INTERNET OF THINGS

SMART FARMER –

IOT ENABLED SMART FARMING APPLICATION

IBM NALAIYATHIRAN

Project Report

TITLE	Smart Farmer IoT Enabled Smart Farming Application
DOMAIN NAME	INTERNET OF THINGS
TEAM ID	PNT2022TMID40857
TEAM LEADERNAME	Venkatesh P
TEAM MEMBER NAME	Yogananthan G Kalaivani B Saranya P
MENTOR NAME	T.Thirunavukarasu

LIST OF CONTENT

1.INTRODUCTION:

1.1 Project Overview:

In India, agriculture is considered a primary livelihood for most of the population, which can never be underestimated. Agriculture has existed for thousands of years in our country and has developed with new technologies and equipment that replaced traditional farming methods. In India, few farmers still use the traditional farming method because they lack the resources to use modern techniques. Though this World Developed a lot but Agriculture in India is not Changed that far. Most of the Farmers still uses the Traditional Farming Mechanism and Modern Technology are not that much simple that the Farmers can use. Our Vision is to reduce burdens of farmers by simplifying their works through Modern Technologies. Our project is to build a User-Friendly System which can be used by farmers to have better understanding about the field by Monitoring the Field Parameters and Motor Control on their Handheld Device. We used Internet Of Things to build a system which is capable of reading Field Parameters and can publish several information to the handheld Device of the farmer.

1.2 Purpose:

- Purpose of Our Project is to enable Farmer, to read and View the Field Parameters like Soil Moisture, Temperature , Humidity and Ph Level from Several Areas of the Field using their Mobile Phone
- And to Control Motor through their Mobile Phone

2.LITERATURE SURVEY

2.1 Existing Problem:

- There is Extra Burden for Farmers because of using Traditional Farming
- Existing Modern Technologies are Cost Expensive and Not user friendly
- Farmers are Always to their field
- Poor Analysis of the Field parameters in Traditional Farming Than compared to Modern Technologies

2.2 Reference:

Smart Farming using IoT, a solution for optimally monitoring farming conditions

https://www.sciencedirect.com/science/article/pii/S1877050919317168

The Authors. Published by Elsevier B.V

The 3rd International workshop on Recent advances on Internet of Things: Technology and Application Approaches (IoT-T&A 2019) November 4-7, 2019, Coimbra, Portugal

Abstract:

The aim is to propose a technology which can generate messages on different platforms to notify farmers. The product will assist farmers by getting live data (Temperature, humidity, soil moisture, UV index, IR) from the farmland to take necessary steps to enable them to do smart farming by also increasing their crop yields and saving resources (water, fertilizers). The product proposed in this paper uses ESP32s Node MCU, breadboard, DHT11 Temperature and Humidity Sensor, Soil Moisture Sensor, SI1145 Digital UV Index / IR / Visible Light Sensor, Jumper wires, LEDs and live data feed can be monitored on serial monitor and Blynk mobile. This will allow farmer to manage their crop with new age in farming

IOT Based Smart Agriculture System

G. Sushanth; S. Sujatha   https://ieeexplore.ieee.org/document/8538702

Published in: 2018 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)

Date of Conference: 22-24 March 2018

It is proposed to develop a Smart agriculture System that uses advantages of cutting edge technologies such as Arduino, IOT and Wireless Sensor Network. The paper aims at making use of evolving technology i.e. IOT and smart agriculture using automation. Monitoring environmental conditions is the major factor to improve yield of the efficient crops. The feature of this paper includes development of a system which can monitor temperature, humidity, moisture and even the movement of animals which may destroy the crops in agricultural field through sensors using Arduino board and in case of any discrepancy send a SMS notification as well as a notification on the application developed for the same to the farmer's smartphone using Wi-Fi/3G/4G. The system has a duplex communication link based on a cellular-Internet interface that allows for data inspection and irrigation scheduling to be programmed through an android application. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

Design and implementation of a connected farm for smart farming system

Minwoo Ryu; Jaeseok Yun; Ting Miao; Il-Yeup Ahn; Sung-Chan Choi; Jaeho Kim

Published in: 2015 IEEE SENSORS https://ieeexplore.ieee.org/abstract/document/7370624

Date of Conference: 01-04 November 2015

Abstract:

Agriculture has been one of the most important industries in human history since it provides humans with absolutely indispensable resources such as food, fiber, and energy. The agriculture industry could be further developed by employing new technologies, in particular, the Internet of Things (IoT). In this paper, we present a connected farm based on IoT systems, which aims to provide smart farming systems for end users. A detailed design and implementation for connected farms are illustrated, and its advantages are explained with service scenarios compared to previous smart farms. We hope this work will show the power of IoT as a disruptive technology helping across multi industries including agriculture.

IOT Based Monitoring System in Smart Agriculture

S. R. Prathibha; Anupama Hongal; M. P. Jyothi

Published in: 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT) https://ieeexplore.ieee.org/document/8081906

Abstract:

Internet of Things (IoT) plays a crucial role in smart agriculture. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. The paper aims making use of evolving technology i.e. IoT and smart agriculture using automation. Monitoring environmental factors is the major factor to improve the yield of the efficient crops. The feature of this paper includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip. Camera is interfaced with CC3200 to capture images and send that pictures through MMS to farmers mobile using Wi-Fi.

IOT Based Smart Agriculture Monitoring System

Dr.N.Suma,Sandra Rhea Samson,S.Saranya, G.Shanmugapriya, R.Subhashri

https://ijritcc.org/index.php/ijritcc/article/view/193

International Journal on Recent and Innovation Trends in Computing and Communication

Abstract:- Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like GPS based

remote controlled monitoring, moisture & temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities. It makes use of wireless sensor networks for noting the soil properties and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any remote device or internet services and the operations are performed by interfacing sensors, Wi-Fi, camera with microcontroller. This concept is created as a product and given to the farmer's welfare.

IoT based Smart Agriculture

Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar
https://www.academia.edu/65409363/IoT_based_Smart_Agriculture

International Journal of Advanced Research in Computer and Communication Engineering

Abstract: Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nation's capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly it includes smart irrigation with smart control and intelligent decision making based on accurate real time field data. Thirdly, smart warehouse management which includes temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and raspberry pi

IoT Based Intelligent Agriculture Field Monitoring System

Md AshifuddinMondal; Zeenat Rehena

Published in: 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence)

Abstract:
Agriculture is becoming an important growing sector throughout the world due to increasing population. Major challenge in agriculture sector is to improve farm productivity and quality of farming without continuous manual monitoring to meet the rapidly growing demand for food. Apart from increasing population, the climate change is also a big concern in agricultural sector. The purpose of this research work is to propose a smart farming method based on Internet of

Things (IoT) to deal with the adverse situations. The smart farming can be adopted which offer high precision crop control, collection of useful data and automated farming technique. This work presents an intelligent agriculture field monitoring system which monitors soil humidity and temperature. After processing the sensed data it takes necessary action based on these values without human intervention. Here temperature and moisture of the soil are measured and these sensed values are stored in ThingSpeak [11] cloud for future data analysis.

IoT-Enabled Smart Agriculture: Architecture, Applications, and Challenges

Vu Khanh Quy , Nguyen Van Hau , Dang Van Anh , Nguyen Minh Quy , Nguyen Tien Ban , Stefania Lanza , Giovanni Randazzo and Anselme Muzirafuti

Abstract: The growth of the global population coupled with a decline in natural resources, farmland, and the increase in unpredictable environmental conditions leads to food security is becoming a major concern for all nations worldwide. These problems are motivators that are driving the agricultural industry to transition to smart agriculture with the application of the Internet of Things (IoT) and big data solutions to improve operational efficiency and productivity. The IoT integrates a series of existing state-of-the-art solutions and technologies, such as wireless sensor networks, cognitive radio ad hoc networks, cloud computing, big data, and end-user applications. This study presents a survey of IoT solutions and demonstrates how IoT can be integrated into the smart agriculture sector. To achieve this objective, we discuss the vision of IoT-enabled smart agriculture ecosystems by evaluating their architecture (IoT devices, communication technologies, big data storage, and processing), their applications, and research timeline. In addition, we discuss trends and opportunities of IoT applications for smart agriculture and also indicate the open issues and challenges of IoT application in smart agriculture. We hope that the findings of this study will constitute important guidelines in research and promotion of IoT solutions aiming to improve the productivity and quality of the agriculture sector as well as facilitating the transition towards a future sustainable environment with an agroecological approach

https://www.mdpi.com/2076-3417/12/7/3396

IoT based Smart Farming System

Akshay Atole, Amar Biradar, Apurva Asmar, Nikhil Kothawade, Sambhaji Sarode

"IoT based Smart Farming System", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.4, Issue 4, page no.29-31, April-2017, Available :http://www.jetir.org/papers/JETIR1704008.pdf

Abstract

Farming is a major input sector for economic development of any country. Livelihood of majority of population of the country like India depends on agriculture. In this project, it is proposed to develop

a Smart Farming System that uses advantages of cutting-edge technologies such as IoT, Wireless Sensor Network and Cloud computing to help farmers enhance the way farming is done. Using sensors like temperature, humidity, moisture etc. are used to get information about the field and help farmers to take precise decisions on insights and recommendations based on the collected data.

IoT based Smart Agriculture Monitoring System

Published August 25, 2021

Ashish Choudhary

In this project, we are going to build a **Smart Farming System using IoT**. The objective of this project is to offer assistance to farmers in getting Live Data (Temperature, Humidity, Soil Moisture, Soil Temperature) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. This smart agriculture using IoT system powered by NodeMCU consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip. When the IoT-based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, and soil temperature. It then sends this data to the IoT cloud for live monitoring. If the soil moisture goes below a certain level, it automatically starts the water pump. We previously build Automatic Plant Irrigation System which sends alerts on mobile but doesn't monitor other parameters. Apart from this, Rain alarm and soil moisture detector circuit can also be helpful in building Smart Agriculture Monitoring System.

Smart Farming: The Future of Agriculture

By SciForce June 202

"Smart farming" is an emerging concept that refers to managing farms using technologies like IoT, robotics, drones and AI to increase the quantity and quality of products while optimizing the human labor required by production.

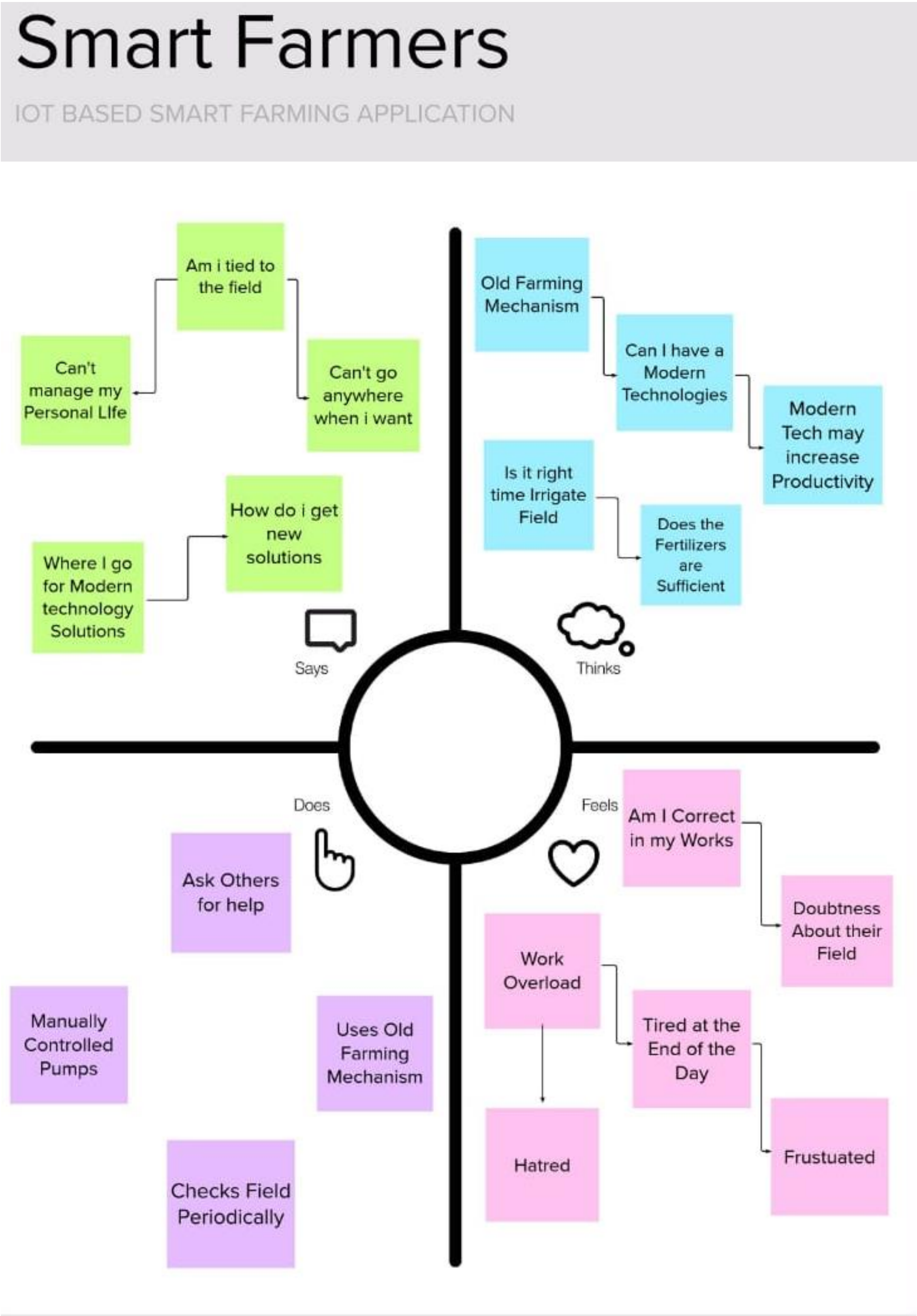
Reference: Smart Farming: The Future of Agriculture (iotforall.com)

2.3 Problem Statement Definition:

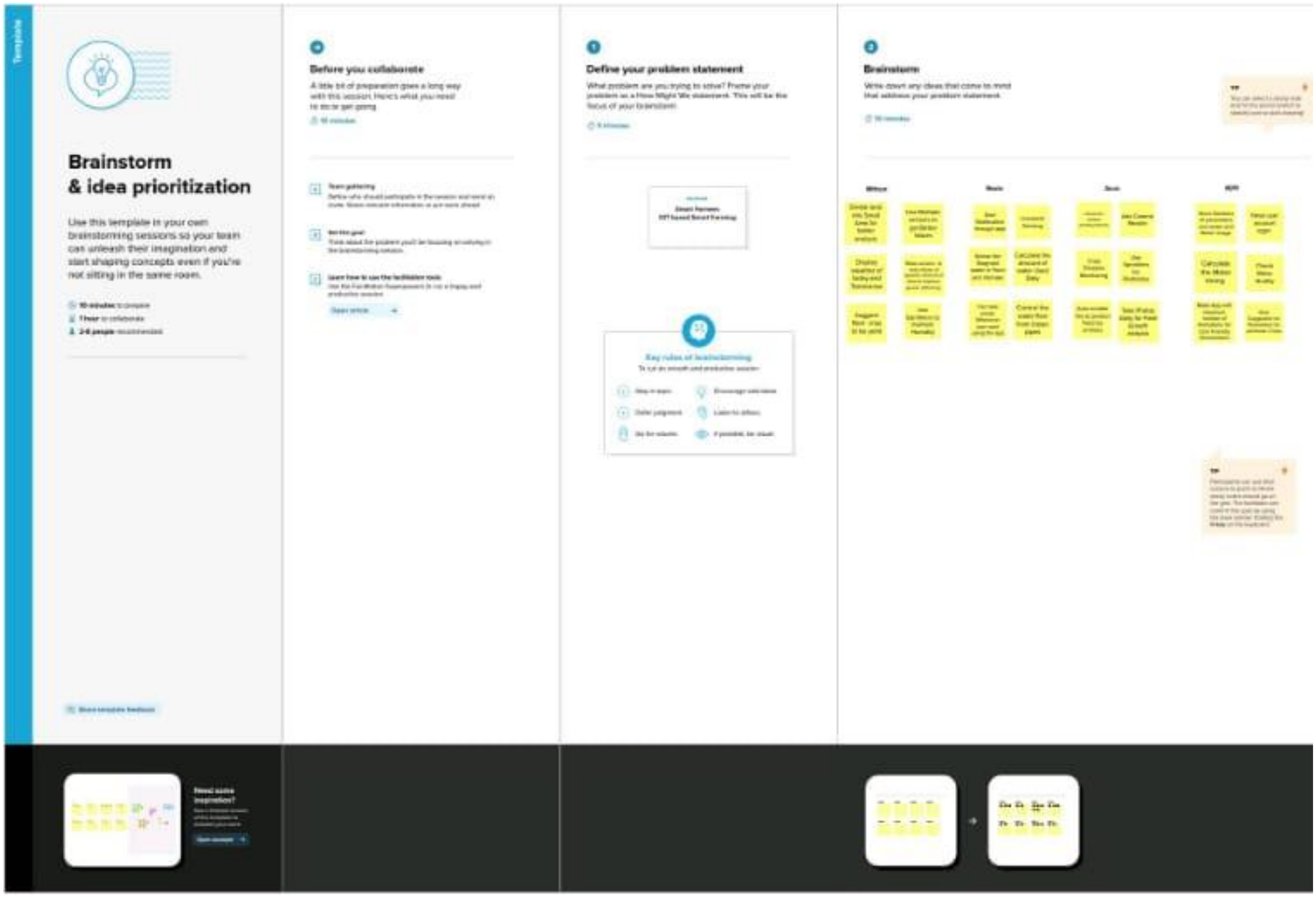
- To Build a IOT based Smart Farming System
- Monitor the parameters like Soil Moisture, Temperature, Humidity using Sensors
- Enable the parameters to be viewed by Farmers on Mobile application or Web
- Make a Pump control on Mobile app

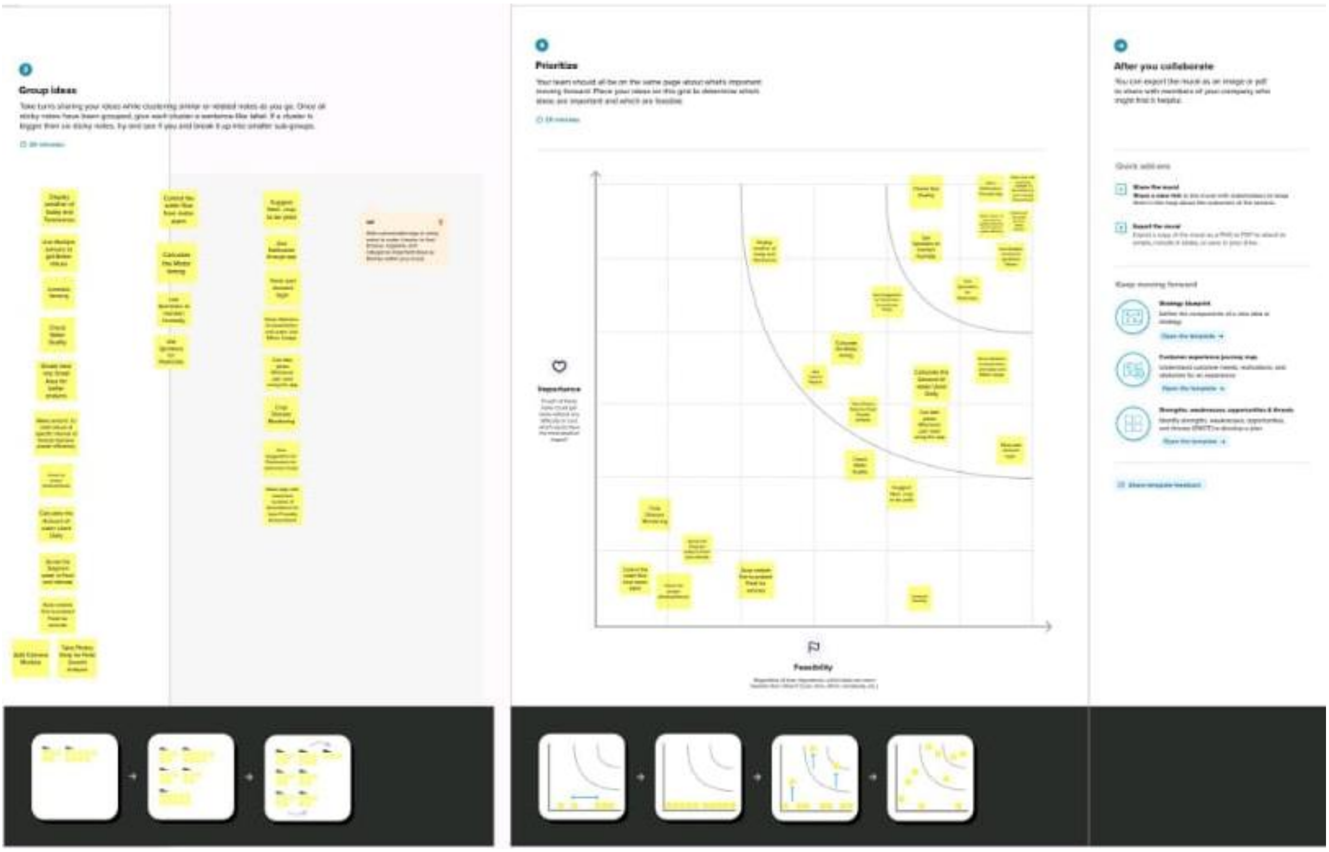
3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:





3.3 Proposed Solution:

Sl.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Build a IOT based Smart Farming System. Monitor the parameters like Soil Moisture Temperature, Humidity using Sensors. Enable the parameters to be viewed by Farmers on Mobile application or Web make a Pump control
2.	Idea / Solution description	Collect Parameters through sensors and upload it to cloud and to display Parameters on App. Have a Motor Control in the App and to give Suggestion to the Farmers. Add Weather Monitoring system, Next Crop suggestion, Parameter level Suggestion, Fertilizer Level Suggestion.
3.	Novelty / Uniqueness	Combined System to monitor parameter, Controlling pump and Farmers Guide Multiple Sensors to have a Accurate value
4.	Social Impact / Customer Satisfaction	Reduce burden of Farmers Farmers will have Better Knowledge about their fields
5.	Business Model (Revenue Model)	END CUSTOMERS-Farmers/Agriculture based companies Profit is through Selling the System to users and Through the Maintenance Cost
6.	Scalability of the Solution	Can be extended to next level through it can be implemented by everyone who have small fields/Gardens in their home. Can be developed for Scientific Analysis and Complete monitoring of a plant. Can be specifically developed for different Situations

3.4 Problem Solution fit:

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS
- Farmer

6. CUSTOMER CONSTRAINTS CC
- Low power consumption
- Cost
- Network connection
- Education

5. AVAILABLE SOLUTIONS AS
- Using Traditional Manual Method for Farming and Irrigation
- Using Separate Setup for Analyzing Field and for Motor Control

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P
- Monitoring soil, temperature, Humidity levels
- Display those Parameters in user friendly Interface
- Have a Motor control on that Interface

9. PROBLEM ROOT CAUSE RC
- Using Traditional Manual Farming method which increases work load
- Less understanding about the Field
- Human errors which may affect productivity

7. BEHAVIOUR BE
- Continuous monitoring of soil moisture, humidity and temperature level
- Controlling Motor pump

Focus on J&P, tap into BE, understand RC

3. TRIGGERS TR
- Work load
- Watering crops are on assumptions

4. EMOTIONS: BEFORE / AFTER EM
- Lots of problem in maintain soil, temperature and watering crops.

After:
- Feel comfortable to handle.

10. YOUR SOLUTION SL
- Usings Sensors to read field parameters
- And display those parameters on user friendly interface
- Suggest right time for irrigation, right plant to be planted next
- Weather forecast
- Controlling Motor through the Mobile application.

8. CHANNELS of BEHAVIOUR CH
- Online: There should be internet connection for monitoring crops soil moisture and temperature to display app.
- Offline: Notification to user.

4.REQUIREMENT ANALYSIS

4.1 Functional Requirement:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User interface	Mobile Application
FR-2	Read parameters	Reading field parameters like Soil moisture, Humidity, Temperature
FR-3	Motor controlling	Motor pump controlling
FR-4	Hardware device	For handling sensors and value
FR-5	Cloud Connectivity	Connecting Hardware to cloud
FR-6	Cloud Database	Database service on cloud
FR-7	External API-1	External API for weather access
FR-8	External API-2	External API for GPS access

4.2 Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

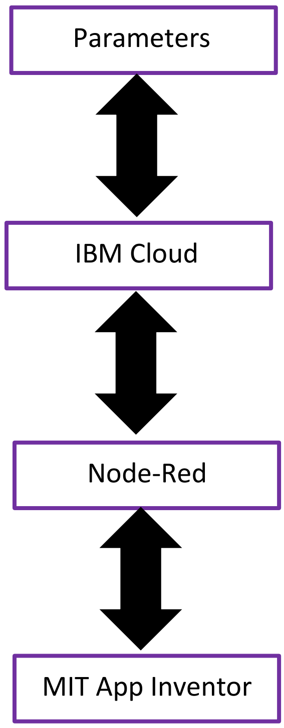
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	*Remote management. With farms being located in far off areas and distant lands, farmers are seeking a better solution to their management issues. *real-time crop monitoring *Crop protection... *Soil testing and it’s quality...
NFR-2	**Security**	User login

NFR-3	**Reliability**	High quality sensor used so, we can get high precision and accurate value for long time
NFR-4	**Performance**	Due to the use of high-performance microprocessor board. we can get high performance.
NFR-5	**Availability**	Online shopping, agency,Dealers
NFR-6	**Scalability**	Camera module

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:

Data Flow Diagrams: A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored



5.2 SOLUTION & TECHNICAL ARCHITECTURE:

Its goals are to:

1. Multiple Sensor nodes to read Parameters of the Field - Random Values Generated in Python Script
2. IOT Enabled Microprocessor/Microcontroller board to read Sensor values and push data to cloud - Values are Published to IBM cloud By Python Script
3. Motor Controller (Solenoid Valve) connected with board – Motor Control Commands Are Received in Python Script
4. Mobile Application to view the Sensor Values in real time and to control Motor
5. Irrigation suggestion tools in the application

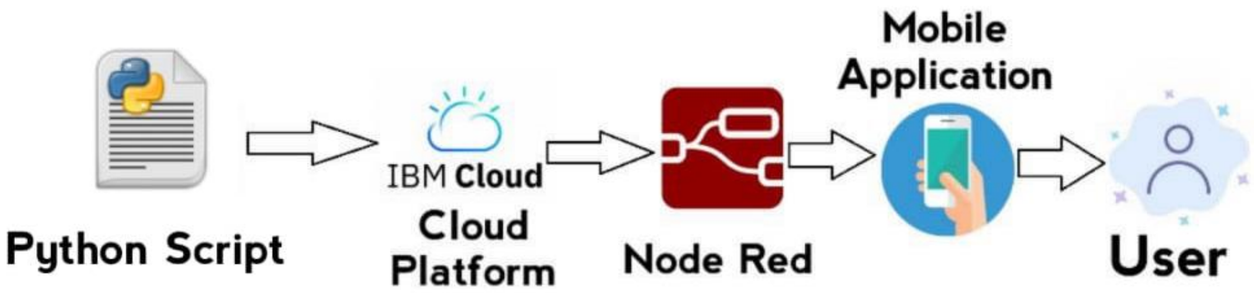


Table-1: Components & Technologies:

S. No	Component	Description	Technology
	User Interface	Mobile Application	MIT app Inventor
	Reading Parameters	Reading Field Parameters like Soil Moisture, Humidity, Temperature	Various Sensors nodes
	Motor Controlling	Motor Pump Controlling	Solenoid Valve connected with Microcontroller
	Hardware device	For Handling Sensors and Valve	Microcontroller/Microprocessor Board
	Cloud Connectivity	Connecting Hardware to Cloud	Wi-fi Module or ESP32
	Cloud Database	Database Service on Cloud	IBM Watson
	External API-1	Purpose of External API used in the application	IBM Weather API
	External API-2	Purpose of External API used in the application	GPRS

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	open-source frameworks used	Django
2.	Security Implementations	security / access controls implemented, use of firewalls etc.	User login Credentials
3.	Scalable Architecture	scalability of architecture	Can add and Modify Sensors anytime
4.	Availability	availability of application	The Applications will be Available on Playstore and File will be provided for the users directly
5.	Performance	Performance of System	Can handle connected sensors data and Network connectivity simultaneously

5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Farmer)	Monitoring the parameters	USN-1	As a user, I want to know about the parameters of my field in correct quantity	I know the better knowledge about my field	High	Sprint-1
	Motor control	USN-2	As a user, I want to control the motor if I not near in my land	By controlling my motor, I can move any place and can operate the motor	High	Sprint-1
	Moisture Level	USN-3	As a user, I want to know the moisture level in my land	I can take decision whether water the crop or postponed it	High	Sprint-2
Customer (Farming Companies)	Monitoring large lands	USN-4	As a user, I need to monitor my large land with live at all	I can monitor my large land even I not near to my field	High	Sprint -1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Creating And Connecting IBM cloud for Project and Python Code	USN-1	As a user, I want to know about the parameters of my field and control motors from anywhere	2	High	S. Mithun Srinivasan
Sprint-2	Creating Node-Red service and connect with IBM cloud and WebUI	USN-2	As a user, I want to View my parameters on WebUI	1	High	G. Ravin
Sprint-3	Preparing User interface on MIT app Invertor	USN-3	As a user, I want to know the parameters on Mobile app	2	Low	S. Ajith Kumar
Sprint-4	Connecting and Configuring the services and debug the errors	USN-4		2	Medium	M. Arun Kumar

6.2 Sprint Delivery Schedule:

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	40	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	16 Nov 2022

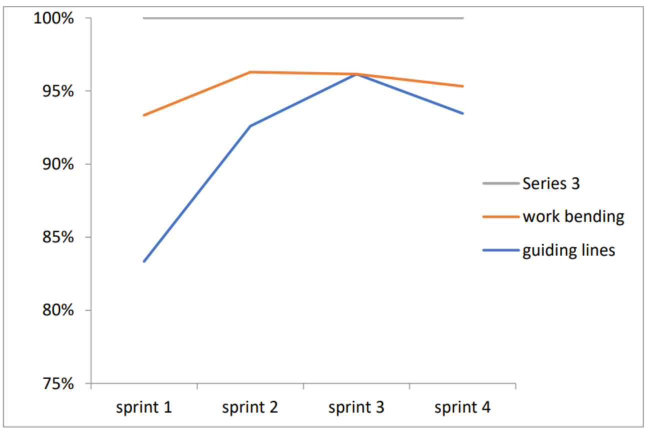
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

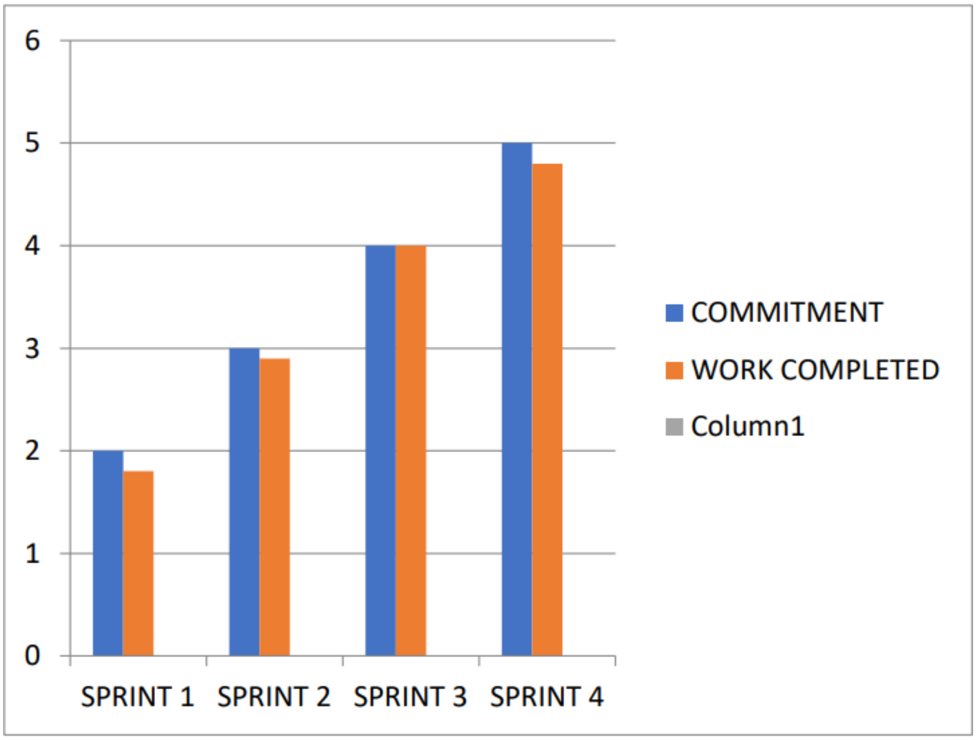
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

BURNDOWN

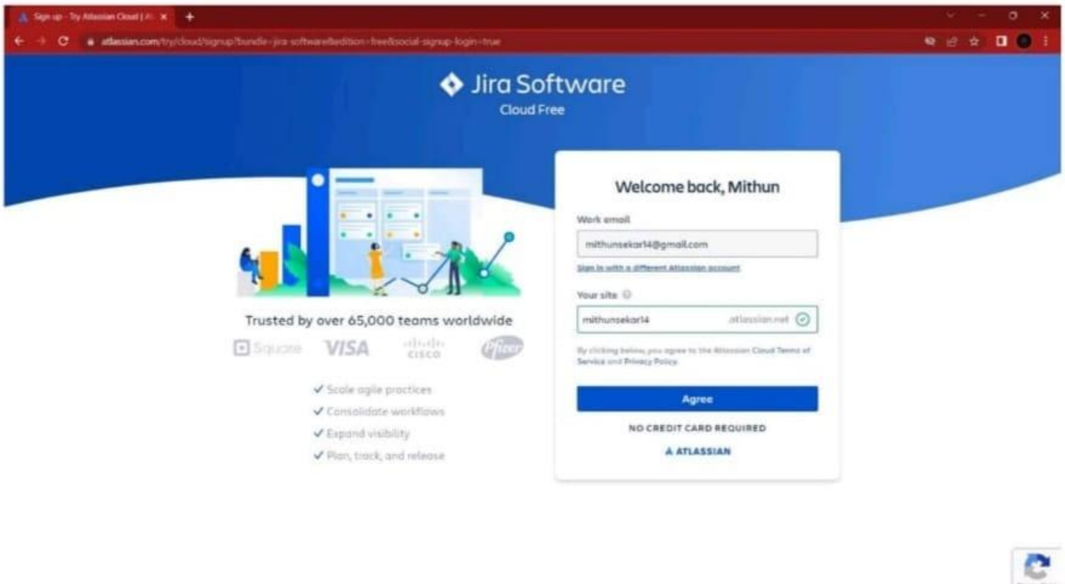


VELOCITY

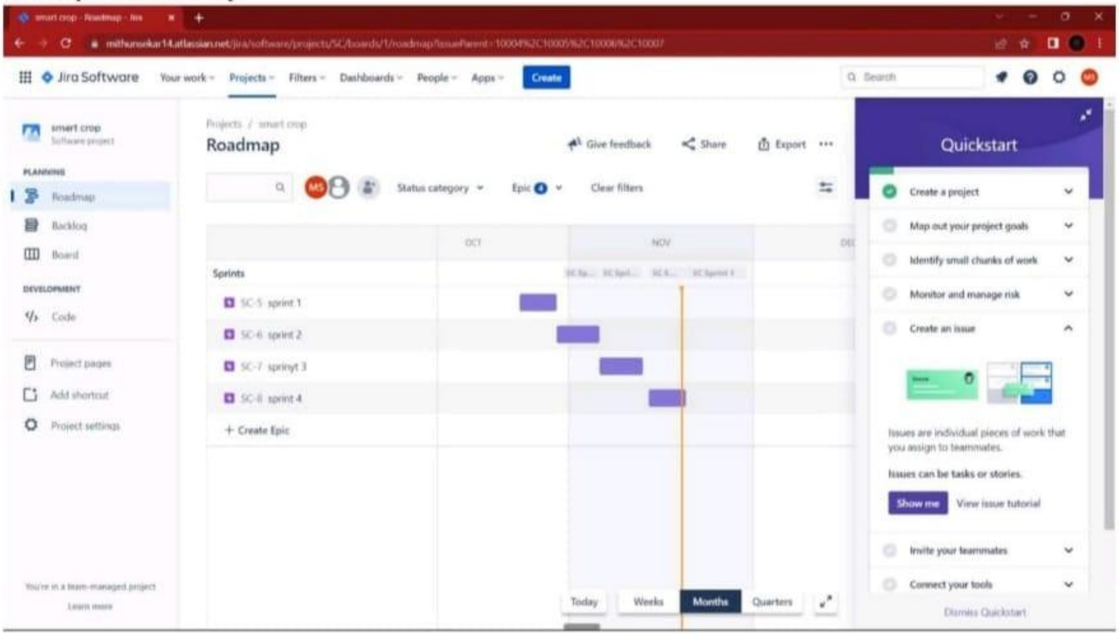


6.3 Report from JIRA

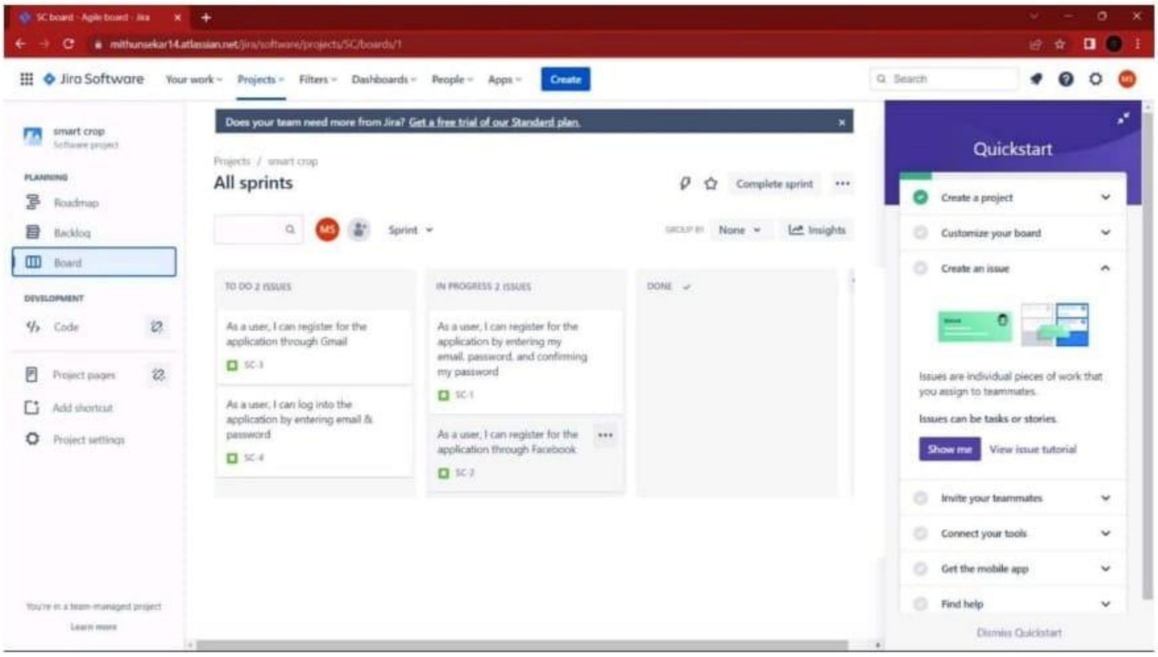
JIRA Login:



JIRA Sprint Delivery:



All Sprints:



7.CODING & SOLUTIONING

Code:

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


#Provide your IBM Watson Device Credentials
organization = "kv09p4"
deviceType = "Groot"
deviceId = "13"
authMethod = "token"
authToken = "12345678"
global flag
flag=0
n=int(input("Enter no of Field Divisions"))
# Initialize GPIO

def myCommandCallback(cmd):
   print("Command received: %s" % cmd.data['command'])
   status=cmd.data['command']
   if status=="motoron":
      print ("motor is on")
   if status=="motoroff" :
      print ("motor is off")
   #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:
     Sug="Suggestion For Irrigation"
     #Get Sensor Data from DHT11
     avgt=0
     avgh=0
     avgs=0
     avgp=0
     for i in range(0,n):
        temp=random.randint(0,100)
        Humid=random.randint(0,100)
        soilmoisture=random.randint(0,1023)
        Phlevel=random.randint(0,14)
        print("T:",temp)
        print("H:",Humid)
        print("S:",soilmoisture)
        print("P:",Phlevel,"\n")
        avgt += temp
        avgh += Humid
        avgs += soilmoisture
        avgp += Phlevel
     temp = avgt/n
     Humid = avgh/n
```

```
        soilmoisture = avgs/n
        Phlevel = avgp/n


        data = { 'temp' : temp, 'Humid': Humid,'soilmoisture' : soilmoisture ,'Phlevel' : Phlevel}
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,"Soil Moisture is %s %%" % soilmoisture,"PH level is %s" %Phlevel ,"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()
```

7.1 Feature 1:

Feature 1:

Can generate Values for Multiple nodes Based on User Choice and Find Average value and then Publish the Value into Cloud. This Helps us to get Accurate Value.

Code Segment:

```
while True:
        Sug="Suggestion For Irrigation"
        #Get Sensor Data from DHT11
        avgt=0
        avgh=0
        avgs=0
```

```
avgp=0
for i in range(0,n):
    temp=random.randint(0,100)
    Humid=random.randint(0,100)
    soilmoisture=random.randint(0,1023)
    Phlevel=random.randint(0,14)
    print("T:",temp)
    print("H:",Humid)
    print("S:",soilmoisture)
    print("P:",Phlevel,"\n")
    avgt += temp
    avgh += Humid
    avgs += soilmoisture
    avgp += Phlevel
temp = avgt/n
Humid = avgh/n
soilmoisture = avgs/n
Phlevel = avgp/n
```

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
==================== RESTART: D:\IBM project\IBM iot.py ====================
Enter no of Field Divisions5
T:2022-11-17 21:25:00,849   ibmiotf.device.Client      INFO    Connected successfully: d:kv09p4:Groot:13
10
H: 46
S: 992
P: 4

T: 67
H: 12
S: 466
P: 12

T: 93
H: 68
S: 53
P: 10

T: 34
H: 24
S: 74
P: 7

T: 67
H: 37
S: 265
P: 14

Published Temperature = 54.2 C Humidity = 37.4 % Soil Moisture is 370.0 % PH level is 9.4 to IBM Watson
T: 98
H: 66
S: 492
P: 8

T: 94
H: 49
S: 392
P: 7

T: 8
H: 62
S: 202
P: 11
```

Ln: 59 Col: 0

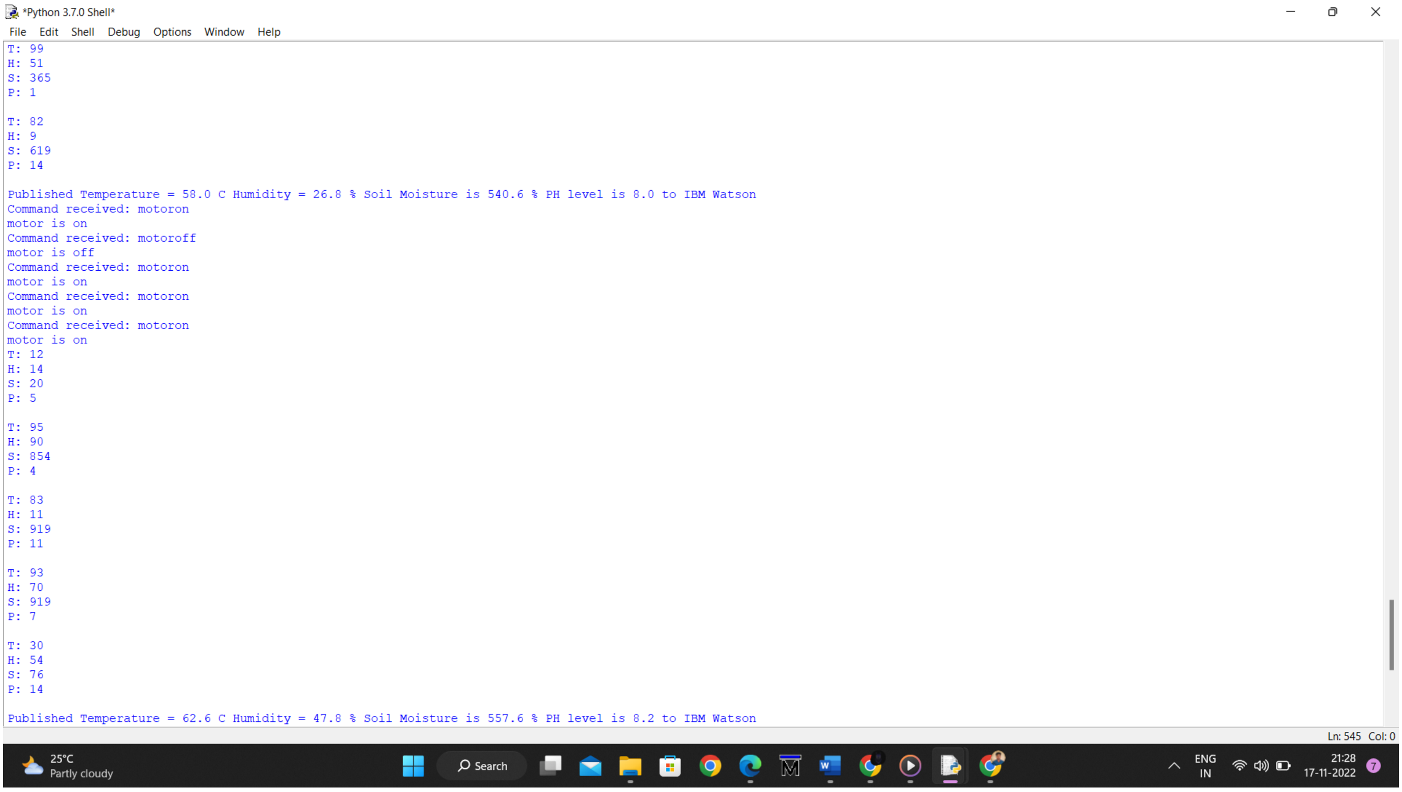
25°C Partly cloudy   Search   ENG IN   21:25 17-11-2022

Feature 2:

Can receive various Commands from the Mobile app and works based on the Command Received.

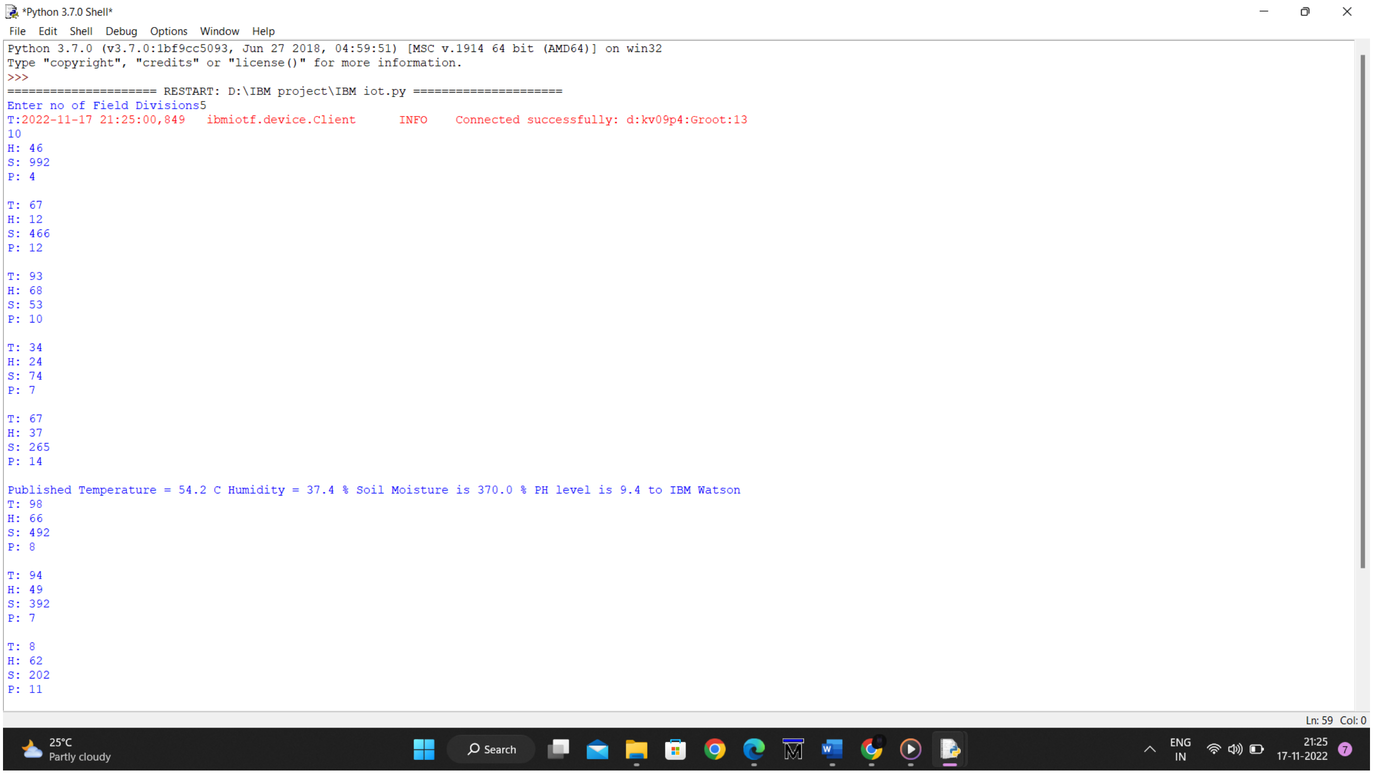
Code Segment:

```
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    if status=="motoroff" :
        print ("motor is off")
```

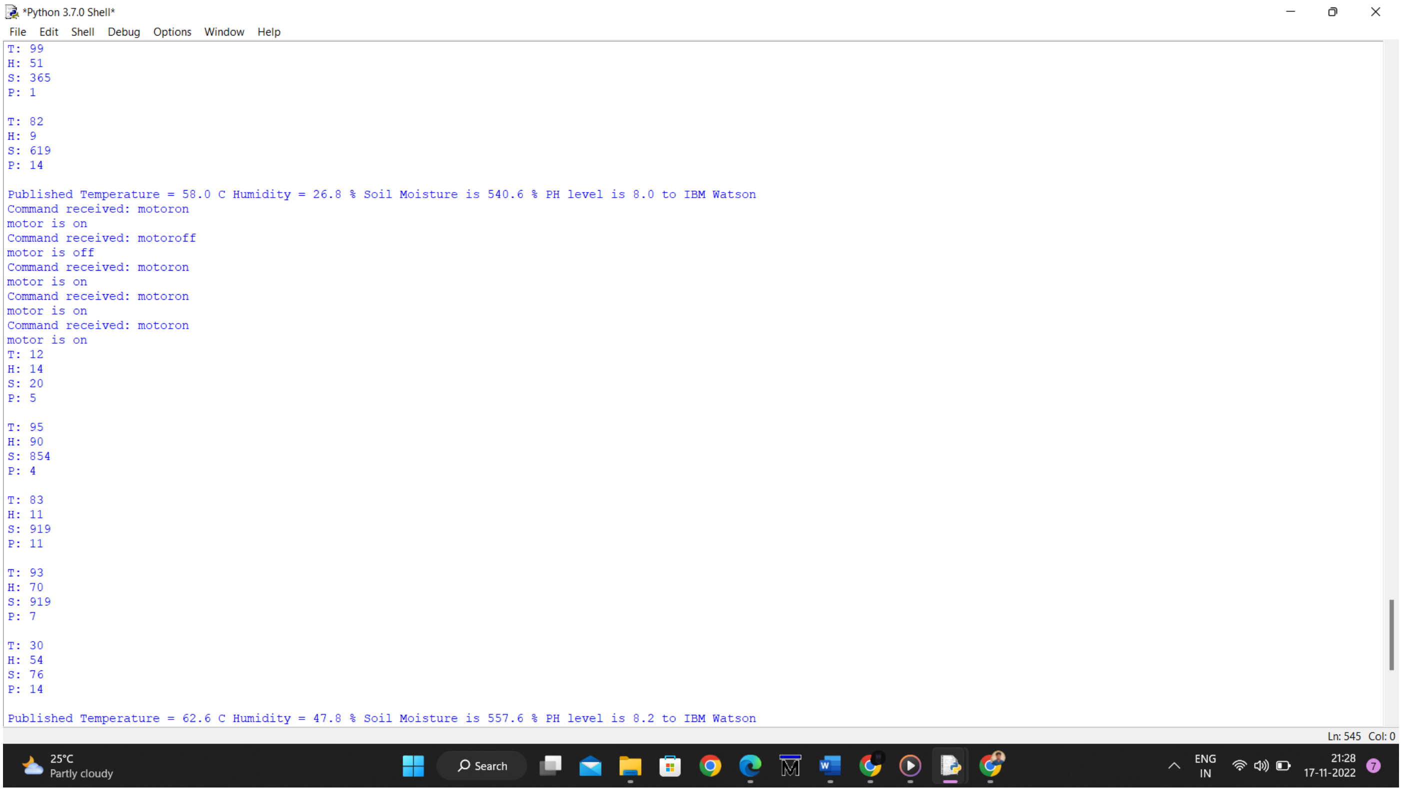


8.TESTING

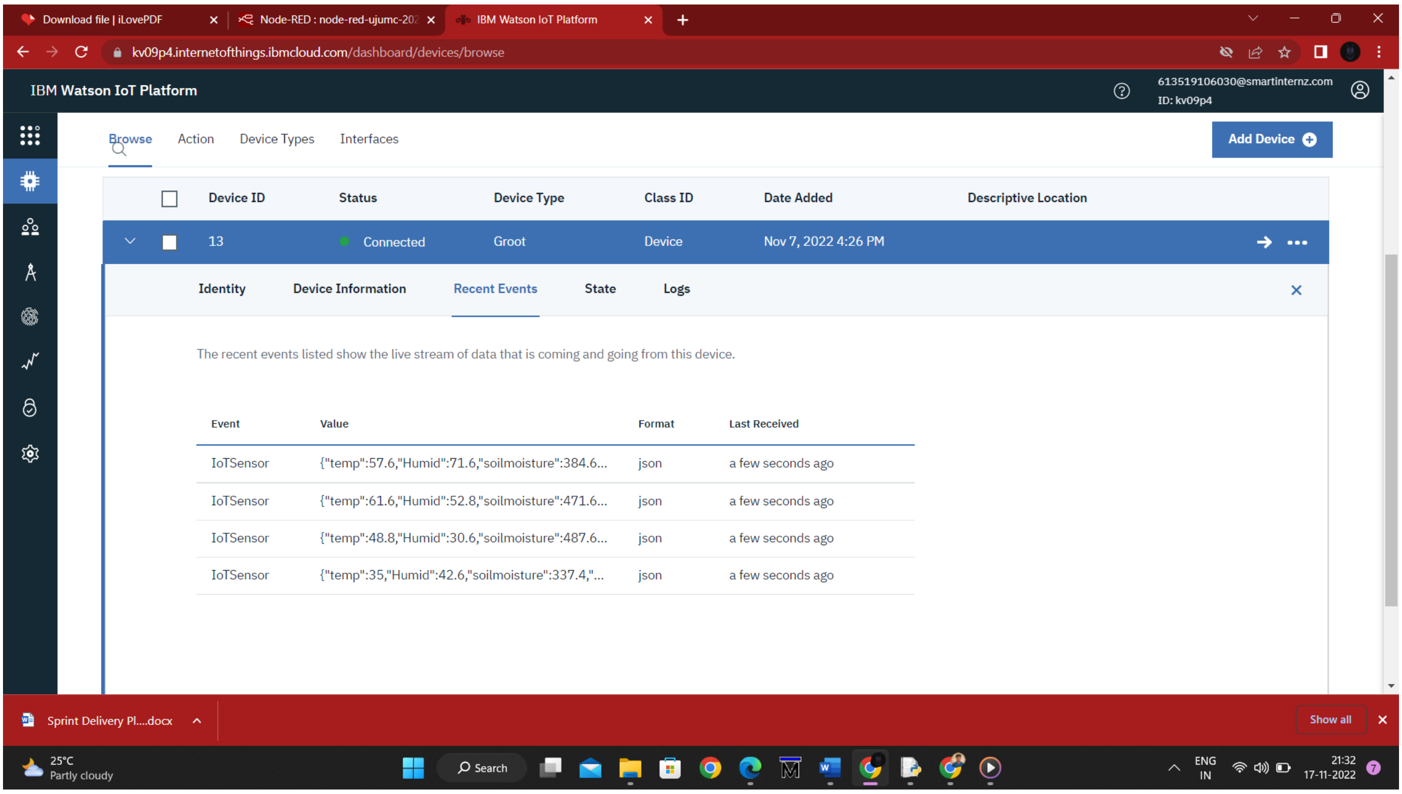
8.1 Test Cases:



```
*Python 3.7.0 Shell*
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
==================== RESTART: D:\IBM project\IBM iot.py ====================
Enter no of Field Divisions5
T:2022-11-17 21:25:00,849  ibmiotf.device.Client      INFO    Connected successfully: d:kv09p4:Groot:13
10
H: 46
S: 992
P: 4

T: 67
H: 12
S: 466
P: 12

T: 93
H: 68
S: 53
P: 10

T: 34
H: 24
S: 74
P: 7

T: 67
H: 37
S: 265
P: 14

Published Temperature = 54.2 C Humidity = 37.4 % Soil Moisture is 370.0 % PH level is 9.4 to IBM Watson
T: 98
H: 66
S: 492
P: 8

T: 94
H: 49
S: 392
P: 7

T: 8
H: 62
S: 202
P: 11
Ln: 59 Col: 0
25°C Partly cloudy    Search    ENG IN    21:25 17-11-2022
```

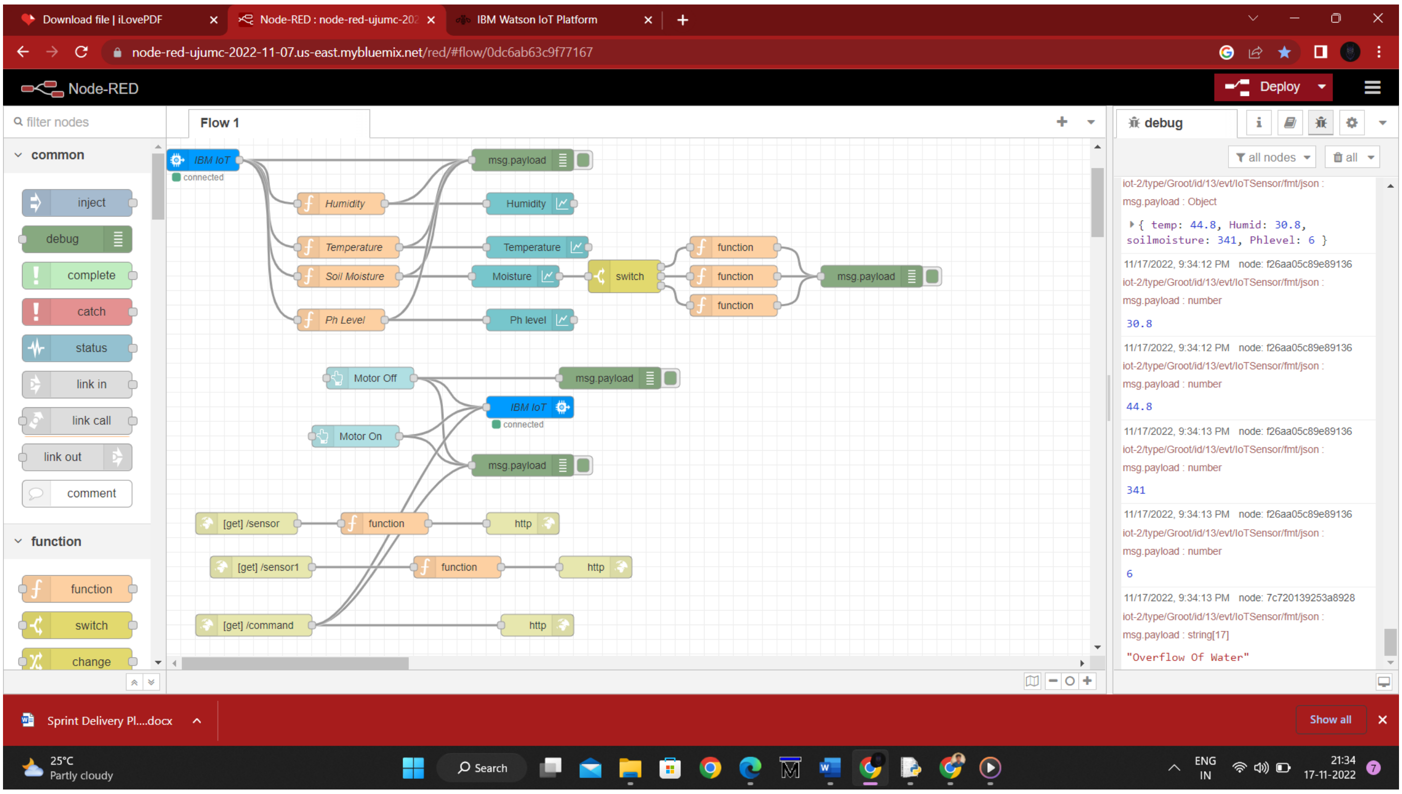


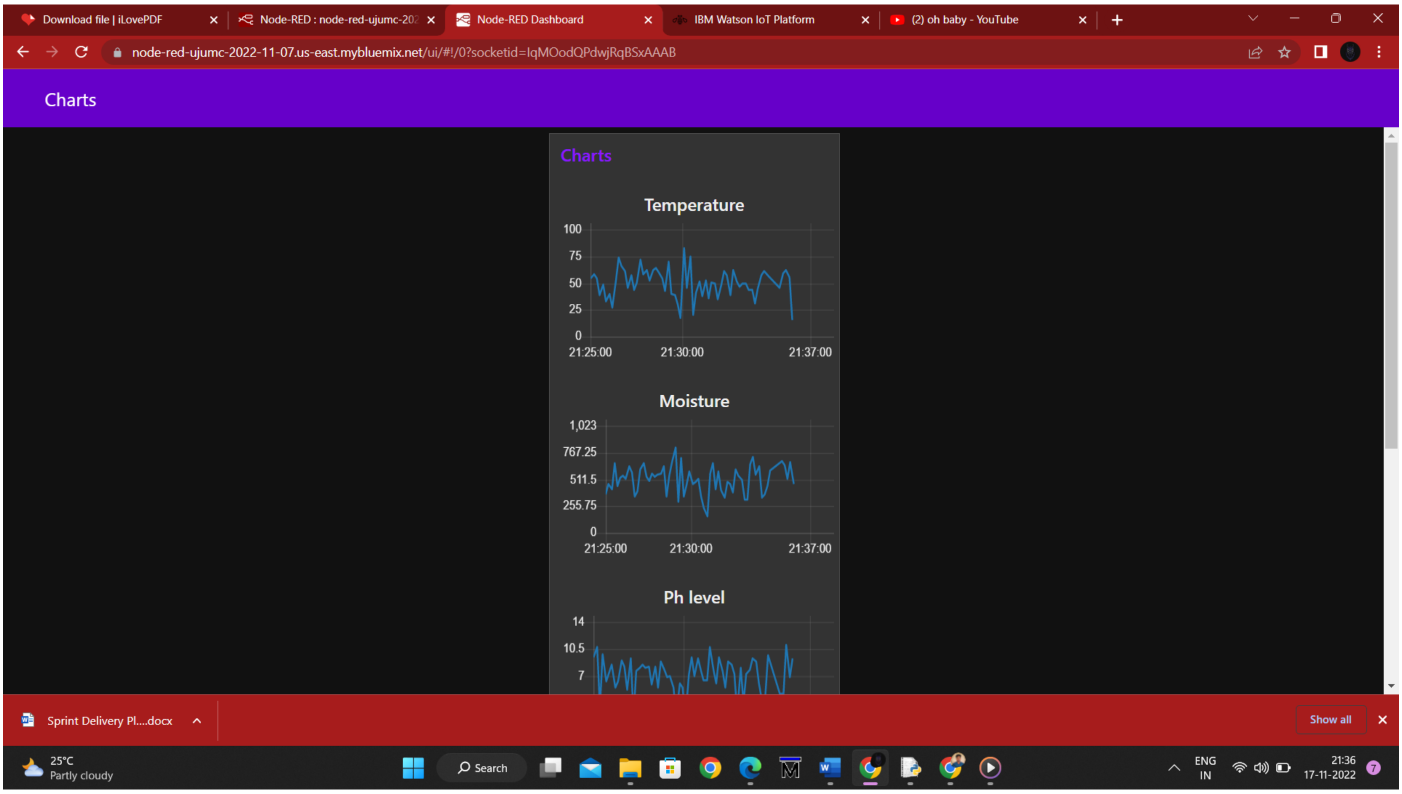
```
*Python 3.7.0 Shell*
File Edit Shell Debug Options Window Help
T: 99
H: 51
S: 365
P: 1

T: 82
H: 9
S: 619
P: 14

Published Temperature = 58.0 C Humidity = 26.8 % Soil Moisture is 540.6 % PH level is 8.0 to IBM Watson
Command received: motoron
motor is on
Command received: motoroff
motor is off
Command received: motoron
motor is on
Command received: motoron
motor is on
Command received: motoron
motor is on
T: 12
H: 14
S: 20
P: 5

T: 95
H: 90
S: 854
P: 4

T: 83
H: 11
S: 919
P: 11

T: 93
H: 70
S: 919
P: 7

T: 30
H: 54
S: 76
P: 14

Published Temperature = 62.6 C Humidity = 47.8 % Soil Moisture is 557.6 % PH level is 8.2 to IBM Watson
Ln: 545 Col: 0
25°C Partly cloudy    Search    ENG IN    21:28 17-11-2022
```

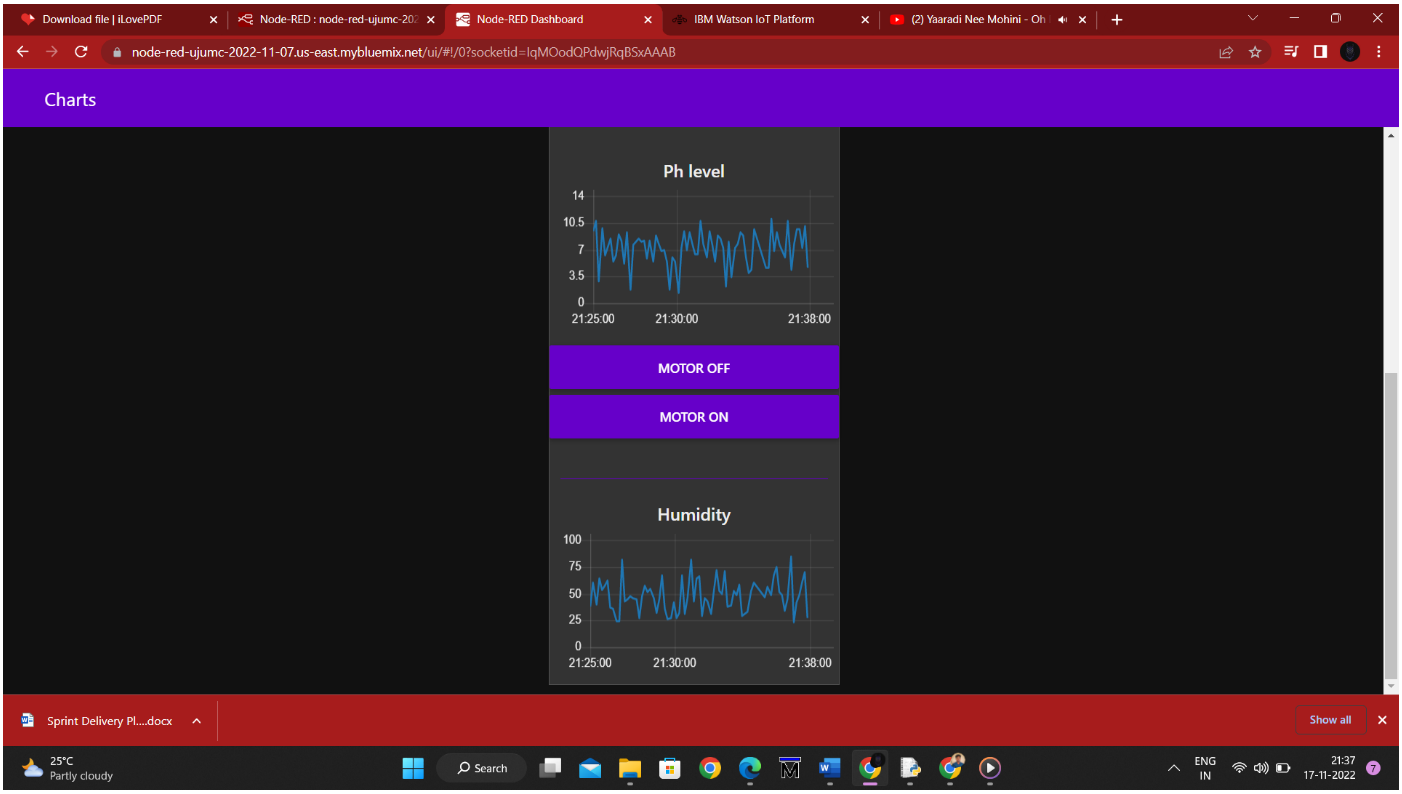


8.2User Acceptance Testing:

Node-Red:

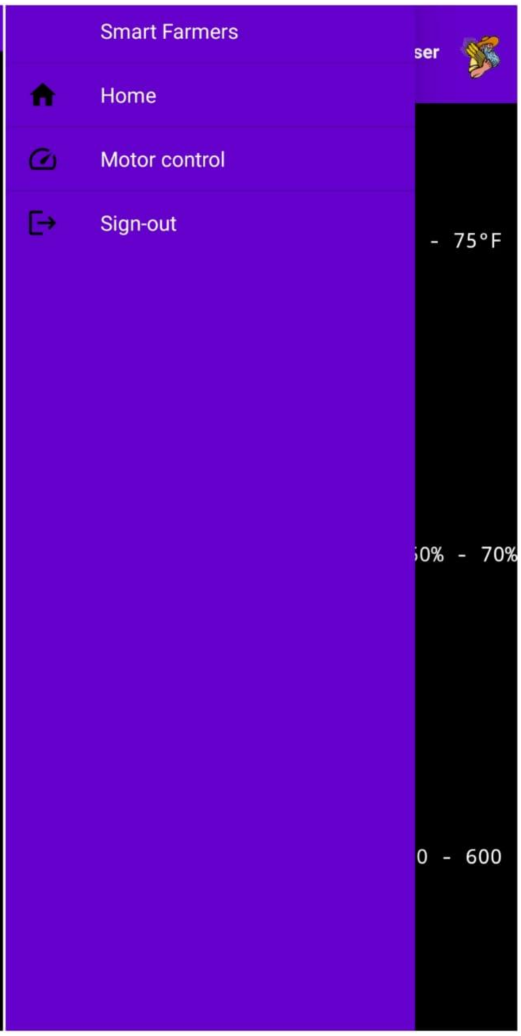


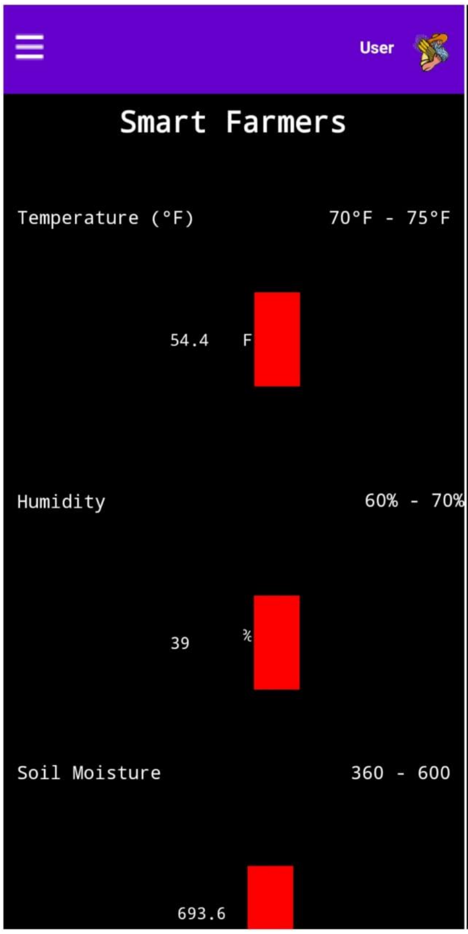

Charts
Charts
Temperature
Moisture
Ph level

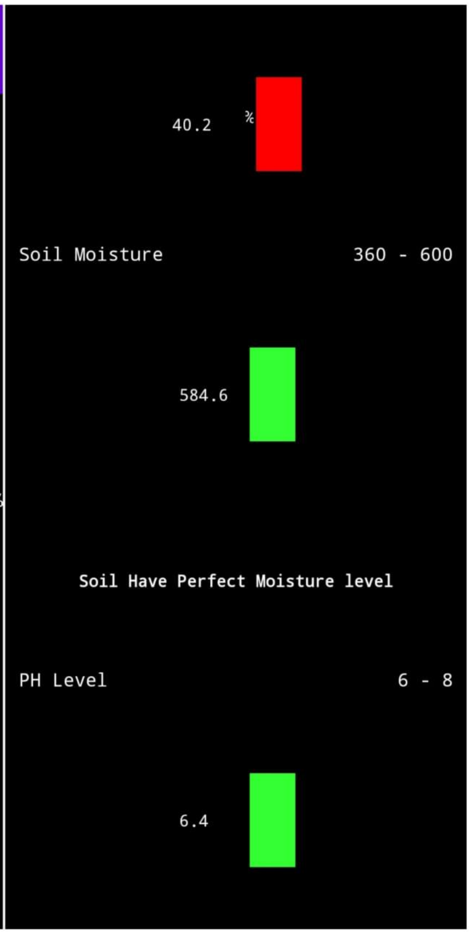

Charts
Ph level
MOTOR OFF
MOTOR ON
Humidity

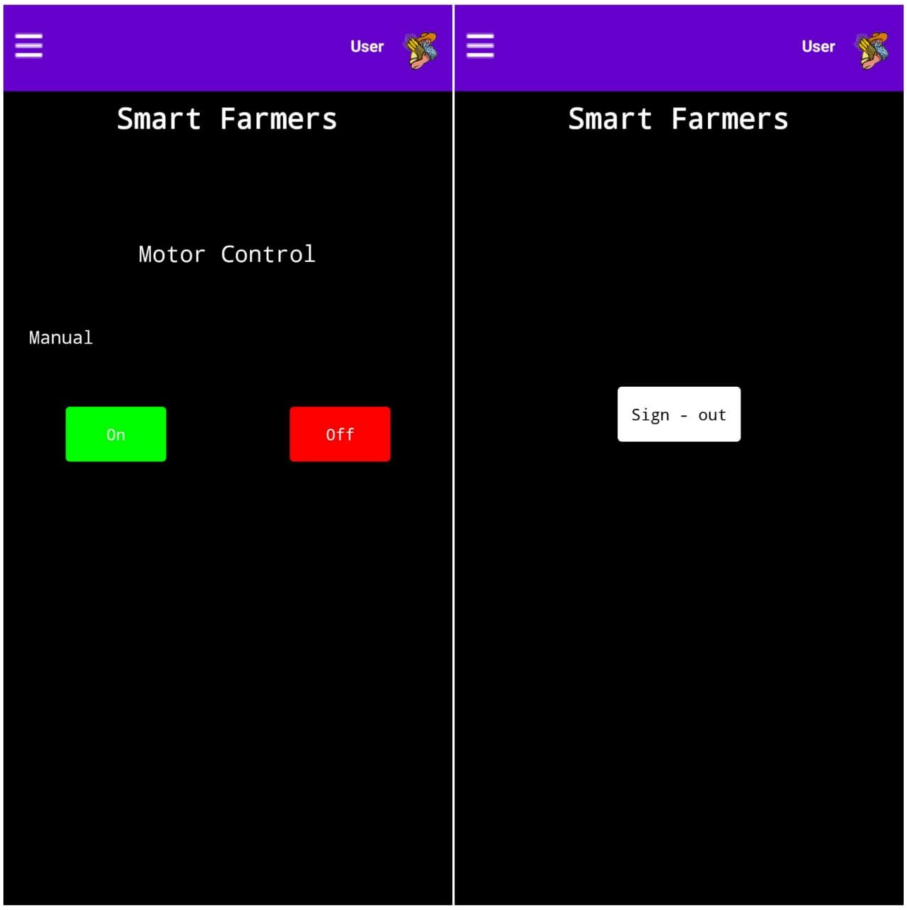
Mobile App:


Sign in
User Name
Mithun
Password
Login
Create Account


Smart Farmers
Home
Motor control
Sign-out

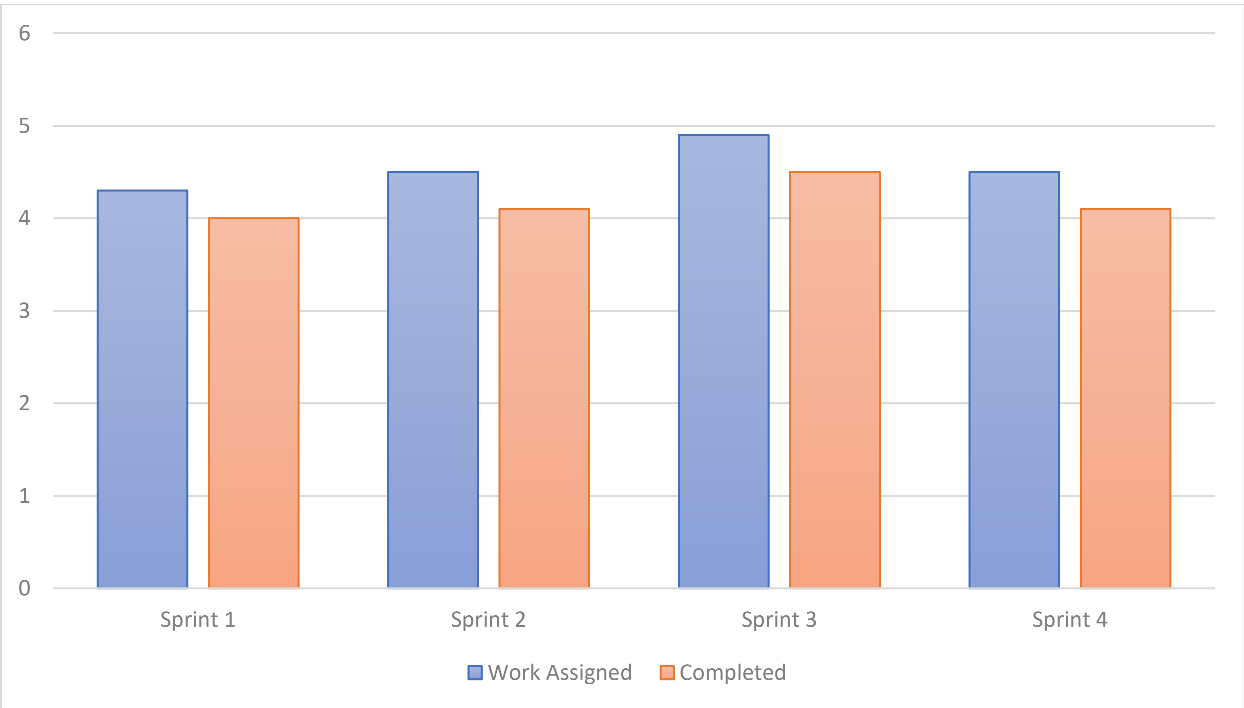

User
Smart Farmers
Temperature (°F)
70°F - 75°F
54.4
F
Humidity
60% - 70%
39
%
Soil Moisture
360 - 600
693.6


40.2
%
Soil Moisture
360 - 600
584.6
Soil Have Perfect Moisture level
PH Level
6 - 8
6.4

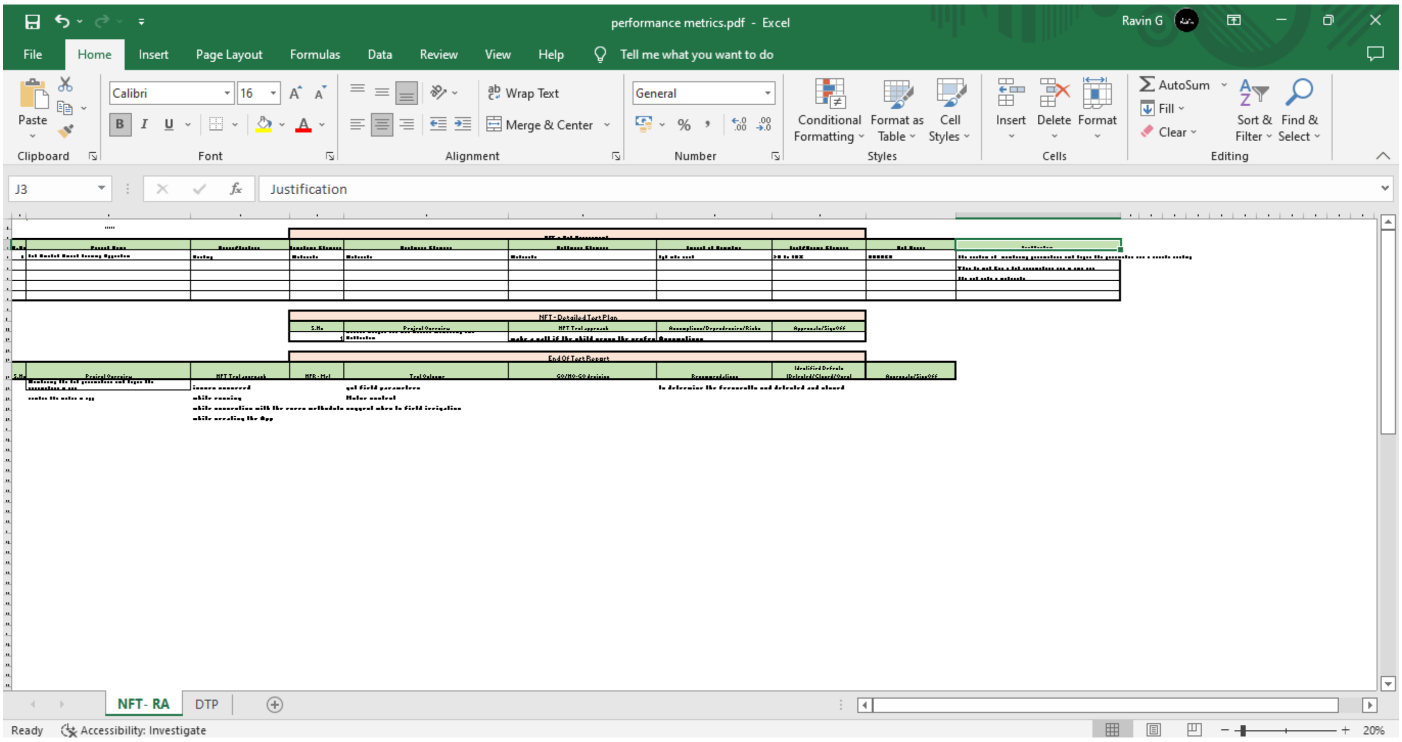


9.RESULT

9.1 Performance Metrics:



Project Metrics
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Performance
User Friendly
Scalability
Availability
Column1
Column2
Column3



performance metrics.pdf - Excel
Ravin G
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Help
Tell me what you want to do
Calibri
16
Wrap Text
Merge & Center
General
Conditional Formatting
Format as Table
Cell Styles
Insert
Delete
Format
AutoSum
Fill
Clear
Sort & Filter
Find & Select
Clipboard
Font
Alignment
Number
Styles
Cells
Editing
J3
Justification
NFT- RA
DTP
Ready
Accessibility: Investigate
20%

9. ADVANTAGES & DISADVANTAGES

9.1 ADVANTAGES:

- Simplifies the farmers work in great extend
- Helps Farmers to have Better Understanding about their field
- Enables Farmer to have motor control on a Handheld Device (Mobile Phone)
- Enables Farmers to have all in all data and controls on their Mobile phone
- Multiple sensor nodes ensure the Accurate field parameters
- Gives Farmers a Combined Solution For their Field Monitoring and controls on a mobile phone

9.2 DISADVANTAGES:

- Practical Difficulties during implementation of the project
- Using Multiple Nodes may increase implementation Cost
- Lack of Availability of project in Market

10.CONCLUSION

Through our Project we created a user friendly app with secured Login facility to monitor Soil Parameters like soil Moisture, Humidity, Temperature and PH level of the soil. This enables farmers to have a better understanding about their Field and to have a Entire Irrigation Control on their Hand Held Device like Mobile phones. Farmers can have Data and Motor control from the place where he/she is.Using Multiple sensor nodes also ensures the accuracy of the Values.

11.FUTURE SCOPE

- This Project can be made in large Scale which will be very useful to Farming related Companies
- Camera Module Can be added to have a Better monitoring on day by day growth of the project

12.APPENDIX

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random

#Provide your IBM Watson Device Credentials

organization = "kv09p4"

deviceType = "Groot"

deviceId = "13"

authMethod = "token"

authToken = "12345678"

global flag

flag=0

n=int(input("Enter no of Field Divisions"))

# Initialize GPIO


def myCommandCallback(cmd):

    print("Command received: %s" % cmd.data['command'])

    status=cmd.data['command']

    if status=="motoron":

        print ("motor is on")

    if status=="motoroff" :

        print ("motor is off")
```

```
    #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:
      Sug="Suggestion For Irrigation"
      #Get Sensor Data from DHT11
      avgt=0
      avgh=0
      avgs=0
      avgp=0
      for i in range(0,n):
         temp=random.randint(0,100)
         Humid=random.randint(0,100)
         soilmoisture=random.randint(0,1023)
         Phlevel=random.randint(0,14)
         print("T:",temp)
```

```
        print("H:",Humid)
        print("S:",soilmoisture)
        print("P:",Phlevel,"\n")
        avgt += temp
        avgh += Humid
        avgs += soilmoisture
        avgp += Phlevel
    temp = avgt/n
    Humid = avgh/n
    soilmoisture = avgs/n
    Phlevel = avgp/n

    data = { 'temp' : temp, 'Humid': Humid,'soilmoisture' : soilmoisture ,'Phlevel' : Phlevel}
    #print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,"Soil Moisture is %s %%" % soilmoisture,"PH level is %s" %Phlevel ,"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()
```

GitHub and Project demo link:

https://github.com/IBM-EPBL/IBM-Project-25759-1659972696

https://drive.google.com/drive/folders/1GcPjoQBKjW9SqOU2QAEaG5_J3-8JRvkR