REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM.

BY:-

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a. Project Overview

Project is real-time river water quality monitoring and control system is about we do have so many low laying pits and the big pits are called canals and flow of water is called rivers .now a days most of the rivers are filled with dirty water and in some places we can not able to draw the water and we can not make use of the ground water because in our country or in the worlds there are place where any body can not able to make use of the ground water .there are people who only depend on the stream of water that flowing there near by simply rivers .such that river water plays an crucial role in so many lifes.not only human beings but also other animals and living things that are living inside the water ,so there is in need of using the good and efficient water .normally the purity of water is depend up on or the drinking water is safe is determined not only on impurities present in the water but also one thing is ph lever the ph level of the water should be 7 that is neutral state so we are using this project to control the river water ph level with the help of IOT. 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 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.

b. Purpose

In this project, we depict the design of Wireless Sensor Network (WSN) [4-7] that assists to monitor the quality of water with the support of information sensed by the sensors dipped in water. Using different sensors, this system can collect various parameters from water, such as pH, dissolved oxygen, turbidity, conductivity, temperature, and so on. The rapid development of WSN technology provides a novel approach to real-time data acquisition, transmission, and processing. The clients can get ongoing water quality information from far away. Now a day's Internet of things (IoT) is an innovative technological phenomenon. It is shaping today's world and is used in different fields for collecting, monitoring and analysis of data from remote locations. IoT integrated network if everywhere starting from smart cities, smart power grids, and smart supply chain to smart wearable [7- 12]. Though IoT is still under applied in the field of environment it has huge potential. It can be applied to detect forest fire and early earthquake, reduce air population, monitor snow level, prevent landslide, and avalanche etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system [4, 13]. Water quality monitoring has gained more interest among researchers in this twenty-first century. Numerous works are either done or ongoing in this topic focusing on various aspects of it. The key theme of

all the projects was to develop an efficient, cost-effective, real-time water quality monitoring system which will integrate wireless sensor network and internet of things [14]. In this research, we monitor the physical and chemical parameters of water bodies inside
Chittagong city by using an IoT based sensor network.

LITERATURE SURVEY

a. Existing problem

Nowadays water is the is the most valuable for all the human beings drinking water utilities faces challenges in real time operation. These challenges occurred because of growing population, limited water resources, ageing infrastructure etc. Hence there is a need of better methodologies for monitoring the water quality. To reduce the water related diseases and prevent water population World health Organization (WHO) has also stated This crisis as "the largest mass poisoning of a population in history". The main goal of this paper to build a Sensor- based Water Quality Monitoring System.

b. References

1. Real-Time River Water Quality Monitoring System- International Journal of Engineering Research & Technology (IJERT)
2. Real-Time Water Quality Monitoring System -International Research Journal of Engineering and Technology (IRJET)

c. Problem Statement Definition

Water is the primary need of all living beings and living without water is impossible. With the advancement of technology and industrialization, environmental pollutions have become a major concern. Water pollution is one of the most serious types of this environmental pollution. Our lives depend on the quality of water that we consume in different ways, from juices which are produced by the industries. Any imbalance in the quality of water would severely affect the humans' health and at the same time it would affect the ecological balance among all species. Water quality refers to the chemical, biological, radiological, and biological parameters of the water.

3.IDEATION & PROPOSED SOLUTION

a. Empathy Map Canvas
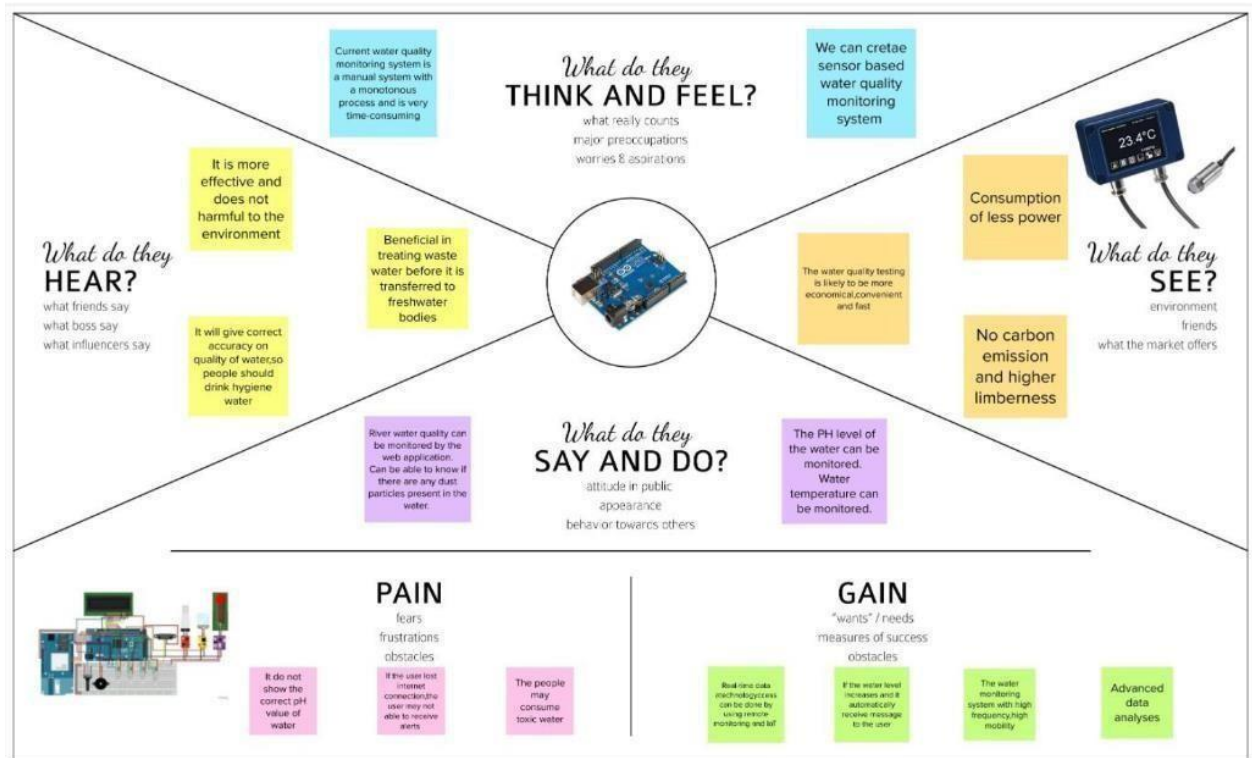
b. Ideation & Brainstorming
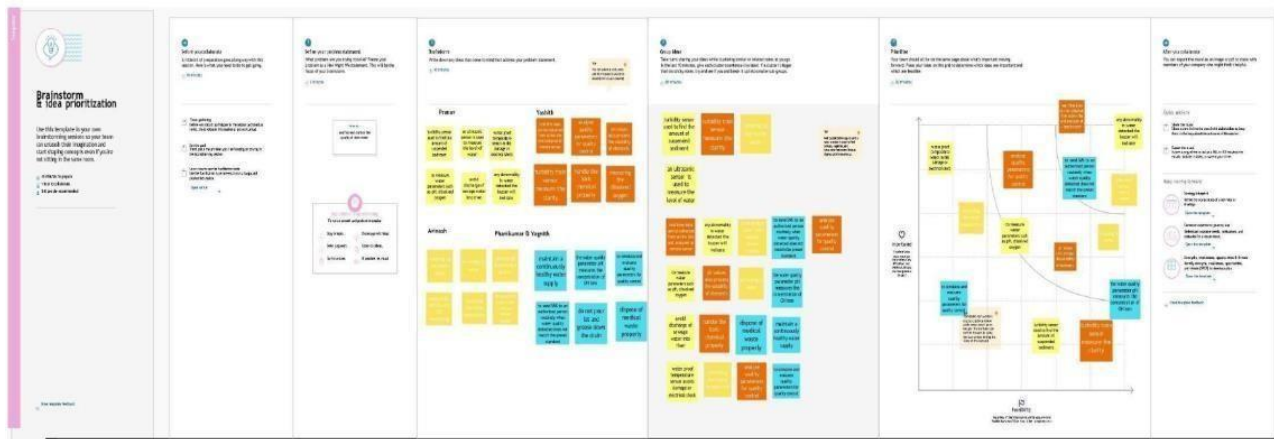
c. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Control the Algal bloom and monitor the water parameters such as ph, turbidity and dissolved solvents.
2.	Idea / Solution description	Monitoring water parameters by using Arduino and Sensors and control measures by ultrasonic frequency.
3.	Novelty / Uniqueness	Controlling Algal Blooms using Ultrasonic frequencies.
4.	Social Impact / Customer Satisfaction	People come to know about the quality of water.
5.	Business Model (Revenue Model)	Water Monitoring and Control Model.
6.	Scalability of the Solution	The process of operating this Model is very easy.

d. Problem Solution fit

1. CUSTOMER SEGMENT(S) — CS

Who is your customer?

According to our problem statement, people living in rural areas and so, who uses river water.

6. CUSTOMER CONSTRAINTS — CC

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

Only one system is used for specific area and so people may find it hard to recover if any fault occurs, as we used sensors to detect temperature and pH.

5. AVAILABLE SOLUTIONS — AS

Which solutions are available to the customers when they face the problem need to get the job done? What have they tried in the past? What pros & cons do these solutions have?

Eventhough the individual notifications to each people could not be sent, the system will still notify the corporation and they can further notify the people.

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

Which jobs-to-be-done (or problems) do you address for your customers?

The river water quality monitoring system checks the temperature and pH of the water periodically and notifies the public when the quality of the water varies.

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?

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

7. BEHAVIOUR — BE

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

The customer could use the user guide provided to overcome the problem or else they can report and contact the corporation. They will take care of the problem.

3. TRIGGERS — TR

What triggers customers to act? I.e. seeing their neighbour installing

For Example : If certain area people start using this quality monitoring system and so they are staying healthy without any water borne diseases, it will trigger the other area people start using it.

4. EMOTIONS: BEFORE / AFTER — EM

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

The customers might feel hard first, we will guide them with a user guide and they will find it easy to use.

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 propeosition, 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.

Our Solution is to check the quality of the river water periodically using two sensors. The parameters like temperature and pH of the river water is monitored and alerts when any changes in the parameters occus.

8. CHANNELS of BEHAVIOUR — CH

8.1 ONLINE

What kind of actions do customers take online?

If it is in online mode, they can use the helpline number to contact the authorities.

8.2 OFFLINE

What kind of actions do customers take offline?

If it is in offline mode, the customers can directly reach the corporation office and report the problem.

2. REQUIREMENT ANALYSIS

a. Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Email Registration through product mobile UI
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Ph level detection	To monitor the water quality Ph sensor is used and the signals are sent to Arduino.
FR-4	Turbidity detection	Turbidity sensor measures the clarity of element or muddiness utter in the water and the signals are send to Arduino.
FR-5	Ultrasonic generator	At regular interval times the waves are generated to clear algae 25%,50%,100%

b. Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It has simple monitoring system and efficient to use.
NFR-2	Security	Mobile application is secured with firewalls protection.
NFR-3	Reliability	Real time sensor output values with future predicted data storage. 98% efficient monitoring output. It also gives assurance for aquaculture safety.
NFR-4	Performance	It has greater performance and environmentally safe model.
NFR-5	Availability	In the form of mobile UI 24 x 7 monitoring system.
NFR-6	Scalability	Highly Scalable. It is capable to produce a best final output.
NFR-7	Stability	The stability is very high
NFR-8	Efficiency	It is highly efficient, high mobility and low powered.

3. PROJECT DESIGN

a. 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.
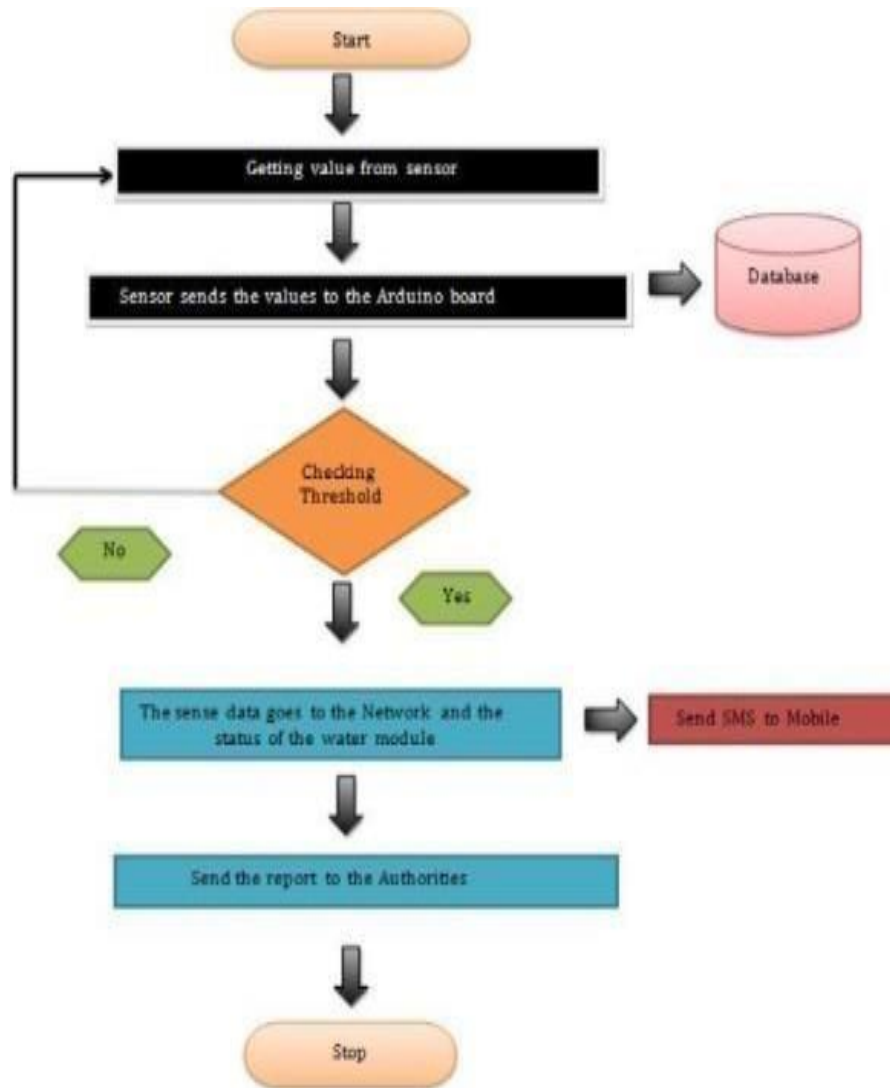
User Stories

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 email, password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email 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 & access the 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-friendly manner	I can able to access easily.	Medium	Sprint-1
Customer (Web user)	dashboard	WUSN-1	As a web user, I can access the specific info (ph value, temp, humidity, quality).	I can able to know the quality of the water.	High	Sprint-1
Customer Care Executive (input)	View manner	CCE-1	As a customer care, I can view data in visual representation manner(graph)	I can easily understand by visuals.	High	Sprint-1
	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-1
	Color visibility	CCE-3	As a customer care , I can able predict the water color	I can easily know the condition by color	High	Sprint-1
Administrator	Risk tolerant	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

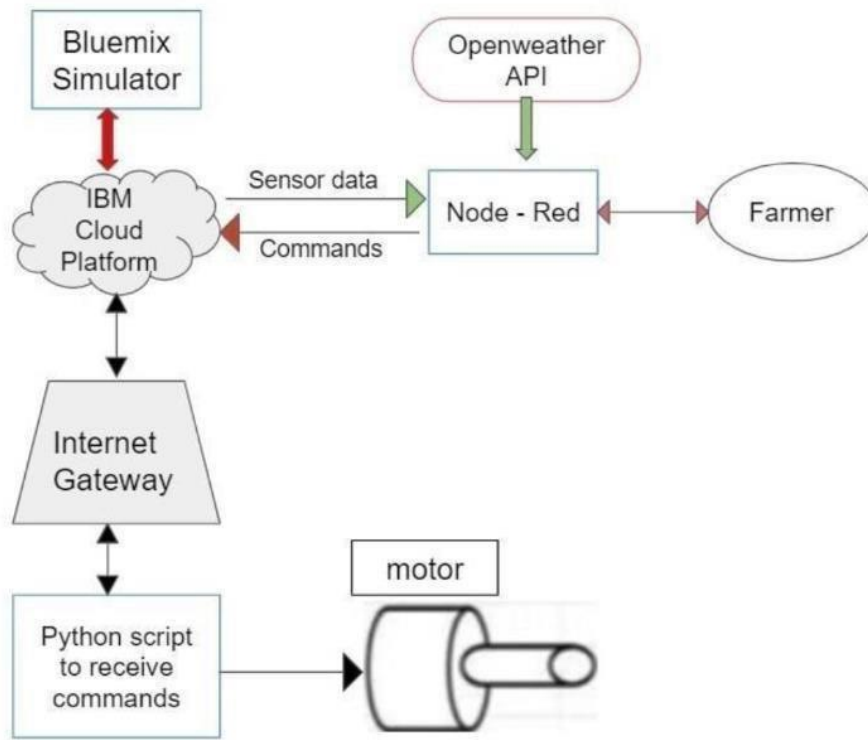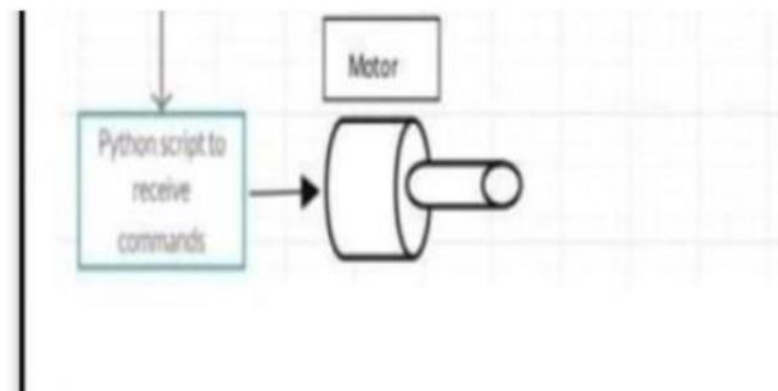**b. Solution & Technical Architecture**

<div align="center"><u>**TECHNICAL ARCHITECTURE**</u></div>

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application	HTML, CSS, Node-Red ,Cloud,etc
2.	Application Logic-1	Logic for a process in the application	JAVA/PYTHON
3.	Application Logic-2	Logic for a process in the application	IBM WATSON STT services
4.	Application Logic-3	Logic for a process in the application	BM WATSON Assistant
5.	Database	Data Type, Configurations etc	MySQL,PostgresSQL
6.	Cloud Database	Database Service on Cloud	IBM DB2,IBM Cloudant etc
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc
10.	Machine Learning Model	Purpose of External API used in the application	Object Recognition Model, etc..
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application	Technology used

c. User Stories

The image is a user story map / experience map with a SCENARIO "Testing and Experimenting with various water sources" and columns: PREREQUISITE, PROJECT FLOW, WORKING, BENEFITS, OUTCOME. Rows: Steps, Interactions, Goals & motivations, Positive moments, Negative moments, Areas of opportunity.

	PREREQUISTE	PROJECT FLOW	WORKING	BENEFITS	OUTCOME
Steps — What does the person (or group) typically experience?	Techniques: availability of Internet of Things and Remote sensing. purpose: To purify the water resources	sites: It is necessary to observe the water quality in a large area such as lake, river, and aquaculture. Process: IoT and remote sensing techniques are used, congregate and analyzing data from the remote locations.	Info Transfer: An android application will be used to determine the sensor values and examined via cloud and warnings will be provided to user. The values are then compared with the threshold value	It Can diminish the contaminants present in water. It changes to a drinking water	The related authorities can take measures to boost the water quality which makes it more usable for human purpose. It has high frequency, high mobility, and low powered.
Interactions — What interactions do they have at each step along the way? People / Places / Things	Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology. Can be displayed in visual format on a server PC	To check water quality by analyzing the parameters such as Temperature, pH and conductivity, and so on. It supervising, congregate and analyzing data from the remote locations	If the acquired value is above the SMS alert will be sent to the user	Using IoT Integrated Big Data Analytics will immensely help people to become conscious against using contaminated water	It can be extended into an efficient water management system of a local area.
Goals & motivations — At each step, what is a person's primary goal or motivation?	Customer requires the system consist of several Sensors. It is used to measuring physical and chemical parameters of the water.	The aim is to develop a system for continuous monitoring of river water quality at remote places using wireless sensor networks. With low power consumption, need	The data will be stored in the cloud or local storage will be implemented. Using the sensed parameters, the customer predicts the water quality	The customer requires a low cost system. By the sensors, water contaminants must be detected.	The issue is that the traditional method, such as workers, needs to go to each tank or river to collect data
Positive moments — What steps does a typical person find enjoyable, productive, fun, motivating, delightful, or exciting?	This project has successfully achieved its objective where water quality data (pH and temperature) can be monitored		Implementation by a reconfigurable smart sensor interface device for water quality monitoring system in an IoT environment	It proposed the system collects parameters of water pH, turbidity on the surface of water. With high speed from multiple different sensor nodes.	It will immensely help customer to become conscious against using contaminated waste as well as to stop polluting the water.	It was satisfied by low cost water quality monitoring system has been developed for large area of coverage. It was attributed to its long iterative operation, flexibility, and reproducibility
Negative moments — What steps does a typical person find frustrating, confusing, angering, costly, or time-consuming?	Customer felt that the sensors are installed very deep inside the water and their positions are fixed.		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	The maintenance cost is also very high.	To test other Parameters, the new sensors can be included.
Areas of opportunity — How might we make each step better? What ideas do we have? What have others suggested?	The design of a real time, and low cost water quality monitoring system	Track whether protection and restoration measures are working	Customer can analyze data continually and instantly alert users to changes in the system. It reduces the need for unreliable and expensive sampling.	No need to compromise the water quality by the presence of infectious agents, toxic chemicals, and radiological hazards.	The system has wide application and it is usable and affordable

4. PROJECT PLANNING & SCHEDULING

a. Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-1	Registration via Facebook	USN-2	As a user, I can register for the application through Facebook	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-1	registration via Gmail	USN-3	As a user, I can register for the application through Gmail	2	Medium	Pranav, Yashith Reddy, Avinash, Phanikumar,

						Yagnith Varma
Sprint-2	Confirmation	USN-4	As a user I will receive confirmation email once I have registered for the application	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-2	IBM cloud service	USN-6	Get access to IBM cloud services	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
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	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-3	Create node red service	USN-8	To create a node red service to integrate the IBM Watson along with Web UI	1	Low	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-3	Create Web UI	USN-9	To create Web UI to access the data from cloud And display all parameters	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-3	To develop a python code	USN-10	Create python code to sense the physical quantity and store data	2	Medium	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
Sprint-4	Publish data to cloud	USN-11	Publish data that is sensed by the microcontroller to the cloud	3	High	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma
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	2	Medium	Pranav, Yashith Reddy, Avinash, Phanikumar, Yagnith Varma

b. Sprint Delivery Schedule

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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	10	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	12 Nov 2022	10	12 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

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

5. RESULTS

a. Performance Metrics

The accuracy score of model using Random forest classifier and some softwares is 0.77(77%) (f1score).

6. ADVANTAGES & DISADVANTAGES

ADVANTAGES:-

1.We can see the results from the hand set.

2.We can monitor the ph level.

3.We can deliver the good quality water through our app.

DISADVANTAGES:-

The drawback of the system is to the sensors and the maintain is somewhat hard its not like that fully on electronic device but there are sensors are present and we need to maintain.

10.CONCLUSION

In this way that we can monitor the system from remote and we can make the living beings to drink and use good water by using this product.

11. FUTURE SCOPE

We are seeing most of the natural resources are destroyed and being destroyed such that we neet to preserve the remaining for the feature generations.

So we can use this and ewe can save the river water from the harmful chemicals and we can preserve that water for the feature generations.

These days everything is becoming artificial so many diplomats are said that the worlwar-3 should be on water. And so many rivers re-flowing from other neighboring countries there is chance that

they can poisonous the flow such that the water become harmful and dangerous so that we can use this.