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REAL-TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

TEAM ID: PNT2022TMID30880

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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1. INTRODUCTION

1.1 PROJECT OVERVIEW:

Water pollution is one of the biggest fears for green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitored in real time. In this project “Python Based Water Monitoring System” we design and develop a low cost system for real time monitoring of the water quality using IOT,(internet of things).The system consists of several sensors used to measure physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The measured values from the sensors can be processed by the core controller. The Raspberry Pi model can be used as a core controller. Finally, the sensor data can be viewed on the internet using the WI-FI system.

Keywords - Temperature Sensors, pH Sensor, Turbidity Sensor, Arduino Uno, Raspberry Pi

1.3 PURPOSE:

It has been seen that the quality of the water being distributed to most areas (both rural and urban) has been deteriorating with time as the water sources from where the water is being drawn gets polluted, as well as lapses in the part of the civic body responsible for the maintenance of the quality of water. It may also be due to no proper maintenance of the machines which perform the actions necessary to clean or improve the quality of water being distributed to homes. This has been observed to majorly affect the number of water

borne-diseases in the city. This project works on achieving proper evaluation of the quality of water with respect to some of the most basic parameters i.e. the temperature will be monitored so that the climatic changes don't affect the water. The PH will be monitored so that it remains in the most optimal range and is fit for human consumption and prevents the growth of disease causing microbes. The flow of the water is monitored so that there are no disruptions or leaks and also to maintain a specific flow rate which prevents the growth of fungal and small plants in the transport network. Finally The turbidity of the water is monitored so that it gives us a measure of the amount of impurities in the water and if needed it can prompt the required action to change and modify the quality of water if it's not in the permissible range. A major advantage of the system is the real time monitoring of the quality of the water (i.e:-its immediate quality is monitored) which gives us the ability to immediately determine if the water is really safe for consumption or not. The system provides us the facility to immediately identify the attributes or parameters of water and see if there should be any additional measures taken to clean or improve the quality of the water.

2. LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

The amount of diseases caused by water borne microorganisms in today's India is increasing at an alarming rate and has become a critical issue which hinders the growth of the populace and it is

affecting the effective working of the cities as a whole. One of the major reasons for this is the pollution of most water bodies and no proper methods to detect if the water being sent to us is treated properly or not. No effective measures have been taken with respect to the quality control of water sources.

2.2 REFERENCES:

1.Dr.Mohan Kumar S & Dr. Balakrishnan, Classification Of Breast Mass Classification – CAD System And Performance Evaluation Using SSNE, IJISET – International Journal of Innovative Science, Engineering & Technology, Vol. 2, Issue 9, 417-425, ISSN 2348 – 7968

2. Dr. Mohan Kumar S, Dr. Balakrishnan, Classification Of Breast Mass Classification–CAD System With Performance Evaluation, International Journal of Engineering And Computer Science, Volume 4, Issue 09, 14187-14193, ISSN 2319-7242, September, 2015 3. Dr. Mohan Kumar S, Dr. Balakrishnan, Classification Of Breast Microcalcification- CAD System And Performance Evaluation Using SSNE, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5 , Issue 9, 824-830, ISSN: 2277 128X, Sep- 2015

Review through Web Reference

www.codenotes.com
www.pythwon.org
www.w3schools.com

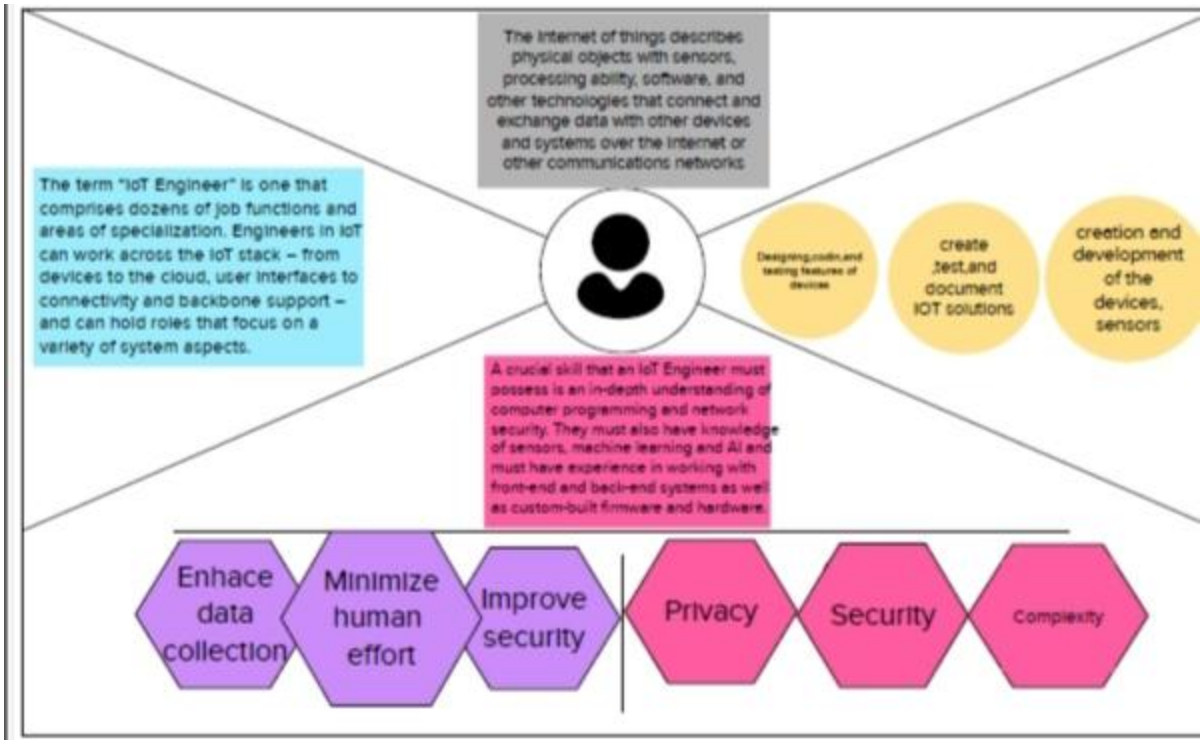
2.3 PROBLEM STATEMENT DEFINITIONS:

The amount of diseases caused by water borne microorganisms in today's India is increasing at an alarming rate and has become a critical issue which hinders the growth of the populace and is affecting the effective working of the cities as a whole. One of the major reasons for this is the pollution of most water bodies and no proper methods to detect if the water being sent to us is treated properly or not. No effective measures have been taken with respect to the quality control of water sources.

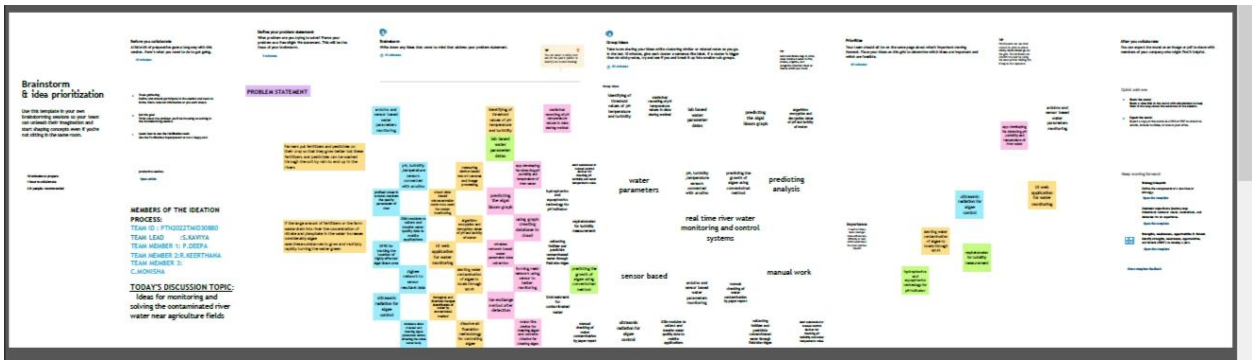
The quality of water has deteriorated a lot as can be seen by how most lakes in our cities are frothing with foam due to the impurities released into the lakes. The water must definitely be treated to make it fit for consumption and daily use. Moreover, we should have a means to measure the quality in terms of parameters which we can easily understand and monitor the quality in real time. Now that there is a large amount of people fussing about water especially in summer, the government has started identifying a few cases where the water is not treated before use and are in need of a solution.

3. IDEATION & PROPOSED SOLUTION:

3.1 EMPATHY MAP:



3.2 Ideation & Brainstorming:



3.3 Proposed Solution:

S.No	Parameter	Description

1.	Problem statement	• Water gets polluted due to industrial waste, medical waste, fertilizers or farm wastes. So water cannot be used for domestic purposes.
2.	Idea / Solution description	• To measure various chemical and physical properties of water like pH, temperature and particle density of water using sensors. • Dispose the industrial waste, toxic chemicals and medical waste properly.
3.	Novelty / Uniqueness	• If the acquired value is above the threshold value automated warning SMS will be sent to the agent. • The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility and low powered
4.	Social Impact / Customer Satisfaction	• Living organisms such as aquatics, human beings, and animals suffer due to polluted water so this can be avoided. • Water borne diseases such as Typhoid, Cholera, Polio etc.. can be prevented and avoided.
5.	Business Model (Revenue Model)	• Water quality monitoring system by aeron systems for industrial water treatment plant, river bodies, aqua forming digital loggers.

6.	Scalability of the Solution	• Water quality data with a high spatial and temporal resolution for thousands of lakes at a time. • It supports the evaluation of environmental problems and potential health risks through the analysis of changes in water quality and the detection of harmful algal blooms.

4. FUNCTIONAL REQUIREMENTS:

4.1 Functional requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Login	Confirmation through password verification
FR-2	View Water Details	Measured pH, temperature, turbidity values provides the detail about quality of water bodies
FR-3	Logout	Log out the user successfully

The above figure shows the functional requirements with sub requirements.

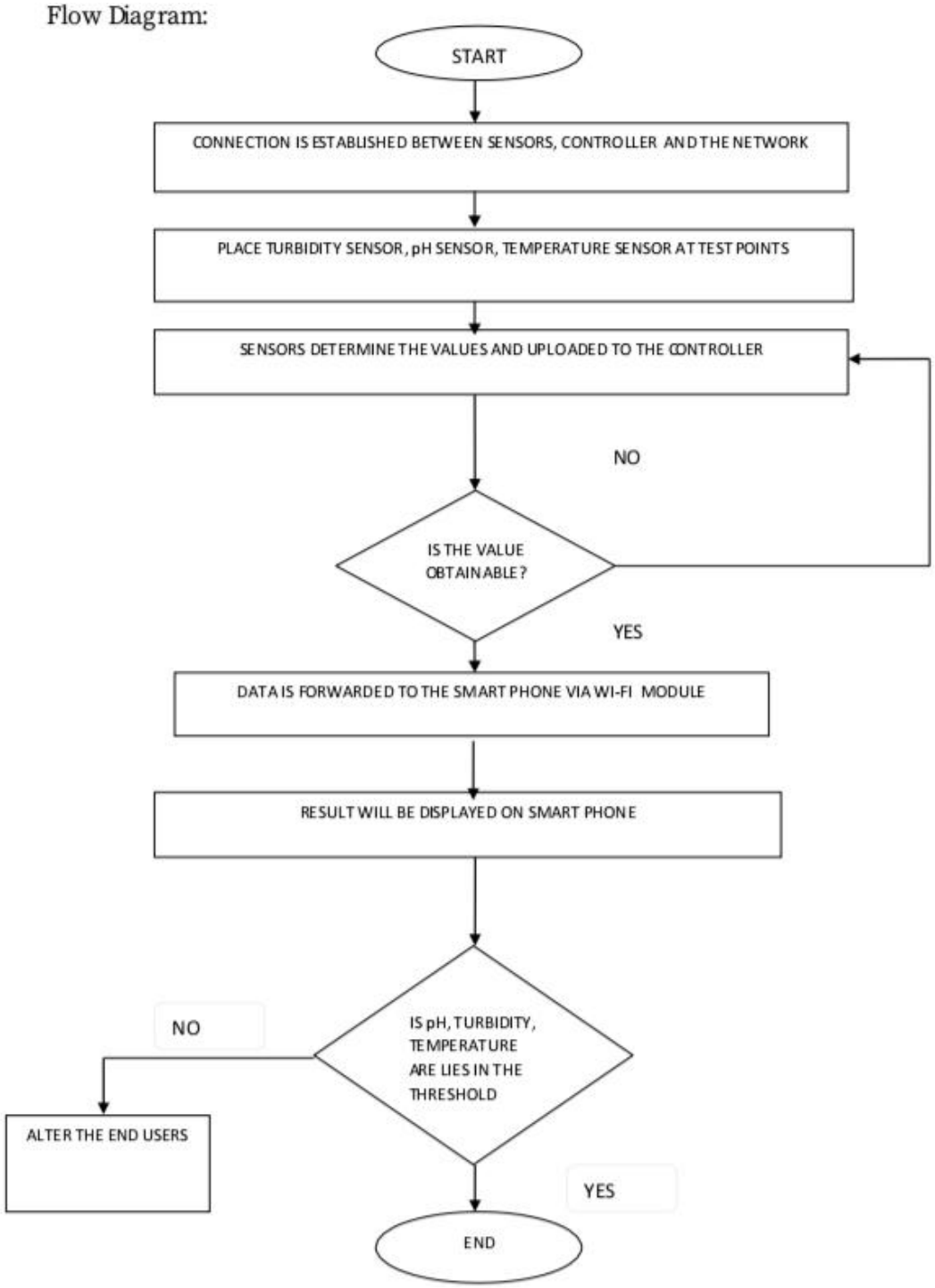
4.2 Non-Functional requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Load time for user interface screen shall not be more than 2 seconds.
NFR-2	**Security**	User account is password protected 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. Login info verified within 10 seconds.
NFR-5	**Availability**	Maximum down time will be about 4 hours
NFR-6	**Scalability**	System can handle about 1000 users at any given time

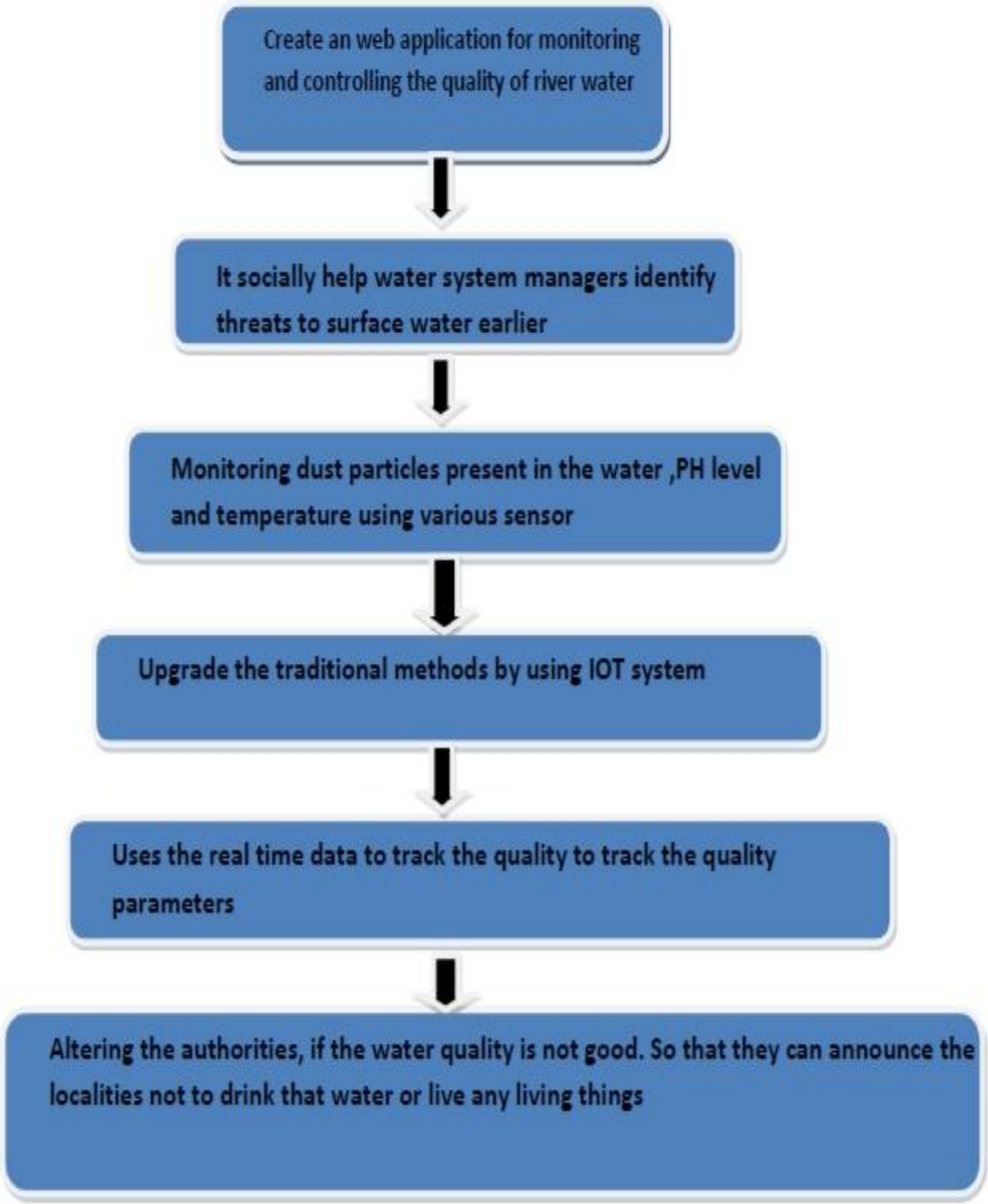
5. PROJECT DESIGN:

5.1 Data Flow Diagrams:

Flow Diagram:



5.2Solution&TechnicalArchitecture:



5.3 User Stories:

UserType	Functional Requirement(Epic)	User StoryNumber	UserStory/Task	Acceptance criteria	Priority	Release
Customer(Mobileuser)	Registration	USN-1	As a user, I can register fortheapplicationby enteringmy email, password, andconfirmingmypassword.	I can access myaccount/dashboard	High	Sprint-1
		USN-2	Asa user,Iwillreceiveconfirmationemailoncelhaveregisteredfortheapplication	Ican receiveconfirmation email&clickconfirm	High	Sprint-1
		USN-3	Asauser,Icanregisterforthe application throughFacebook	I can register &accessthe dashboard withFacebookLogin	Low	Sprint-2
		USN-4	As a user, I can register fortheapplicationthroughGmail		Medium	Sprint-1
	Login	USN-5	Asauser,Icanloginto the applicationbyenteringemail&password		High	Sprint-1
Customer(Webuser)	Registration	USN-1	As a user, I can register fortheapplicationby enteringmy email, password, andconfirmingmypassword.	I can access myaccount/dashboard	High	Sprint-1
		USN-2	Asa user,Iwillreceiveconfirmationemailoncelhaveregisteredfortheapplication	Ican receiveconfirmation email&clickconfirm	High	Sprint-1
r		USN-3	Asauser,Icanregisterforthe application throughFacebook	I can register &accessthe dashboard withFacebookLogin	Low	Sprint-2
		USN-4	As a user, I can register fortheapplicationthroughGmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into theapplicationbyenteringemail &password		High	Sprint-1
Customer CareExecutive	Login	USN-5	Asa,CustomerCareExecutiveIcanlogintothe applicationbyenteringserveremail&password	Icanaccess DBMS	High	Sprint-1
Administrator	Login	USN-5	Asa Administrator,Icanlogintotheapplicationbyenteringseveremail &password	Icanaccess DBMS	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning,Estimation & Delivery:

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 confirmingmy password.	2	High	Kaviya S
Sprint-1		USN-2	As a user, I will receive confirmation email onceI have registered for the application	1	High	Deepa P
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Keerthana R
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Monisha C
Sprint-1	Login	USN-5	As a user, I can log into the application by Entering email & password	1	High	Deepa P

7.CODING & SOLUTIONING:

Program:

```
import time import sys
import ibmiotf.application
import ibmiotf.device
import random
#organization="m89nt2"
deviceType="arduino"
deviceID="123"
authMethod = "token"
authToken = "87654321"
#Initialize GPIO
def myCommandCallback(cmd):
print("command received: %s"%cmd.data['command']) status=cmd.data['command']
if status=="light on":
print ("led is on")
elif status=="light off":
print ("led is 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()
# connect and send a datapoint "hello"with value "world" info the cloud as an event of
type"greetings"10 times
```

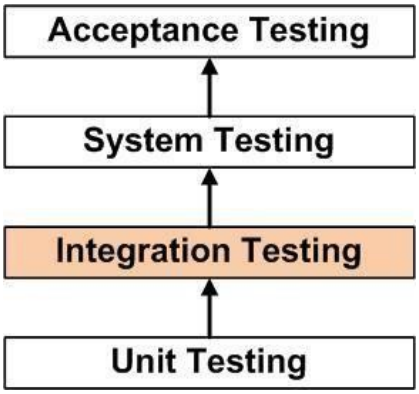
```
deviceCli.connect()
while True:
#Get sensor Data from DHT11
temp=random.randint(90,110)
pH=random.randint(0,14)
turbidity=random.randint(0,100)
data = { 'Temperature' : temp, 'pH': pH, 'Turbidity':turbidity }
 #print data
def myOnPublishCallback():
print("published Temperature = %s C" % temp, "pH = is %s %%" % pH, "Turbidity= is%s
%%" % turbidity,"to IBM Watson")
success=deviceCli.publishEvent("IOTSensor",
"json",data,qos=0,on_publish=myOnPublishCallback)
if not success:
print("Not connected to IOTF") time.sleep(10)
deviceCli.commandCallback=myCommandCallback deviceCli.disconnect()
```

8. TESTING:

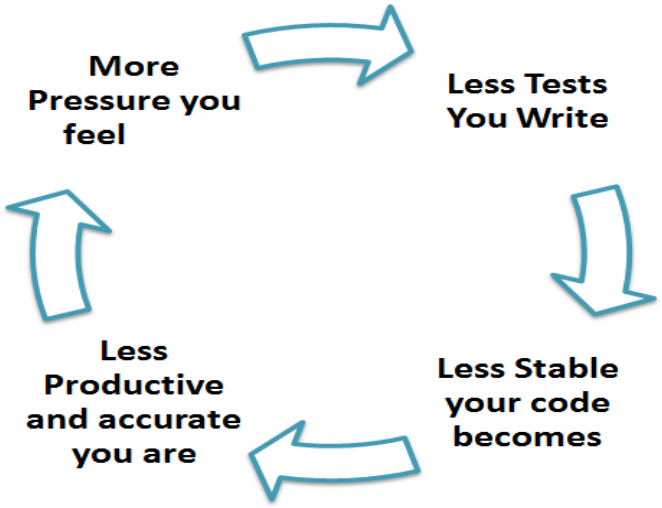
Testing is the most important part of the software development process. Some of the reasons for its importance are as follows:

- Testing helps find and fix the bugs in the software which prevent the program from performing as required or as efficiently as needed.
- Bug fixing in the early development stages helps to save a lot of time and effort.
- Testing is very essential to make sure that the final output product will work well without any errors once deployed.Testing improves the quality of the software.
- Validation is the process of ensuring that the software built is in accordance with the expected business requirements. It assures to satisfy customer needs.

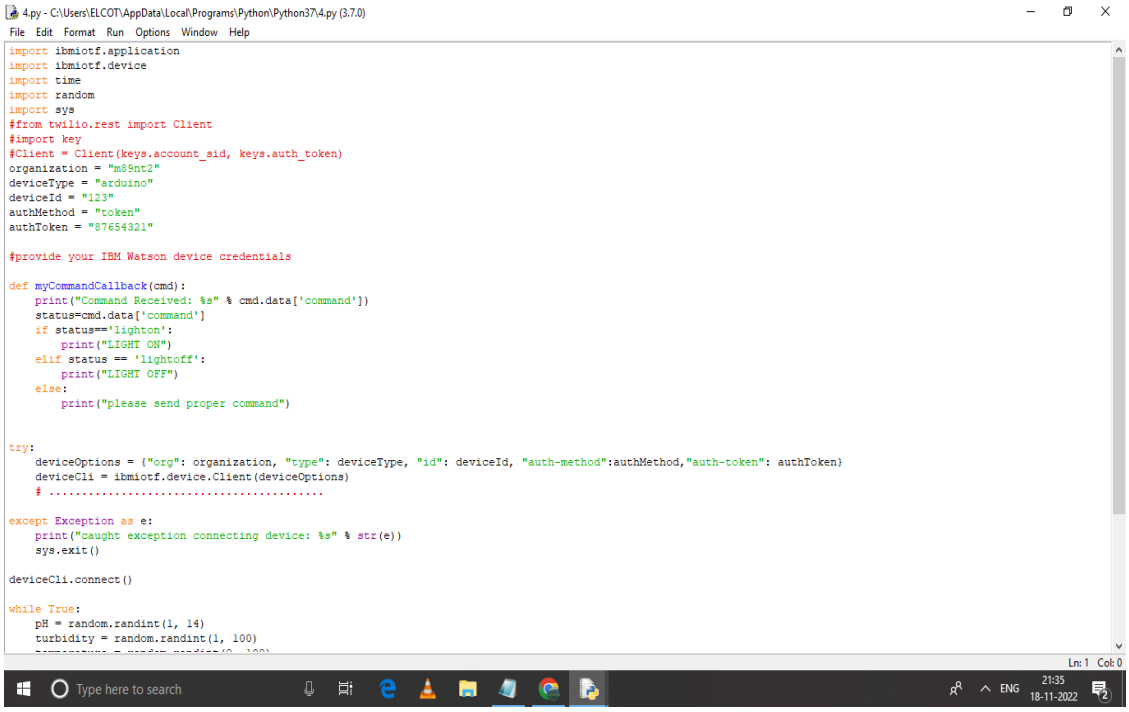
8.1 Test Cases:

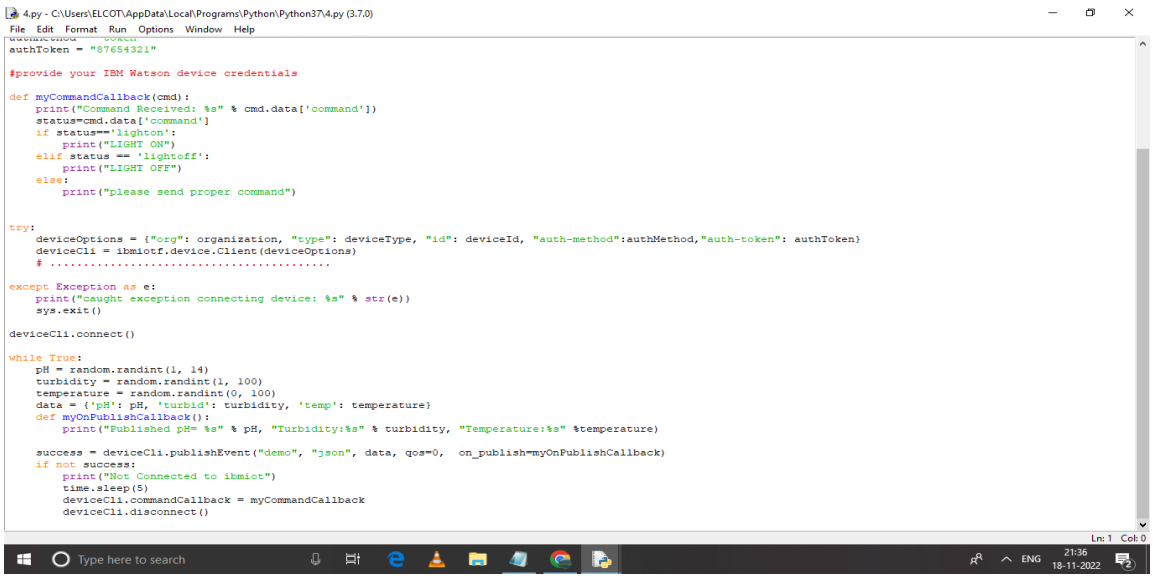


8.2 User Acceptance Testing:



9. RESULTS:





9.1 Performance Metrics:

Epoch	Accuracy	Loss	Val-loss	Val Accuracy
1	0.8612	0.5750	0.9289	0.2057
2	0.9151	0.2386	0.9151	0.1584
3	0.9461	0.1595	0.9316	0.1794
4	0.9526	0.1530	0.9026	0.2408
5	0.9480	0.1525	0.9237	0.1976
6	0.9342	0.1873	0.9289	0.1569
7	0.9507	0.1657	0.9421	0.1541
8	0.9533	0.1549	0.9316	0.1917
9	0.9513	0.1451	0.9368	0.1848
10	0.9520	0.1589	0.1496	0.9447

10. ADVANTAGES:

The proposed system tackles the problems mentioned in the existing system such as:

- The system provides real time quality measures of the water sample.
- Accurate and timely available sensor data.
- Easily deployable.

Sophisticated visual representation of the sensor data lets us.

DISADVANTAGES:

The system which is implemented and is deployed across the country has certain limitations such as:

- The experts in the lab measure the sample and give a report to the concerned authorities before the water is sent to the consumers if it passes

the QA testing . If the water sample gets contaminated during the transfer to the customer it cannot be detected. The consumer is not made aware of the details of the water sample like its components . They are just told that it's safe for use.

11. CONCLUSION:

Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensors with unique advantage and existing GSM network. The need to monitor these values of water arises with the rise in the risk caused due to the current water quality and standards of water available for drinking, domestic and household purposes. Even if we humans get adapted to the current standards and quality of water content, there are many other living organisms and plants that need a good supply of clean water to survive. The water quality monitoring is performed automatically by the system 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. This system can be used to monitor other water quality parameters only by replacing the corresponding sensors and changing the relevant software programs. The working is simple, the system can be put to better and more use to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and an extension value. In this project, a IOT based bio monitoring system is proposed which uses sensors to get the most essential values which can be used to obtain other parameters of all

the sensors that are being used in the model. The project serves its purpose well to cater the needs of current and future generations. The fact that it focuses on the most sensitive and basic need for survival makes it that valuable and resourceful. The project focuses completely on something that goes completely unnoticed and ignored, the quality of water being consumed and used for other needs. If the quality of water of many places were known, people would immediately stop consuming or avoid using that particular water due to how harmful and dangerous it may turn out to be for daily usage. People moving into new locations have no idea about the water quality and standards of that place, and need a source to monitor the same, this project would definitely prove to be of great use in such circumstances. Also, knowledge of such quality of water would help make changes and provide better water.

12. FUTURE SCOPE:

The data that is collected over time can be sent to a system or program that can be used to obtain additional parameters such as density, amount of bacteria, the viscosity of water etc. and then these parameters can be analyzed by the software. This project serves as a great purpose to current and future generations. Water monitoring in these times of having irregular and low quality water supply proves to be very essential to household and domestic needs. The current generation has suffered a lot of water pollution and unsafe water, and definitely need an approach to keep track of the water that they are

consuming and using for domestic needs. The future however, this project can be implemented just the way it is or also with major and minor changes to suit the needs of the future generations. The fact that there are a lot of dying water bodies and the need for water arising every day this project would indeed be Of great help to many people.

13. APPENDIX Source Code:

PROGRAM:

```
import time import sys
import ibmiotf.application
import ibmiotf.device
import random
#organization="m89nt2"
deviceType="arduino"
deviceID="123"
authMethod = "token"
authToken = "87654321"
#Initialize GPIO
def myCommandCallback(cmd):
print("command received: %s"%cmd.data['command']) status=cmd.data['command']
if status=="light on":
print ("led is on")
elif status=="light off":
print ("led is 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()
#connect and send a datapoint "hello"with value "world" info the cloud as an event of type"greetings"10 times
deviceCli.connect()
while True:
#Get sensor Data from DHT11
temp=random.randint(90,110)
pH=random.randint(0,14)
turbidity=random.randint(0,100)
data = { 'Temperature' : temp, 'pH': pH, 'Turbidity':turbidity }
```

```
 #print data
def myOnPublishCallback():
print("published Temperature = %s C" % temp, "pH = is %s %%" % pH, "Turbidity= is%s %%" %
turbidity,"to IBM Watson")
success=deviceCli.publishEvent("IOTSensor","json",data,qos=0,on_publish=myOnPublishCallb
ack)
if not success:
print("Not connected to IOTF") time.sleep(10)
deviceCli.commandCallback=myCommandCallback deviceCli.disconnect()
```

GitHub & Project Demo Link:

https://www.mediafire.com/file/ywfpq0z8ly3fdaw/project+video.mp4/file