

PROJECT REPORT

Real-Time River Water Quality Monitoring and Control System

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INTRODUCTION

1.1 PROJECT OVERVIEW

Water pollution is a foremost global problem which needs ongoing evaluation and adaptation of water resource directorial principle at the levels of international down to individual wells. It has been studied that water pollution is the leading cause of mortalities and diseases worldwide. River water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. The system consists of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The most important function of the system is to ensure that the data collected from the sensor reflects the actual aquatic scenario and the data are transmitted and delivered as a display of information in the web or as a short message service (SMS) sent to pre-identified key users in a timely manner.

1.2 PURPOSE

Monitoring provides objective evidence necessary to make sound decisions on managing river water quality today and in the future. River water quality monitoring is used to alert us to current, on going and emerging problems and to determine compliance with river water standards and to protect the other beneficial uses of water.

LITERATURE SURVEY

1.3 PROBLEM STATEMENT

Water is a finite resource that is necessary for agriculture, industry and the survival of all living things on the planet, including humans. Many people are unaware of the need of drinking adequate amounts of water on a daily basis. Many unregulated methods waste more water. Poor water allocation, inefficient consumption, lack of competent and integrated water management are all factors that contribute to this problem. Therefore, efficient use and water monitoring are potential constraint for home or office water management system.

1.4 REFERENCES

1) IoT-based System for Real-time Water Pollution Monitoring of Rivers

Mohammad Ariful IslamKhan;Mohammad AkidulHoque; Sabbir Ahmed

IEEE September 2021

INFERENCE:

The research proposes a system to remotely monitor the water quality of a river so that the authorities can gather better insights about the condition of that particular river and predict the critical future phenomena.

2) Design and Implementation of Real Time Approach for The Monitoring of Water Quality Parameters

Siti Aishah Binti Makhtar;Norhafizah Binti Burham;Anees Bt Abdul Aziz

IEEE - June 2022

INFERENCE:

Access to safe drinking water is essential to nurturing human life on earth. Polluted air and unsanitary water can cause health problems. Unhygienic water can cause stomach and health-related problems.

3) An IoT Based Smart Water Quality Monitoring System using Cloud

Ajith Jerom B.; R. Manimegalai; R. Manimegalai

IEEE – April 20203)

INFERENCE:

Other sources of pollution include agricultural runoff and unregulated small scale industry that results in polluting, most of the rivers, lakes and surface water in India. In this paper, An IoT Based Smart WaterQuality Monitoring Systemusing Cloud and Deep Learning is proposed to monitor the quality of the water in water-bodies.

4) IoT Based Real-time River Water Quality Monitoring System

Mohammad Salah UddinChowdury, Talha BinEmran

Science Direct – 2018

INFERENCE:

This paper proposes a sensor-based water quality monitoring system. The main components of Wireless SensorNetwork (WSN) include a microcontroller for processing the system, communication system for inter and intra node communication and several sensors.

5) A Development and Implementation of Water Quality Assessment Monitoring (WQAM) System using the Internet of Things (IoT) in Water Environment

Muhammad Farhan Johan, S. Abdullah, A. Zanal Saurabh S.

Soman, Hamidreza Zareipour, Om Malik JEVA

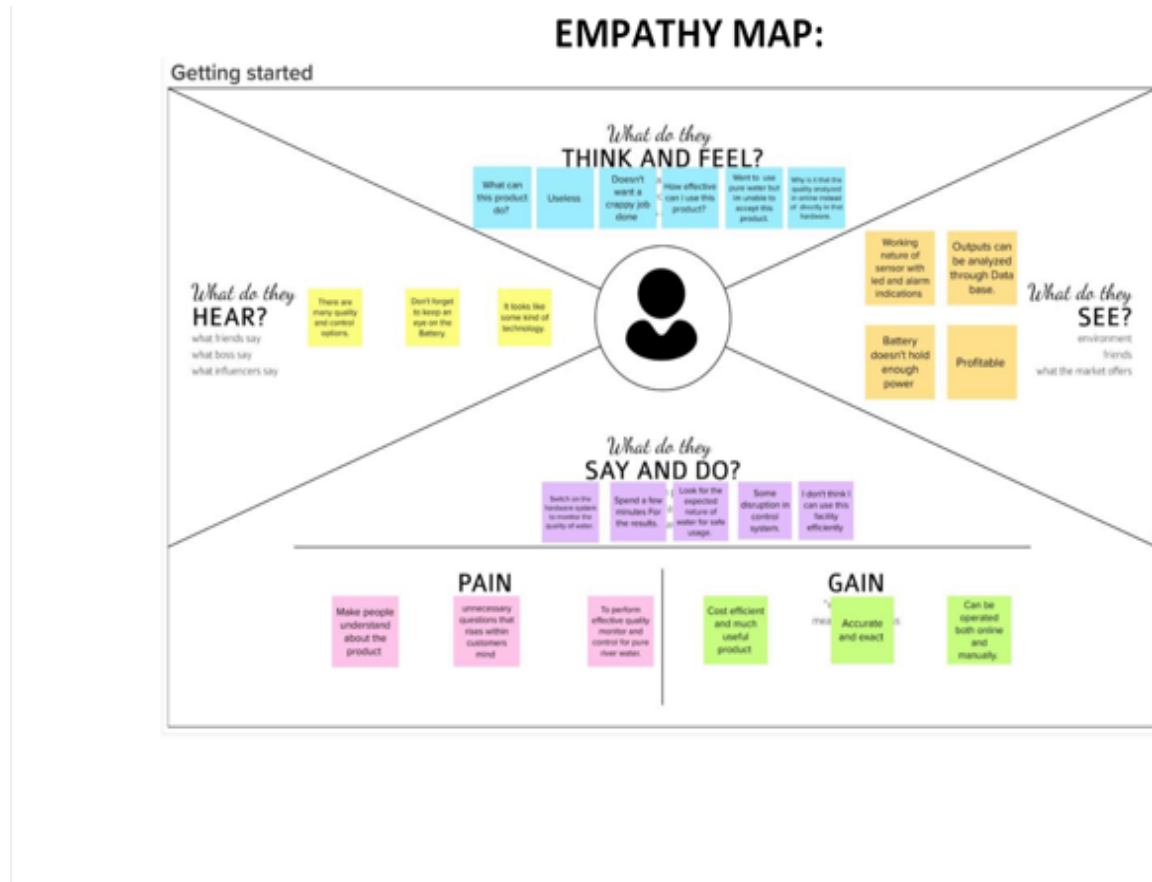
- 23 November 2021

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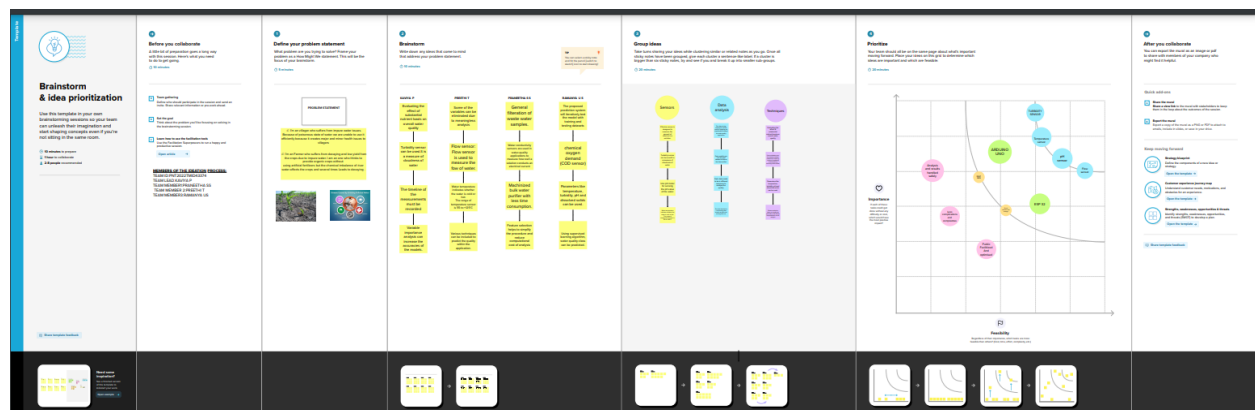
This paper presents the development and implementation of Water Quality Assessment and Monitoring (WQAM) system. The system development used Wi-Fi enabled microcontroller to connect with the IoT environment and store the data in the IoT cloud server.

IDEATION AND PROPOSED SOLUTION

1.6 EMPATHY MAP




1.7 IDEATION AND BRAINSTORMING



1.8 PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	To Control the impure water issues & to avoid decaying crops due to unhealthy water.
2.	Idea / Solution description	Monitoring water parameters by using Arduino and Sensors and control measures by ultrasonic frequency.
3.	Novelty / Uniqueness	Using Wireless sensor network to monitor the quality of water
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.

1.9 PROBLEM SOLUTION FIT

PROBLEM SOLUTION FIT DOCUMENT		Purpose/Vision	
Define CS fit into CC	1.CUSTOMER SEGMENT(S) Government authorities, Farmers and Drinking Water supplier.	6.CUSTOMER CONSTRAINTS River water quality analysis replaces the need for using laboratory checking and reduces the time of delay required for result. The give instant solutions and suggestions like what it is and what can be done to change.	5.AVAILABLE SOLUTIONS This work presents the architecture of river water monitoring systems based on contemporary IoT communication technology, AI, and Wireless Networks. AI-based IoT applications to boost and save time for results and suggestions to the problems.
	2.JOBS-TO-BE-DONE / PROBLEMS <ul style="list-style-type: none"> Check the water quality. Check the level of chlorine in water. Check temperature of water. Check the pH level of water. Find if the water is suitable for drinking, agriculture and aquaculture. 	9.PROBLEM ROOT CAUSE Root Cause Analysis supported by input from the problems-sufferers, instruction manual studies, comparing design and actual operating data, gathering know how from relevant literature, tech journals articles and advertisements especially on new products.	7.BEHAVIOUR Understand this decision-making process, the study attempts to assess river water monitoring technology model based on available resources, prevailing social and economic conditions and personal aspects of users India.
Focus on I&P tap into B Project Design Phase-I	3.TRIGGERS River water quality analysis work by checking the river water quality for providing clean drinking water for the people, farming, promoting aquaculture and other industries. It is a best replacement for checking water quality in laboratories. <u>The best quality is that it is user friendly.</u>	10. YOUR SOLUTION <ul style="list-style-type: none"> Implement IOT based river water quality monitoring system to get instant results. Suggestions can be made to solve if any problem arises. 	8.CHANNELS OF BEHAVIOURS Online portal for making recommendations for problems based on pH parameters using Machine Learning.
	4.EMOTIONS: BEFORE /AFTER Without river water quality analysis it becomes difficult for government authorities, farmers, water suppliers and many more to analyze the quality of water for their purpose. After river water quality analysis, <u>the process is made much simpler and easy to use.</u>		
Identify strong TR&EM			

REQUIREMENT ANALYSIS

1.10 FUNCTIONAL REQUIREMENT ANALYSIS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User registration	Registration with Gmail Create an account By Following the instructions
FR-2	User Authentication	The credentials are accessible only to the authorized users to access the model.
FR-3	User Confirmation	Confirmation via Alarm Confirmation via SMS
FR-4	Interface sensor	Interface sensor-temperature sensor, turbidity sensor, etc. If contaminated water is present in the river, it gives alarm.
FR-5	Accessing datasets	Datasets are retrieved from Cloudant DB server
FR-6	Mobile application	Can see water is contaminated or not. Can control the motor to stop the flow of contaminated water

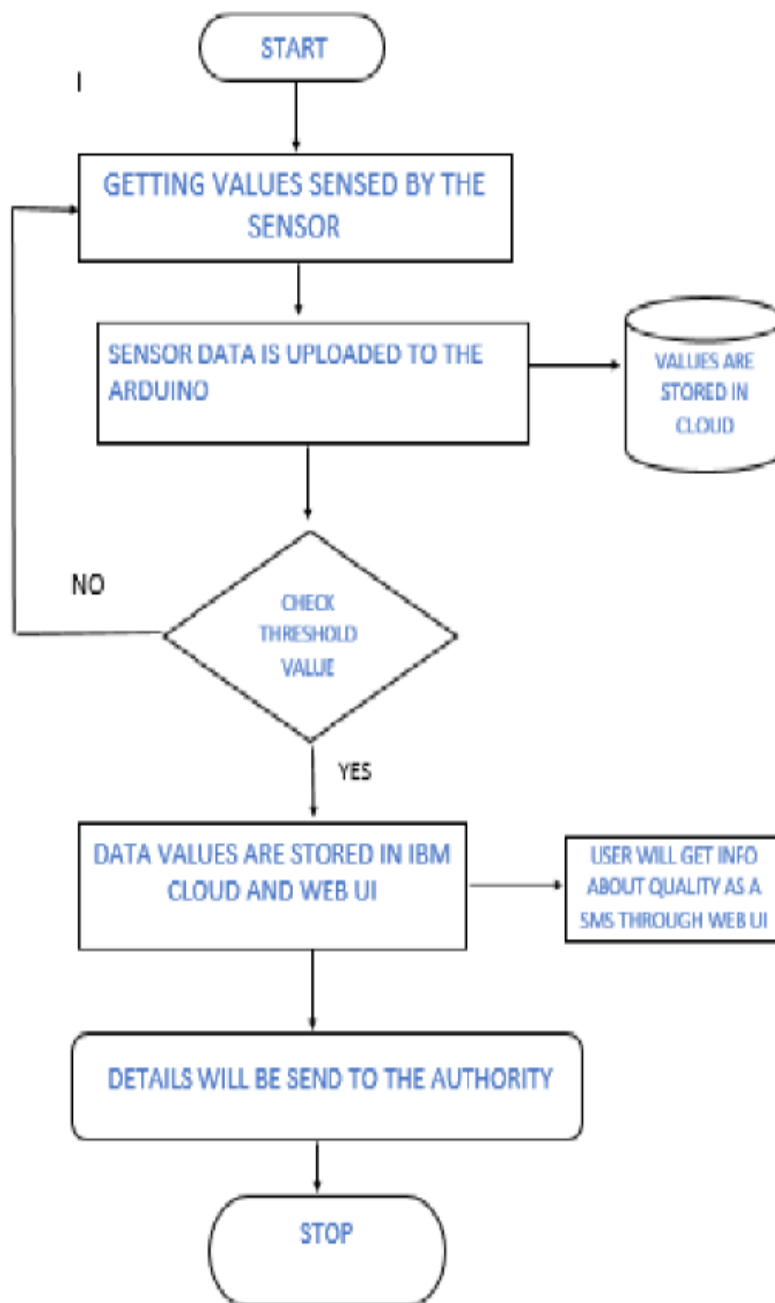
1.11 NON FUNCTIONAL REQUIREMENTS

Following are the non-functional requirements of the proposed solution

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The smart protection system defines that this project helps people to protect the drinking water and agriculture.
NFR-2	Security	We have designed this project to secure the water from contaminated water or chemical or sewage.
NFR-3	Reliability	This project will help people's in protecting their water and save them from several diseases
NFR-4	Performance	IOT devices and sensors are used to alert the station control person by a message when water in the river is contaminated and not suitable for drinking.
NFR-5	Availability	By developing and deploying resilient hardware and software we can protect the river from contamination chemicals, sewage etc.... and also thereby can alert the people about any contamination if happened and also can protect them from several diseases. This project can be implemented in every river across the country
NFR-6	Scalability	This project used to collect real time information in water and measure quality

PROJECT DESIGN

1.12 DATA FLOW DIAGRAM



1.13 SOLUTION AND TECHNICAL ARCHITECTURE

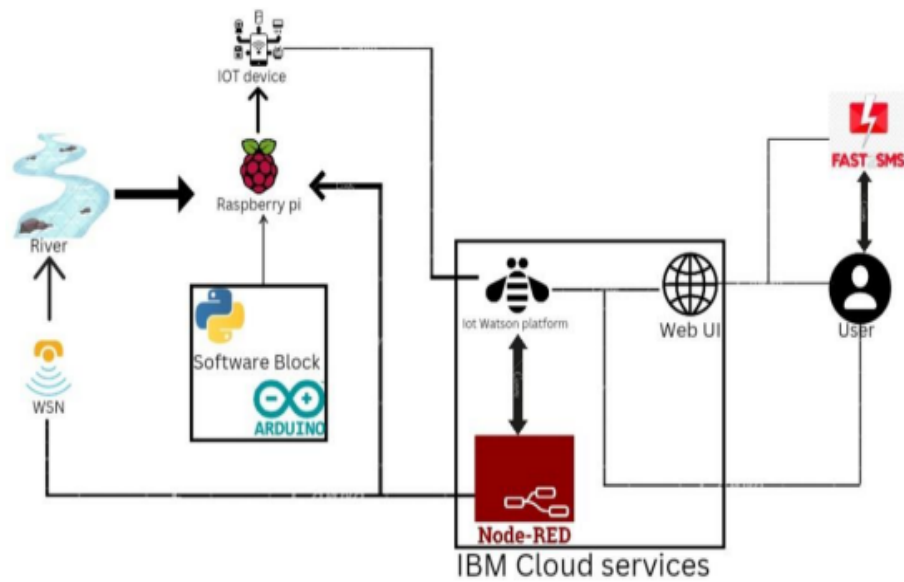
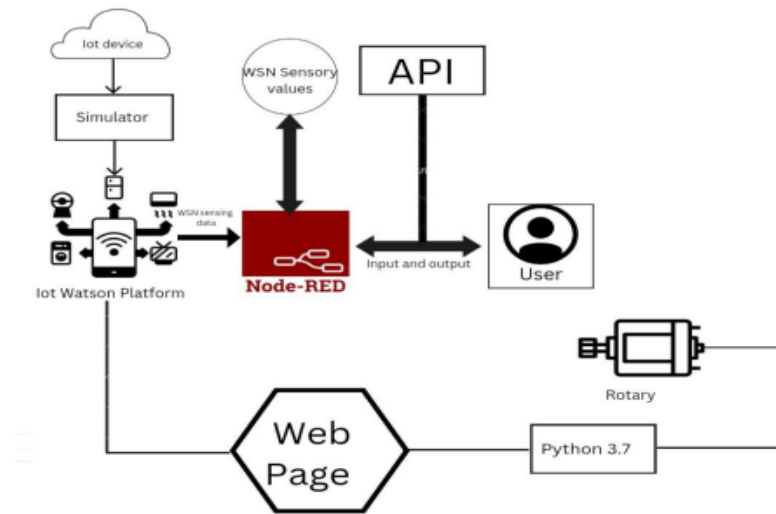


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js /React Js 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 service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
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, Hive mqttt etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	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
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Open source framework Wokwi, IBMwatson, NodeRed
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 (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc	Technology used

1.14 USER STORIES

Real Time River Water Quality Monitoring And Control System PNT2022TMD43374						
		PREREQUISITE	PROJECT FLOW	WORKING	BENEFITS	OUTCOME
Steps		How does someone initially become aware of this product?	What do people experience as they begin the process?	In the core moments in the process, what happens?	What do people typically experience as the process unfolds?	What happens after the experience is over?
Customer experience journey map Use this framework to better understand customer needs, motivations, and obstacles by illustrating a key scenario or process from start to finish. When possible, use this map to document and summarize interviews and observations with real people rather than relying on your hunches or assumptions. Created in partnership with:	Identify Research, testing, observing, and using a local city tour	Our goal can be achieved by analyzing and computing of real time data to implement the measures to be taken to purify the river water. For this IoT and WSN play a vital role to group things.	For an ideal water treatment or storage process we need efficient solution. For this a large water treatment unit is used. It is a water treatment unit that has been designed for large scale use. It is a water treatment unit that has been designed for large scale use. It is a water treatment unit that has been designed for large scale use.	A bit interaction system created between BM cloud and IoT platform is constructed to monitor the data generation. This is developed in an android app which is developed for the customers to view the sensor information via mobile. A effective message system developed that provide notifications and warnings.	The hazardous nature of water containing unconditional physical and chemical aspects are taken care of and assures perfectly purified river water resource.	HIGH FREQUENCY AND MOBILITY GAUARENTEED BY THIS SYSTEM CAN IMPROVE THE WATER QUALITY WHICH CAN BE USED FOR DRINKING PURPOSE. AUTHORITIES LINKED TO THIS PRODUCT CAN TAKE MEASURES IF CONTACTED.
	Survey Details What interactions do they have at each step along the way? Existing systems Product placement Need for the project	To access the data collected by the system we just need to use internet of things and time continuous monitoring unit. This can be provided by the WSN which makes for the internet sensing technology needed for data collection. We can then visual format on android using the cloud computing system through machine learning in Python. Computational neural networks is used to comparison of values.	So the product is basically a smart technology for river quality monitoring such a way designed to analyze the pH, temperature and turbidity of water	If the safety level of water exceeds basic scale on a fast SMS is sent by the agent as an alert.	The knowledge through SMS gives people consciousness of contaminated water and to stop pollution of it further more also involves them in teachings.	An efficient water management system can be developed as said before there are innovative chances given with the platform in the system design.
	Goals & motivations At each step, what is a person's primary goal or motivation? (They are...? They are...?)	SINCE WATER CONSISTS OF MORE THAN SEVERAL ISSUES TO MEET WITH THE CONSTRAINTS MORE NUMBER OF SENSORS ANALYSING AND COMPUTING RESULTS BASED ON CONDITION OF WATER IS DEMANDED BY THE CUSTOMER	the core point is to create a time continuous system that can monitor the quality of water using WSN and ZIGBEE for allow power cost efficient system.	there are two options of storage in this system we can either use cloud storage or external memory that can be locally used to gain sensed parameters.	Low cost is the first priority from all users that is satisfied yet another constraint making our customer's happy is that it is a high performance gain system in low cost.	Manual operations consumes time and energy and are unreliable due to change in reading occasionally which is solved by this system providing energy and time saving and high accuracy.
	Advantages What does this a typical person find attractive, positive, fun, compelling, delightful, or useful?	Water qualities analyzed through the pH and temperature sensors are computed and are stored in DBMS for the turbidity, pH, temperature factors of river water to be controlled using IoT device.	the interfacing of multiple sensor nodes using WSN architecture is critically implemented in the controller using IoT platform, which itself make an dynamic powerful system to use.	The different sensor nodes each connected via WSN are dynamically involving in river water physical and chemical parameter analysis and collection of values which is efficient and quick	IoT makes integration of all the components as analytical interfacing block. DBMS and IoT device for innovation, in turn gives people to learn, acknowledge and develop the product system.	As per design we used a low power consuming high end power source that can create long durability and extra life, which creates flexible system at low cost.
	Disadvantages What does this a typical person find frustrating, confusing, warning, costly, or time consuming?	On one hand customer had disbelief in the product. Also thought may malfunction due to placement of the system deep in the water.	The disadvantage is maintenance such as dysfunctional battery power source needs to be periodically replaced.	Animal water crossing, accidental human interferences and calamities can affect the mounted WSN to be damaged	Since a complex battery for low power units is used the methods are not abundant and also the resources for maintenance. Hence maintenance may cost some people money.	other sensors too can be included.
	Required Areas How might we make each step better? What does the user need? What have others suggested?	These types are products highly required in fields of a portable and real time water quality monitoring system, also in prototype remote and automatic system in low cost manufacture.	The water quality is to be maintained as the important factor is monitoring, this has to be improved as from the values inferred that water can support living standards and see whether system is functional.	24/7 customer is open to the sensing parameter and data streams which enables them to have a reliable system providing instantaneous alert for changes in the system.	Now with this system everyone can demand a fresh river water resource instead of drinking polluted water.	large variety of applications and innovative ideas can be derived from this technology

PROJECT PLANNING & SCHEDULING

1.15 SPRINT PLANNING AND 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	P.Kaviya, T. Preethi
Sprint-2	confirmation	USN-2	As a user, I will receive confirmation emailonce I have registered for the application	1	High	Praneetha S S Ramanya U S
	IBM cloud service access		Get access to ibm cloud services	2	High	
Sprint-3	Create the IBM Watson IOT and Device Settings	USN-6	To create the IBM watson platform and integrate the microcontroller with it ,to send the sensed data and cloud	2	High	RamanyaU S, Preethi T, Kaviya P, Praneetha S S

	Create a Nodered Service	USN-7	TO create a nodered service to intergrate the IBM watson along with the web UI	2	Medium	
	Create a Web UI	USN-8	To create a web UI,to access the data from the cloud and display all the parameters	2	Medium	
	To develop a python code	USN-9	Create a python code to sense the physical quantity and store data.	2	Medium	
Sprint-4	Publish data to cloud	USN-10	Publish data that is sensed by the microcontroller to the cloud	3	High	P. Kaviya, T.Preethi, Praneetha S S ,Ramanya U S
	Fast SMS service	USN-11	Use fast SMS to send alert message to once the parameters like pH,turbidity and temperature goes beyond the threshold	3	High	

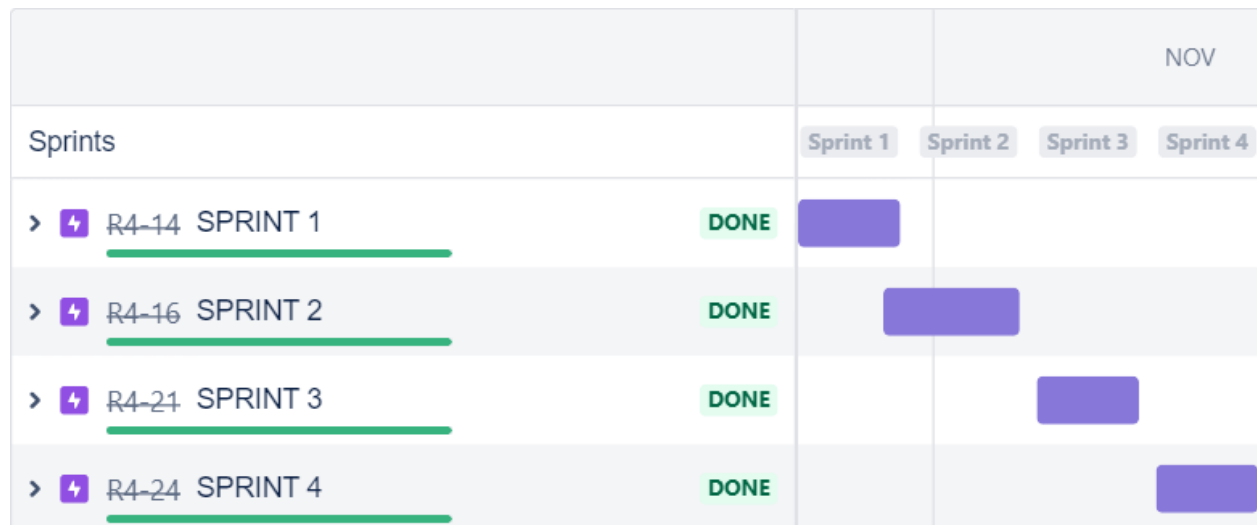
	Testing	USN-1 2	Testing of project and final deliverables	3	Medium	
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1.16 SPRINT DELIVERY SCHEDULE:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	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

1.17 REPORTS FROM JIRA

ROADMAP:



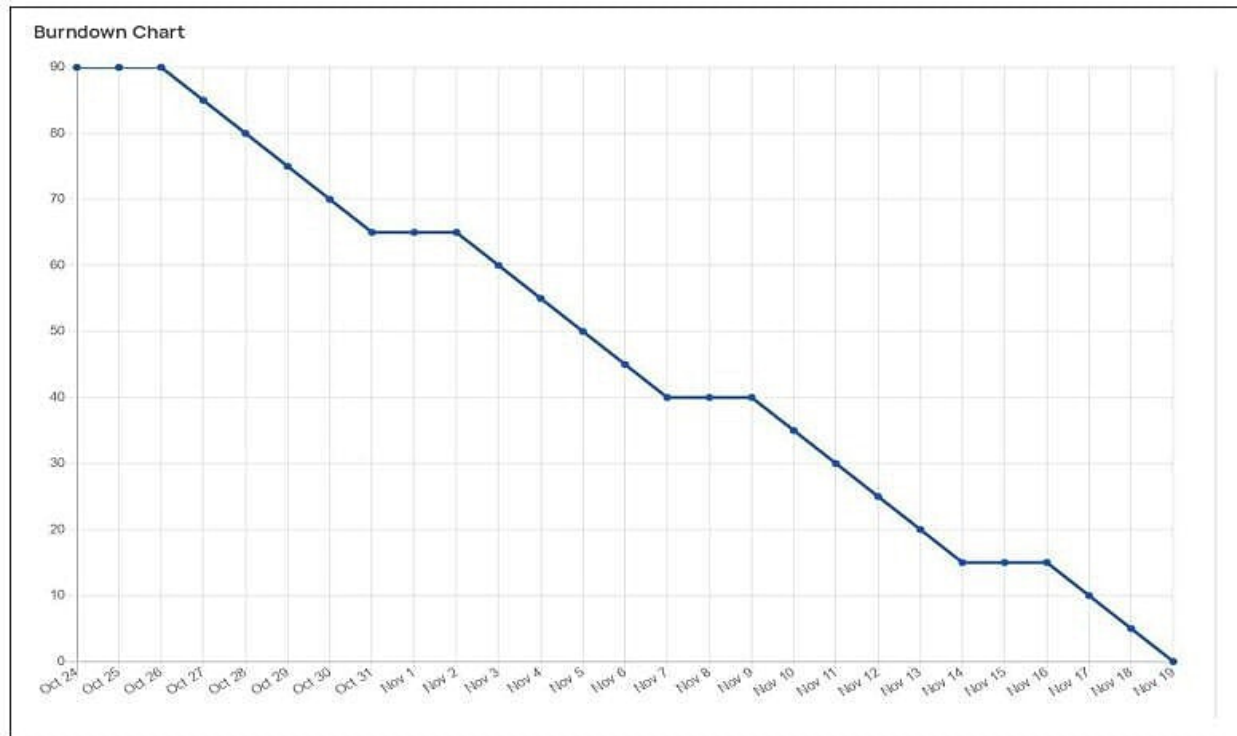
$$\begin{aligned} \text{AV} &= \text{Sprint duration} / \text{Velocity} = 20/10 \\ &= 2 \end{aligned}$$

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

Burndown Chart:

A burndown chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burndown charts can be applied to any project containing measurable progress over time.



CODING AND SOLUTIONING

DEVELOPMENT OF PYTHON SCRIPT

Importing the library functions:

```
1 import ibmiotf.application
2 import ibmiotf.device
3 import time
4 import random
5 import sys
```

IBM watson device credentials:

```
9 organization="gdkgkx"
10 deviceType="kprp"
11 deviceid="2222"
12 authMethod="token"
13 authToken="na)UXp4FW0jf1iJh0n"
14
```

Generate random values for pH and turbidity:

```
18 def myCommandCallback(cmd):
19     print ("command received: %s" % cmd.data)
20     if(cmd.data['command']=="MOTOR_ON"):
21         print('motoron')
22     elif(cmd.data['command']=="MOTOR_OFF"):
23         print('motoroff')
24     try:
25         deviceOptions={"org": organization,"type": deviceType,"id": deviceid,"auth-method":authMethod, "auth-token":authToken}
26         deviceCli = ibmiotf.device.Client(deviceOptions)
27
28     except Exception as e:
29         print ("caught exception connecting device %s" %str(e))
30         sys.exit()
```

connect and sending data:

```
35 deviceCli.connect()
36
37 while True:
38     pH=random.randint(0,14)
39     turb=random.randint(0,250)
40     temp=random.randint(0,40)
41
42     data={'pH':pH,'Turbidity':turb,'Temperature':temp}
43     print(data)
44     def myOnPublishCallBack():
45         print("pH Value of Water %s " %pH)
46         print("Turbidity Value of Water %s " %turb)
47         print("Temperature Value of Water %s " %temp)
48     success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=myOnPublishCallBack)
49     if not success:
50         print ("Not connected to IoT")
51     time.sleep(2)
52
53     deviceCli.commandCallback=myCommandCallback
```

Disconnect the device from the cloud:

```
58 deviceCli.connect()
```

TESTING

1.21 USER ACCEPTANCE TESTING

1. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	5	4	3	21
Duplicate	2	0	2	0	4
External	3	4	1	2	10
Fixed	10	1	5	17	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	2	3
Won't Fix	0	3	3	1	7
Totals	24	13	17	25	79

2. Test case Analysis:

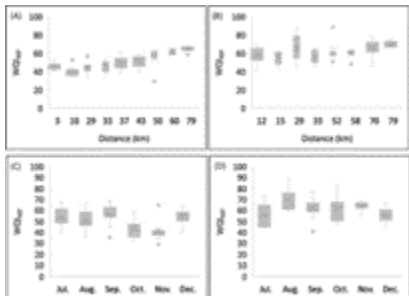
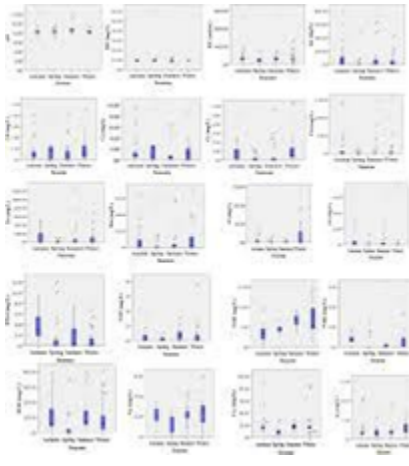
This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	15	0	0	15
Client Application	45	0	0	45
Security	1	0	0	1

Outsource Shipping	2	0	0	2
Exception Reporting	10	0	0	10
Final Report Output	4	0	0	4
Version Control	3	0	0	3

RESULTS

1.23 PERFORMANCE METRICS

S.no	Parameter	Values	Screenshot
1.	Model summary	Real time river water quality monitoring system is based on iot which is implemented such a way for best product performance.	
2.	Accuracy	<p>Training accuracy- While training the start point may be front end or back end.so there is no disturbance while training as objects,modules and methods are perfectly implemented.</p> <p>Validation accuracy-</p>	

		<p>Risk management is immediate and efficient as risk resources act immediately.its because resources are implemented long before testing of products.</p>	
3.	<p>Confidence level(only yolo project)</p>	<p>Class detected- Yes Confidence score- 90%</p>	<p>The figure contains two line graphs side-by-side, both titled 'MV normal, variance ratio 1:1'. The x-axis for both graphs is 'n', with values 5, 10, 15, 20, 30, 40, 50. The left graph's y-axis is 'Type I error rate (%)' ranging from 0 to 40. It shows four data series: Wilks (green line with circles), Pillai (red line with circles), Hotelling (purple line with circles), and Roy (blue line with triangles). The Roy test consistently shows the highest Type I error rate, starting around 35% at n=5 and fluctuating between 30% and 35% for higher n. The other three tests (Wilks, Pillai, Hotelling) are clustered together, showing a Type I error rate that remains very close to 5% across all values of n. The right graph's y-axis is 'Empirical power (%)' ranging from 0 to 100. It shows the same four data series. All four tests show a rapid increase in empirical power as n increases, starting from approximately 20-30% at n=5 and reaching nearly 100% by n=30, with the curves for all four tests being very similar.</p>

ADVANTAGES AND DISADVANTAGES

Any system of its own has both advantages and disadvantages. The advantages and disadvantages of this model are as follows

ADVANTAGES:

Using this system has many advantages. Some of them are:

- can provide valuable data on the condition of a particular body of water.
- allowing you to accurately create a water management plan with the data.
- analyse data continually and instantly alert users to changes in system.
- allowing easy access of all the data in one place, accessible via any enabled device.
- protect human health and avoid the costs related to medical care, productivity loss, and even loss of life.

DISADVANTAGES:

Using this system has some disadvantages. Some of them are:

- Not reliable for long distance can only apply to single source of water.
- The system is less effective as sensors are installed very deep inside the water and their positions are fixed
- The sensors are very expensive. Moreover their maintenance cost is also very high. This leads to higher cost on the regulatory body.
- The sensors which work on power source may often required to be replaced in case of malfunctioning.
- Mounted Sensors may get damage during natural disasters and often by aquatic animals.

CONCLUSION

Water turbidity, PH, and temperature are monitored using a water detection sensor that has a unique advantage and is already connected to a GSM network. The technology can automatically monitor water quality, is low-cost, and does not require personnel to be on duty.

As a result, water quality testing will most likely be more cost-effective, convenient, and quick. The method is very adaptable. This system may be used to monitor different water quality metrics by simply replacing the matching sensors and modifying the required software packages. The procedure is straightforward. The system can be expanded to track hydrologic, air pollution, industrial, and agricultural output, among other things. It is widely used and has a large number of applications. Keeping embedded devices in the environment for monitoring allows the environment to protect itself (i.e., smart environment).

This will necessitate the deployment of sensor devices in the environment for data collection and processing. We can bring the environment to life by placing sensor devices in it, allowing it to communicate with other things over the network. The end user will then have access to the collected data and analysis results via Wi-Fi.

FUTURE SCOPE

The future scope of this project is monitoring environmental conditions, drinking water quality, treatment and disinfection of waste water etc. This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

Main Improvements can be done in:

- Connections between nodes and base station are via WSN, while connections among different base stations are via Ethernet. The Ethernet can also be connected to Internet so that users can login to the system and get real time water quality data faraway Process Improvement
- The wireless data acquisition from remote places and database storage is the supporting structure of the system which can be used for further research studies like soil content analysis using different simulators.
- Finally, the prototype system with a single sensor node and base station is designed and implemented. Real-time water quality data can be seen from a GUI window in PC.

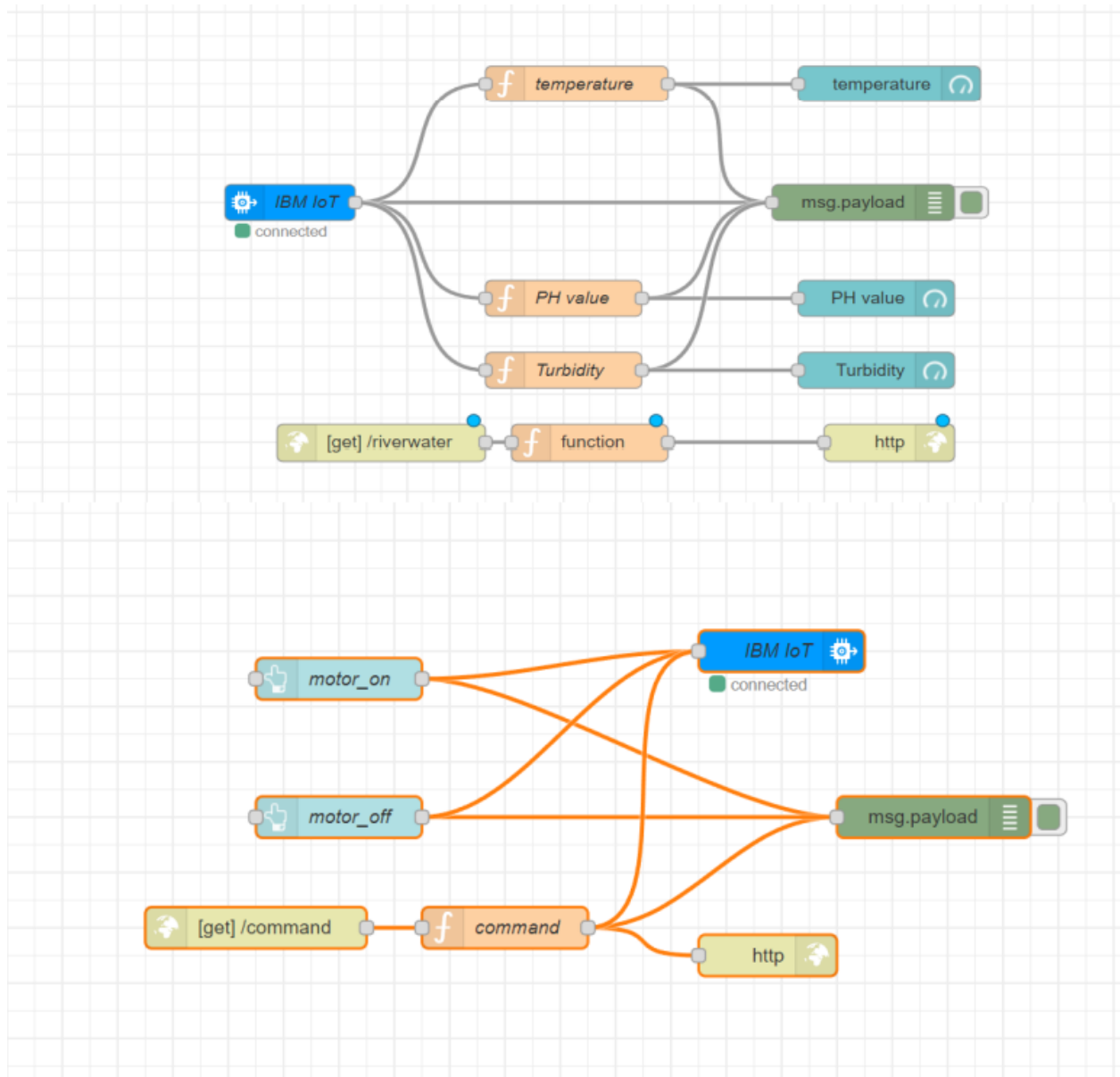
APPENDIX

SOURCE CODE

```
1  import ibmiotf.application
2  import ibmiotf.device
3  import time
4  import random
5  import sys
6
7  #ibm watson device credentials
8
9  organization="gdkgkx"
10 deviceType="kprp"
11 deviceId="2222"
12 authMethod="token"
13 authToken="na)UXp4FW0jf1iJh0n"
14
15 #generate random values for pH and turbidity
16
17
18 def myCommandCallback(cmd):
19     print ("command received: %s" % cmd.data)
20     if(cmd.data['command']=="MOTOR_ON"):
21         print('motoron')
22     elif(cmd.data['command']=="MOTOR_OFF"):
23         print('motoroff')
24
25 try:
26     deviceOptions={"org": organization,"type": deviceType,"id": deviceId,"auth-method":authMethod, "auth-token":authToken}
27     deviceCli = ibmiotf.device.Client(deviceOptions)
```

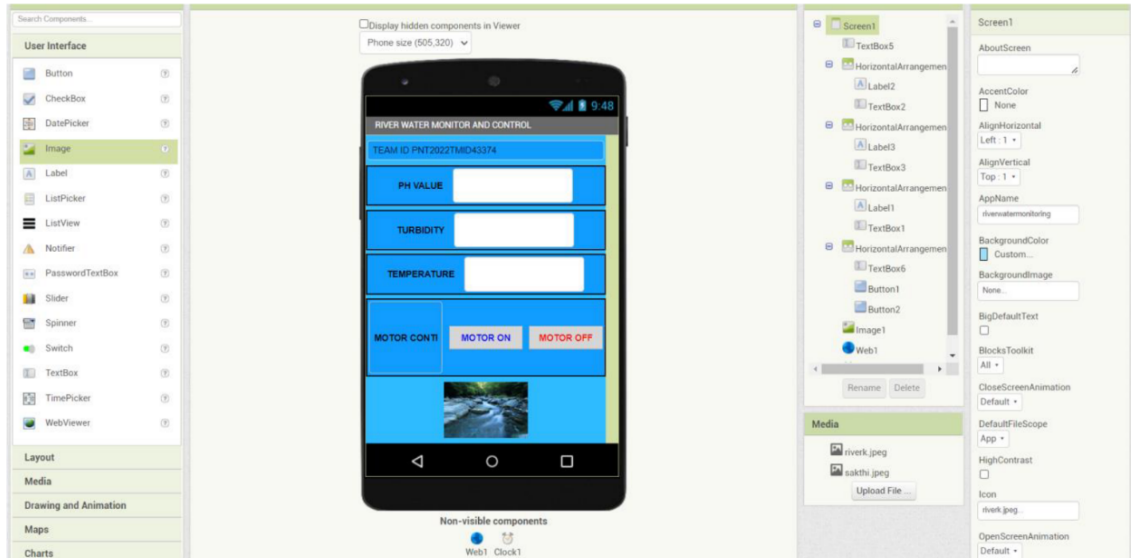
```
28 except Exception as e:
29     print ("caught exception connecting device %s" %str(e))
30     sys.exit()
31
32
33 #connect and sending data
34
35 deviceCli.connect()
36
37 while True:
38     pH=random.randint(0,14)
39     turb=random.randint(0,250)
40     temp=random.randint(0,40)
41
42     data={'pH':pH,'Turbidity':turb,'Temperature':temp}
43     print(data)
44     def myOnPublishCallBack():
45         print("pH Value of Water %s " %pH)
46         print("Turbidity Value of Water %s " %turb)
47         print("Temperature Value of Water %s " %temp)
48     success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=myOnPublishCallBack)
49     if not success:
50         print ("Not connected to IoT")
51         time.sleep(2)
52
53     deviceCli.commandCallback=myCommandCallback
54
55
56 #disconnect the device from the cloud
57
58 deviceCli.connect()
```

NODE RED

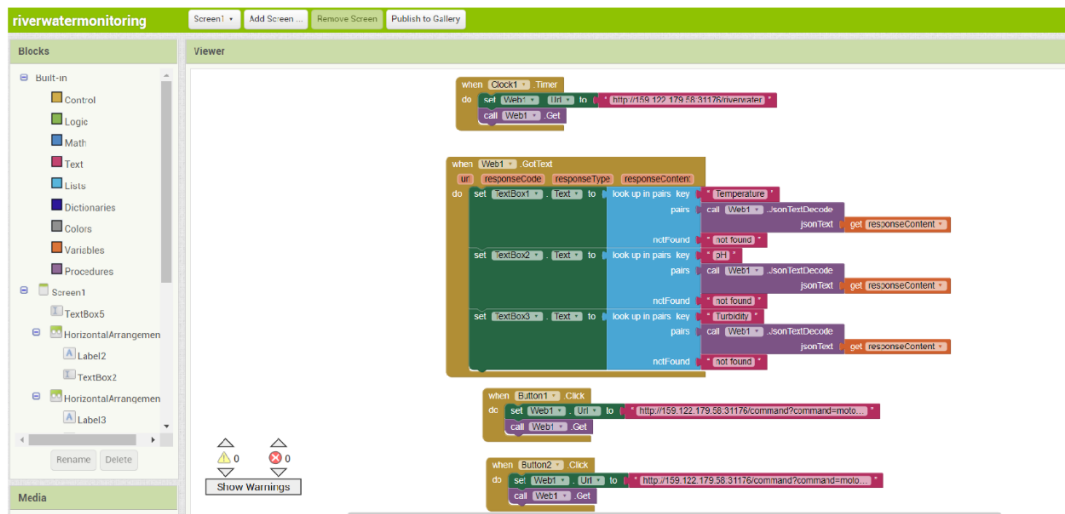


MOBILE APP USING MIT APP INVENTOR:

Design Your UI To Display The Water Turbidity, PH Values, Temperature values



Configure The Application To Receive The Data From Cloud



GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-42399-1660661456>

DEMO LINK:

https://drive.google.com/file/d/1kO1WRaEDn2bA5lrm8cNUPQ9xL9u5j5zU/view?usp=share_link