IOT BASED SMART CROP PROTECTION SYSTEM

FOR AGRICULTURE

TEAM ID: PNT2022TMID54090

TEAM LEADER: DHARUN.E

TEAM MEMBER 1: GOKULAKRISHNAN.B
TEAM MEMBER 2: MOHAN RAJ.M
TEAM MEMBER 3: MULANGI CHENCHU KRISHNA TEJA

1. INTRODUCTION:

a. Overview :

i. This project is based onInternet Of Things (IoT), that can measure soil moisture,Humidityand temperature conditions for agriculture and crop protection using Watson IoT services. IoT is network that connects physical objects or things embeddedwith electronics, software and sensorsthrough network connectivity thatcollects and transfers data using cloud for communication. Data is transferred throughinternet without humanto human or human to computer interaction.

ii. In this projectwe have not used any hardware. Insteadof real soil moisture, Humidity and Temperature data obtained from sensors we make use of IBM IoT Simulatorwhich can transmitthese parameters as required.

b. **Project requirements**: Node-RED, IBM Cloud, IBM Watson IoT,Node.js, IBM Device, IBM IoT Simulator, Python 3.7, Open Weather API platform.

c. **Project Deliverables**: Application for IoT based Smart Agriculture System

d. Purpose:

i. An intelligent crop protection system helps the farmers in protecting the crop fromthe animals and birds which destroythe crop.

ii. This system also helps farmers to monitor the soil moisture levels in the field and also the temperature and humidity values near the field.

1.1 SCOPE OF WORK

1. Create a devicein IBM Cloud Account.
2. Install Node-RED and configure the nodes that we want to use in the project.
3. Create the open weathermap account and get the API key and the weatherconditions using API key in the Node-RED.
4. Create a web application for user interaction for observation and controlactions.

2. LITERATURESURVEY

a. **EXISTING PROBLEM**

i. Agriculture is a field which forms the basis of our economy.Yet it faces alot of problemsin terms of availability of resources, Irrigation, increasing rate of Pesticides, Climatic disasters, Insects which ruin the crops and makes a huge lossthis sector.

ii. In agriculture water isneeded for the crops for their growth. If the Soil getsdry it is necessary to supply water. But sometimeif the farmerdoesn't visit the field it isnot possibleto knowthe condition of soil.

iii. Sometimes over supply of water or less supply of wateraffects the growthof crops.

iv. Sometimes if the weather/temperature changessuddenly it is necessaryto takecertainactions.

b. **PROPOSED SOLUTION**

1. Soil Moisture can be checked by using the sensors that can sense the soil conditionand send the moisture contentin the soil over the cloud servicesto the web application.
2. The supplyof water can be controlled from anywhere by controlling themotor state (ON/OFF), using web application.
3. Surrounding temperature can also be sensed by the sensorsanddisplayed on the application.
4. Real time weather conditions can also be known by using different

3 THEORITICAL ANALYSIS

a. Block Diagram

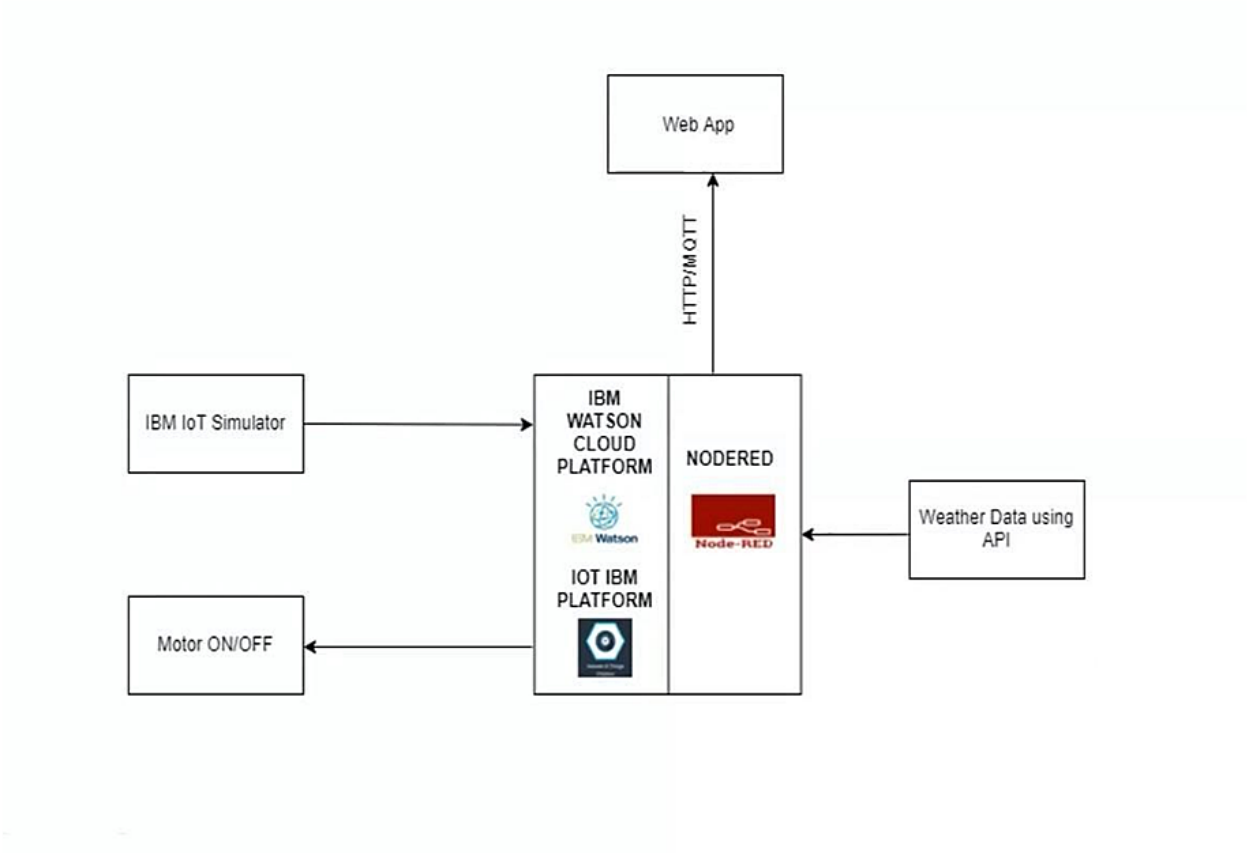


figure 3.1

b. Hardware / Software Designing

1. Create a devicein IBM Cloud.
2. Connect the deviceto IBM Simulator to get theweather conditions.
3. Build Node-REDflow to build a web application to display the weather conditions and control the devices.
4. Get the real time weather condition data from open weather map andintegrate it in the Node-RED.
5. Control the workingof the web application to the devicesby python coding.

c. Solution & Technical Architecture

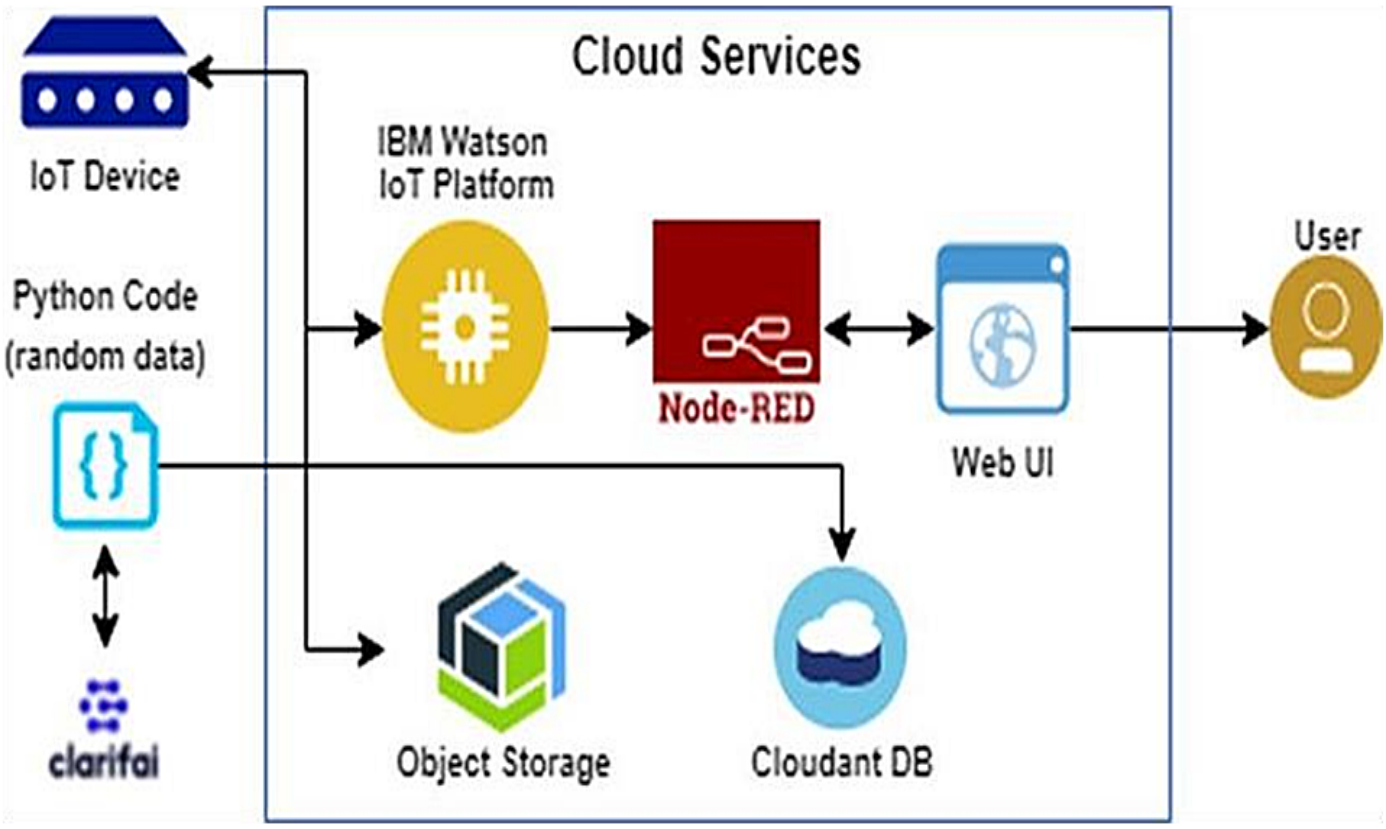


figure 3.2

d.User stories

User Type	Functional requirement(Epic)	User Story number	User Story/Task	Acceptancecriteria	Priority	Release
Customer (Mobil user)	Registration	USN-1	User can enter into the web application	I can accessmy account /dashboard	High	Sprint 1
		USN-2	User can register their credentials likeemail id and password	I can receive confirmation email & click confirm	High	Sprint 1
	Login	USN-3	User can log into theapplication by entering email & password	I can login tomy account	High	Sprint 1
	Dashboard	USN-4	User can view the temperature	I can view the data given by the device	High	Sprint 2
		USN-5	User can view thelevel of sensor monitoring value	I can view the data given by the device	High	Sprint 2
Customer(Web user)	Usage	USN-1	User can view the web page and get theinformation	I can view the data given by the device	High	Sprint 3
Customer	Working	USN-1	User act according to the alert given by thedevice	I can get thedata work according to it	High	Sprint 3

4 PROJECT PLANNING& SCHEDULING

Sprit planning & estimation

TITLE	DESCRIPTION	DATE
Literature Survey on The Selected Project and Information Gathering	A Literature Survey is a compilation summary of research done previously in the given topic. Literature survey can be taken from books, research paper online or from any source.	20 September 2022
Prepare Empathy Map	Empathy Map is a visualization tool which can be used to get a better insight of the customer	22 September 2022
Ideation-Brainstorming	Brainstorming is a group problem solving session where ideas are shared, discussed and organized among the team members.	28 September 2022
Define Problem Statement	A Problem Statement is a concise description of the problem or issues a project seeks to address. The problem statement identifies the current state, the desired future state and any gaps between the two.	20 September 2022
Problem Solution Fit	This helps us to understand the thoughts of the customer their likes, behaviour, emotions etc.	01 October 2022
Proposed Solution	Proposed solution shows the current solution and it helps is going towards the desired result until it is achieved.	18 October 2022
Solution Architecture	Solution Architecture is a very complex process I.e it has a lot of sub-processes and branches. It helps in understanding the components and features to complete our project.	18 October 2022
Customer Journey	It helps us to analyse from the perspective of a customer, who uses our project.	01 November 2022
Functional Requirement	Here functional and nonfunctional requirements are briefed. It has specific features like usability, security, reliability, performance, availability and scalability.	01 November 2022
Data Flow Diagrams	Data Flow Diagram is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement.	03 November 2022
Technology Architecture	Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies that needs to be implemented in the project.	03 November 2022
Prepare Milestone & Activity List	It helps us to understand and evaluate our own progress and accuracy so far.	06 November 2022
Spring Delivery Plan	Sprint planning is an event in scrum that kicks off the sprint. The purpose of sprint planning is to define what can be delivered in the sprint and how that work will be achieved.	06 November 2022

5 Codeing & solution

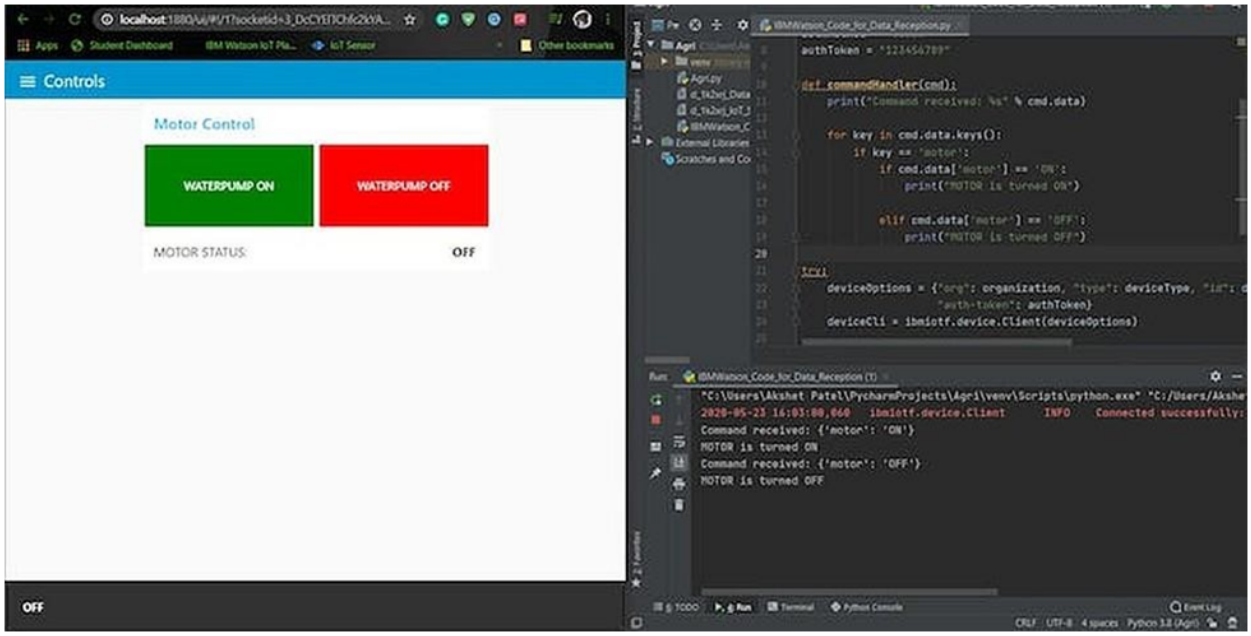


figure 5.1

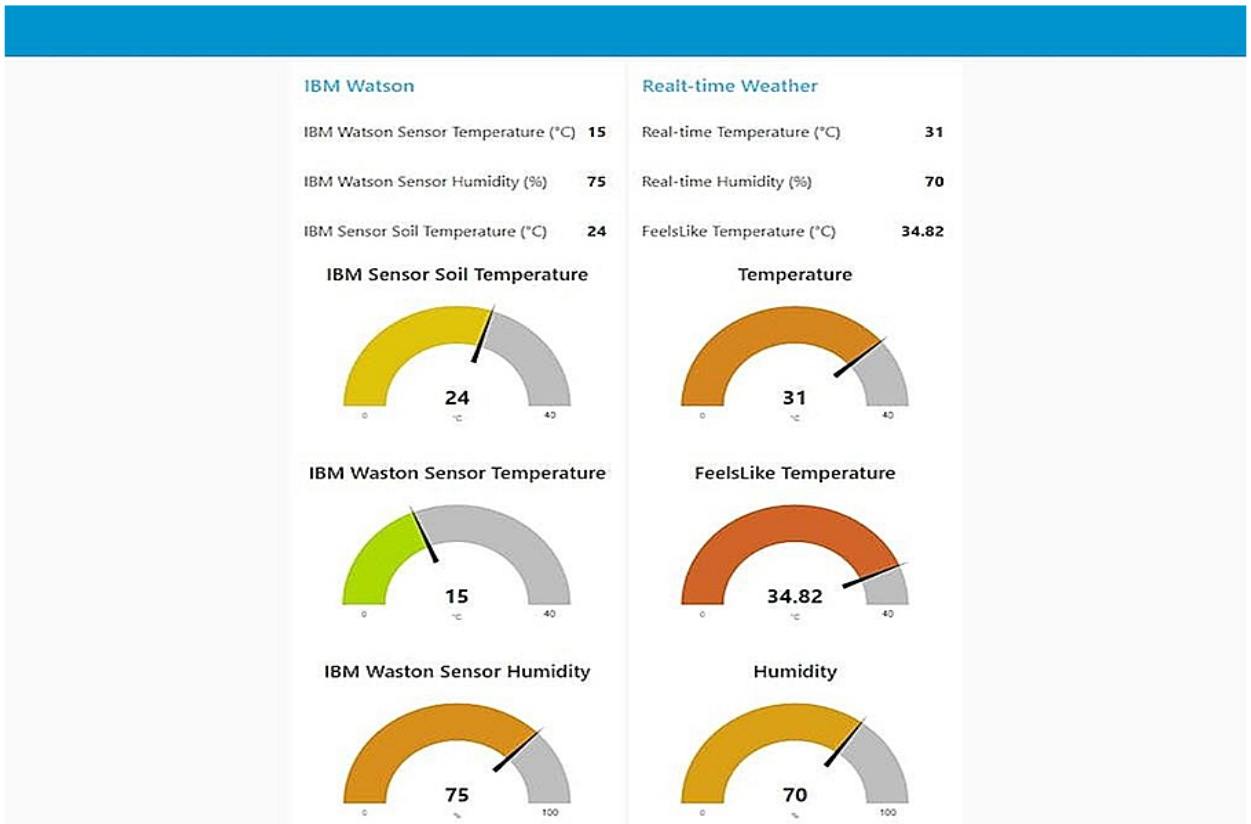


figure 5.2

DEVICE CONTROLACTION

In this project we send the weather data through IoT Simulator shown in fig(a) instead of real soil and temperature conditions. Simulator passes the data through IBM Cloud to the web application. The data is displayed on the Dash board show in fig (b1 &b2). Web Application is build using Node-RED. We have created 2 tabs:

1. IoT Smart Agriculture.
2. Graphical Representation.

Web Application is also used to controlthe devices furtherlike motor,pumps, lights, or any other devices in the agricultural field. In this project the output is passed using python code and the control action is displayed in python

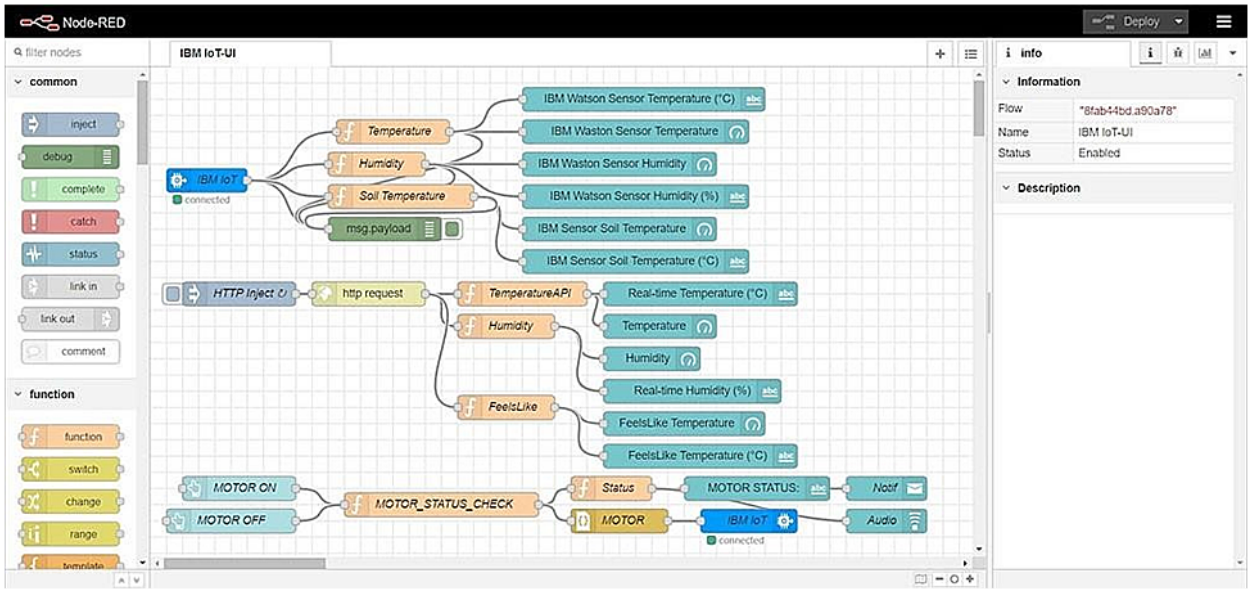
Following are the nodes used in the projectin the Web Application:

1. IBM IoT: IN and OUT Nodes.
2. function Nodes.
3. Gauge Nodes.
4. Chart Nodes.
5. Debug Node.
6. Button Nodes

Following are the nodes used for the weather condition from open weathermap:

1. Timestamp Node.
2. http request Node
3. Function Nodes.
4. Text Nodes.

6 Node Red:



7 Result:

We have successfully build a web based UI and integrated all the services using Node-RED.
Web Application : https://node-red-aab.eu-gb.mybluemix.net/ui/

8 ADVANTAGES & DISADVANTAGES:

a. ADVANTAGES

3.All the data like climaticconditions and changesin them, soil or crop conditions everything can be easilymonitored.
Risk of crop damage can be loweredto a greater extent.
Many difficultchallenges can be avoided makingthe process automatedand the quality of crops can be maintained.
The processincluded in farmingcan be controlled using the web

b.DISADVANTAGES:

1.Smart Agriculture requires internet connectivity continuously, but ruralparts cannot fulfillthis requirement.
2.Any faultsin the sensors can cause great loss in the agriculture, due to wrongrecords and the actions of automated processes.
3.IoT devices need much money to implement.

9 APPLICATIONS:

1. Precision Farming that is farming processes can be made more controlled andaccurate.
2. Live monitoring can be done of all the processesand the conditions on theagricultural field.
3. All the controlscan be made just on the click.
4. Quality can be maintained.

10 CONCLUSION:

IoT based smart Crop Monitoring System for Agriculture for Live Monitoring of Temperature and Soil Moisture and to control motor and light remotely has been proposed usingNode Red and IBM CloudPlatform. The Systemhas high efficiency and accuracy in fetching the live data of temperature and soil moisture.The IoT based smart farming System being proposed via this project will assist farmers in increasing theagriculture yield and take efficient care of foodproduction as the System will always provide helpinghand to farmers for gettingaccurate live feed of environmental temperature and soil moisture with more than 99% accurate results.Therefore, the project proposesa thought of consolidating the most recentinnovation into the agrarian field to turn the customary techniques for water system to current strategies in this way making simpleprofitable and temperatetrimming.

11 FUTURE SCOPE:

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IoT can be implemented in most of the places.

12 APPENDIX:

GithubLink: https://github.com/IBM-EPBL/IBM-Project-35934-1660290587

source code

```
import
time
import
sys
import ibmiotf.application  # to installpip install ibmiotfimport
ibmiotf.device

# Provide your IBM Watson DeviceCredentials
organization = "8gyz7t"  # replace the ORG ID
deviceType = "weather_monitor" # replace the Device type
deviceId = "b827ebd607b5" # replace Device ID authMethod =
"token"
authToken = "LWVpQPaVQ166HWN48f"  # Replace the authtoken

def myCommandCallback(cmd):  # function for Callbackif

cmd.data['command'] == 'motoron':


print("MOTOR ON IS RECEIVED")

elif cmd.data['command'] ==
```

```
    'motoroff':print("MOTOR OFF IS
    RECEIVED")
if cmd.command == "setInterval":if

    'interval' not in cmd.data:

    print("Error - command is missing required information: 'interval'")
    else:
        interval = cmd.data['interval']
    elif cmd.command == "print":
    if 'message' not in cmd.data:
    print("Error - command is missing required information: 'message'")

    else:
    output = cmd.data['message']
    print(output)


    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 cloudas an event oftype
    "greeting" 10 times
    deviceCli.connect()

    while True:
    deviceCli.commandCallback = myCommandCallback

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

SENSOR.PY

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

# Provideyour IBM Watson Device Credentials
organization = "8gyz7t"  # replace the ORG ID
deviceType = "weather_monitor" # replace the Device type
deviceId = "b827ebd607b5" # replace Device ID authMethod =
"token"
authToken = "LWVpQPaVQ166HWN48f"  # Replace the authtoken



def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['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 exceptionconnecting device: %s"% str(e))sys.exit()
```

```
# Connect and send a datapoint "hello" with value "world" into the cloud as an event oftype "greeting" 10 times
deviceCli.connect()

while True:
temp=random.randint(0,100)
pulse=random.randint(0,100)
soil=random.randint(0,100)

data = { 'temp': temp, 'pulse': pulse ,'soil':soil}

#print data
def myOnPublishCallback():
        print ("Published Temperature = %s C"% temp, "Humidity = %s %%"%pulse,"Soil Moisture = %s %%" % soil,"to IBM Watson")

    success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)
if not success:
    print("Not connected to IoTF")
time.sleep(1)

deviceCli.commandCallback = myCommandCallback

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

A. Node-RED FLOW :

```
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"z":"630c8601c5ac3295",
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"outputType":"cmd",
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```

```
"deviceType":"weather_monitor",
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"commandType":"",
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"finalize":"",
"lib
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],
"x"
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