY_SERIAL.println(phv
ol); delay(1000);
if (phval <=1 | |
phval>13.90){
MY_SERIAL.print("Check
the pH meter");return
13.89 ;
}
return phval;
}

//////////////////Temperature
Sensor/////////////////floatmytemp(){
```

```
float temp;
DS18B20.requestTemper
atures();
temp=DS18B20.getTemp
CByIndex(0);
MY_SERIAL.print("Tempe
rature: "); return temp;
}
```

GIT HUB AND DEMO LINK:

https://github.com/IBM-EPBL/IBM-Project-13079-1659509933.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