REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

submitted by:

TEAM ID:

PNT2022TMID5000

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DATE:

19/11/2022

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INTRODUCTION

1.1 Project Overview

To measure critical water quality parameters such as physical and chemical properties. System must be low cost,more efficient as well as processingter sending and viewing data on cloud through Wi-Fi to mobile. To collect data fromvarious sensor nodes and send it to base station by wirelss channel.

The environment around consists of five key elements e.g., soil, water, climate, natural vegetation, and landforms. Among these water is the utmost crucial element for human life. It is also vital for the persistence of other living habitats. [1]. Whether it is used for drinking, domestic use, and food production or recreational purposes, safe and readily available water is the need for public health. [2] So it is highly imperative for us to maintain water quality balance. Otherwise, it would severely damage the health of the humans and at the same time affect the ecological balance among other species [3] . Water pollution is a foremost global problem which needs ongoing evalution and adaptation of water resource directorial principle at the levels of international down to individual wells. It has been studied that water pollution is the leading cause of mortalities and diseases worldwide. The records show that more than 14,000 people die daily worldwide due to water pollution. In many developing countries,dirty or contaminated water is being used for drinking without any proper prior treatment. One of the reasons for this happening is the ignorance of pubilc and administration and the lack of water quality monitoring system which makes serious health issues[3,4]. In this project, we depict the design of IBM cloud app that assists to monitor the qualityof

water with the support of information sensed by the sensors dipped in water. Using different sensors, this system can collect various parameters from water, such as pH, dissolved oxygen, turbidity, conductivity, temperature, and so on. The rapid development of IBM app technology provides a novel approach to real-time data acquistion, transmission, and processing. The clients can get ongoing water quality information from far away. Now a day's Internet of things (IoT) is an innovation technological phenomeon. It is shaping today's world and is used in different fields for collecting, monitoring and analysis of data from remote location.The key theme of all the projects was to develop an efficient , cost-effective,real-time water quality monitoring system which will integrate IBM cloud app and internet of things.

1.2 Purpose

Monitoring water quality is very important for maintaing ecosystem health and the livehood of the population. It reflects the health of surface water bodies as a snapshot in time (weeks, months,and years). Therefore, best practices and efforts are needed to monitor and improve water quality.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing problem

Many water testing laboratories face technical difficulties such as a shortage of specialized equipment used in the water testing process, failure to pre-schedule calibration and maintenace of analytical instruments and enforcement of standard operating procedures key issues include adapting to and mitigating the impact of, population growth and climate change security future funding in the environment, adderessing, storm water overflow tacking over-abstraction and

protecting chalk streams.

2.2 Reference

1.C.Pradinaud et al., "Defining freshwater as a natural resource: a framework linking water use to the area of protection natural resources " , The international of life cycle assessment, vol.24,no.5,pp.960-974,2019.

2.S.S. Ray and A.Ray, "Major ground water development issues in south asia: an overview" in Ground Water Development-Issues and Sustainable Solutions, Springer,pp. 3-11,2019.

3.G. Ofosu, A. Dittmann, D. Sarpong and D. Botchie, "Socio-economic and environmental implications of Artisanal and Small-scale Mining (ASM) on agriculture and livelihoods",Environmental Science & Policy,vol.106,pp.210-220,2020.

4.G. W.Y.BOOK and N. Delhi, "Central Ground Water Board",2020.

5.R. Srinivas, A.P. Singh, K. Dhadse and C. Garg, "An evidence based integrated watershed modelling system to assess the impact of non-point source pollution in the riverine ecosystem", Journal of Cleaner Production,vol.246,pp.118963,2020.

6.G.G. Haile, Q. Tang, S. Sun, Z. Huang, X. Liu, "Droughts in East Africa: Causes impacts and resilience", Earth-science reviews,vol.193,pp. 146-161,2019.

7.X. Zhang et al.,"Urban drought challenge to 2030 sustainable development goals", Science of the Total Environment, vol.579-584,2019.

8.H. Razalli, M.H. Alkawaz and A.S. Suhemi, "Smart IoT Surveillance Multi-Camera Monitoring System", 2019 IEEE 7th Conference on systems Process and Control (ICSPC), pp.167-171,2019.

2.3 Problem Statement Definition

Water pollution is the contamination of water sources by substances which make the water unusable for drinking, cooking, cleaning, swimming, and other activities. Pollution include chemicals, trash, bacteria, and parasites. All forms of pollution eventually make their way to water. Developing countries are most affeccted by water shortages, flooding and poor water quality. Up to 80% of illnesses in the developing world are linked to inadequate water and sanitation. In many countries, pollution or rising sea levels are contaminating trusted water sources.

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

Says and do:

- Moniter the live river water quality.
- Control water quality in real-time.
- Measure various chemical & physical .

Thing and feel:

- create conscious against contaminated.
- Detect the Minerals.
- Prevent acquatic organisms from great disasters.

See:

- Pollution of rivers.
- It affects aquatic life.
- It leads to pollution.

Here:

- Contaminated by fertilizer .Urea, phasporas.
- 14,000 people die through water pollution.

- Water pollution.

Pain:

- Many Disease.
- Water Pollution.
- Cost Effective.

Gain:

- Identify the Minerals.
- Prevent from many Disease.
- Improve water quality.

3.2 Ideation& Brainstorming

3.3 Proposed Solution

- Problem Statement(Problem to be solved):

The water has dangerous particles or chemical mixed and general purpose water purifier cannot purify that. And it's impossible to check the quality of water manually in every time. So an automatic real-time monitoring system is required to monitor the health of the water reserved in our water tank of the society or apartment

- Idea/ So;ution description:

Measure water parameter as pH sensor using A remote place. To assemble data form various sensor. To assemble data from various sensor nodes and send to the base station by the wireless channel. To send sms an authorized person routinely when water quality detected, so the necessary action can be taken.

- Novelty/Uniqueness:

To develop a system for continues monitoring of river water quality at remote places using wireless sensor network with low power consumption.

- Social Impact/Customer Satisfaction:

Appeared to be a better solution as reliable, scalability, speed and persistence can be provided.

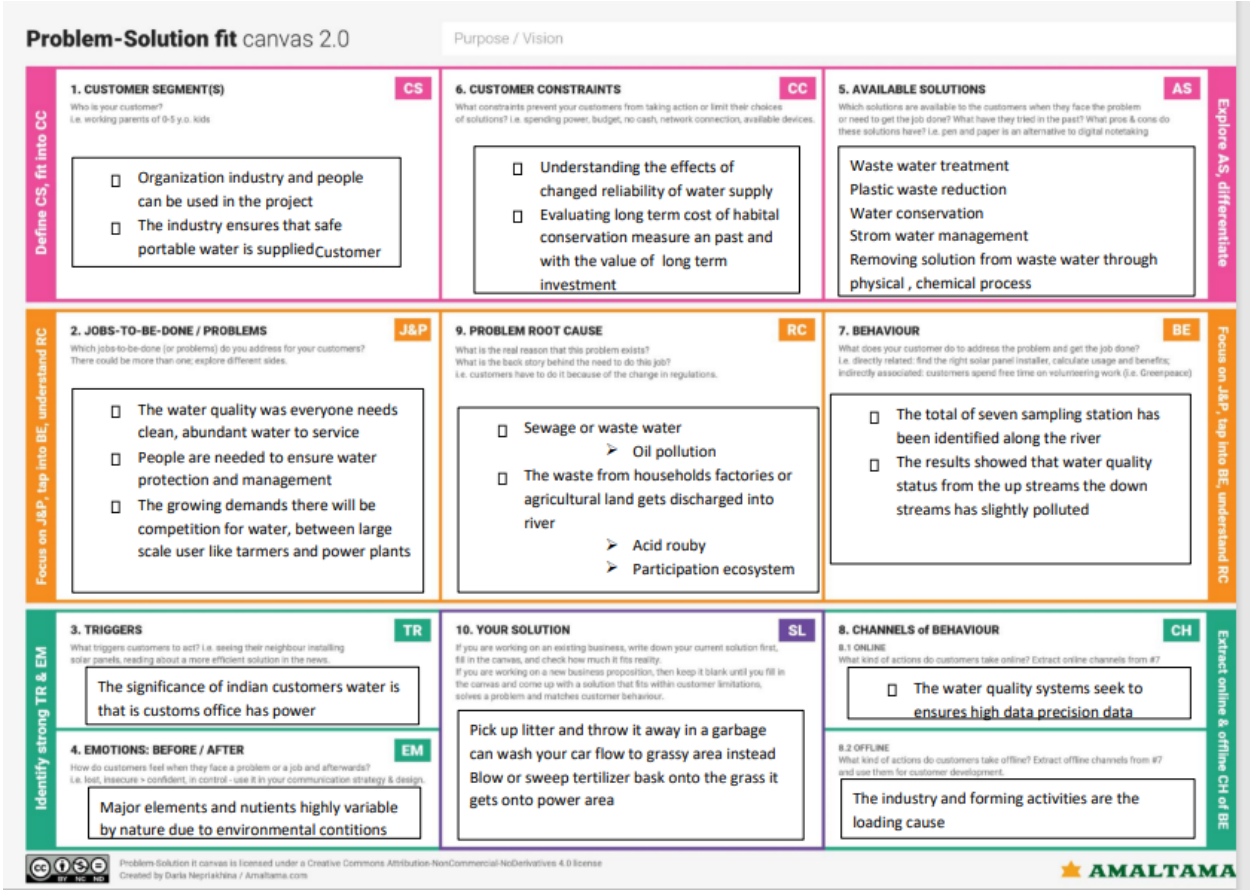
- Business Model(Revenue Model):

We can provide the consumers.

- Scalability of the Solution:

Performance and speed do not slow down . We can check the quality of the water anytime and from anywhere. By keeping this mind we desingned this system especially for residential areas.

3.4 Problem Solution fit



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Funtional requirement

Following are the functional requirements of the proposed solution.

FR. No.	**Functional Requirement (Epic)**	**sub Requirement (Story/sub-Task)**
FR-1	User Registration	Registration through Form Registration through Gamil Registration through LinkIn.
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP.
FR-3	Benefits	With the dearth of quality souce water a major and worsening issue for utilities and industry, water level monitoring is paramount for successful operations as is stepping up to IOT technology.
FR-4	Strength	Populations to become conscious against contaminated water as well as to stop polluting the water.
FR-5	Specification	will immensely help people to become

		conscious against using contaminated water as well as to stop polluting the water.
FR-6	Security	This data can be accessed by the authorized users by logging into tgeur accounts using a User ID and password to view data. The data is collected, processed, analyzed,and transmitted and displayed all in real time.

4.2 Non-Functional Requirements

Following are the non-functional requirements of the proposed solution

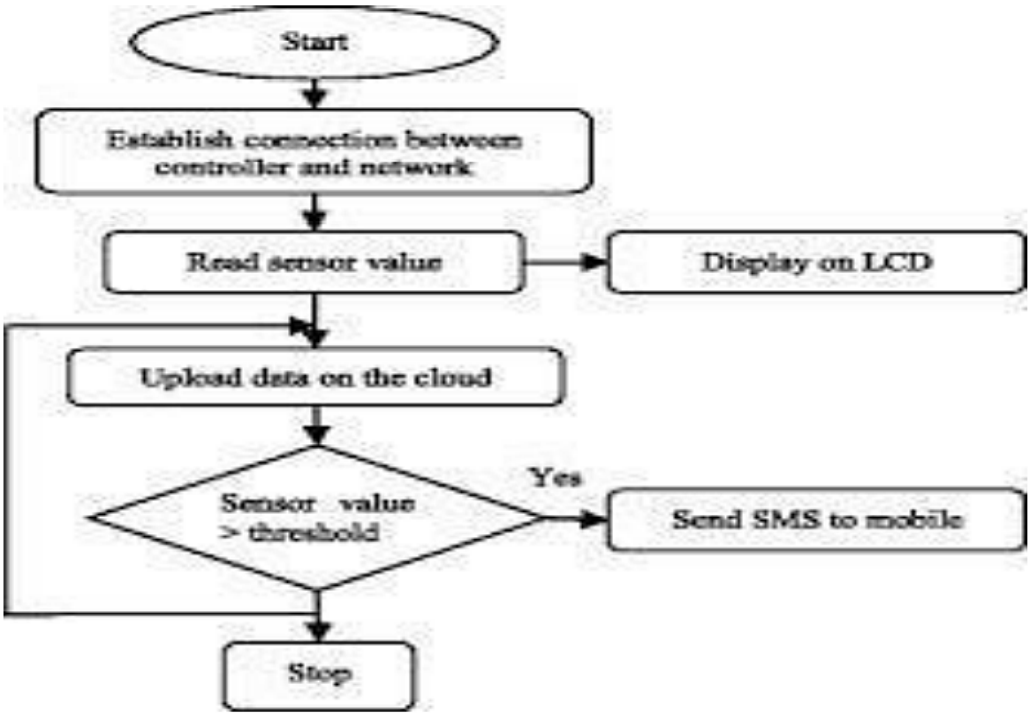
NFR.NO	**Non-Functional Requirements**	**Description**
NFR-1	Usability	To measure water parameters such as pH, dissolved oxygen,turbidity,conductivity ,etc. using aailable sensors at a remote place.
NFR-2	Security	This data can be accessed by the authorized users by logging into their accounts using a User ID

		and password to view data. The data is collected processed, analyzed, and transmitted aand displayed all oin real time.
NFR-3	Reliability	Wireless sensor networks with low power consumption low-cost and high detection accuracy.pH,conductivity, trubidity level,etc.

CHAPTER 5

PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

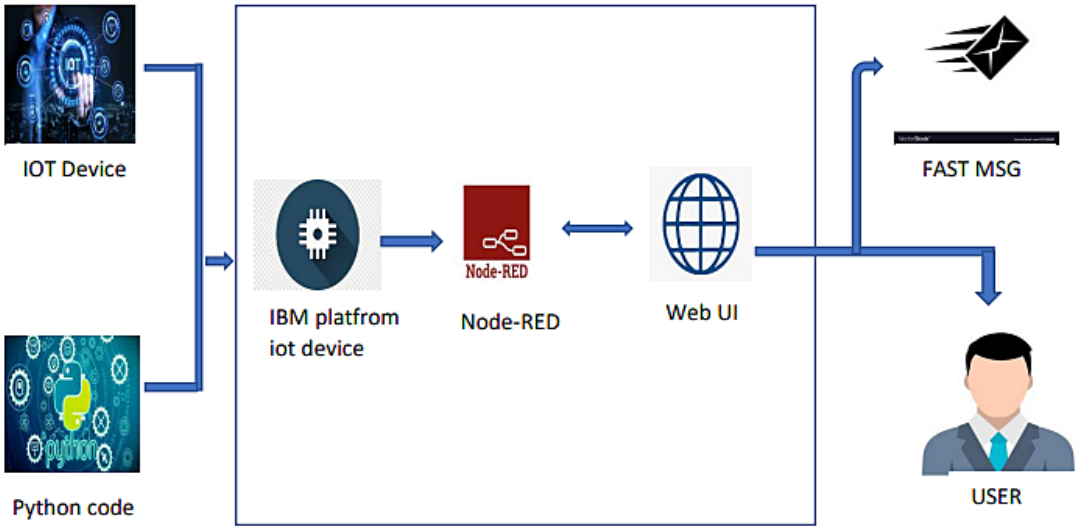
Solution Architecture:

Solution architecture is a complex process-with many sub-processes-that bridges the gap between business problems and technology solutions. Its goals are to: Find the best tech solution to solve existing business problems. Descripe the strucure, characteristics,behavior,and other aspects of the software to project stakeholders. Define features,development phases, and solution requiements. Provide specifications according to which the solution is defined, managed, and delivered.

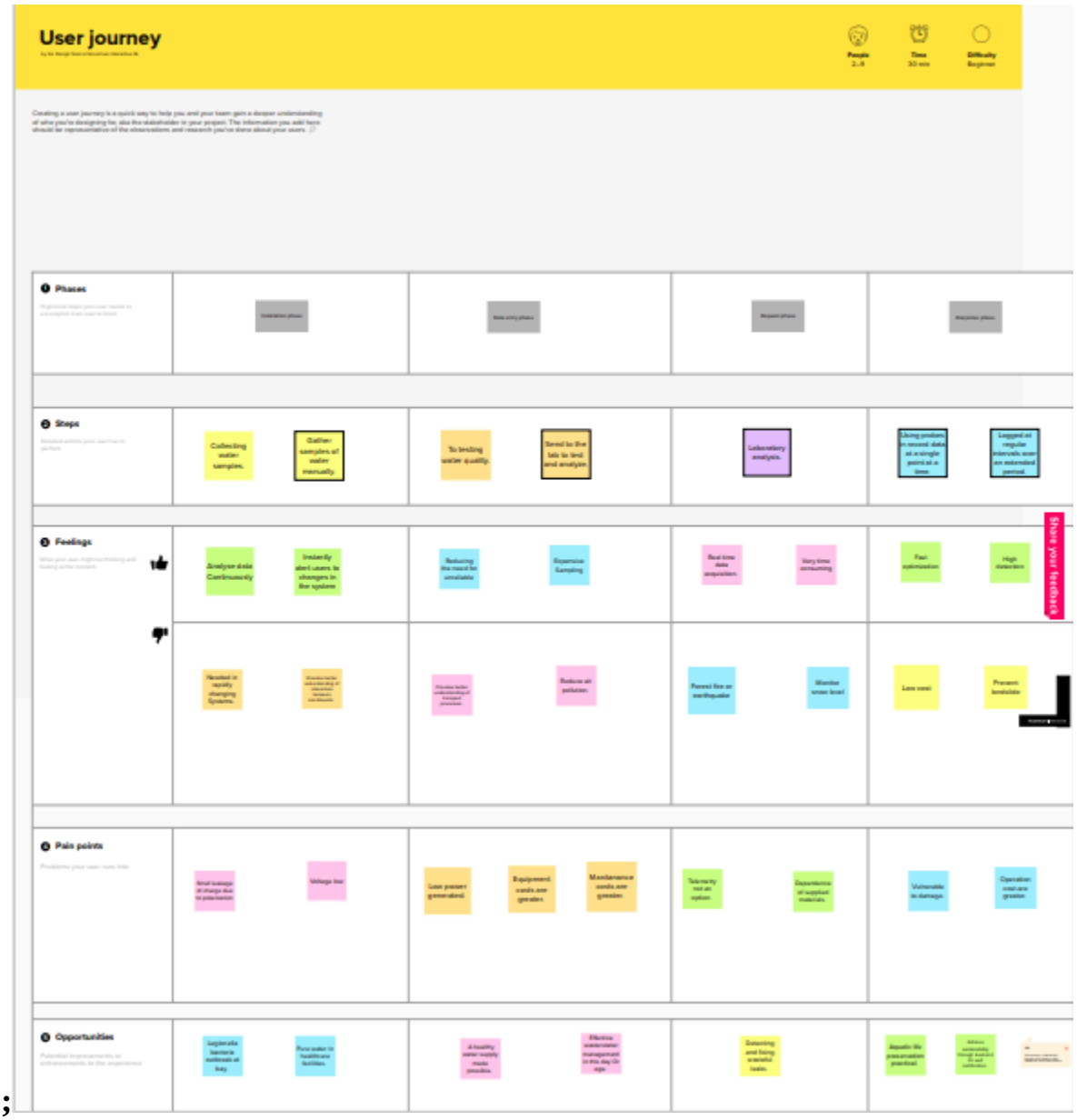
Solution Architecture Diagram:

t

Technical Architecture:



5.3 User Store:



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CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

S.No	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION

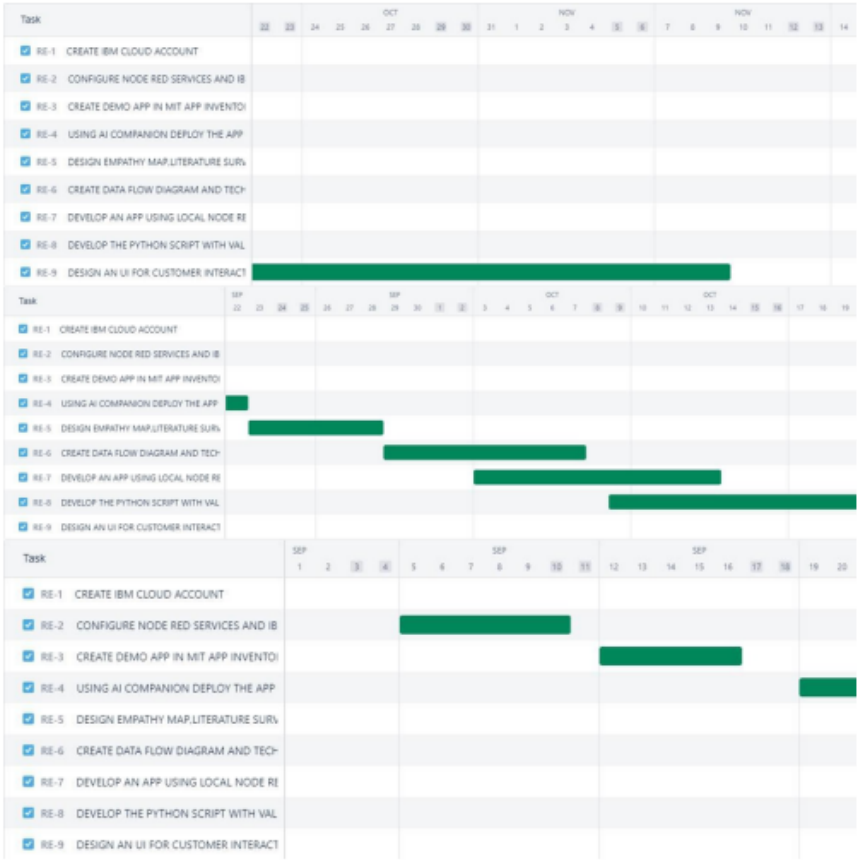
1	Understanding the project requirement	Assign the team members and create repositary in the Github,Assign the task to each members and teach how to use and open and class the Github and IBM career education.	1 week
2	Starting of project	Advice students to attend classes of IBM portal create and develop an eough diagram based on project description and gather of information on IOT and IBM project and team leader assign task to each member of the project	1 week
3	Attend class	Team members and team lead must watch and learn from classes provided by IBM and NALAYATHIR	4 week

		AN and must gain access of MIT license for their project.	
4	Budget and scope of project	Budget and analyze the use of IOT in the project and dicuss with team for budget prediction to predict the favorability for the customer to buy.	1 week

6.2 sprint delivery paln

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	Registering into the application.	2	High	Gowsalya M
Sprint-1		USN-2	Conformation on email while registering the Application	1	High	Maheshwari P
Sprint-2		USN-3	Registration through facebook	2	Low	Sindhu K
Sprint-1		USN-4	Registration through gmail	2	Medium	Kowsalya M
Sprint-1	Login	USN-5	Application login using email and password	1	High	Maheshwari P
Sprint-1	User Interface	USN-6	User should not need any pre-requiste to use UI	1	Medium	Gowsalya M
Sprint-1	Dashboard	WUSN-1	Access of inputs from sensors , through web.	2	High	Sindhu K
Sprint-1	View Manner	CCE-1	Understandable data visualization to customer care	2	High	Kowsalya M
Sprint-1	Taste	CCE-2	The composition of water (e.g. Minerals, etc.) must be understandable to customer care	1	High	Gowsalya M
Sprint-1	Colour Visibility	CCE-3	Water color should be visible to customer care	1	High	Maheshwari P
Sprint-2	Risk Tolerant	ADMIN-1	System, server and application should be handled by administrator.	1	High	Kowsalya M

6.3 Reports from JIRA

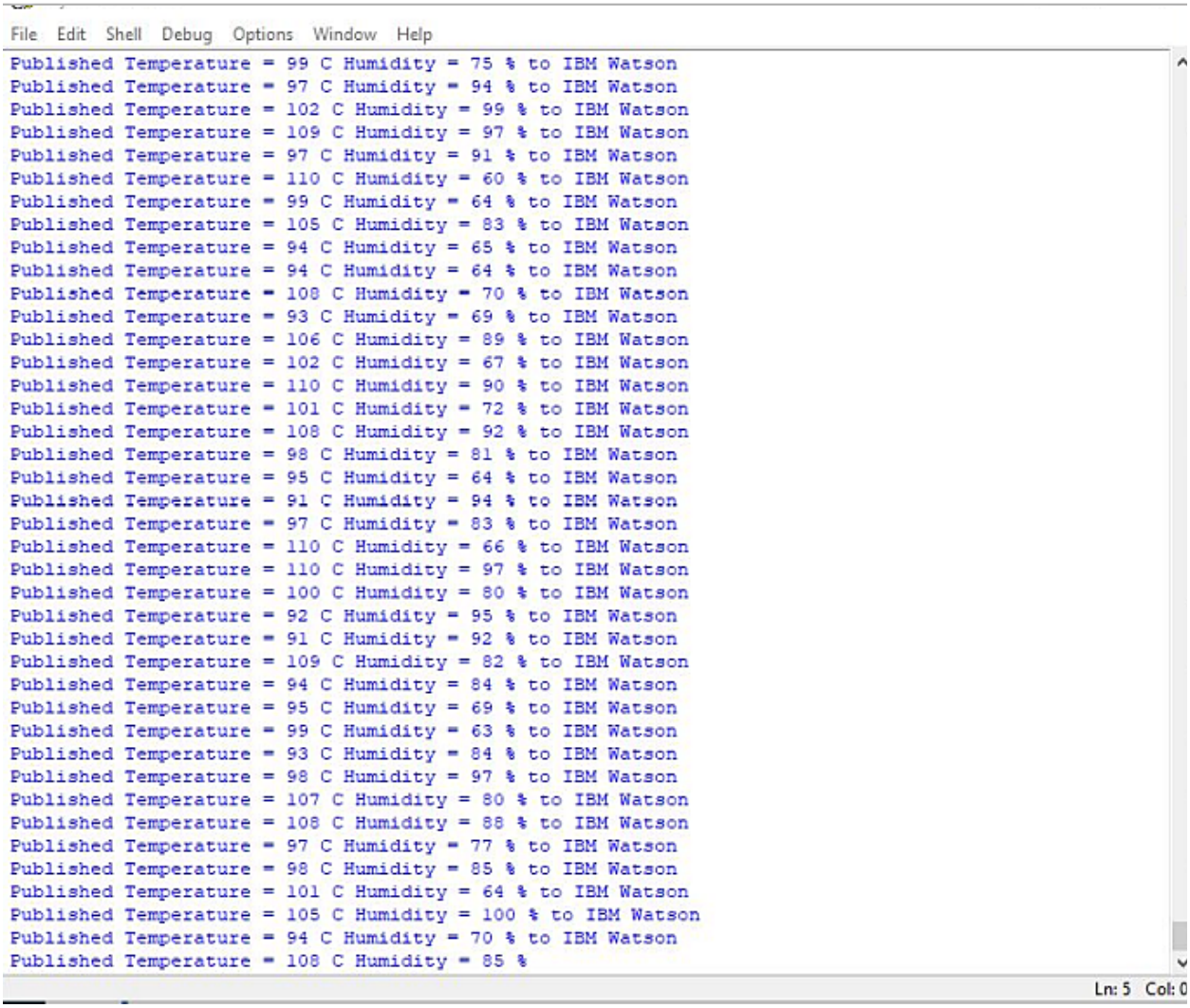


CHAPTER 7

CODING & SOLUTIONING (Explain the feature added in the project along with code)

7.1 Feature 1


ibmpublish.py - E:\IBM PROJECTS\ibmpublish.py (3.7.0)
File Edit Format Run Options Window Help
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "84708c"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"
def myCommandCallback (cmd):
print ("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
if status=="lighton":
print ("led is on")
elif status == "lightoff":
print ("led is off")
else:
print ("please send proper command")
try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId
deviceCli= ibmiotf.device.Client (deviceOptions)
#..
except Exception as e:
print ("Caught evention connecting devica: %s" % str(e))
sys.exit()
deviceCli.connect()
while True:
temp=random.randint (90,110)
Humid=random.randint (60,100)
data = {'temp' : temp, 'Humid': Humid }
def myonPublishCallback():
print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publis
if not success:
print("Not connected to IOTF")
time.sleep (10)
deviceCli.commandCallback = myCommandCallback
deviceCli.disconnect()
Ln: 31 Col: 0


File Edit Shell Debug Options Window Help
Published Temperature = 99 C Humidity = 75 % to IBM Watson
Published Temperature = 97 C Humidity = 94 % to IBM Watson
Published Temperature = 102 C Humidity = 99 % to IBM Watson
Published Temperature = 109 C Humidity = 97 % to IBM Watson
Published Temperature = 97 C Humidity = 91 % to IBM Watson
Published Temperature = 110 C Humidity = 60 % to IBM Watson
Published Temperature = 99 C Humidity = 64 % to IBM Watson
Published Temperature = 105 C Humidity = 83 % to IBM Watson
Published Temperature = 94 C Humidity = 65 % to IBM Watson
Published Temperature = 94 C Humidity = 64 % to IBM Watson
Published Temperature = 108 C Humidity = 70 % to IBM Watson
Published Temperature = 93 C Humidity = 69 % to IBM Watson
Published Temperature = 106 C Humidity = 89 % to IBM Watson
Published Temperature = 102 C Humidity = 67 % to IBM Watson
Published Temperature = 110 C Humidity = 90 % to IBM Watson
Published Temperature = 101 C Humidity = 72 % to IBM Watson
Published Temperature = 108 C Humidity = 92 % to IBM Watson
Published Temperature = 98 C Humidity = 81 % to IBM Watson
Published Temperature = 95 C Humidity = 64 % to IBM Watson
Published Temperature = 91 C Humidity = 94 % to IBM Watson
Published Temperature = 97 C Humidity = 83 % to IBM Watson
Published Temperature = 110 C Humidity = 66 % to IBM Watson
Published Temperature = 110 C Humidity = 97 % to IBM Watson
Published Temperature = 100 C Humidity = 80 % to IBM Watson
Published Temperature = 92 C Humidity = 95 % to IBM Watson
Published Temperature = 91 C Humidity = 92 % to IBM Watson
Published Temperature = 109 C Humidity = 82 % to IBM Watson
Published Temperature = 94 C Humidity = 84 % to IBM Watson
Published Temperature = 95 C Humidity = 69 % to IBM Watson
Published Temperature = 99 C Humidity = 63 % to IBM Watson
Published Temperature = 93 C Humidity = 84 % to IBM Watson
Published Temperature = 98 C Humidity = 97 % to IBM Watson
Published Temperature = 107 C Humidity = 80 % to IBM Watson
Published Temperature = 108 C Humidity = 88 % to IBM Watson
Published Temperature = 97 C Humidity = 77 % to IBM Watson
Published Temperature = 98 C Humidity = 85 % to IBM Watson
Published Temperature = 101 C Humidity = 64 % to IBM Watson
Published Temperature = 105 C Humidity = 100 % to IBM Watson
Published Temperature = 94 C Humidity = 70 % to IBM Watson
Published Temperature = 108 C Humidity = 85 %
Ln: 5 Col: 0

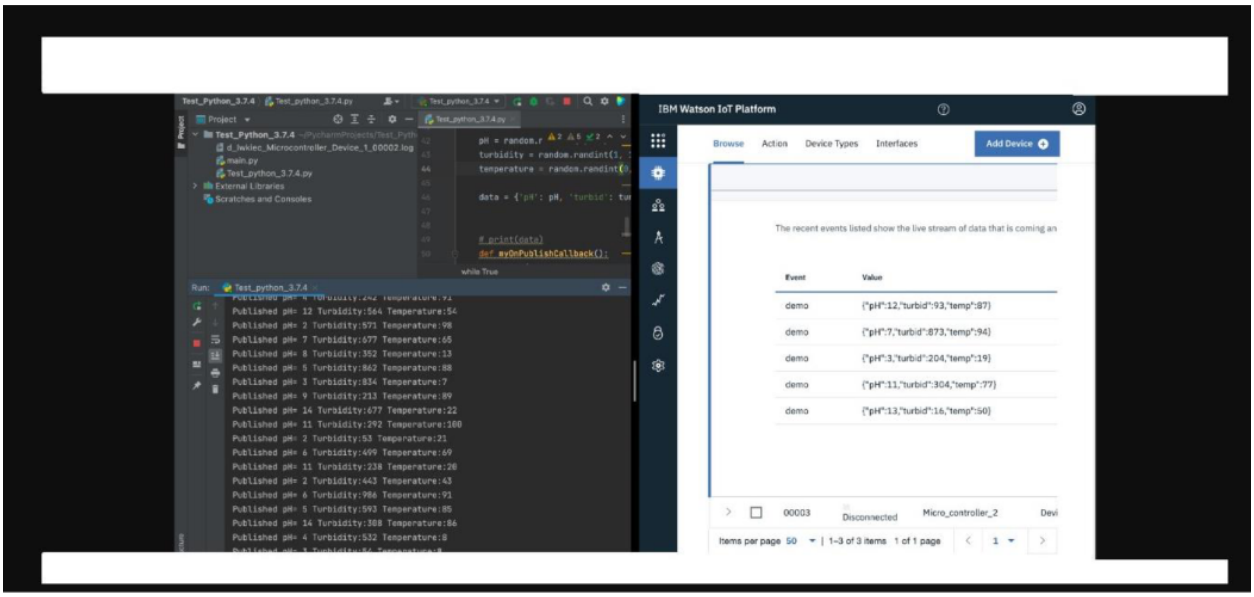
7.2 Feature 2

```
import ibmiotf.application
import ibmiotf.device
import time
import random
import sys
from twilio.rest import Client
import keys
Client = Client(keys.account_sid, keys.auth_token)

organization = "lwkiec"
deviceType = "Microcontroller_Device_1"
deviceId = "00002"
authMethod = "token"
authToken = "sushi@123"


pH = random.randint(1, 14)
turbidity = random.randint(1, 1000)
temperature = random.randint(0, 100)




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(1, 14)
   turbidity = random.randint(1, 1000)
   temperature = random.randint(0, 100)
```

```
  data = {'pH': pH, 'turbid': turbidity, 'temp': temperature}
  def SMS():
    message = Client.messages.create(
      body="ALERT!! THE WATER QUALITY IS DEGRADED",
      from_=keys.twilio_number,
       to = keys.target_number)
    print(message.body)

  if temperature>70 or pH<6 or turbidity>500:
    SMS()

  def myOnPublishCallback():
    print("Published pH= %s" % pH, "Turbidity:%s" % turbidity, "Temperature:%s" %
temperature)
```

```
   success = deviceCli.publishEvent("demo", "json", data, qos=0,
on_publish=myOnPublishCallback)
   if not success:
      print("Not Connected to ibmiot")
   time.sleep(5)
   deviceCli.commandCallback = myCommandCallback

deviceCli.disconnect()
```

7.3 Database Schema(if Applicable)



CHAPTER 8

TESTING

8.1 Test Cases

Water quality tests will give information about the condition of the waterway. By testing water over a period of time, the changes in the quality of the water can be seen. Perameters that may be tested include temperature, pH, turbidity ,salinity, nitrates,and phosphates.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	15	0	0	15
Client Application	45	0	0	45
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	10	0	0	10
Final Report Output	4	0	0	4
Version Control	3	0	0	3

8.2 User Acceptance Testing

1.purpose of Document

The purpose of this doucument is briefly explain the test coverge and open issueof the REAL TIME WATER OUALITY MONITORING AND CONROL SYSTEM projcet at the of the relase to user acceptannce testing

2.Defect Analysis

this report shows number of resloved closed bug at each serverity level,and how they were resolved

Goal:

The main goal of this project is to imporve supply of water by monitoring the quality of water comparing with standard values.

Scope:

Future works can be focused on system using more number of sensors,. The system is with advantage such as low power consumption more flexible to deploy.

Duration:

10 months

Approach:

The system developed is used for testing different water samples and if limits exceeded alert is used to send to the user.

CHAPTER 9

RESULTS

9.1 Performance Metrics

We are displaying the resulting sensor pH, temp, turbidity,and ORP values. It continuously senses the values of pH,temp, turbidity,and ORP and the resulting values are displayed to the LCD,PC or mobile in real time. If the acquired values is above the threshold value comments will be displayed as 'BAD' . If the acquired value is lower than the threshold value comments will be displayed as 'GOOD' . A bar/line graph will also be shown for perfect understanding.

The time series representation of sensor data with decision.

S.NO	Project Name	Scope/Feature	Functional Changes	Hardware Change	Software Change	Impact of Down time	Load/Volume Change	Risx Change	Justification

1	REAL TIME RIV ER WAT ER QUA LITY MON ITIO RING AND CON TROL SYST EM	New	Low	No Chan ge	Mode rate	3days	>5to 10%	ORA NGE	As we have seen the chang es

CHAPTER 10

10. ADVANTAGES & DISADVANTAGES

Advantage:

- The boat is mobile in nature and hence large number of semples are easily collected from different locations in less time.

•It is very easy to maintain the IoT based water quality monitoring system as all the electronic boards are available in the boat itself.
•The system is very cheap as the hardware and software does not cost much.

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

Disadvantage:

•The cost of analysis is very high,
•The lab testing and analysis takes some time and hence the lab results does not reflect real time water quality measurement due to delay in measurements.
•The process is time consuming due to slow process odf manual data collection from different locations of the water body.
•It is difficult to collect the water samples from all the area of the water body.
•The method is prone to human errors of various form.

CHAPTER 11

11. CONCLUSION:

Thus our project is used to Monitoring of Turbidity,pH, & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters.

This presents a detailed survey on the tools and techniques employed in existing smart water quality monitoring systems. Also a low cost, less complex

water quality monitoring system is proposed. The implementation enables sensor to provide online data consumers. This can be improved by incorporating algorithms for anomaly detections in water quality.

CHAPTER 12

12. FUTURE SCOPE:

We use water detection sensor has unique advantage. It consumes less time to monitor than a manual method for checking polluted levels, and notifies immediately to reduce affected rate of pollution in water. People who are living in rural areas near to the river will be very satisfied with our idea. It will be useful to monitor water pollution in specific area. So this system prevent people from water pollution. It will be used for farming purpose to check quality water,temperature and pH level. Our Impact of this project is also create a social satisfaction for farmers too. The scalability of this project gives the addition of more different type of sensors. By interfacing the relay we can control the supply of water. We can also implement as a revenue model. This system could also be implement in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

Monitoring environmental conditions,drinking water quality, treatment and disinfection of waste water etc. This system could also be implemented in various industrial processes.

Monitoring allows results, processes and experiences to be documented and used as a basis to steer decisions making and learning processes. Monitoring is checking progress against plans. The data acquired through

monitoring is used for evalution.

CHAPTER 13

13. APPENDIX

13.1 SOURCE CODE:

PHYTHON CODE TO PUBLISH DATA

#program to publish data in IBM Waston iot platform import time import sys
import ibmiotf.application import ibmiotf.device import random

#Provide your IBM Waston Device Credentials

#Org_ID organization = "84708c"
#Device Type deviceType = "ab cd"
#device ID deviceId = "12345"
#Method of Authentication authMethod = "token"
#Auth-token authToken = "12345678"
#exception handing method
#try block try: deviceOptions = {"org": organization."type":
deviceType,"id":deviceId, "auth-method":authMethod, "auth-token":authToken}
deviceCli= ibmiotf.device.Client(deviceOptions)
#to handle the errors except Exception as e: print("Caught event ion connecting

```
device: %s" % str(e)) sys.exit()
#device connection deviceCli.connect()
#while Loop for getting the values while True:
    Ph=random.randint (6,8)
    WaterTurbidity=random.randint(15,100)
     salinity=random.randint(500,1000)
    DissolvedOxygen=random.randit(60,130)
    conductivity=randam.randint(100,1200)
data={'Ph':Ph,
'WaterTurbidity':WaterTurbidity','Salinity':salinity,'DissolvedOxygen':
DissolvedOxygen,'conductivity':conductivity}
#define myonpublisgcallback
function def mtonPublishCallback():
print("Published Ph=%s"%Ph,"WaterTurbidity=%s%%"%
WaterTurbidity,"salinity=%s"%salinity,"DissolvedO2=%s"%
DissolvedOxygen,"conductivity=%s"%conductivity)
if(Ph<7.4 and salinity<600 and DissolvedOxygen<80 and conductivity<200):
if(Ph>7.4 and salinity>900 and DissolvedOxygen>120 and conductivity>1100):
print("UNSAFE,THE VALUES OF PARAMETERS ARE NOT IN THE
RANGE")
else:
print("Quality of River water is measured and its correct")
success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on_publish=myon
PublishCallback)
if not success:
print("Not connected to IOTF")
#sleep time.sleep(10)
#disconnect device deviceCli.disconnect()
```