PROJECT REPORT

Date	13 November 2022
Project Name	Smart Farmer - IoT Enabled Smart Farming Application
TEAM ID	PNT2022TMID15139

***Abstract*— In olden Days Farmers used to figure the ripeness of soil and influenced suspicions to develop which to kind of yield. They didn't think about the humidity, level of water and especially climate condition which terrible a farmer increasingly The Internet of things (IOT) is re-modeling the agribusiness empowering the agriculturists through the extensive range of strategies, for example, accuracy as well as practical farming to deal with challenges in the field. IOT utilize farmers to get related with his residence from wherever and at whatever point.**

Index Terms— IBM, Node-Red, Watson IoT Sensor Simulator, IBM cloud platform, Python, Open Weather API.

I. INTRODUCTION

Overview: Agriculture is the root to country's economic development. In recent times, huge scientific advancement has been implemented in various agricultural fields for the betterment of the future. Despite of various researches, proper assessment and productivity couldn't be reached. The Agriculture Parameters are utilizing an IOT Technology and system availability that draw in these objects to assemble and deal information. The IOT enables things selected recognized or potentially forced remotely crosswise over completed the process of existing configuration, manufacture open gateways for all the additional obvious merge of the substantial earth into PC based frameworks, in addition to acknowledging overhauled capacity, precision and cash interconnected favoured stance. Precisely when IOT is extended with sensors and actuators, the improvement modifies into an occasion of the all the extra wide category of electronic physical structures, which in like manner incorporates headways, for instance, clever grids, splendid homes, canny moving and smart urban groups.

Purpose: We have tried to focus on different scientific applications which could be put together in agricultural field for better accuracy with better productivity using less manpower. Moreover, we include a method for monitoring the agricultural fields from any remote location and assess the basic condition of the field.

This is the project from the motivation of the farmers working in the farmlands are solely dependent on the rains and bore wells for irrigation of their land. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required.

II. LITERATURE SURVEY

Existing Problem:

Horticulture is the foundation of our Nation. In long time past days agriculturists used to figure the ripeness of soil and influenced presumptions to develop which to kind of product. They didn't think about the dampness, level of water and especially climate condition which horrible an agriculturist more. They utilize pesticides in view of a few suspicions which made lead a genuine impact to the yield if the supposition isn't right. The profitability relies upon the last phase of the harvest on which agriculturist depends.

Problem Solution Fit:

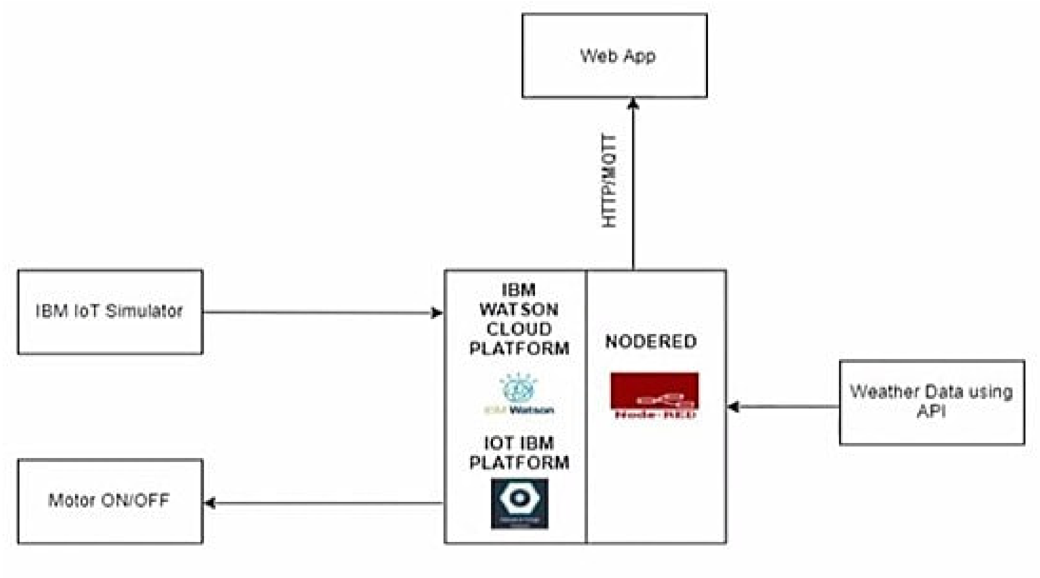
The problem of farmland conditional monitoring for the physically varying environmental conditions could be monitored over a temporal parameters over timely instances by employing various sensors for respected measurand and employing an user interface application to have an overview of those parameters and to take over decisions depending over the situations.

Proposed Solution:

To improve the efficiency of the product there by supporting both rancher and country we need to utilize the innovation which appraises the nature of harvest and giving recommendations. The Internet of things (IOT) is revamping the agribusiness engaging the farmers by the broad assortment of techniques, for instance, accuracy and conservative cultivation to go up against challenges in the field. In this project, on a farm, management can monitor different environmental parameters effectively using sensor devices such as temperature sensor, relative humidity sensor and soil moisture sensor. Periodically (30 seconds) the sensors are collecting information of agriculture field area and are being logged and stored online using cloud computing and Internet of Things. By using wireless transmission, the sensed data forwarded towards to web server database. If irrigation is automated, then that means if the moisture and temperature fields fall below of the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to the user.

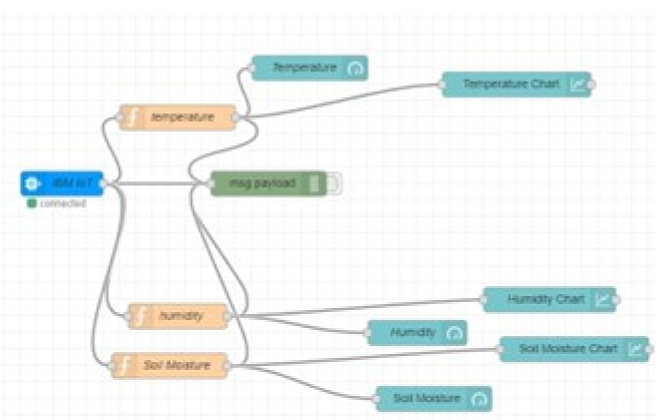
III. WORKFLOW AND REQUIREMENTS

WORKFLOW



Initially, the IBM Watson Platform is used for iot interfacing, used for iot enabling features and then the python idle platform is used out for run the process flow and it's test parameters are viewed over the ibm watson cloud platform wherein the data is also stored out. The node-red is used for the back-end application simulation for webapp request and then the front-end development are made in the mit app developer.

Block Diagram:(BACK-END APPLICATION INTERFACE)



FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Software Designing:

a. Watson IoT Platform

Two devices have been created in Watson IoT Platform. One for sending command to the User and another to receive the data from an IoT simulator (Temperature, humidity & soil moisture) and Open Weather API (recent weather information of the farm). Device is connected to the IoT Simulator to get the simulator data.

b. Node Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. Device is connected to

Node red is installed on the PC and required nodes is installed in the node red to configure the device to display the received data from simulator and open weather api to user interface dashboard.

c. Web App

A web application is created which displays the temperature, humidity, and soil moisture data of past one hour that is received by the device from the IoT simulator. It also displays live weather parameters of the farm using open weather api.

There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely.

A python code is written to track down the commands (like turning motor and light ON/OFF) that are being sent by the user through web application.

Node Red Flows:(DATA FLOW DIAGRAM)

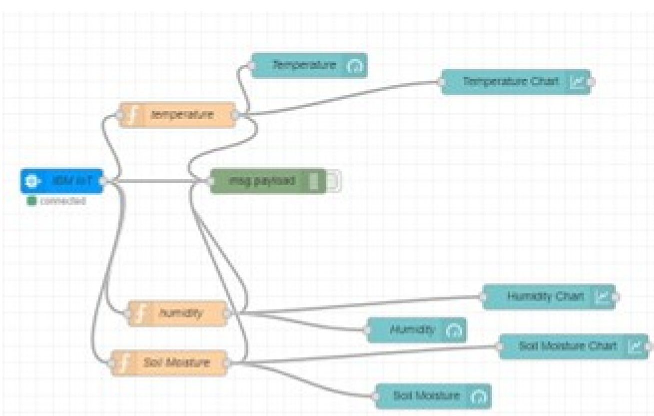


Figure 2. Node Red Flow To get Simulator Data

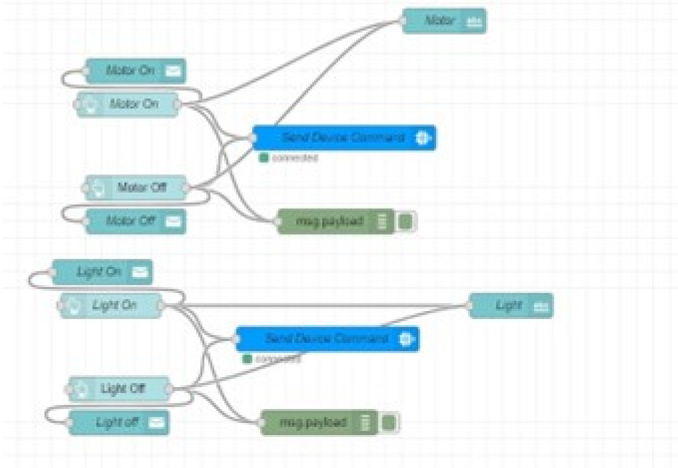


Figure 3. Node Red Flow To control motor and light

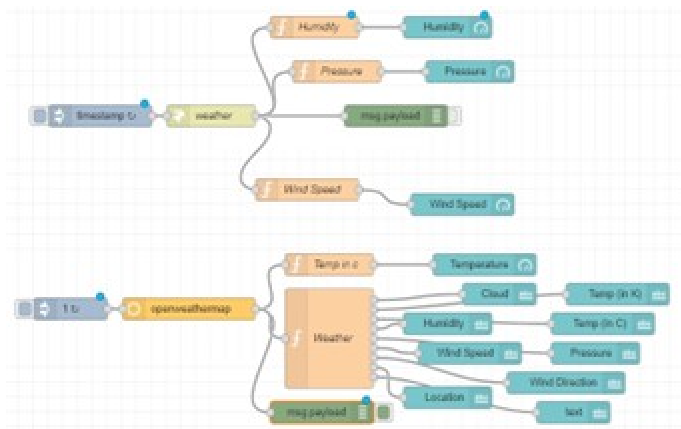
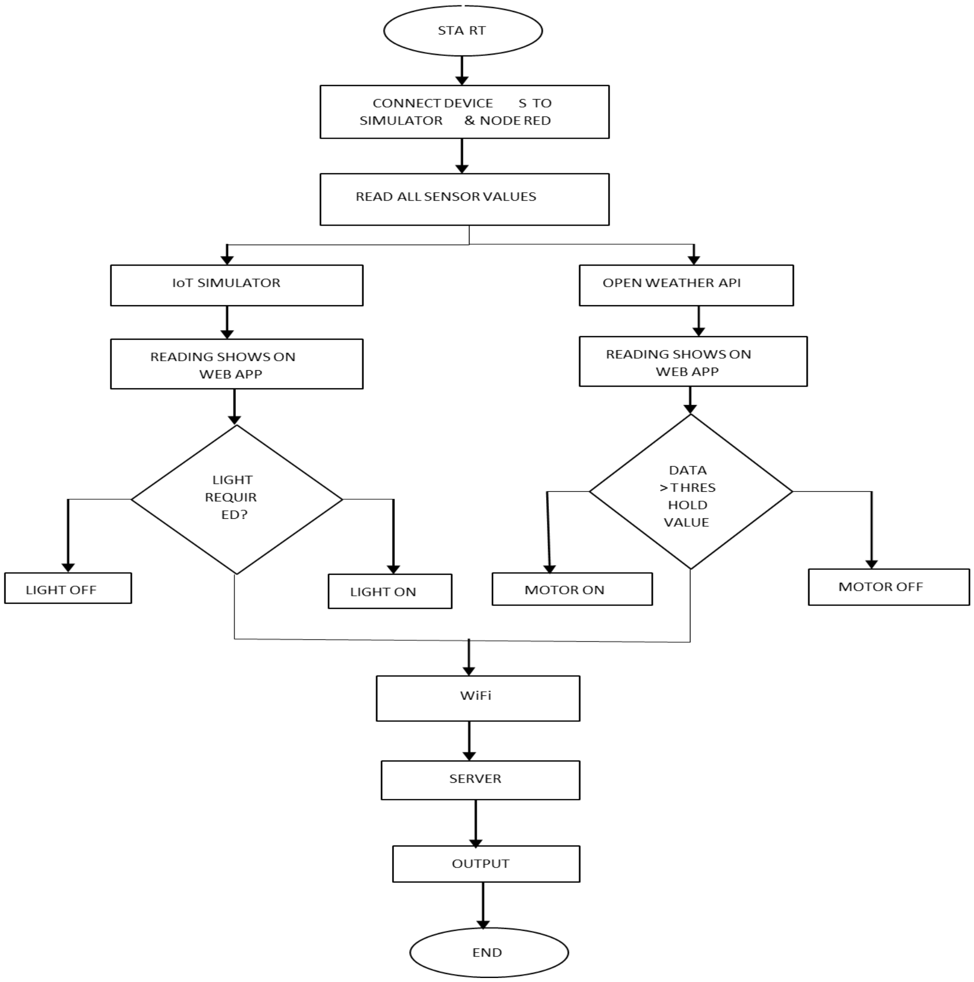


Figure 4. Node Red Flow To get Open Weather API data

IV. FLOWCHART



V. TESTING AND RESULT ANALYSIS

The yield appeared beneath signifies the temperature, soil moisture and humidity data received from the IoT simulator sensor and open weather api. The web app displays all these data of past one hour. There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely.

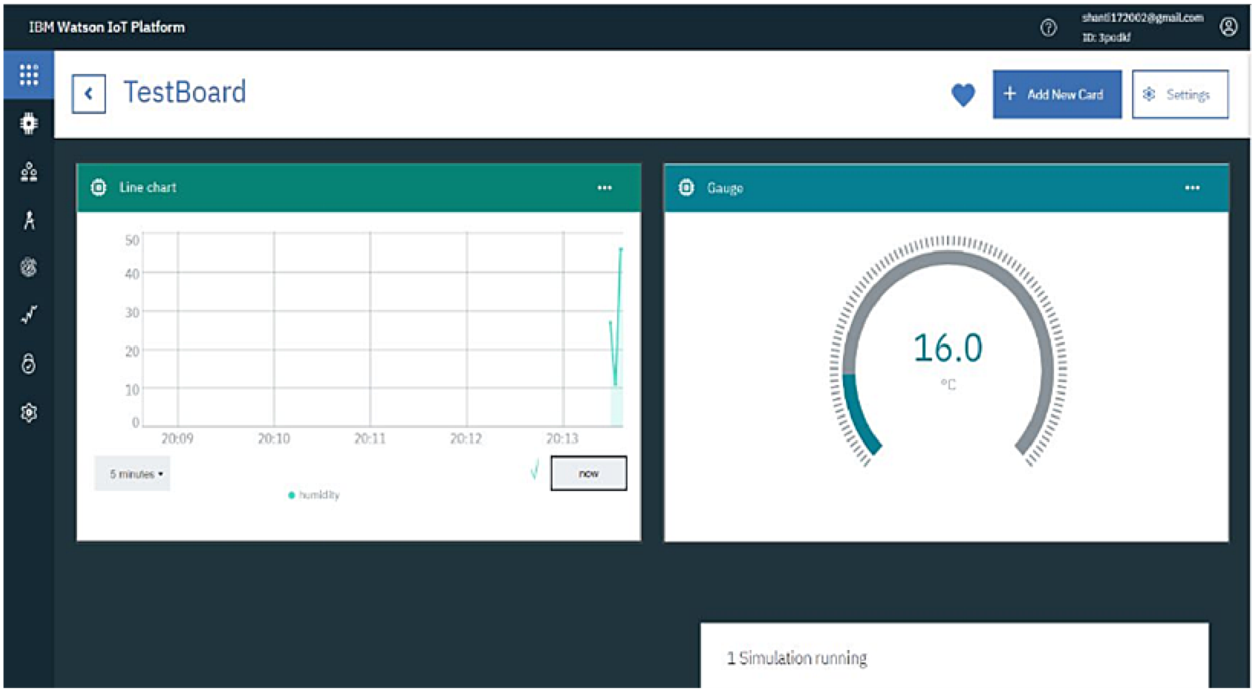


Figure 5. Data from IoT simulator sensor

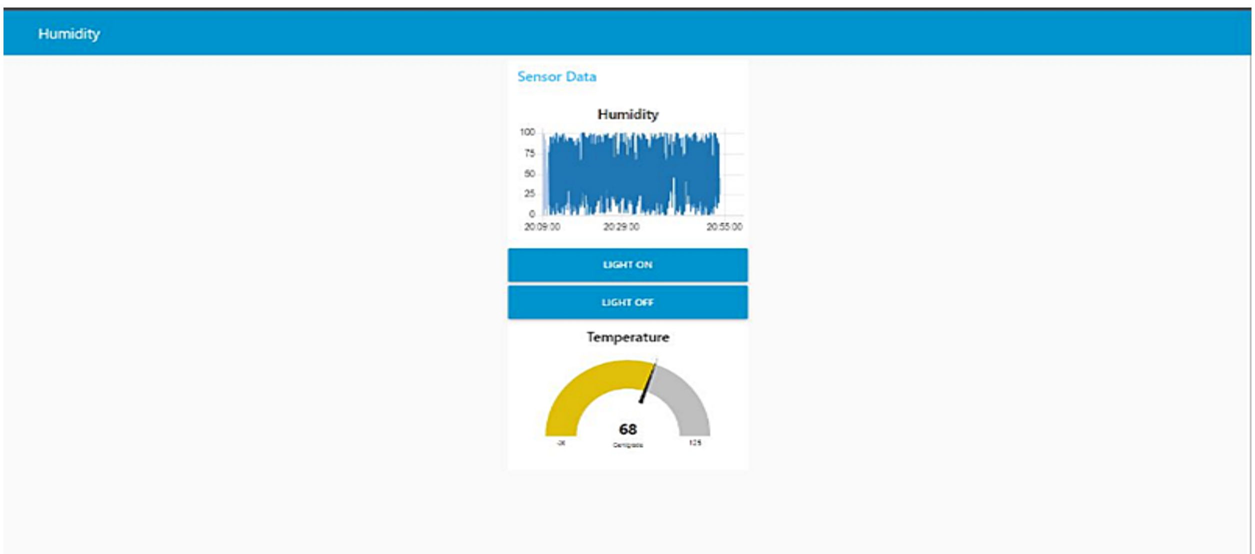
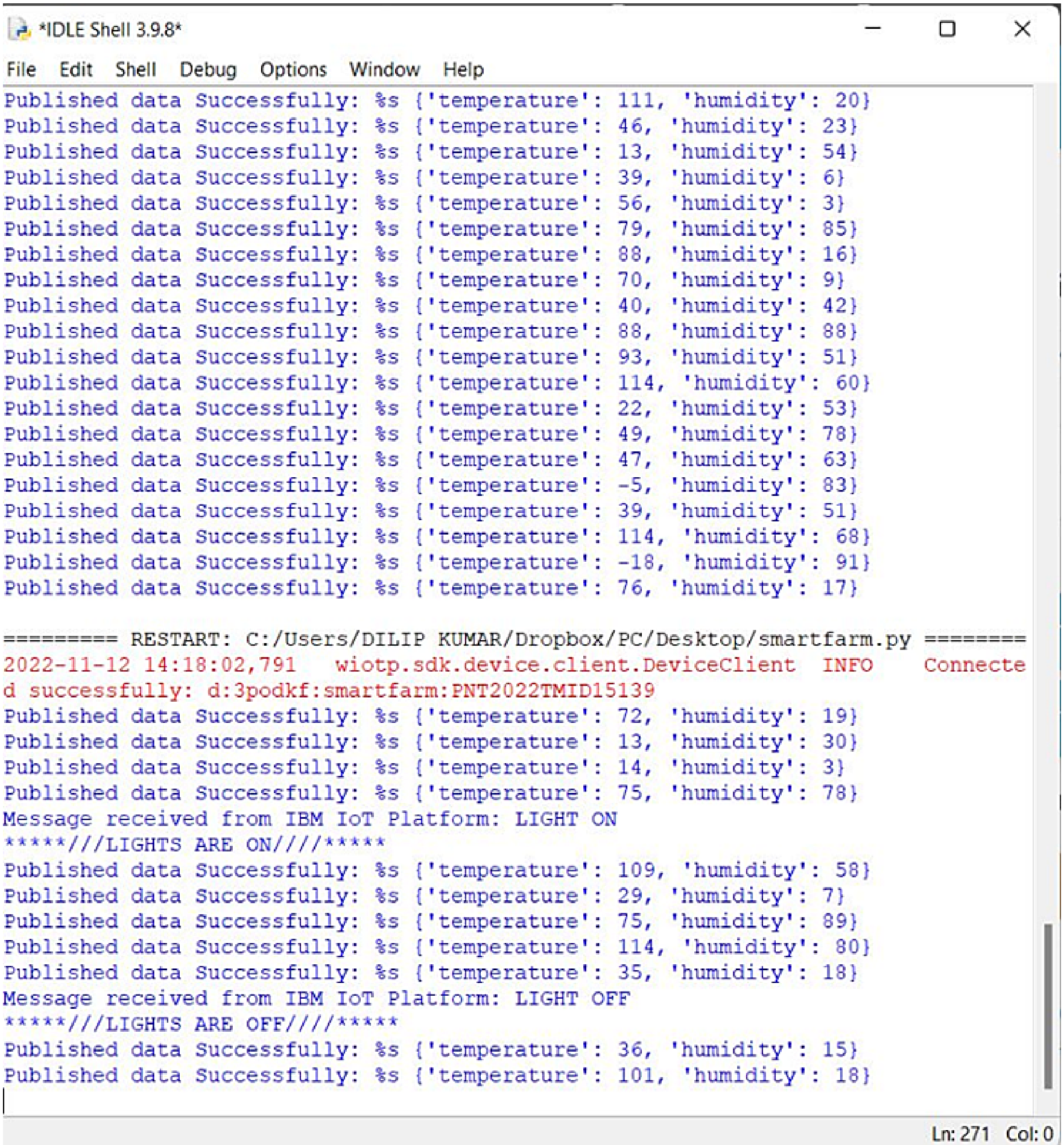


Figure 6. Data from Open Weather API



```
*IDLE Shell 3.9.8*
File Edit Shell Debug Options Window Help
Published data Successfully: %s {'temperature': 111, 'humidity': 20}
Published data Successfully: %s {'temperature': 46, 'humidity': 23}
Published data Successfully: %s {'temperature': 13, 'humidity': 54}
Published data Successfully: %s {'temperature': 39, 'humidity': 6}
Published data Successfully: %s {'temperature': 56, 'humidity': 3}
Published data Successfully: %s {'temperature': 79, 'humidity': 85}
Published data Successfully: %s {'temperature': 88, 'humidity': 16}
Published data Successfully: %s {'temperature': 70, 'humidity': 9}
Published data Successfully: %s {'temperature': 40, 'humidity': 42}
Published data Successfully: %s {'temperature': 88, 'humidity': 88}
Published data Successfully: %s {'temperature': 93, 'humidity': 51}
Published data Successfully: %s {'temperature': 114, 'humidity': 60}
Published data Successfully: %s {'temperature': 22, 'humidity': 53}
Published data Successfully: %s {'temperature': 49, 'humidity': 78}
Published data Successfully: %s {'temperature': 47, 'humidity': 63}
Published data Successfully: %s {'temperature': -5, 'humidity': 83}
Published data Successfully: %s {'temperature': 39, 'humidity': 51}
Published data Successfully: %s {'temperature': 114, 'humidity': 68}
Published data Successfully: %s {'temperature': -18, 'humidity': 91}
Published data Successfully: %s {'temperature': 76, 'humidity': 17}

========= RESTART: C:/Users/DILIP KUMAR/Dropbox/PC/Desktop/smartfarm.py ========
2022-11-12 14:18:02,791   wiotp.sdk.device.client.DeviceClient  INFO    Connecte
d successfully: d:3podkf:smartfarm:PNT2022TMID15139
Published data Successfully: %s {'temperature': 72, 'humidity': 19}
Published data Successfully: %s {'temperature': 13, 'humidity': 30}
Published data Successfully: %s {'temperature': 14, 'humidity': 3}
Published data Successfully: %s {'temperature': 75, 'humidity': 78}
Message received from IBM IoT Platform: LIGHT ON
*****///LIGHTS ARE ON////*****
Published data Successfully: %s {'temperature': 109, 'humidity': 58}
Published data Successfully: %s {'temperature': 29, 'humidity': 7}
Published data Successfully: %s {'temperature': 75, 'humidity': 89}
Published data Successfully: %s {'temperature': 114, 'humidity': 80}
Published data Successfully: %s {'temperature': 35, 'humidity': 18}
Message received from IBM IoT Platform: LIGHT OFF
*****///LIGHTS ARE OFF////*****
Published data Successfully: %s {'temperature': 36, 'humidity': 15}
Published data Successfully: %s {'temperature': 101, 'humidity': 18}

Ln: 271 Col: 0
```

Figure 7. Retrieving Command from web app using python code

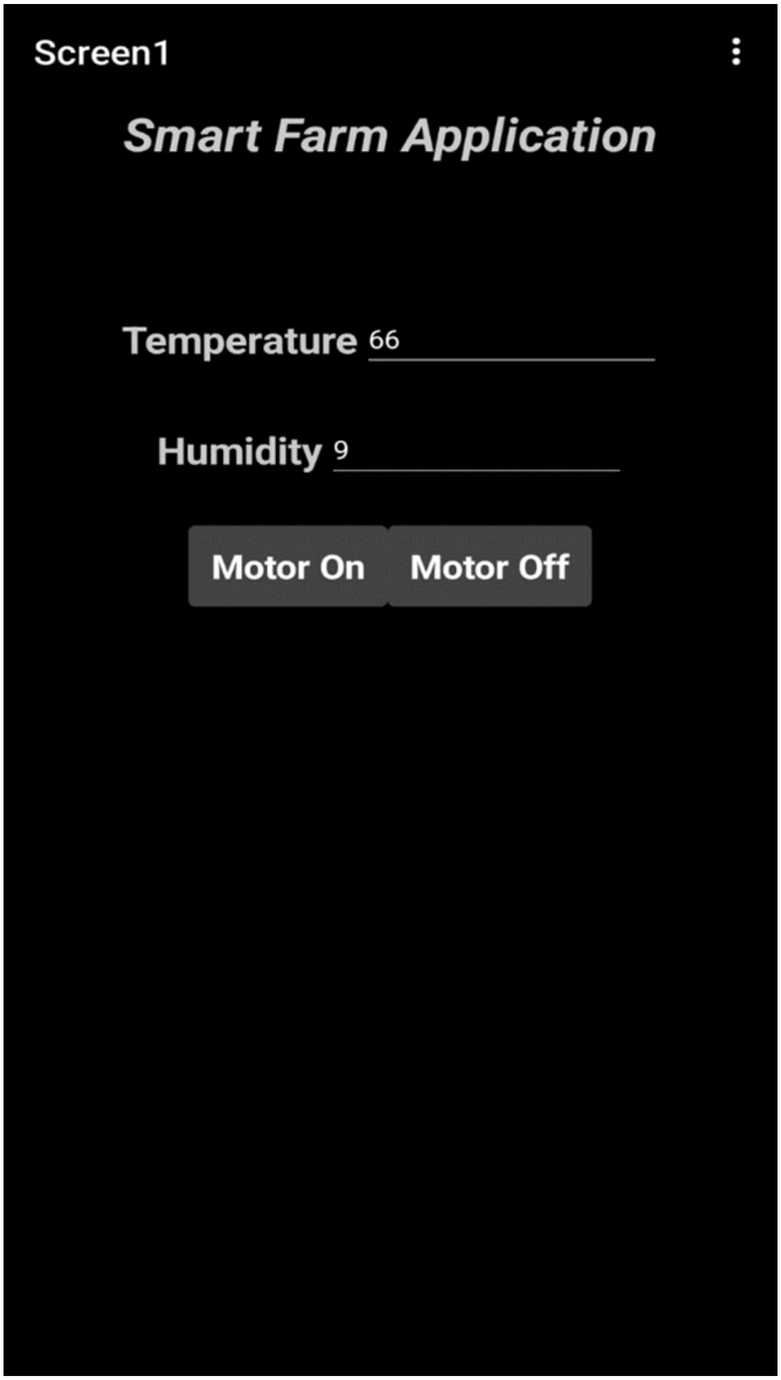


Figure 7.1 Output Data from mit app

VI. ADVANTAGES AND DISADVANTAGES

The following are the benefits of adopting new technology - Internet of Things in Agriculture:

1. Climate Condition
   IoT solution enables us to know the real-time weather conditions. Sensors are placed inside and outside of the agriculture fields. They collect data from the environment which is used to choose the right crops which can grow and sustain in the particular climatic conditions.

2. Precision Farming
   The goal of precision farming is to analyze the data, generated via sensors, to react accordingly. Precision Farming helps farmers to generate data with the help of sensors and analyze thatinformation to take intelligent and quick decisions. With the help of Precision farming, you can analyze soil conditions and other related parameters to increase the operational efficiency.

3. Smart Greenhouse
   To make our greenhouses smart, IoT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions. Adoption of IoT in Greenhouses has eliminated the human intervention, thus making entire process costeffective and increasing accuracy at the same time.

4. Data Analytics
   Cloud based data storage and an end-to-end IoT Platform plays an important role in the smart agriculture system. These systems are estimated to play an important role such that better activities can be performed. In the IoT world, sensors are the primary source of collecting data on a large scale. The data is analyzed and transformed to meaningful information using analytics tools. The data analytics helps in the analysis of weather conditions, livestock conditions, and crop conditions.

Figure 8: Major Hurdle's in Technology Implementation for Smart Agriculture

VII. APPLICATION

By implementing the latest sensing and IoT technologies in agriculture practices, every aspect of traditional farming methods can be fundamentally changed. Currently, seamless integration of wireless sensors and the IoT in smart agriculture can raise agriculture to levels which were previously unimaginable. By following the practices of smart agriculture, IoT can help to improve the solutions of many traditional farming issues, like drought response, yield optimization, land suitability, irrigation, and pest control. Figure 9 lists a hierarchy of major applications, services and wireless sensors being used for smart agriculture applications.

VIII. CONCLUSION

IoT based SMART AGRICULTURE SYSTEM for Live
Monitoring of Temperature and Soil Moisture and to control motor and light remotely has been proposed using Node Red and IBM Cloud Platform. The System has 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 the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results. Therefore, the project proposes a thought of consolidating the most recent innovation into the agrarian field to turn the customary techniques for water system to current strategies in this way making simple profitable and temperate trimming.

IX. FUTURE SCOPE

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to fullfledged Agriculture Precision ready product

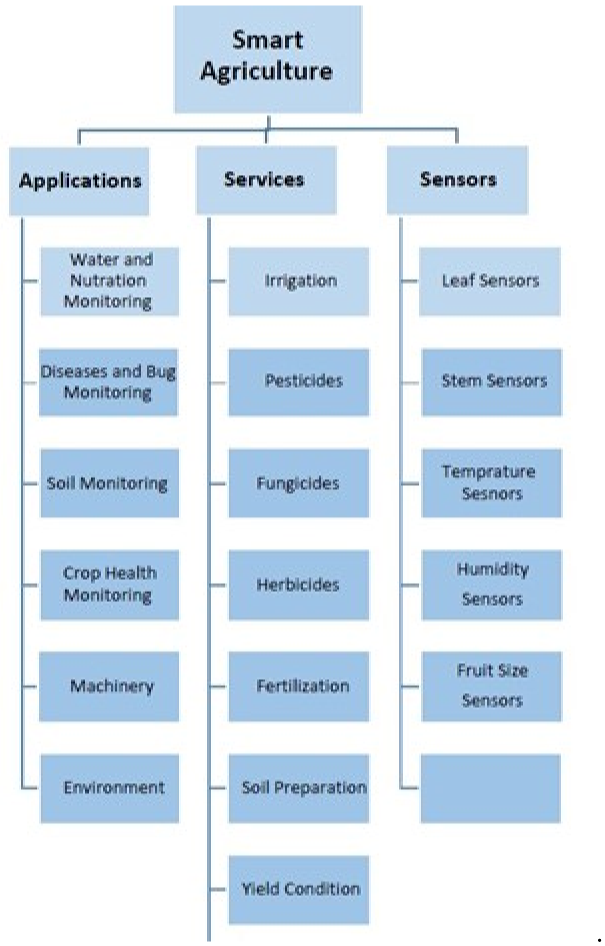


Figure 9: General Hierarchy of Possible Applications, Services and Sensors for Smart Agriculture

X. REFERENCES

1. https://www.techtarget.com/searchcloudcomputing/definition/IBM-Bluemix
2. https://www.iotforall.com/smart-farming-future-of-agriculture
3. https://nodered.org/docs/user-guide/messages
4. http://ai2.appinventor.mit.edu/reference/
5. https://github.com/IBM-EPBL/IBM-Project-34458-1660236112

XI. APENDIX

a. Source Code(Python code to retrieve command from web app):

```python
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "3podkf",
        "typeId": "smartfarm",
        "deviceId":"PNT2022TMID15139"
    },
    "auth": {
        "token": "z(TNhcKsgpIbASn-8K"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']
    if(m=="lighton"):
        print("*****///LIGHTS ARE ON////*****")
    elif(m=="lightoff"):
        print("*****///LIGHTS ARE OFF////*****")
    else:
        print("*****///WRONG COMMAND/////*****")

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    myData={'temperature':temp, 'humidity':hum}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

GITHUB LINK: [IBM-EPBL/IBM-Project-34458-1660236112: SmartFarmer - IoT Enabled Smart Farming Application (github.com)]

PROJECT DEMO LINK: https://www.youtube.com/embed/PwaX7NHsihM