PROJECT REPORT

Project Title : **REAL-TIME-RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM**

Team ID : PNT2022TMID34532

COLLEGE : PONJESLY COLLEGE OF ENGINEERING
DEGREE : BACHELOR OF ENGINEERING
DEPT : ELECTRONICS AND COMMUNICATION ENGINEERING

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ABSTRACT

The environment consists of five key elements e.g., soil, water, climate, natural vegetation,and landforms. Among these water is the major need of human life. It is also vital for the persistence of other living habitats. 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. 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. 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.

INTRODUCTION

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. It is sensor-based water quality monitoring system. 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.

In this project, we have used IBM Watson IoT platform as our core platform for our project. The project starts with the Python Script, while running the code the description connects with the Cloud platform and generates the output.Let us move on to the complete details of our project in upcoming sections.

LITERATURE SURVEY

Real-Time River Water Quality Monitoring and Control System helps us to monitor the quality of the river water by analyzing specific requirements such as Temperature, Humidity and pH Value. Farming and irrigation, mining, and forestry all rely on water and all pose risks of returning higher than normal concentrations of chemicals, nutrients or sediments to our waterways. Urban runoff from expanding cities also poses an increased risk to water quality. These risks are addressed by regulating the way water is used and managing the effect our activities have on our local waterways.

1) Wireless communication developments are creating new sensor capabilities. The current developments in the field of sensor networks are critical for environmental applications. Internet of Things (IoT) allowsconnections among various devices with the ability to exchange and gather data. IoT also extends its capability to environmental issues in addition to automation industry by using industry 4.0. Around 40% of deaths are caused due to contaminated water in the world. Hence, there is a necessity to ensure supply of purified drinking water for the people both in cities and villages. Water Quality Monitoring (WQM) is a cost-effective and efficient system designed to monitor drinking water quality which makes use of Internet of Things (IoT) technology.
Ref. Nikhitha Kashya.

2)Water quality monitoring (WQM) system is widely being explored as it is needed to prevent the problem of water contamination worldwide.This paper presents the development and implementation of Water Quality Assessment and Monitoring (WQAM) system. The system development used WiFi enabled microcontroller to connect with the IoT environment and store the data in the IoT cloud server. The microcontroller used is Arduino UNO that interacts with three types of sensor probes which are pH, turbidity and temperature probe. The IoT cloud used to utilize the data frame is ThingSpeak. This system was implemented on Bandar Perda Lake and Derhaka River in Pulau Pinang with two systems implemented at each location. The sensors were placed on the water surface for more accurate measurements. This system continuously measures the readings of pH, turbidity dan temperature on the lake/river for every 1 hour. Twenty readings were taken for every 1 hour within the first 20 minutes with 1 minute interval and the readings were stored in the IoT cloud server *Ref.Muhammad Farhan.*

IDEAS FOR THE WELL DEVELOPED PROJECT

Our goal is to develop a system for real time quality assessment for water health at residential places using Internet of Things, pH, temperature sensors are used to gather the parameters necessary to monitor water health in real time.

The Quality of the Water will be determined by our IoT process.

- While consuming the impure water causing various diseases, this can be stopped by Controlling pollutants.
- We provide proper solution to overcome this disaster.
- Perfect measuring is done in our experiment.

Some Ideas to ensure better rresults in water qualiity testing are as follows,

- ➤ User friendly application. Usage of simplified devices to give accurate results.
- ➤ Quality of Service
- ➤ Quick response from the server
- ➤ Detailed help desk for the service
- ➤ IBM Cloud Platform is the best area to configure output in very detailed process
- ➤ Using Node-Red Service can easily develope the Web UI and Application in a well profossional manner and very simplified manner
- ➤ Overall Application Interface can be developed using MIT App Inventor for more specifications

TECHNICAL ARCHITECTURE

Our Technological Architectrue composed of the Python Code, IBM Watson IoT Platform, Node-Red Service, MIT App Inventor.

As the Python code is made to run, the code switch connects to the IBM IoT Platform and the results are then shown in the Node-Red Service. At the dashboard section of the Node-Red, we can manage and direct to the User Interface Section. Finally the output is responded in the developed application from MIT App Inventor.

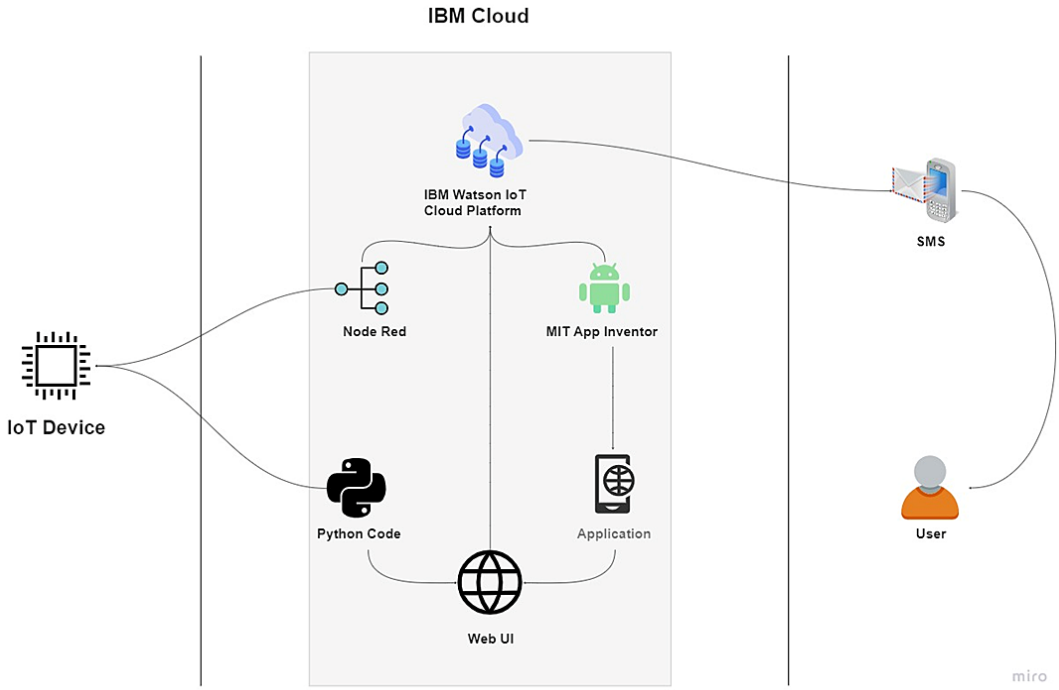


Fig.Technical Architecture

CREATED SPRINTS

We have speratted our project work in terms of Sprints. Totally we have 4 Sprints. We seperated each sprints between our team members and done our project successfully.
At the start of the project, we have developed the IBM Watson Iot Platform by loging in with specific credentials which are given to us in the IBM Profile Section. After the Creation of the Cloud Platform we move on to the Node-Red Service.

In the Node-Red Service, we have created the perfect set of circuits with the given requirements such as Temperature, Humidity and pH Value. Then we set the "http" block for the web connection process. Thus the user interface is created successfully.

Next section is to build the application, we have developed the application by using the MIT App Inventor. In the MIT App Inventor we have so many specifications to progress a well professional application.

Final Process is to build the Python Script. The python script is developed in order to make connection with the IoT Cloud Platform.

Our Process Simulation as follows

- ☆ IBM Watson IoT Platform
- ☆ Python Script
- ☆ Node-Red
- ☆ Application Development

IBM WATSON IoT PLATFORM

The very first process in this project section is to develop the IBM IoT Platform. This IoT platform is the core formula for all the connection process. As the only way of connecting several applications is the basic work of the cloud platform.

The process of signing in to the cloud process is the large process which carries verfication segments too. After creating the Cloud Profile, lets move to device creation part.

Device Creation

Now the next step is to create a device, we have created a device with following details
Device Type : 1234
Device Id : 1234567
With following details, we have created a device and the code for this device carries the requirements which satisfies the project specification. We used temperature, humidity and the pH value in the code.

- temperature - 0 to 100
- humidity - 0 to 100
- ph value - 0 to 14

While, the device is made to run the results are appeared in the Recent Events tab near the Device part.

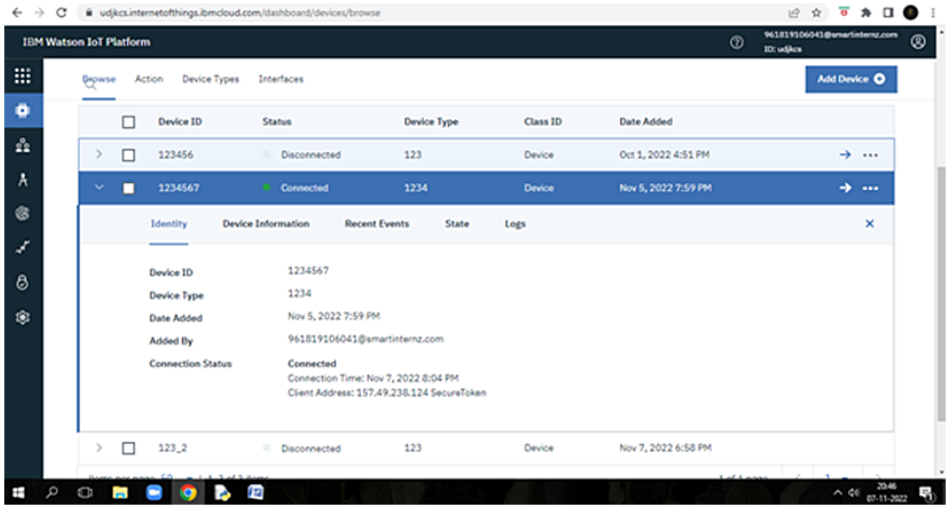


Fig.Created Device

NODE-RED SERVICE

After registering to the IBM IoT Platform and created the device, now we move on to the Node-Red Service, in this here we can create the Web user interface and the Web Application by designing the circuit. Our Node-Red Circuit designing are as follows.

The first step is to install the IBM IoT block from the node-red service and we have set three functions namely, temp, hum, pH these three functions processess temperature, humidity and the pH value. And the three functions are connected to the msg.payload button. At seperately the functions are designed in the wave of chart, where temperature and humidity are designed in the Line Chart and pH value as Gauge chart.

After this, we set two buttons of the Switch board, Light ON and Light OFF. This button works as if it pressed to light ON, the python code displays "led is on", if light OFF, it shows " led is off".

Now for connecting to web we use "http" extention. And also, for connection to the Application we use MIT app application with get option function in Node-Red. The Node-Red website is copied and added "/sensor" to review the output.

For simulating the Node-Red Service, there appears "Deploy" button.

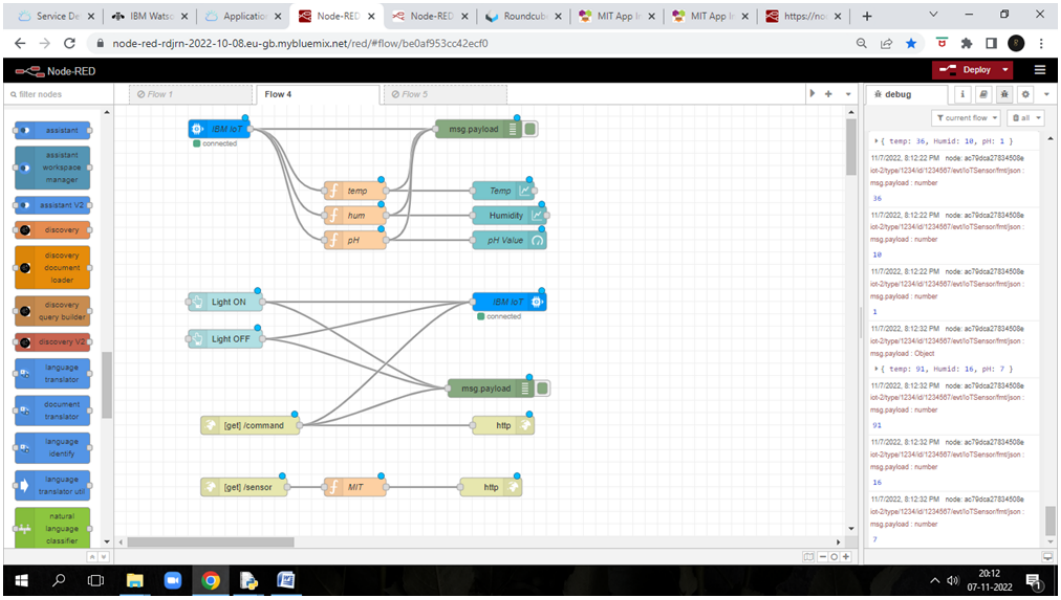


Fig. Node-Red Circuit Design

User Interface

After the successful simulation of the Node-Red Service, User Interface is created. Our Web UI includes Temperature, Humidity, pH Value in accordance with Switch Board of Light ON and Light OFF. The Temperature and Humidity varies from 0 to 100. And the pH varies from 0 to 14.

Our Executed User Interface from the Node-Red is shown below.

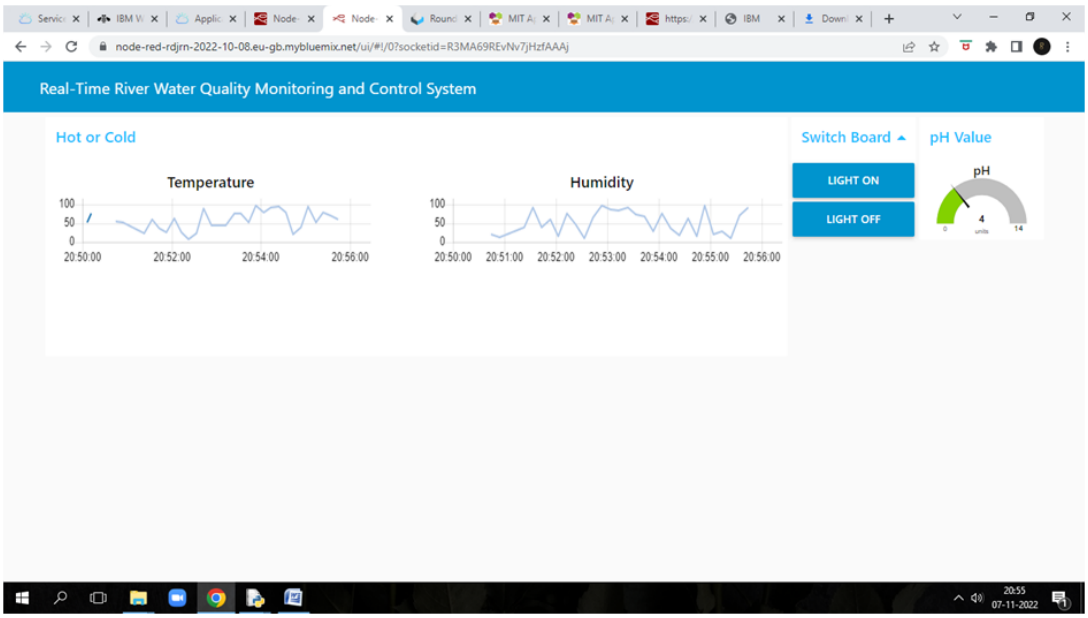


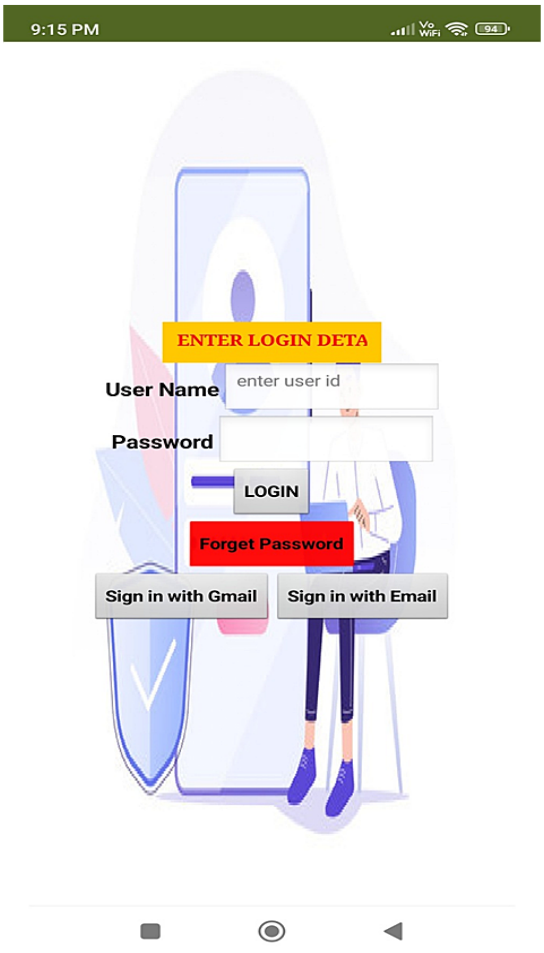
Fig.Node-Red Page Web User Interface

MIT APP INVENTOR

This phase is the most priority requirement of our project. Using an application helps users to monitor in easy way. MIT App inventor helps to desgin our application. We have created 6 Screens for our App.

The First screen, lets you get started with the application. The Second Screen is the login Page and following the registration page screen, we have kept the buttons sign in with gmail and email. Through the respective screen the user can sign up with the application. Also we have place the notify condition, when the detalis goes wrong, it alerts "Check your Credentials". As the detalis are correct it moves on to the next screen. We have set the credentials as 1234 for both username and password.

Here we display the Login Page of our Application



Following the Login Page, Selection of process is shown with three categories such as Temperature, Humidity and pH value and atlast Logout button.

When the category is selected the page moves on to the Output Display Page where we can see all the three results as the python code is made simulated.

The last page contains Switch board of Light ON and Light OFF. As same as user interface, here also when we press these buttons the output of led on or off is displayed in the Python code

As this way the Application Simulation Works.

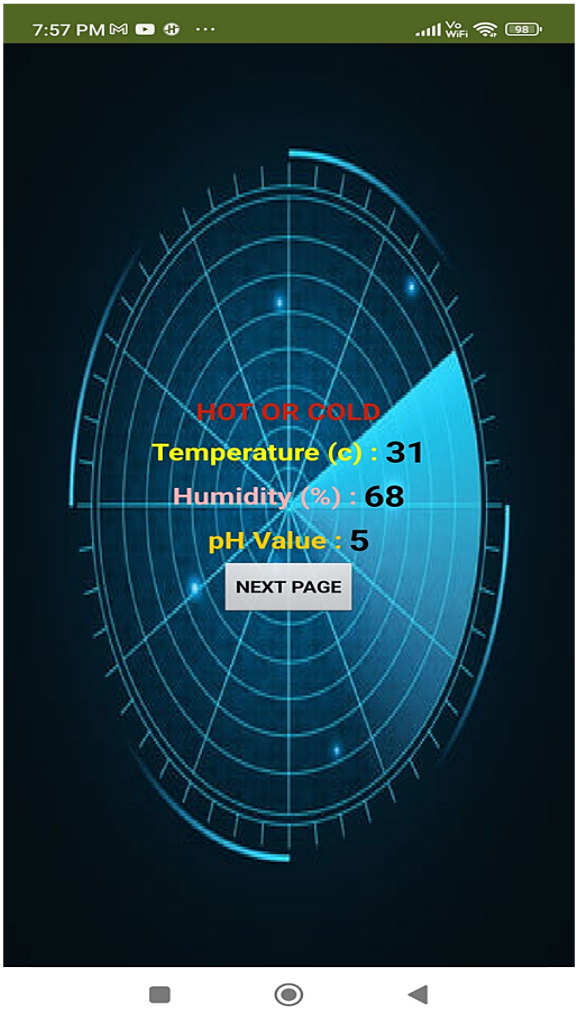


Fig. Output Displayed in Application

PYTHON CODE

Our Python Code is very Simple and easy to understand. The programs carries our device detalis and the requirements of the project are kept defined. All conditions are made properly and the output is done successfully.

CODE

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


#Provide your IBM Watson Device Credentials
organization = "udjkcs"
deviceType = "1234"
deviceId = "1234567"
authMethod = "token"
authToken = "123456789"

# Initialize GPIO


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")

    #print(cmd)
```

```
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" into the cloud as an event of type "greeting" 10
times
deviceCli.connect()

while True:
      #Get Sensor Data from DHT11

      temp=random.randint(0,100)
      Humid=random.randint(0,100)
      pH=random.randint(0,14)

      data = { 'temp' : temp, 'Humid': Humid ,'pH' : pH }
      #print data
      def myOnPublishCallback():
         print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "pHValue =
%s" % pH,  "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

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

CODE RESULTS

As the code is made to run, the system waits to connect with IoT platform. On account of coonection with the IBM Watson Platform, the code displays the output with relevant details. The output is shown in Cloud platform, the links to Node-Red also to the UI section. Finally when the Application is operated, the output is also displayed in it.

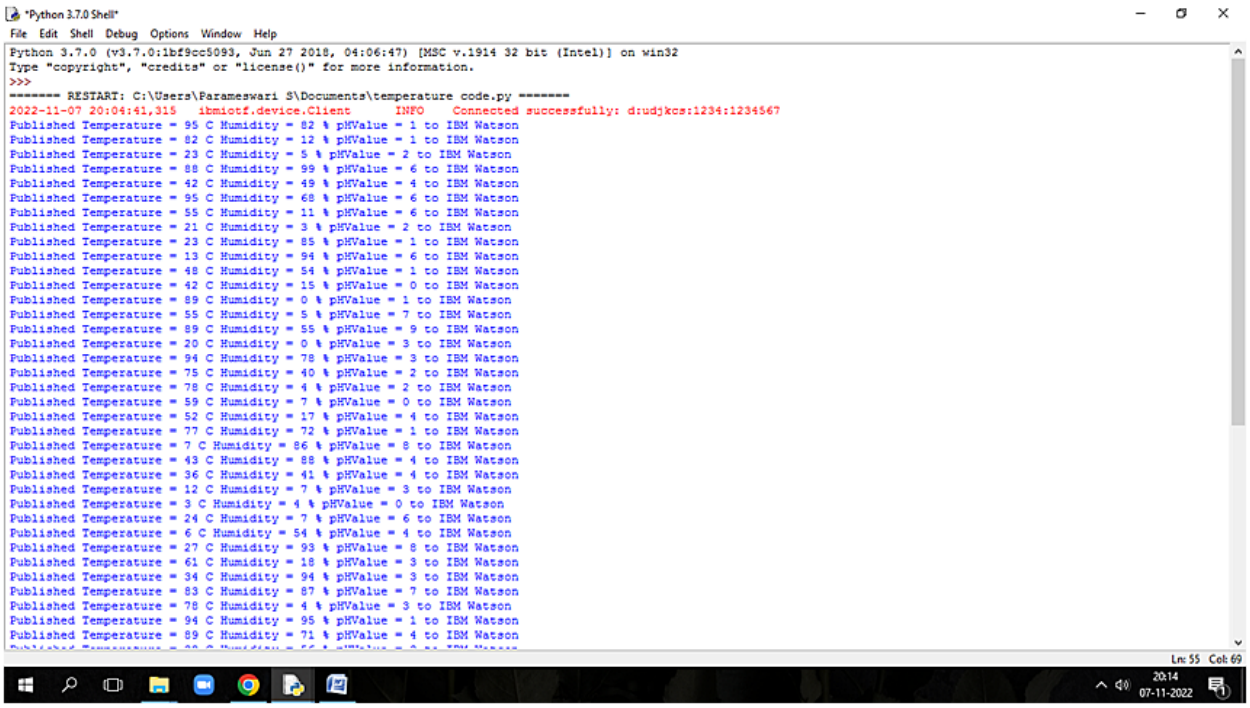


Fig.Python Output

CONCLUSION

This way of monitoring the water quality made us very easy. Water monitoring is a crucial part of maintaining many environments including industrial buildings, commercial properties and healthcare establishments. Technology has advanced to the extent that there are now highly sophisticated, accurate and convenient water monitoring systems which offer a whole host of benefits. The major cause of water impurity by industrial wastes and also human acts. By analyzing the quality of water we can consume healthy state, but if we reduce the pollution causing acts we can gain more water ie.pure water even naturally. Stop polluting the river water and make environment clean and hygienic.