REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

NALAIYA THIRAN PROJECT

A PROJECT REPORT

Submitted by

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BACHELOR OF ENGINEERING

IN

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St. JOSEPH'S COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai)

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BONAFIDECERTIFICATE

Certified that this project report titled "**Real-Time River Water Quality Monitoring and Control System by NALAIYA THIRAN PROJECT BASED LEARNING Program**", is the bonafide work of **ALLEN CLEMENT.J (312319104013),HARINI.R(312319104041),DINESH RAJA.N (312319104501), JOE ANTONY.V(312319104060)** who carried out the work under faculty mentor and industry mentor supervision, for the partial fulfillment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING IN COMPUTER SCIENCE AND ENGINEERING .**

Certified further that to the best of my knowledge and belief, the work reported here in does not form part of any other thesis or dissertation on the basis of which a degree or an award was conferred on an earlier occasion

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 system consists of several sensors which is used to measure physical and chemical parameters of the water. 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.

Now a day's Internet of things (IoT) is an innovative technological phenomenon. It is shaping today's world and is used in different fields for collecting, monitoring and analysis of data from remote locations. IoT integrated network if everywhere starting from smart cities, smart power grids, and smart supply chain to smart wearable. Though IoT is still under applied in the field of environment it has huge potential. It can be applied to detect forest fire and early earthquake, reduce air population, monitor snow level, prevent landslide, and avalanche etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system. 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.

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CHAPTER 1

1. INTRODUCTION

The Internet of Things (IoT) is a system that allows devices to be connected and remotely monitored across the Internet. In the last years, the IoT concept has had a strong evolution, being currently used in various domains such as real-time river water quality monitoring and control system, telemedicine, industrial environments, etc. According to Human Rights Watch, twenty million people in our country are still drinking water contaminated with arsenic. The World health Organization (WHO) has also stated this crisis as "the largest mass poisoning of a population in history". To reduce the water related diseases and prevent water population, we have to measure water parameters such as pH, turbidity, conductivity, temperature etc. Traditional methodology of water monitoring requires collecting data from various sources manually. Afterwards samples will be sending to laboratory for testing and analyzing. In order to save time consumption and decrease manual effort my testing equipment's will be placed in any water source. As a result, this model can detect pollution remotely and take necessary actions.

1.2. COMPANY PROFILE

International Business Machines Corporation (IBM) is a technology company engaged in providing hybrid cloud and artificial intelligence (AI) solutions. It offers integrated solutions and products that use data and information technology (IT) in industries and business processes. Its segments include Software, Consulting, Infrastructure and Financing. Software segment consists of two business areas: Hybrid Platform & Solutions, which includes software to help clients operate, manage, and optimize their IT resources and business processes within hybrid, multi-cloud environments, and Transaction Processing, which includes software that supports clients' mission-critical, on-premises workloads in various sectors. Consulting segment is engaged in business transformation, technology consulting and application operations. Infrastructure segment is engaged in hybrid infrastructure and infrastructure support. Financing segment is engaged in client financing and commercial financing business

CHAPTER 2

2. OBJECTIVE

Project based learning are generally thought of to be reserved for college students looking to gain experience in a particular field. However, the aim is to develop a system for continuous monitoring of river water quality at remote places using wireless sensor networks with low power consumption, low-cost and high detection accuracy. pH, conductivity, turbidity level, etc. are the limits that are analyzed to improve the water quality. The main objective of this project is to

- Gain knowledge of Watson IoT Platform.
- Connecting IoT devices to the Watson IoT platform and exchanging the sensor data.
- Gain knowledge on Cloudant DB
- Creating a Web Application through which the user interacts with the device.

This project makes the human work much easier.

2.1. TECHNOLOGY

The Internet of things (IoT) describes physical objects with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. IoT is a giant, digitally connected universe of billions of physical devices around the world; “things” that collect and share data about how they’re used and the environment around them. These objects are embedded with internet connectivity, software, sensors, and other hardware that enable them to connect and exchange data with other systems and devices over the web IoT extends the power of the internet beyond smart phones and computers to ordinary household objects such as light bulbs, locks, smart microwaves, wearable fitness devices, sophisticated industrial tools, and self-driving cars, affording them a higher degree of analytical and computing capabilities.

CHAPTER 3

3.1 IDEATION PHASE

In order to support our project, the below mentioned were reviewed.

1. This paper work applied principal component analysis (PCA) and principal factor analysis (PFA) techniques to evaluate the effectiveness of the surface water quality-monitoring network in a river where the evaluated variables are monitoring stations. The objective was to identify monitoring stations that are important in assessing annual variations of river water quality. Twenty-two stations used for monitoring physical, chemical, and biological parameters, located at the main stem of the lower St. Johns River in Florida, USA, were selected for the purpose of this study .Ouyang, Y., 2005. Evaluation of river water quality monitoring stations by principal component analysis. Water research, 39(12), pp.2621-2635.

2. This paper work focuses on monitoring the River water with IoT 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. Chowdury, Mohammad Salah Uddin, Talha Bin Emran, Subhasish Ghosh, Abhijit Pathak, Mohd Manjur Alam, Nurul Absar, Karl Andersson, and Mohammad Shahadat Hossain. "IoT based real-time river water quality monitoring system." Procedia Computer Science 155 (2019): 161-168.

3. This research reports the state of the art of various AI models implemented for river WQ simulation over the past two decades (2000–2020).The survey covers the model structure, input variability, performance metrics, regional generalization investigation and comprehensive assessments of AI models progress in river water quality research. Tung, Tran Minh, and Zaher Mundher Yaseen. "A survey on river water quality modeling using artificial intelligence models: 2000–2020." Journal of Hydrology 585 (2020): 124670.

3.2 Empathy Map

3.3 Ideation

Brainstorm & Idea Prioritization

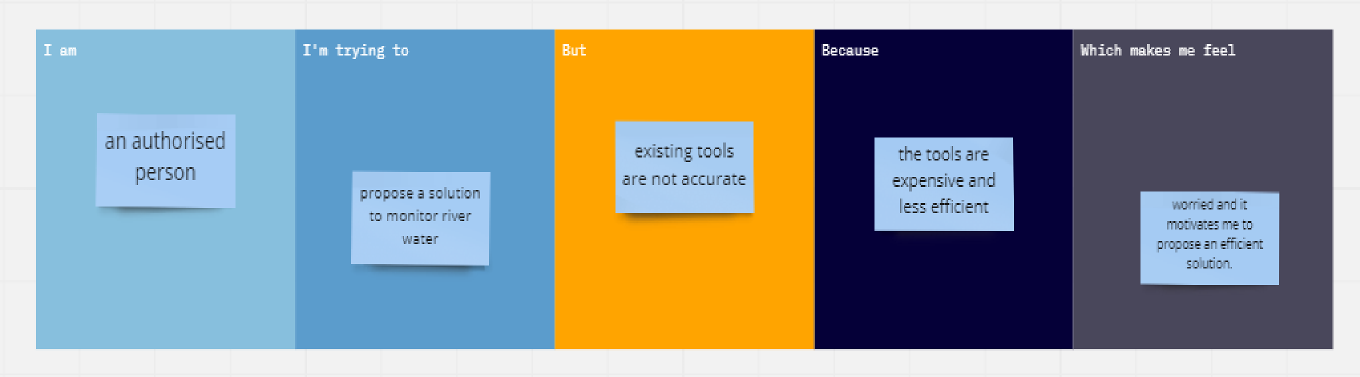
The main aim is to develop a system for continuous monitoring of river water quality at remote places using wireless sensor networks with low power consumption, low-cost and high detection accuracy. pH, conductivity, turbidity level, etc. are the limits that are analyzed to improve the water quality. Following are the aims of idea implementation.

(a) To measure water parameters such as pH, dissolved oxygen, turbidity, conductivity, etc. using available sensors at a remote place.

(b) To assemble data from various sensor nodes and send it to the base station by the wireless channel.

(c) To simulate and evaluate quality parameters for quality control. (d) To send SMS to an authorized person routinely when water quality detected does not match the preset standards, so that, necessary actions can be taken

3.4 Problem Statemen



I am (Customer)	An authorized person who is supposed to ensure the safety of common people.	Common people living around a river mostly depend on that river for water usage. So it is important to make sure that the river water is safe to use.
I am trying to	Monitor the River Water quality.	Wants to monitor the river water quality consumed by the people by checking its pH value, Turbidity and dust particles in it.
BUT	The existing models are not accurate.	Accuracy of the existing model is not enough to monitor efficiently in rainy seasons.
Because	They are of High cost and consume high power and don’t have automated monitoring systems.	It is difficult to alert about the lack of quality of water at every single time.
Which makes me feel	Worried about the safety of the people.	So, If the authorized person is not aware whether the water is contaminated or not, he won’t be able to give alerts to residents near the river. This could lead to disease spread.

CHAPTER 4

4.1 Proposed Solution

		Description
1.	**Problem Statement (Problem to be solved)**	It's about being aware of and little expenses and management that makes great differences. Often people lose track of where and how much was spent in the long run, ultimately have to live while sustaining the little money they have left for their essential needs. There is a need for people to track and monitor their expense regularly and doing this through paper and pen or in excel is not that completely feasible or that
2.	**Idea / Solution description**	The main idea is to enable users to track and better suggest the expense of the users so that they will be aware of their financial income and expenses to better plan their future investments. Expense Management and Tracking is performed by noting down and analyzing the transactions of an individual or an organization over a particular period.
3.	**Novelty / Uniqueness**	Detailed analyses of what and how the user spends, and all the spending habits can be tracked and accordingly adjusted. The weekly, monthly, and year-wise comparison of expenditures will be and will let the user know the area where and how much is spent. When you track your expenses, you are taking control of your finances. It lets you regulate spending impulses and eliminate worthless spending, thereby avoiding debt. At every point, you will be aware about how much money you are left with.
4.	**Social Impact / Customer Satisfaction**	It can help you to * Track and prioritize spending * Avoid wasteful spending habits *Take Control of Your Finances *Suggestions for future Investment and growth
5.	**Business Model (Revenue Model)**	Through our application the revenue for the company will be in the form of ads. Makes the user know about what are all the good things and trending ways to invest money safely and securely.
6.	**Scalability of the Solution**	The system can handle a large number of users since it is based on the cloud system. It is very easy to store and retrieve data from the cloud rather than getting it from a database.

4.2 Problem Solution Fit

Project Title: Real-Time River Water Quality Monitoring and Control System | **Project Design Phase-I - Solution Fit** | **Team ID: PNT2022TMID02419**

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Farmers, Fishermen, Riverside communities and Drinking water supplier.

6. CUSTOMER CONSTRAINTS CC

In manual method, it is difficult to collect the water samples from all the area of the water body but, It is very easy to maintain the IoT based water quality monitoring system as all the electronic boards are available in the WQM system itself. River water quality analysis replaces the need for using laboratory checking and reduces the time of delay required for result.

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 apps can speed up and cut back on the time it takes to get findings and solutions to issues.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

- ➢ Measure the water parameters such as pH, dissolved oxygen, turbidity, etc. using available sensors at a remote place.
- ➢ Assemble data from various sensor nodes and send it to the base station by the wireless channel.
- ➢ Simulate and evaluate quality parameters for quality control.

9. PROBLEM ROOT CAUSE RC

- ➢ The cost of analysis is very high.
- ➢ The lab testing and analysis takes some time and hence the lab result 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.

7. BEHAVIOUR BE

By measuring physical and chemical parameters of river water by using an IoT based sensor network, It simulates and evaluates quality parameters for quality control finally, sends SMS to an authorized person routinely when water quality detected does not match the preset standards, so that, necessary actions can be taken

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS

It ensures high data precision, data accuracy, timely reporting, easy accessibility of data, cost effective and completeness.

4. EMOTIONS: BEFORE / AFTER

In earlier days, Water quality data are collected mainly by manual field sampling which consumes huge amount of time and it was difficult for river side communities, farmers, water suppliers and many more to analyze the quality of water for their purpose. After river water quality analysis ,A real-time water quality monitoring system can be applied forth management of drinking-water-supply processes, in rivers, lakes and the sea

10. YOUR SOLUTION SL

- ❖ To implement a cost effective technique for monitoring water river quality and controlling in real-time using IoT.
- ❖ Due to advancement in IoT technology, the water quality monitoring system is becoming smarter with reduced power consumption and ease of operation.
- ❖ Advanced data collection could significantly benefit purposes such as continuous monitoring of water resources, assessments of flood areas, pollution management, and effects due to anthropogenic activities. Recently, automated sampling devices have been used to collect the water samples on a regular basis (e.g., few-hour interval) to estimate the pollutant load in designated field streams.

8. CHANNELS of BEHAVIOUR CH

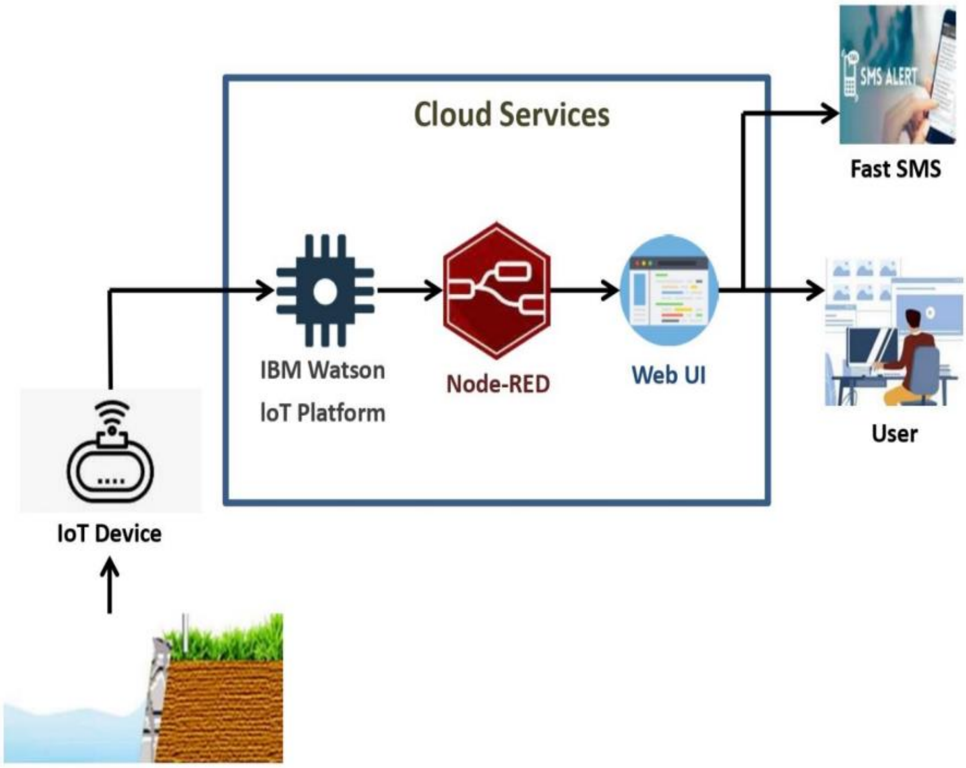
8.1 ONLINE

Online website provides the information according to the customer's need.

8.2 OFFLINE

In offline, according to the information acquired from the SMS sent to the authorized person regarding water quality necessary actions can be taken(i.e.)when water quality detected does not match the preset standards, so that, necessary actions can be taken.

4.3 Solution Architecture



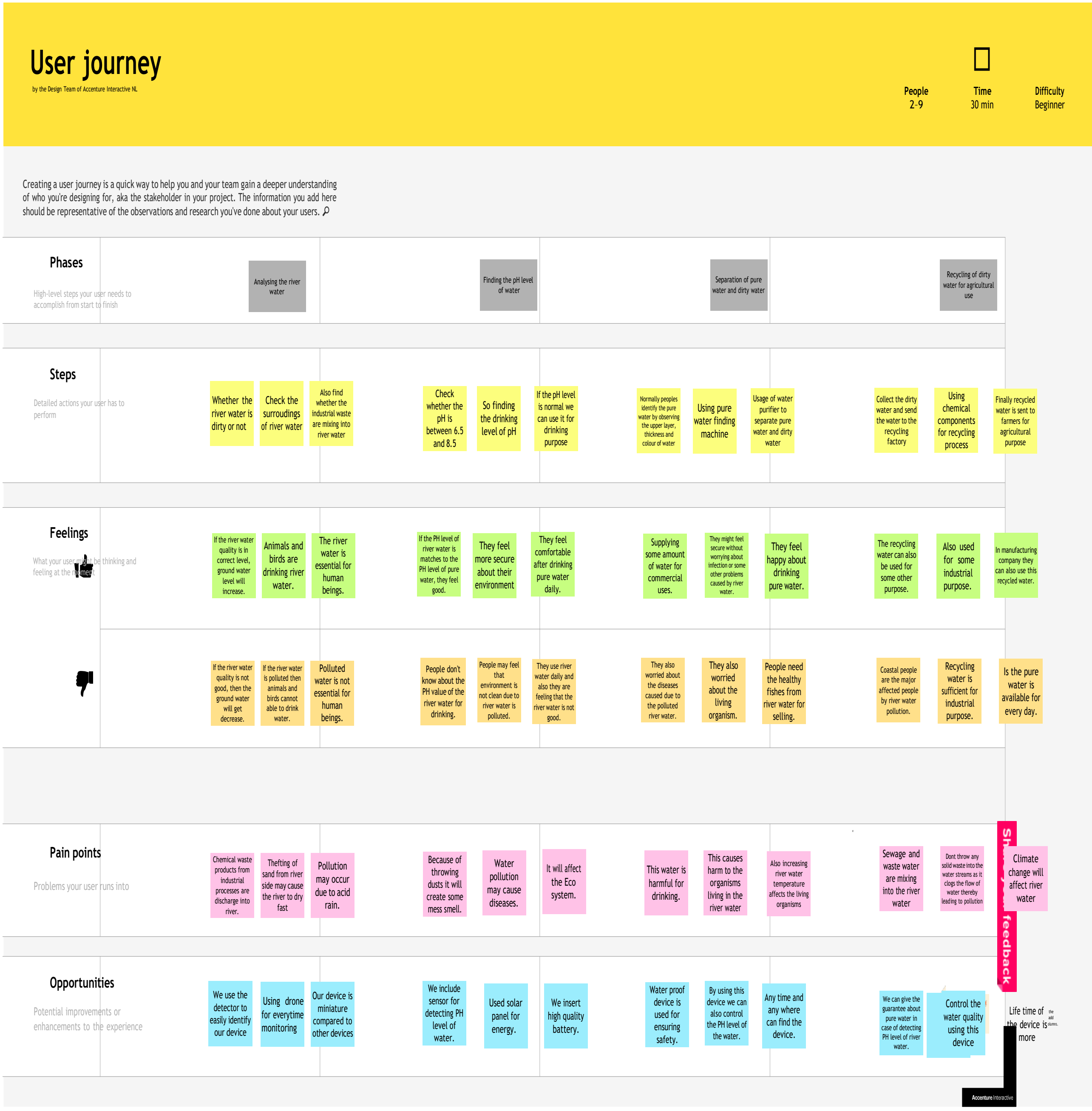
PROJECT DESCRIPTION:

- River water quality can be monitored by the web application.
- The web application and the user are interfaced.
- The pH level and the turbidity of the water can be monitored.
- If the water quality is not good then the authorities get alerted by the message.

CHAPTER 5

PROJECT DESIGN PHASE 2

5.1 Customer Journey Map



5.2 Requirement Analysis

Functional Requirements:

FR Functional Requirement Sub Requirement (Story / Sub-Task) No. (Epic)

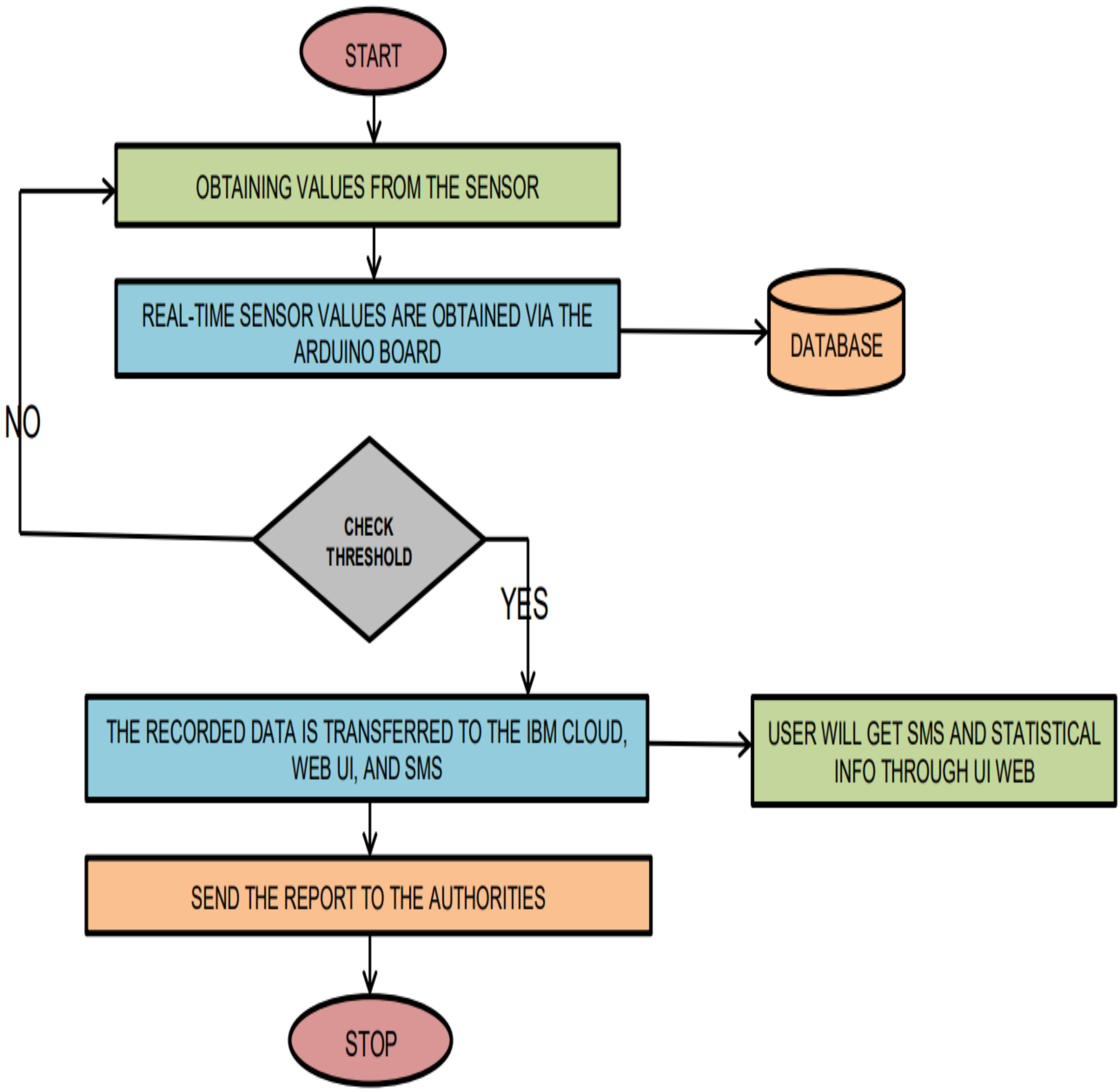
FR-1	Data Gathering	The WSN must be able to detect and the temperature of a particular area in real.
FR-2	Location Detection	The WSN must be able to detect when a wearable device has entered an area near it.
FR-3	Wireless Sensor Network	The WSN must be able to share its stored data with both the wearable device and admin dashboard through the cloud.
FR-4	Wearable Device Display	The wearable device must be able to display the temperature of the area where the worker is currently present.
FR-5	SMS Notification	If the temperature of the area is found to reach dangerous levels, the worker should be informed via SMS to their phone instructing them to leave the area.
FR-6	Admin Dashboard	If the temperature of the area is found to reach dangerous levels the admin is informed via the dashboard and must take the necessary precautions.

Non-functional Requirement

NFR-1	Usability	The wearable device should be slim and not annoy or disturb the workers who are wearing them. They should also reliably display the temperature without large delays and notifications should be clear in cases of detected danger.
NFR-2	Security	The connection of the WSN to the cloud and wearable devices should be secure. The security of the database housing all the temperature data should also be bolstered.
NFR-3	Reliability	The wearable device should be able to function without any faults even at dangerous temperatures. If a fault is detected it should notify the user and the admin to be immediately repaired and replaced. The WNS should also be regularly maintained to ensure reliability.
NFR-4	Performance	The device should update temperature readings in real time and requires high end sensors and processors to do so. The time to send data to the cloud and other devices should also be made as small as possible.
NFR-5	Availability	The user should be able to check the temperature of the area no matter where or at what time they are in the plant. The dashboard should be constantly active so as to ensure safety precautions can be executed whenever danger is detected.
NFR-6	Scalability	If the area that needs to be monitored needs to be increased all one has to do is install new WSN devices and connect them to the same system as the previous beacons. It can also be replicated in different plants with different factors to be monitored giving it highly scalability.

5.3 Data Flow Diagrams

Data Flow Diagrams:

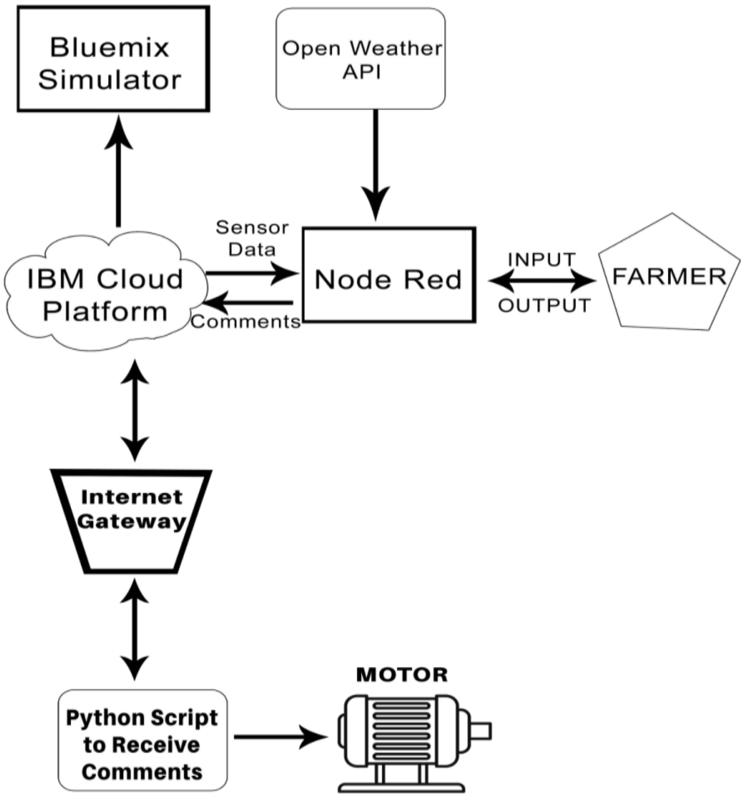


User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering email, password, and confirming my password.	I can access my account /dashboard.	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application.	I can receive confirmation Email &click confirm.	High	Sprint-2
		USN-3	As a user, I can register for the application through Google.	I can register & access the dashboard with Google.	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail.	I can register through the mail.	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email, password and captcha.	I can receive login credentials.	High	Sprint-1
	Interface	USN-6	As a user, the interface should be in an approachable way.	I can able to access easily.	Medium	Sprint-1
Customer (Web user)	Dashboard	WUSN-1	As a web user, I can access specific parameters (pH value, Temperature, Turbidity).	I can able to know the quality of the water.	High	Sprint-1
Customer Care Executive (input)	View Point	CCE-1	As a customer service, I can view data in a graphical representation style.	I can easily understand by visuals.	High	Sprint-1
	Taste	CCE-2	As a customer service, I can analyze the standard (salinity) of the water.	I can easily know whether it is saline or not.	High	Sprint-1
	Color visibility	CCE-3	As a customer service, I can determine the state of the water based on its color.	I can easily know the condition by color.	High	Sprint-1
Administrator	Risk tolerant	ADMIN-1	An administrator who is in charge of the system should update and maintain the application.	Admin should monitor the records properly.	High	Sprint-2

5.4 Technology Stack

Technical Architecture:



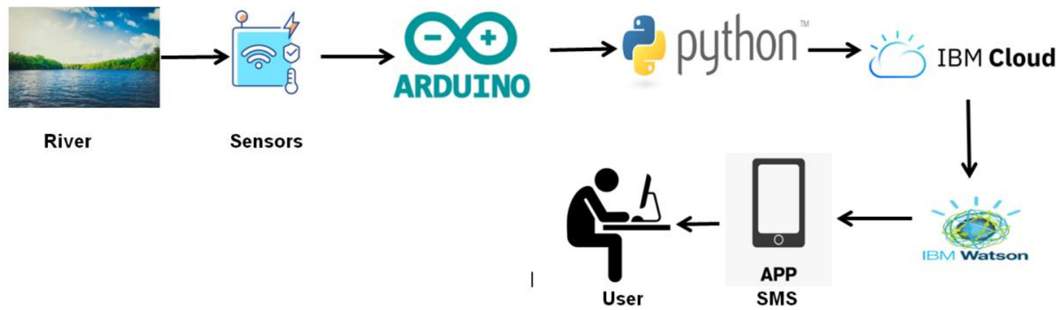


Table-1: Components & Technologies:

S. No	Component	Description	Technology
1.	Received data from sensors	The data collected form the sensor units placed inriver sides	ESP32 Wi-Fi module
2.	Web interface	The collected data were displayed visually	HTML,CSS, JavaScript
3.	Database	Data type	MySQL
4.	Cloud database	Database service on cloud	IBM cloud
5.	Data storage	File storage requirements	IBM Block storage

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	pH level monitoring	The pH level of river water can be monitored viaplacing sensors in rivers	pH-sensor
2.	Temperature monitoring	The temperature of river water can be monitored	Temperature sensor
3.	Pollution monitoring	The clarity and purity of river water can bemonitored	Conductive sensor
4.	Soil level monitoring	The amount of soil mixed in river water can bemeasured	Turbidity sensor

CHAPTER 6

PROJECT PLANNING PHASE

1.1 Milestone and Activity list

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project is done by gathering information about related details on technical papers and web browsing.	22 SEPTEMBER 2022
Empathy Map	Prepared Empathy Map Canvas to combine thoughts and pains, gains of the project with all team members.	22 SEPTEMBER 2022
Ideation	Brainstorming session is conducted with all team members to list out all the ideas and prioritize the top 3 ideas.	22 SEPTEMBER 2022
Proposed Solution	Prepared the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	27 SEPTEMBER 2022
Problem Solution Fit	Prepared problem - solution fitdocument.	06 OCTOBER 2022

Solution Architecture	Prepared solution architecture document with basic design Ideas.	09 OCTOBER 2022
Customer Journey	Prepared the customer journey maps to understand the user interactions & experiences with the application.	22 OCTOBER 2022
Functional Requirement	Functional requirement is prepared with listing both functional and non -functional needs.	22 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submitted user stories.	27 OCTOBER 2022
Technology Architecture	Prepared architecture with components & technologies, Application characteristics.	30 OCTOBER 2022
Prepare Milestone & Activity List	Prepared the milestones & activity list of the project.	10 NOVEMBER 2022
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS.

1.2 Sprint Delivery Plan

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	HARISH GOWTHAM REDDY JANANI JAYALAKSHMI
	Registration via Mail ID	USN-2	As a user, I can register for the application through Gmail	2	MEDIUM	HARISH GOWTHAM REDDY JANANI JAYALAKSHMI
Sprint-2	Confirmation	USN-3	As a user, I will receive confirmation email once I have registered for the application	1	HIGH	HARISH GOWTHAM REDDY
	Login	USN-4	As a user, I can log into the application by entering email & password	1	HIGH	JANANI
	IBM Cloud service Access		Get access to IBM cloud services.	2	HIGH	JAYALAKSHMI
Sprint-3	Create the IBM Watson IoT and device Settings	USN-5	To create the IBM Watson IoT Platform and integrate the microcontroller with it, to send the sensed data on Cloud	2	HIGH	HARISH GOWTHAM REDDY
	Create a node red service	USN-6	To create a node red service to	2	MEDIUM	JANANI JAYALAKSHMI

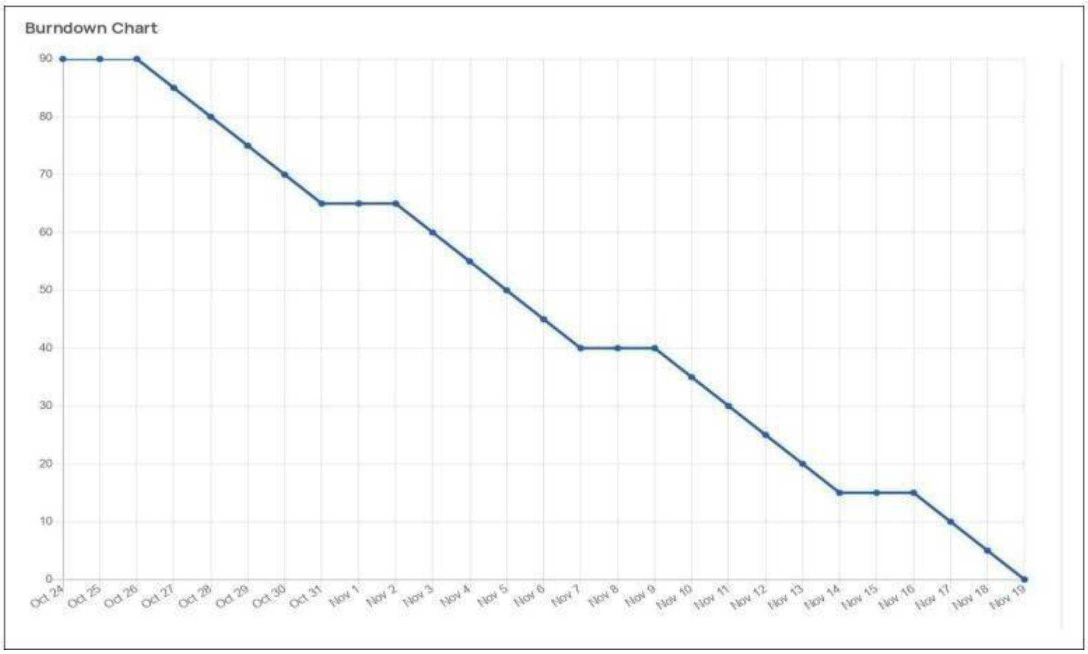
			integrate the IBM Watson along with the Web UI			HARISH GOWTHAM REDDY
	Create a Web UI	USN-7	To create a Web UI, to access the data from the cloud and display all parameters.	2	MEDIUM	JANANI
	To develop a Python code	USN-8	Create a python code to sense the physical quantity and store data	2	MEDIUM	JAYALAKSHMI
Sprint-4	Publish Data to cloud.	USN-9	Publish Data that is sensed by the microcontroller to the Cloud	3	HIGH	HARISH
	Fast-SMS Service	USN-10	Use Fast SMS to send alert messages once the parameters like pH, Turbidity and temperature goes beyond the threshold	3	HIGH	GOWTHAM REDDY
	Testing	USN-11	Testing of project and final deliverables	3	MEDIUM	JAYALAKSHMI JANANI

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

Velocity:

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

Burndown Chart:



CHAPTER 7

PROJECT DEVELOPMENT PHASE

7.1 Project Development – Delivery of Sprint-1

PYTHON CODE

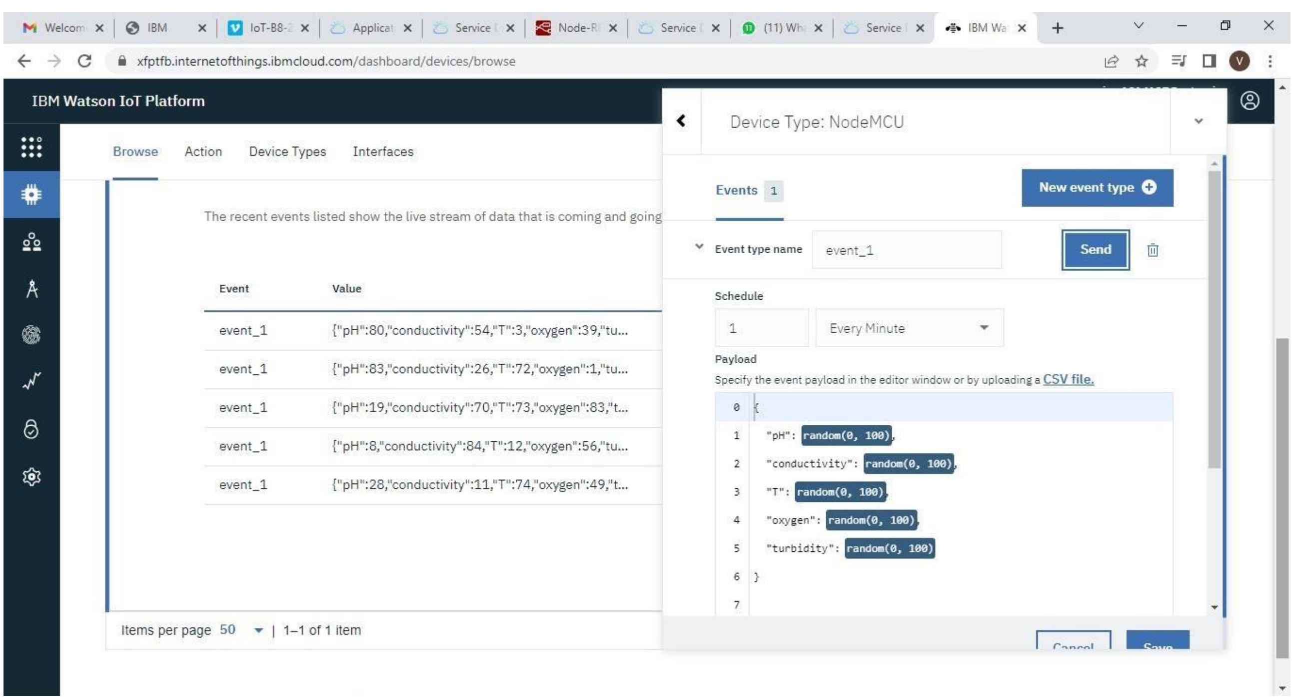
```python
import random
import time
import sys
import ibmiotf.application
import ibmiotf.device


# Provide your IBM Watson Device Credentials

organization = "xfptfb"  # repalce it with organization ID
deviceType = "NodeMCU"  # replace it with device type
deviceId = "19141"  # repalce with device id
authMethod = "use-token-auth"
authToken = "1914137383010209"  # repalce with token


def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status == 'lighton':
        print("LIGHT ON")
    elif status == 'lightoff':
        print("LIGHT OFF")
    else:
        print ("please send proper command")


try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod,
                     "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
# ..............................................

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

deviceCli.connect()

while True:
    pH = random.randint(0,100)
```

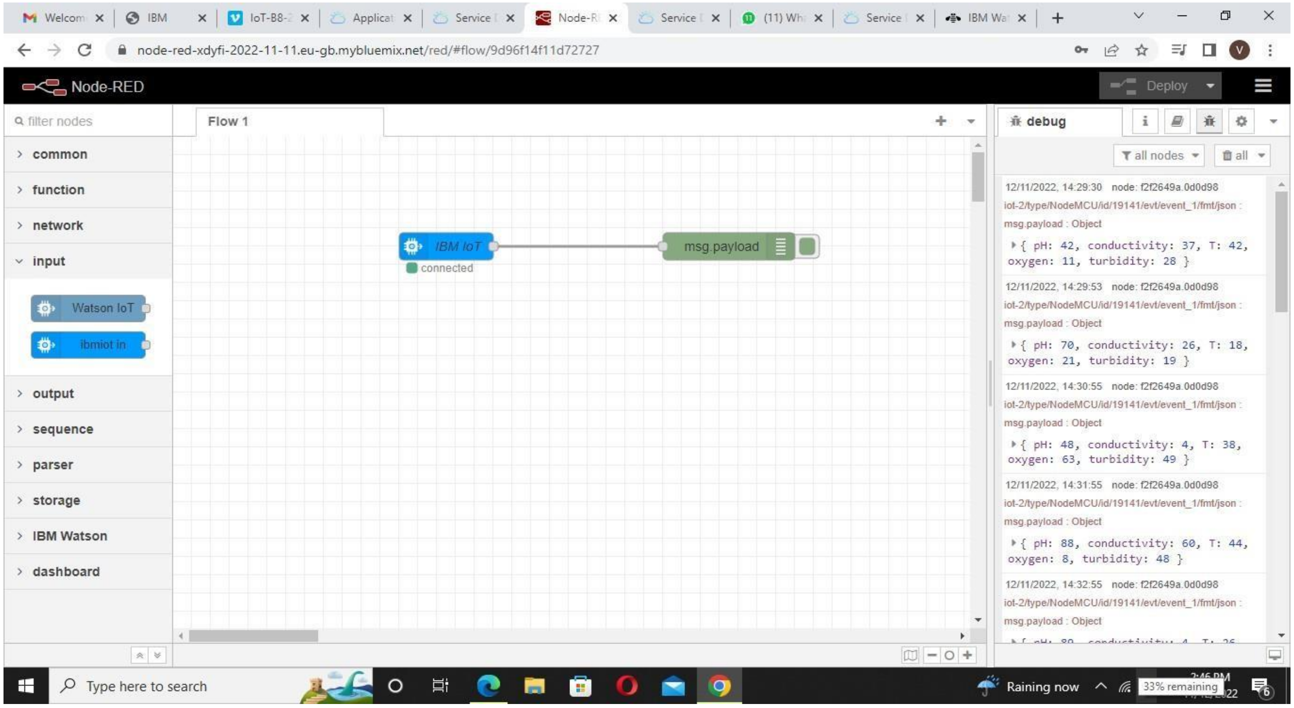
File Edit Format Run Options Window Help

```
        print("LIGHT OFF")
    else:
        print ("please send proper command")


try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod,
                     "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
# ..............................................

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

deviceCli.connect()

while True:
    pH = random.randint(0,100)
    conductivity = random.randint(0,100)
    T = random.randint(0,100)
    oxygen = random.randint(0,100)
    turbidity = random.randint(0,100)
    # Send Temperature & Humidity to IBM Watson
    data = {'temperature': T,'ph':pH,'conductivity':conductivity,'oxygen':oxygen,"turbidity":turbidity}


    # print data
    def myOnPublishCallback():
        print("Published data",data, "to IBM Watson")


    success = deviceCli.publishEvent("event", "json", data, 0, myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(5)

    deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
```

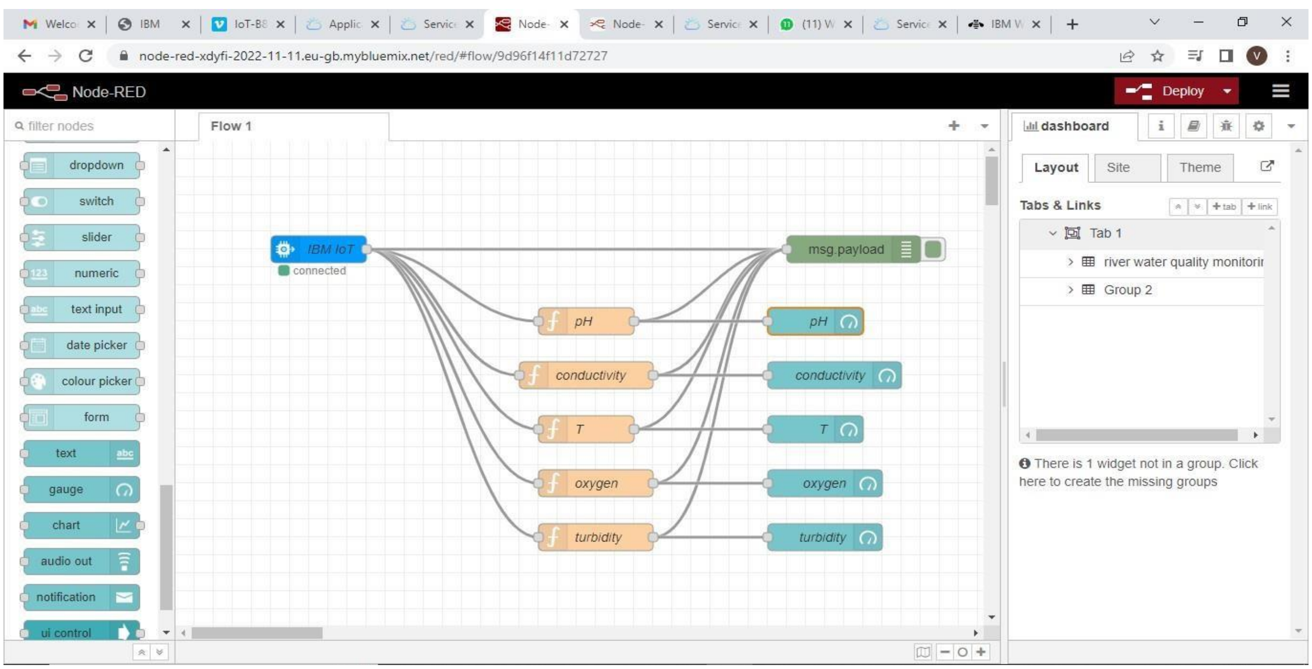
Ln: 1 Col: 0

7.2 Project Development – Delivery of Sprint – 2

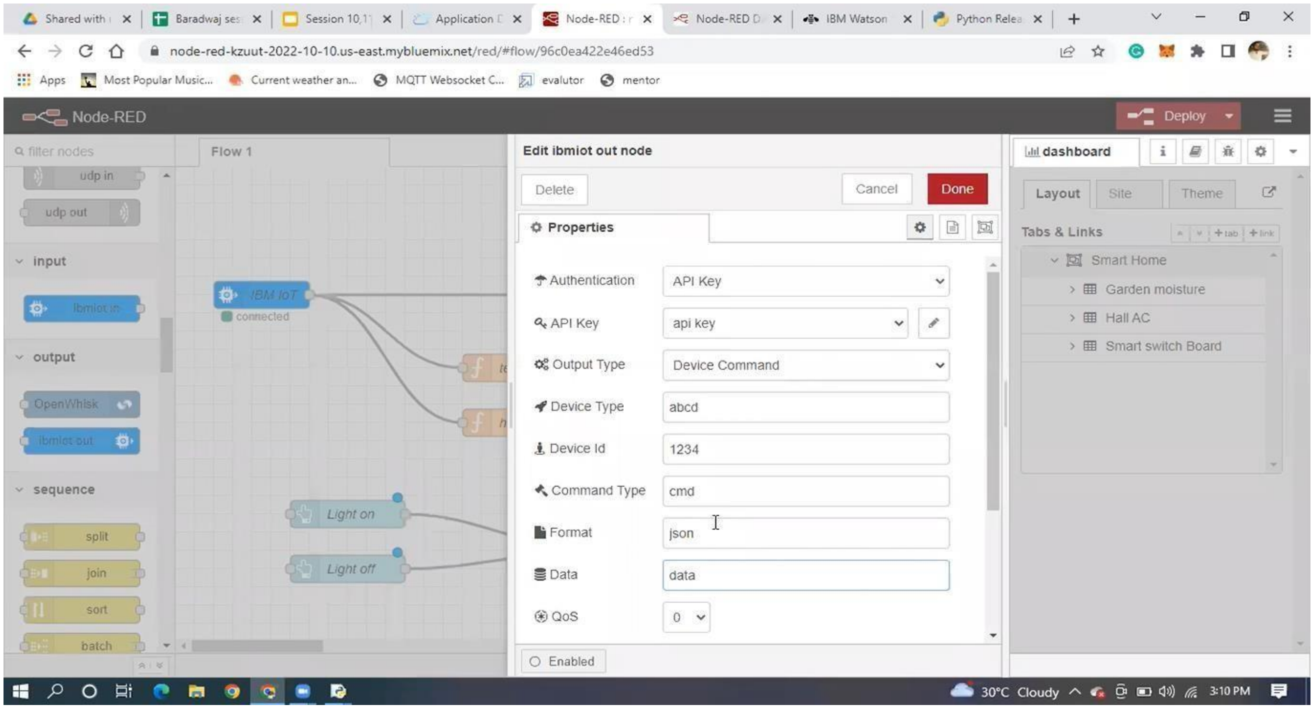


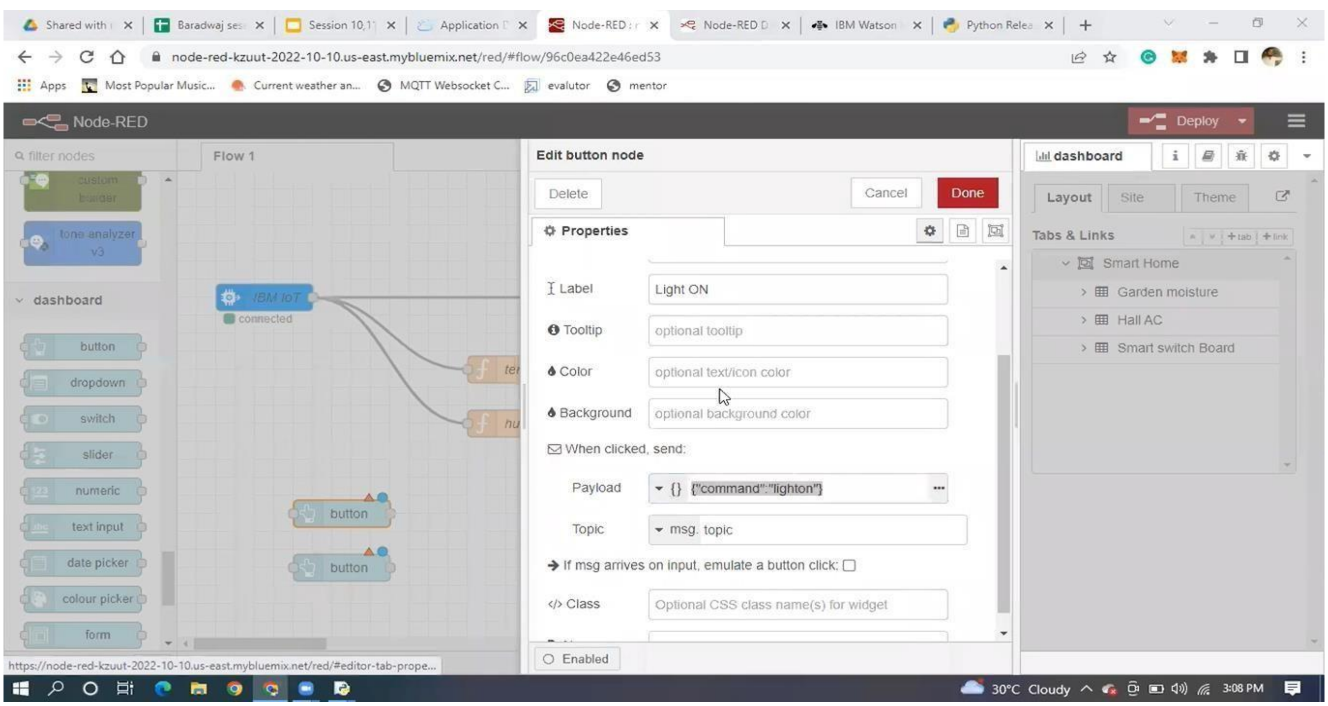


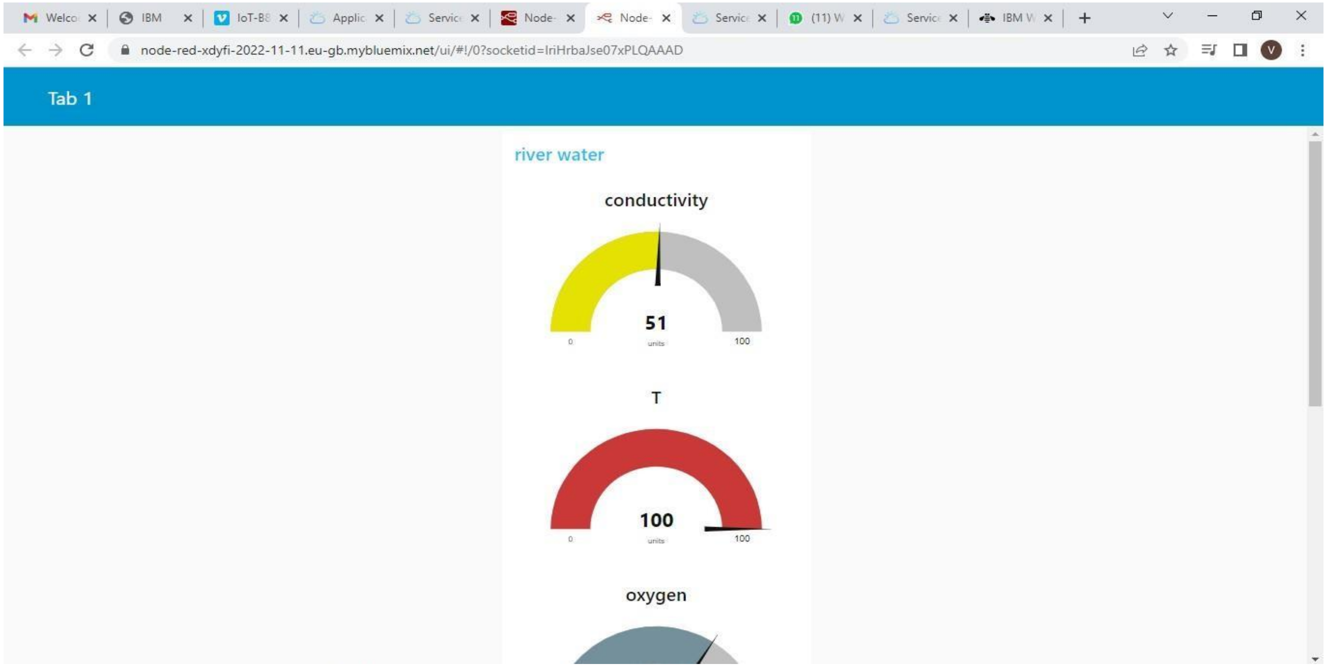
node-red-xdyfi-2022-11-11.eu-gb.mybluemix.net/red/#flow/9d96f14f11d72727
Node-RED
Deploy
filter nodes
common
function
network
input
Watson IoT
ibmiot in
output
sequence
parser
storage
IBM Watson
dashboard
Flow 1
IBM IoT
connected
msg.payload
debug
all nodes
all
12/11/2022, 14:29:30 node: f2f2649a.0d0d98
iot-2/type/NodeMCU/id/19141/evt/event_1/fmt/json : msg.payload : Object
{ pH: 42, conductivity: 37, T: 42, oxygen: 11, turbidity: 28 }
12/11/2022, 14:29:53 node: f2f2649a.0d0d98
iot-2/type/NodeMCU/id/19141/evt/event_1/fmt/json : msg.payload : Object
{ pH: 70, conductivity: 26, T: 18, oxygen: 21, turbidity: 19 }
12/11/2022, 14:30:55 node: f2f2649a.0d0d98
iot-2/type/NodeMCU/id/19141/evt/event_1/fmt/json : msg.payload : Object
{ pH: 48, conductivity: 4, T: 38, oxygen: 63, turbidity: 49 }
12/11/2022, 14:31:55 node: f2f2649a.0d0d98
iot-2/type/NodeMCU/id/19141/evt/event_1/fmt/json : msg.payload : Object
{ pH: 88, conductivity: 60, T: 44, oxygen: 8, turbidity: 48 }
12/11/2022, 14:32:55 node: f2f2649a.0d0d98
iot-2/type/NodeMCU/id/19141/evt/event_1/fmt/json : msg.payload : Object
Type here to search
Raining now
33% remaining

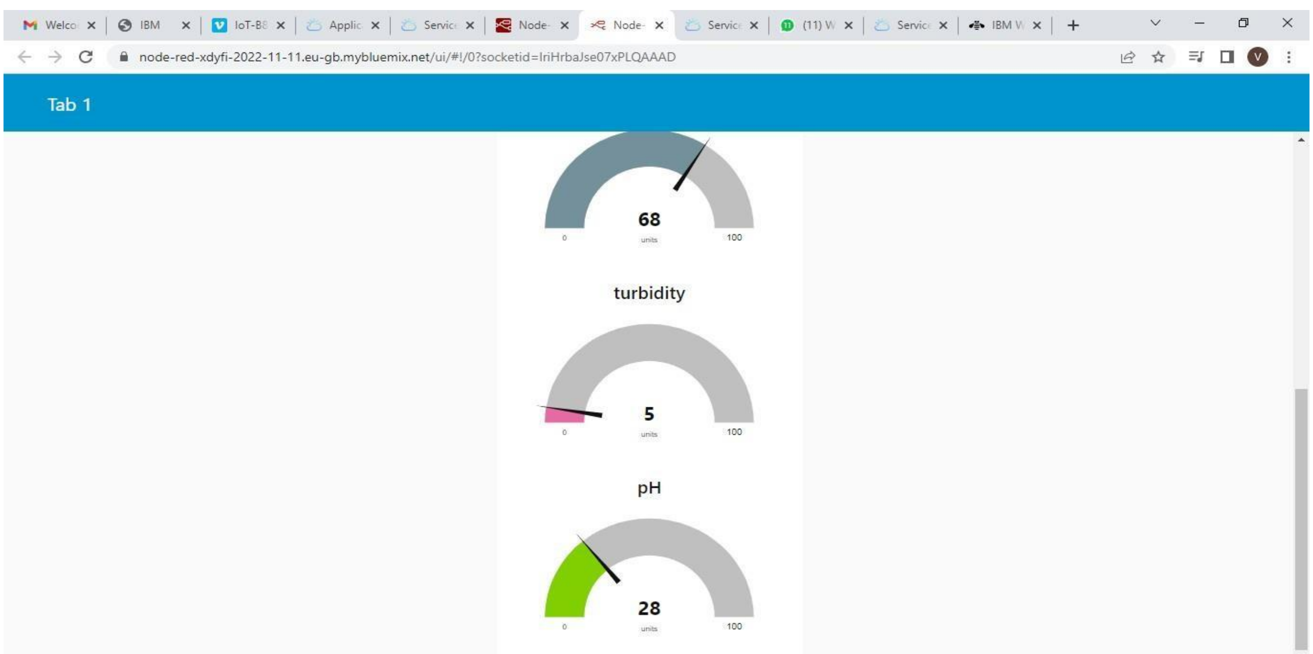


node-red-xdyfi-2022-11-11.eu-gb.mybluemix.net/red/#flow/9d96f14f11d72727
Node-RED
Deploy
filter nodes
dropdown
switch
slider
numeric
text input
date picker
colour picker
form
text
gauge
chart
audio out
notification
ui control
Flow 1
IBM IoT
connected
msg.payload
pH
conductivity
T
oxygen
turbidity
dashboard
Layout
Site
Theme
Tabs & Links
Tab 1
river water quality monitori
Group 2
There is 1 widget not in a group. Click here to create the missing groups

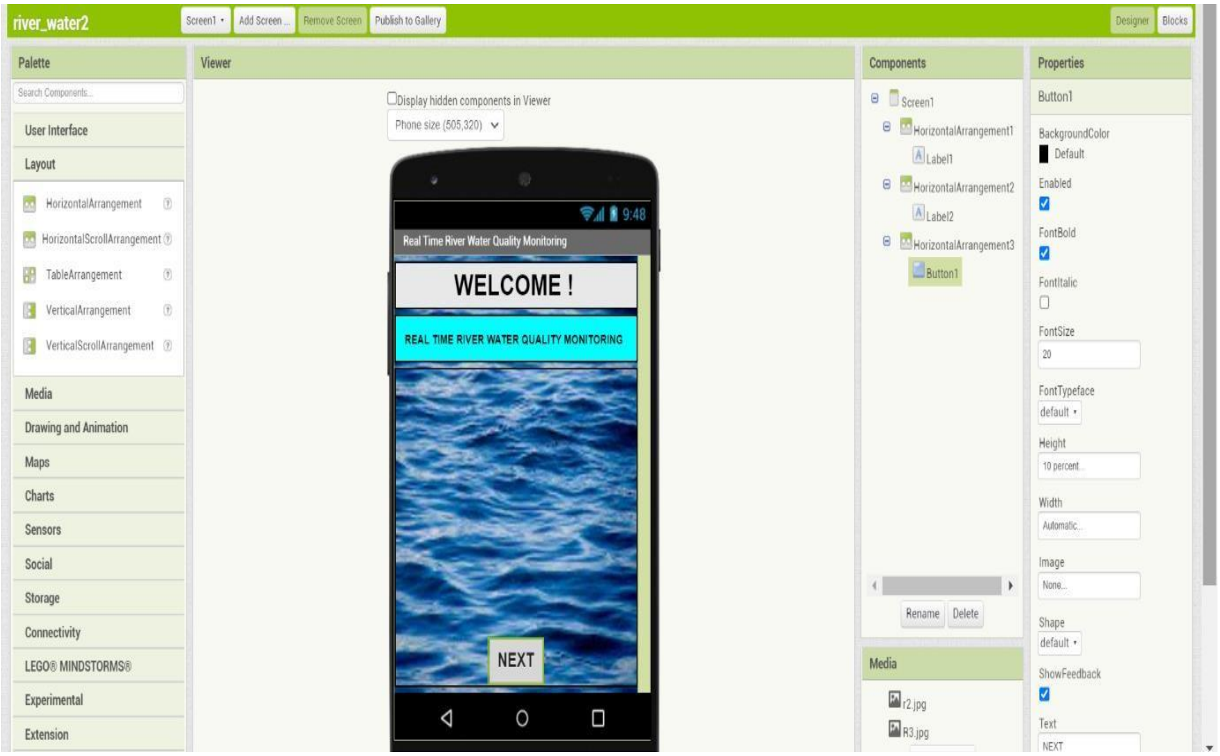

node-red-kzuut-2022-10-10.us-east.mybluemix.net/red/#flow/96c0ea422e46ed53
Node-RED
Deploy
Flow 1
Edit ibmiot out node
Delete
Cancel
Done
Properties
Authentication
API Key
API Key
api key
Output Type
Device Command
Device Type
abcd
Device Id
1234
Command Type
cmd
Format
json
Data
data
QoS
0
Enabled
dashboard
Layout
Site
Theme
Tabs & Links
Smart Home
Garden moisture
Hall AC
Smart switch Board
Light on
Light off
IBM IoT
connected

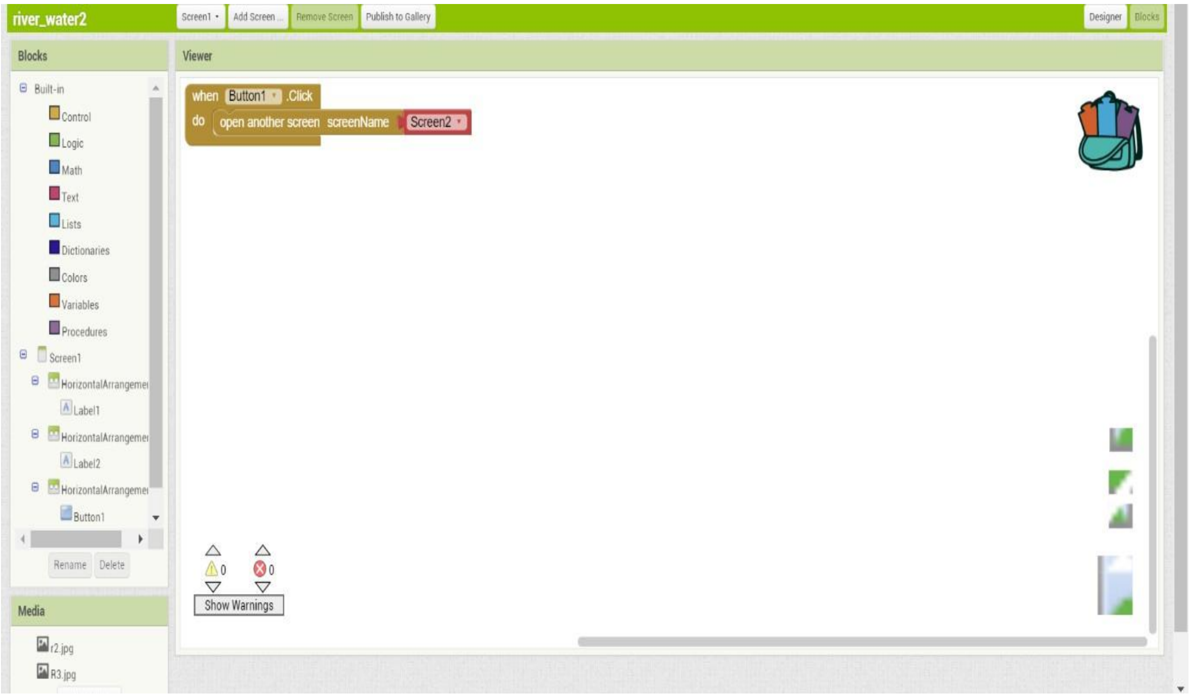

node-red-kzuut-2022-10-10.us-east.mybluemix.net/red/#flow/96c0ea422e46ed53
Node-RED
Deploy
Flow 1
Edit button node
Delete
Cancel
Done
Properties
Label
Light ON
Tooltip
optional tooltip
Color
optional text/icon color
Background
optional background color
When clicked, send:
Payload
{"command":"lighton"}
Topic
msg. topic
If msg arrives on input, emulate a button click:
Class
Optional CSS class name(s) for widget
Enabled
dashboard
Layout
Site
Theme
Tabs & Links
Smart Home
Garden moisture
Hall AC
Smart switch Board
button
button
IBM IoT
connected

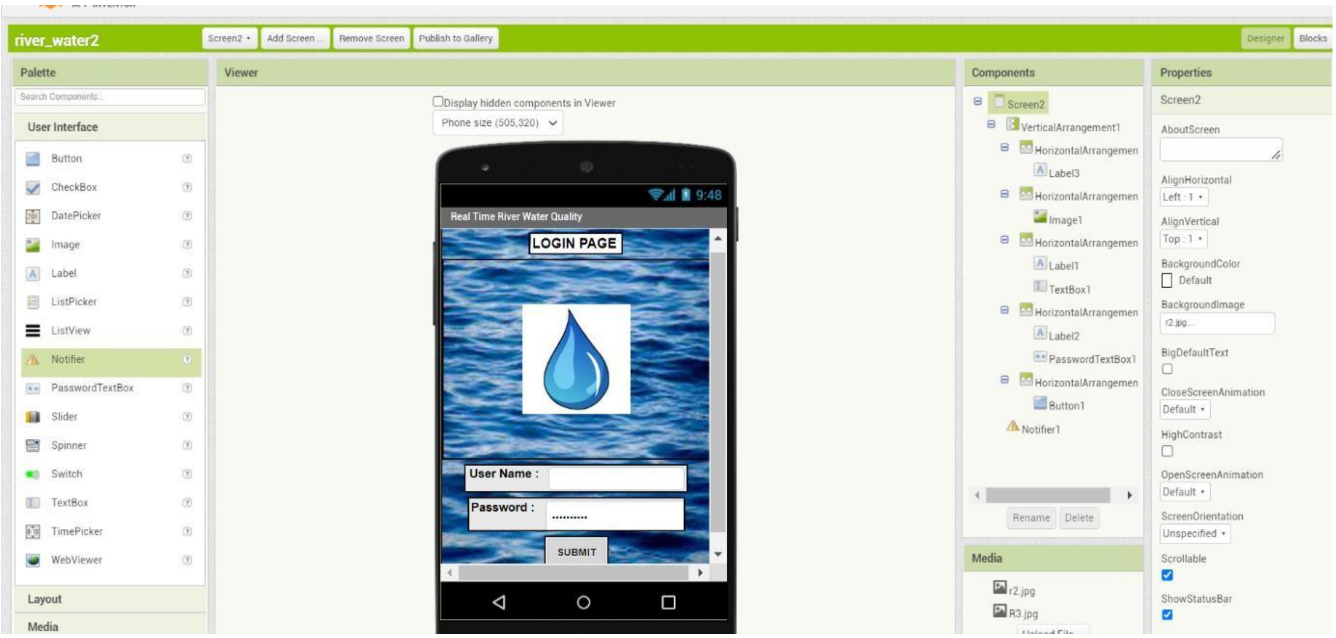

node-red-xdyfi-2022-11-11.eu-gb.mybluemix.net/ui/#!/0?socketid=IriHrbaJse07xPLQAAAD
Tab 1
river water
conductivity
51
T
100
oxygen

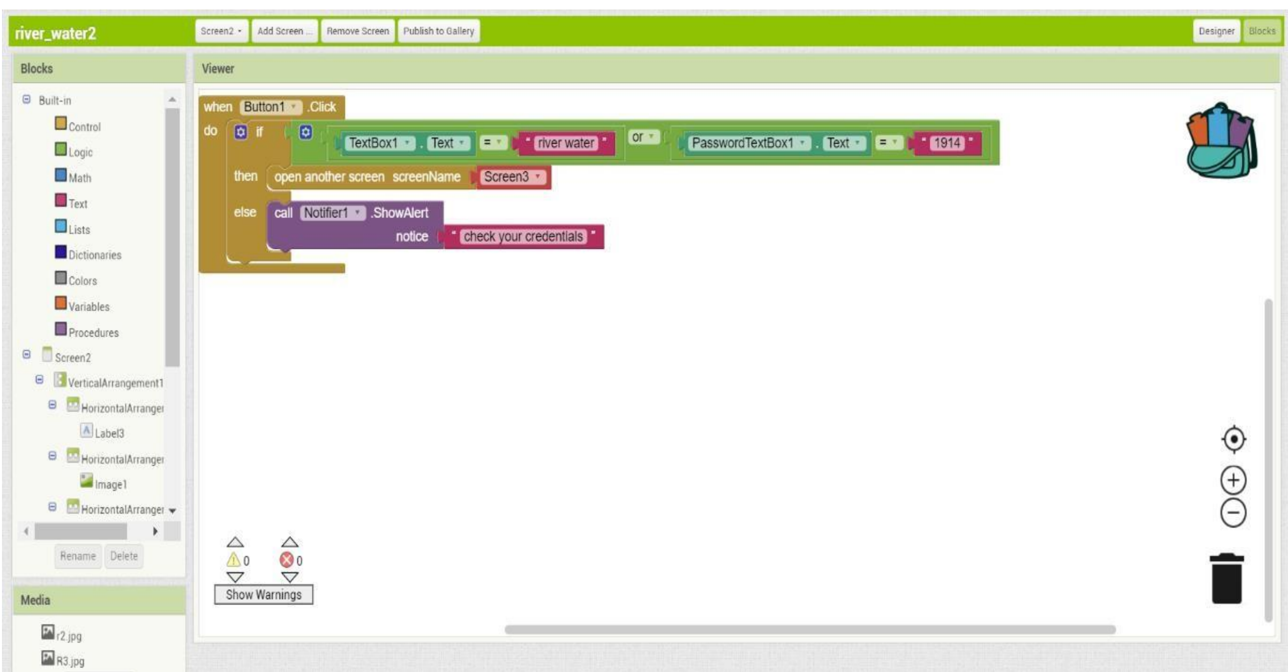

node-red-xdyfi-2022-11-11.eu-gb.mybluemix.net/ui/#!/0?socketid=IriHrbaJse07xPLQAAAD
Tab 1
68
turbidity
5
pH
28

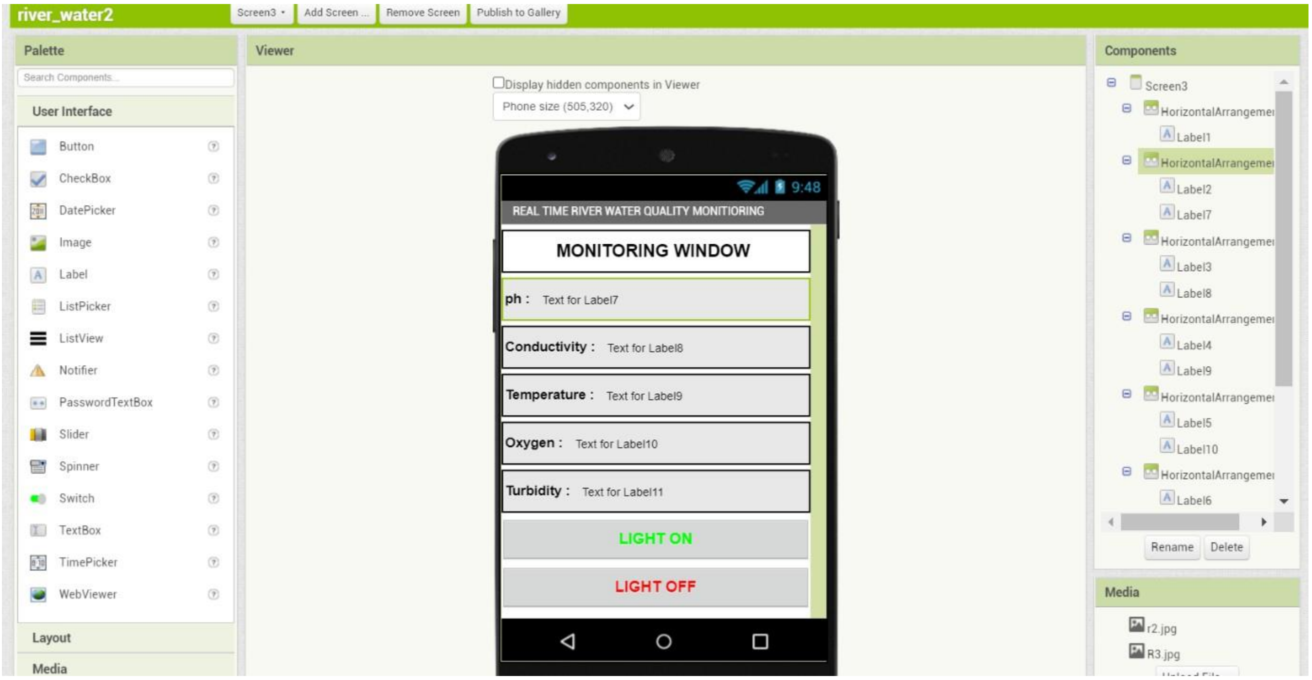
7.3 Project Development – Delivery of Sprint – 3

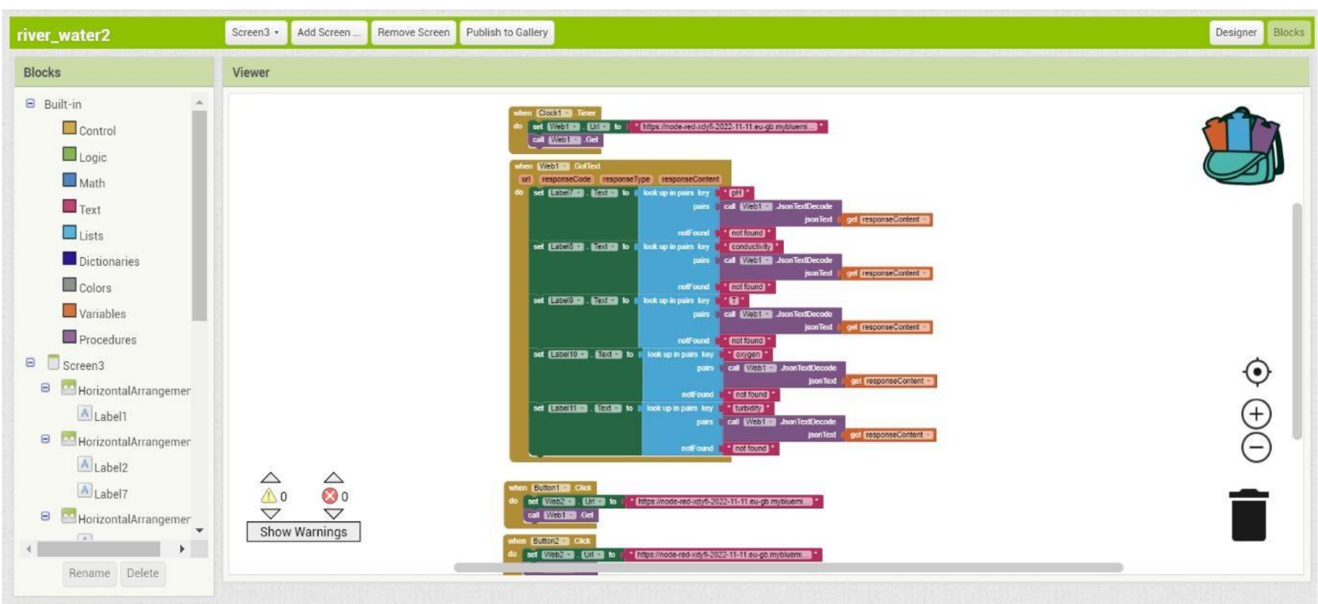




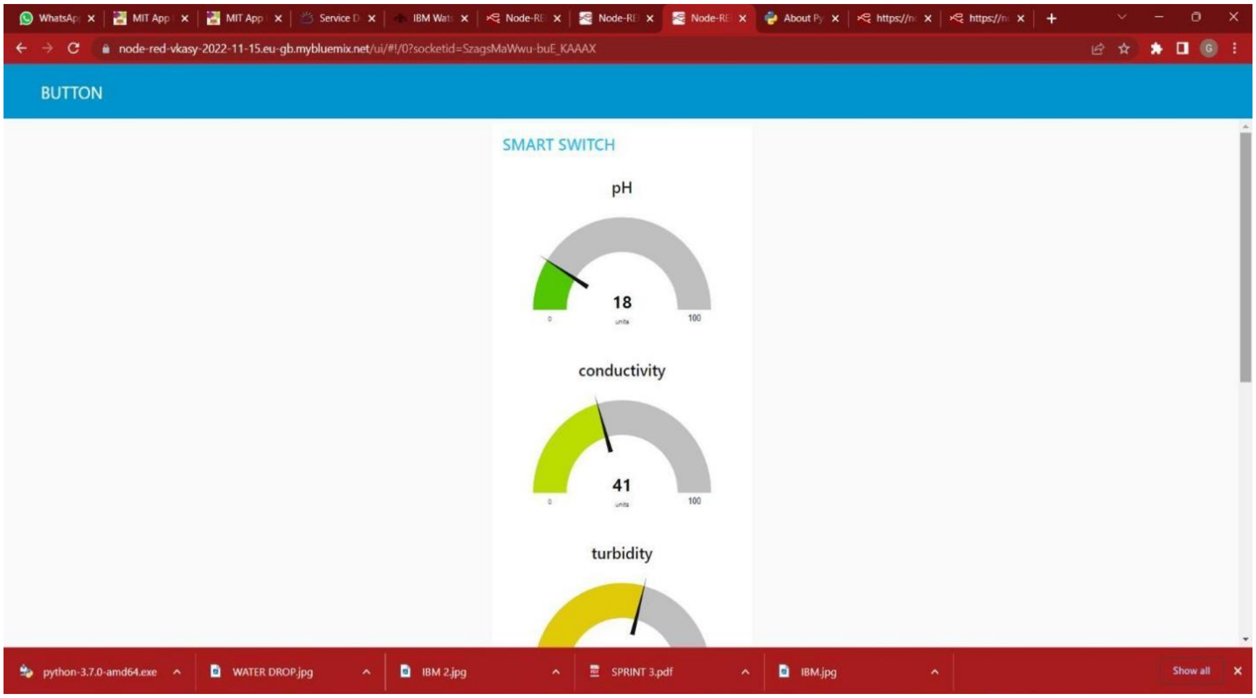

river_water2
Screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Viewer
Display hidden components in Viewer
Phone size (505,320)
9:48
Real Time River Water Quality
LOGIN PAGE
User Name :
Password :
SUBMIT
Components
Screen2
VerticalArrangement1
HorizontalArrangemen
Label3
HorizontalArrangemen
Image1
HorizontalArrangemen
Label1
TextBox1
HorizontalArrangemen
Label2
PasswordTextBox1
HorizontalArrangemen
Button1
Notifier1
Rename
Delete
Media
r2.jpg
R3.jpg
Properties
Screen2
AboutScreen
AlignHorizontal
Left : 1
AlignVertical
Top : 1
BackgroundColor
Default
BackgroundImage
r2.jpg...
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar

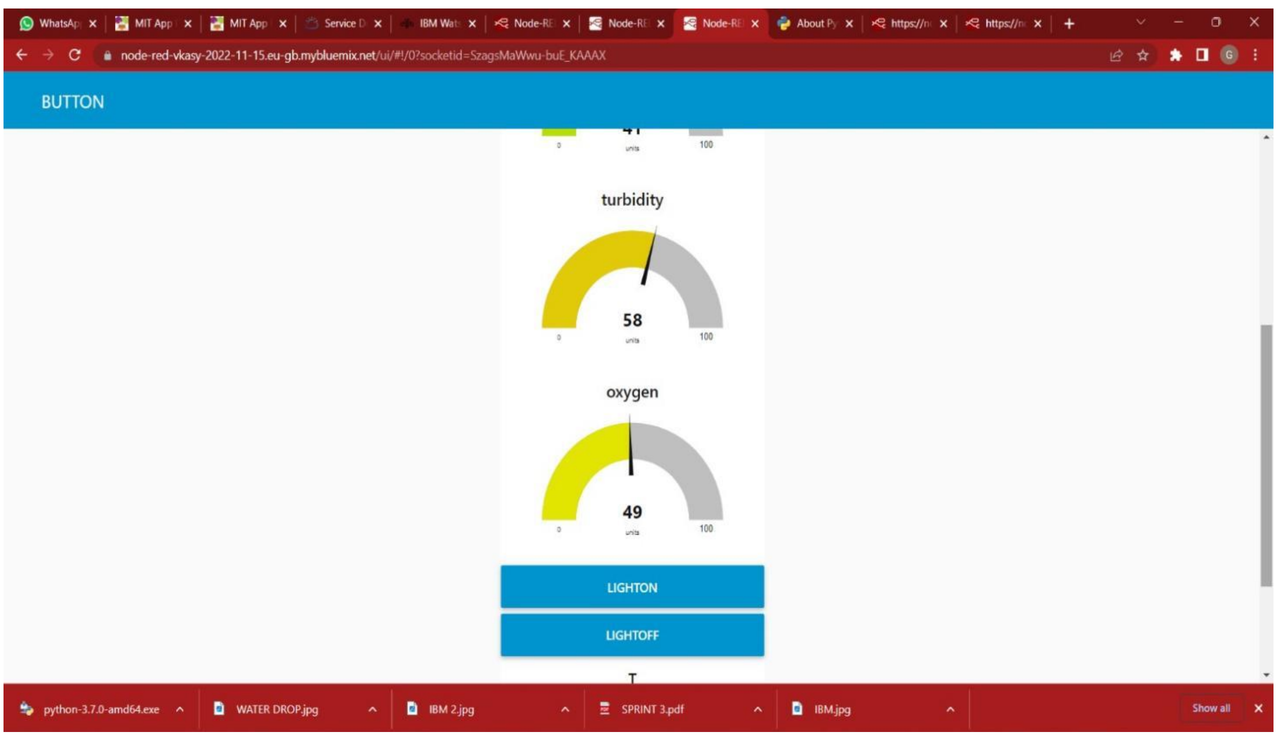

river_water2
Screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen2
VerticalArrangement1
HorizontalArranger
Label3
HorizontalArranger
Image1
HorizontalArranger
Rename
Delete
Media
r2.jpg
R3.jpg
Viewer
when Button1 .Click
do if
TextBox1 . Text = " river water "
or
PasswordTextBox1 . Text = " 1914 "
then open another screen screenName Screen3
else call Notifier1 .ShowAlert
notice " check your credentials "
0
0
Show Warnings

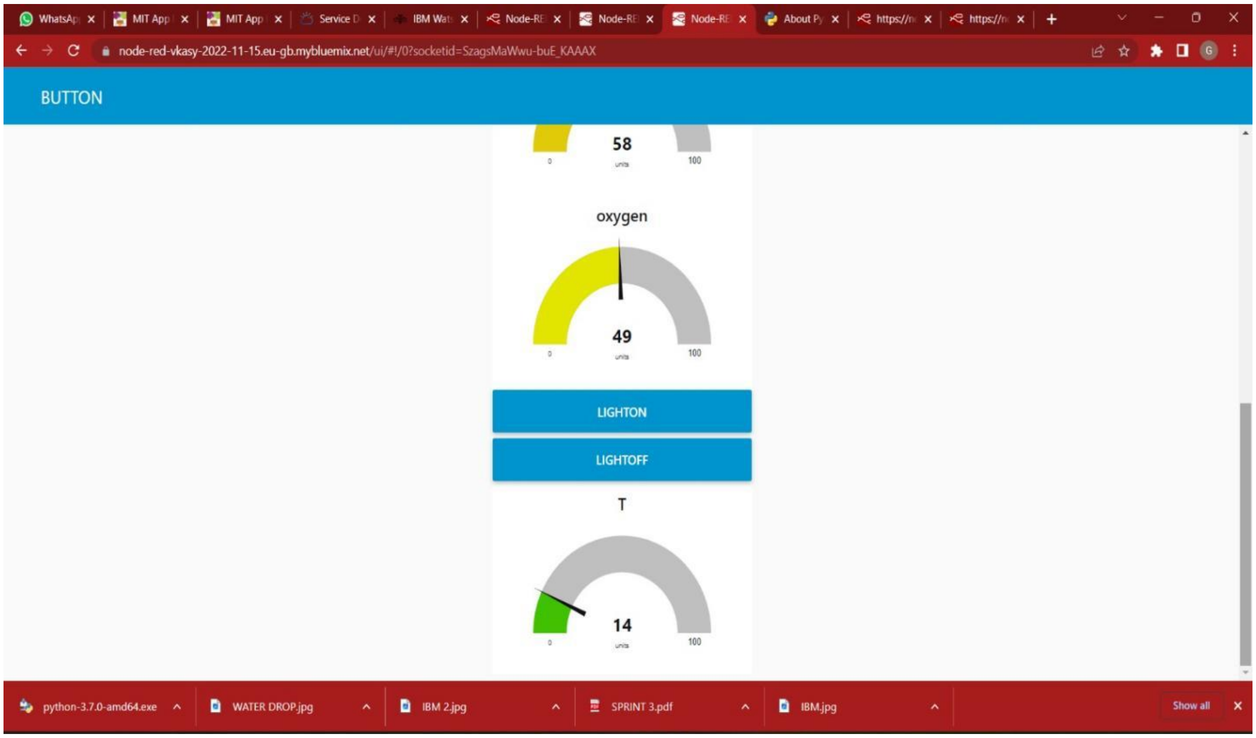

river_water2
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Palette
Viewer
Components
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Display hidden components in Viewer
Phone size (505,320)
9:48
REAL TIME RIVER WATER QUALITY MONITORING
MONITORING WINDOW
ph : Text for Label7
Conductivity : Text for Label8
Temperature : Text for Label9
Oxygen : Text for Label10
Turbidity : Text for Label11
LIGHT ON
LIGHT OFF
Screen3
Label1
Label2
Label7
Label3
Label8
Label4
Label9
Label5
Label10
Label6
Rename
Delete
r2.jpg
R3.jpg

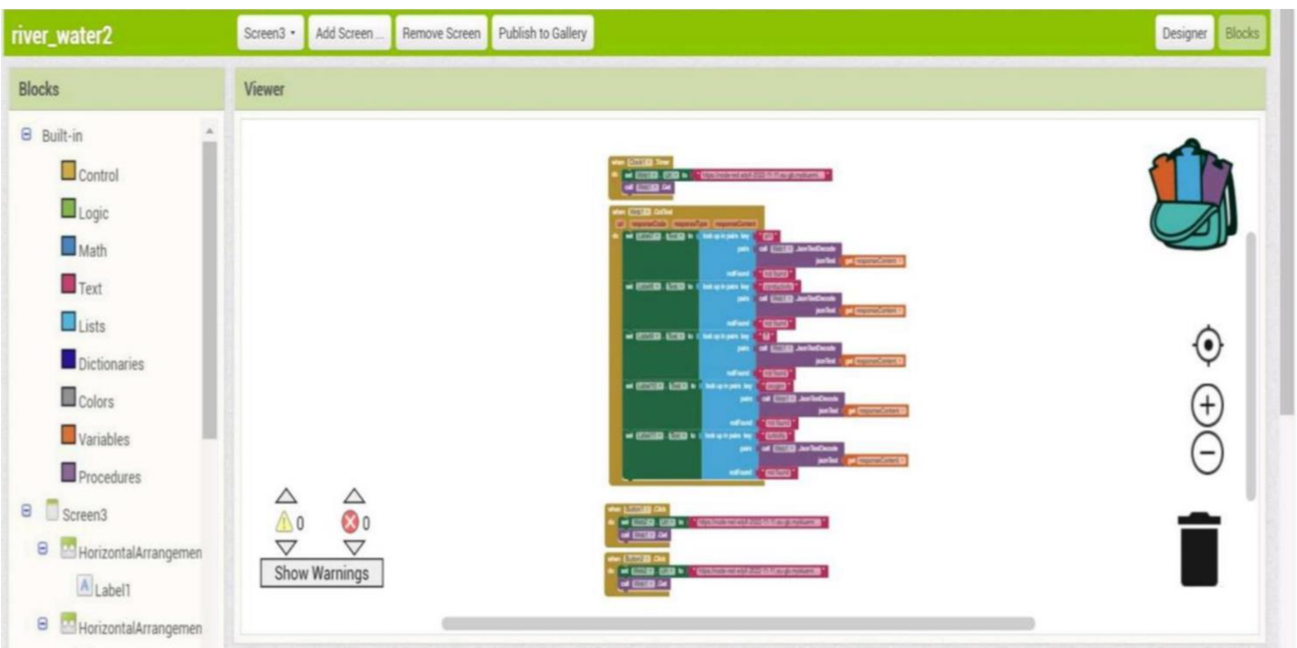

river_water2
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
Label1
Label2
Label7
Rename
Delete
Show Warnings

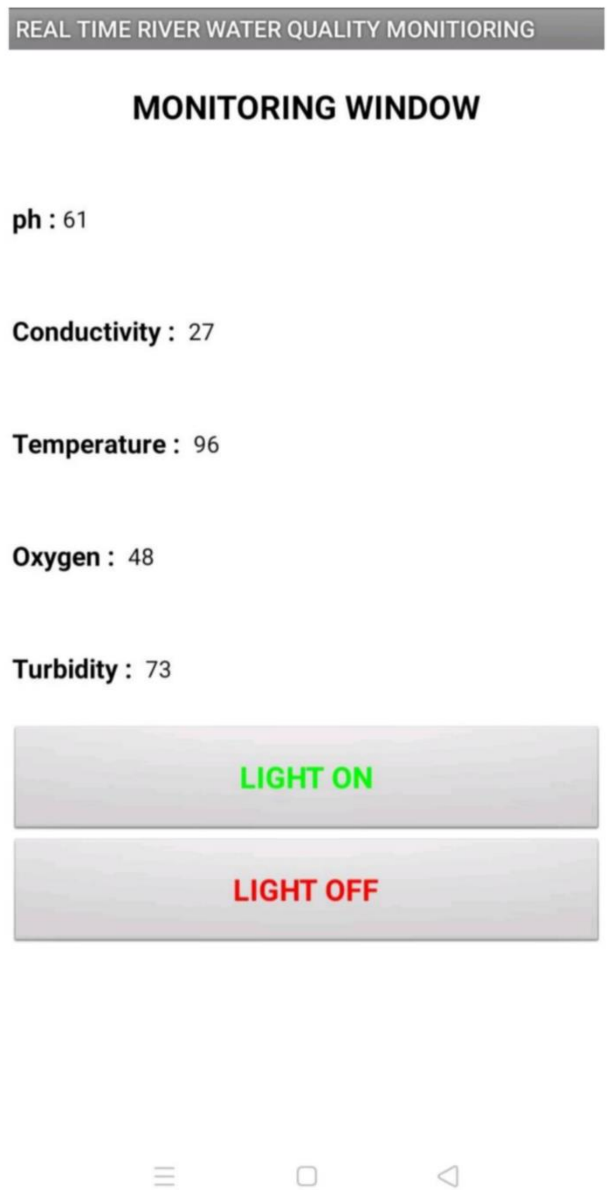
7.4 Project Development – Delivery of Sprint – 4






node-red-vkasy-2022-11-15.eu-gb.mybluemix.net/ui/#!/0?socketid=SzagsMaWwu-buE_KAAAX
BUTTON
58
oxygen
49
LIGHTON
LIGHTOFF
T
14
python-3.7.0-amd64.exe
WATER DROP.jpg
IBM 2.jpg
SPRINT 3.pdf
IBM.jpg
Show all


river_water2
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
HorizontalArrangemen
Label1
HorizontalArrangemen
Show Warnings


REAL TIME RIVER WATER QUALITY MONITIORING
MONITORING WINDOW
ph : 61
Conductivity : 27
Temperature : 96
Oxygen : 48
Turbidity : 73
LIGHT ON
LIGHT OFF

CONCLUSION

Real-time monitoring of water quality by using IoT will immensely help people to become conscious against using contaminated water as well as to stop polluting the water. The research is conducted focusing on monitoring river water quality in real-time. Therefore, IoT is appeared to be a better solution as reliability, scalability, speed, and persistence can be provided.

IoT devices use various types of sensors to collect data about turbidity, ORP, temperature, pH, conductivity, etc. Of river water continuously. Also, IoT devices have capability to stream the array of collected data wirelessly to the remote Data Aggregator Server in the cloud. Moreover, the volume of semi structured data increases with time in such a velocity that only the Big Data Analytics applications can efficiently store and analyze the data constantly. Due to the limitation of the budget, we only focus on measuring the quality of river water parameters. This project can be extended into an efficient water management system of a local area. Moreover, other parameters which wasn’t the scope of this project such as total dissolved solid, chemical oxygen demand and dissolved oxygen can also be quantified. So the additional budget is required for further improvement of the overall system.

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