IBM NALAIYATHIRAN
(HX8001)

PROJECT REPORT On

Smart Farmer - IoT Enabled Smart Farming Application

TEAM ID: *PNT2022TMID26544*

TEAM MEMBERS:

Sl.no	*NAME*	*REGISTER.NO*
1.	*SINGAREDDY MANEESH*	*211719106078*
2.	*PRAVEEN KUMAR*	*211719106060*
3.	*YOGESH SAI*	*211719106098*
4.	*VENKATESHAN*	*211719106094*

in partial fulfillment for the award of the degree Of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

RAJALAKSHMI INSTITUTE OF TECHNOLOGY

Chennai 600025.

INDEX

INTRODUCTION

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a Wifi module producing live data feed that can be obtained online using MIT app inventor.

LITERATURE SURVEY

*1. **TOPIC : IoT-Enabled Smart Agriculture***

AUTHOR : Vu Khanh Quy , Nguyen Van Hau , Dang Van

DESCRIPTION : 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.*

2.TOPIC : Smart Farm Monitoring Using Raspberry Pi and Arduino

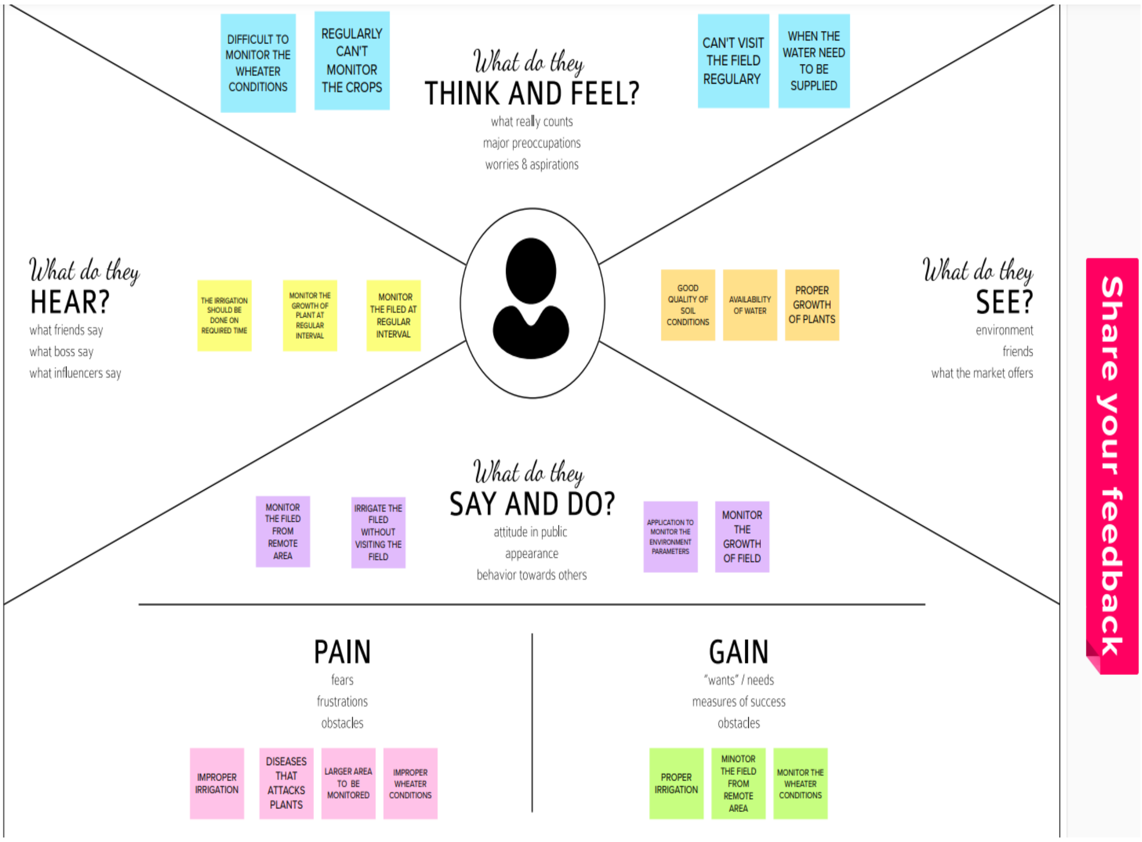
AUTHOR : Siwakorn Jindarat, Pongpisitt Wuttidittachotti

DESCRIPTION : This study aimed to investigate an establishment using an Intelligent System which employed an Embedded System and Smart Phone for chicken farming management and problem solving using Raspberry Pi and Arduino Uno. An experiment and comparative analysis of the intelligent system was applied in a sample chicken farm in this study. The findings of this study found that the system could monitor surrounding weather conditions including humidity, temperature, climate quality, and also the filter fan switch control in the chicken farm. The system was found to be comfortable for farmers to use as they could effectively control the farm anywhere at anytime, resulting in cost reduction, asset saving, and productive management in chicken farming.

IDEATION & PROPOSED SOLUTION

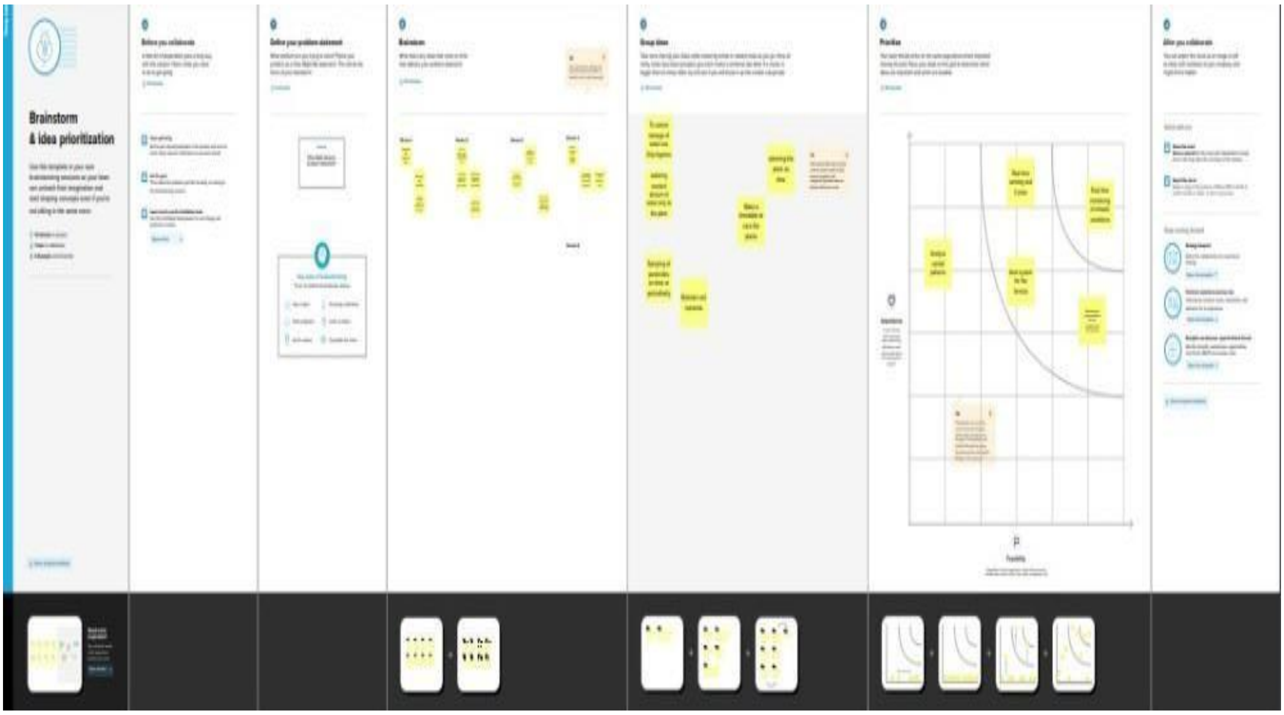
1.Empathy Map Canvas:

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by *dave gray* and has gained much popularity within the agile community


DIFFICULT TO MONITOR THE WHEATER CONDITIONS
REGULARLY CAN'T MONITOR THE CROPS
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
CAN'T VISIT THE FIELD REGULARY
WHEN THE WATER NEED TO BE SUPPLIED
What do they
HEAR?
what friends say
what boss say
what influencers say
THE IRRIGATION SHOULD BE DONE ON REQUIRED TIME
MONITOR THE GROWTH OF PLANT AT REGULAR INTERVAL
MONITOR THE FILED AT REGULAR INTERVAL
GOOD QUALITY OF SOIL CONDITIONS
AVAILABILITY OF WATER
PROPER GROWTH OF PLANTS
What do they
SEE?
environment
friends
what the market offers
Share your feedback
MONITOR THE FILED FROM REMOTE AREA
IRRIGATE THE FILED WITHOUT VISITING THE FIELD
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
APPLICATION TO MONITOR THE ENVIRONMENT PARAMETERS
MONITOR THE GROWTH OF FIELD
PAIN
fears
frustrations
obstacles
IMPROPER IRRIGATION
DISEASES THAT ATTACKS PLANTS
LARGER AREA TO BE MONITORED
IMPROPER WHEATER CONDITIONS
GAIN
"wants" / needs
measures of success
obstacles
PROPER IRRIGATION
MINOTOR THE FIELD FROM REMOTE AREA
MONITOR THE WHEATER CONDITIONS

*2.*Ideation & Brainstorming:

Ideation essentially refers to the whole creative process of coming up with and communicating new ideas. Ideation is innovative thinking, typically aimed at solving a problem or providing a more efficient means of doing or accomplishing something. It encompasses thinking up new ideas, developing existing ideas, and figuring out means or methods for putting new ideas into practice. Ideation is similar to a practice known as brainstorming.



PROPOSED SOLUTION

To provide efficient decision support system using wireless sensor network which handle different activities of farm and gives useful information related to farm such as Soil moisture, Temperature and Humidity *content . Smart Agricultural System solutions provide an integrated IoT platform in agriculture that allows farmers to use different types of sensors and used to collect the information of various parameter and analyse real- time data in order to make informed decisions. IoT based smart framing for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing . 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 report will assist farmers in increasing the agriculture yield*

REQUIREMENT ANALYSIS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	*Functional Requirement (Epic)*	*Sub Requirement (Story / Sub-Task)*
FR-1	*IoT devices*	*Sensors and Wifi module.*
FR-2	*Software*	*Web UI, Node-red, IBM Watson, MIT app*

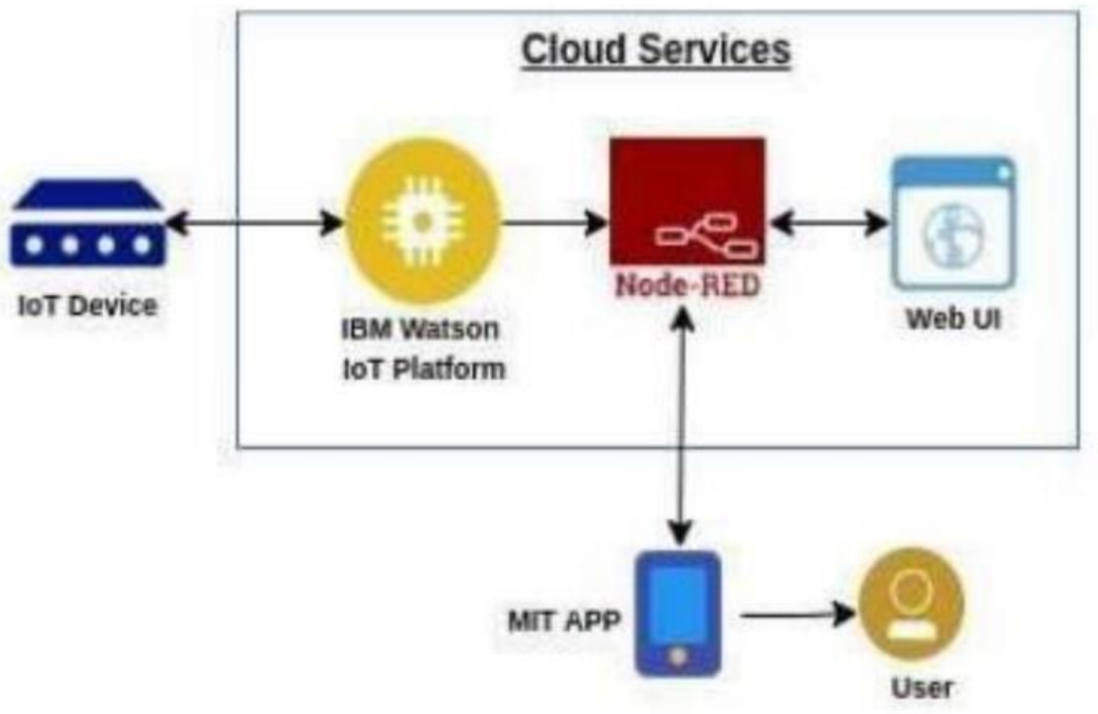
Non-functional Requirements:

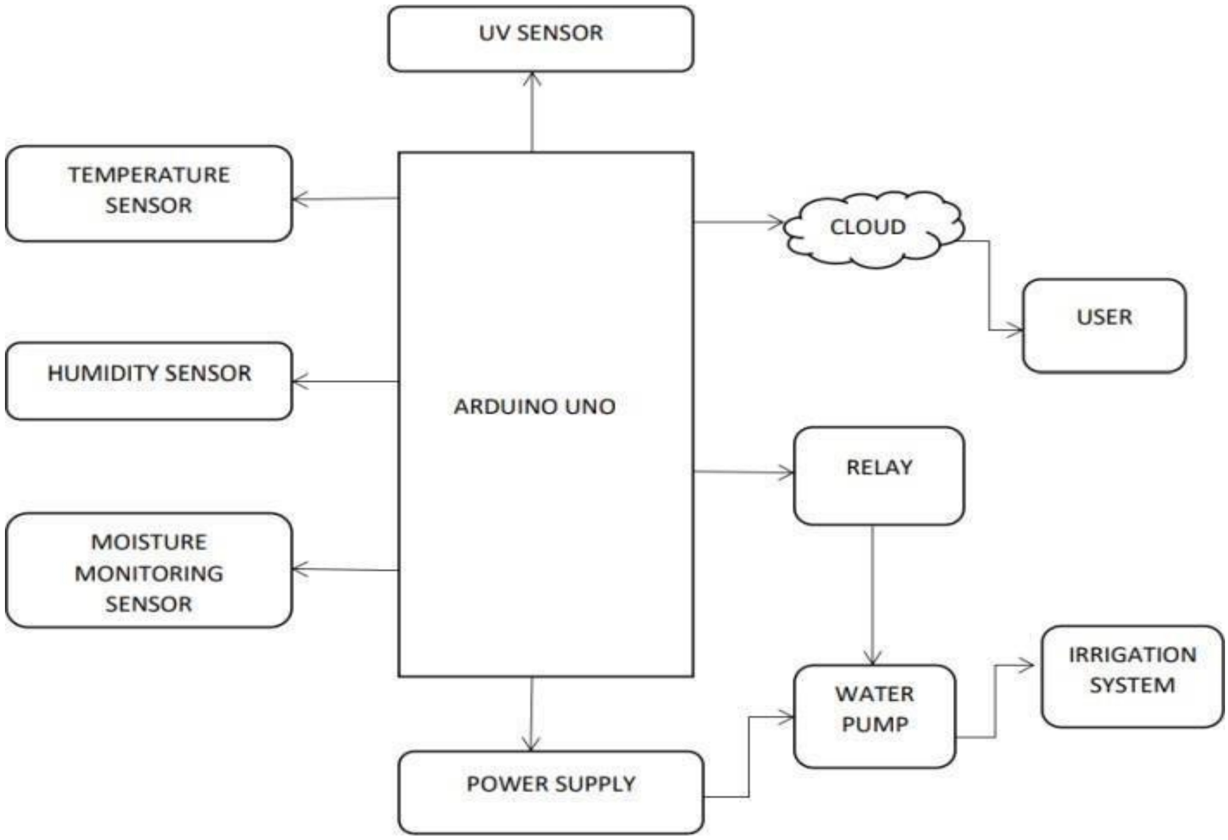
Following are the non-functional requirements of the proposed solution.

FR No.	*Non-Functional Requirement*	*Description*
NFR-1	***Usability***	*Time consumability is less, Productivity is high.*
NFR- 2	***Security***	*It has high level of security features due to integration of sensor data*

NFR- 3	***Reliability***	*Accuracy of data and hence it is Reliable.*
NFR- 4	***Performance***	*Performance is high and highly productive.*
NFR- 5	***Availability***	*With permitted network connectivity the application is accessible.*
NFR- 6	***Scalability***	*It is perfectly scalable and many new constraints can be added.*

PROJECT DESIGN





User Stories

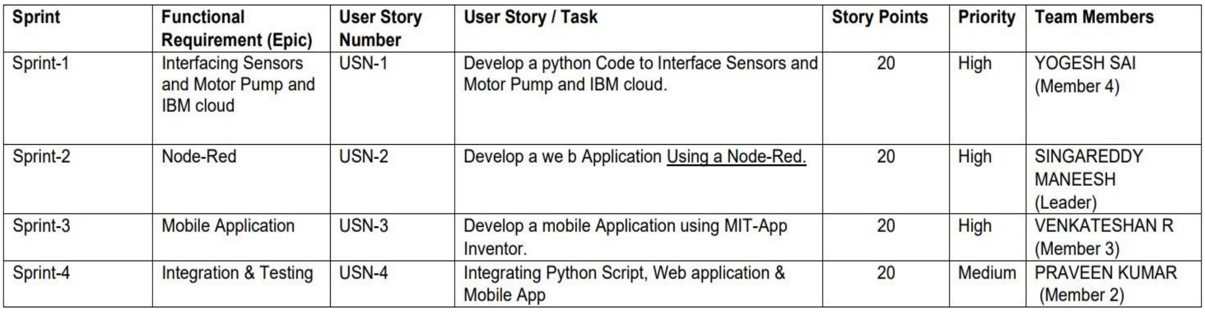
Type	Requiremen	User Story Number		Acceptance criteria	Priority	
(Mobile use	Registration		As a user, I can register for the application by entering my email, password and confirmi my password.	I can access my account/ dashboard	igh	Spri
			As a user, I will receive confirmation email once I registered for the applicatio		igh	

				confirmation email & click confirm.		Spri
					igh	
(Web user)	Login		As a user, I can log into the application by entering emai password.	I can register & access the dashboard with Login		Spri
	credentials		As a user, I can register for the application through mobile application	Temperature and Humidity detai	ium	Spri
			include the check roles of access and then move to the manage modules.	smart farming application system.	ium	Spri
					igh	
Executive			with the software.	store in cloud services.		Spri
			As a user once view the mana modules this describes the			

	IOT devices		manage system admins and Manage Roles of user and etc		ium	Spri
	Log out			Sign out	igh	Spri

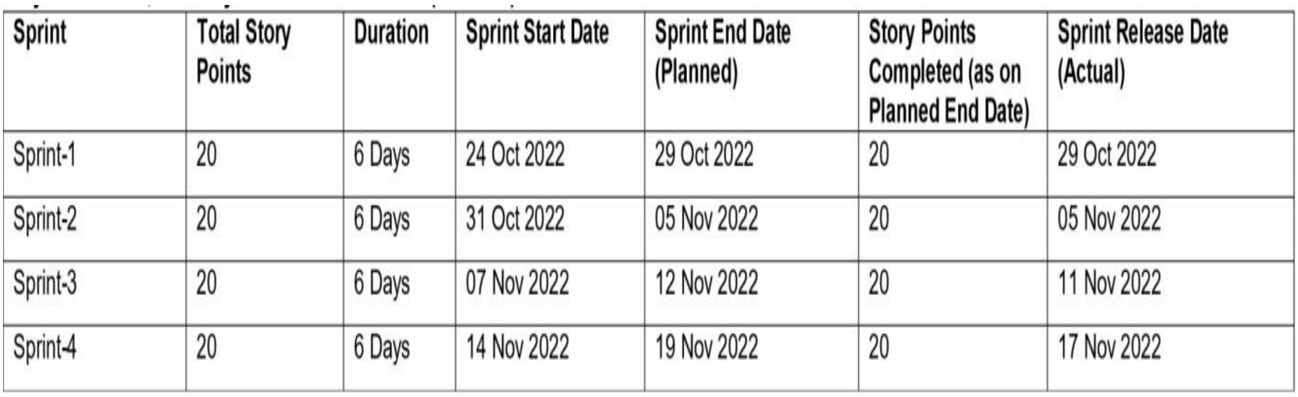
PROJECT PLANNING & SCHEDULING

Product Backlog, Sprint Schedule, and Estimation



Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Interfacing Sensors and Motor Pump and IBM cloud	USN-1	Develop a python Code to Interface Sensors and Motor Pump and IBM cloud.	20	High	YOGESH SAI (Member 4)
Sprint-2	Node-Red	USN-2	Develop a we b Application Using a Node-Red.	20	High	SINGAREDDY MANEESH (Leader)
Sprint-3	Mobile Application	USN-3	Develop a mobile Application using MIT-App Inventor.	20	High	VENKATESHAN R (Member 3)
Sprint-4	Integration & Testing	USN-4	Integrating Python Script, Web application & Mobile App	20	Medium	PRAVEEN KUMAR (Member 2)

Project Tracker, Velocity & Burndown Chart



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	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Nov 2022

CODING & SOLUTIONING

Python Code:

- *For Connecting IBM Cloud*
- *For NODE RED*
- *Weather Map Information MIT App Inventor*

Python Code

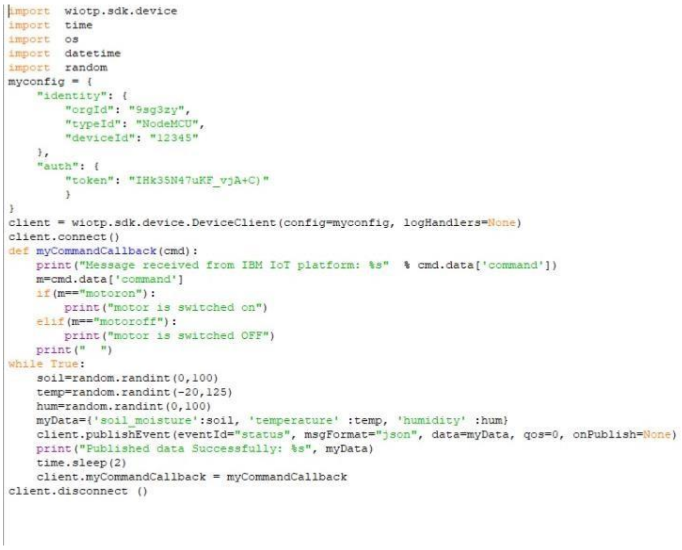
```
import  wiotp.sdk.device

import   time  import   os

import  datetime import

random myconfig = {

    "identity": {

        "orgId": "9sg3zy",

        "typeId": "NodeMCU",

        "deviceId": "12345"

    },

    "auth": {

        "token": "IHk35N47uKF_vjA+C)"

        }

}

client = wiotp.sdk.device.DeviceClient(config=myconfig, logHandlers=None)
client.connect() def myCommandCallback(cmd):

    print("Message received from IBM IoT platform: %s"  %
cmd.data['command'])     m=cmd.data['command']
if(m=="motoron"):

        print("motor            is            switched            on")

elif(m=="motoroff"):

        print("motor is switched OFF")

print("  ") while True:
```

soil=random.randint(0,100) temp=random.randint(-20,125) hum=random.randint(0,100)

myData={'soil_moisture':soil, 'temperature' :temp, 'humidity' :hum} client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)

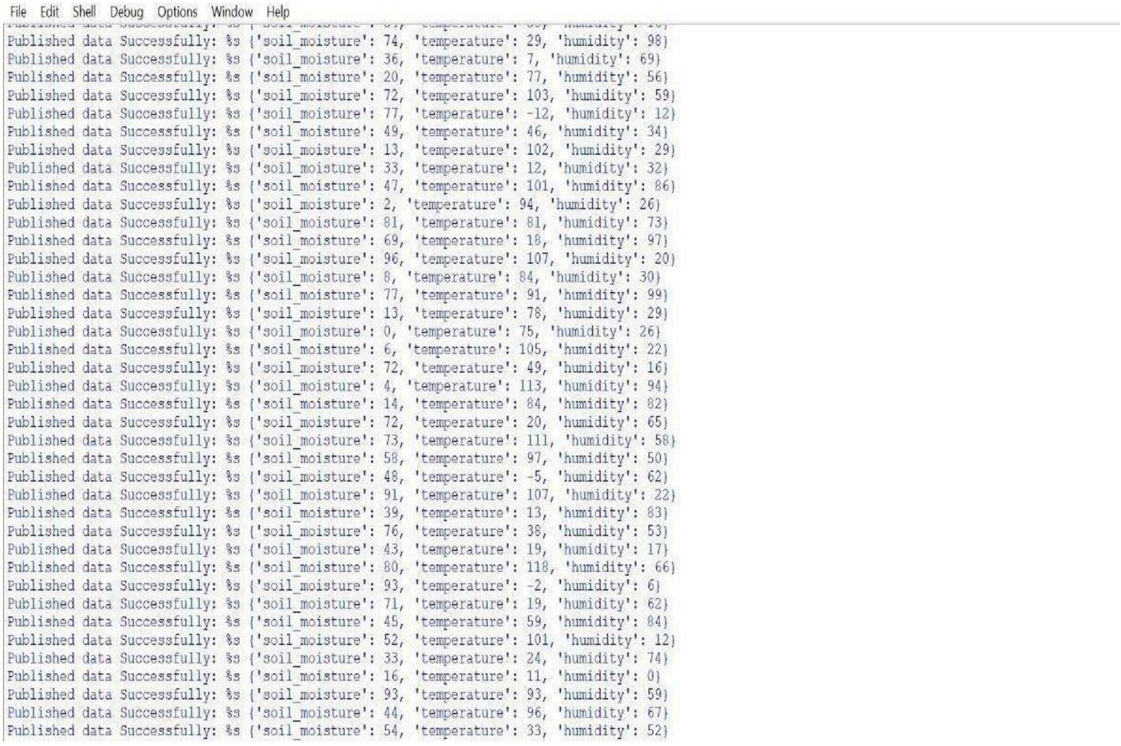
print("Published data Successfully: %s", myData) time.sleep(2)

client.myCommandCallback = myCommandCallback client.disconnect ()



```
import  wiotp.sdk.device
import  time
import  os
import  datetime
import  random
myconfig = {
    "identity": {
        "orgId": "9sg3zy",
        "typeId": "NodeMCU",
        "deviceId": "12345"
    },
    "auth": {
        "token": "IHk35N47uKF_vjA+C)"
        }
}
client = wiotp.sdk.device.DeviceClient(config=myconfig, logHandlers=None)
client.connect()
def myCommandCallback(cmd):
    print("Message received from IBM IoT platform: %s"  % cmd.data['command'])
    m=cmd.data['command']
    if(m=="motoron"):
        print("motor is switched on")
    elif(m=="motoroff"):
        print("motor is switched OFF")
    print("  ")
while True:
    soil=random.randint(0,100)
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    myData={'soil_moisture':soil, 'temperature' :temp, 'humidity' :hum}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    time.sleep(2)
    client.myCommandCallback = myCommandCallback
client.disconnect ()
```

Running of programs



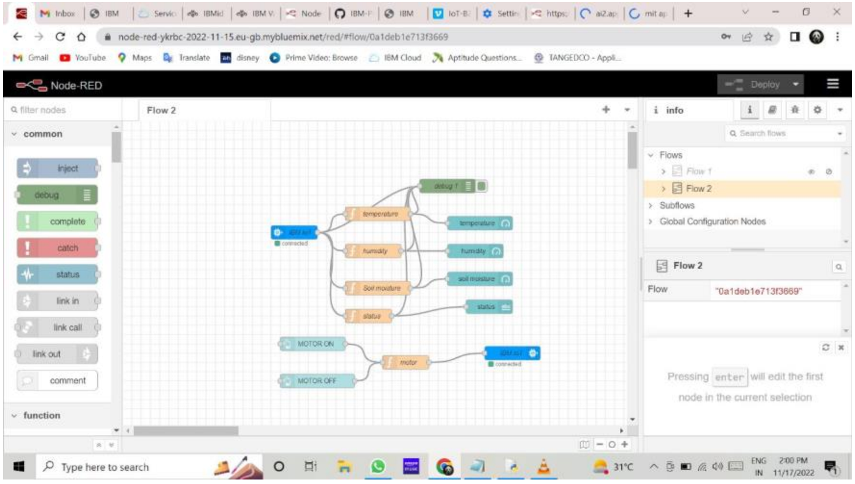
```
Published data Successfully: %s {'soil_moisture': 74, 'temperature': 29, 'humidity': 98}
Published data Successfully: %s {'soil_moisture': 36, 'temperature': 7, 'humidity': 69}
Published data Successfully: %s {'soil_moisture': 20, 'temperature': 77, 'humidity': 56}
Published data Successfully: %s {'soil_moisture': 72, 'temperature': 103, 'humidity': 59}
Published data Successfully: %s {'soil_moisture': 77, 'temperature': -12, 'humidity': 12}
Published data Successfully: %s {'soil_moisture': 49, 'temperature': 46, 'humidity': 34}
Published data Successfully: %s {'soil_moisture': 13, 'temperature': 102, 'humidity': 29}
Published data Successfully: %s {'soil_moisture': 33, 'temperature': 12, 'humidity': 32}
Published data Successfully: %s {'soil_moisture': 47, 'temperature': 101, 'humidity': 86}
Published data Successfully: %s {'soil_moisture': 2, 'temperature': 94, 'humidity': 26}
Published data Successfully: %s {'soil_moisture': 81, 'temperature': 81, 'humidity': 73}
Published data Successfully: %s {'soil_moisture': 69, 'temperature': 18, 'humidity': 97}
Published data Successfully: %s {'soil_moisture': 96, 'temperature': 107, 'humidity': 20}
Published data Successfully: %s {'soil_moisture': 8, 'temperature': 84, 'humidity': 30}
Published data Successfully: %s {'soil_moisture': 77, 'temperature': 91, 'humidity': 99}
Published data Successfully: %s {'soil_moisture': 13, 'temperature': 78, 'humidity': 29}
Published data Successfully: %s {'soil_moisture': 0, 'temperature': 75, 'humidity': 26}
Published data Successfully: %s {'soil_moisture': 6, 'temperature': 105, 'humidity': 22}
Published data Successfully: %s {'soil_moisture': 72, 'temperature': 49, 'humidity': 16}
Published data Successfully: %s {'soil_moisture': 4, 'temperature': 113, 'humidity': 94}
Published data Successfully: %s {'soil_moisture': 14, 'temperature': 84, 'humidity': 82}
Published data Successfully: %s {'soil_moisture': 72, 'temperature': 20, 'humidity': 65}
Published data Successfully: %s {'soil_moisture': 73, 'temperature': 111, 'humidity': 58}
Published data Successfully: %s {'soil_moisture': 58, 'temperature': 97, 'humidity': 50}
Published data Successfully: %s {'soil_moisture': 48, 'temperature': -5, 'humidity': 62}
Published data Successfully: %s {'soil_moisture': 91, 'temperature': 107, 'humidity': 22}
Published data Successfully: %s {'soil_moisture': 39, 'temperature': 13, 'humidity': 83}
Published data Successfully: %s {'soil_moisture': 76, 'temperature': 38, 'humidity': 53}
Published data Successfully: %s {'soil_moisture': 43, 'temperature': 19, 'humidity': 17}
Published data Successfully: %s {'soil_moisture': 80, 'temperature': 118, 'humidity': 66}
Published data Successfully: %s {'soil_moisture': 93, 'temperature': -2, 'humidity': 6}
Published data Successfully: %s {'soil_moisture': 71, 'temperature': 19, 'humidity': 62}
Published data Successfully: %s {'soil_moisture': 45, 'temperature': 59, 'humidity': 84}
Published data Successfully: %s {'soil_moisture': 52, 'temperature': 101, 'humidity': 12}
Published data Successfully: %s {'soil_moisture': 33, 'temperature': 24, 'humidity': 74}
Published data Successfully: %s {'soil_moisture': 16, 'temperature': 11, 'humidity': 0}
Published data Successfully: %s {'soil_moisture': 93, 'temperature': 93, 'humidity': 59}
Published data Successfully: %s {'soil_moisture': 44, 'temperature': 96, 'humidity': 67}
Published data Successfully: %s {'soil_moisture': 54, 'temperature': 33, 'humidity': 52}
```

TESTING & RESULTS

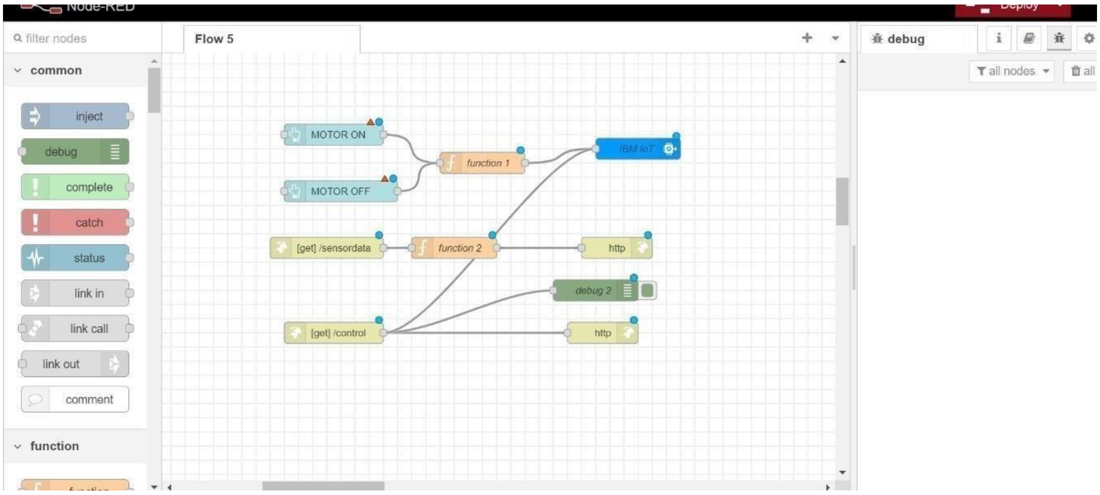
NODE RED Flow Connections

- *Interfacing IBM Cloud*
- *Intefacing & Getting Sensor Datas*
- *Connecting MIT App Inventor Weather Map Parameters*

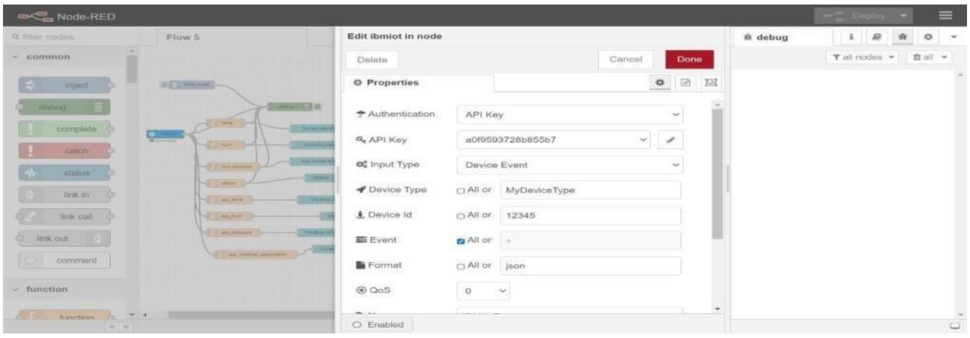
Flow:1



Flow:2



Flow:1 Configuring All Nodes With IBM IOT Platform



Edit ibmiot in node

Authentication: API Key

API Key: a0f9593728b855b7

Input Type: Device Event

Device Type: □ All or MyDeviceType

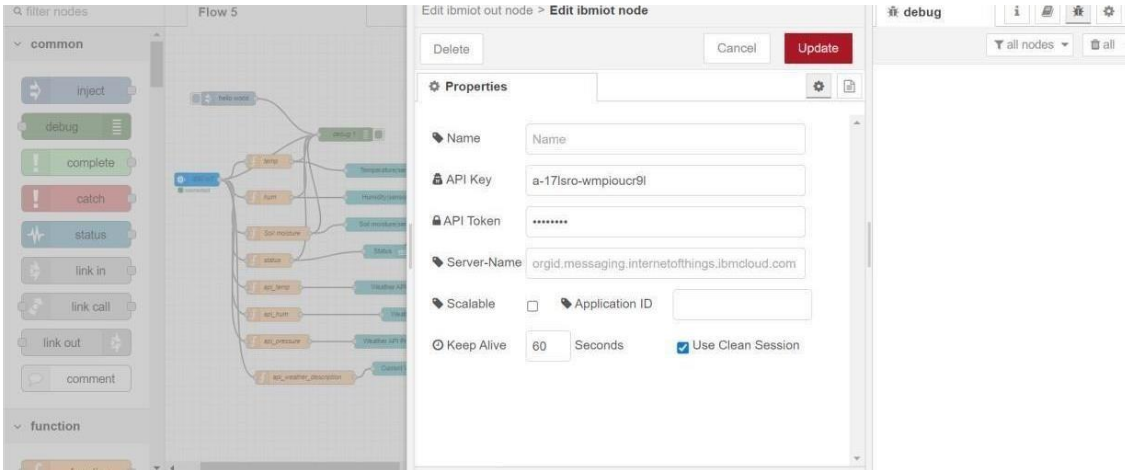
Device Id: □ All or 12345

Event: ☑ All or +

Format: □ All or json

QoS: 0

Flow:2 Configuring All Nodes With IBM IOT Platform



Edit ibmiot out node > **Edit ibmiot node**

Name: Name

API Key: a-17lsro-wmpioucr9l

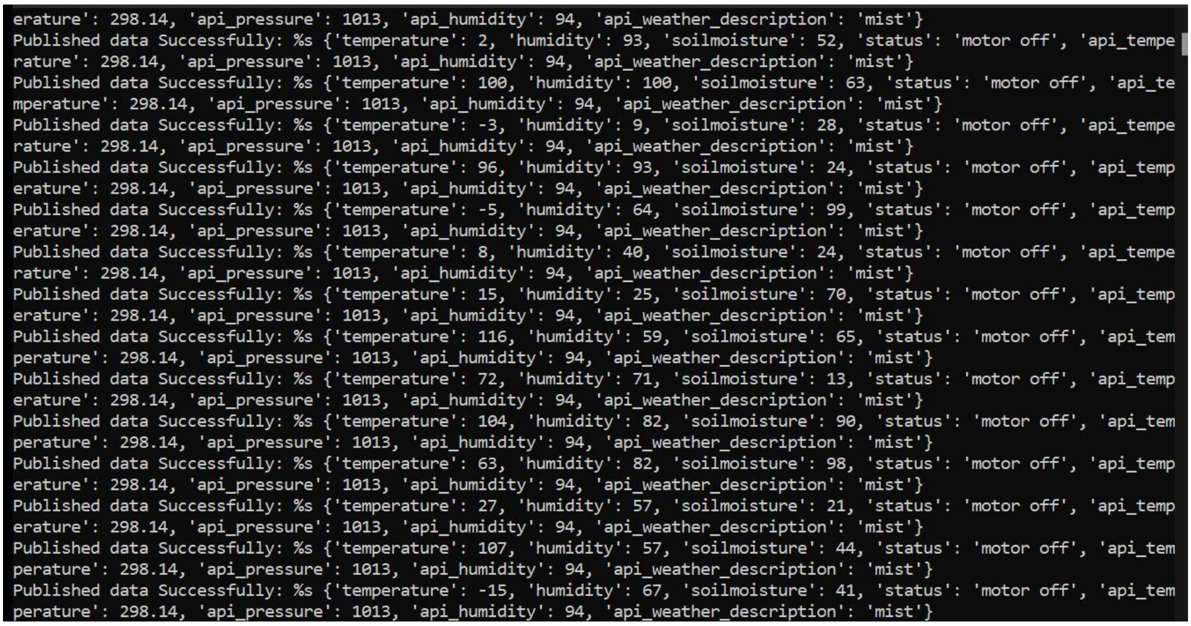
API Token: ••••••••

Server-Name: orgid.messaging.internetofthings.ibmcloud.com

Scalable: □ Application ID:

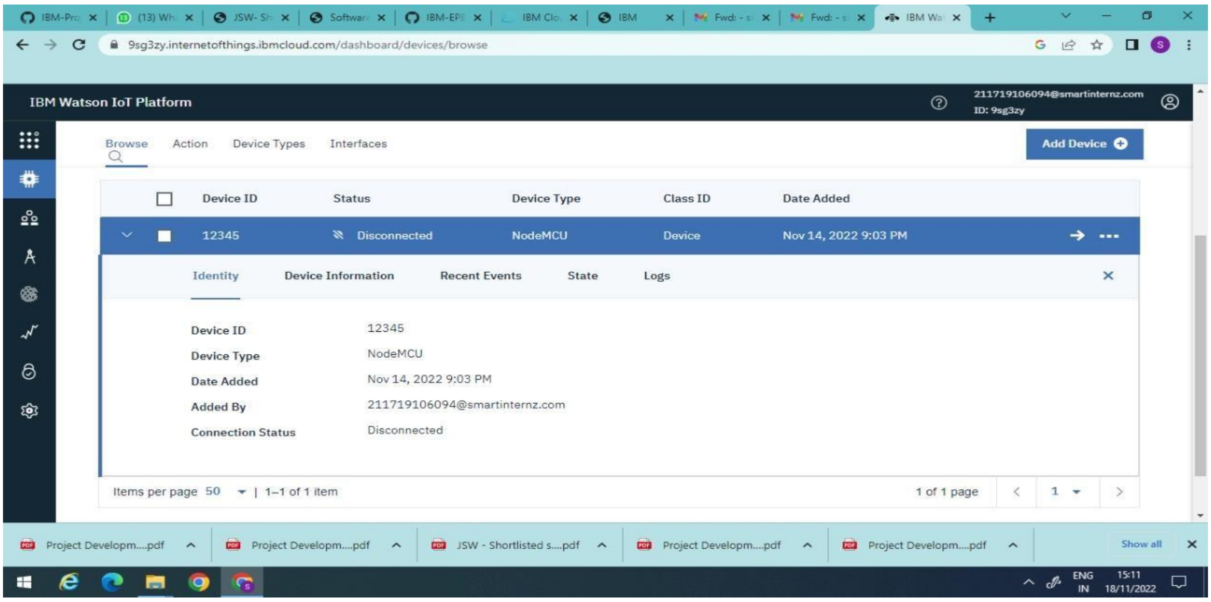
Keep Alive: 60 Seconds ☑ Use Clean Session

Execution of python program



```
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 2, 'humidity': 93, 'soilmoisture': 52, 'status': 'motor off', 'api_tempe
rature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 100, 'humidity': 100, 'soilmoisture': 63, 'status': 'motor off', 'api_te
mperature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': -3, 'humidity': 9, 'soilmoisture': 28, 'status': 'motor off', 'api_tempe
rature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 96, 'humidity': 93, 'soilmoisture': 24, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': -5, 'humidity': 64, 'soilmoisture': 99, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 8, 'humidity': 40, 'soilmoisture': 24, 'status': 'motor off', 'api_tempe
rature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 15, 'humidity': 25, 'soilmoisture': 70, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 116, 'humidity': 59, 'soilmoisture': 65, 'status': 'motor off', 'api_tem
perature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 72, 'humidity': 71, 'soilmoisture': 13, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 104, 'humidity': 82, 'soilmoisture': 90, 'status': 'motor off', 'api_tem
perature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 63, 'humidity': 82, 'soilmoisture': 98, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 27, 'humidity': 57, 'soilmoisture': 21, 'status': 'motor off', 'api_temp
erature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': 107, 'humidity': 57, 'soilmoisture': 44, 'status': 'motor off', 'api_tem
perature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
Published data Successfully: %s {'temperature': -15, 'humidity': 67, 'soilmoisture': 41, 'status': 'motor off', 'api_tem
perature': 298.14, 'api_pressure': 1013, 'api_humidity': 94, 'api_weather_description': 'mist'}
```

IBM Watson IoT Platform Device Connect & Live Data

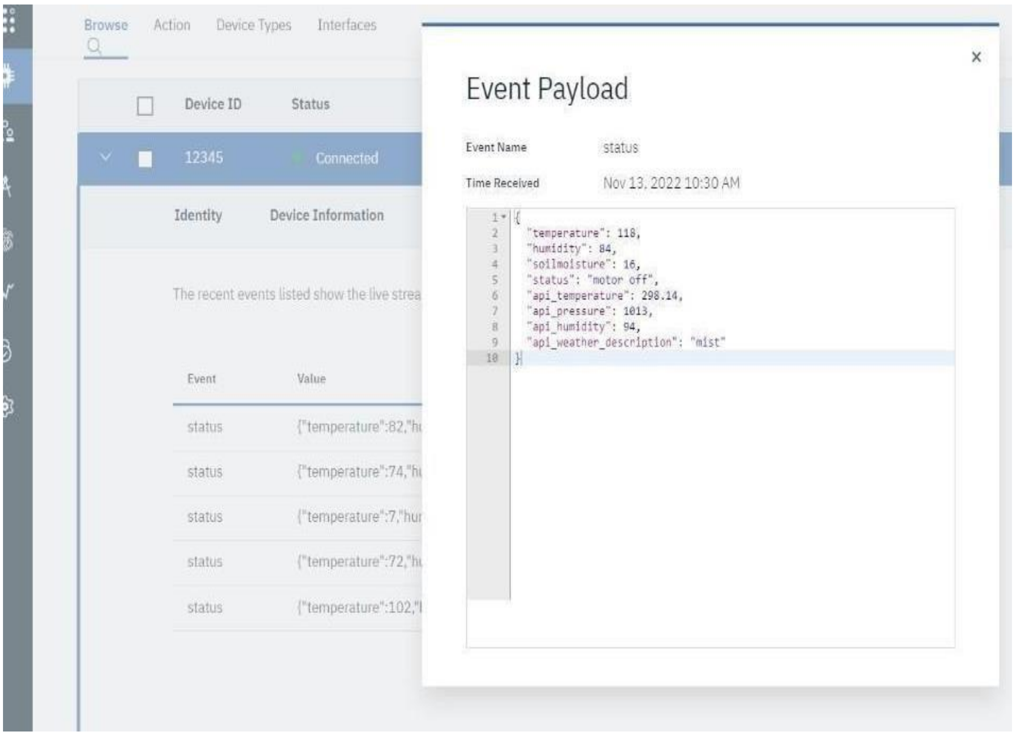


9sg3zy.internetofthings.ibmcloud.com/dashboard/devices/browse
IBM Watson IoT Platform
211719106094@smartinternz.com
ID: 9sg3zy
Browse
Action
Device Types
Interfaces
Add Device

Device ID	Status	Device Type	Class ID	Date Added
12345	Disconnected	NodeMCU	Device	Nov 14, 2022 9:03 PM

Device ID	12345
Device Type	NodeMCU
Date Added	Nov 14, 2022 9:03 PM
Added By	211719106094@smartinternz.com
Connection Status	Disconnected

Items per page 50 | 1–1 of 1 item   1 of 1 page



Device ID	Status
12345	Connected

The recent events listed show the live strea

Event	Value
status	{"temperature":82,"h
status	{"temperature":74,"h
status	{"temperature":7,"hur
status	{"temperature":72,"h
status	{"temperature":102,"

Event Payload

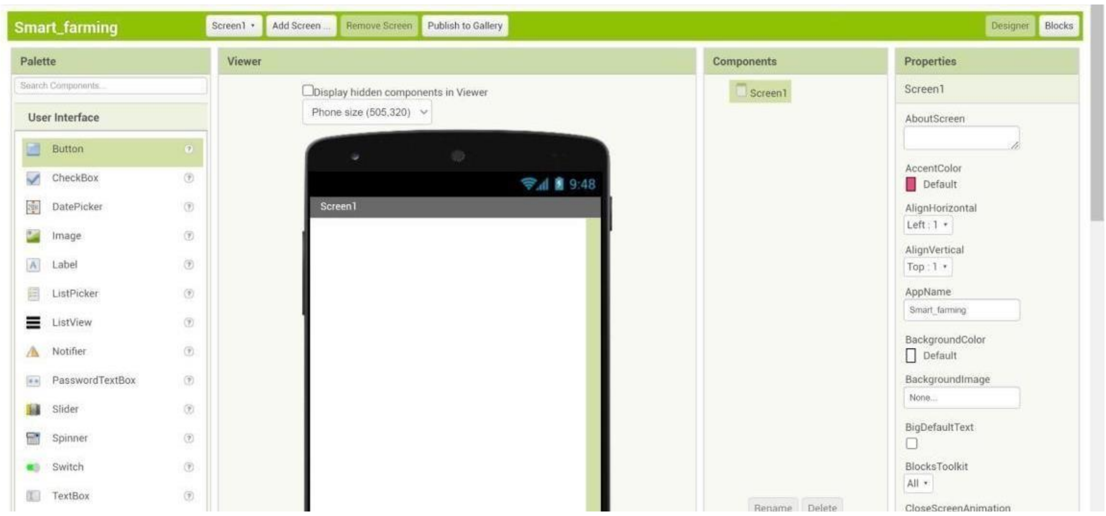
Event Name status

Time Received Nov 13, 2022 10:30 AM

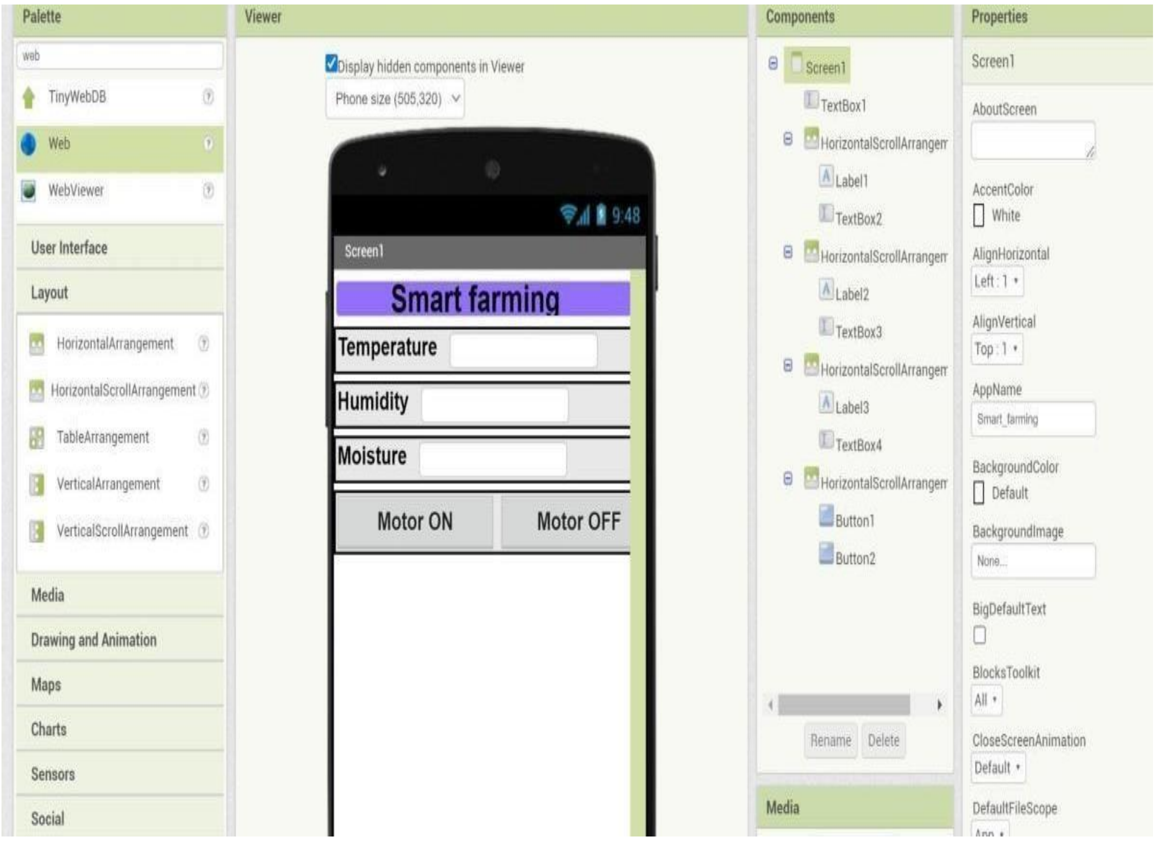
```
{
  "temperature": 118,
  "humidity": 84,
  "soilmoisture": 16,
  "status": "motor off",
  "api_temperature": 298.14,
  "api_pressure": 1013,
  "api_humidity": 94,
  "api_weather_description": "mist"
}
```

MIT APP INVENTOR

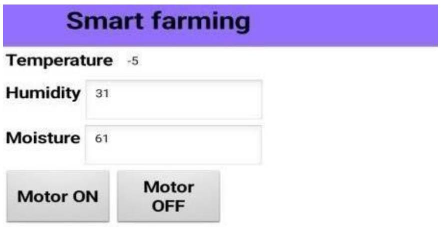
Step 1: Login Into MIT App Inventor



Step 2: Create Your User Interface By Using the Preset Tools



Step 3: Live Output In Mobile Application


Smart farming

Temperature -5

Humidity 31

Moisture 61

Advantages :

A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labor-intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed. For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor- driven hardware become the next logical step. Various sensors will help to increase the productivity and customers can be benifeted

Disadvantages:

- Cost
- Reliability
- Increased channel maintenance

CONCLUSION:

IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing . 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 report 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.*

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 full-fledged Agriculture Precision ready product

APPENDIX

https://github.com/IBM-EPBL/IBM-Project-22516-1659853453

DEMO VIDEO LINK

https://drive.google.com/file/d/1DW9RyOOi1rtYXc3rvsqPISHeXZuHZNYM/view?usp=drivesdk