SMART FARMING APPLICATION

Project Report

1.Introduction:

1.1 Project overview:

Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of Things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants. It gives better control to the farmers for their livestock, growing crops, cutting costs, and resources.

1.2 Purpose:

We have tried to focus on different scientific applications which could be put together in the 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 assessing the basic condition of the field. This is the project from the motivation of the farmers working in the

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

2.literature survey:

2.1 Existing Problem:

Agriculture is the foundation of our Nation. In the past, agriculturists used to figure out the ripeness of soil and influenced presumptions to develop which kind of product. They didn't think about the dampness, level of water and especially climate conditions which are more horrifying to an agriculturist. They utilize pesticides in view of a few suspicions which lead a genuine impact to the yield if the supposition isn't right. Profitability relies upon the last phase of the harvest on which agriculturists depend.

2.2 References:

[1] S. S. Gill, I. Chana, C. Science, and R. Buyya, "IoT Based Agriculture as aCloud and Big Data Service: The Beginning of Digital India," vol. 29, no. 4, pp. 1–23, 2017.

[2] R. K. Kodali and A. Sahu, "An IoT based Weather Information Prototype Using WeMos," no. 1, pp. 612–616, 2016.

[3] I. Mat, M. Rawidean, M. Kassim, A. N. Harun, I. M. Yusoff, and M. Berhad, "Smart Agriculture Using Internet of Things," 2018 IEEE Conf. Open Syst., pp. 54–59, 2018.

[4] S. R. Prathibha, A. Hongal, and M. P. Jyothi, "IOT BASED MONITORING SYSTEM IN SMART AGRICULTURE," pp. 5–8, 2017.

[5] Y. Bo and H. Wang, "The Application of Cloud Computing and The Internet of Things in Agriculture and Forestry," pp. 168–172, 2011.

[6] Tien Cao Huang and Can Nguyen Duy, "Environment Monitoring for Agricultural Application Based on Wireless Sensor Network.", April 16-17.

[7] M. K. Gayatri, "Providing Smart Agricultural Solutions to Farmers for better yielding using IoT," no. Tiar, pp. 40–43, 2015.

[8] S. V. Mukherji, R. Sinha, S. Basak, and S. P. Kar, "Smart Agriculture using Internet of Things and MQTT Protocol," 2019 Int. Co

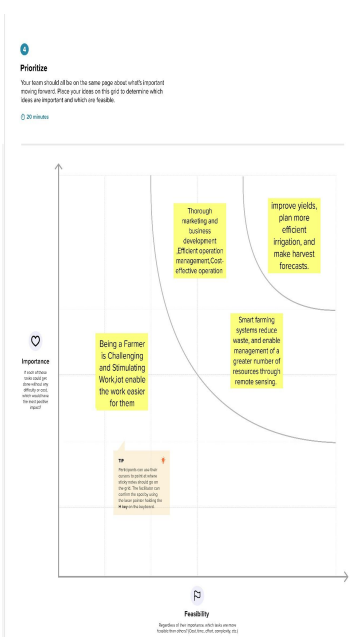## 2.3 Problem Statement Definition:

The researcher is supposed to implement an "IoT Based Smart Farming System" with various sensors, which will help to collect the data and analyse it. The proposed system collects information about different agricultural parameters (temperature, humidity, moisture) using an IoT sensor. These values collected are then sent over the mobile via SMS. Farmers can view all the parameters required for a smart farming system through the webpage.

3. IDEATION AND PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

Develop shared understanding and empathy

Summarize the data you have gathered related to the people that are impacted by your work. It will help you generate ideas, prioritize features, or discuss decisions.

WHO are we empathizing with?
Who is the person we want to understand?
What is the situation they are in?
What is their role in the situation?

Farmer's problems with farming

Reduced production due to lack in technical data

GOAL

What do they need to DO?
What do they need to do differently?
What job(s) do they want or need to get done?
What decision(s) do they need to make?
How will we know they were successful?

What do they HEAR?
What are they hearing others say?
What are they hearing from friends?
What are they hearing from colleagues?
What are they hearing second hand?

using old farming methods is time consuming and resource much

By using up to date technologies, chance of getting high productivity

this can be more beneficial and comfortable to farmers

What do they THINK and FEEL?

PAINS
What are their fears, frustrations, and anxieties?

Tired of Bugs and Insects

Most of the plants die in winter

GAINS
What are their wants, needs, hopes, and dreams?

Efforts made are worth for time

Visible progress of the Plants

What other thoughts and feelings might influence their behavior?

Increased Pesticides and Chemicals harms the farmland

When plants don't grow well they can google for solutions

can see the visible growth

Resource full place and place for new experiments

What do they SEE?
What do they see in the marketplace?
What do they see in their immediate environment?
What do they see others saying and doing?
What are they watching and reading?

What do they SAY?
What have we heard them say?
What can we imagine them saying?

Time consuming Require lot of effort & Don't Know which pesticides to use

good harvest and new learning experience

What do they DO?
What do they do today?
What behavior have we observed?
What can we imagine them doing?

Farmers can get immediate information about the field

comfortable practically applicable and sustainable

To think about monitoring of plants

3.2 Ideation & Brainstorming:

1 Define your problem statement
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

Stay in topic.
Defer judgment.
Go for volume.
Encourage wild ideas.
Listen to others.
If possible, be visual.

In traditional farming methods, it was a mainstay for the farmer to be out in the field, constantly monitoring the land and condition of crops, but using IOT or smart technologies it can be avoided .

2 Brainstorm

3 Group ideas

Enables the farming easy and effective to reduce the starving of each and every human, IoT in agriculture can make use of robots, drones, remote sensors, and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money.

4 Prioritize
Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

Thorough marketing and business development ,Efficient operation management,Cost-effective operation

improve yields, plan more efficient irrigation, and make harvest forecasts.

Smart farming systems reduce waste, and enable management of a greater number of resources through remote sensing.

Importance

Being a Farmer is Challenging and Stimulating Work,Iot enable the work easier for them

Feasibility

3.2 Proposed Solution:

To improve the efficiency of the product thereby supporting both rancher and country we need to utilize the innovation which appraises the nature of harvest and gives recommendations. The Internet of things (IOT) is revamping agribusiness, engaging farmers by a 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 the agriculture field area and are being logged and stored online using cloud computing and Internet of Things. By using wireless transmission, the sensed data is forwarded towards the web server database. If irrigation is automated, then that means if the moisture and temperature fields fall below the potential range. The user can monitor and control the system remotely with the help of an application which provides a web interface to the user.

3.4 Problem Solution fit:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper	Explore AS, differentiate
	The customer for this product is a farmer who grows crops. Our goal is to help them, monitor field parameters remotely. This product saves agriculture from extinction.	Using a large number of sensors is difficult. An unlimited or continuous internet connection is required for success.	The irrigation process is automated using IoT. Meteorological data and field parameters were collected and processed to automate the irrigation process. Disadvantages are efficiency only over short distances, and difficult data storage.	
Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job?	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace).	Focus on J&P, tap into BE, understand RC
	The purpose of this product is to use sensors to acquire various field parameters and process them using a central processing system. The cloud is used to store and transmit data using IoT. The Weather API is used to help farmers make decisions. Farmers can make decisions through mobile applications.	Frequent changes and unpredictable weather and climate made it difficult for farmers to engage in agriculture. These factors play an important role in deciding whether to water your plants. Fields are difficult to monitor when the farmer is not at the field, leading to crop damage.	Use a proper drainage system to overcome the effects of excess water from heavy rain. Use of hybrid plants that are resistant to pests.	

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 Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop diseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of live stock conditions

4.2 Non-Functional requirements:

FR No.	Non-Functional Requirement	Description
FR-1	Usability	The application must be useful to all sorts of people, Its complexity level should be low and should be usable by uneducated farmers. It should be simple rather than confusing
FR-2	Security	Since it involves cloud storage of gathered sensor data, which could be misused, Data handling must be highly secure.
FR-3	Reliability	Since it is used for remote monitoring, It can be used in cases where a single farmer is managing the entire farm, Data should be more accurate and should not be misleading.
FR-4	Performance	Highly effective monitoring, tracking, and recovery of farm assets, tracking range should be greater than at least 5km. Continuous readings on temperature,gas,humidity,pH,smoke detection ,water and fuel levels are necessary.
FR-5	Availability	It should monitor water level, fuel level, electric fence-theft monitoring, temperature, humidity, tractor guidance, GPS tags, soil moisture, and toxic gases.
FR-6	Scalability	It should be made used in remote areas where technological

5. PROJECT DESIGN

5.1 Data Flow Diagrams:
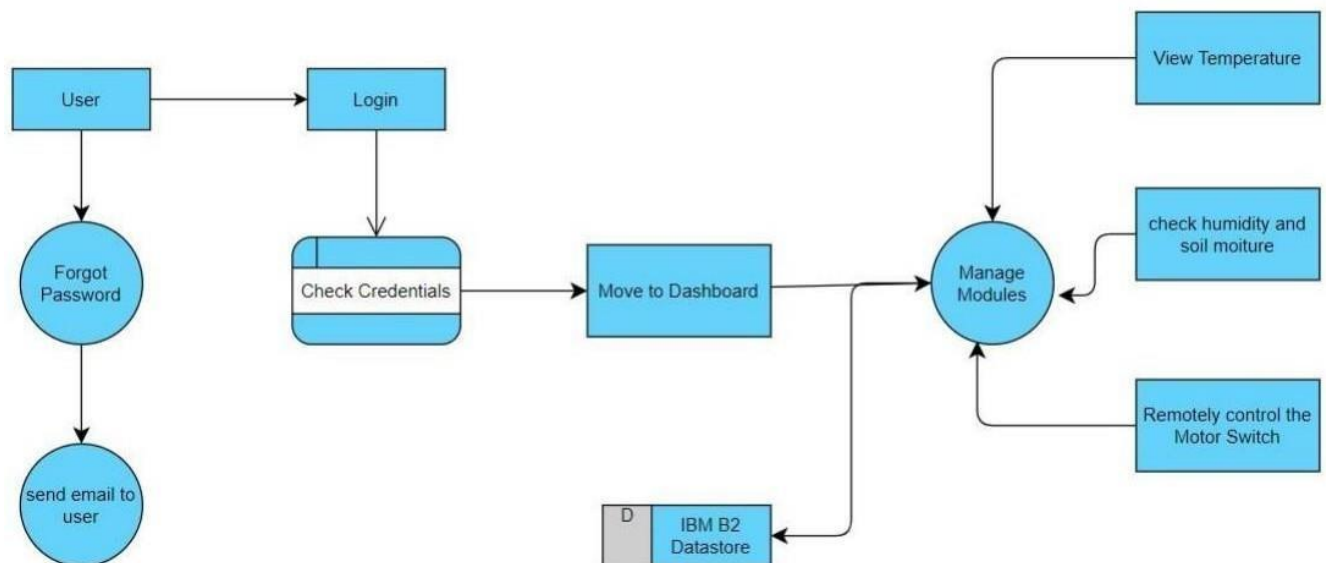
5.2 Solution & Technical Architecture:

- IoT-based agriculture systems help the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors.

- Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for farmers.

- They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

Technical Architecture Project

Flow:
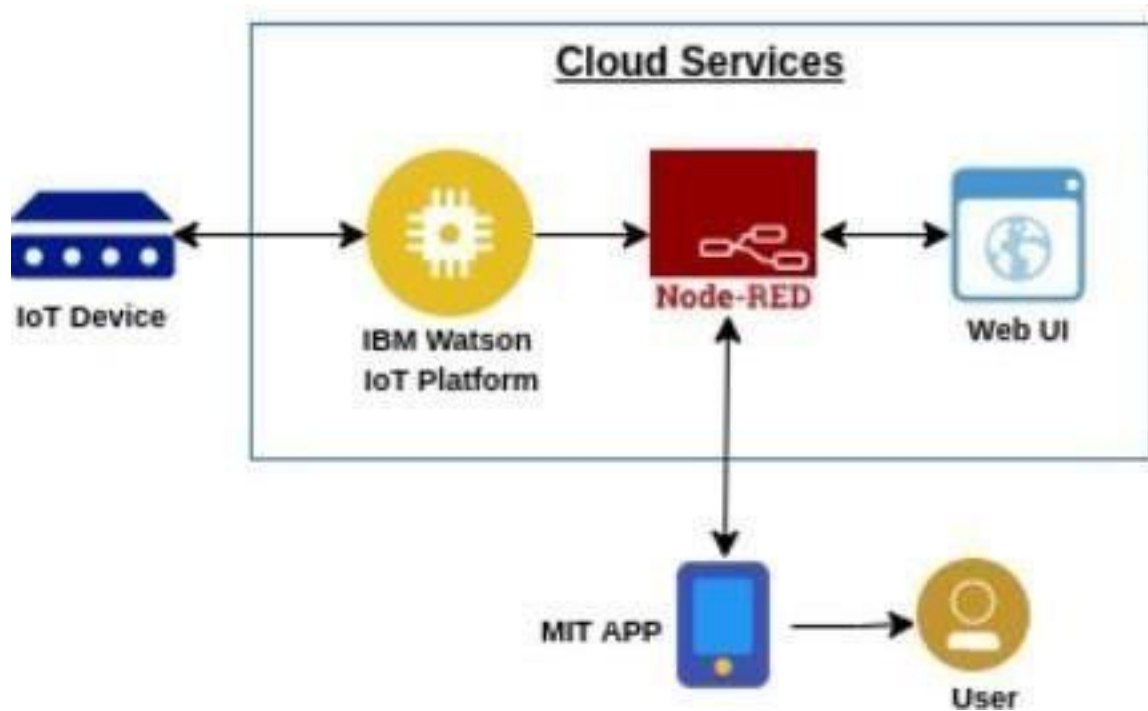
- The parameters like temperature, humidity, and soil moisture are updated to the Watson IoT platform

- The device will subscribe to the commands from the mobile application and control the motors accordingly

- APIs are developed using Node-RED service for communicating with Mobile Application

- A mobile application is developed using the MIT App inventor to monitor the sensor parameters and control the motors.

- To accomplish this, we must complete all the activities and tasks listed below:

- Create and configure IBM Cloud Services

- Create a device & configure the IBM IoT Platform

- Create Node-RED service

- Create a database in Cloudant DB to store all the sensor parameters

- Develop a python script to publish and subscribe to the IBM IoT platform

- Configure the Node-RED and create APIs for communicating with mobile application

- Develop a mobile application to display the sensor parameters and control the motors

5.3 User Stories:

List of all the user stories for the Smart farming application are as follows:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Farmer-Mobile user	End User-Mobile app	USN-1	I have to check the temperature value of my field.	Click on the button to view the temperature.	High	Sprint-1
		USN-2 I	I have to monitor the soil moisture content near my crops.	Click on the button to view the moisture content	High	Sprint-1
		USN-3 I	I have to measure the humidity conditions for crop storage.	Click on the button to view the crop storage..	Low	Sprint-2
		USN-4 I	I have to measure the current temperature and compare it with previous temperature.	Click on the option to compare results.	Medium	Sprint-1
		USN-5	I have to visualize the graph of crop production.	Click on the graph button to visualize the results.	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING 6.1 Sprint Planning & Estimation:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my Gmail, email then you can received the OTP or Verification Code.	2	High	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
Sprint-1		USN-2	As a user, I will receive confirmation Gmail or email once I have registered for the application.	1	High	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
Sprint-2		USN-3	As a user, I can register for the application through Gmail and phone number.	2	Low	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	Gayathri V Mahalakshmi I Kalpitha E Harshitha G

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
	Dashboard	USN-6	Once confirmation message received after login the system and Check Credentials Once check the credentials after go to the Manage modules.	2	High	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
		USN-7	In this manage modules described the below functions like Manage System Admins Manage Roles of User Manage User permission and etc..	2	Medium	Gayathri V Mahalakshmi I Kalpitha E Harshitha G
	Logout	USN-8	Then check Temperature, humidity and moisture after then logout or exist the application.	1	Medium	Gayathri V Mahalakshmi I Kalpitha E Harshitha G

6.2 Sprint Delivery Schedule:

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1	Understanding the project	Assign ed the team Members after that create repository in the GitHub and then assign task to each member and guide them how to access the GitHub while submitting the assignments	1 week
2	Staring The Project	We the Team Members were Assigned all the Tasks Based on Sprints and Work on It Accordingly	1 week
3	Completing Every Task	Team Leader should ensure that whether every team member have completed the assigned task or not	1 week
4	Stand Up Meetings	Team Lead Must Have a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session	1 week
5	Deadline	Ensure that team members are completing every task within the deadline	1 week
6	Budget and Scope of project	Analyze the overall budget which must be 1 week within certain limit it should be favorable to every person	1 week

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

PYTHON CODE:

To develop the python code to publish and subscribe to the commands from the IBM cloud.

PROGRAM:

```
import time

import sys

import ibmiotf.application

import ibmiotf.device import

random


#Provide your IBM Watson Device Credentials

organization = "olwipo" deviceType = "abcd"

deviceId = "12345" authMethod = "token"

authToken =

"12345678"


#   Initialize   GPIO   def   myCommandCallback(cmd):
print("Command received:

     %s" % cmd.data['command']) m=cmd.data['command']


     if (m=="motoron"):
```

```python
        print ("motor is switched on") elif
        (m=="motoroff"): print ("motor is
        switched off") else :
        print ("please send proper command")

try: deviceOptions = {"org": organization, "type": deviceType, "id":
    deviceId, "auth-method": authMethod, "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
        #...........................................

except Exception as e:

        print("Caught exception connecting device: %s" % str(e)) sys.exit()


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

        while True:

                #Get Sensor Data from DHT11

                moist=random.randint(0,100) temp=random.randint(-
                20,125) Humid=random.randint(0,100) data =

                { 'moist' : moist , 'temp' : temp ,'Humid': Humid}

                #print     data  def myOnPublishCallback():

                print ("Published moist = %s C" % moist, "temp= %s %%" %
        temp, "Humid = %s %%" % Humid, "to IBM Watson")


                    success = deviceCli.publishEvent("IoTSensor", "json", data,
```

```
qos=0, on_publish=myOnPublishCallback)
    if not success: print("Not connected
    to IoTSensor") time.sleep(10)


    deviceCli.commandCallback = myCommandCallback
```

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

7.1 Feature 1 - SOIL MOISTURE DETECTION
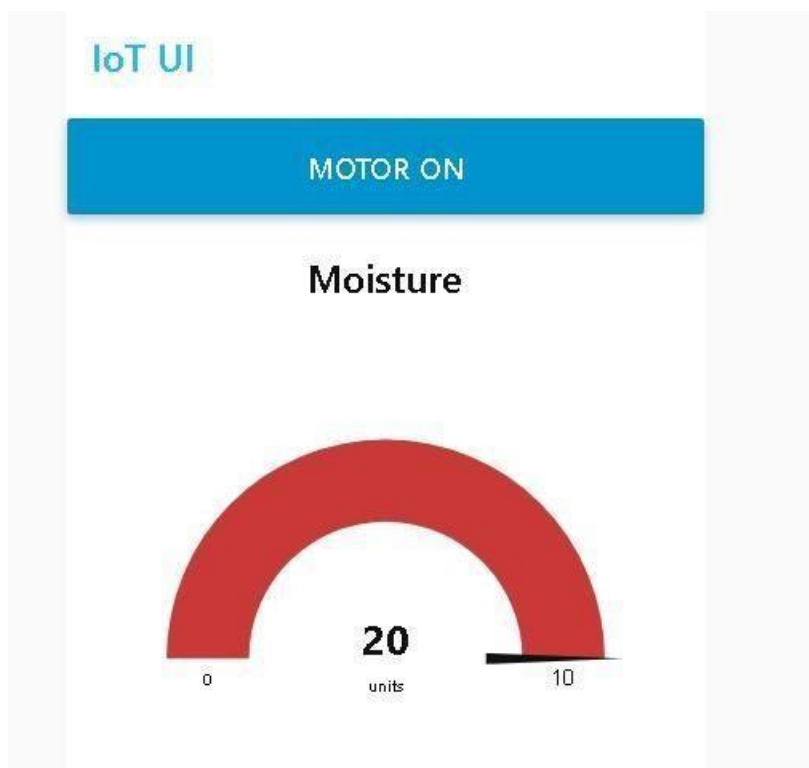
7.2 Feature 2 - HUMIDITY DETECTION
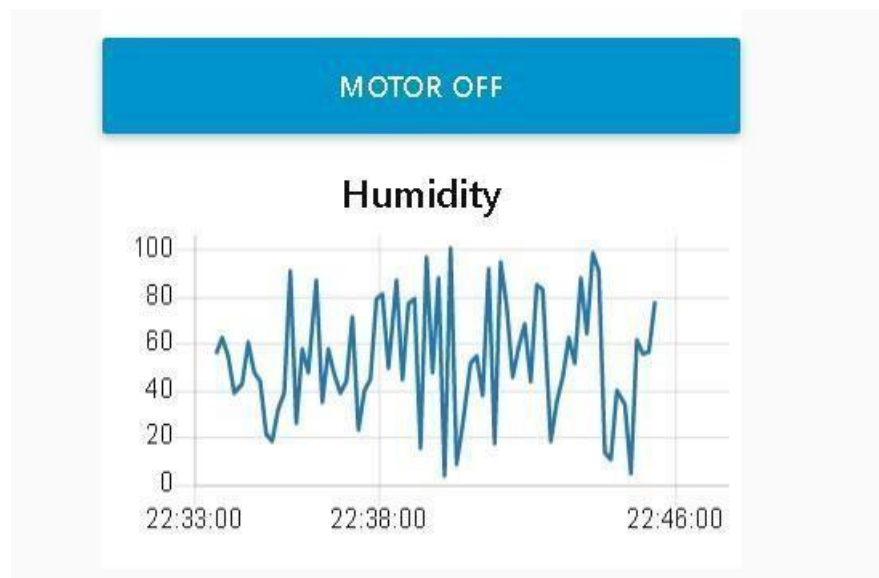
7.3 Feature 3 - TEMPERATURE DETECTION
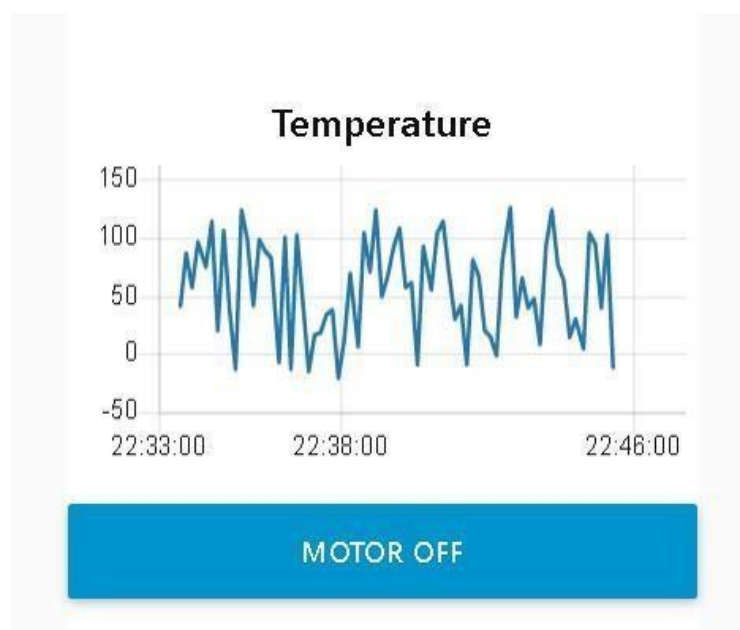
7.4 Feature 4 - MOTOR ON AND OFF
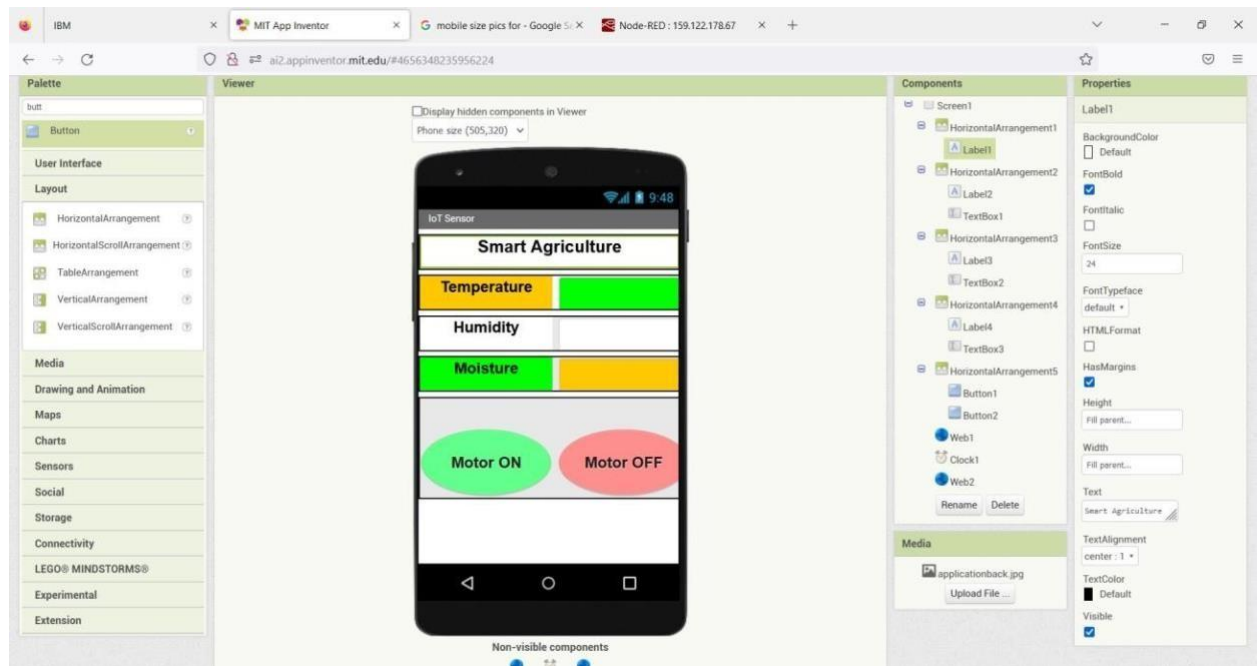
8. TESTING

8.1 Test Cases:

1. IBM Watson IOT service:

To create an IBM Watson IOT service Steps to create an IBM Watson IOT service: and create a device using it.

● Click on catalog in IBM cloud account.

● Click on services.

● Enter as an Internet of things platform.

● Enter region and pricing plan.

● Enter service name and click create.

● Click on launch.

● Then IBM Watson OT platform opens.

● Click on sign in.
● Enter IBM Id.

● Enter Password.

● Then you can access IBM Watson IOT platform.

Steps to create a device:

● Click on devices in IBM Watson IOT platform.

● Choose to create a device● Enter the device type as abcd.

● Enter the device ID as 12345.

● Click next.

● Enter device credentials (optional).

● Click next.

● Enter the authentication token as 12345678.

● Click on continue.

● Click on next.

● Click finish Device is created successfully, and we can see device credential

2. Creation of Node – Red Service:

To create a Node Red service.

Steps to create a Node-Red service:
● Click on catalog in IBM cloud account.

● Click on services.

- Enter the Node red service.

- Node red app opens click on get started.

- Enter app name as default.

- Enter the region as London.

- Choose a pricing plan as lite.

- Click create.

- You will be redirected to a new page.

- Click on deploy your app.

- Choose cloud foundry.

- Enter IBM API key (by clicking new+).

- Choose memory size as default.

- Enter the region as London.

- Click next.

- Click create.

- Status will be updated after creation.

- Click on App URL.

- Click next.

- Choose not recommended.

- Click next.

- You will see the Node red page.

- Go to your node red flow editor.

- In the left panel choose nodes

8.2 User Acceptance Testing:

9. RESULTS:

The yield appearing beneath signifies the temperature, soil moisture and humidity data received from the IoT simulator sensor and open weather API. The web app displays all this data for the past one hour. There are a 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.

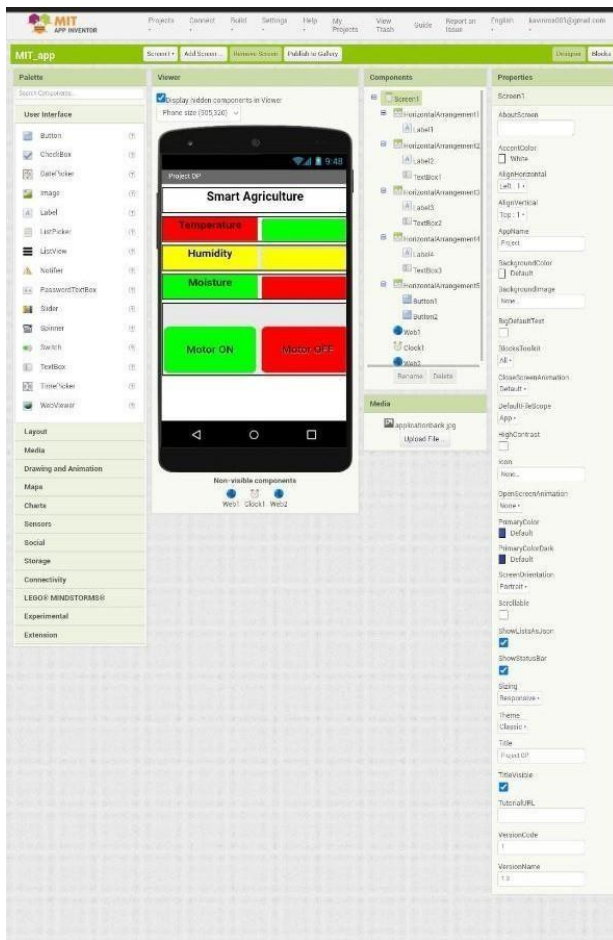## 9.1 Performance Metrics:

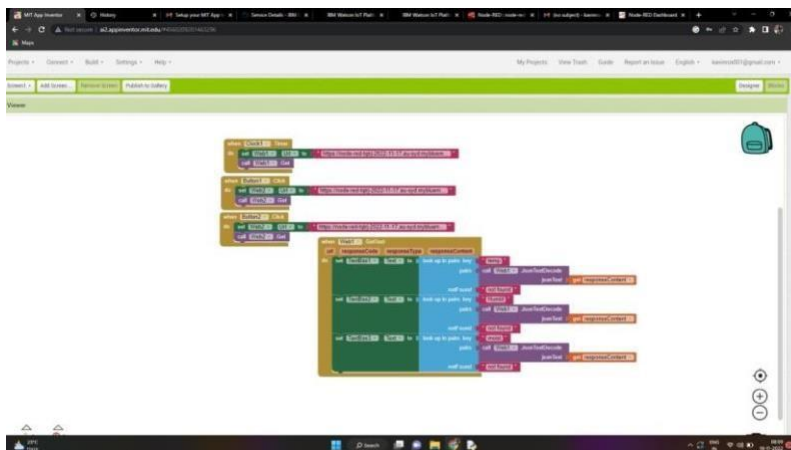### Python code Results:

IBM Watson-IOT Platform:

NODE-RED Flow:
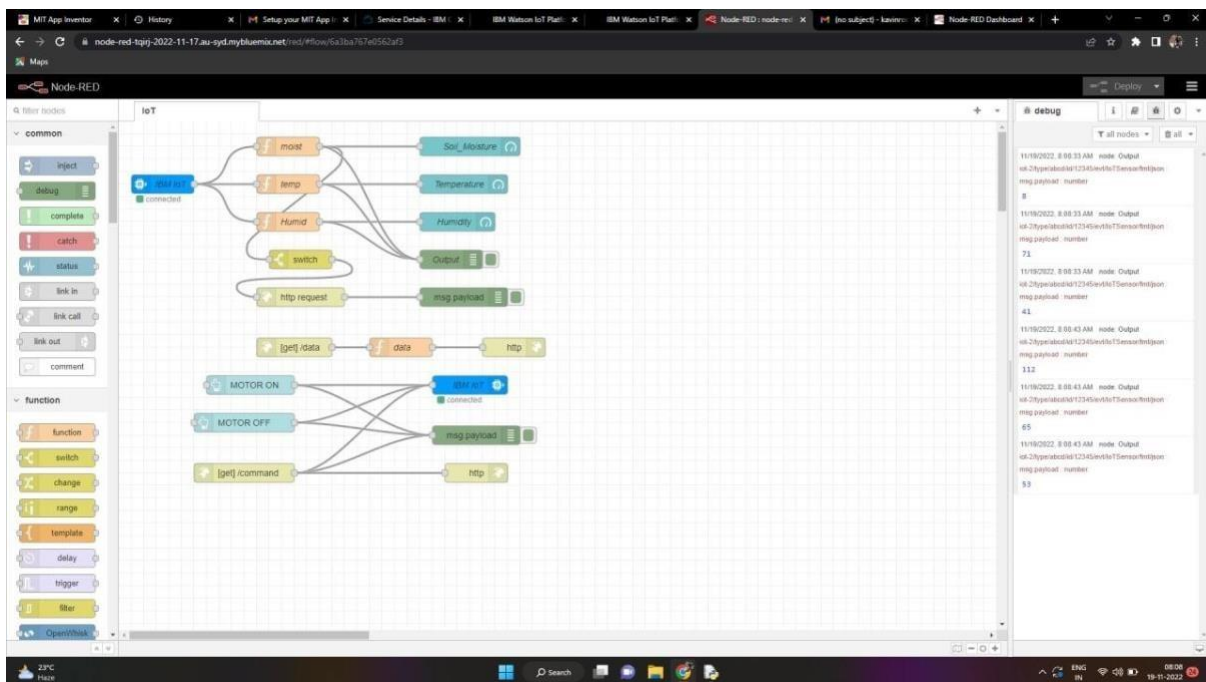
MIT App Inventor:

Blocks:

10. ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

1.   Communicating the device at a larger distance through web application. It will play an important role in reducing the manpower and traveling expenses of a farmer.

2.   Monitoring parameters like temperature, humidity etc. will play an important role in improving the growth of the plant.

3.   Integrating the weather station to the web browser will provide the details of status of the cloud, wind speed etc. It will allow the farmer to protect their plants from natural calamities.

DISADVANTAGE:

1.   Since the real time sensor will be connected to the controller, the controller requires continuous supply of the internet to transfer the data.

2.   Non availability of weather prediction for a long period of time. Since the long weather prediction requires additional payment to open weather.

11. CONCLUSION:

IoT based SMART AGRICULTURE SYSTEM for Live Monitoring of Temperature and Soil Moisture and to control motor and light remotely have 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 a 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 systems to current strategies in this way making simple profitable and temperate trimming.

12. FUTURE SCOPE:

The project has vast scope in developing the system and making it more user friendly and the additional features of the system like:

- By installing a webcam in the system, photos of the crops can be captured and the data can be sent to a database.

- Speech based options can be implemented in the system for the people who are less literate.

- GPS (Global Positioning System) can be integrated to provide specific location of the farmer and more accurate weather reports of agriculture fields and gardens.

- Regional language features can be implemented to make it easy for the farmers who are aware of only their regional language.

13.APPENDIX:

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

#Provide your IBM Watson Device Credentials
organization = " olwipo " deviceType = "abcd"
deviceId = "12345" authMethod = "token"
authToken =
"12345678"

# Initialize GPIO
def   myCommandCallback(cmd):   print("Command
    received:    %s"    %    cmd.data['command'])
    status=cmd.data['command'] if status=="motoron":
        print ("motor is on")
    elif status == "motoroff":
        print ("motor is off")
    else    :    print ("please   send proper
        command")

try: deviceOptions = {"org": organization, "type": deviceType, "id":
deviceId, "auth-method": authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)

#..........................................

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
```

```
    sys.exit()

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

while True:
    #Get Sensor Data from DHT11

    temp=random.randint(90,110) Humid=random.randint(60,100)
    moist=random.randint(10,80)

    data = { 'temp' : temp, 'Humid': Humid, 'moist' : moist}
    #print     data  def myOnPublishCallback():
    print ("Published Temperature = %s C" % temp, "Humidity = %s
%%"          % Humid, "moisture = %s %%" % moist, "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()
DEMO LINK
```