REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

IBM-Project-42790-1660709218

NALAIYA THIRAN PROJECT BASED LEARNING ON PROFESSIONAL READINESS FOR INNOVATION, EMPLOYMENT AND ENTERPRENEURSHIP

PROJECT REPORT BY

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INDEX

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

      a. Feature 1

      b. Feature 2

      c. Database Schema (if Applicable)

8. TESTING

      a. Test Cases

      b. User Acceptance Testing

9. RESULTS

      a. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

    Source Code

    GitHub & Project Demo Link

1.INTRODUCTION

TEAM ID   : PNT2022TMID33407
INDUSTRY MENTOR : BHARADWAJ
FACULTY MENTOR   : ANANDAN D

A) PROJECT OVERVIEW

Current water quality monitoring system is a manual framework with a dreary cycle and is very tedious. This paper proposes a sensor-based water quality observing framework. The principal parts of Wireless Sensor Network (WSN) incorporate a microcontroller for handling the framework, correspondence framework for entomb and intra hub correspondence and a few sensors. Constant information access should be possible by utilizing remote observing and Internet of Things (IoT) innovation. Information gathered at the separated site can be shown in a visual configuration on a server PC with the assistance of Flash streaming examination through Flash MLlib, Profound learning brain network models, Belief Rule Based (BRB) framework and is likewise contrasted and standard qualities. Assuming that the gained esteem is over the limit esteem robotized cautioning SMS ready will be shipped off the specialist. The uniqueness of our proposed paper is to get the water observing framework with high recurrence, high portability, and low fueled. In this manner, our proposed framework will hugely assist Bangladeshi populaces with becoming cognizant against debased water as well as to quit dirtying the water.

B) PURPOSE

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 efficient 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 battery is completely insulated and rechargeable so that the system is continuous. By using this product people can predict, analyse the hardness of water and also the factors like temperature and turbidity of water for having a safe drinking and water with better consistency for house hold purposes. Since water is an essential compound in our daily basis intake of it in a 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. In many developing countries, dirty or contaminated water is being used for drinking without any proper prior treatment. One of the reasons for this happening is the ignorance of public and administration and the lack of water quality monitoring system which makes serious health issues.

2.LITERATURE SURVEY

A) Existing problem

Extremely high fine particulate matter (PM2.5) concentration has been a topic of special concern in recent years because of its important and sensitive relation with health risks. However, many previous PM2.5 exposure assessments have practical limitations, due to the assumption that population distribution or air pollution levels are spatially stationary and temporally constant and people move within regions of generally the same air quality throughout a day or other time periods. To deal with this challenge, they propose a novel method to achieve the real-time estimation of population exposure to PM2.5 in China by integrating mobile-phone locating-request (MPL) big data and station based PM2.5 observations. Nationwide experiments show that the proposed method can yield the estimation of population exposure to PM2.5 concentrations and cumulative inhaled PM2.5 masses with a 3-h updating frequency. Compared with the census-based method, it introduced the dynamics of population distribution into the exposure estimation, thereby providing an improved way to better assess the population exposure to PM2.5 at different temporal scales. Additionally, the proposed method and dataset can be easily extended to estimate other ambient pollutant exposures such as PM10, O3, SO2, and NO2, and may hold potential utilities in supporting the environmental exposure assessment and related policy driven environmental actions.

B) References

[1] Chen, B., Song, Y., Jiang, T., Chen, Z., Huang, B., & Xu, B. (2018). Real-time estimation of population exposure to PM2. 5 using mobile-and station-based big data. International journal of environmental research and public health, 15(4), 573.

[2] Paul, B. (2018). Sensor based water quality monitoring system (Doctoral dissertation, BRAC University).

[3] Andersson, K., & Hossain, M. S. (2014, May). Smart risk assessment systems using belief-rule-based DSS and WSN technologies. In 2014 4th International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace & Electronic Systems (VITAE) (pp. 1-5). IEEE.

[4] Thombre, S., Islam, R. U., Andersson, K., & Hossain, M. S. (2016, April). Performance analysis of an IP based protocol stack for WSNs. In 2016 IEEE conference on computer communications workshops (INFOCOM WKSHPS) (pp. 360-365). IEEE

B) Problem Statement Definition

Problem Statement:

Mr. XYZ tells that Water is a limited asset that is essential for farming, industry and the endurance of every single living thing in the world, including people. Many individuals know nothing about the need of drinking sufficient measures of water consistently. Numerous unregulated strategies squander more water. Unfortunate water portion, wasteful utilization, absence of able and incorporated water the executives are factors that add to this issue. Consequently, effective use and water observing are possible limitation for home or office water the executives systems.

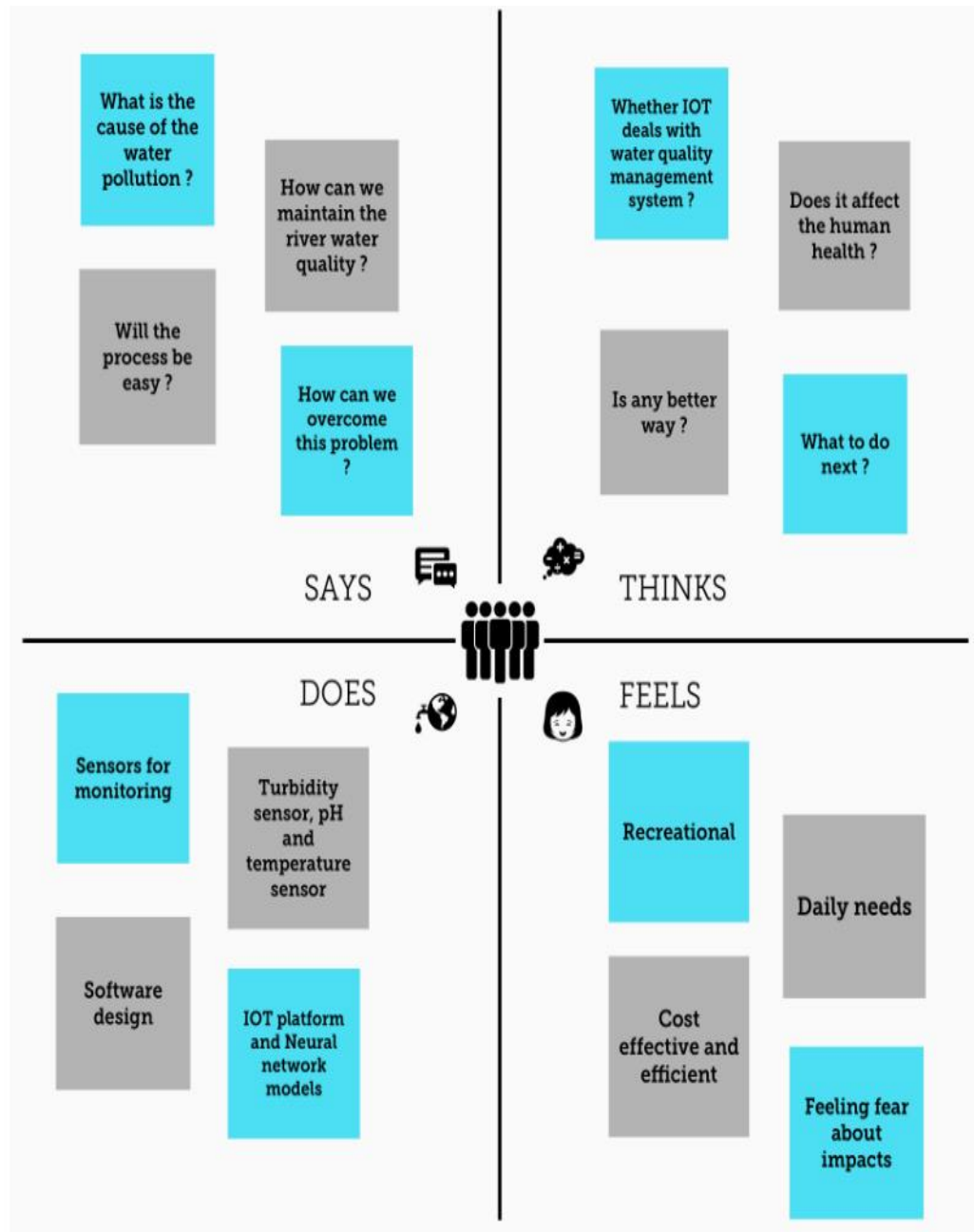| I am	Mr. XYZ, who needs to monitor the River water Quality.
I'm trying to	Reduce the water pollution by using different sensors to avoid health issues and maintain ecological balance.

But,	I could not control and monitor the quality of water daily.
Because	I am trying to have a report on all financial actions on a daily, weekly, monthly, and annual basis.
Which makes me feel	Relaxed and helps me to access all information at any time and from any location and saved in offline mode.

I am	**I'm Trying to**	**But**	**Because**	**Which Makes Me Feel**
Mr. XYZ, who needs to monitor the River water Quality.	Reduce the water pollution by using different sensors to avoid health issues and maintain ecological balance.	I could not Control and Monitor the quality of water daily.	I am trying to have a report on all actions on a daily, weekly, monthly, and annual basis.	Relaxed and helps me to access all information at any time and from any location and saved in offline mode.

Problem Statement (PS)	I am	I'm trying to	But	Because	Which makes me feel
PS-1	Busy Employee	Keep track of water quality.	It is uncomfortable for me to make calculations manually.	I don't feel that I am good at doing calculations.	Doubtful and insecure.
PS-2	Busy Employee	Have an update on the pH level of river water.	It is not possible by paper and pen calculation.	I don't have enough time to calculate it and I may miss some calculations.	To me and around me have difficulty in water quality monitoring.

3. IDEATION & PROPOSED SOLUTION
A)EMPATHY MAP CANVAS

SAYS
- What is the cause of the water pollution?
- How can we maintain the river water quality?
- Will the process be easy?
- How can we overcome this problem?

THINKS
- Whether IOT deals with water quality management system?
- Does it affect the human health?
- Is any better way?
- What to do next?

DOES
- Sensors for monitoring
- Turbidity sensor, pH and temperature sensor
- Software design
- IOT platform and Neural network models

FEELS
- Recreational
- Daily needs
- Cost effective and efficient
- Feeling fear about impacts

B) Ideation & Brainstorming

SANGEETHA

Connection between controller and network	Sample detection by turbidity and pH sensor
Read and determine the values	Assessing Water Quality

RAMYA

Quantifying Treatment Cost	Determining Reservoir Sitation rates
Designing Infrastructure	Maintaining Navigation Channels

SOWMIYA

Assessing Channel Stability	Developing best management practices
Preventing and predicting mobilization of pollutants	Measure Water Quality Parameters(NO3-N,DRP)

VENNILAVU

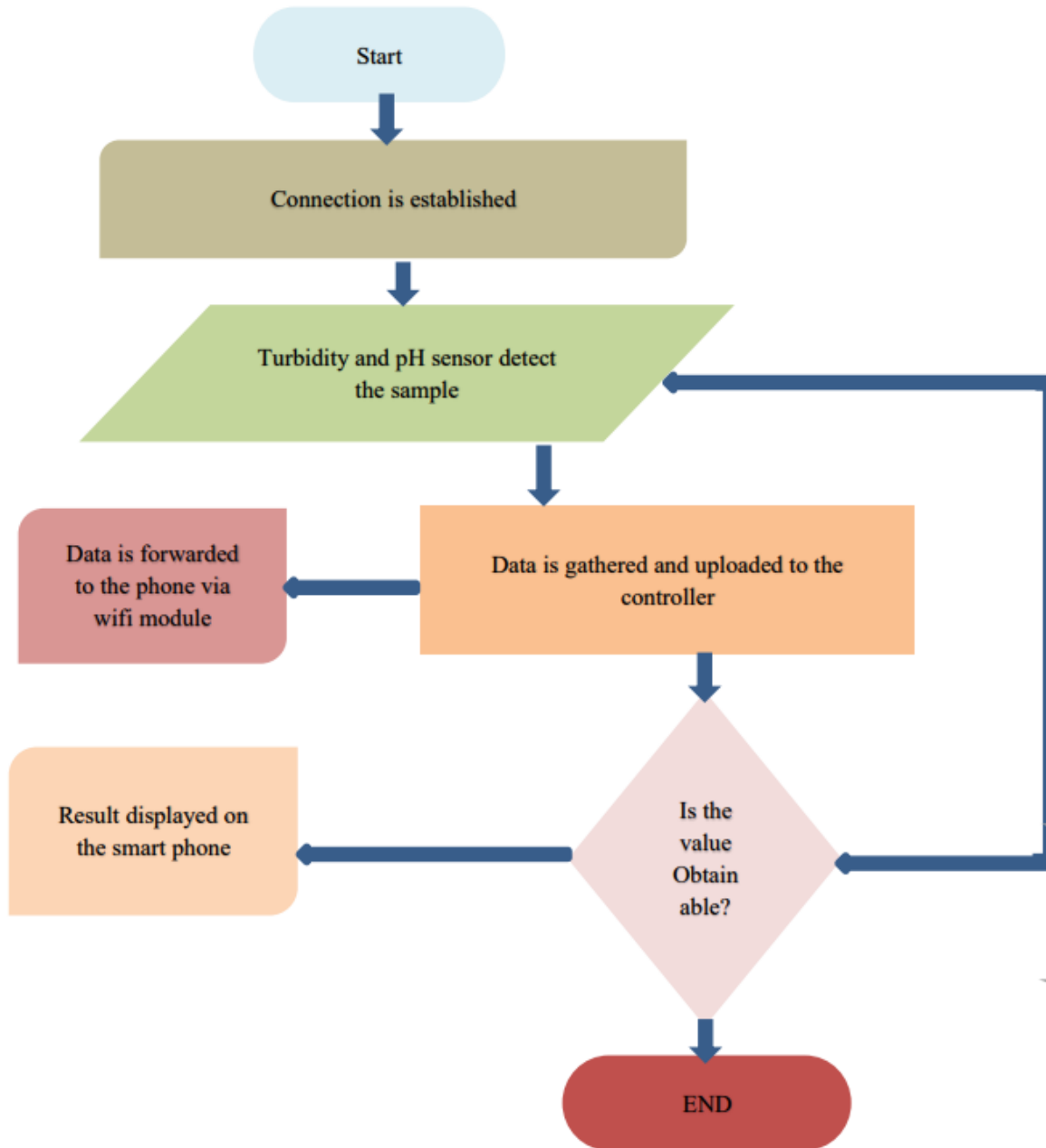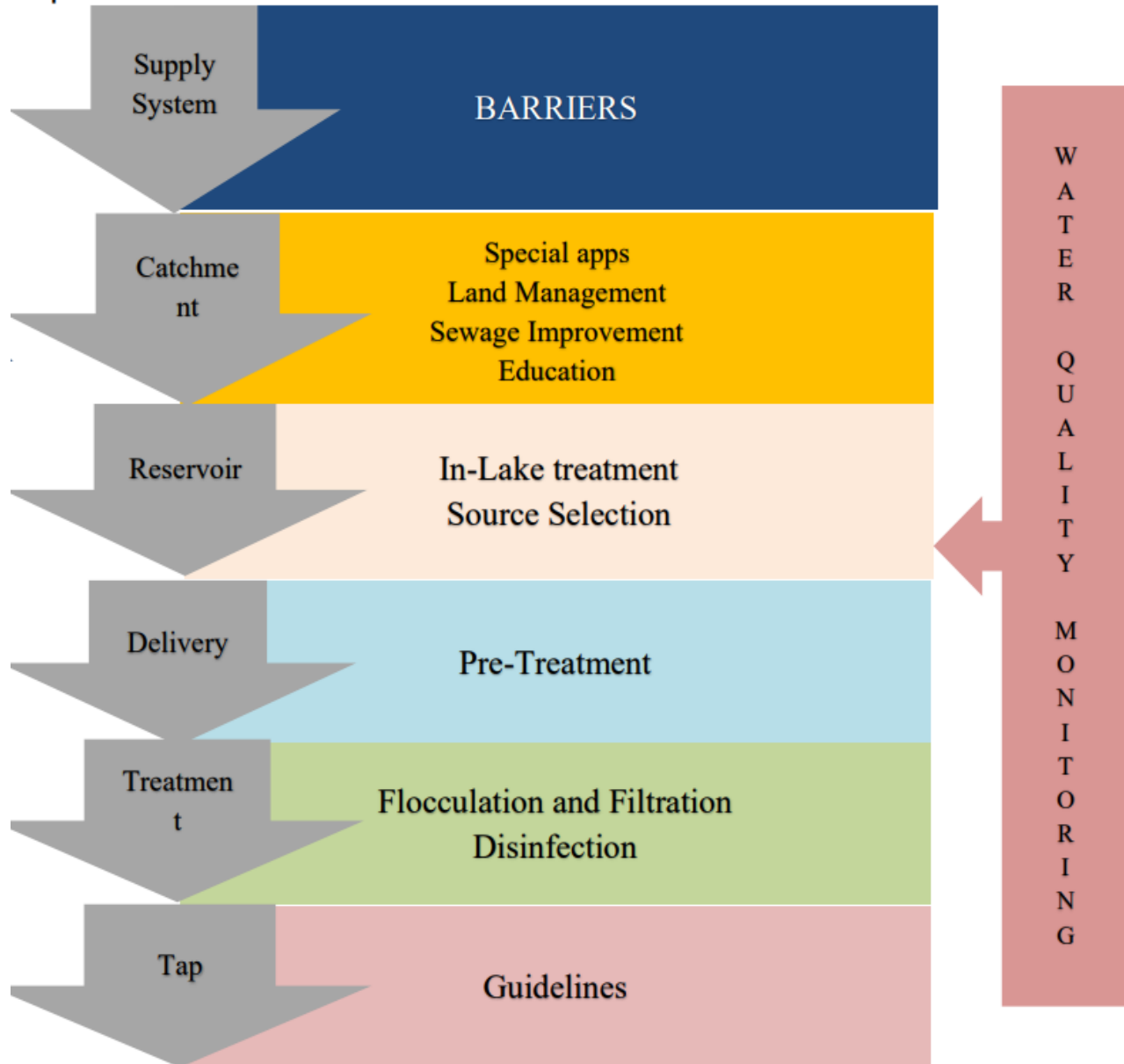|	
Measure Flow rate and temperatur	Uploading data to the controller
Forwarding data to the Smart Phone	Result will be displayed on the smart phone

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.

```
                        ┌──────────────┐
                        │    Start     │
                        └──────────────┘
                                │
                                ▼
                   ┌────────────────────────────┐
                   │   Connection is established │
                   └────────────────────────────┘
                                │
                                ▼
                   ╱────────────────────────────╲
                  ╱  Turbidity and pH sensor      ╲
                  ╲  detect the sample             ╱
                   ╲────────────────────────────╱
                                │
     ┌──────────────────┐       ▼           ┌──────────────────────────┐
     │ Data is forwarded│◀──────────────────│ Data is gathered and     │
     │ to the phone via │                   │ uploaded to the          │
     │ wifi module      │                   │ controller               │
     └──────────────────┘                   └──────────────────────────┘
                                                        │
                                                        ▼
     ┌──────────────────┐                         ╱──────────╲
     │ Result displayed │◀───────────────────────│  Is the    │
     │ on the smart     │                        │  value     │
     │ phone            │                        │  Obtain    │
     └──────────────────┘                        │  able?     │
                                                  ╲──────────╱
                                                        │
                                                        ▼
                                                ┌──────────────┐
                                                │     END      │
                                                └──────────────┘
```

Prioritize

You can convey the wall laying out as an image or pdf to give to people from your association who could believe that it is helpful

Supply System	BARRIERS
Catchment	Special apps Land Management Sewage Improvement Education
Reservoir	In-Lake treatment Source Selection
Delivery	Pre-Treatment
Treatment	Flocculation and Filtration Disinfection
Tap	Guidelines

WATER QUALITY MONITORING

C) PROPOSED SOLUTION

IDEA / SOLUTION DESCRIPTION:

Water-quality checking is utilized to make us aware of momentum, continuous, and arising issues; to decide consistence with drinking water principles, and to safeguard other benefits of water. Water quality can be estimated by gathering water tests for research center examination or by utilizing tests which can keep information at a solitary moment, or logged at standard stretches over a drawn out period. The Division of Water utilizes water quality data to support choices about water asset the executives. Observing water quality is vital for keeping up with biological system wellbeing and the job of the populace. It mirrors the wellbeing of surface water bodies as a preview in time (weeks, months, and years). In this manner, best practices and endeavors are expected to screen and further develop water quality.

NOVELTY / UNIQUENESS:

The significant objective is to make a framework that utilizes remote sensor organizations to screen stream consistently water quality at distant areas with low power utilization, minimal expense and high recognition exactness. pH, conductivity, turbidity level and different boundaries are estimated to improve water quality. The remote detecting innovation is the foundation of IoT-based water quality checking. This carries out the methodology by utilizing the pH sensor, turbidity sensor to get simple readings for water defiles. What's more, for the explicit application, we can add additional sensor components.

SOCIAL IMPACT / CUSTOMER SATISFACTION:

Constant observing of water quality utilizing IoT-coordinated Huge Information Examination would extraordinarily help people in becoming mindful of the risks of drinking sullied water and in not harming the climate. The exploration is centered around ongoing observing of stream water quality. Since an outcome, IoT-coordinated large information examination seems, by all accounts, to be an improved arrangement, as it can give constancy, versatility, speed, and lastingness. An escalated similar assessment of constant examination advancements, for example, Flash streaming investigation through Flash MLlib, Profound learning brain network models, and Belief Rule Based (BRB) framework will be attempted during the venture advancement period. This study proposes that the offered advancements be tried in a deliberate way in Bangladeshi stream water of different qualities. Because of financial plan requirements, we are simply estimating the nature of stream water boundaries. This idea could be ventured into a neighborhood water the executives framework. Different factors like absolute disintegrated solids, synthetic oxygen

interest, and broke up oxygen can likewise be evaluated, which were excluded from the extent of this examination. Accordingly, the extra spending plan is expected to work on the general framework.

BUSINESS MODEL (FINANCIAL BENEFITS):

1) Sensing module: Microcontroller, pH sensor, Turbidity sensor, and Temperature sensor are all part of the data sensing module. The sensor's data will be routed through an amplifier circuit (signal Conditioning circuit) to alter the analogue signal such that it fits the requirements of the following stage for further processing. The data that has been altered will then be sent to the microcontroller unit. The analogue signal will be converted to a digital signal for further processing by the controller's inbuilt ADC module. The GPRS module is used to send the converted data to the server. The pH sensor in this study uses the operational amplifier, which is an integrated circuit operational amplifier that combines the benefits of high IOT Based Real-Time River Water Quality Monitoring System voltage PMOS and high voltage bipolar transistors on a single monolithic chip. It measures light transmittance and scattering rate, which fluctuates with the amount of total suspended solids (TSS) in water, to identify suspended particles in water. The level of liquid turbidity rises as the TTS rises. Water quality in rivers and streams, wastewater and effluent measurements, control instruments for settling ponds, sediment transport research, and laboratory measurements all use turbidity sensors. This liquid sensor can output both analogue and digital signals.

2) Server Module: The server module consists of a PC connected to the internet, on which an application has been designed to store the data received in the cloud.

3) User Module: The user module includes a GPRS communication module that will receive data from the base station. The data from the server module can be accessed through PC, Mobile, or Tablet. The server module provides a service that allows data to be kept, monitored, and backed up remotely. It lets the user to save data online and access it from any computer with an internet connection. When a suitable connection is established, the server delivers data to the web page. We will be able to monitor and control the system through the web page. We may get the matching web page by providing the IP address of the server that is being monitored. The web website provides data on the pH level, turbidity level, and temperature fluctuations in the area where the embedded monitoring device is installed.

SCALABILITY OF SOLUTION:

Water turbidity, PH, and temperature are checked utilizing a water identification sensor that has a one of a kind advantage and is as of now associated with a GSM organization. The innovation can consequently screen water quality, is minimal expense, and doesn't expect staff to be on the job. Accordingly, water quality testing will most probable be more savvy, advantageous, and fast. The strategy is truly versatile. This framework might be utilized to screen different water quality measurements by basically supplanting the matching sensors and altering the required programming bundles. The method is clear. The framework can be extended to follow hydrologic, air contamination, modern, and agrarian result, in addition to other things. It is generally utilized and has countless applications. This will require the arrangement of sensor gadgets in the climate for information assortment and handling. We can rejuvenate the climate by putting sensor gadgets in it, permitting it to speak with different things over the organization. The end client will then approach the gathered information and investigation results by means of Wi-Fi

C) PROBLEM SOLUTION FIT

Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) `CS`

People

6. CUSTOMER CONSTRAINTS `CC`

What constraints prevent your customer from taking action or limit their choices of solutions?

Ongoing repair and maintanance,uncertainty about future,data quality,device reliability,training users on the equipments.

5. AVAILABLE SOLUTIONS `AS`

Which solutions are available to the customers when they face the problem or need to get the job done?

Waste water treatment,green agriculture,storm water management,plastic waste reduction and water conservation.

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

Due to fast growing urbanisation, supply of safe drinking wqater is a challenge for every city.So an automatic real time monitoring system is required to monitor the health of water.

9. PROBLEM ROOT CAUSE `RC`

What is the real reason that this problem exists?

When harmful micro organisms and chemical substances contaminate bodies of water,they cause the water quality to derease and potentially make it toxic.
Industrial waste,marine dumping,global warming,radioactive waste are also some root cause.

7. BEHAVIOUR `BE`

What does your customer do to address the problem and get job done?

People should inform the respected authorities,they can also take some effecient measures such as using less plastic,resusing items,recyclable options etc..

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

Identify strong TR & EM

3. TRIGGERS `TR`

What triggers customer to act?

Water pollution severely damage the human health and affect the ecological baance among the other species.

4. EMOTIONS: BEFORE / AFTER `EM`

How do customers feel when they face a problem or a job and afterwards?

After: Recreational,cost effecient,fearing about impacts.
Before: Insufficient water,fear about health,badly affected.

10. YOUR SOLUTION `SL`

The IOT has the ability to lessen this worrying picture.Smart water monitoring and management systems based on the combination of sensors,big data and AI technologies.

8. CHANNELS of BEHAVIOUR `CH`

8.1 Online

With the help of social medias we can create awareness through facebook,twitter,instagram etc...

8.2 Offline

By conducting awareness program in rural areas and conducting rally in urban areas,we can spread the importance of water and prevent the water pollution.

Extract online & offline CH of BE

4.REQUIREMENT ANALYSIS

A) FUNCTIONAL REQUIREMENTS

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 Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Dashboard	Can access the dashboard

B) NON FUNCTIONAL REQUIREMENTS

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To determine the drinking water standards like PH,Turbidity
NFR-2	Security	Manage the safety and security of drinking water services
NFR-3	Reliability	The system is more reliable because of its system adequacy and system security.
NFR-4	Performance	High performance because of the system efficiency
NFR-5	Availability	High availability because it allows continuous functioning, even some of its components fail.
NFR-6	Scalability	More number of users can be access the data

5.PROJECT DESIGN

A) DATA FLOW DIAGRAM

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.
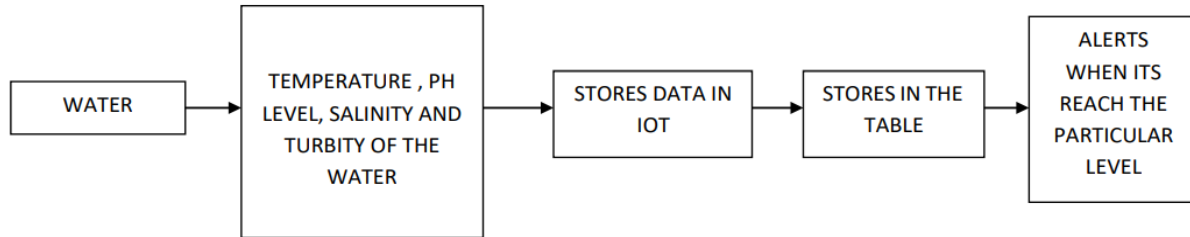
Example :

Example: DFD Level 0 (Industry Standard)

B) SOLUTION AND TECHNICAL ARCHITECTURE

| WATER | → | TEMPERATURE , PH LEVEL, SALINITY AND TURBITY OF THE WATER | → | STORES DATA IN IOT | → | STORES IN THE TABLE | → | ALERTS WHEN ITS REACH THE PARTICULAR LEVEL |
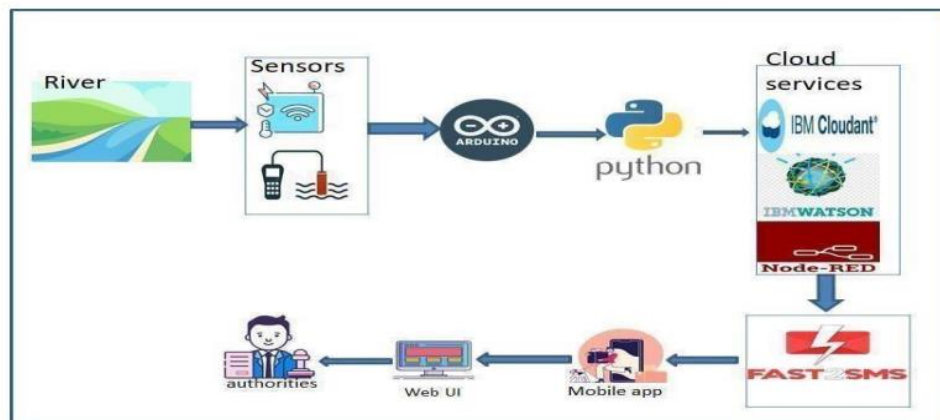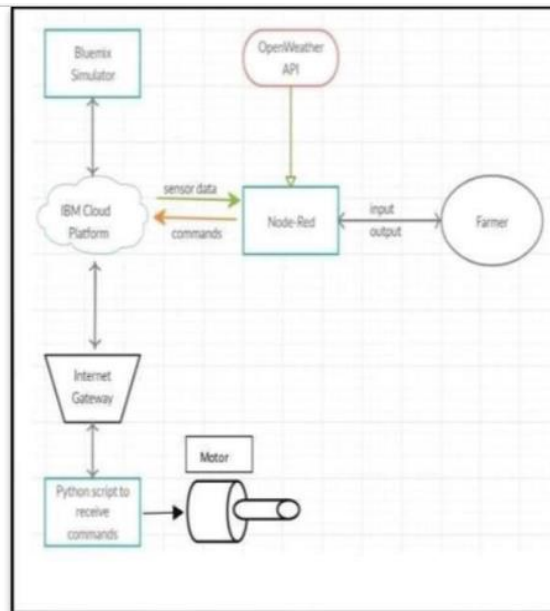
C) USER STORIES

Use the below template to list all the user stories for the product.

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-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					

6.PROJECT PLANNING AND SCHEDULING
A) SPRINT PLANNING AND ESTIMATION

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	Ramya R
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Sangeetha S
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Sowmiya SB
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Vennilavu PM
Sprint-1	Login	USN-5	As a user, I can log into the application by Entering email & password	1	High	Ramya R

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

B)SPRINT DELIVERY PLAN

S.NO	MILESTONES	ACTIVITIES	DATE
1.	**Preparation Phase**	Pre-requisites	24 Aug 2022
		Prior Knowledge	25 Aug 2022
		Project Structure	23 Aug 2022
		Project Flow	23 Aug 2022
		Project Objectives	22 Aug 2022
		Registrations	26 Aug 2022
		Environment Set-up	27 Aug 2022
2.	**Ideation Phase**	Literature Survey	29 Aug 2022 – 03 Sept 2022
		Empathy Map	5 Sept 2022 - 7 Sept 2022
		Problem Statement	8 Sept 2022 - 10 Sept 2022
		Ideation	12 Sept 2022 – 16 Sept 2022

S.NO	MILESTONES	ACTIVITIES	DATE
3.	**Project Design Phase - 1**	Proposed Solution	19 Sept 2022 – 23 Sept 2022
		Problem Solution Fit	24 Sept 2022 – 26 Sept 2022

		Solution Architecture	27 Sept 2022 – 30 Sept 2022

4.	**Project Design Phase - 2**	Customer Journey Map	03 Oct 2022 – 08 Oct 2022
		Requirement Analysis	09 Oct 2022 – 11 Oct 2022
		Data Flow Diagrams	11 Oct 2022 – 14 Oct 2022
		Technology Architecture	15 Oct 2022 - 16 Oct 2022
5.	**Project Planning Phase**	Milestones & Tasks	17 Oct 2022 – 18 Oct 2022
		Sprint Schedules	19 Oct 2022 – 22 Oct 2022

C)REPORTS FROM JIRA

7.CODING AND SOLUTIONING(Explain the features added in the project along with code)

Circuit Design of Home Automation System in Tinkercad using 2+ sensors, LED, Buzzer in single code and circuit.

CODE:

```
int z=2;
int a=3;

void setup()
{
 Serial.begin(9600);
 pinMode(z,OUTPUT);
 pinMode(a,INPUT);
 pinMode(12,OUTPUT);
}

void loop()
{
 //ultrasonic sensor
 digitalWrite(z,LOW);
 digitalWrite(z,HIGH);
 delayMicroseconds(10);
 digitalWrite(z,LOW);
 float dur=pulseIn(a,HIGH);
 float dis=(dur*0.0343)/2;
 Serial.print("Distance is: ");
 Serial.println(dis);

  //LED ON
 if(dis>=100)
 {
  digitalWrite(8,HIGH);
  digitalWrite(7,HIGH);
 }

 //Buzzer For ultrasonic Sensor
```

```
if(dis>=100)
{
for(int i=0; i<=30000; i=i+10)
{
tone(12,i);
delay(1000);
noTone(12);
delay(1000);
}
}



  //Temperate Sensor
double a= analogRead(A0);
double z=(((a/1024)*5)-0.5)*100;
Serial.print("Temp Value: ");
Serial.println(z);
delay(1000);


//LED ON
if(z>=100)
{
  digitalWrite(8,HIGH);
  digitalWrite(7,HIGH);
}

//Buzzer for Temperature Sensor
if(z>=100)
{
```

```
for(int i=0; i<=30000; i=i+10)
{
tone(12,i);
delay(1000);
noTone(12);
delay(1000);
}
}

 //LED OFF
if(z<100)
{
  digitalWrite(8,LOW);
  digitalWrite(7,LOW);
}
}
```

REGISTRATION PAGE :

HTML CODE:

```html
<html>
  <head>
  <title>
  Registration Page
  </title>
  </head>
  <body>
  <br>
  <br>
  <form>
  name
  <label> Firstname </label> <br>
  <input type="text" name="firstname" size="15"/> <br> <br>
  <label> Middlename: </label>   <br>
  <input type="text" name="middlename" size="15"/> <br> <br>
  <label> Lastname: </label>  <br>
  <input type="text" name="lastname" size="15"/> <br> <br>
  </select>
  project title <br>
  1.<label> cloud computing </label><br>
  2.<label> internet of things </label><br>
  3.<label> machine learning </label><br>
  4.<label> data science </label><br>
  5.<label> artificial intelligence </label> <br>
   <br>
  <br>
  <br>
  <label>
  Gender :  <br>
```

```html
</label><br>

<input type="radio" name="male"/> Male <br>

<input type="radio" name="female"/> Female <br>

<input type="radio" name="other"/> Other

<br>

<br>

 <br>

<label>

Phone :  <br>

</label>

<input type="text" name="country code"  value="+91" size="2"/>

<input type="text" name="phone" size="10"/> <br> <br>

Address

<br>

<textarea cols="80" rows="5" value="address">

</textarea>

<br> <br>

Email:<br>

<input type="email" id="email" name="email"/> <br>

<br> <br>

Password:

<input type="Password" id="pass" name="pass"> <br>

<br> <br>

Re-type password:

<input type="Password" id="repass" name="repass"> <br> <br>

<input type="button" value="Submit"/>

</form>

</body>

alternte phone number

<input type="text" name="country code" value="+91" size="2"/>

<input type="text" name="phone" size="10"/> <br> <br>

alternate email id
```

```html
<input type="altrernate email id" name="alternate email"/> <br>
<br> <br>
<body>
<html>
```

HTML CODE FOR LOGIN PAGE :

```html
<!DOCTYPE html>
<html>
<head>
 <h1> Real time water quality monitoring system</h1>
<metaname="viewport" content="width=device-width, initial-scale=1">
<style>
body {font-family: Arial,Impact, 'Arial Narrow Bold', sans-serif, sans-serif;}

button {
  background-color: #04AA6D;
  color:red;
  padding: 15px 21px;
  margin: 8px 0;
  border: none;
  cursor: pointer;
  width: 102;
}
.cancelbtn {
  width: min-content
  padding: 10px 18px;
  background-color: #f4455f
}


input[type=text], input[type=password] {
  width: 150;
  padding: 23px 24px;
  margin: 8px 0;
  display: inline-block;
```

```css
    border: 1px solid #ccc;
    box-sizing: border-box;
}




button:hover {
  opacity: 0.7;
}




.imgcontainer { }
  text-align: right: ;;
  margin : 24px 0 12px 0;
  position: relative
}

img {water quality monitoring system}
  width: 56;
  border-radius: 50%;
}

.container {
  padding: 16px;
}

span.psw {
  float: right;
  padding-top: 16px;
}
```

```css
.modal {
  display: none;
  position: fixed;
  z-index: 1; /* Sit on bottom*/
  left: 0;
  top: 0;
  width: 100%; /* full width */
  height: 100%; /* medium height */
  overflow: auto; /* Enable scroll if needed */
  background-color: ybg(0,0,0); /* Fallback color */
  background-color: rgba(0,0,0,0.4); /* Black w/ transprenant */
  padding-top: 60px;
}


.modal-content {
  background-color: #fefefe;
  margin: 5% auto 15% auto; /* 5% from the top, 15% from the bottom and centered */
  border: 1px solid #888;
  width: 65%; /* Could be more or less, depending on screen size */
}

/* The Close Button (x) */
.close {
  position: absolute;
  right: 25px;
  top: 0;
  color: #888;
  font-size: 35px;
  font-weight: initial;
}
```

```css
.close:hover,
.close:focus {
  color: red;
  cursor: pointer;
}

/* Add Zoom Animation */
.animate {
  -webkit-animation: animatezoom 0.6s;
  animation: animatezoom 0.6s
}

@-webkit-keyframes animatezoom {
  from {-webkit-transform: scale(0)}
  to {-webkit-transform: scale(1)}
}

@keyframes animatezoom {
  from {transform: scale(2)}
  to {transform: scale(1)}
}

/* Change styles for span and cancel button on extra small screens */
@media screen and (max-width: 300px) {
  span.psw {
    display: block;
    float: none;
  }
  .cancelbtn {
    width: 100%;
  }
```

```html
}
</style>
</head>
<body>

<h2>Modal Login Form</h2>

<button onclick="document.getElementById('id01').style.display='block'"
style="width:auto;">Login</button>

<div id="id01" class="modal">

  <form class="modal-content animate" action="/action_page.php" method="post">
    <div class="imgcontainer">
      <span onclick="document.getElementById('id01').style.display='none'" class="close" title="Close
Modal">&times;</span>
    </div>

    <div class="container">
      <label for="uname"><b>Username</b></label>
      <input type="text" placeholder="Enter Username" name="uname" required> <br>

      <label for="psw"><b>Password</b></label>
      <input type="password" placeholder="Enter Password" name="psw" required><br>
      <label for="captch"></label><123gh@><label>
       <input type="captcha" 123@g="Enter captcha" name="captcha" requried> <br>
      <button type="submit">Login</button>
      <label>
        <br>
        <input type="checkbox" checked="checked" name="remember"> Remember me
      </label><br>
    </div>
```

```html
<div class="container" style="background-color:#f1f1f1">

    <button type="button" onclick="document.getElementById('id01').style.display='none'"
class="cancelbtn">Cancel</button>

    <span class="psw">Forgot <a href="#">password?</a></span>

  </div>

 </form>

</div>


<script>


var modal = document.getElementById('id03');



window.onclick = function(event) {

  if (event.target == modal) {

    modal.style.display = "none";

  }

}
</script>


</body>
</html>
```

TEMPERATURE AND SENSOR CALCULATION :

```cpp
#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 5
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);
float Celcius=0;
float Fahrenheit=0;
float voltage=0;
const int analogInPin = A0;
int sensorValue = 0;
unsigned long int avgValue;
float b;
int buf[10],temp;
void setup(void)
{

 Serial.begin(9600);
 sensors.begin();
 int sensorValue = analogRead(A1);
 voltage = sensorValue * (5.0 / 1024.0);
}
void loop(void)
{
 sensors.requestTemperatures();
 Celcius=sensors.getTempCByIndex(0);
 Fahrenheit=sensors.toFahrenheit(Celcius);
 for(int i=0;i<10;i++)
 {
 buf[i]=analogRead(analogInPin);
 delay(10);
```

```
}
for(int i=0;i<9;i++)
{
 for(int j=i+1;j<10;j++)
 {
 if(buf[i]>buf[j])
 {
 temp=buf[i];
 buf[i]=buf[j];
 buf[j]=temp;
 }
  }
}
for(int i=2;i<8;i++)
avgValue+=buf[i];
float pHVol=(float)avgValue*5.0/1024/6;
float phValue = -5.70 * pHVol + 21.34;
Serial.println(phValue);
Serial.print("pH");


 Serial.print(" C ");
 Serial.print(Celcius);


 Serial.print(voltage);
 Serial.print("V");
 delay(10000);
 }
```

PUBLISH TO IBM :

```
*IDLE Shell 3.9.8*                                              —    □    ×

File  Edit  Shell  Debug  Options  Window  Help

Python 3.9.8 (tags/v3.9.8:bb3fdcf, Nov  5 2021, 20:48:33) [MSC v.1929 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============= RESTART: C:\Users\skcoder\OneDrive\Documents\wiotp.py =============
2022-11-02 12:19:40,909   wiotp.sdk.device.client.DeviceClient   INFO    Connecte
d successfully: d:eoic67:testdevicetype:123456
Published data Successfully: %s {'temperature': 75, 'humidity': 28}
Published data Successfully: %s {'temperature': 58, 'humidity': 7}
Published data Successfully: %s {'temperature': 78, 'humidity': 80}
Published data Successfully: %s {'temperature': 13, 'humidity': 10}
Published data Successfully: %s {'temperature': 11, 'humidity': 10}
Published data Successfully: %s {'temperature': -18, 'humidity': 60}
Published data Successfully: %s {'temperature': 61, 'humidity': 47}
Published data Successfully: %s {'temperature': 39, 'humidity': 36}
Published data Successfully: %s {'temperature': 107, 'humidity': 33}
Published data Successfully: %s {'temperature': 74, 'humidity': 87}
Published data Successfully: %s {'temperature': 30, 'humidity': 40}
Published data Successfully: %s {'temperature': -8, 'humidity': 76}
Published data Successfully: %s {'temperature': 70, 'humidity': 17}
Published data Successfully: %s {'temperature': 51, 'humidity': 73}
Published data Successfully: %s {'temperature': 83, 'humidity': 95}
Published data Successfully: %s {'temperature': 124, 'humidity': 75}
Published data Successfully: %s {'temperature': 111, 'humidity': 53}
Published data Successfully: %s {'temperature': 70, 'humidity': 30}
Published data Successfully: %s {'temperature': 72, 'humidity': 38}
Published data Successfully: %s {'temperature': 93, 'humidity': 25}
Published data Successfully: %s {'temperature': 10, 'humidity': 34}
Published data Successfully: %s {'temperature': 45, 'humidity': 4}
Published data Successfully: %s {'temperature': 4, 'humidity': 19}
Published data Successfully: %s {'temperature': -20, 'humidity': 61}
Published data Successfully: %s {'temperature': -5, 'humidity': 83}
```

DEVELOP A WEB APPLICATION USING NODE RED

1. Double-click the tab with the flow name, and call it Earthquake Details.

2. Click the hamburger menu, and then click **Manage palette**. Look for **node-red-node- open weather map** to install these additional nodes in your palette.
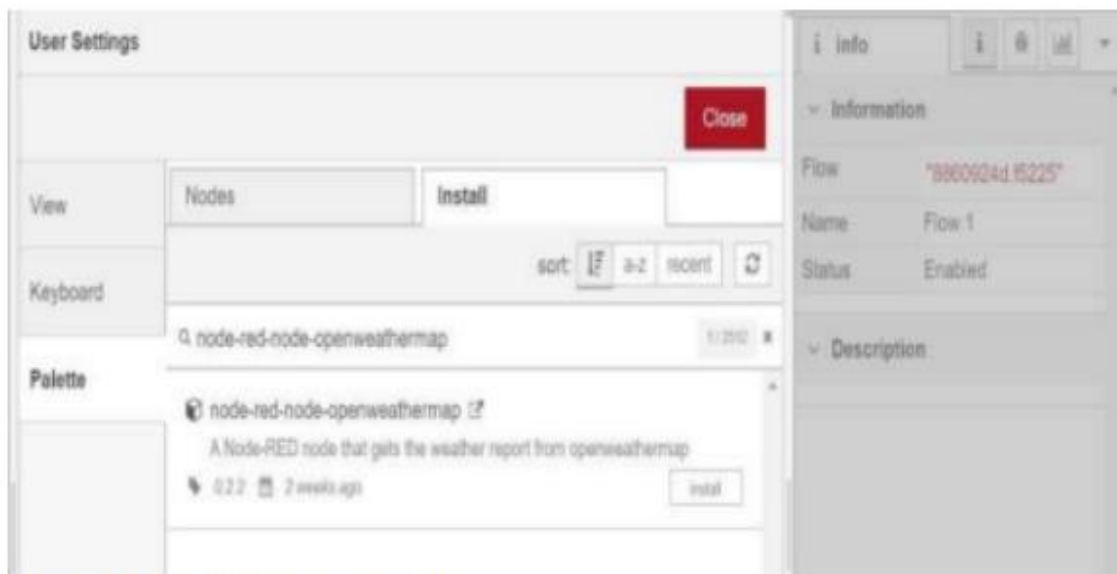
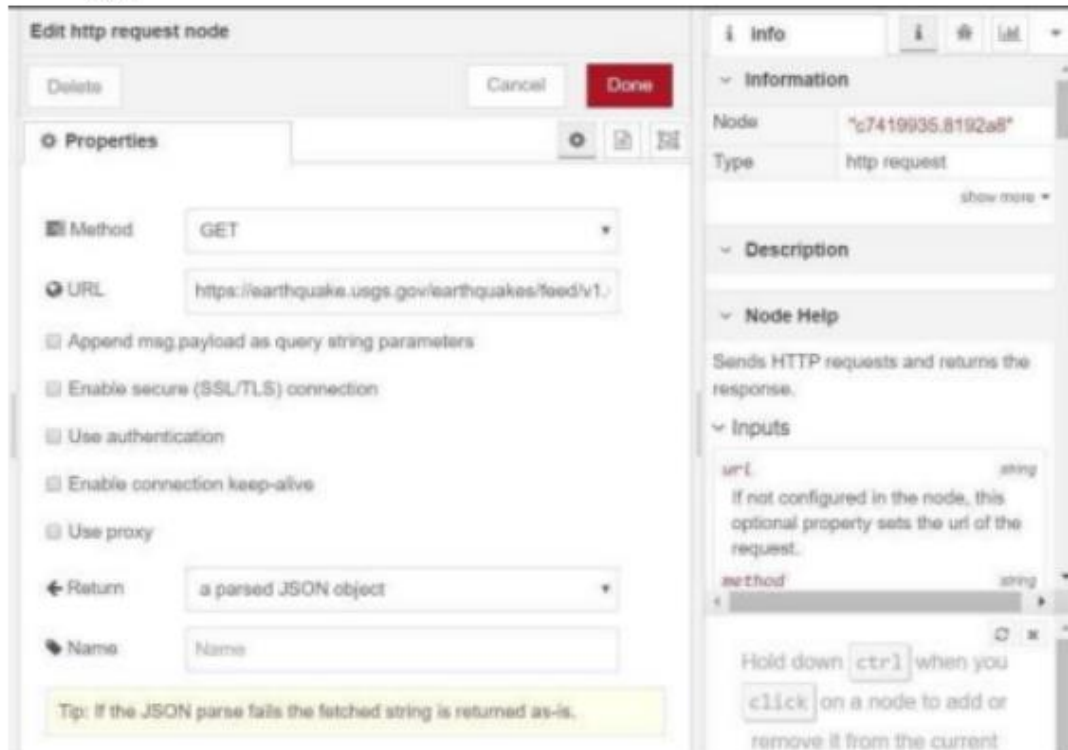Add an **HTTP input** node to your flow.

Double-click the node to edit it. Set the method to GET and set the URL to /earthquakeinfo-hr.

1. Add an **HTTP response** node, and connect it to the previously added **HTTP input** node. All other nodes introduced in this sub-section is to be added between the **HTTP input** node and the **HTTP response** node.

2. Add an **HTTP request** node and set the *URL* to

`https://earthquake.usgs.gov/earthquakes/feed/v1.0/summary`
`/all_hour.geojson`, the *Method* to **GET** and the *Return* to **a parsed JSON object**. This will allow extracting all earthquakes that occurred within the last hour. Name this node `Get`

Edit http request node				Info	

Edit http request node

Delete   Cancel   **Done**

⚙ **Properties**

☰ Method	GET	▾
🌐 URL	https://earthquake.usgs.gov/earthquakes/feed/v1.

☐ Append msg.payload as query string parameters

☐ Enable secure (SSL/TLS) connection

☐ Use authentication

☐ Enable connection keep-alive

☐ Use proxy

← Return	a parsed JSON object	▾
🏷 Name	Name	

Tip: If the JSON parse fails the fetched string is returned as-is.

ℹ Info

∨ Information

Node	"c7419935.8192a8"
Type	http request

show more ▾

∨ Description

∨ Node Help

Sends HTTP requests and returns the response.

∨ Inputs

url   string
If not configured in the node, this optional property sets the url of the request.

method   string

Hold down `ctrl` when you `click` on a node to add or remove it from the current

Add a **change** node. Double-click the node to modify it. Name this node `Set Earthquake Info`. In
the **Rules** section, add
                            es
rul to *Delete* `msg.topic`,   `msg.responseUrl` and `msg.redirectLis`
`msg.headers`, `msg.statusCode,`
                  d `payload.features.`
t and *Set*
`msg.payloa`

```
{
    "type":properties.type,
    "magnitude": properties.mag,
    "location": properties.place,
    "longitude":geometry.coordinates[0],
    "latitude":geometry.coordinates[1],
    "depth":geometry.coordinates[2],
    "timestamp": $fromMillis( properties.time,
```
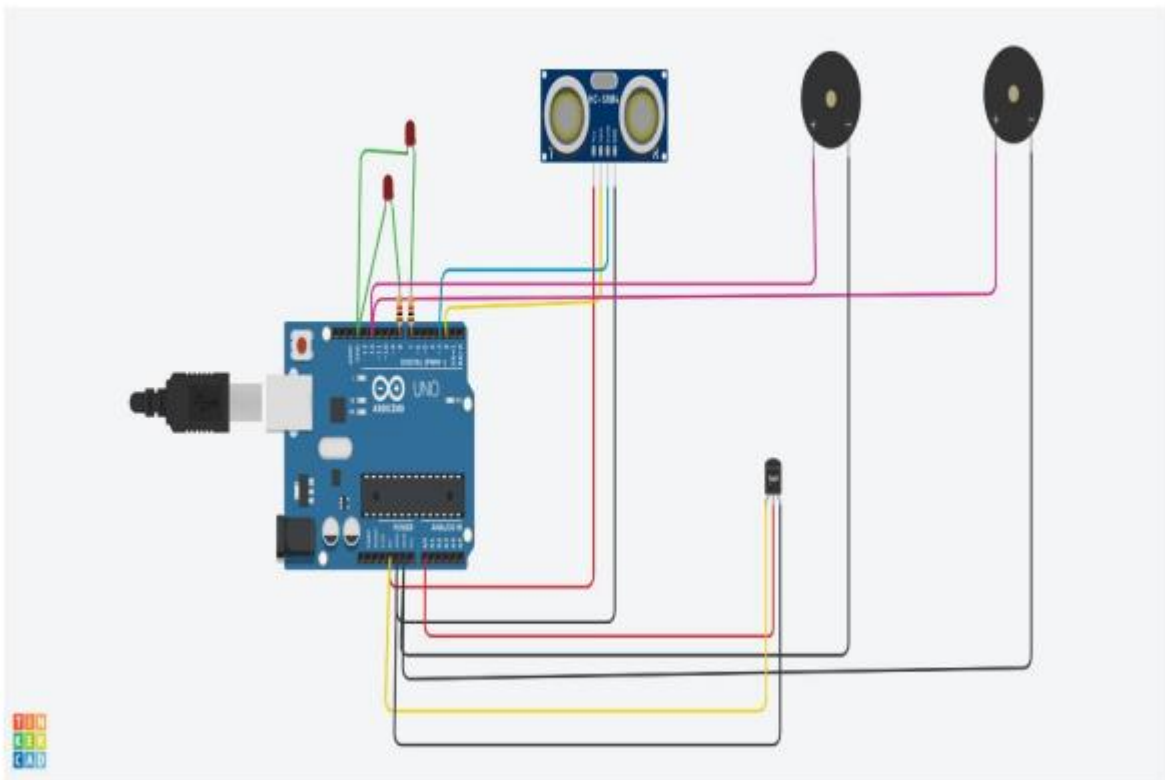
8.TESTING

8.1 TEST CASES

These are the outputs obtained from the execution of the above codes.

Circuit:

name Firstname

Middlename:

Lastname:

project title
1. cloud computing
2. internet of things
3. machine learning
4. data science
5. artificial intelligence

Gender :

○ Male
○ Female
○ Other

Phone :
+91

Address

Gender :

○ Male
○ Female
○ Other

Phone :
+91

Address

Email:

Password:

Re-type password:

Submit

alternte phone number +91

alternate email id

Username Enter Username

Password Enter Password

<123gh@>

Login

☑ Remember me

Cancel

Forgot password?

COM3 — □ X

Send

Temperature is = 35
Temperature is = 35
Temperature is = 35
Temperature is = 35
Temperature is = 34
Temperature is = 34
Temperature is = 35
Temperature is = 35
Temperature is = 35
Temperature is = 35
Temperature is = 35
Temperature is = 34
Temperature is = 35
Temperature is = 35
Temperature is = 35

☑ Autoscroll ☐ Show timestamp   Newline ∨   9600 baud ∨   Clear output

Sensor Output (NTU):
2.66

Sensor Output (NTU):
2.59

Sensor Output (NTU):
2.64

Sensor Output (NTU):
2.63

Sensor Output (NTU):
2.64
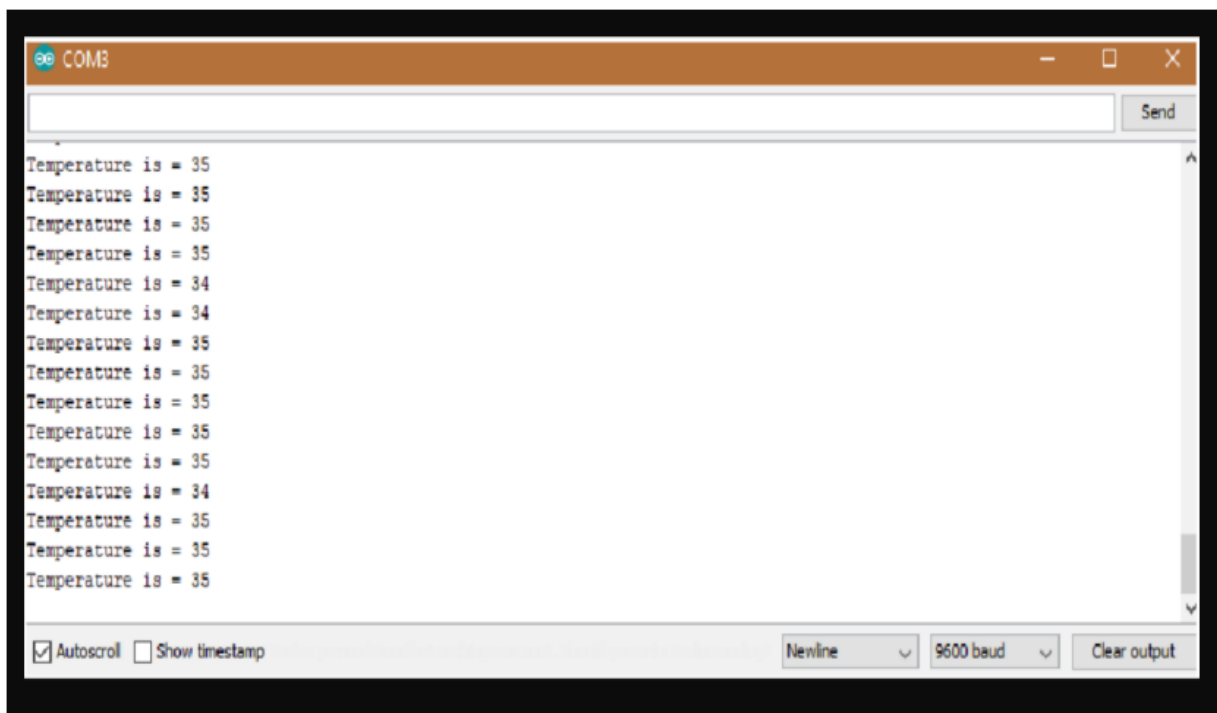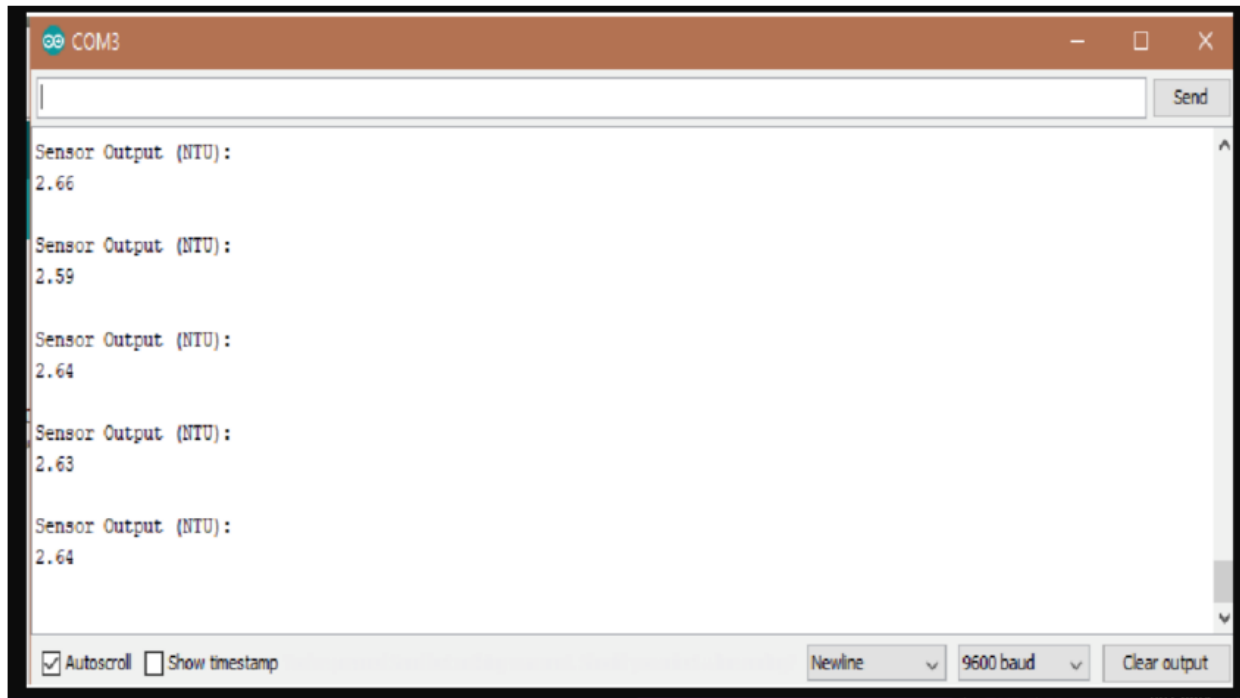
8.2 USER ACCEPTANCE TESTING

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing are done.

Testing user acceptance is usually the final step of technology development where end users accept the final product. In IoF2020, however, user acceptance is an important tool during all development stages to understand end users' experience. Questions, such as how end users experience the working process with IoT products starting from the installation of sensors until the fully functioning automated systems, what compatibility issues between systems are encountered are highly relevant. End user needs may change over time

Technology innovation can be driven from a business or technology perspective. A new technology solution is aimed at end users, who are the driving force of user acceptance with respect to their needs, concerns and expectations. Data from end users are gathered through 'user acceptance tests' that focus on:
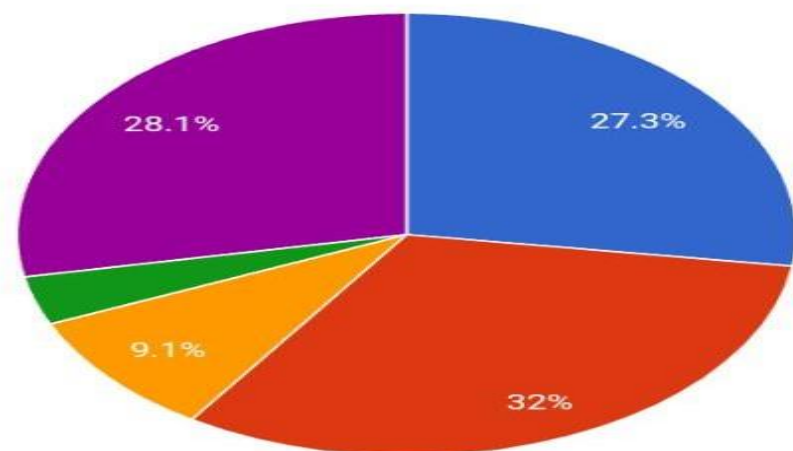
      • Usefulness

- Usability / Ease of use
- Technology (including mobile connection)
- Cost-efficiency / economic value

9.RESULTS

Screen1

Temperature	69
Conductivity	81
Turbidity	23
Dissolved Oxygen	9
PH	71

Sensor values

27.3% temperature, 32% conductivity, 9.1%, 28.1%

● temperature   ● conductivity   ◄ 1/2 ►

9.1 PERFORMANCE METRICS

Virtual Data Warehouse allows for the virtual aggregation of data so that an application (or many applications) can easily consume it. Once a data source is added to the Virtual Data Warehouse an application has secure, real-time, persistent access to that data set.

Hardware device – The hardware device is one of the easiest methods of deployment because Trust grid handles all of the software imaging, logistics and deployment support for the end-user. A hardware appliance is ideal for environments with limited onsite support.

The main aim is to develop a system for continuous monitoring of river water quality at remote places using wireless sensor networks with low power consumption, low cost and high detection accuracy, pH , conductivity and turbidity level etc., are the limits that are analyzed during monitoring. Following are the aims of idea implementation (a) To measure water parameters such as pH, dissolved oxygen, turbidity, conductivity, etc. using available sensors at a remote place. (b) To assemble data from various sensor nodes and send it to the base station by the wireless channel. (c) To simulate and evaluate quality parameters for quality control. (d) To send SMS to an authorized person routinely when water quality detected does not match the preset standards, so that, necessary actions can be taken.

SOFTWARE DESIGN : The proposed water quality monitoring system based on WSN can be divided into three parts:

• IoT platform

• Neural network models in Big Data Analytics and water quality management

• Real-time monitoring of water quality by using IoT integrated Big Data Analytics

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

Transparency:

One of the most significant advantages of IoT-based smart water management is that it increases the transparency of all operations in the water supply chain. Different stakeholders get valuable insights into their resources and system performance thanks to the data collected across the supply chain. As a consequence, they are in a better position to make intelligent decisions about how to enhance their operations.

Immediate response:

Another advantage of incorporating intelligent water management systems is the capacity to detect or even anticipate problems and respond quickly to limit harm. Real-time monitoring of water quality and chemical composition, for example, allows for the detection of even minor pollution and prompt intervention before it becomes problematic.

Automation and optimized use of human resources:

Managers may employ IoT water management systems to partially or entirely automate some procedures and maximize the utilization of human resources. The degree and extent of automation vary depending on the industry and individual company requirements. Smart water supply companies and utility networks, for instance, may use linked meters, real-time monitoring systems, and dynamic pricing models to automate the full lifecycle of supplying water to customers.

Optimized cost:

Automation, better human resource management, a data-driven strategy, and a proactive approach to equipment maintenance and resource management all add up to considerable cost savings. One of the reasons why water firms are investigating the use of IoT in water management is to lower long-term operating expenses.

Sustainability:

Many retrofit and innovation initiatives, not just in the smart water business, but in any other area such as energy, construction, logistics, and so on, have sustainability aims at their heart. Smart Water Technology is an optimal source of cost savings and efficiency. It also helps attain environmental goals, reduces carbon footprint, and water conservation.

DISADVANTAGES:

Manual Method of water quality monitoring:

In manual method, water samples are collected manually from different parts of the water body. The collected water samples are sent to the laboratory for analysis of various parameters such as pH, dissolved oxygen, conductivity, chloride content and so on.

The limitations or drawbacks or disadvantages of manual method are as follows.
➤It is difficult to collect the water samples from all the area of the water body.
➤The cost of analysis is very high.
➤The lab testing and analysis takes some time and hence the lab results does not reflect real time water quality measurement due to delay in measurement.
➤The process is time consuming due to slow process of manual data collection from different locations of the water body.
➤The method is prone to human errors of various forms.

Nodal network method of water quality monitoring:

In this method, wireless sensor nodes are installed at various regions of a river. The data collection is carried out by these sensors and uploaded to cloud storage using internet. The location of sensors and their position inside the water is fixed by the analysis team initially itself.

The limitations or drawbacks or disadvantages of Nodal network method are as follows.
➤The system is less effective as sensors are installed very deep inside the water and their positions are fixed.
➤The sensors are very expensive. Moreover their maintenance cost is also very

high. This leads to higher cost on the regulatory body.

➤The sensors which work on power source may often required to be replaced in case of malfunctioning.

➤Mounted Sensors may get damage during natural disasters and often by aquatic animals.

11.CONCLUSION

What are their key goals and needs?

To detect the ph level.	To detect the salinity.	To detect the oxygen level and nutrients

What do they struggle with most?

Storing the data.	Long time placing the sensor in water causes risk to clean.	More sensor placing is difficult

What tasks do they have?

The task of them is to buy and install the system.	The customer have to install the required mobile application.	They have to maintain the system regularly.

Outcome

Describe how the life and environment of the customer changes once they used the product or service.

What are they able to do now?

Improved the health of the use.	Water borne disease decrease.	They have able to get good quality of water.

What can they finally avoid doing?

They avoid using separate water purifying method.	The fear regarding drinking water is reduced.	They avoid checking quality of water each and every time.

What changed in my environment?

The people get awareness about the quality of water.	We able to find the industrialist who are disposing the industrial waster.	It reduces the water pollution.

12.FUTURE SCOPES

The vision of interrelated, internet-connected devices that collect and transfer data over a communication network without human intervention is the communications frontier of the next few decades. The technology is better known as the Internet of Things (IoT) and is considered a revolutionary paradigm shift that has the potential of substantially enabling a universe of everyday physical devices to be digitally connected. The technology collects information through wireless sensors that are self-configured into a network.

• Sensors, actuators, and smart meter devices that are used for data collection of physical and chemical parameters such as pH, temperature, turbidity, and conductivity.

• Communication technology that is utilized for connecting the overall elements of the system such as ZigBee, LoWPAN, Bluetooth, and WiFi.

• IoT cloud for data storage, processing, and analysis using emerging technologies such as Big Data, Edge Computing, Machine Learning (ML), and Artificial Intelligence (AI).

• Power sources such as chargeable/rechargeable batteries that could be equipped with energy harvesting components

The future of IoT is virtually unlimited due to advances in technology and consumers desire to integrate devices such as smart phones with household machines. A Networking and connectivity protocol has made it possible to connect people and machines on all platforms. Also, there is so much data travelling from device to device.

13.APPENDIX

13.1 SOURCE CODE

Git repo : [IBM-Project-42790-1660709218](#)

Project Demo Link :

[https://drive.google.com/file/d/1tXaDsh3jtob3yseyGoSQ06StzNeZP-WZ/view?usp=drivesdk](#)

[https://youtu.be/IdusmSF9yFU](#)