RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI
Department of Information Technology

TITLE: SmartFarmer - IoT Enabled Smart Farming Application

TECHNOLOGY: INTERNET OF THINGS

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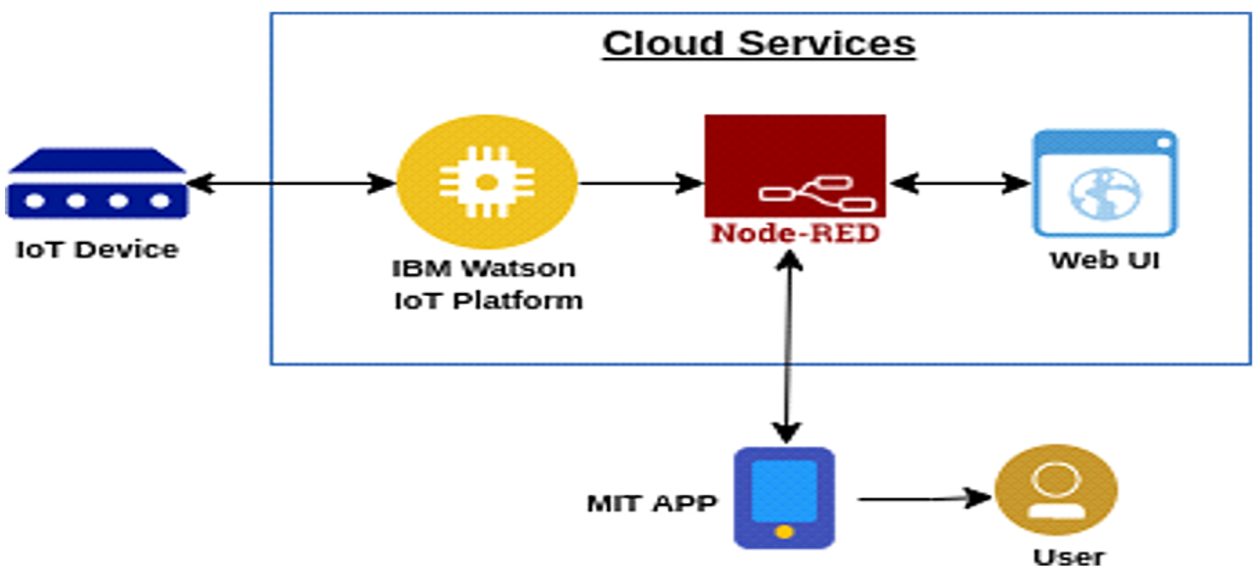
1. **INTRODUCTION**

• **Project Overview**

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, 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 the 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.



- **PURPOSE**

The smart agriculture model main aim to avoid water wastage in the irrigation process. It is low cost and efficient system Is shown below. It includes

NodeMCU, Arduino Nano, sensors like soil moisture and Dht11, solenoidvalves, relays.

2. LITERATURE SURVEY

- **Existing Problem**

The challenges of a smart agriculture system include the integration of these sensors and tying the sensor data to the analytics driving automation and response activities. When integrated, the use of data analytics can reduce the overall cost of agriculture and contribute to higher production from the same amount of area through precise control of water,fertilizer and light. Smart methods allow for

farming on smaller and more distributed lands through remote monitoring, whether indoor oroutdoor.

To successfully deploy a smart agriculture system, consider setting up a communications networkthat can integrate a limited number of sensors across a large area of farmland. This will require third-party network provisioning or setting up a private network consisting of access points and uplinks to a private backhaul network, which channels all the data traffic to centralized monitoring software or an analytics head-end system

a. It is nota secure system.
b. There is no motion detection for protection of agriculture field.
c. Automation is not available.

References

- ISSN No:-2456-2165 Volume 4, Issue 2 Feb – 2019: "Solars' Energy: - A safe and reliable, eco-friendly and sustainable Clean EnergyOption for Future India: - A Review."

- Universal Paper of advanced science and science and exploration technology. [2] GRD Journals- Global Research and Development Journal for Engineering | Volume 4 | Issue 3 | February (2019) ISSN: 2455-5703 “Design and Implementation of an AdvancedSecurity System for Farm Protection from Wild Animals”.
- International Journal of Innovationsin Engineering and Science, Impact Factor Value

4.046 e-ISSN: 2456-3463 Vol.4, No. 5, 2019 “Solar Powered Smart Fencing System for Agriculture Protection using GSM & Wireless Camera”.

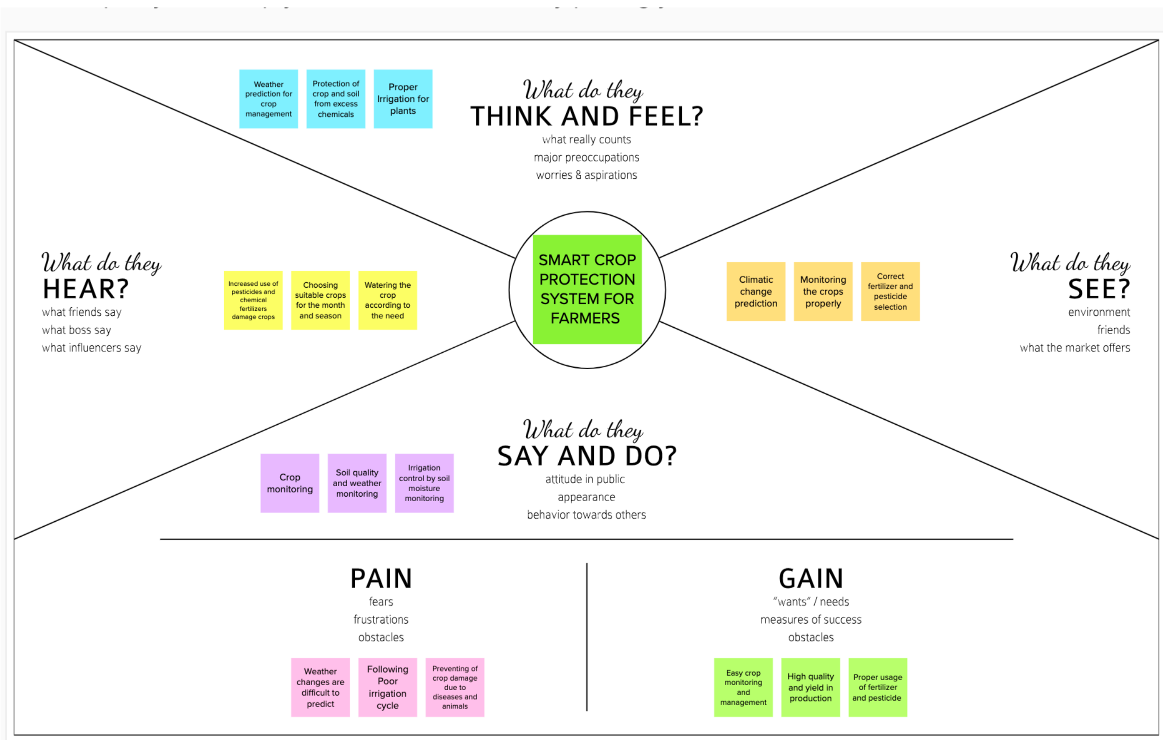
- International Journal of Management, Technology And Engineering ISSN NO : 2249- 7455 Volume 8, Issue VII, JULY/2018”Protecting Crops From Birds, Using Sound Technology In Agriculture” [5] American Journalof Engineering Research(AJER)2018 eISSN: 2320-0847 p- ISSN : 2320- 0936 Volume-7, Issue-7, pp-326-330 “Moisture Sensing Automatic Plant Watering System Using Arduino Uno”.

Problem StatementDefinition

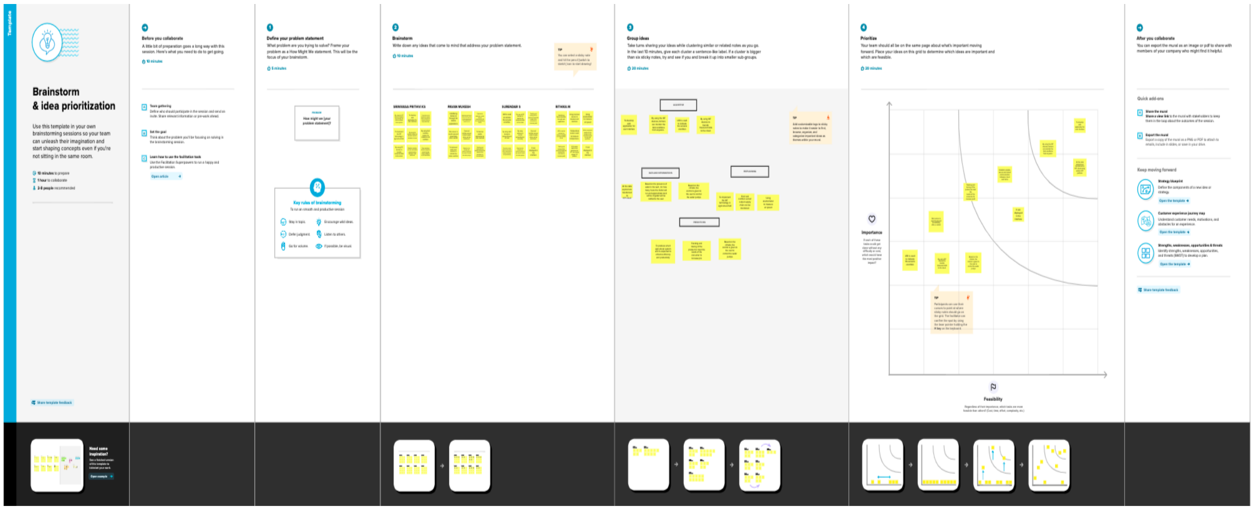
The soil moisturesensor measures wetnesscontent in the soil. The Arduino UNO microcontroller used to receiveinput from a various sensorsand it can be controlled automatically. When soil moisture sensor goes low the water pump will be on and it exceeds defined levels of the water motor will turn off automatically. We can constantly monitor the growth of a crop using ultrasonic sensor. PIR sensor detects the motion or unusual movement in the agricultural land. This device his very helpful to the former to monitorand control environmental parameters at their field. The farmers did not go to theirfield, they can remotely monitor and controlusing cloud.

3. IDEATION & PROPOSED SOLUTION

- Empathy Map Canvas



• Ideation and Brainstorming



Introduction on Internet of Things (IoT), application of IoT in agricultural field to improve the yield and quality by reducing the cost is provided. The sensors which are used in the architecture are discussed briefly and the process of transmission of data from the agriculture field to the central system is explained. The proposed system advantages are included. In addition, open research issues, challenges, and future ofIoT in agricultural field are highlighted. The concept is basically developed on an idea, where there are numerous things or objects - such as Arduino, sensors, GSM models, LCD display, etc., that are connected with the Internet. Each of the objects has a different address and is able to interact with other items. The things or objects co- operate with each other to reach a common goal.

We are going to construct a smart agricultural monitoring system which can collect crucial agricultural data and send it to an IoT platform called Thingspeak in real time where the data can be logged and analyzed. The logged data on Thingspeak is in graphical format, a botanist or a reasonably knowledged farmer can analyze the data (from anywhere in the world) to make sensible changes in the supplied resources (tocrops) to obtain high qualityyield.

Smart agriculture monitoring system or simply smart farmingis an emerging technology concept where data from several agricultural fields ranging from small to large scale and its surrounding are collected using smart electronic sensors. The collecteddata are analyzedby experts and local farmers to draw short term and long-term conclusion on weather pattern, soil fertility, current quality of crops, amount of water that will be required for next week to a month etc.

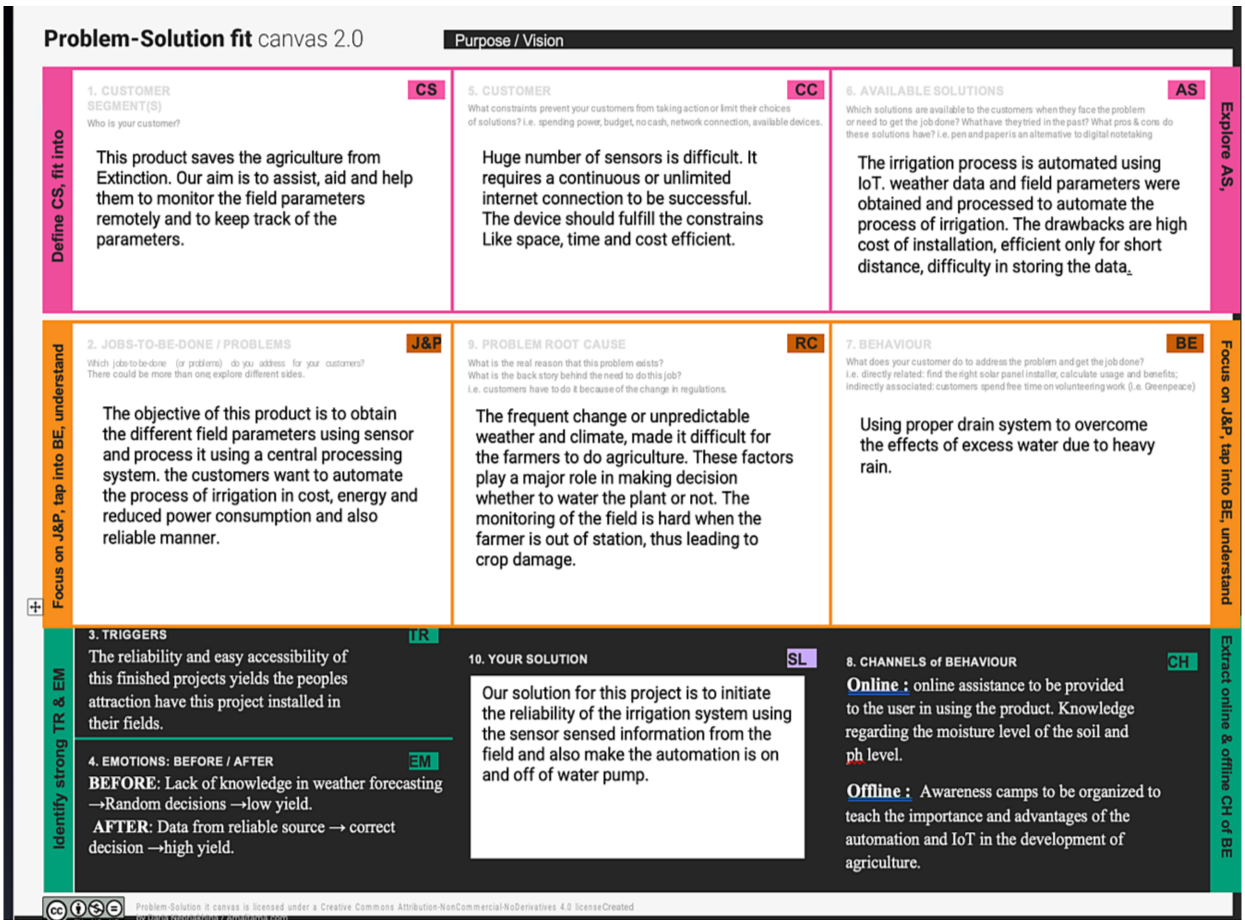
We can take smart farming a step further by automating several arts of farming, for example smart irrigation and water management. We can apply predictive algorithms on microcontrollers or SoC to calculate the amount of water that will be required today fora particular agriculture field. Say, if there was rain yesterday and the quantity of water required today is going to be less. Similarly, if humidity was high the evaporation of water at upper ground level is going to be less, so water required will be less than normal, thus reducing water usage.

1. **Proposed Solution -**

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	IoT Based Smart Farming System with various sensors which will help to collect the data and analyse it. The proposed system collects information n related to farm. Information related to Soil moisture, Temperature and Humidity content These values collected are then sent over the mobile . Farmers can view all the parameters required for a smart farming system through the webpage.
2.	Idea / Solution description	Smart Agricultural System solutions provide an integrated IoT platform in agriculture that allows farmers to leverage sensors, smart gateways and monitoring systems to collect information, control various parameters on their farms and analyse real-time data in order to make informed decisions.
3.	Novelty / Uniqueness	It depends on IOT thus eliminating the need of physical work of farmers and thus increasing the productivity in every possible manner. The weather data are taken from the reliable source.
4.	Social Impact / Customer Satisfaction	Reduces the wages for labours who work in the agricultural field. It saves a lot of time. IoT can help improve customer relationships by enhancing the customer's overall experience.
5.	Business Model (Revenue Model)	A monthly subscription is charged to farmers for prediction and suggesting the irrigation timing based on sensors parameters like temperature, humidity, soil moisture.

6.	Scalability of the Solution	Automatic farming equipment adjustment is made feasible by integrating information such as crops/weather and equipment to automatically alter temperature, humidity, and so on. With the use of sensors, it has enabled farmers to reduce waste and increase output.

2.Problem solution fit



3.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	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Log in to system	Check Credentials Check Roles of Access.
FR-4	Manage Modules	Manage System Admins Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Log out	Exit

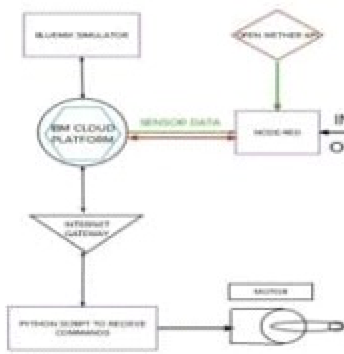
PRODUCT DESIGN

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.

1. The different soil parameters temperature, soil moistures and then humidity are sensed using different sensorsand obtained value is stored in the IBMcloud.
2. Arduino UNO is used as a processing Unit that process the data obtained from thesensors and whether data from the weatherAPI.
3. NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTTprotocol is followedfor the communication.
4. All the collected data are provided to the user through a mobile application

thatwas developed using the MIT app inventor. The user could plan throughan app, weatherto water the crop or not depending upon the sensor values. By using the app they can remotely operate to the motor switch.



DFD 0 FLOW SMART FAMING APPLICATION USING IOT

Solution and Technical Architecture

The Deliverable shall include the architectural diagram as below and the information as per thetable1 & table 2 Guidelines:

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2. Arduino UNO is used as a processing Unit that process the data obtained from thesensorsand whether data from the weather API.
3. NODE-RED is used as a programming tool to write the hardware, software, andAPIs.The MQTT protocol is followed for the communication.
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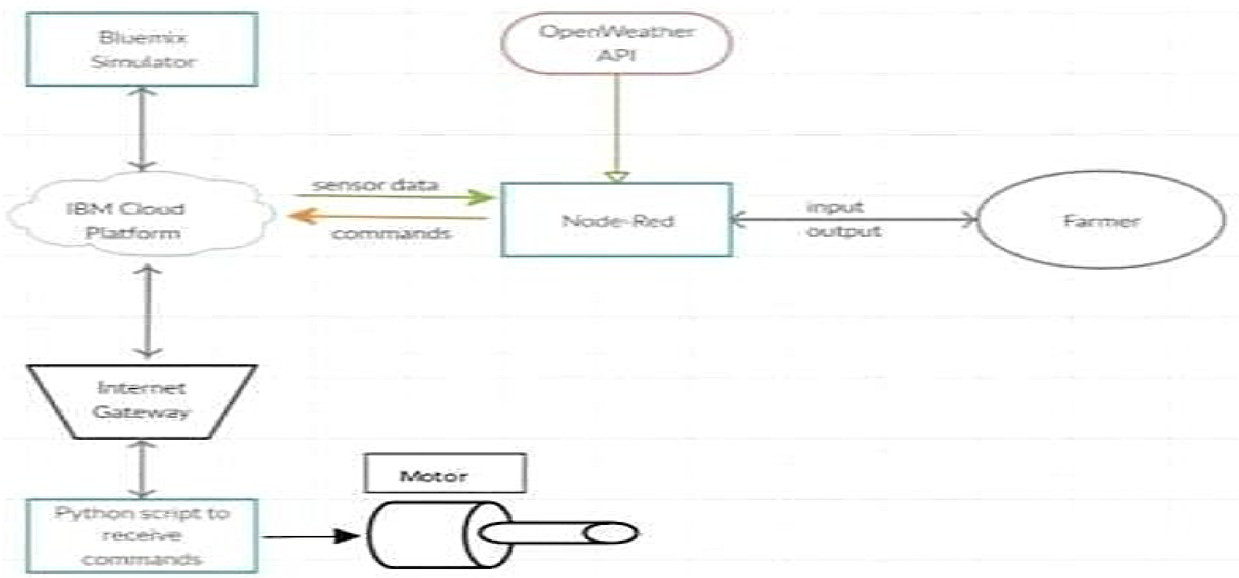


6. PROJECT PLANNING AND SCHEDULING

Sprint	Functional Requirement(Epic)	User Story Number	User Story/ Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensorsand Arduino withpython code	2	High	Pavan Mukesh Srinivasa prithvi KS
Sprint-2	Software	USN-2	Creating device in the IBM WatsonIoT platform, workflow for IoTscenarios using Node-Red	2	High	Srinivasa prithvi KSPavan Mukesh Surendar S Rithika M
Sprint-3	MIT AppInventor	USN-3	Develop an application for the Smart farmerproject using MITAppInventor	2	High	Surendar S

Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Rithika M
Sprint-4	Web UI	USN-4	To make the userto interact withsoftware.	2	High	Srinivasa prithvi KSPavan Mukesh Surendar S Rithika M

7. CODING AND SOLUTIONING

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random

organization = "1yc3ld"

deviceType = "SSPR"

deviceId = "12345"

authMethod = "use-token-auth"


authToken = "12345678"

def myCommandCallback(cmd):

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

    status=cmd.data['command']

    if status=="motoron":

        print ("motor is on")

    else :
```

```
        print ("motor is off")
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()
deviceCli.connect()


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


        data = { 'temp' : temp, 'Humid': Humid }


        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "to IBM Watson")


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

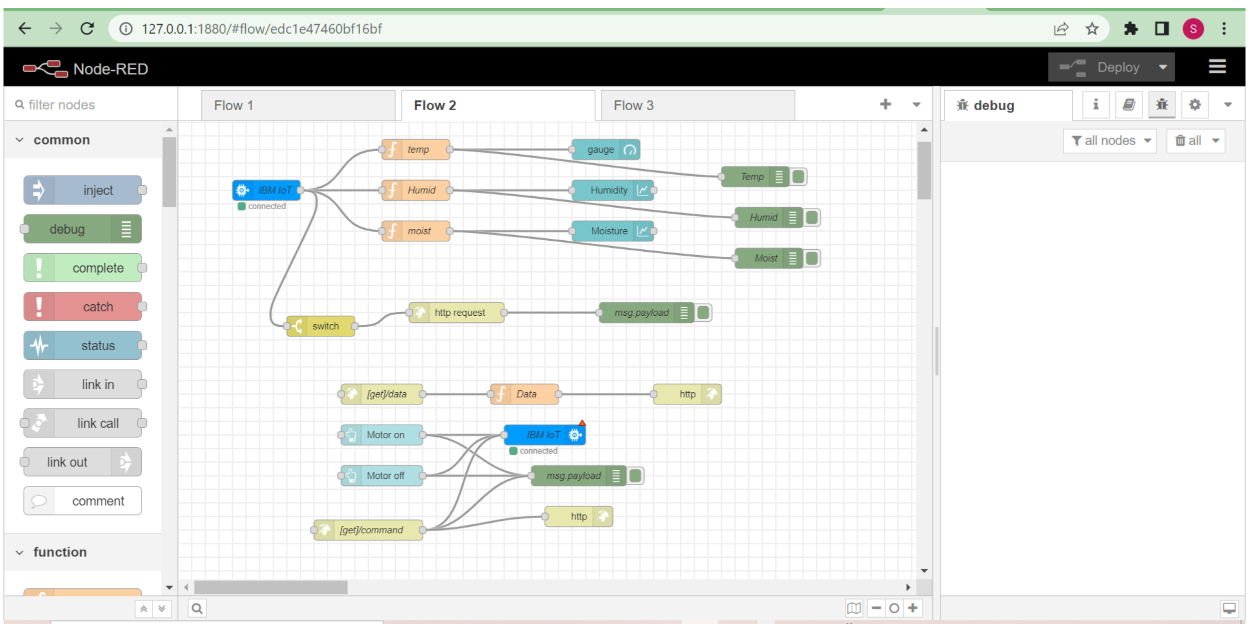
deviceCli.commandCallback = myCommandCallback

deviceCli.disconnect()

8. TESTING

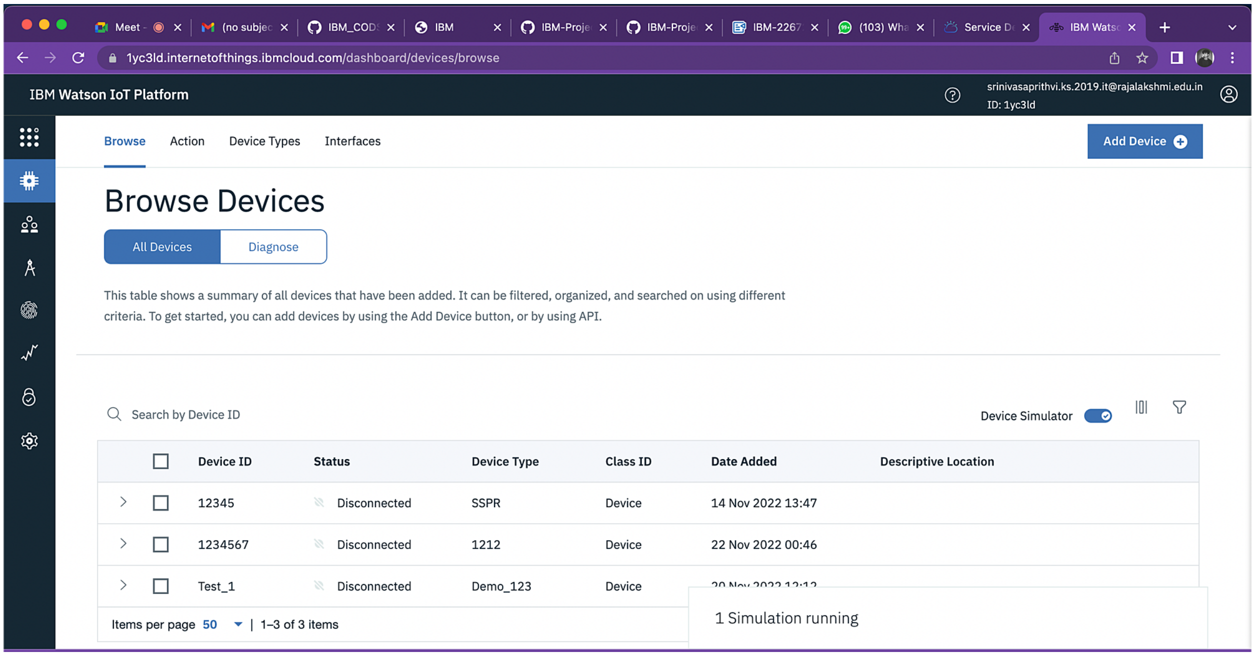
- **Test case**

Web application using Node Red



Iot WatsonPlatform

Device creation and connection to node-red



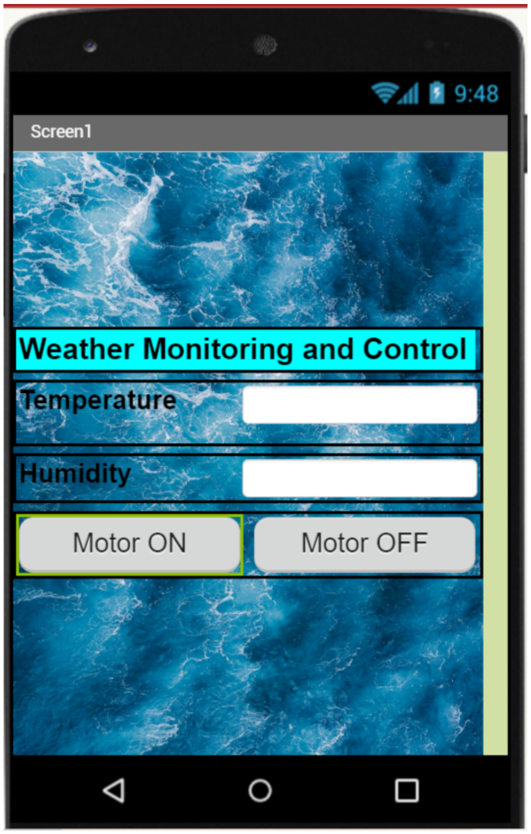
Python code connected to Iot watson platform

note the wiotp.py - C:\Users\ADMIN\OneDrive\Desktop\note the wiotp.py (3.11.0)

File Edit Format Run Options Window Help

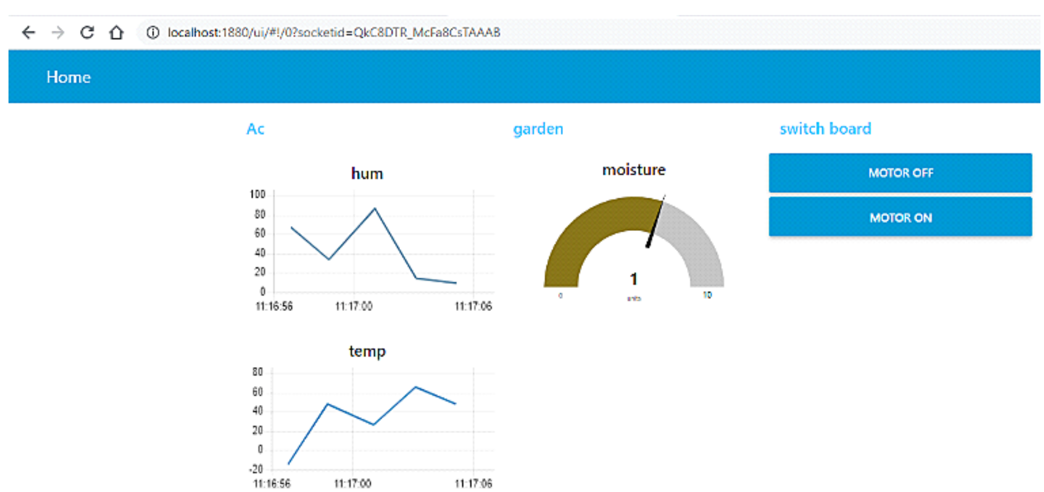
```python
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


#Provide your IBM Watson Device Credentials
organization = "1yc3ld"
deviceType = "SSPR"
deviceId = "12345"
authMethod = "use-token-auth"
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")
    else :
        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()
```

User Acceptance Testing



9. RESULTS

Performance Metrics



10.Advantages and disadvantages

Advantages:

1. 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 measureof water was distributed.

2. 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 thenext logical step.

3. Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a signto the unit within secondsby means of a mobile phone system.

4. Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveysalarms dependent on variousconditions.

Disadvantages:

1. The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
2. The smart farmingbased equipment require farmers to understand and learn the use of technology. This is major challengein adopting smart agriculture farmingat large scale across the countries.

11. CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be adjusted dependent on the local environmental variables. This technology also detects animal invasions, which are a major cause of crop loss. This technology aids in the scheduling of irrigation based on present data from the field and records from a climate source. It helps in deciding the farmer to whether to do irrigation or not to do. Continuous internet connectivity is required for continuous monitoring of data from sensors. This also can be overcome by using GSM unit as an alternative of mobile app. By GSM, SMS can be sent to farmers phone.

12. Future scope

In the current project we have implemented the project that can protect and maintain the the crop. In this project the farmer monitor and control the field remotely. In future we can add or updatefew more things to this project

- We can create few more models of the same project ,so that the farmer can have information of a entire.

1. We can update the this project by using solar power mechanism. So that the power supply from electric poles can be replaced with solar panels. It reduces the power line cost. It will be a one time investment. We can add solar fencing technology to this project.
2. We can use GSM technology to this project so that the farmers can get the information directly to his home through SMS. This helps the farmer to get information if there is a internet issues.
3. We can add camera feature so that the farmer can monitor his field in real time.This helps in avoiding thefts.

13. Appendix

Source Code:

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

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        deviceCli.commandCallback = myCommandCallback
deviceCli.disconnect()
```

GITHUB LINK :

https://github.com/IBM-EPBL/IBM-Project-22672-1659855939

DEMO VIDEO LINK :

https://drive.google.com/file/d/172TIAd10QNZiqYblhzXQdb-VSIUbKNik/view?usp=sharing