

# **REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM**

**TEAM ID: PNT2022TMID15959**

## **INTRODUCTION**

### **PROJECT OVERVIEW:**

we depict the design of Wireless Sensor Network (WSN) 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 is everywhere starting from smart cities, smart power grids, and smart supply chain to smart wearable. Though IoT is still under applied in the field of environment it has huge potential. It can be applied to detect forest fire and early earthquake, reduce air pollution, monitor snow level, prevent landslide, and

avalanche etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system. Water quality monitoring has gained more interest among researchers in this twenty-first century. Numerous works are either done or ongoing in this topic focusing on various aspects of it. The key theme of all the projects was to develop an efficient, cost-effective, real-time water quality monitoring system which will integrate wireless sensor network and internet of things. In this research, we monitor the physical and chemical parameters of water bodies inside Chittagong city by using an IoT based sensor network we depict the design of Wireless Sensor Network (WSN) that assists to monitor the quality of water with the support of information sensed by the sensors dipped in water.

## **ABSTRACT:**

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. This paper proposes a sensor-based water quality monitoring system. The 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.

## **PURPOSE**

The main objective of this research is to monitor the river water level by using the internet of things. This system can keep a strict check on the pollution of the water resources and be able to provide an environment for safe drinking water. 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

- available on the web in real-time.
- accurate measurements on pH.
- total dissolved salts.
- electrical conductivity.

## **LITERATURE SURVEY**

### **EXISTING PROBLEM:**

Traditional methods of inlet wastewater monitoring involve the manual collection of water samples and the manual reading of the sensors, followed by laboratory analytical techniques to enable early detection and warning in the event of impermissible inlet wastewater to the sewage plant. Such methods take a while to execute and are no longer considered efficient. The current system for monitoring industrial wastewater discharged into the wastewater treatment plant consists of the following components: 1. Analog pH electrode: This electrode is used to monitor the pH of the wastewater inflow. 2. pH transmitter with display: this device is used to display pH readings. 3. SCADA system screen: utilized to monitor all instrument measurements in real-time. The system works as follows: Throughout his shift, the worker checks the display numbers to determine whether they are less than 6.5 or greater than 9, indicating the presence of

industrial effluent. The existing technology is incapable of autonomously closing and opening the entrance gates and does not include an audible alarm, SMS notification, or alerts.

## **REFERENCE:**

- [1] R. Rondón, M. Gidlund, and K. Landernäs, “Evaluating bluetooth low energy suitability for time-critical industrial IoT applications,” *International Journal of Wireless Information Networks*, vol. 24, no. 3, pp. 278–290, Sep 2017.
- [2] G. Patti, L. Leonardi, and L. L. Bello, “A bluetooth low energy real-time protocol for industrial wireless mesh networks,” in *IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society*, Oct 2016, pp. 4627–4632.
- [3] M. Marinoni, A. Biondi, P. Buonocunto, G. Franchino, D. Cesarini, and G. Buttazzo, “Real-time analysis and design of a dual protocol support for bluetooth LE devices,” *IEEE Transactions on Industrial Informatics*, vol. 13, no. 1, pp. 80–91, Feb 2017.
- [4] A. Al-Fuqaha, A. Khreishah, M. Guizani, A. Rayes, and M. Mohammadi, “Toward better horizontal integration among IoT services,” *IEEE Communications Magazine*, vol. 53, no. 9, pp. 72–79, 2015.
- [5] J. P. Tomas, “Thames water rolls out smart meter project in London,” 2017.

## **PROBLEM STATEMENT DEFINITION**

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 ML

lib, 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. 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 is everywhere starting from smart cities, smart power grids, and smart supply chain to smart wearable . Though IoT is still under applied in the field of environment it has huge potential. It can be applied to detect forest fire

and early earthquake, reduce air pollution, monitor snow level, prevent landslide, and avalanche etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system. Water quality monitoring has gained more interest among researchers in this twenty-first century. Numerous works are either done or ongoing in this topic focusing on various aspects of it. The key theme of all the projects was to develop an efficient, cost-effective, realtime water quality monitoring system which will integrate wireless sensor network and internet of things.

## **IDEATION AND PROPOSED SOLUTION**

### **EMPATHY MAP CANVAS:**



The empathy map is about describing the project with a gain and pain in this regard the depicts about the outcome of our real time water monitoring system.

4

## Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes



## **IDEATION AND BRAINSTROMING:**

### **PROPOSED SOLUTION:**

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Massive growth of algae called eutrophication leads to pollution (monitoring and controlling the quality of river water)
2.	Idea / Solution description	Detecting the dust particles, PH level of water, Dissolved oxygen and temperature to be monitored and alerting the authorities if water quality is not good.
3.	Novelty / Uniqueness	River water quality can be monitored by web application. Quality parameter will track continuously with standard measurements.
4.	Social Impact / Customer Satisfaction	Localities will not get suffered by poor quality of water by alerting them when the water quality is not good.
5.	Business Model (Revenue Model)	Water quality monitoring system by sensor systems for industrial water treatment plant, river bodies, aqua forming, digital loggers.
6.	Scalability of the Solution	Measuring of real time values and continuous monitoring helps in maintaining the quality of water.



## PROBLEM SOLUTION FIT:

<p><b>1. CUSTOMER SEGMENT(S)</b>  <small>Who is your customer?          i.e. sending parents of 0-5 y.o. kids</small></p> <p>People living in rural areas near to the river ,who uses river water</p>	<p><b>6. CUSTOMER CONSTRAINTS</b>  <small>What constraints prevent your customers from taking action or using your solution? i.e. spending money, budget, no cash, network connection, available devices</small></p> <p>Water quality monitoring system is used for identify the water pollution on specific area. People may find it hard to recover if any fault occurs,this system prevent people from water pollution.</p>	<p><b>5. AVAILABLE SOLUTIONS</b>  <small>What solutions are available to the customers when they face the problem?          or need to get the job done? What have they tried in the past? What pros &amp; cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</small></p> <p>Individual notification to each people could be sent,it is not possible . this system will still notify the corporation and they can further notify the people to aware.</p>
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<p><b>2. JOBS-TO-BE-DONE / PROBLEMS</b>  <small>Which jobs to be done (or problems) do you address for your customers? There could be more than one, explore different sides</small></p> <p>The river water quality monitoring system that checks periodically ,the dust particles,temperature and PH level and gave notifies for the public when the water quality varies</p>	<p><b>9. PROBLEM ROOT CAUSE</b>  <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations</small></p> <p>We know that the sensor are expensive and the system needs more than one sensors to work,these sensors are used periodically to check the quality of water and if any problem, need to be replace frequently.</p>	<p><b>7. BEHAVIOUR</b>  <small>What does your customer do to address the problem and <del>if they have</del> find the right color panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</small></p> <p>The customer could use the user guide provided to overcame the problem or else they can report and contact the corporation. They will take care of the problem.</p>
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## REQUIREMENT ANALYSIS:

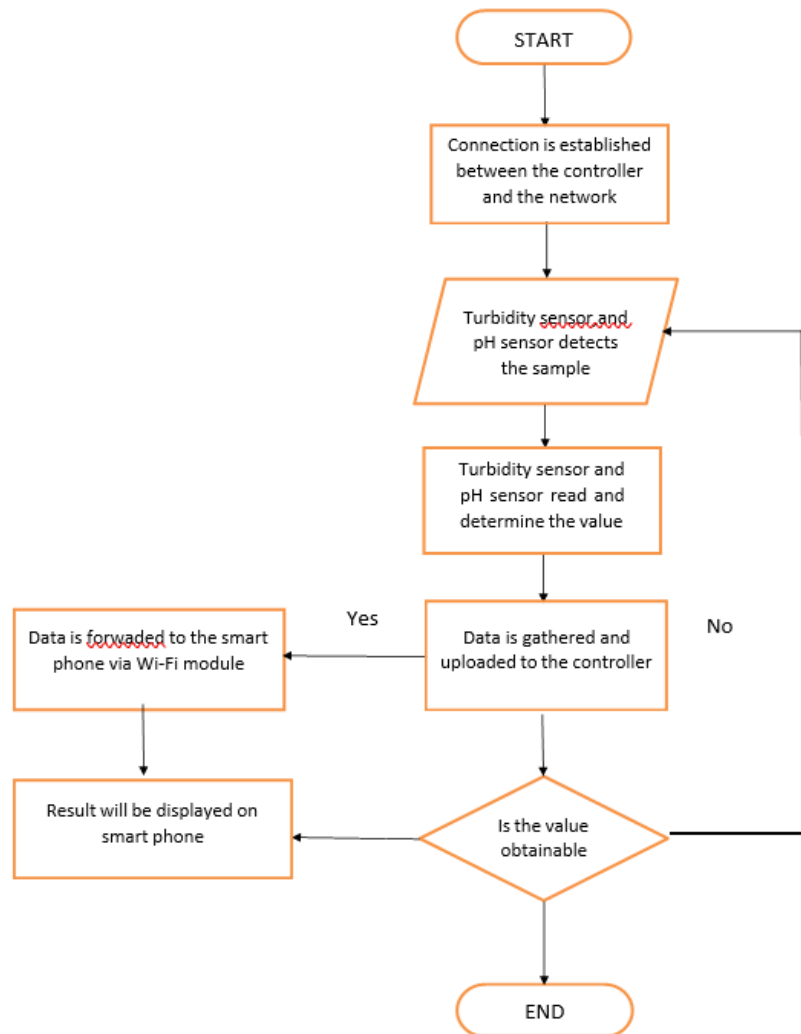
FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	User Login	Confirmation <u>through verified</u> password
FR-2	View Water Details	View current water details in website View <u>traditional water</u> eligibility in website
FR-3	Logout	Logs <u>out the</u> user successfully

## NON FUNCTIONAL REQUIREMENTS:

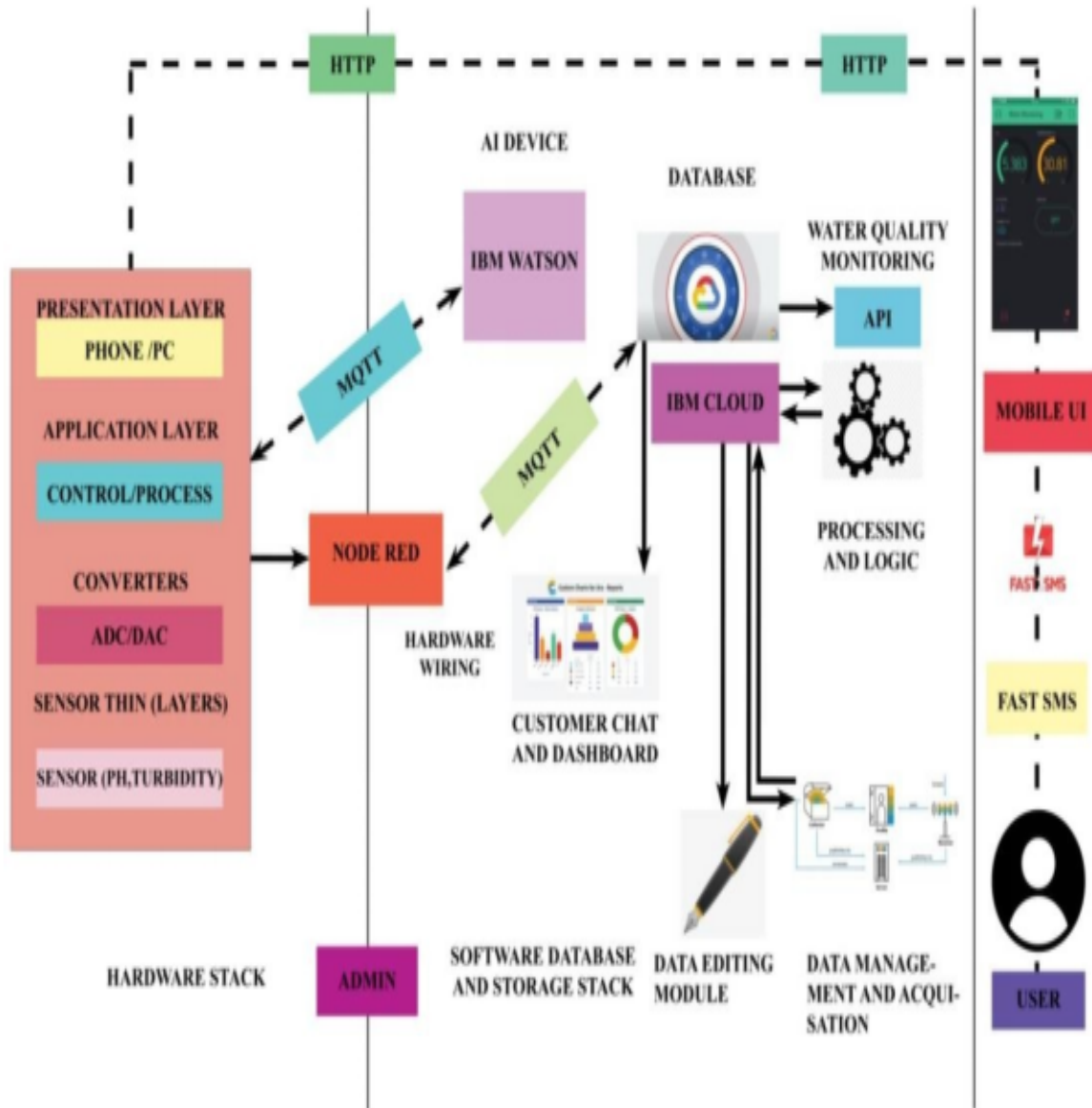
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Load time for user interface screens shall not be more than 2 seconds.
NFR-2	Security	User account is password protected Account creation <u>done only after email verification</u>
NFR-3	Reliability	Users can access <u>their account</u> 98% of the time without failure
NFR-4	Performance	Load time for user interface screens shall not be more than 2 seconds. Login info verified within 10 seconds.
NFR-5	Availability	Maximum downtime will be about 4 hours
NFR-6	Scalability	System can handle about 1000 users at any <u>given time</u>

## PROJECT DESIGN

### DATA FLOW DIAGRAM:



## SOLUTION & TECHNICAL ARCHITECTURE:



**Table-1 : Components & Technologies:**

S.No	Component	Description	Technology
1	User Interface	Mobile UI	HTML, CSS, java script
2	Application Logic-1 (mobile application)	Scale meter is introduced to monitor the water parameters	Java
3	Application Logic-2 (AI Application)	<u>For predicting future values of water quality range</u>	<u>IBM Watson Assistant</u>
4	Database	Data Type	NOSQL.
5	Cloud Database	Database Service on Cloud	<u>IBM Cloudant</u>
6	File Storage	File storage requirements: <u>Container Platform Version 4.6</u>	<u>IBM Block Storage</u>
7	External API-1	The data is used to compare the values for sensor with threshold values	<u>IBM water quality API</u>
8	External API-2	For the locals and authorities to know the water quality	mobile API,
9	Machine Learning Model (node-red)	For interfacing hardware and software application (a virtual wiring tool)	Platform: <u>Node.js</u>
10	Infrastructure (Server/ Cloud)	Application Deployment on cloud Cloud Server Configuration : <u>application-client-bnd</u>	<u>IBM cloud</u>

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	<u>Bootstrap</u>	CSS
2.	Security Implementations	MQTT, <u>CoAP</u> , DTLS, 6LoWPAN	<u>Encryptions</u> , OWASP
3.	<u>Scalable Architecture</u>	The scalability of architecture (3 – tier)	IOT and mobile application
4.	Availability	Distributed servers	IBM cloud and Watson
5.	Performance	Use of cache, better performance	Fast SMS application

## 5.3 USER STORIES

1 Phases	Analysing the river water	Finding the pH level of water	Separation of pure water and dirty water	Recycling of dirty water for agricultural use
High-level steps your user needs to accomplish from start to finish				
2 Steps	Whether the river water is dirty or not Check the surroundings of river water Also find whether the industrial waste are mixing into river water	Check whether the pH is between 6.5 and 8.5 If the pH level is normal we can use it for drinking purpose So finding the drinking level of pH	Using pure water finding machine Normally people identify the pure water by observing the appearance, thickness and colour of water Usage of water purifier to separate pure water and dirty water	Collect the dirty water and send the water to the recycling factory Using chemical components for recycling process Finally recycled water is sent to farmers for agricultural purpose
3 Feelings	<div>           If the river water quality is in correct level, ground water level will increase.            Animals and birds are drinking river water.            The river water is essential for human beings.         </div> <div>           If the river water quality is not good, then the ground water level will get decrease.            If the river water is polluted then animals and birds cannot able to drink water.            Polluted water is not essential for human beings.         </div>	<div>           If the pH level of river water is matches to the pH level of pure water they feel good.            They feel more secure about their environment.            They feel comfortable after drinking pure water daily.         </div> <div>           Polluted water is not essential for human beings.            People may feel that environment is not clean due to river water is polluted.            They use their water daily and also they are feeling that the river water is not good.         </div>	<div>           Supplying some amount of water for commercial uses.            They feel happy about drinking pure water.            They might feel secure without worrying about infection or some other problems, causing less water.         </div> <div>           They also worried about the diseases caused due to the polluted river water.            People need the healthy fishes from river water for selling.            They also worried about the living organism.         </div>	<div>           The recycling water can also be used for some other purpose.            Also used for some industrial purpose.            In manufacturing company they can also use this recycled water.         </div> <div>           Coastal people are the major affected people by river water pollution.            Recycling water is sufficient for industrial purpose.            Is the pure water is available for every day.         </div>
4 Pain points	Chemical waste products from industrial processes are discharge into river. Throwing of sand from river side may cause the river to dry fast. Pollution may occur due to acid rain.	Because of throwing dusts it will create some mess smell. Water pollution may cause diseases. It will affect the Eco system.	This water is harmful for drinking. This causes harm to the organisms living in the river water. Also increasing river water temperature affects the living organisms.	Sewage and waste water are mixing into the river water. Don't throw any solid waste into the water stream as it stops the flow of water thereby leading to pollution. Climate change will affect river water.
5 Opportunities	We use the detector to easily identify our device. Using drone for everytime monitoring. Our device is miniature compared to other devices.	We include sensor for detecting PH level of water. Used solar panel for energy. We insert high quality battery.	Water proof device is used for ensuring safety. By using this device we can also control the PH level of the water. Any time and any where can find the device.	We can give the guarantee about pure water in case of detecting PH level of river water. Control the water quality using this device. Life time of the device is more.

## 6. PROJECT PLANNING & SCHEDULING

### 6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story/ Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	1
Sprint-1	User Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	Medium	2
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	2	High	3
Sprint-2	Interface Sensor	USN-1	A sensor interface is a bridge between a device and any attached sensor. The interface takes data collected by the sensor and outputs it to the	2	High	2
Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	4
Sprint-4	Web Application	USN-1	As a user, I will show the current Information of the River water.	1	Medium	2

## 6.2 SPRINT DELIVERY SCHEDULE

<b>Sprint</b>	<b>Total Story Points</b>	<b>Duration</b>	<b>Sprint Start Date</b>	<b>Sprint End Date (Planned)</b>	<b>Story Points Completed (as on Planned End Date)</b>	<b>Sprint Release Date (Actual)</b>
Sprint-1	20	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022



## 7.CODING & SOLUTIONING

### 7.1 FEATURE 1

```
import time

i=0

while (i<=10):

    i=i+1

    time.sleep(1)

import random

temperature=random.randint(0,30)

humidity=random.randint(1,100)

if temperature<=15:

    print(temperature, "temperature is low")

elif temperature<=25:

    print(temperature, "temperature is normal")

else :

    print(temperature, "temperature is high")

if humidity<=30:

    print(humidity, "humidity is low ")

elif humidity<=60:

    print(humidity, "humidity is normal")

else :

    print(humidity, "humidity is high")
```

## 7.2 FEATURE 2

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 13, 11, 10, 9, 8);

int pirPin=7;

int pirInput=0;

int bulbPin=6;

int photoValue=0;

int tempReading=0,temp1=0,temperature=0;

int fanPin=5;

int gasReading=0;

int greenLed=4;

int yellowLed=3;

int redLed=2;

int piezoPin=0;

void scrollScreenSaver() {

  lcd.clear() ;

  lcd.setCursor(15, 0);

  lcd.print("Welcome");

  lcd.setCursor(15, 1);

  lcd.print("to my home");

  for (int positionCounter = 0; positionCounter < 22; positionCounter++) {

    lcd.scrollDisplayLeft();

    delay(50);

  }

} void setup(){
```

```

lcd.begin(16, 2);

lcd.print("hello, world!");

pinMode(pirPin, INPUT);

pinMode(bulbPin, OUTPUT);
}

void loop()
{
  lcd.setCursor(0, 1);

  lcd.print(millis() / 1000);

  pirInput=digitalRead(pirPin);
  photoValue=analogRead(A0);
  Serial.println(photoValue);

  tempReading=analogRead(A1);
  temperature=(5000.0/1024.0*tempReading/10.0);
  Serial.println(temperature);

  gasReading=analogRead(A2);
  Serial.println(gasReading);
  Serial.println(".....");

  digitalWrite(greenLed,gasReading>100 ? HIGH : LOW);
  digitalWrite(yellowLed,gasReading>200 ? HIGH : LOW);
  digitalWrite(redLed,gasReading>300 ? HIGH : LOW);
  if(pirInput==HIGH)
  {
    lcd.clear();

    lcd.setCursor(0,0);

```

```

lcd.print("Motion Detected");
if(photoValue<300)
{
    digitalWrite(bulbPin,HIGH);
    lcd.setCursor(0,1);
    lcd.print("Light is on");
    delay(1000);
} if(temperature>25)
{
    digitalWrite(fanPin,HIGH);
    lcd.setCursor(0,1);
    lcd.print("          ");
    lcd.setCursor(0,1);
    lcd.print("Fan is on");
    delay(1000);
}
}
else
{
    scrollScreenSaver() ;
}
delay(1000);
digitalWrite(13, LOW);
delay(1000);
}

```

## 8.1 TEST CASES

```
6 temperature is low
88 humidity is high
1 temperature is low
25 humidity is low
11 temperature is low
79 humidity is high
20 temperature is normal
13 humidity is low
9 temperature is low
92 humidity is high
12 temperature is low
42 humidity is normal
17 temperature is normal
75 humidity is high
27 temperature is high
23 humidity is low
13 temperature is low
30 humidity is high
10 temperature is low
4 humidity is low
10 temperature is low
22 humidity is low

...Program finished with exit code 0
Press ENTER to exit console.
```

[illegible]

## 8.2 USER ACCEPTANCE TESTING

The screenshot displays the IBM Cloud Dashboard interface. At the top, the 'Dashboard' title is followed by links for 'Edit dashboard', 'Upgrade account', and a prominent blue 'Create resource' button. Below this, a 'For you' section features a horizontal scrollable list of service tiles. The first tile, 'Build', is highlighted with a blue-to-purple gradient. Other tiles include 'Explore IBM Cloud Shell', 'Create and deploy an application', 'Visit the IBM Cloud catalog', 'Build a web app with Watson Speech to Text', and 'Invite Users'. Each tile provides a brief description and a 'Getting started' button with an estimated time. The bottom of the dashboard contains a 'News' section with two articles, and three status-related sections: 'Recent support cases', 'Planned maintenance', and 'IBM Cloud status' (which includes a server status visualization).

Dashboard ▾ Edit dashboard Upgrade account Create resource +

For you Select an option ▾

**Build**  
Explore IBM Cloud with this selection of easy starter tutorials and services.

**Explore IBM Cloud Shell**  
Try a command-driven approach for creating, developing, and deploying a web project.  
Getting started 2 min

**Create and deploy an application**  
Browse our starter kits, and then select one to jump start the process to create and deploy your app.  
Getting started 5 min

**Visit the IBM Cloud catalog**  
Explore our unique product catalog that contains 190+ services and software for your business solutions.  
Getting started 1 min

**Build a web app with Watson Speech to Text**  
Deploy a conversational interface compatible with any application, device, or channel.  
Getting started 15 min

**Invite Users**  
Invite users to join your account and get started on something new.  
Recommended 3 min

**News** View all  
WebSphere Application Server Support Restatement  
IBM Adds Lifecycle Services to Enterprise Networking and Deepens Strategic Partnership with Cisco

**Recent support cases** View all

**Planned maintenance** View all

**IBM Cloud status** View all

## **9. RESULTS**

### **9.1 PERFORMANCE METRICES**

The proposed system can provide an efficient IoT-based dynamic, continuous, and real time online monitoring of the industrial wastewater discharged into wastewater treatment plants, as well as remote control of the water's path to avoid all forms of damage. The system is designed for low cost, small size, high sensitivity, easy operation, and lightweight. It minimizes the time involved in lab testing. The results are recorded in the cloud so that any previous data of testing can be selected easily. No wired Networks were used. The system has more scalability of sensors and reduces power consumption: it is easy to add new sensors and new IoT devices, and more than two sensors can be connected to one IoT module. The wastewater department can easily analyse the data and make reports. Using IoT, an integrated sensor is used to analyse the accuracy of data in real-time. These sensors could share data among various wastewater stations in the city because they are connected to IoT networks. Further, SMS notifications keep all administrators up to date on all events and allow for continuous follow-up, making control, monitoring, and decision-making easier. It reduces the manpower as less manual work is needed. The government can identify the company that discharged illegal industrial wastewater based on the data and act against the guilty parties. Network management enables users to connect to any available WIFI network for flexibility of use in different locations, rather than being restricted to a fixed WIFI network in the current location. Communication management supports auto transfer mode between WIFI and GPRS connections in the case of WIFI disconnection to ensure continuous data transfer. The primary advantage of any system is that the operators in each station have fast access to various reports to make decisions. The proposed system has the advantage of enabling remote ON/OFF Control in different wastewater stations. The proposed system provides various alert options.

## **10. ADVANTAGES & DISADVANTAGES**

### **ADVANTAGES:-**

- The boat is mobile in nature and hence large number of samples are easily collected from different locations in less time.
- It is very easy to maintain the IoT based water quality monitoring system as all the electronic boards are available in the boat itself.
- The system is very cheap as the hardware and software does not cost much.

- Machine learning techniques have made it very easy to plot the data collected in various formats for proper analysis.
- Cloud storage platforms such as adafruit, azure helps in storing the sensor data immediately and wirelessly to the robust servers.

#### DISADVANTAGES:-

- 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 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.

## 11. CONCLUSION

Our main intentions of this research work were to create a small, economical, flexible,easily configurable, and portablesystem that could monitor, and control industrial wastewater discharged into waste water treatment plants and prevent damage in the treatment process and equipmentandprotect the workers which are not qualified to deal with such type of water. Realtime data accesscan be done by using remote monitoring and Internet of Things (IoT) technology.

Data collectedatthe apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through SparkMLlib, Deep learning neural network models,Belief Rule Based (BRB) system and is also compared with standard values.Also it assures lowcost 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 batteryis 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 turbidityof 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 an healthy manner is provided by our cost efficient quality monitoring and control system.



which is market affordable and greatly life saving factor for people using river water. The environment around consists of five key elements e.g., soil, water, climate, natural vegetation, and landforms. Among these water is the utmost crucial element for human life. It is also vital for the persistence of other living habitats. Whether it is used for drinking, domestic use, and food production or recreational purposes, safe and readily available water is the need for public health. The system can achieve reliability and feasibility in the monitoring processing by verifying the parameters of water and the warnings notifications which made the system more flexible and controllable. This research protects the natural ecosystem of water resources. Based on the comparison study, the proposed system was found to outperform the existing system and related work.

## **12. FUTURE SCOPE**

More water parameters will hopefully be added in future work so that all water parameters can be analysed. Further improvisation will develop a custom dashboard using the mobile application would be ideal for such application in consumer networks. This research protects the natural ecosystem of water resources. Based on the comparison study, the proposed system was found to outperform the existing system and related work. Physical parameters such as DO, turbidity, conductivity, Residual Chlorine, waste water Flow will be added to the system using additional sensors to propose a complete SCADA system that integrates with IoT technology for real-time monitoring of all pumping stations and treatment plants. Automatic control of all equipment was done based on results and sending SMS notifications for abnormal values and necessary actions to be taken by the users. Further more it is vital to protect sensor data communication via wireless networks from intrusion. Machine learning will be used to supplement the system, which will be a terrific addition to the system in keeping.

## **13. APPENDIX**

### **SOURCE CODE**

```
import random
print('Hazardous Water Level=',str(random.randint(0,100)))
print('Temperature=',str(random.randint(0,100)))
print('Humidity=',str(random.randint(0,100)))
print('Pressure=',str(random.randint(0,100)))
```

Idle - 8/python/ibm.py (3.10.0)

File Edit Format Run Options Window Help

```
import random
print('Hazardous Water Level=',str(random.randint(0,100)))
print('Temperature=',str(random.randint(0,100)))
print('Humidity=',str(random.randint(0,100)))
print('Pressure=',str(random.randint(0,100)))
```

Python 3.10.0

File Edit Shell Debug Options Window Help

Python 3.10.0 (tags/v3.10.0:b494f59, Oct 4 2021, 19:00:16) [MSC v.1929 64 bit (AMD64)] on win32  
Type "help", "copyright", "credits" or "license()" for more information.

```
>>>
===== RESTART: Shell: python/ibm.py =====
Hazardous Water Level= 45
Temperature= 56
Humidity= 13
Pressure= 1
```

```
>>>
===== RESTART: Shell: python/ibm.py =====
Hazardous Water Level= 13
Temperature= 97
Humidity= 87
Pressure= 95
```

Ln 15 Col 0



