KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

HX 8001-PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

NALAIYA THIRAN PROJECT REPORT 2022

Submitted by

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Team ID: PNT2022TMID13544

NOVEMBER 2022

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

In this project I have developed a mobile application using which a higher authorities can monitor the temperature, Turbitity , PH and toxic-elements parameters and etc.. Based on these details we can alter the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.

1.2 PURPOSE

- Water is a vital resource for life. Although most of the planet is covered with water, only less percentage corresponds to fresh water.
- Also, a low percentage of fresh water corresponds to drinking water.so, there is a needs to analyze the water and it is used to increase the fresh water and drinking water percentage.
- The major objective is to provide a system for continuous river water quality monitoring in remote locations using wireless sensor networks with low power, low cost, and high detection accuracy pH, conductivity, turbitity level, etc.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

Title: IoT Based Real - time river water Quality Monitoring System

Author: Mohammad Salah Uddin Chowdury

Year of Publish:2019

It only focuses on measuring the properties of high-quality river water. This project has been expanded to include an effective local water management system.

Title: Real-time water quality monitoring system

Author: Subhasish Chatterjee

Year of Publish:2018

PH, turbidity, and temperature sensors with a Raspberry Pi and an existing Cloud system are used to monitor the quality of water in real time from the reserve tanks of homes and colonies.

Title: Water Quality Monitoring

Author: Spoorth G.B

Year of Publish: 2020

Monitoring of Turbidity , PH & Temperature of Water makes[1] use of water detection sensor with unique advantage and existing GSM network The system is low-cost, does not require someone to be on duty, and can automatically monitor water quality.

Title: An IoT based Real- Time Monitoring of Water quality system

Author: Najiya Naj

Year of Publish: 2020

The proposed system's main aim to implement low cost water quality monitoring in a planted tank. This system will check the quality monitoring in a planted tank. This System will check the quality and features of water in real -time. As the monitoring of water is an important factor to keep the life of aquatic plants and animals healthy and safe.

2.2 REFERENCES

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2.3 PROBLEM STATEMENT DEFINITION

- A problem statement to understand our customer's point of view. It helps us to focus on what matters to create.

- A well-articulated customer problem statement allows us and our team to find the ideal solution for the challenges our customers face. Throughout the process, we'll also be able to empathize with our customers, which helps us for better understand and how they perceive our product or service.

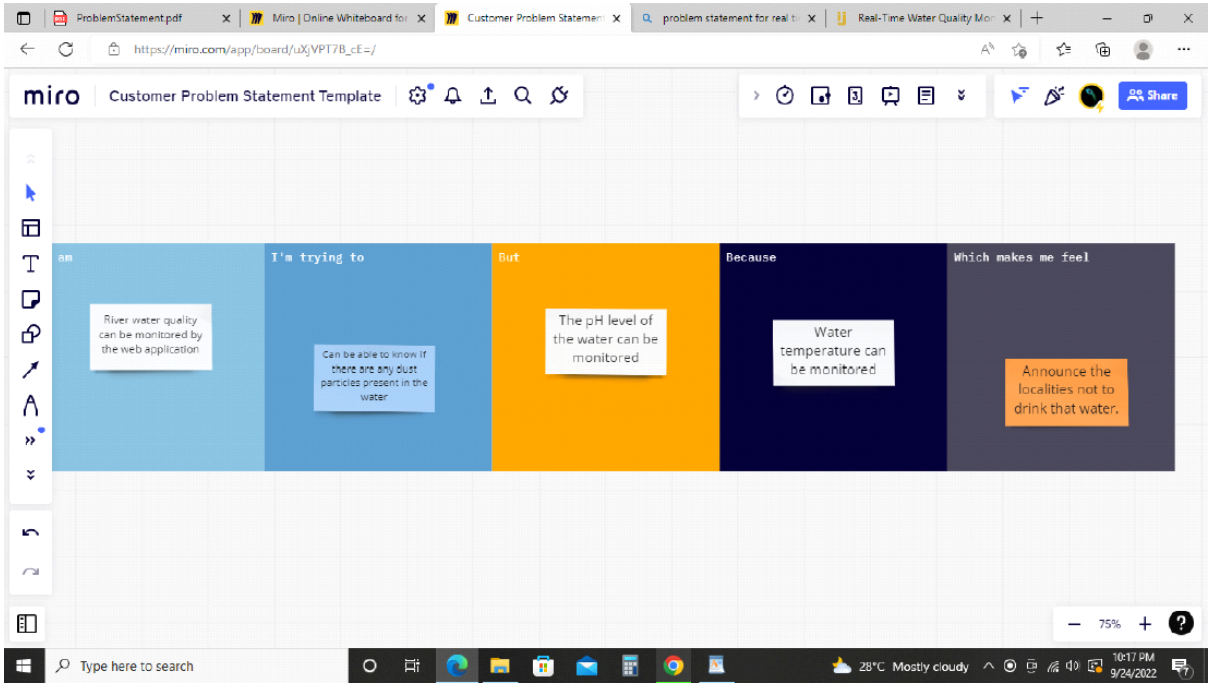


Fig:2.3.1

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

Teams can utilise an empathy map as a collaborative tool to learn more about their clients. An empathy map can depict a group of users, such as a consumer segment, in a manner similar to user personas. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community. Empathy maps can be used whenever you find a need to immerse yourself in a user's environment.

Everyone would add at least one sticky to every section. You might ask questions, such as:

- What would the user be thinking and/or feeling? What are some of their worries and aspirations?

- What would their friends, colleagues, and boss be likely to say while the user is using our product? What would the user hear in these scenarios?

- What would the user see while using our product in their environment?

- What might the user be saying and/or doing while using our product? How would that change in a public or private setting?

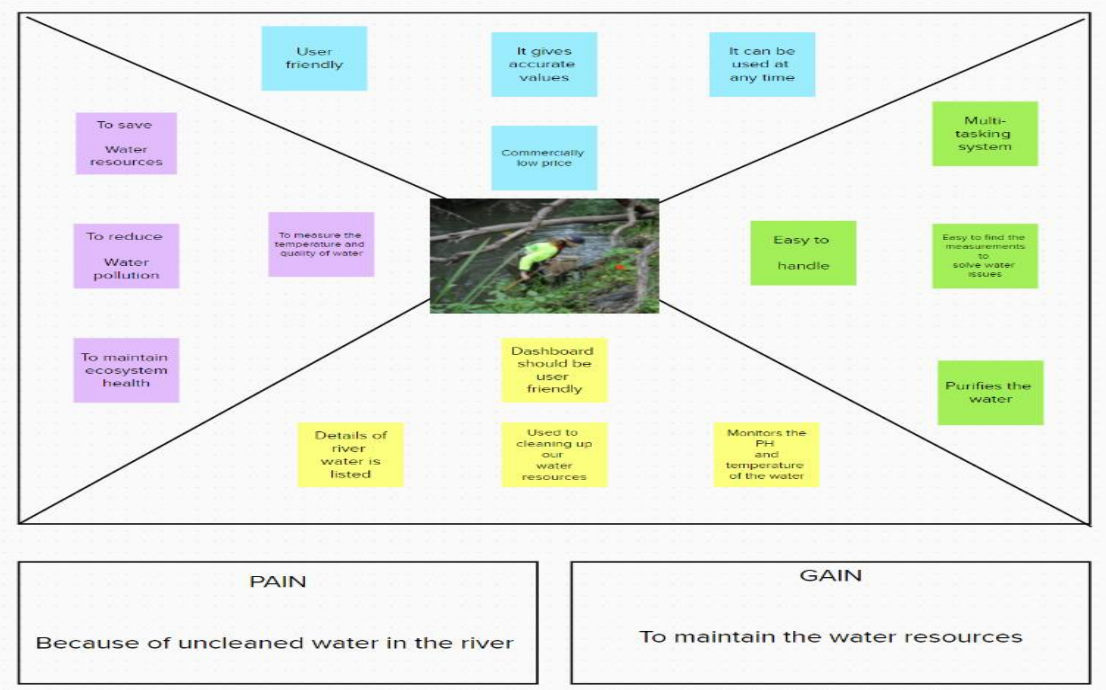


Fig:3.3.1

- What are some of the user's pain points or fears when using our product?
- What gains might the user experience when using our product?

3.2 IDEATION & BRAINSTORMING

- Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas.
- The main distinction between ideation and brainstorming is that whereas brainstorming is nearly often done in groups, ideation is typically seen as being more of a solitary endeavour.
- A group of people are frequently gathered for a brainstorming session to generate either fresh, general ideas or solutions to specific problems or circumstances.
- For example, Top executives from a major firm that recently discovered it is the target of a significant lawsuit would want to get together to develop ways to publicly address the lawsuit being filed.
- In a brainstorming session, participants are encouraged to freely share any ideas that may come to mind.
- According to the theory, by coming up with a lot of ideas, the brainstorming group is more likely to find a workable solution to the problem they are trying to solve.
- The lines between ideation and brainstorming have become a bit more blurred with the development of several brainstorming software programs, such as Bright idea and Idea wake.
- These software programs are designed to encourage employees of companies to generate new ideas for improving the companies' operations and, ultimately, bottom-line profitability.

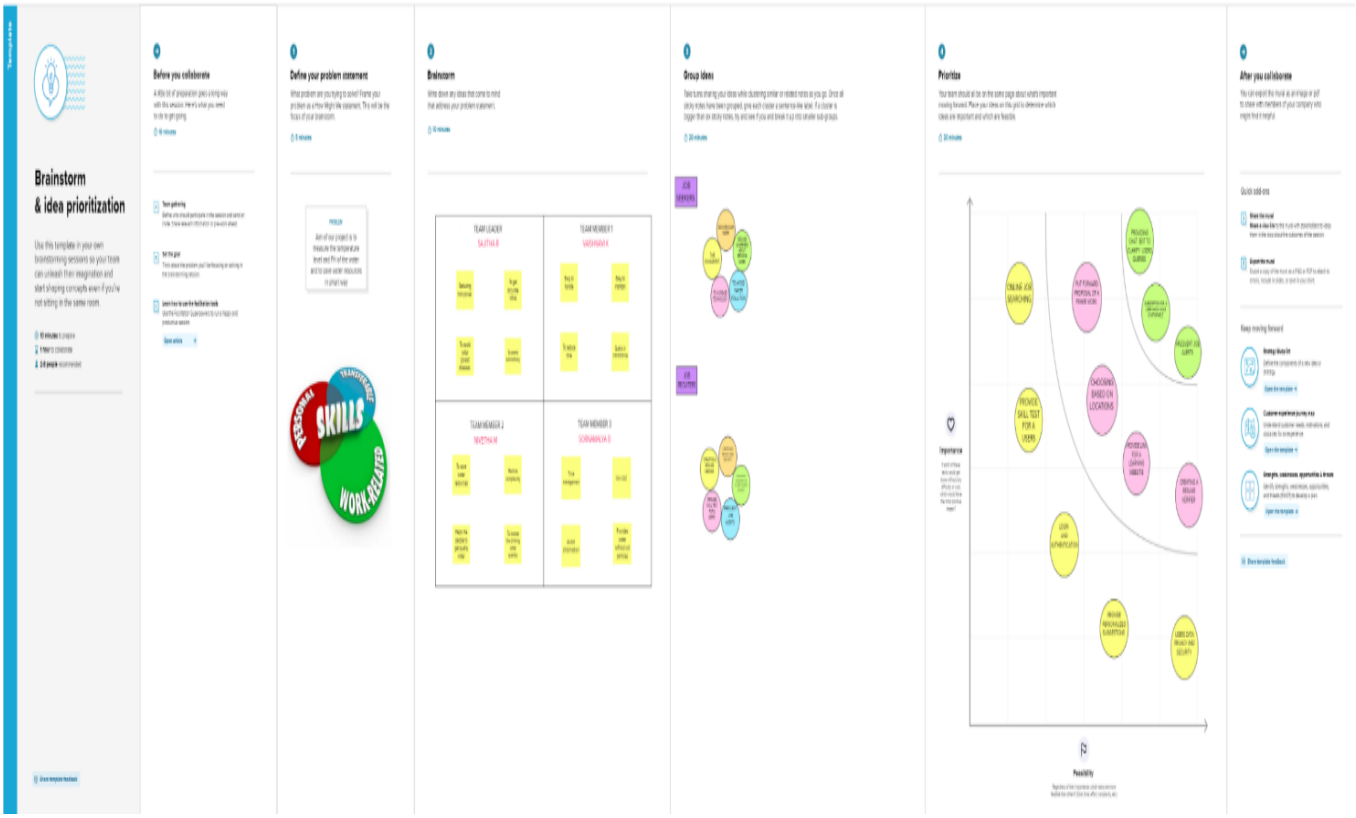


Fig:3.2.1

3.3 PROPOSED SOLUTION

As the climates are changing rapidly and weather is unpredictable, so farmers are facing difficulties so they need a system to tackle this, here we use “open weather API” to get weather information such as temperature, pressure, humidity and weather description at their current location.

Based on which they can decide whether to turn on the motors or turn off the motor if needed temperature and moisture sensors from IBM simulator is displayed on UI for monitoring the weather. An algorithm developed with threshold values of temperature, pressure, humidity is programmed to intimate the farmer if weather conditions go bad. He can control motors remotely from any place through IoT. The use of a mobile application or the Node-RED UI to implement data inspection and irrigation scheduling through an internet interface. The technological development in software and hardware make it easy to develop

this which can make better monitoring and wireless network made it possible to use in monitoring and control of greenhouse parameter in precision agriculture.

S.NO	PARAMETER	DESCRIPTION
1	Problem Statement(Problem to be solved)	A water quality management system helps to check the quality of water which include temperature, humidity and PH in real time and more helpful for human resource.
2	Idea/Solution description	The idea for this project basically contain sensor for detection of water quality and provide pure water for the public in good condition
3	Novelty/Uniqueness	The uniqueness of the project is, it contain high sensitivity and low cost with multiple use and it provide high quality water.
4	Social Impact/Customer Satisfaction	Even-though, it reduces the manpower it help more graduates to work on this project and people can more aware about the latest trends and technologies.
5	Business Model(Revenue Model)	It is more profitable and simple model to manufacture. In business model it provide high revenue with low investment.
6	Scalability of the solution	It can withstand over a long period of time, easily usable product and utilization of more technologies.

Table:3.3.1

3.4 PROBLEM SOLUTION FIT

The Problem-Solution is a tool for entrepreneurs, marketers, and corporate innovators that helps to find ideas with higher odds of solution adoption, minimise time spent on solution testing, and gain a better understanding of the existing situation. Such information is generally acquired "on the fly," following rounds of revisions and consumer interviews, but it is critical to your success. This canvas contains everything you need to find patterns and realise what would work and why, based on the ideas of learn startup, and user experience design. Simply be where your consumers are and address a genuine need, whether it's the same problem done differently or something new presented in a familiar way.

In this project this are the needs for that.

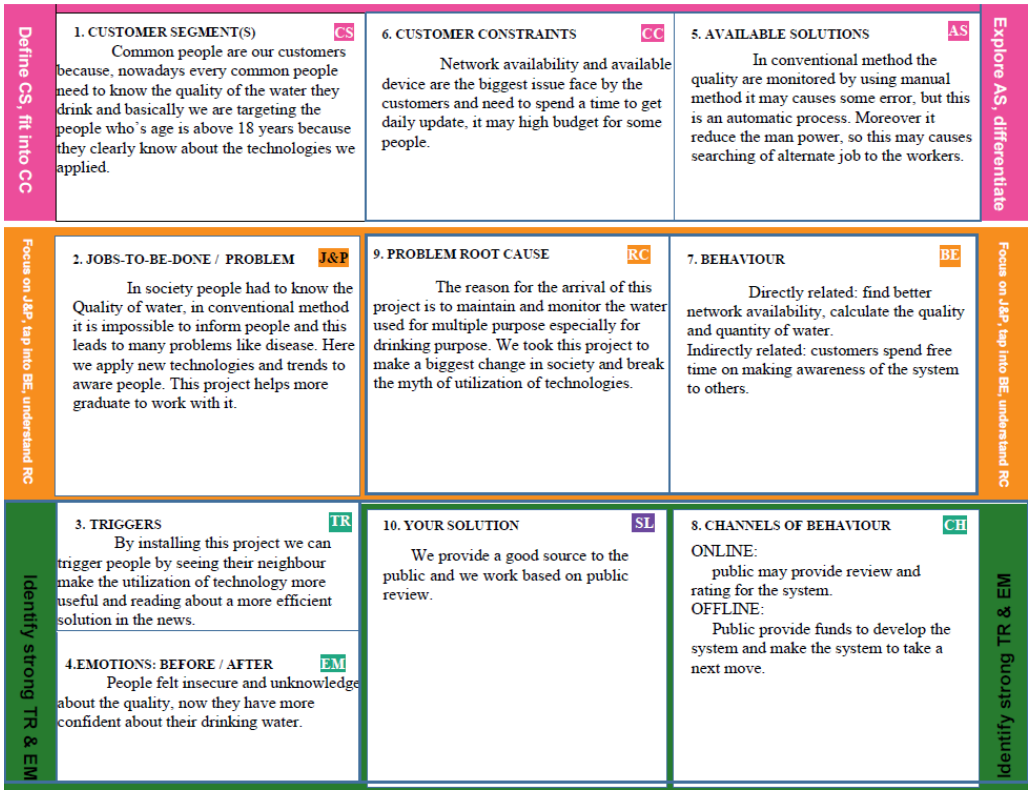


Fig:3.4.1

CHAPTER 4

REQUIREMENT ANALYSIS

- Determining user expectations for a new or modified product is the process known as requirements analysis, sometimes known as requirements engineering.
- These specifications, also known as requirements, must be specific, pertinent, and quantitative.
- In software engineering, such requirements are often called functional specifications.
- Project management includes requirements analysis as a key component. In order to resolve disagreement or ambiguity in requirements as needed by different users or groups of users, eliminate feature creep, and document every step of the project development process from beginning to end, requirements analysis requires continuous communication with system users.
- Energy should be directed towards ensuring that the final system or product conforms to client needs rather than attempting to mold user expectations to fit the requirements.
- Requirements analysis is a team effort that demands a combination of hardware, software and human factors engineering expertise as well as skills in dealing with people.
- The Requirements Analysis Phase's goal is to turn the needs and high-level requirements defined in prior phases into requirements that are clear, complete, consistent, traceable, and approved by all relevant stakeholders.

4.1 FUNCTIONAL REQUIREMENTS

Functional requirements specify what a system should be able to do through computations, technical details, data manipulation and processing, and other specialised functions. The use cases that are used by the system to implement the functional requirements are reflected in the behavioural requirements. The data manipulation and processing, and other specialised functions. The use cases that are used by the system to implement the functional requirements are reflected in the behavioural requirements.

Following are the functional requirements of the proposed solution.

S.NO	FUNCTIONAL REQUIREMENT	SUB-REQUIREMENTS
1	User requirements	❖ River Water Protection ❖ PH ❖ Humidity ❖ Temperature.
2	User Registration	❖ Manual Registration ❖ Registration through Form ❖ Registration through webpage ❖ Registration through Gmail
3	User Confirmation	❖ Confirmation via mail ❖ Confirmation via OTP ❖ Confirmation via Phone
4	Payment Option	❖ Banking/UPI ❖ Credit/Debit/ATM Card
5	Result	❖ Result through mobile application ❖ Result through mail ❖ Result through webpage

Table:4.1.1

4.2 NON-FUNCTIONAL REQUIREMENTS

A non-functional requirement (NFR) is a requirement that, rather of defining specific behaviours, specifies criteria that can be used to assess how well a system performs. Functional requirements, on the other hand, define particular behaviours or functions. The system design includes a thorough plan for putting functional requirements into practise A non-functional requirement (NFR) is a requirement that, rather of defining specific behaviours, specifies criteria that can be used to assess how well a system performs..

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

S.NO	NON-FUNCTIONAL REQUIRMENTS	DESCRIPTION
1	Usability	❖ Have a clear and Self-explanatory manual. ❖ Easier to use. ❖ Even an illiterate farmer have to use the product without any difficulties.
2	Security	❖ Application has to be secured with 2 step authorisation. ❖ Password and passkey will be assigned as per the user need.
3	Reliability	❖ Hardware requires a regular checking and service. ❖ Software may be updated periodically ❖ Immediate alert is provided in case of any system failure.
4	Availability	❖ All the features will be available when the user requires. ❖ It depends on the need of the user.
5	Performance	❖ This application must have a good user interface. ❖ It should have a minimal energy requirements. ❖ It has to save water and energy
6	Scalability	❖ The product has to cover all the places.

Table:4.2.1

CHAPTER 5

PROJECT DESIGN

- The classic visual representation of how information moves through a system is a data flow diagram (DFD).
- A tidy and understandable DFD can graphically represent the appropriate quantity of the system demand.
- It can be manual, automated, or a combination of both. It shows how data enters and leaves the system, what changes the information, and where data is stored.
- The objective of a DFD is to show the scope and boundaries of a system as a whole.
- It can be utilised as a communication tool between a system analyst and any participant in the sequence that serves as the foundation for system redesign.
- The DFD is also known as a bubble chart or data flow graph.
- A location for the collecting of data items is indicated by a series of parallel lines.
- A data store denotes the storage of data that can be used later or by additional operations in a different order.
- The data store can have an element or group of elements.
- The DFD can be used to execute a system or piece of software at any abstraction level.
- Levels that correspond to increasing information flow and functional detail may be partitioned into DFDs.
- Then the system is decomposed and described as a DFD with multiple bubbles.
- Parts of the system represented by each of these bubbles are then decomposed and documented as more and more detailed DFDs.

5.1 DATA FLOW DIAGRAMS

- The conventional visual representation of how information moves through a system is a data flow diagram (DFD).
- A tidy and understandable DFD can graphically represent the appropriate quantity of the system demand. It can be done manually, automatically, or both.
- It shows how data enters and leaves the system, what changes the information, and where data is stored.

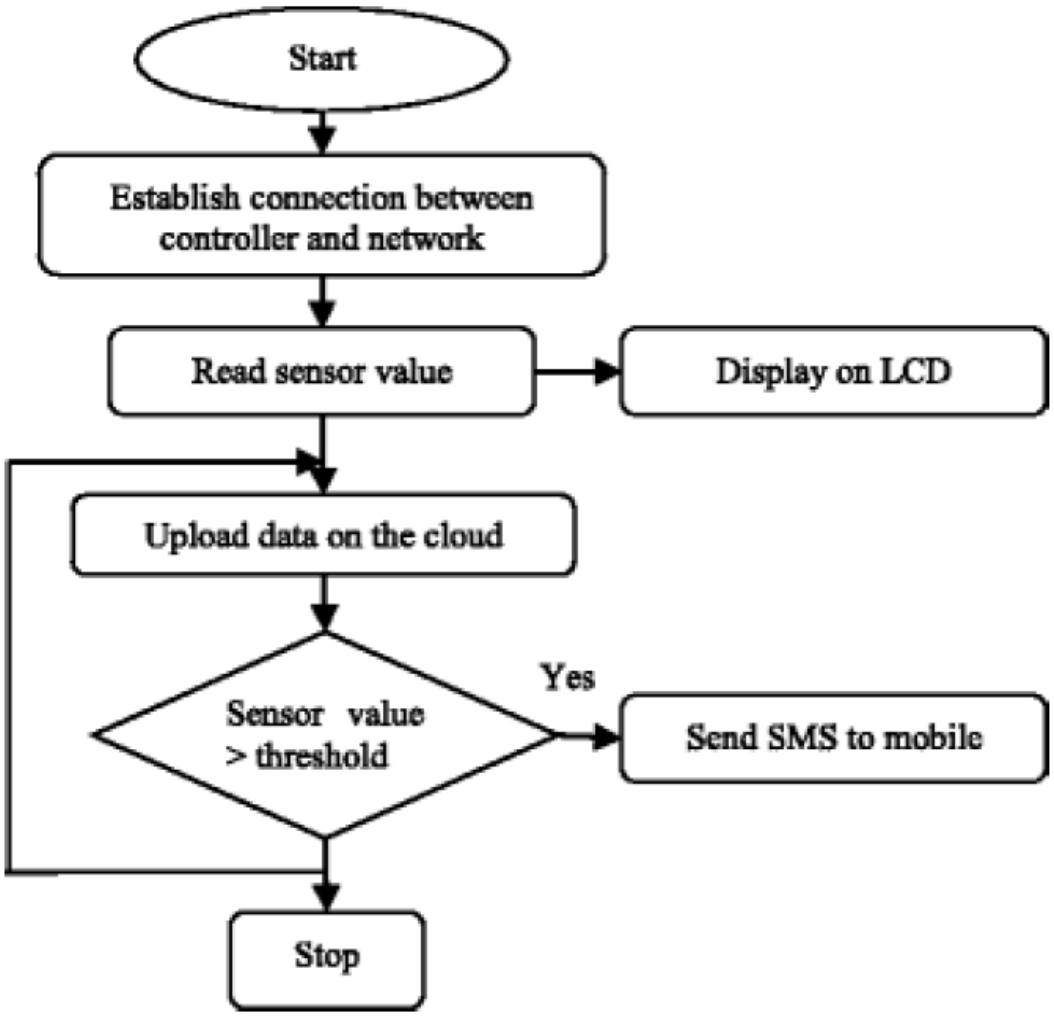
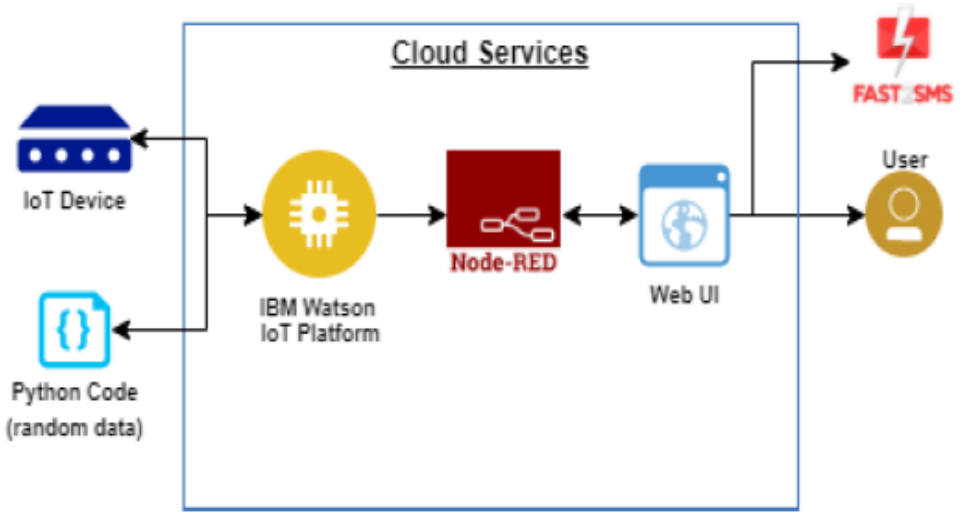

Start
Establish connection between controller and network
Read sensor value
Display on LCD
Upload data on the cloud
Sensor value > threshold
Yes
Send SMS to mobile
Stop

Fig:5.1.1

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

Assuring that all parties, including stakeholders, are on the same page and going in the same direction at all times, solution architects are most like project managers. All tasks resulting in the effective implementation of a new application are managed by technical architects. They suggest a set of building bricks that together offer the optimum solution. It acts as a link between technical architecture and enterprise architecture and is particularly detail-oriented. It also calls for a depth of understanding of the company's technical and administrative operations.



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5.3 USER STORIES

- A user story is the smallest unit of work in an agile framework. It’s an end goal, not a feature, expressed from the software user’s perspective.
- A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer.
- The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer. Note that "customers" don't have to be external end users

in the traditional sense, they can also be internal customers or colleagues within your organization who depend on your team.

- User stories are a few sentences in simple language that outline the desired outcome. They don't go into detail. Requirements are added later, once agreed upon by the team.

User Type	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Acceptance criteria**	**Priority**	**Release**
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-1
		USN-3	As a user, I can register for the application through Gmail.	I can receive confirmation email & click confirm to login.	Medium	Sprint-1

	Login	USN-4	As a user, I can log into the application by entering email& password.		High	Sprint-1
		USN-5	If I forgot my password or username, I can reset it again through my email.	I can receive reset mail to the registered Email Id.	Medium	Sprint-2
Customer (Web user)	Registration	USN-6	As a user, I can register by entering my email, password, and confirming my password	I can access my account / dashboard.	High	Sprint-2
		USN-7	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-2
		USN-8	As a user, I can register for the application	I can receive confirmation email & click	Medium	Sprint-3

			through Gmail.	confirm to login.		
	Login	USN-9	As a user, I can log into the application by entering email & password.		High	Sprint-4

Table:5.3.1

CHAPTER 6

PROJECT PLANNING & SCHEDULING

Planning - Planning pertains to the process of creating a plan of which materials and resources will be required to fulfil incoming and forecasted demand. This step is crucial to ensure that you have enough materials and resource capacity available to produce your orders on time. This component pertains to the ‘what’ and ‘how’ of any project: what exactly needs to be achieved and how it will be accomplished.

Scheduling: Scheduling refers to determining the timing of the utilisation of specified organisational resources.. In production, scheduling involves developing schedules for workers, equipment, and materials. It reflects on the ‘when’ of a project, by assigning the appropriate resources to get the production plan completed within a period of time. Creating optimized production schedules ensures that your facility is able to reduce costs, increase productivity, and deliver goods to customers on time.

6.1 SPRINT PLANNING AND ESTIMATION

Planning: In Sprint Planning, the team decides what it will build in the upcoming Sprint and how they will build it After decomposing user stories into tasks and performing task-level estimation, the team agrees to the Sprint target. Sprint Planning is done by the Product Owner, Scrum Master, and the Team. In Scrum, every project is broken into time blocks called sprints, usually 2-4 weeks long.

The team, which consists of the Scrum Master, Scrum Product Manager, and Scrum Team, gathers for a sprint planning meeting to decide which backlog items will be completed during the following sprint.

Estimation: The entire team estimates during the sprint planning meeting in scrum projects. The goal of the estimation would be to take into account the Sprint's User Stories in terms of Priority and the Team's Capability to Deliver During the Sprint Time Box.

- Product Owner ensures that the prioritized User Stories are clear, can be subjected to estimation, and they are brought to the beginning of the Product Backlog.
- As the Scrum Team in total is responsible for the delivery of the product increment, care would be taken to select the User Stories for the Sprint based on the size of the Product Increment and the effort required for the same.
- The size of the Product Increment is estimated in terms of User Story Points. Once the size is determined, the effort is estimated by means of the past data, i.e., effort per User Story Point called Productivity.

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**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.	High	Sajitha
Sprint-1		USN-1	As a user, I will receive confirmation email once I have registered for the application.	Medium	Sajitha
Sprint-1		USN-1	As a user, I can register for the application through Gmail.	High	Sajitha
Sprint-2	Login	USN-2	As a user, I can log into the application by entering email& password.	High	Nivetha
Sprint-3	Dashboard	USN-2	As a user, I can access my dashboard through the url provided.		Sornamalya

Sprint-4	Scheduling appointments	USN-4	During this interaction, the farmer collects basic information about the field and the climatic condition. With this information, the farmer can cultivate the crop in the field.	High	Vaishnavi

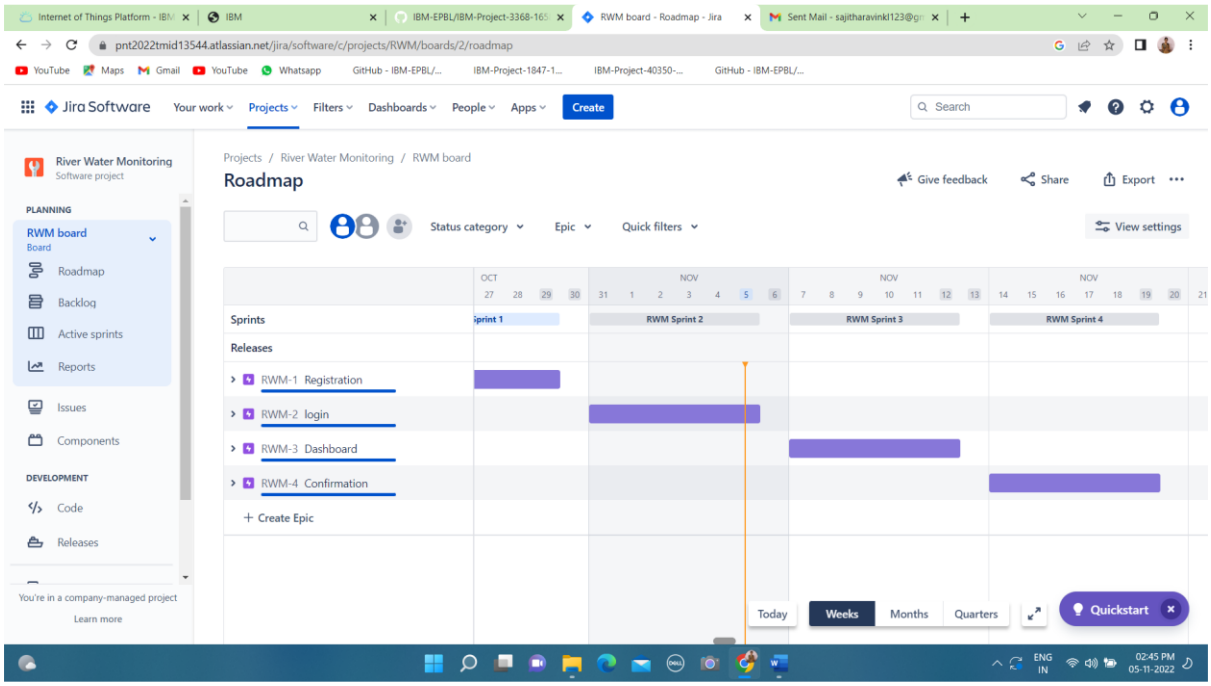
6.2 SPRINT DELIVERY SCHEDULE

- Since sprints take place over a fixed period of time, it's critical to avoid wasting time during planning and development. And this is precisely where sprint scheduling enters the equation.
- In case you're unfamiliar, a sprint schedule is a document that outlines sprint planning from end to end. It's one of the first steps in the agile sprint planning process—and something that requires adequate research, planning, and communication.
- Teams often run into trouble when they create more than few schedules. This can create conflict and derail projects midway through their cycles. To ensure things stay on track, one schedule makes sense.

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

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

6.3 REPORTS FROM JIRA FILES



CHAPTER 7

CODING AND SOLUTIONING

7.1 FEATURE 1

PH Monitoring of the river water is the special feature of this project which is used to provide fresh water and to increase percentage of the fresh water.

CODE:

```
import wiotp.sdk.device
import time
import os
import datetime
import random

myConfig = {
    "identity":{
        "orgId":"jpj8ce",
        "typeId":"NodeMCU",
        "deviceId":"0001"
        },
    "auth":{
        "token":"12345678"
        }
    }
```

```
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

def myCommandCallback(cmd):
    print("Message received from IBM IoT platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="show"):
        print("Output is displayed")
    elif(m=="hide"):
        print("Output is not displayed")
    print(" ")
while True:
    toxic=random.randint(0,100)
    temperature=random.randint(0,60)
    ph=random.randint(1,14)
    myData={'toxic':toxic,'temperature':temperature,'ph':ph}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data successfully: %s", myData)
    time.sleep(2)
    client.commandCallback = myCommandCallback
    client.disconnect()
```

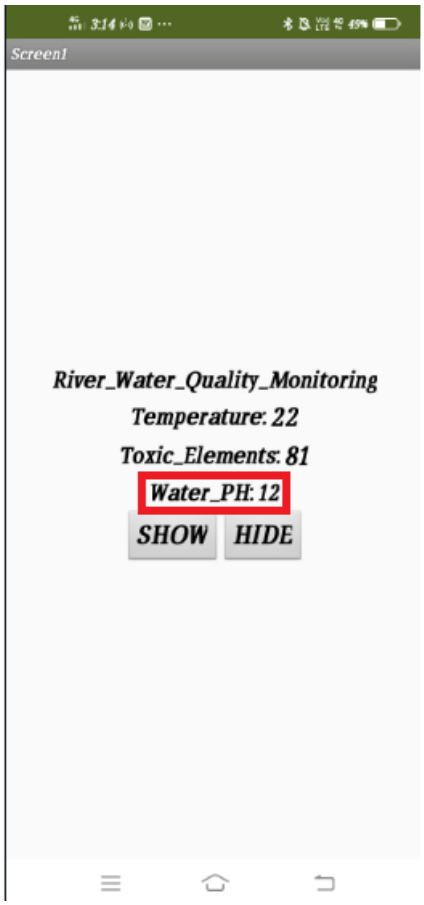


Fig:7.1.1

7.2 FEATURE 2

Temperature and Toxic Substances Monitoring of the river water is the special feature of this project which is used to provide fresh water and to increase percentage of the fresh water.

CODE:

```
import wiotp.sdk.device

import time

import os

import datetime
```

```
import random


myConfig = {
    "identity":{
        "orgId":"jpj8ce",
        "typeId":"NodeMCU",
        "deviceId":"0001"
        },
    "auth":{
        "token":"12345678"
        }
    }
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()


def myCommandCallback(cmd):
    print("Message received from IBM IoT platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="show"):
        print("Output is displayed")
    elif(m=="hide"):
        print("Output is not displayed")
    print(" ")
while True:
```

```
    toxic=random.randint(0,100)
    temperature=random.randint(0,60)
    ph=random.randint(1,14)
    myData={'toxic':toxic,'temperature':temperature,'ph':ph}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data successfully: %s", myData)
    time.sleep(2)
    client.commandCallback = myCommandCallback
client.disconnect()
```

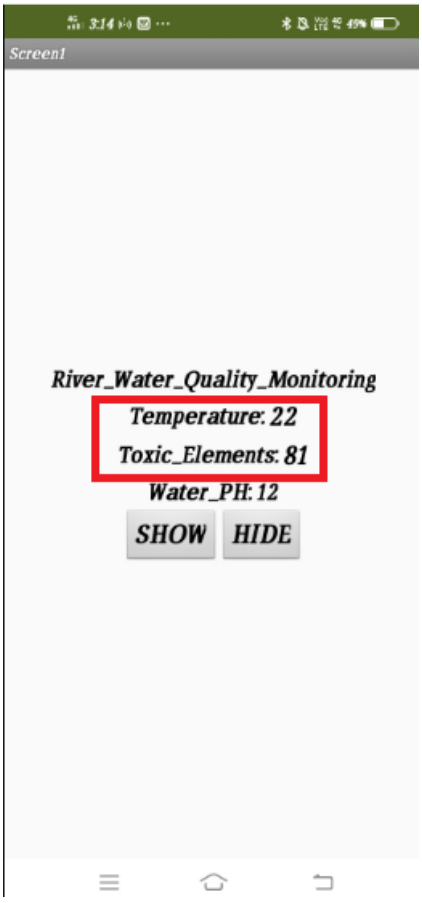


Fig:7.2.1

CHAPTER 8

TESTING

8.1 TEST CASES

Team Id: PNT2022TMID13544
PROJECT : Real Time river Water Monitoring and control system
DATE : 17 NOVEMBER 2022

TEST CASE ID	TEST CASE	TEST SCENARIO	TEST STEPS	INPUTS	EXPECTED OUTPUT	ACTUAL OUTPUT	TEST RESULT	TEST COMMENTS	BUG ID	TESTED BY
1	IBM WATSON IOT PLATFORM	To check whether the ibm watson iot get connected	login to ibm watson iot platform	id , password	it should get login to the watson page	it has been logged in to the login page	PASS	GOOD		Niveitha.M
			check whether it has the separate organization id	new id	it should shows the organization id	separate organization id has been shown	PASS	GOOD		Niveitha.M
			check whether team mates are get connected	team mates id	it should shows the all the team members name / id	it is showing all the team members	PASS	GOOD		Niveitha.M
			check whether separate device name , id , authentication token generated	device name , type	new device should be created	new device has been created	PASS	GOOD		Niveitha.M
			to check whether it is showing output	device code and inputs	it should shows device gets connected and should show the output	its showing that device gets connected and output are verified	PASS	GOOD		Niveitha.M
2	Python Compiler and Wokwi	to check the connection is established in Cloud	To check the whether the pH value is shown are not	pH reading	it need to show the ph value sometimes may random	it show the ph value for the input	PASS	GOOD		Soranmalya.B
			to check whether the Temperature and humidity are shown	Temperature & humidity	it should show temperature & humidity	it show the temperature & humidity value for input	PASS	GOOD		Soranmalya.B
3	NODE-RED	to check whether node-red is connected and shows the output	login in to node-red	id , password	it should get login to the node-red page	its get entered into the login page	PASS	GOOD		Soranmalya.B
			check whether all the necessities are imported and connected	nodes	it should not show any error on nodes	it is not showing any errors	PASS	GOOD		Soranmalya.B
			check whether all the nodes ar connected	node connection	blocks should gets connected	blocks has been connected	PASS	GOOD		Soranmalya.B
			check whether the output are shown in nodered	output found or not	output should be obtained	output has been obtained	PASS	GOOD		Soranmalya.B
4	MIT App Inventor	check whether the outputs are shown in	check whether the login is created	id/password	Get into the MIT app inventor	MIT App inventor is getted	PASS	GOOD		Sajitha.R
			check whether new project is created in MIT	Project created	the new project is created	the new project is created	PASS	GOOD		Sajitha.R
			check whether the designer page is ready to use	create app	it should created	it is created successfully	PASS	GOOD		Sajitha.R
			check whether it the block page is created	create block	block should created	it is created successfully	PASS	GOOD		Sajitha.R
			check whether the block run successfully without error	run block	it should get input from cloud	it has been connected and provide output	PASS	GOOD		Sajitha.R
			check whether the code shows any error	code	it should not shows any error	it is not showing any errors	PASS	GOOD		Sajitha.R
			check whether the MIT provide QR code	QR Code	QR code has been generated	QR code is generated	PASS	GOOD		Sajitha.R
			check whether the MIT app is installed in mobile	install in mobile	user should install mobile app	app is install successfully	PASS	GOOD		Sajitha.R
			check whether the QR code get connected	app link	mobile gets connected	mobile has been connected	PASS	GOOD		Sajitha.R
			check whether the screen is found in mobile	screen found	screen should be generated	screen has been generated	PASS	GOOD		Sajitha.R
6	TESTING	check entire process	check watson is connected	watson	iot watson should produce its output	iot watson has producing its output	PASS	GOOD		Vaishnavi.K
			check node-red is connected	node-red	node-red should produce its output	node-red has been producing its output	PASS	GOOD		Vaishnavi.K
			check whether python is connected	python	python should gets connected	python has been connected	PASS	GOOD		Vaishnavi.K
			check whether details are shown	MIT App	details in MIT should be shown	details in MIT should be shown	PASS	GOOD		Vaishnavi.K

8.2 USER ACCEPTANCE TEST

- Acceptance by users any project testing phase may be crucial, and the tool used for user's participation is crucial.

- Additionally, it guarantees that the system satisfies real-world requirements. At this point, all the cases are executed to ensure that the programme is accurate and complete.

- Before the customer will accept the programme, the test must be passed successfully.

- After customer personnel have verified that the preliminary production statistics load is accurate and that the test suite has been completed flawlessly, the customer formally accepts the delivery of this system.

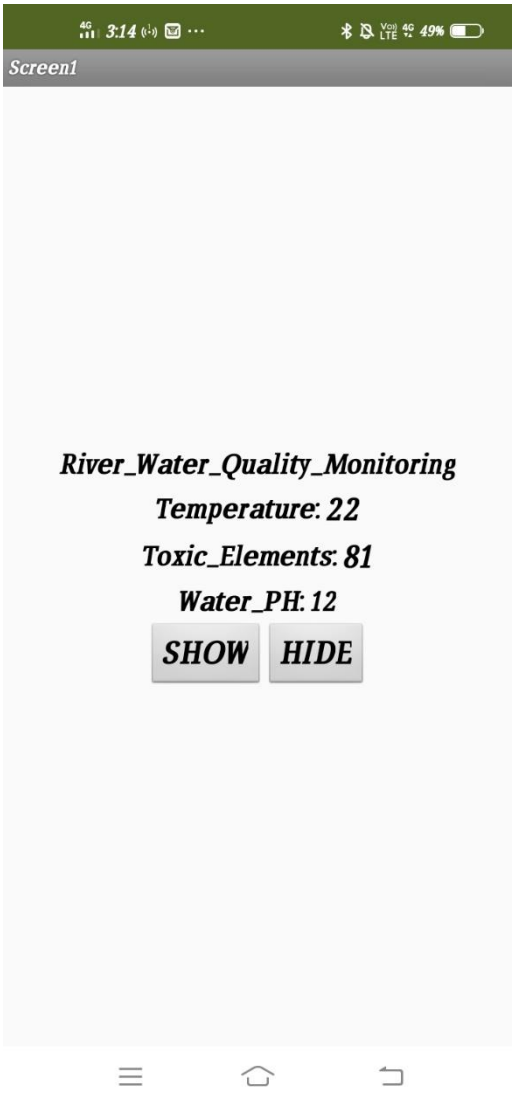

3:14
49%
Screen1
River_Water_Quality_Monitoring
Temperature: 22
Toxic_Elements: 81
Water_PH: 12
SHOW
HIDE

Fig:8.2.1

CHAPTER 9

RESULT

9.1 PERFORMANCE METRICES

IBM WATSON:

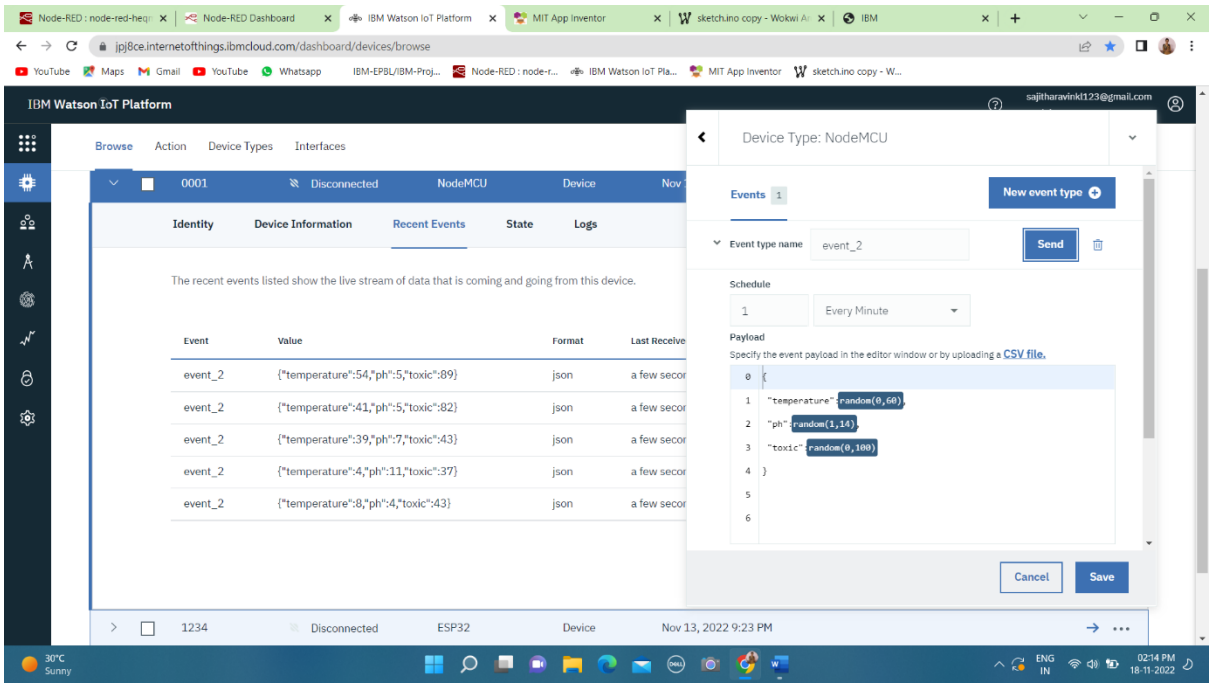


Fig:9.1.1

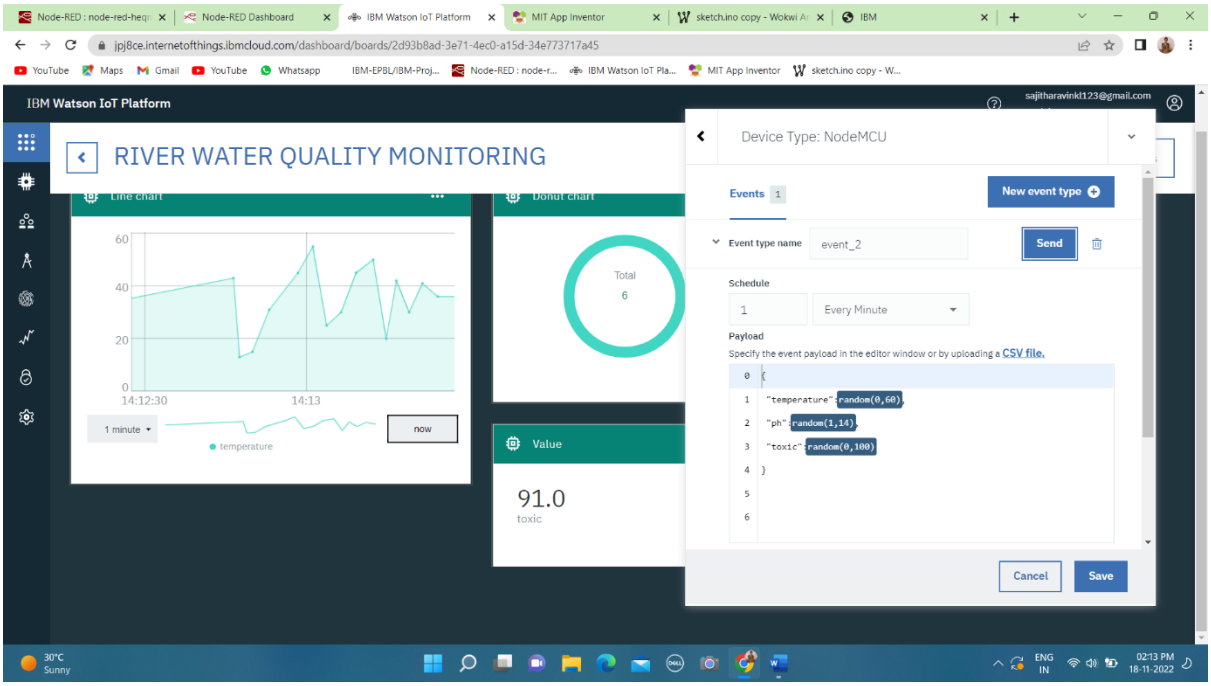


Fig:9.1.2

NODE-RED CONNECTION:

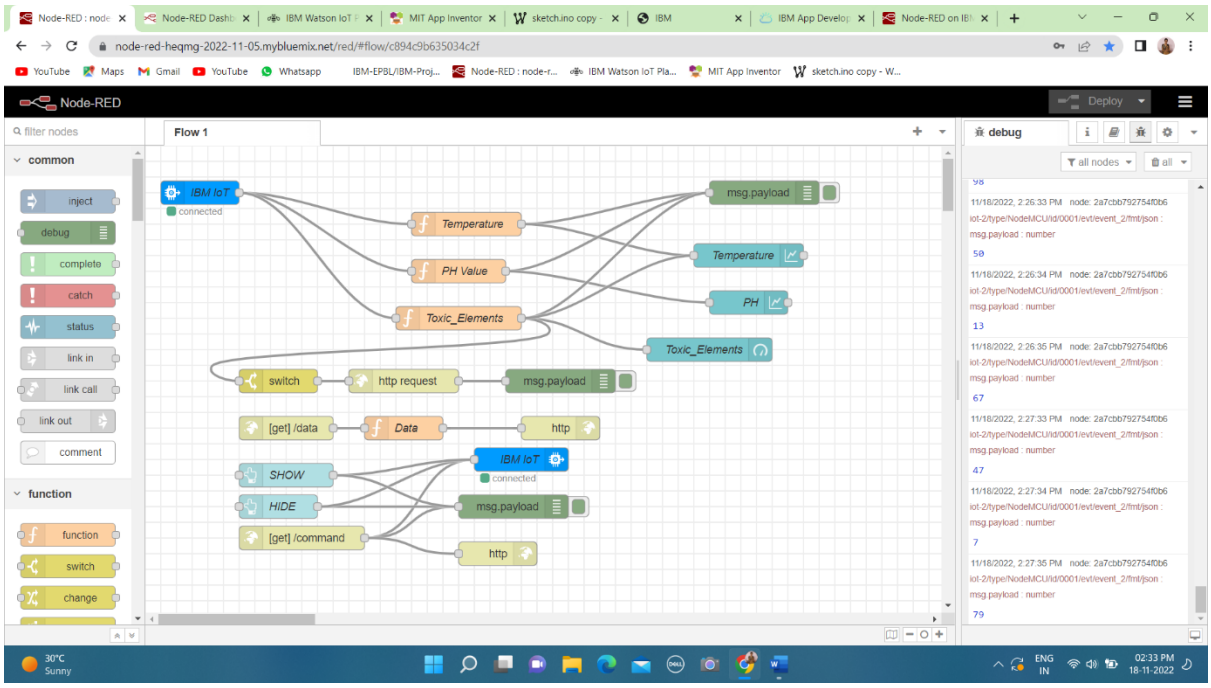


Fig:9.1.3

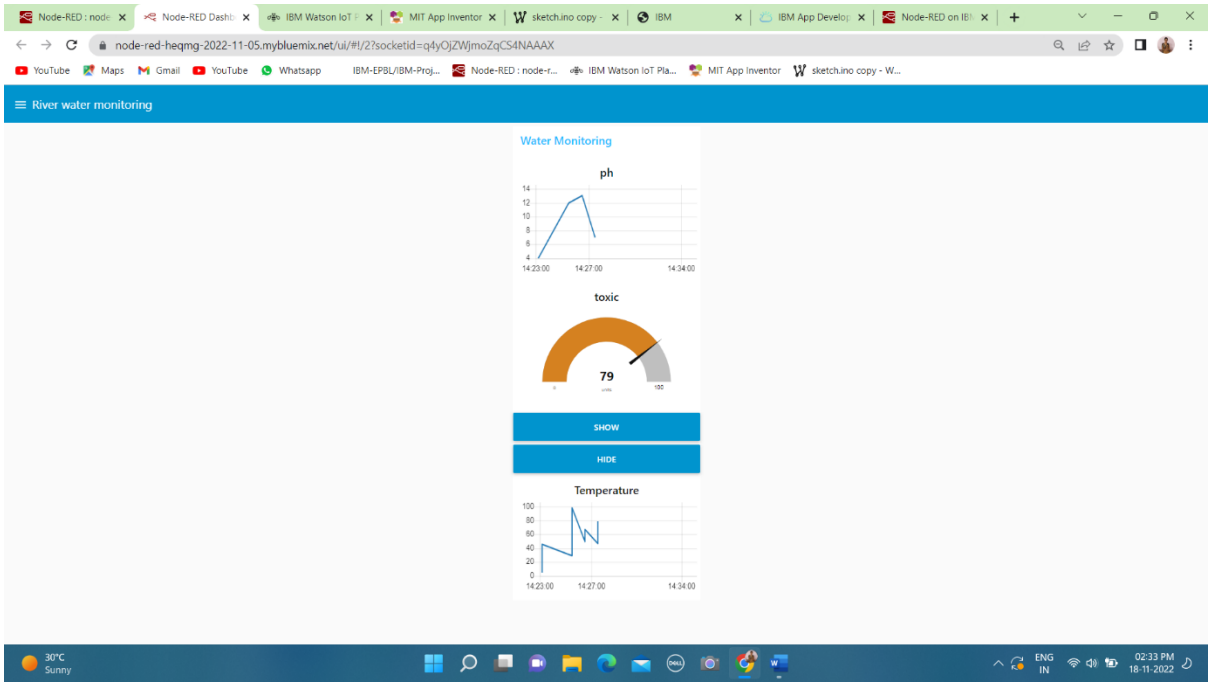


Fig:9.1.4

PYTHON SCRIPT:

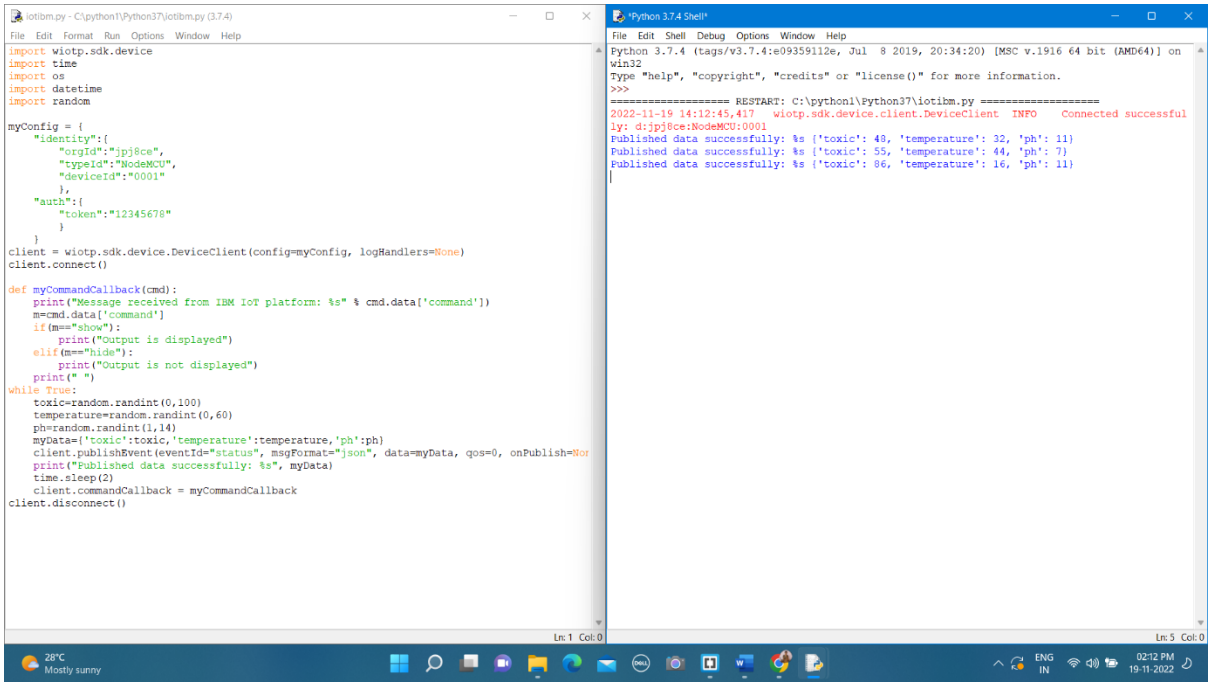


Fig:9.1.5

MIT MOBILE APPLICATION:

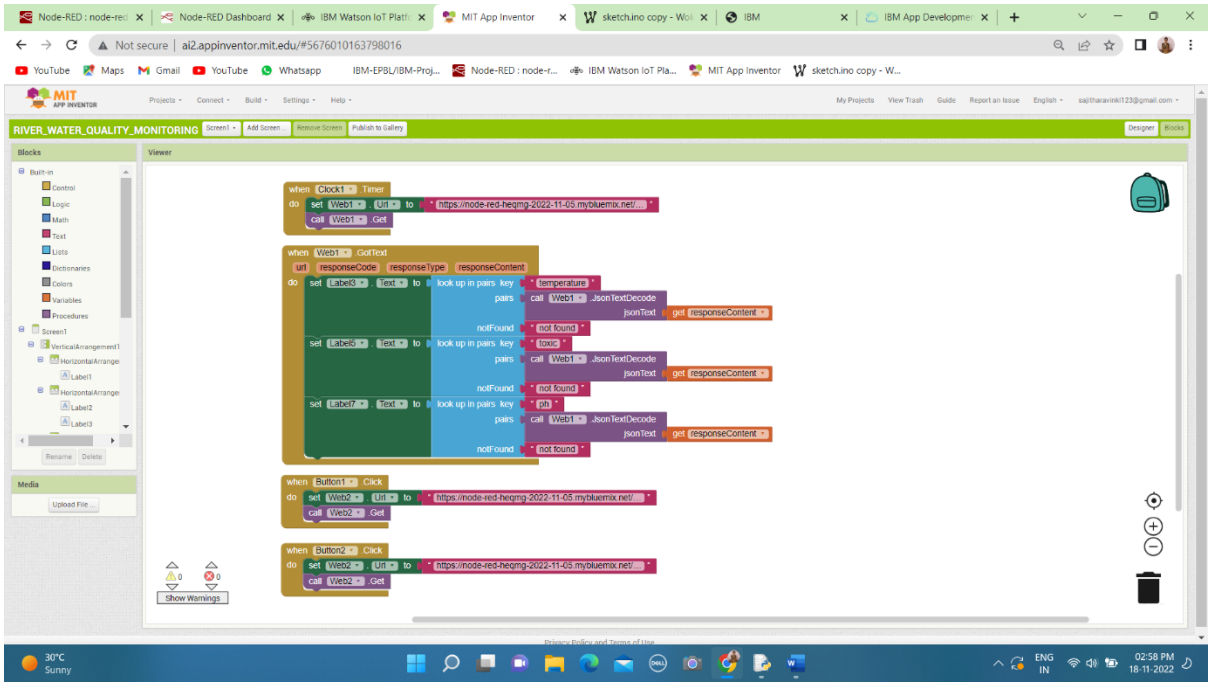


Fig:9.1.6

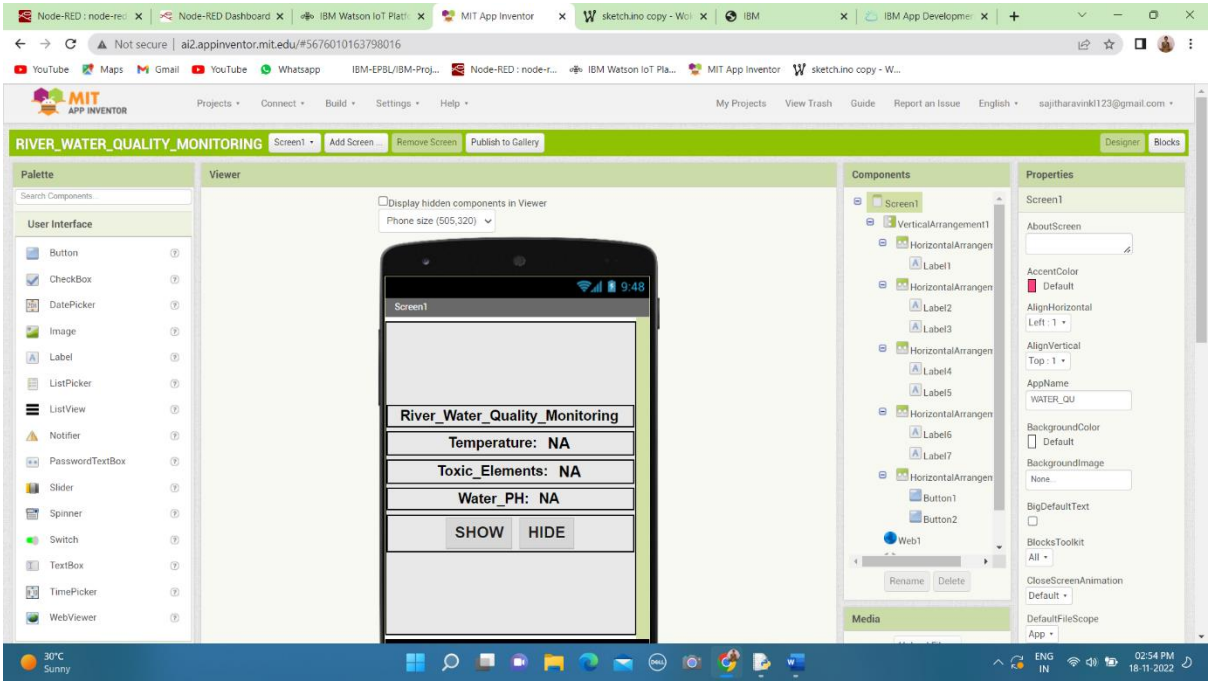


Fig:9.1.7

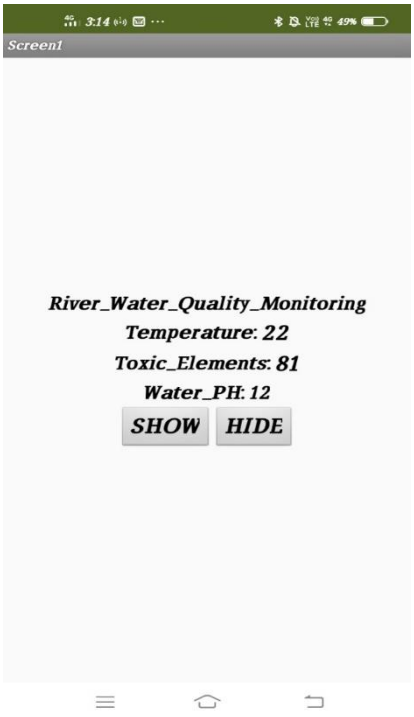


Fig:9.1.8

Wokwi:

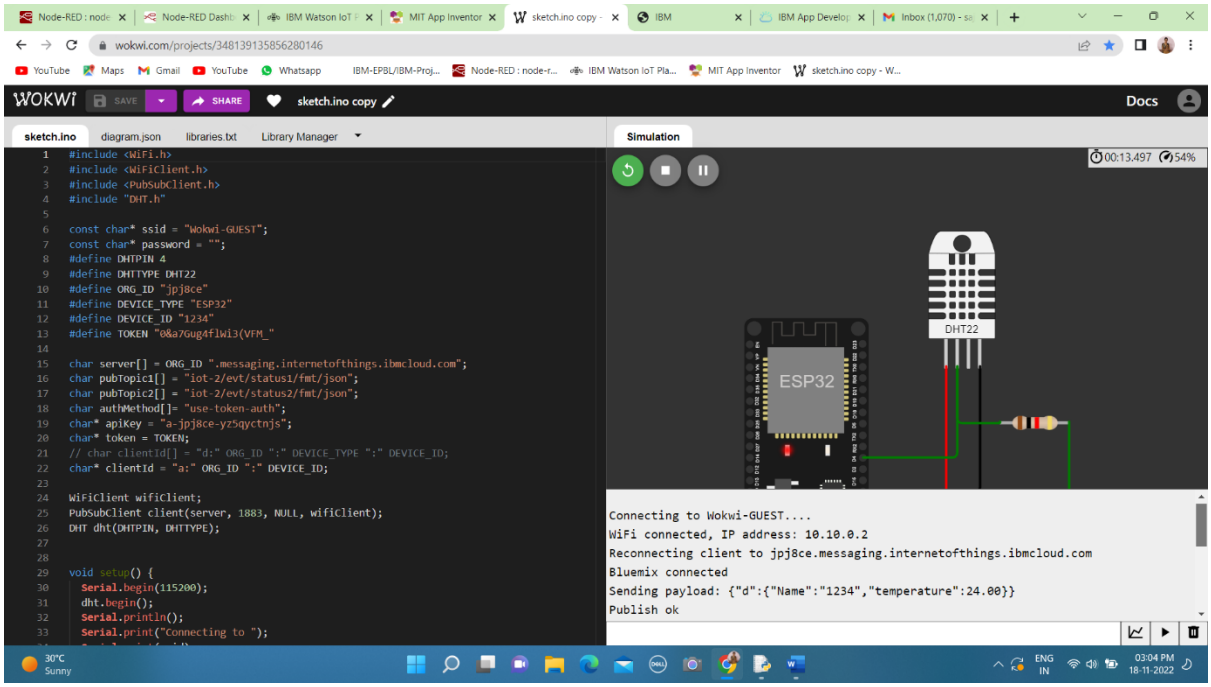


Fig:9.1.9

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Monitor the water PH, Temperature and Turbitity of the river water.
- Alter the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.
- User friendly and efficient.
- Low cost.

DISADVANTAGES:

- Sometimes sensors may have some defects.
- Sometimes values may differ from accurate value.

CHAPTER 11

CONCLUSION

This project concludes that the PH, temperature and Turbitity of the river water is to be monitored. The PH value of the water should be less than 7 because if the PH is higher than 7 it is considered as the acid. The temperature of the water is monitored. The temperature of the water should not be higher than the normal water temperature. Based on these details we can alter the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.

CHAPTER 12

FUTURE SCOPE

This project is used to increase the fresh water level which leads to get good drinking water for people who is suffering from water problem. Water is major source for the people, without water people cannot live for a long time. To increase the drinking water level this project is very useful to the humans. It is also used for alter the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.

CHAPTER 13

APPENDIX

13.1 SOURCE CODE

PYTHON SOURCE CODE:

```
import wiotp.sdk.device
import time
import os
import datetime
import random

myConfig = {
    "identity":{
        "orgId":"jpj8ce",
        "typeId":"NodeMCU",
        "deviceId":"0001"
        },
    "auth":{
        "token":"12345678"
        }
    }
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
```

```
def myCommandCallback(cmd):
    print("Message received from IBM IoT platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="show"):
        print("Output is displayed")
    elif(m=="hide"):
        print("Output is not displayed")
    print(" ")
while True:
    toxic=random.randint(0,100)
    temperature=random.randint(0,60)
    ph=random.randint(1,14)
    myData={'toxic':toxic,'temperature':temperature,'ph':ph}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data successfully: %s", myData)
    time.sleep(2)
    client.commandCallback = myCommandCallback
client.disconnect()
```

WOKWI SOURCE CODE:

```
#include <WiFi.h>
#include <WiFiClient.h>
#include <PubSubClient.h>
```

```
#include "DHT.h"

const char* ssid = "Wokwi-GUEST";
const char* password = "";
#define DHTPIN 4
#define DHTTYPE DHT22
#define ORG_ID "jpj8ce"
#define DEVICE_TYPE "ESP32"
#define DEVICE_ID "1234"
#define TOKEN "0&a7Gug4flWi3(VFM_"

char server[] = ORG_ID ".messaging.internetofthings.ibmcloud.com";
char pubTopic1[] = "iot-2/evt/status1/fmt/json";
char pubTopic2[] = "iot-2/evt/status2/fmt/json";
char authMethod[]= "use-token-auth";
char* apiKey = "a-jpj8ce-yz5qyctnjs";
char* token = TOKEN;
// char clientId[] = "d:" ORG_ID ":" DEVICE_TYPE ":" DEVICE_ID;
char* clientId = "a:" ORG_ID ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, NULL, wifiClient);
DHT dht(DHTPIN, DHTTYPE);
```

```
void setup() {
  Serial.begin(115200);
  dht.begin();
  Serial.println();
  Serial.print("Connecting to ");
  Serial.print(ssid);
  WiFi.begin(ssid, password, 6);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");

  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!client.connect(clientId, apiKey, token)) {
      Serial.print(".");
      delay(500);
    }
    Serial.println("Bluemix connected");
```

```
  }
}

long lastMsg = 0;
void loop() {
  client.loop();
  long now = millis();
  if (now - lastMsg > 3000) {
    lastMsg = now;
    float humidity = dht.readHumidity();
    float temperature = dht.readTemperature();
    String payload = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
    payload += ",\"temperature\":";
    payload += temperature;
    payload += "}}";

    Serial.print("Sending payload: ");
    Serial.println(payload);

    if (client.publish(pubTopic1, (char*) payload.c_str())) {
      Serial.println("Publish ok");
    } else {
      Serial.println("Publish failed");
    }
```

```
  String payload1 = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
  payload1 += ",\"humidity\":";
  payload1 += humidity;
  payload1 += "}}";

  if (client.publish(pubTopic2, (char*) payload1.c_str())) {
    Serial.println("Publish ok");
  } else {
    Serial.println("Publish failed");
  }
}
```

13.2 GITHUB AND PROJECT DEMO LINK:

GITHUB: https://github.com/IBM-EPBL/IBM-Project-3368-1658556140

PROJECT DEMO LINK: https://youtu.be/sberDzWbeKM