Final Report

PROJECT BASED EXPERIENTIAL LEARNINGPROGRAM (NALAIYA THIRAN)

Real-Time River Water Quality

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Monitoring and Control System

TEAMID:PNT2022TMI33916

1) Introduction:

In the 21st century, there are lots of inventions, but at the same time were pollutions, global warming and so on are being formed, because of this there is no safe drinking water for the world's pollution. Nowadays, maintaining pure supply of water to the people is getting more challenging day by day. In India mainly is big cities the municipality corporation use lots of chemical to purify the river water then supply that to the people. And we reserved that water without any test. And we also don't know the water is either safe for drinking or not. And now a day's water quality monitoring in real time faces challenges because of global warming limited water resources, growing population, etc. Hence there is need of developing better methodologies to monitor the water quality parameters in real time. The water parameters pH measures the concentration of hydrogen ions. It shows the water is acidic or alkaline.

Pure water has 7 pH value, less than 7pH has acidic, more than 7pH has alkaline. The range of pH is 0-14pH. For drinking purpose it should be 6.5-8.5pH. Turbidity measures the large number of suspended particles in water that is invisible. Higher the turbidity higher the risk of diarrhea, cholera. Lower the turbidity then the water is clean. Temperature sensor measures how the water is, hot or cold. Here in this paper we tried to find the problem and then make a solution for it.

The experimental results show that the system has great prospect and can be used to operate in real world environment for optimum control and protection of water resources by providing key actors with relevant and timely information to facilitate quick action taking.

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2) LITERATURE SURVEY:

Title	Author	Publication	Contents
Real-time Water Quality Monitoring and Estimation in AIoT for Freshwater Biodiversity Conservation	Yuhao Wang , Ivan Wang-Hei Ho , Senior Member, IEEE, Yang Chen, Yuhong Wang, and Yinghong Lin	DOI 10.1109/JIOT.2021.3078166, IEEE Internet of Things Journal	water quality parameters that impact the biodiversity of freshwater is conducted and identified the top-10 crucial water quality parameters
Sensor based water quality monitoring system	B. Paul	BRAC University, 2018	Causes and effects of water pollution is presented, and comprehensive review of different methods of water quality monitoring and an efficient IoT based method for water quality monitoring has been discussed.
The use of artificial neural networks for the prediction of water quality parameters	H. R. Maier and G. C. Dandy	Water resources Research, vol. 32, pp. 1013-1022, 1996	Analysis gives that ANN models appear to be a useful tool for forecasting salinity in rivers
The real time monitoring of water quality in IoT environment	N. Vijayakumar and R.Ramya	5 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), 2015, pp. 1-5	5 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), 2015, pp. 1-5

Problem Statement Definition:

Now a days water pollution is one of the biggest fears for the green globalization. In order to ensure the safe of water quality is needs to be monitor in real time. water quality is affected by both point and non-point sources of pollution, which include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. It is difficult to maintain river water quality monitoring. By focusing on the above issues, low cost monitoring system to monitor water in real time using IoT is proposed.In this system quality parameters are measured using different sensors such as pH,turbidity, temperature and communicating data onto a platform microcontroller system and GPRS are used.

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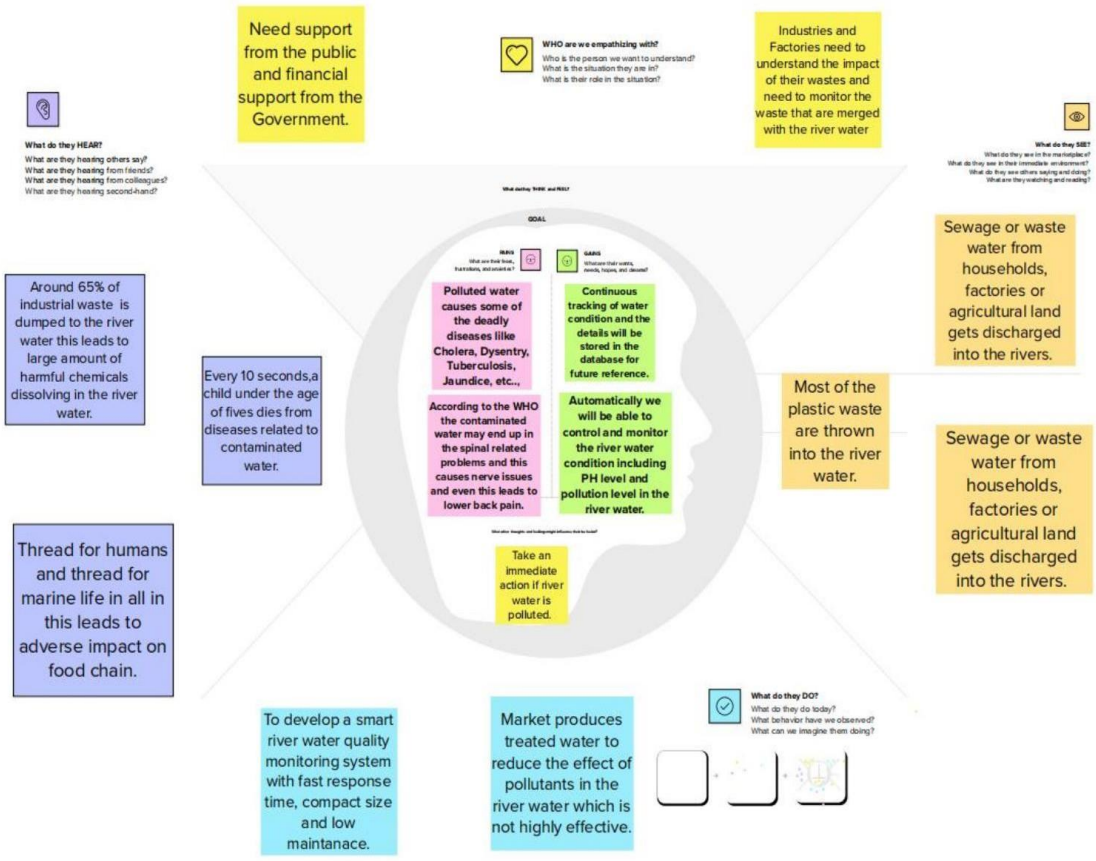
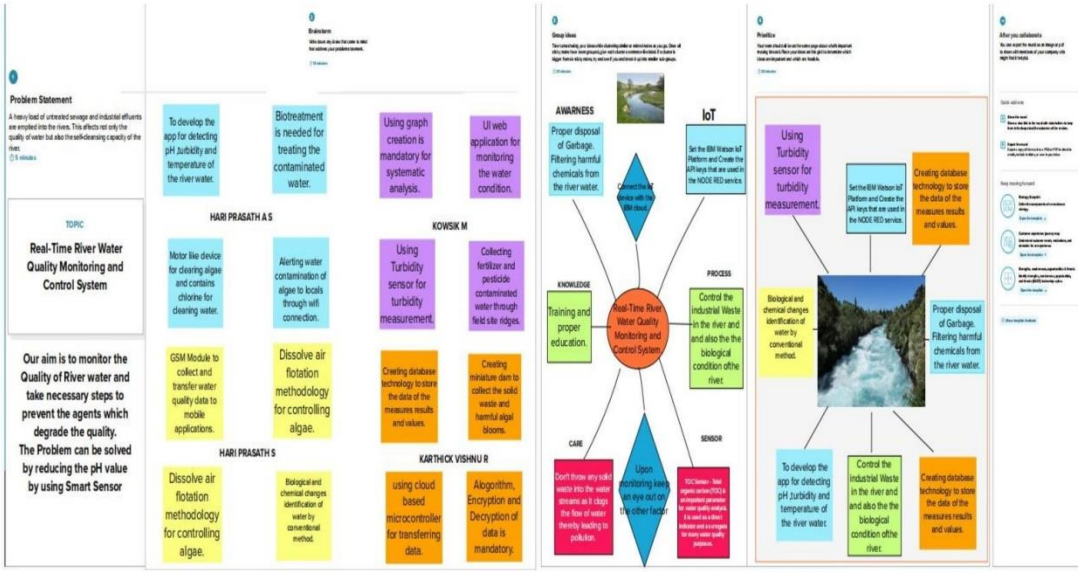
2) IDEATION & PROPOSED SOLUTION

Empathy Map Canvas:



Ideation & Brainstorming



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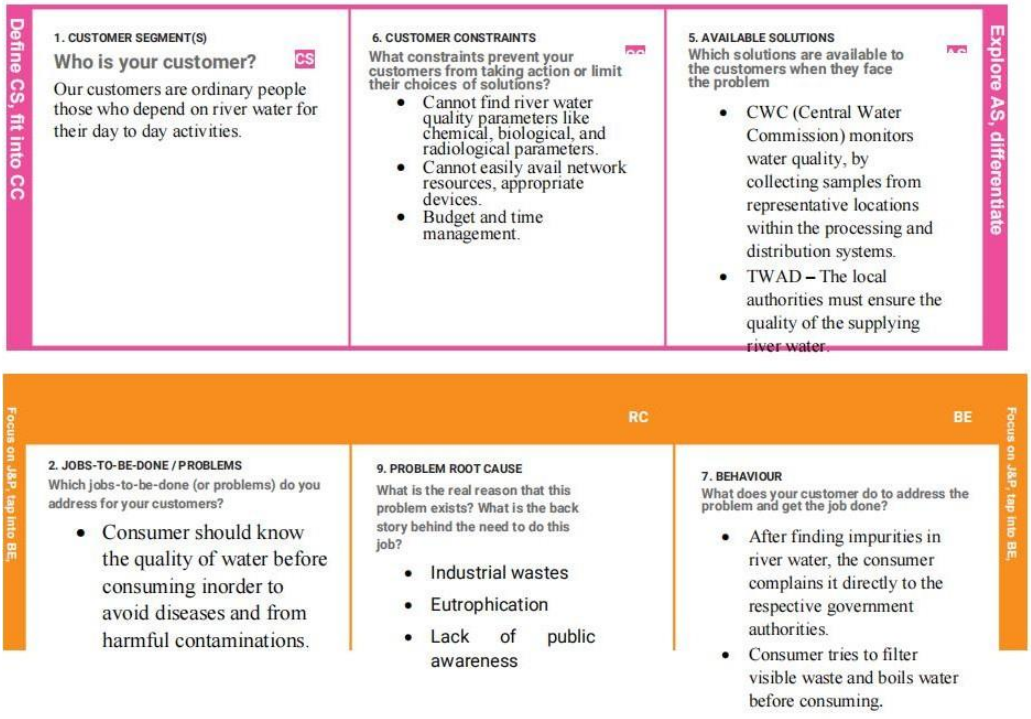
Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Real Time River water quality monitoring and controlling using IOT.
2.	Idea / Solution description	Monitoring water parameters such as pH, TDS, Salinity and hardness using Arduino and sensors.
3.	Novelty / Uniqueness	• Data samples are collected and accurate parameter values are obtained. • Individual notification will be sent to people and to the authorities.
4.	Social Impact / Customer Satisfaction	• Pollution in water can be identified. • Eutrophication can be controlled. • Parameters such as chemical, radiological and biological can be checked to increase the impact on health and vegetation.
5.	Business Model (Revenue Model)	• Cost effective model which people can afford. • Application is flexible to users.
6.	Scalability of the Solution	In this model, data can be collected and sampled using IOT and cloud services, can be viewed from any location at any time. Water quality can be measured even in remote areas without laboratory equipments.

Problem Solution fit



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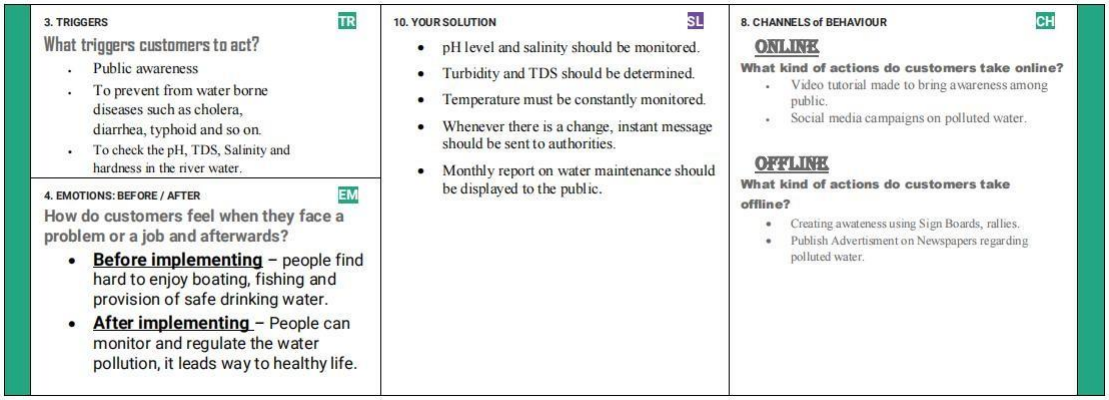

3) REQUIREMENT ANALYSIS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Login	Confirmation through verified password.
FR-2	View Water Details	View current water details in website View traditional water eligibility in website.
FR-3	Historical Data	The Data are stored in the cloud from the beginning stage till the Updation.
FR-4	User Authentication	The credentials is accessible only to the authorized users to access the model.
FR-5	Users Guidelines	There are some specific guidelines which has to be followed by the users.
FR-6	Logout	Logs out the user successfully.

Non-functional Requirements:

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

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 and Account creation done only after email verification.
NFR-3	**Reliability**	Users can access their account 98% of the time without failure.
NFR-4	**Performance**	Load time for user interface screens shall not be more than 2 seconds. For that High quality sensors are used to ease the customer's work.
NFR-5	**Availability**	The model is designed in such a way that are available, usable and can be modified anytime. Maximum down time will be about 4 hours.
NFR-6	**Scalability**	System can handle about 1000 users at any given time. The final data should be easily understandable.

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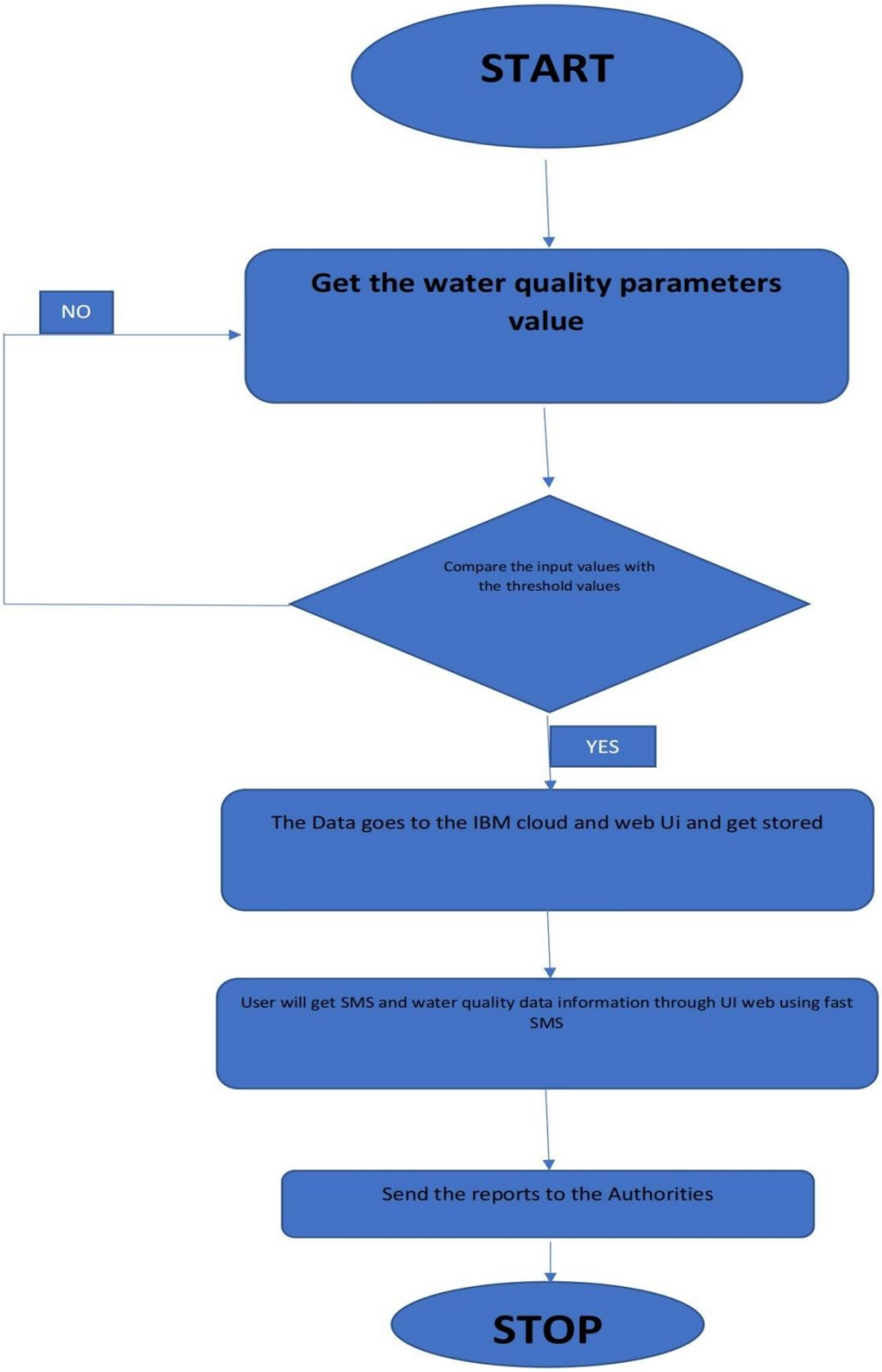
5) PROJECT DESIGN

Data Flow Diagrams



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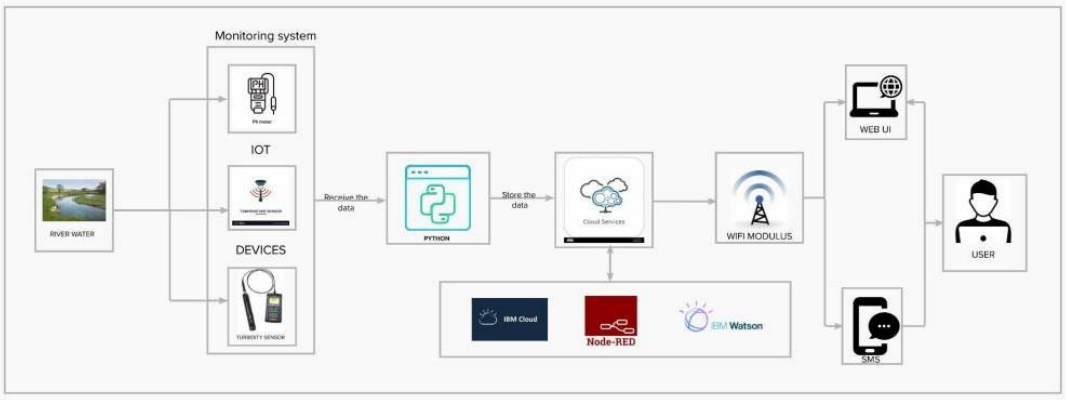
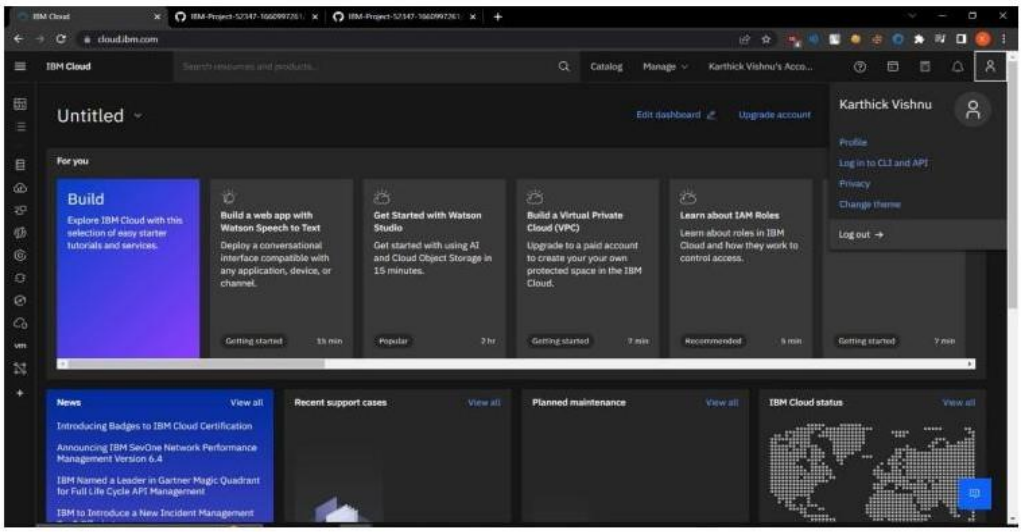
Solution & Technical Architecture

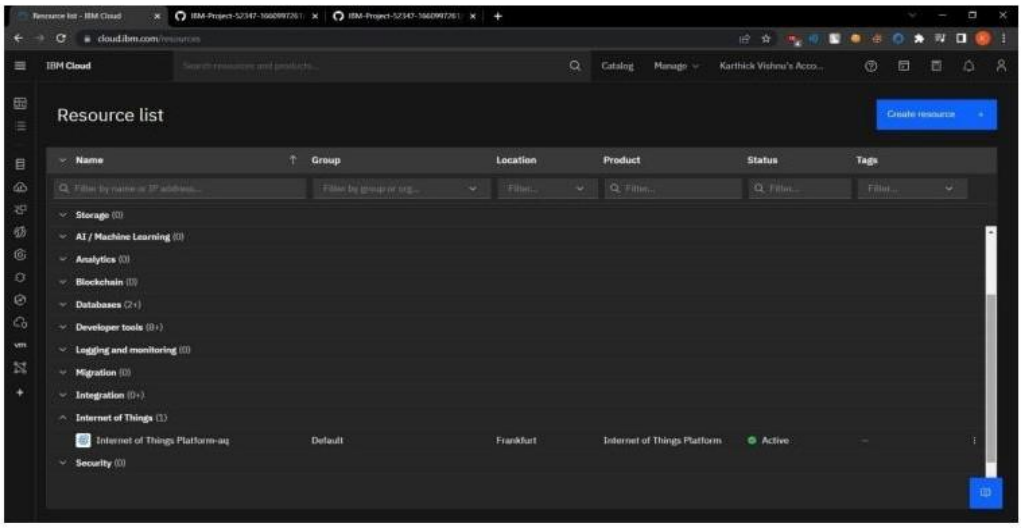


6) PROJECT PLANNING & SCHEDULING

Sprint 1

CREATION OF IBM CLOUD :





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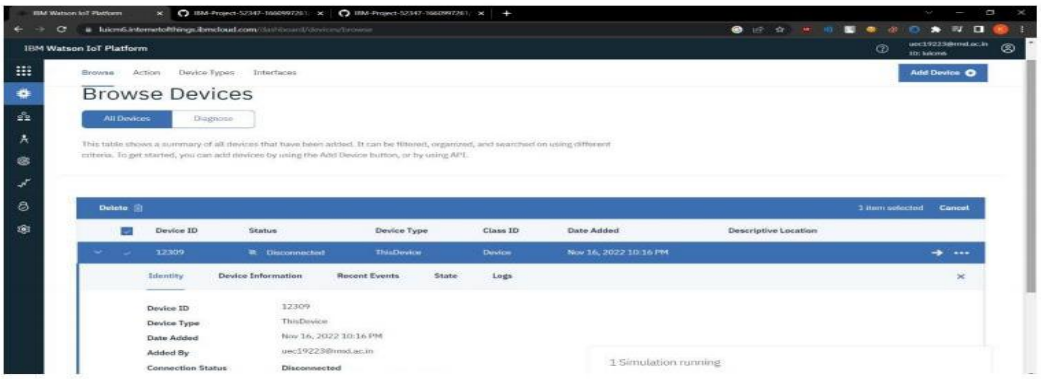
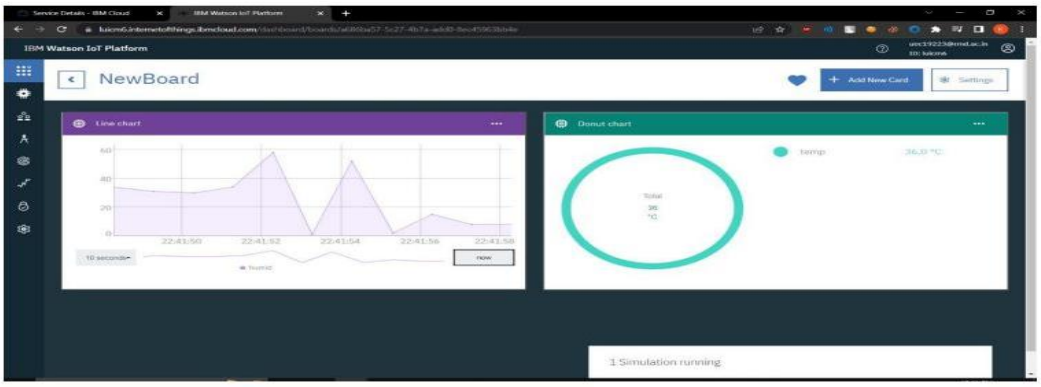
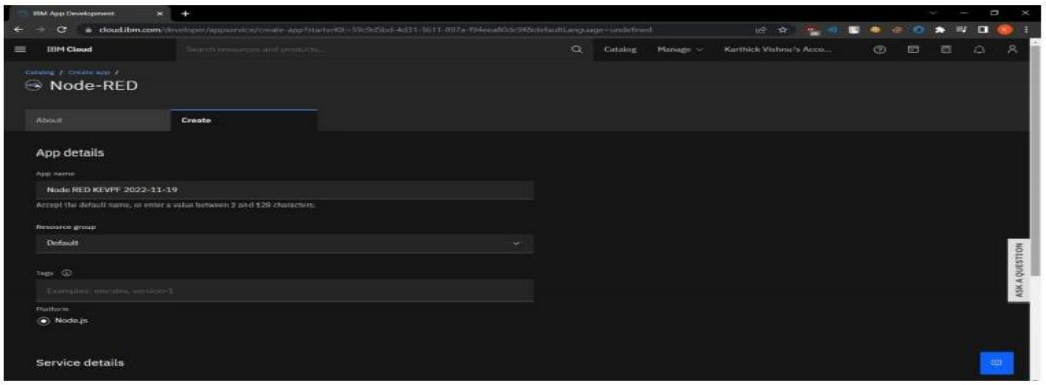
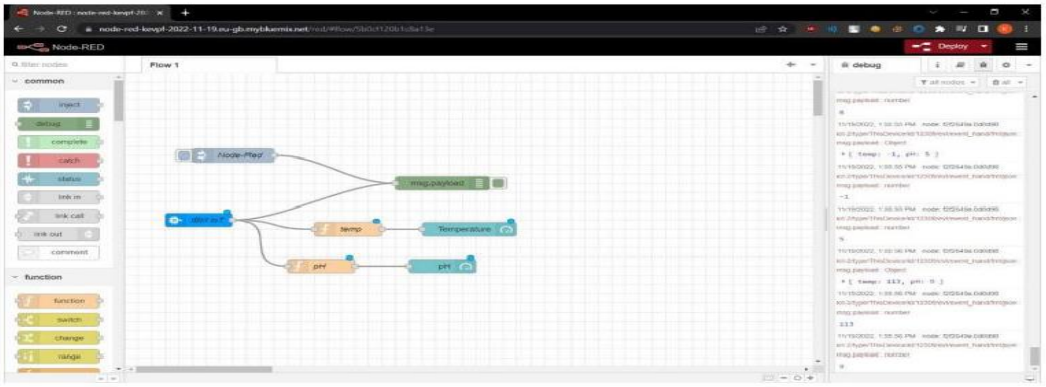
CREATION OF IBM WATSON :





NODE-RED :





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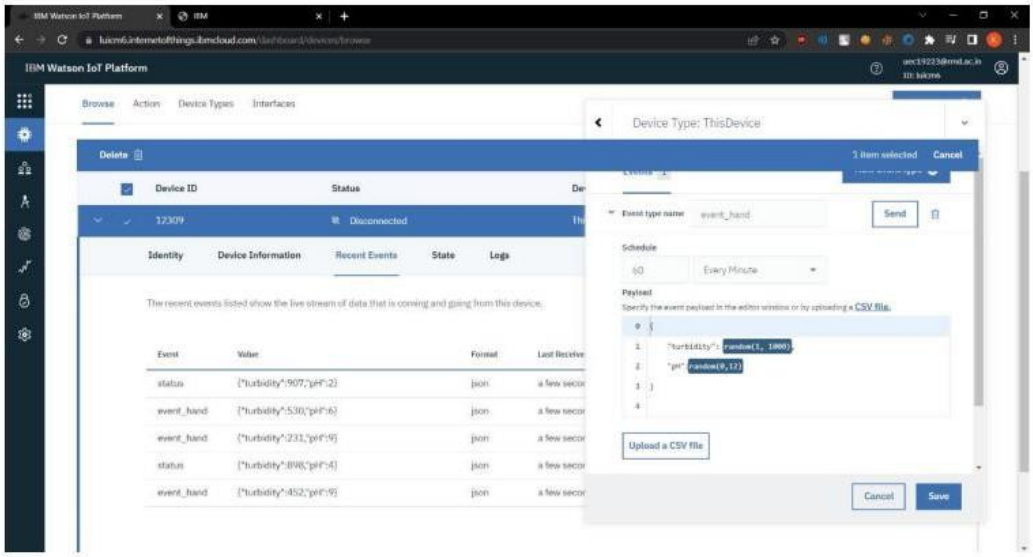
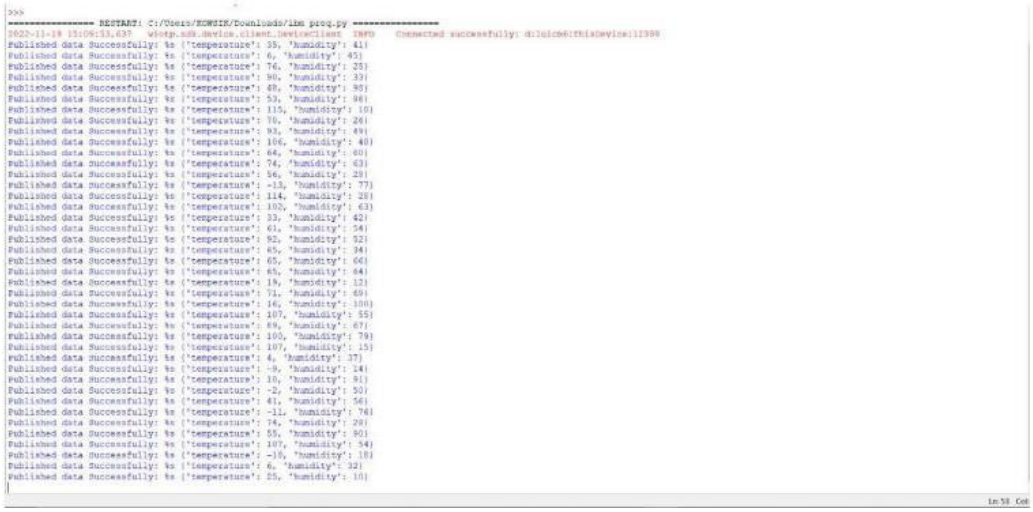
Sprint 2

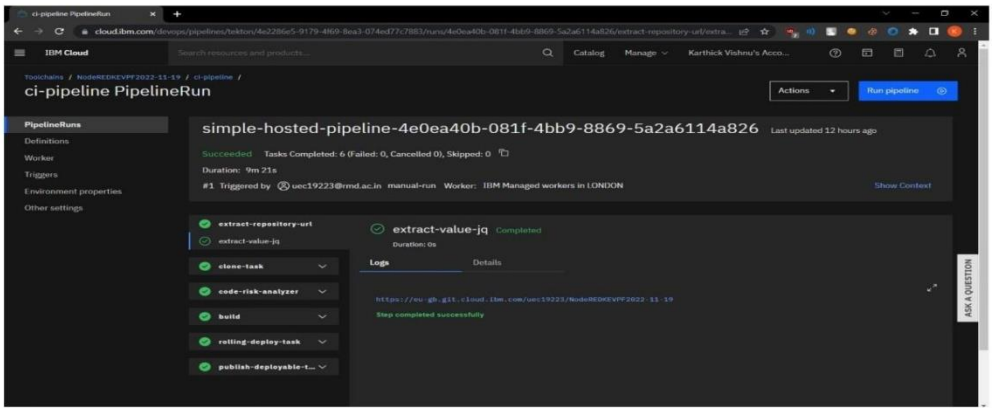
CLOUD SHARING WITH PYTHON SCRIPT:





Sprint 3

GENERATE A LINK TO INTERFACE THE NODE RED SERVICE WITH THE WEB UI/MOBILE APP:



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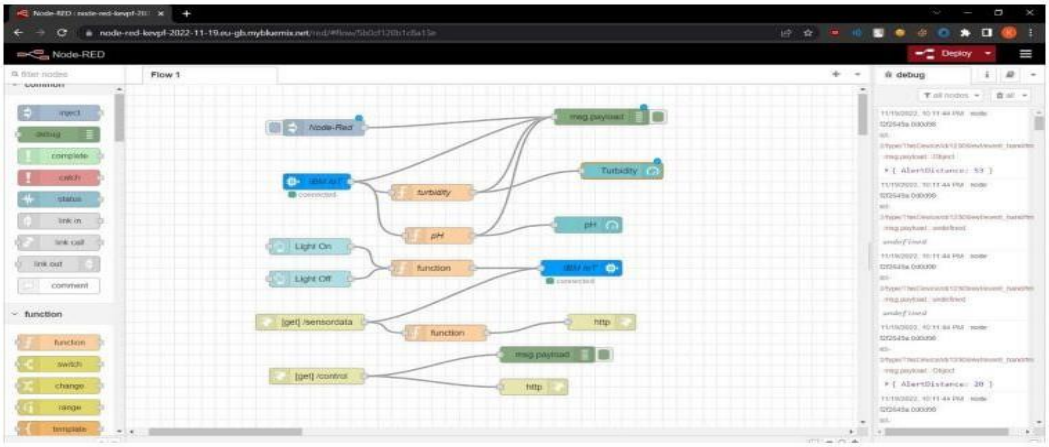
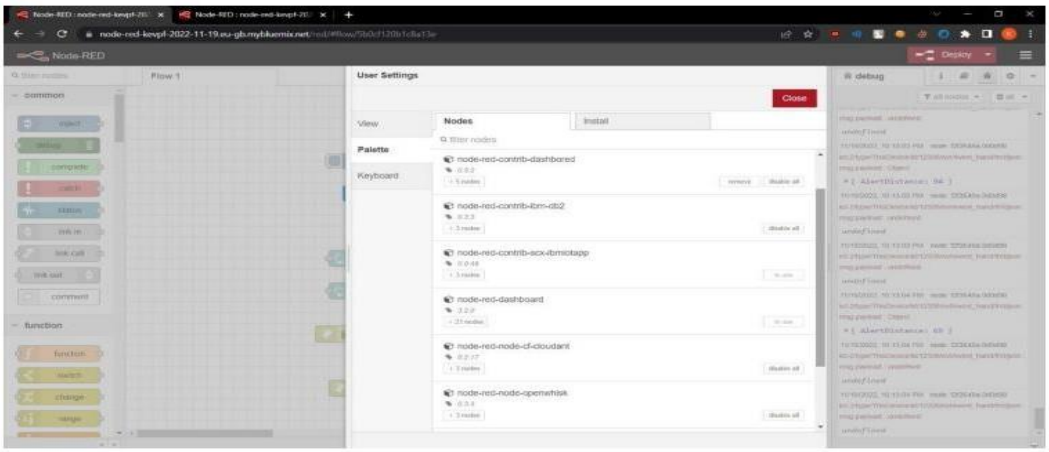
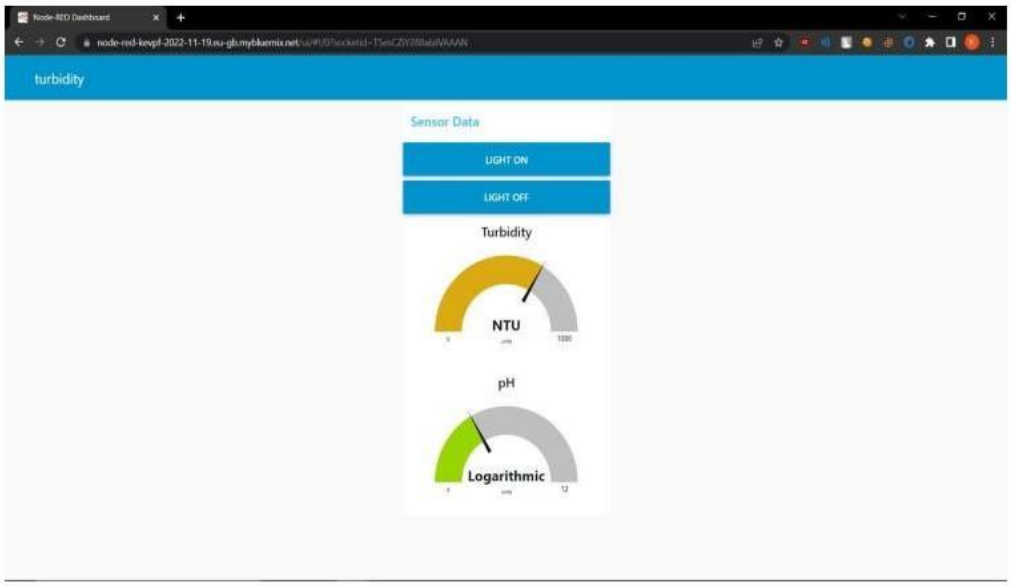
NODE-RED ARCHITECTURE:





WEB UI:

DASHBOARD:



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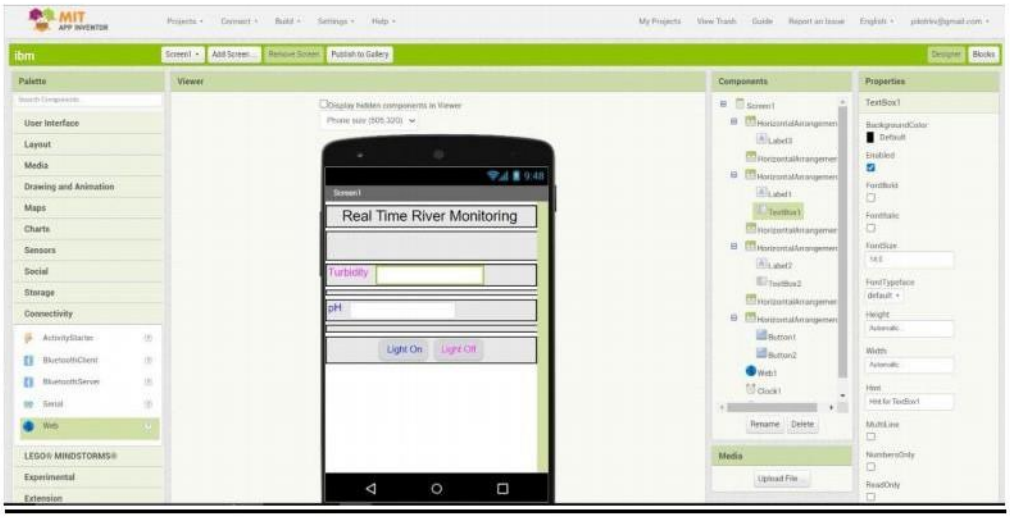
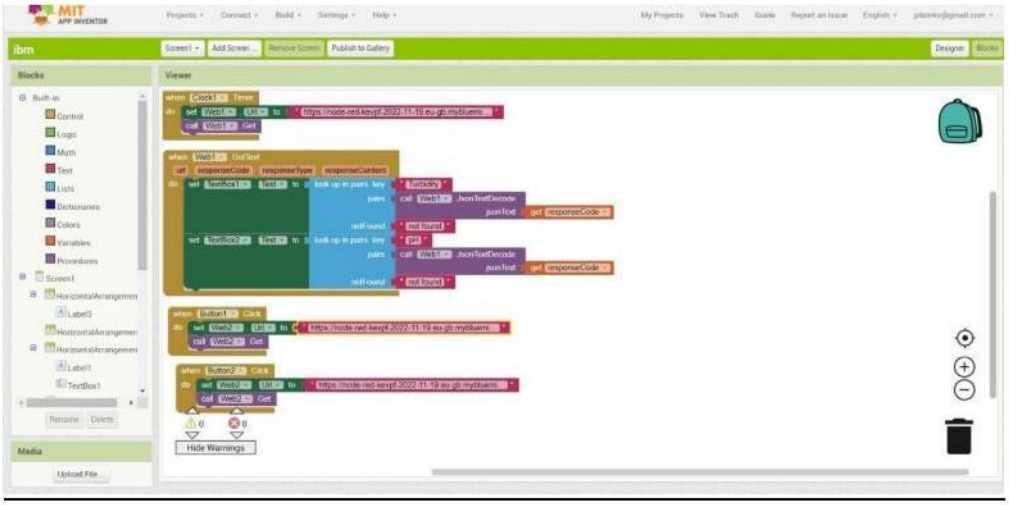
Sprint 4

INTERFACE:



LOGIC BLOCK:



RECEIVE DATA FROM CLOUD:

```
Message received from IBM IoT Platform: L2GHT OFFPublished data Successfully: %s
 {'turbidity': 546, 'pH': 0}
Message received from IBM IoT Platform: L2GHT OFF
Message received from IBM IoT Platform: L2GHT OFF
Published data Successfully: %s {'turbidity': 855, 'pH': 4}
Published data Successfully: %s {'turbidity': 764, 'pH': 11}
Message received from IBM IoT Platform: L2GHT ON
Published data Successfully: %s {'turbidity': 574, 'pH': 11}
Message received from IBM IoT Platform: L2GHT ON
Message received from IBM IoT Platform: L2GHT ON
Message received from IBM IoT Platform: L2GHT ON
Published data Successfully: %s {'turbidity': 977, 'pH': 10}
Published data Successfully: %s {'turbidity': 490, 'pH': 11}
Message received from IBM IoT Platform: L2GHT OFF
Message received from IBM IoT Platform: L2GHT OFF
Message received from IBM IoT Platform: L2GHT OFF
Message received from IBM IoT Platform: L2GHT OFF
Published data Successfully: %s {'turbidity': 762, 'pH': 6}
Published data Successfully: %s {'turbidity': 536, 'pH': 1}
Published data Successfully: %s {'turbidity': 270, 'pH': 10}
Published data Successfully: %s {'turbidity': 345, 'pH': 5}
Published data Successfully: %s {'turbidity': 859, 'pH': 11}
Published data Successfully: %s {'turbidity': 833, 'pH': 0}
Published data Successfully: %s {'turbidity': 779, 'pH': 3}
Published data Successfully: %s {'turbidity': 236, 'pH': 1}
Published data Successfully: %s {'turbidity': 51, 'pH': 8}
Published data Successfully: %s {'turbidity': 904, 'pH': 8}
Published data Successfully: %s {'turbidity': 450, 'pH': 11}
Published data Successfully: %s {'turbidity': 611, 'pH': 9}
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Published data Successfully: %s {'turbidity': 123, 'pH': 4}
Published data Successfully: %s {'turbidity': 324, 'pH': 4}
Published data Successfully: %s {'turbidity': 104, 'pH': 11}
Published data Successfully: %s {'turbidity': 348, 'pH': 7}
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Published data Successfully: %s {'turbidity': 902, 'pH': 9}
Published data Successfully: %s {'turbidity': 285, 'pH': 4}
Published data Successfully: %s {'turbidity': 168, 'pH': 2}
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Published data Successfully: %s {'turbidity': 632, 'pH': 1}
Published data Successfully: %s {'turbidity': 655, 'pH': 3}
Published data Successfully: %s {'turbidity': 194, 'pH': 11}
Published data Successfully: %s {'turbidity': 518, 'pH': 1}
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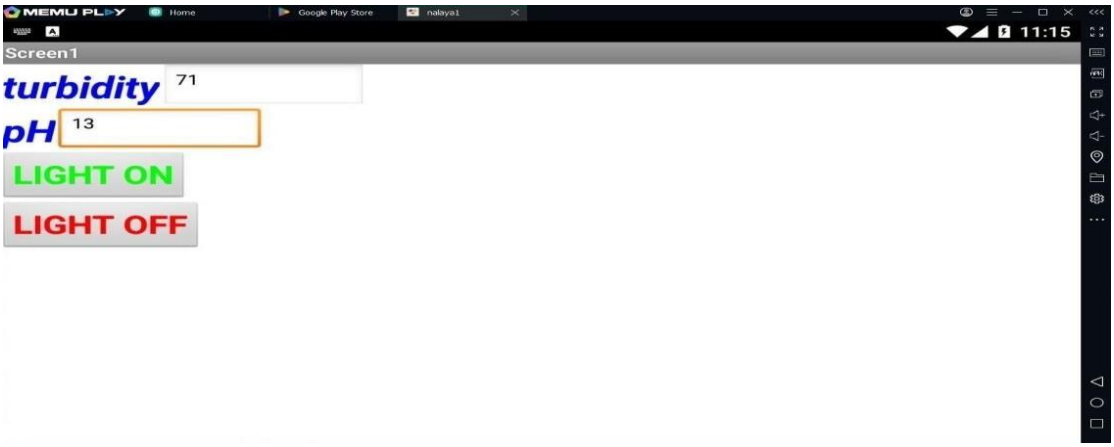
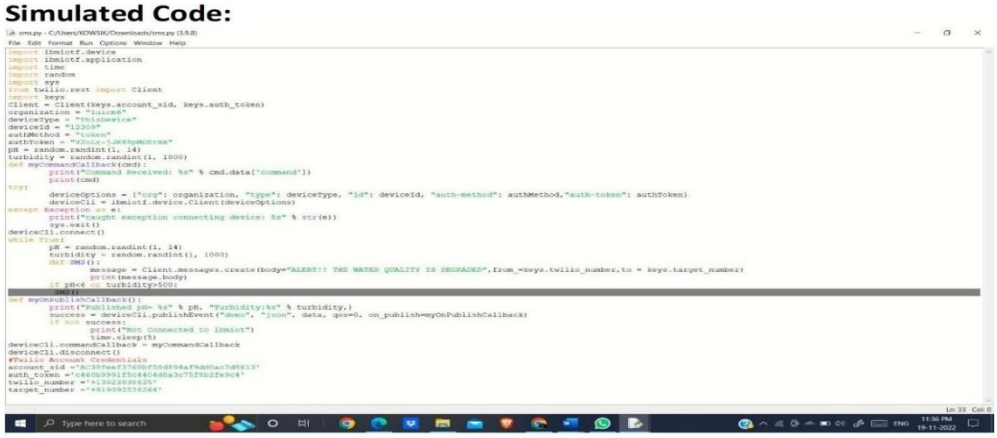


7) CONCLUSION

An IoT system was developed to monitor river water in real time. The IoT system was used to collect the data from identified stations for different water quality parameters such as pH, turbidity, temperature and conductivity to generate a data set that was used to monitor the quality of water. The collected data set can also be used in future to make the system intelligent by applying machine learning techniques.

7) Appendix

Simulated Code:



Github Link:

https://github.com/IBM-EPBL/IBM-Project-33916-1660228895

Google Drive Link:

https://drive.google.com/file/d/1T4o6NDSwgYWuROR854pVjMHW3m7HpD9W/view?usp=share_link

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