REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

IBM PROJECT REPORT

Submitted by

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

- This real time river water quality monitoring and control system is used to help officers in the river water quality checking process. The System provides data on the parameters which can be used to monitor the condition of the river water to monitor and protect the river water. The parameters like temperature, pH, turbidity, etc., can be accessed through the system. The sensors in the system monitor the parameters and provide them to the river water quality officers through the IBM cloud to take the necessary measures.
- Alert SMS is transmitted when the collected sensor values exceeds the standard pure water values.

1.2 PURPOSE

- Monitoring provides the objective evidence necessary to make sound decisions on managing water quality today and in the future. Water-quality monitoring is used to alert us to current, ongoing, and emerging problems; to determine compliance with drinking water standards, and to protect other beneficial uses of water. Assessments based on monitoring data help law makers and water managers measure effectiveness of water policies, determine if water quality is getting better or worse, and formulate new policies to better protect human health and the environment

- Monitoring water quality provides empirical evidence to support decision making on health and environmental issues.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

Existing system has a mechanisms which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. There is need to have human intervention in taking various reading of the water parameters.

LITERATURE SURVEY

A. TOPIC : IOT BASED RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

This project proposes a sensor-based water quality monitoring system. The main components include a microcontroller for processing the system, communication system for inter and intra node communication and several sensors. Real-time dataaccess can be done by using remote monitoring and Internet of Things (IoT) technology. The technology used in this project are IOT webpage, PHP code, MYSQL database, SMS alert, e-mail alert, temperature sensor, PH sensor and turbidity sensor. Water's PH level, temperature, turbidity value and date/time will bestored in webpage .If the acquired value is above the threshold value automated warning SMS alert will be sent to the specified account. The uniqueness of our proposed project is to obtain the water monitoring system with high frequency, high mobility, and low powered.

B. IoT Based Real-time River Water Quality Monitoring System

Author : Mohammad Salah Uddin Chowdury

Published in: The 16th International Conference on Mobile Systems and Pervasive Computing (MobiSPC)

August 19-21, 2019, Halifax, Canada

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 microcontroller for processing the system, communication systemfor inter and intra node communication and several sensors. Real-time data accesscan 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 neuralnetwork 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.

C. IoT-based River Water Quality Monitoring Design for Smart Environments inCimahi City

Author: HP Hanifah, SH Supangkat

Published in: 2019 International Conference on Electrical Engineering and Informatics (ICEEI)

Date of Conference**:** 09-10 July 2019

Smart Environment is one of the Smart City domain that has a primary focus on using technology to help the government to create a comfortable environment for thecommunity. River water pollution is a significant concern in Cimahi City, which has an industrial area where most of its waste is discharged through rivers. Although there are regulations regarding the placement of wastewater treatment plants beforedisposal of wastewater, rogue industry players still commit violations that cause riverwater pollution by industrial waste. Therefore, appropriate technology is needed thatcan be used to monitor and classify river water quality based on the level of water pollution in various river locations. .

D. An IoT Based Smart Water Quality Monitoring System using Cloud

Author : Manimegalai
Published in: 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE)

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuatorsand connectivity which enables these things to connect and exchange data. The number of IoT devices has increased 31% year-over-year to 8.4 billion in 2017 and itis estimated that there will be 30 billion devices by 2020. Water pollution is a major environmental problem in India. The largest source of water pollution in India is untreated sewage. Other sources of pollution include agricultural runoff and unregulated small scale industry that results in polluting, most of the rivers, lakes andsurface water in India.

E. IoT based water quality monitoring system for rural areas

Author:Ali Hadi Abdulwahid

To ensure that safety is guaranteed, it is essential to implement monitoring in real- time for the quality of potable water. This work is about the use of Internet of Things (IoT) technology to develop an affordable system to control water quality in real-time.Several sensors are integrated into the system to measure various chemical and. physical water properties, such as conductivity, pH, turbidity, and temperaure

F. Real Time Internet of Things (IoT) Based Water Quality Management System

Author:Saif Allah H . AlMetwally Mohamed K .Hassan Mohamed H .MouradThe

rapidly transforming technologies and changing of people's expectations

triggered the fourth industrial revolution, commonly referred to as Industry 4.0. Wateris the core resource and a vital for life of all species, as it is a limited resource that needs to be utilized efficiently. Monitoring various aspects of the water quality leads to a clear understanding of the aspects that should be considered for a healthy life and to avoid wastage of water. Using Internet of Things (IoT) should allow for the integration of real time monitoring and controlling of water quality.

G. IoT Based Real-Time Spring Water Quality Monitoring System

Author : Aditya Roy; Subhadeep Mukhopadhyay; Sahadev Roy.

As the technologies in different fields are developing rapidly to improve society for the betterment of human life, more and more environmental problems are arising. Water is one of the most crucial elements for human life to sustain on this planet. Soto monitor the coantinuous supply of filtered and purified water is becoming more important nowadays. Now, most of the monitoring systems that are present today are not automated and also equipped with the same repeated process and also verytime-consuming. In this proposed work we present a water quality monitoring systemthat will be consists of various spring water quality measuring sensors, microcontroller for processing gathered data and various communication systems fornode communication with the cloud server.

2.2 REFERENCES

- Hanifah, Hani Purwati, and Suhono Harso Supangkat. "IoT-based River Water Quality Monitoring Design for Smart Environments in Cimahi City." 2019 International Conference on Electrical Engineering and Informatics (ICEEI). IEEE, 2019.
- Chowdury, Mohammad Salah Uddin, et al. "IoT based real-time river water quality monitoring system." Procedia Computer Science 155 (2019): 161-168.
- Hanifah, Hani Purwati, and Suhono Harso Supangkat. "IoT-based River Water Quality Monitoring Design for Smart Environments in Cimahi City." 2019 International Conference on Electrical Engineering and Informatics (ICEEI). IEEE, 2019.
- Abdulwahid, Ali Hadi. "IoT based water quality monitoring system for rural areas." 2020 9th International Conference on Renewable Energy Research and Application (ICRERA). IEEE, 2020.

2.3 PROBLEM STATEMENT DEFINITION

- Existing system has a mechanisms which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. There is need to have human intervention in taking various reading of the water parameters.

- The instruments or tools are used either by putting/inserting a water sensing part into water and seeing the result on small display device or by directly inserting a portable device in water and watching the output on the display

- The samples are analysed at the well-equipped laboratories. At these laboratories, samples of raw water, filter water and treated water are taken for analysis, these analysis can be performed by human intervention which for specific period only. The disadvantage of this system is, water is not monitoring seamlessly, and it always needs a human intervention.

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS
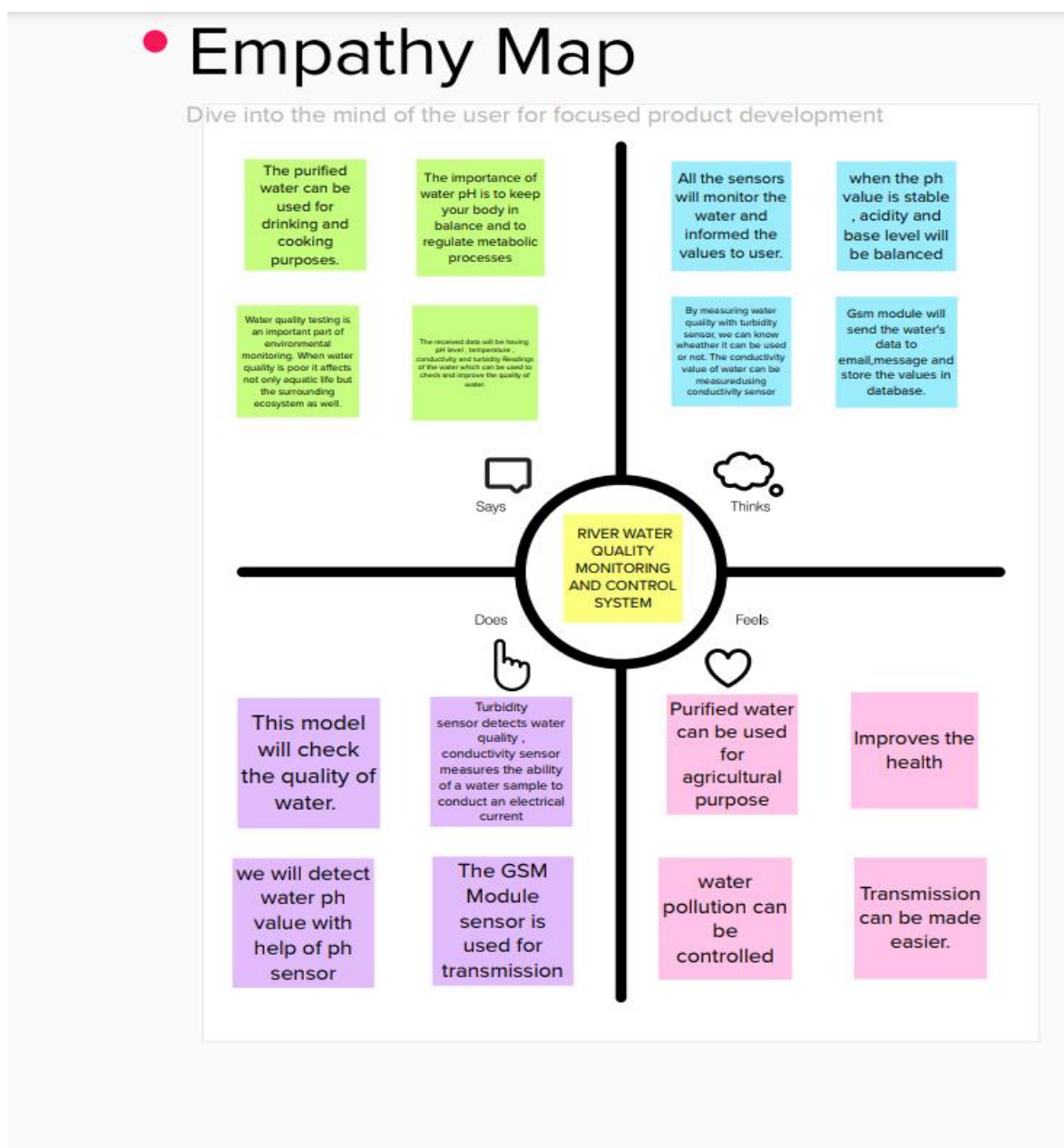
Figure 3.1: Empathy Map

3.2 IDEATION & BRAINSTROMING

Brainstorm & idea prioritization

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

🕐 **10 minutes** to prepare
⏳ **1 hour** to collaborate
👤 **2-8 people** recommended

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕐 10 minutes

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

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

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

Open article →

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕐 5 minutes

PROBLEM
How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

Stay in topic.   Encourage wild ideas.

Defer judgment.   Listen to others.

Go for volume.   If possible, be visual.
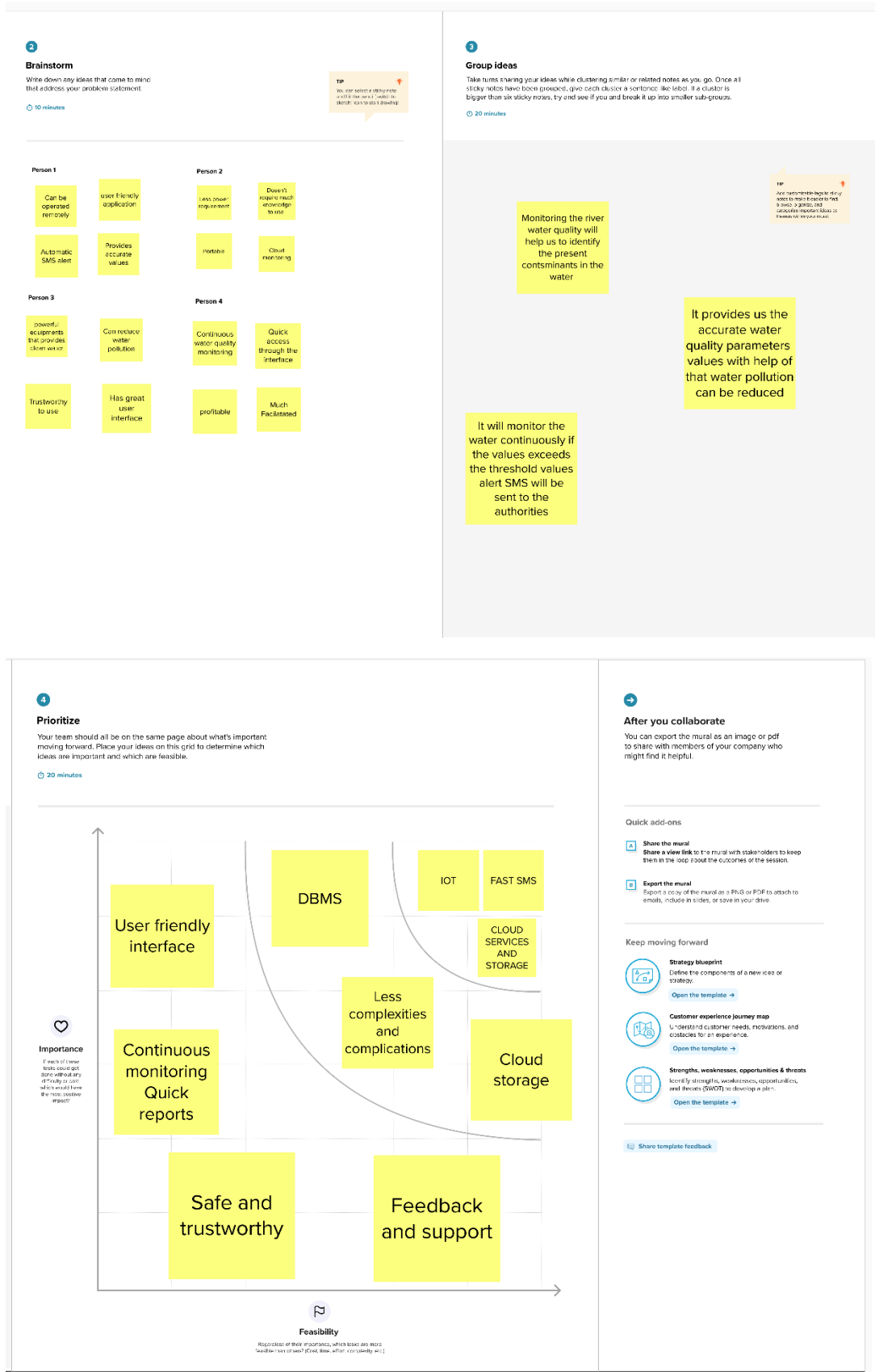
Figure 3.2: Ideation And Brainstroming.

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1	problem Statement (Problem to be solved)	t is difficult to measure the water quality parameters manually for testing the quality of water
2	idea / Solution description	This project proposes a sensor-based water quality monitoring system. Using the pH sensor , Turbidity sensor ,temperature sensor the pH , turbidity , temperature of the water can be measured. If the acquired value is above threshold value automated warning SMS alert will be sent to the specified account.
3	Novelty / Uniqueness	The uniqueness of our proposed project is , the quality of water is obtained with high frequency , high mobility and low powered.
4	Social Impact / Customer Satisfaction	Using this project the quality of water can be measured easily so that necessary actions can be taken to avoid or reduce the water pollution
5	Business Model (Revenue Model)	This project reduces the man power and time need to measure water quality parameters . All the water quality parameters will be displayed by this model so that necessary actions can be taken to improve the quality of water.
6	Scalability of the Solution	The main advantage of this project is its scalability. It is very compact in size such that it can be taken anywhere easily to measure the water quality .

Table 3.1: Proposed Solution

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S) `CS`

- Water quality checkers

- Enducers (public), organizations responsible for supplying drinking water are the customer's

6. CUSTOMER CONSTRAINTS `CC`

- Budget is the main factor which limits the customers in taking actions. The proposed project is cost effective.

- Man power is the another factor. The proposed system needs no man power

5. AVAILABLE SOLUTIONS `AS`

The current water quality monitoring system is a manual system with a monotonous process and is very time consuming

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

- The water quality parameters datas are obtained using the sensors and the datas are stored and monitored continuously

- If the water is polluted an sms alert will be sent to the specified customer

9. PROBLEM ROOT CAUSE `RC`

Due to industrial waste and other pollutants such as plastics, nitrates, bacteria ,Fertilizers etc. The water is polluted very much so it is difficult to convert the river water into drinking water.

7. BEHAVIOUR `BE`

If the water is polluted very much install the water quality monitoring system which is proposed in this project so that the customers gets the details about temperature, turbidity and pH of the water and with the help of those details necessary actions can be taken to improve the quality of the water.

Figure 3.3: Problem Solution Fit

CHAPTER 4
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Software requirements	IOT cloud platform , IBM IOT platform , IBM CLOUDANT DB, node - RED
FR-4	System requirements	RAM minimum 4GB Processor. Configuration OSWindows.

Table 4.1:Functional Requirements

4.2 NON - FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It is very important to monitor the water quality to ensure that it is safe to drink and by monitoring the water continuously we can also ensure the safety of sea animals and also we can reduce the water pollution.
NFR-2	Usability	The networks used in this project are incredibily safe and the transmission speed is also high
NFR-3	Reliability	In this project standardized software components are used so that the desired outputs can be obtained which makes the project more reliable.
NFR-4	Performance	The water quality will be monitored continuously and SMS alert will be sent to the specified customer if the water quality is poor
NFR-5	Availability	This project is portable so that it can be taken to anywhere. It can be used at any time with accuracy
NFR-6	Scalability	The main advantage of this project is its scalability. It is very compact in size such that it can be taken anywhere easily to measure the water quality

Table 4.2: Non Functional Requirements

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM
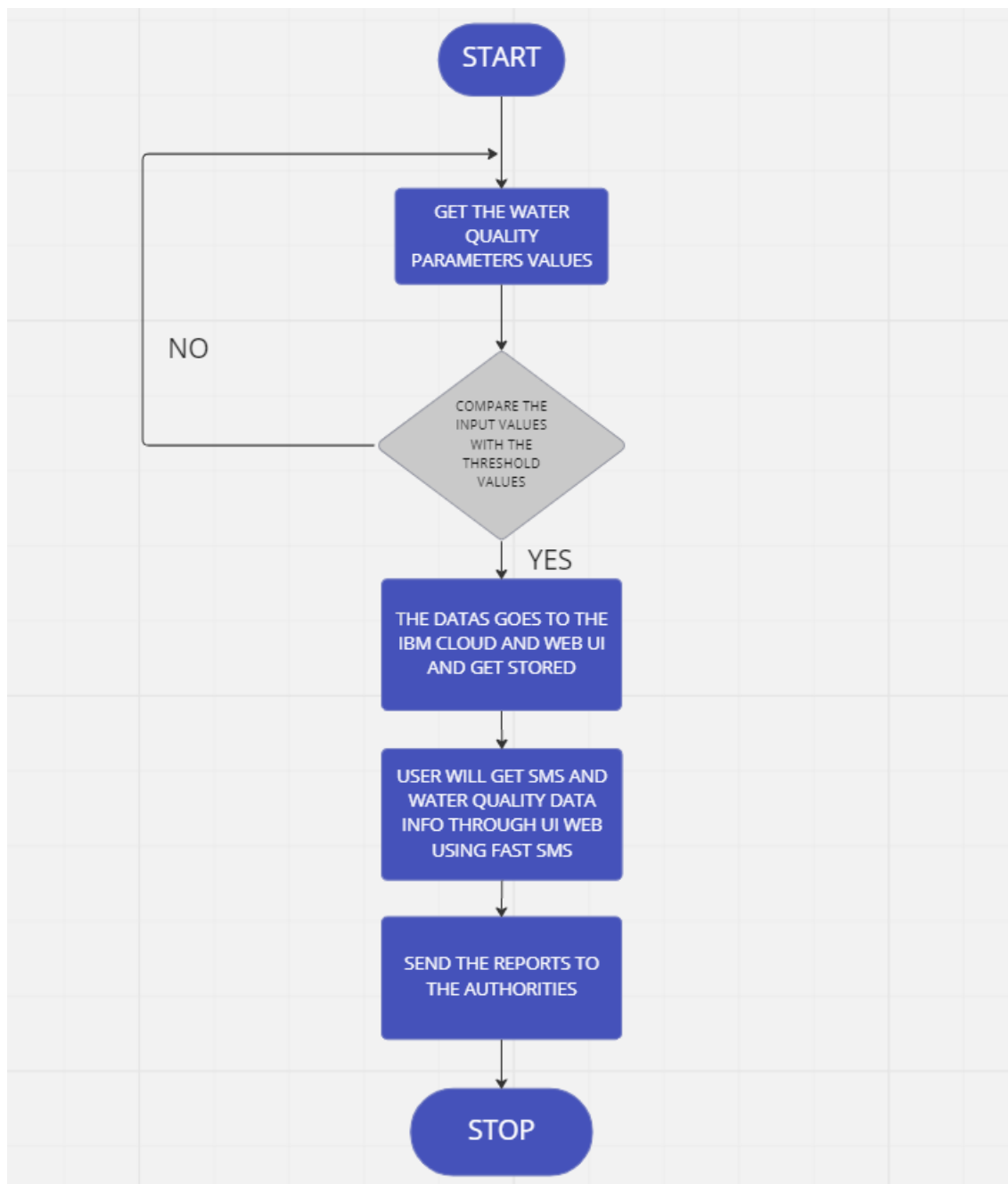
Figure 5.1: Data Flow diagram

5.2 SOLUTION AND TECHNICAL ARCHITECTURE
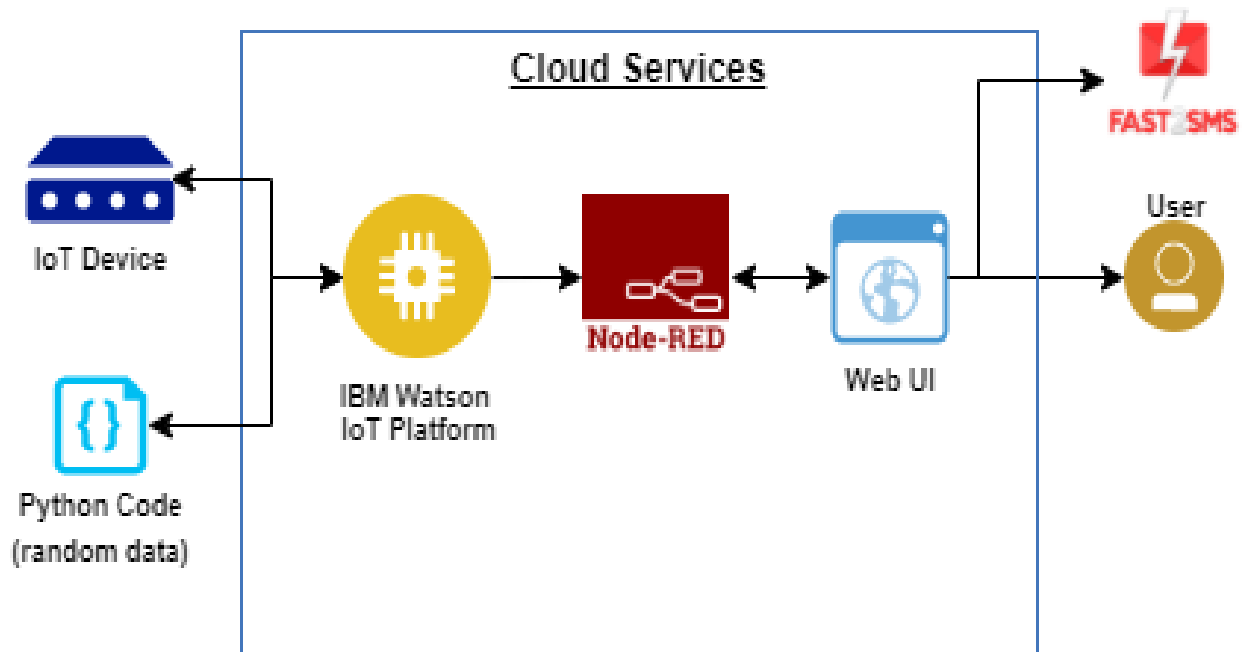
Figure 5.2: Solution And Technical Architecture

S.No	Component	Description	Technology
1	User Interface	The user receives alert through SMS which contains a website link .In the website all the water quality data will be available.	HTML, CSS, JavaScript , Node-red.
2	IBM Watson IOT platform	It is a fully managed cloud hosted service that makes it simple to derive value from internet of things	Python , java , node.js
3	Node - Red	It is a flow based development tool for visual programming used for wiring devices , APIs and online services .It provides a web browser based flow editor which can be	Java Script

S.No		Description	Technology
		used to create javascript functions.	
4	Web interface	The collected data will displayed visually for the user	HTML , CSS , Javascript
5	Data Storage	File storage requirements	IBM Block Storage
6	Cloud Database	The water quality data will be stored in the IBM cloud platform.	IBM DB2, IBM Cloudant.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1	Fast SMS	This application is used to send SMS alert to the specified user	GSM
2	Security Implementations	Application security testing can expose application-level flaws, assisting in the prevention of these attacks	SHA-256, Encryptions, IAM Controls, OWASP
3	Scalable Architecture	Microservices allow a large application to be separated into smaller independent parts, with each part having its own realm of responsibility.	Java, python
4	Availability	The load balancer intelligently routes client requests to the right server, in a manner that maximizes performance and capacity utilization while sending requests only to servers that are online.	Server load balancing (SLB)
5	Performance	Great UI (User Interface), Fast Loading Time and High Performance, Compatible with a Mobile Platform	Python , HTML , JS , IBM Watson , GSM

Table 5.1: Solution And Technical Architecture

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through google	I can register & access the dashboard with google Login	low	Sprint-2
		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	I can receive login credentials.	high	Sprint-1
	Interface	USN-6	As a user, the interface should be userfriendly manner	I can able to access easily.	Medium	Sprint-4
Customer (Web user)	Dashboard	WUSN-1	As a web user, I can access the specific info (ph value, temp, humidity)	I can able to know the quality of the water	High	Sprint-3
Customer Care Executive	View manner	CCE-1	As a customer care, I can view data in	can easily understand by visuals	High	Sprint-3

			visual representation manner(graph			
	Taste	CCE-2	As a customer care , I can able to view the quality(salty) of the water	I can easily know whether it is salty or not	High	Sprint-3
	Color Visibility	CCE-3	As a customer care , I can able to view the quality(salty) of the water	I can easily know the condition by color	High	Sprint-4
Adminstrator	Risk tolerent	ADMIN-1	An administrator who Is handling the system should update and take care of the application.	Admin should monitor the records properly	High	Sprint-2
customer	View manner	USN-7	dentification of water source	Visualization of water source	High	Sprint-4

Table 5.2: User Stories

CHAPTER 6

PROJECT PLANNING &SCHEDULE

6.1 SPRINT PLANNING AND ESTIMITION

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	KOLLA HARIBABU , SHARATH KUMAR NB
Sprint-1	Registration via Facebook	USN-2	As a user, I can register for the application through Facebook	2	low	KOLLA HARIBABU , SHARATH KUMAR NB

Sprint-1	registration via Gmail	USN-3	As a user, I can register for the application through Gmail	2	medium	KOLLA HARIBABU , SHARATH KUMAR NB
Sprint-2	Confirmation	USN-4	As a user I will receive confirmation email once I have registered for the application	1	high	AJAY KUMAR , DINESH M
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email & password	1	high	AJAY KUMAR , DINESH M
Sprint-2	IBM cloud service	USN-6	Get access to IBM cloud services	2	high	AJAY KUMAR , DINESH M
Sprint-3	Create IBM Watson and device settings	USN-7	To create the IBM Watson IOT platform and Intergrate the microcontroller with it to send sensed data to cloud	2	high	AJAY KUMAR , DINESH M
Sprint-3	Create node red service	USN-8	To create a node red service to integrate the IBM Watson along with Web UI	2	Medium	AJAY KUMAR , DINESH M
Sprint-3	Create Web UI	USN-9	To create Web UI to access the data from cloud And display all parameters	2	Medium	AJAY KUMAR , DINESH M
Sprint-3	To develop a python code	USN-10	Create python code to sense the physical quantity and store data	1	Medium	AJAY KUMAR , DINESH M
Sprint-4	Publish data to cloud	USN-11	Publish data that is sensed by the	3	high	KOLLA HARIBABU , SHARATH

Sprint						
			microcontroller to the cloud			KUMAR NB
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	3	high	KOLLA HARIBABU , SHARATH KUMAR NB
Sprint-4	Testing	USN-13	Testing of project	3	medium	KOLLA HARIBABU , SHARATH KUMAR NB

Table 6.1: Sprint Planning And Estimation

6.2 SPRINT DELIVERY SCHEDULE

Table 6.2: Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Point 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	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

CHAPTER 7
CODING AND SOLUTIONING

7.1 FEATURE 1

- The main feature of this project is that it will be able to monitor the river water quality parameters using the sensors and send the data to the IBM cloud. From the IBM cloud, the data will be transferred to the mobile application through which the water quality check officers can be able to access the parameters remotely from anywhere. The system provides data of the parameters like temperature, pH and turbidity of the river water. The water quality check officer by checking these parameters, can be able to make decisions about the river water quality and he can alert the people to not to drink the water.

7.2 FEATURE 2

- The another feature of the project is that automatically an alert SMS will be sent to the registered user if the river water quality is poor

- The data provided by the system cannot only be viewed in mobile application but can also be visualized using Web UI provided by the Node-RED in its dashboard.

CHAPTER 8

TESTING

8.1 TEST CASES

Date	03-Nov-22
Team ID	PNT2022TMID27339
Project Name	Project - Real time river water qua
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO 1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	Kindly use the given drive link and download the app in your mobile	1.Enter url and download the app 2.Verify login/Register popup displayed or not	https://drive.google.com/fil e/d/1GNQrqo5x8hvaTETAYY Dsh9Za4rfxEUvn/view?usp= drivesdk	Login/Register popup should display	Working as expected	Pass	steps are clear and simple	N	NIL	Ajay kumar R
LoginPage_TC_OO 2	UI	Home Page	Verify the UI elements in Login/Signup popup	Kindly use the given drive link and download the app in your mobile	1.Enter URL and download app 2.Verify login/Register popup with below UI elements: a.username text box b.password text box c.Login button d.Register button	https://drive.google.com/fil e/d/1GNQrqo5x8hvaTETAYY Dsh9Za4rfxEUvn/view?usp= drivesdk	Application should show below UI elements: a.email text box b.password text box c.Login button d.New User? Register button	Working as expected	pass	user friendly user interface	N	NIL	Dinesh M
LoginPage_TC_OO 3	Functional	Home page	Verify user is able to log into application with Valid credentials		1.Enter URL and download the app 2.Enter Valid username/email in username text box 3.Enter valid password in password text box 4.Click on login button	Username: ajay10 password: 1234	User should navigate to user account homepage	Working as expected	Pass	clear information was given	N	NIL	Ajay kumar R
LoginPage_TC_OO 4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL download the apk 2.Enter InValid username/email in username text box 3.Enter valid password in password text box 4.Click on login button	Username: user12345 password: 1234	Application should show 'wrong username or password ' validation message.	Working as expected	Pass	High Security	N	NIL	Sharath kumar NB
LoginPage_TC_OO 4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL and download the app 2.Enter Valid username/email in username text box 3.Enter Invalid password in password text box 4.Click on login button	Username: user10 password: wrong567	Application should show 'Incorrect username or password ' validation message.	Working as expected	Pass	High Security	N	NIL	Kolla Hari Babu
LoginPage_TC_OO 5	Functional	Main page	Verify user is able to log see the water quality parameters		1.Enter URL and download the app 2.Enter InValid username/email in username text box 3.Enter Invalid password in password text box	The user will be able to see the temperature,Ph,turbidity values from sensors	Application should show the water quality parameters values from ibm cloud	Working as expected	Pass	simple and easy to use	N	NIL	Dinesh M

Figure 8.1: Test Cases

8.2 USER ACCEPTANCE TESTING

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Sub Total
By Design	5	1	0	0	**6**
Duplicate	0	0	0	0	**0**
External	8	0	4	1	**12**
Fixed	13	2	4	1	**18**
Not reproduced	7	2	0	0	**9**
Skipped	1	0	0	0	**1**
Won't Fix	0	0	0	0	**0**
Totals	**34**	**5**	**8**	**2**	**46**

Table 8.1:Defect Analysis

Section	Total Cases	Not Tested	Fail	Pass
Temperature sensor	35	0	0	35
pH Sensor	40	0	0	40
Turbidity sensor	25	0	0	25
Transmission of data to IBM Cloud	3	0	0	3
Data Transmission from Cloud to Mobile App	5	0	0	5
User login in Mobile Application	10	0	0	10
Accessing the Parameters in Mobile App	15	0	2	13
Controlling the Motor from the Mobile App	5	0	0	5
Viewing the parameters in the Node RED	5	0	0	5
Controlling the Motor from Node RED	3	0	0	3

Table 8.2 Test Case Analysis

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRIC

			Date	3-Nov-22								
			Team ID	PNT2022TMID27339								
			Project Name	River water quality monitoring and control system								
			Maximum Marks	4 marks								

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	App should be installed used in the mobile	1.Enter url and download the app 2.Verify login/Register popup displayed or not	https://drive.google.com/file/d/1GNQrqo5x8hvaTETAYYDsh9Za4rfxEUvn/view?usp=drivesdk	Login/Signup popup should display	Working as expected	Pass	Steps are clear and simple	N	Nil	Sharath kumar N B
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup	App should be installed used in the mobile	1.Enter URL and download app 2.Verify login/Register popup with below UI elements: a.username text box b.password text box c.Login button d.Register button	https://drive.google.com/file/d/1GNQrqo5x8hvaTETAYYDsh9Za4rfxEUvn/view?usp=drivesdk	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	simple design	N	Nil	Sharath kumar N B
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials	App should be installed used in the mobile	1.Enter URL and download the app 2.Enter Valid username/email in username text box 3.Enter valid password in password text box 4.Click on login button	Username: ajay10 password: 1234	User should navigate to user account homepage	Working as expected	Pass	Easy and user friendly ui	N	Nil	Kolla Hari Babu
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	App should be installed used in the mobile	1.Enter URL download the apk 2.Enter InValid username/email in username text box 3.Enter valid password in password text box 4.Click on login button	Username: ajay12345 password: 1234	Application should show 'wrong username or password ' validation message.	Working as expected	Pass	clear information was given	N	Nil	Kolla Hari Babu
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	App should be installed used in the mobile	1.Enter URL and download the app 2.Enter Valid username/email in username text box 3.Enter Invalid password in password text box 4.Click on login button	Username: ajay10 password: wrong567	Application should show 'Incorrect username or password ' validation message.	Working as expected	Pass	clear information was given	N	Nil	Dinesh M
MainPage_TC_OO6	Functional	Main page	Verify user is able to log see the water quality parameters	The user should be successfully navigated from the login page	The user should be successfully navigated from the login page	The user will be able to see the temperature,Ph, turbidity values from sensors	Application should show the water quality parameters values from ibm cloud	Working as expected	Pass	The parameters can be viewed remotely and motor controlling is easy	N	Nil	Dinesh M
MainPage_TC_OO7	Functional	Main page	Verify user is able to log see the water quality parameters	when the values of the parameters are above the threshold value	The user should be successfully navigated from the login page	Temperature=3, pH=3, Turbidity=404	ALERT!! THE WATER QUALITY IS DEGRADED	Working as expected	Pass	The parameters can be viewed remotely and motor controlling is easy	N	Nil	Ajay Kumar R
MainPage_TC_OO8	Functional	Main page	Verify user is able to log see the water quality parameters	when the values of the parameters are within the threshold value	The user should be successfully navigated from the login page	Temperature=45, pH=7, Turbidity=350	no alert sms is sent	Working as expected	Pass	The parameters can be viewed remotely and motor controlling is easy	N	Nil	Ajay Kumar R

Figure 9.1:Performance Metrics

NFT detailed test plan

S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/Sign Off
			NFT - Detailed Test Plan	
1.	River water quality monitoring	Spike Testing – For the sensors in the module.	1. For the temperature, PH and turbidity sensors, the values should be tested at extreme high, moderate, and extreme low levels to know that the indication is going on correctly. 2. The ESP32 module should process and transmit data to IBM cloud.	Approved
2.	River water quality monitoring	Endurance Testing – For Watson IoT visualization boards.	1. The parameter data should be accessed through the IBM Watson IoT Platform. 2. The visualization data should be continuously stored for a specified long duration.	Approved
3.	River water quality monitoring	Resilience Testing – For Node-Red Dashboard Visualization.	1. The Node-Red should be able to perform well with different datasets or payloads coming from the module. 2. The Node-Red should display the correct parameter data and both the IBM and Node-Red data should match.	Approved
4.	River water quality monitoring	Load Testing – For accessing the parameter data and controlling the motor from the mobile application.	1. The parameter data can be viewed and the motor should be controlled from the mobile application itself. 2. The data should be precise even if multiple user data for visualization.	Approved

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

1. The river water quality monitoring and control system helps the water quality checker to monitor the river water quality remotely through the mobile application.

2. The system enables the water quality checkers to take necessary actions by monitoring the conditions of the river water.
3. controlling the motor from the mobile application or through the Web UI.

4. With the help of the reiver water quality monitoring and control system the water pollution and diseases can be reduced.

DISADVANTAGES

1.Disadvantage is that this system not reliable for long distance can only apply to single source of water

2.This project focuses only on the pH, temperature and turbidity of the water ,there are other parameters also.

CHAPTER 11

CONCLUSION

IoT is considered the backbone of River water quality monitoring , as it connects all components of smart systems and other applications. Concerning the use of IoT in River water quality, it can be used in many practices such as water quality monitoring, reducing water pollution ,minimizing water borne diseases etc. IoT connects several sensors with processing units, then analyses data, then makes appropriate decisions in real-time. Real-time monitoring of water quality by using IoT integrated will immensely help people to become conscious against contaminated water as well as to stop polluting the water.

CHAPTER 12

FUTURE SCOPE

1. The future scope of this project is monitoring drinking water quality ,treatment and disinfection of waste water etc .

2.It can be used as an efficient water management system of local area.

APPENDIX

SOURCE CODE

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

# Provide your IBM Watson Device Credentials
organization = "f7du5q"
deviceType = "RasberryPi"
deviceId = "979"
authMethod = "token"
authToken = "12345678"


# Initialize GPIO


def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status = cmd.data['command']
    if status == "motoron":
        print("Motor is on")
    else:
        print("Motor is off")

    # print(cmd)


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

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

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
    # Get Sensor Data from DHT11

    temp = random.randint(0, 100)
    pH = random.randint(0, 14)
    turbidity = random.randint(0,100)


    data = {'temperature': temp, 'pH': pH,'turbidity':turbidity}
```

```python
# print data
def myOnPublishCallback():
    print("Published Temperature = %s C" % temp, "pH = %s " % pH, "turbidity = %s " % turbidity ,"to IBM
Watson")


    if ((temp > 50)&(pH>6)&(turbidity>50)):
        import requests

        url = 'https://www.fast2sms.com/dev/bulkV2'
        message = 'water quality is poor'
        numbers = 9790828557
        payload = f'sender_id =
FastSM&message={message}&route=v3&language=english&numbers={numbers}'
        headers = {
            'authorization':
'S4iYQnRsA8kMj0GOvKJTux3WE6czyewV5NClDPoXmUdaLp9bHBm0ItCj5UhK7DSds9LkWPEF1RwVY
Ole',
            'content-Type': 'application/x-www-form-urlencoded'
        }
        response = requests.request("POST", url=url, data=payload, headers=headers)
        print(response.text)


    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(1)

    deviceCli.commandCallback = myCommandCallback


# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

GIT HUB LINK

https://github.com/IBM-EPBL/IBM-Project-19013-1659692166

PROJECT DEMO LINK

https://clipchamp.com/watch/LOlH95Ty7K3