PROJECT REPORT

PROJECT NAME : SMARTFARMER- IOT ENABLED SMART FARMING APPLICATION

TEAM ID : PNT2022TMID33621

TEAM LEADER : SUNILKUMAR A

TEAM MEMBERS : SANTHOSH KUMAR M

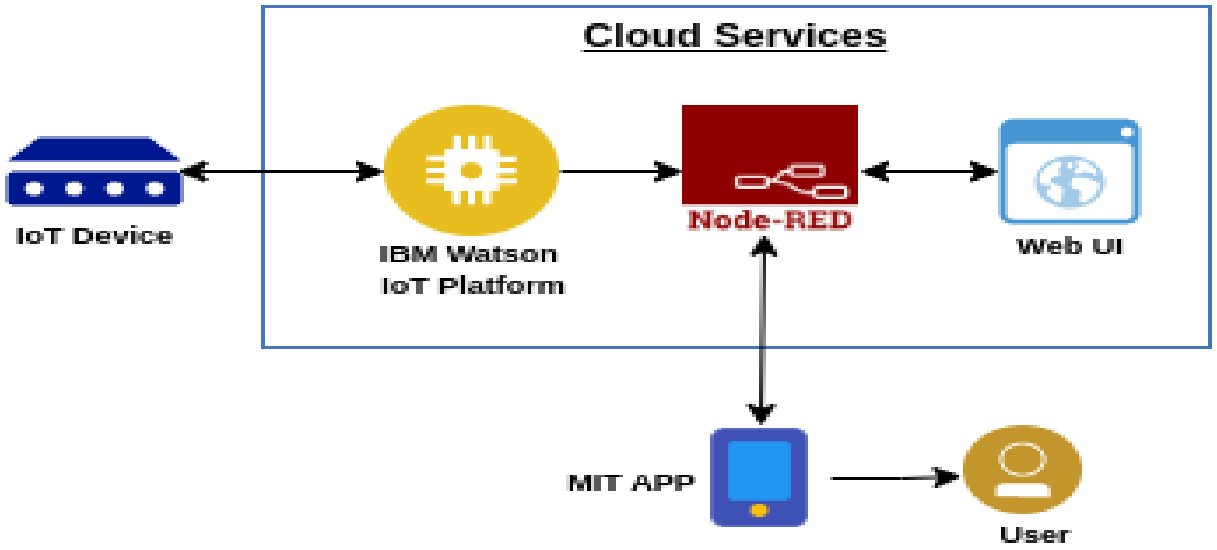
THULASINATHAN S

VIBIN M K

1. INTRODUCTION

1.1 Project Overview

IoT-based agriculture system helps the farmer in monitoring different parameters of his fieldlike soil moisture, Temperature, humidity using some sensors. Farmers can monitor all the sensorparameters by using a web or mobile application even if the farmer is not near his field. Wateringthe 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.



1.2 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, solenoid valves, relays.

2. LITERATURE SURVEY

2.1 Existing problem :

The author describes [1] The farming of agriculture has started past 12000 years back,Neolithic age gave birth of civilization, Farming and later being continued as traditional farmingpractices. India being an agrarian's country, Mostly Indian farming are dependent on rains, soil, dampness and environment challenges .Our farmers upgraded to modern state of art technologyin cultivation. Globally the IoT systems has contributed its application in many fields and proven to be successful. It is the time that Indian farmer need to introduce the Smart Agricultural systems for higher crop yield. The productivity with compilation of data from sensors, actuators and modern electronic gadgets the farmer can monitor agricultural fields. Smart Agriculture can forecast weather data, switching ON the pump motor acknowledging the dampness of soil termsof moisture levels with help of sensors which are interfaced to process module Arduino-UNO. The Smart agriculture system can be operated from anywhere with help of networking technology. On joining process in research and development in Smart Agriculture& Artificial Intelligence can be cutting edge technology in data compiling and resource optimization .Thepest & insects controls that protects damaging the crop and also optimisation resources utilisation can be breakthrough.

The author describes [2] Farming is the backbone of the economy and it is the fundamental method for occupation. The large population of the world depends on farming for living day to day life. Around 70% of the Indian population depends on cultivation. Most of the cultivation cannot be productive only by physical activities so have to be handled by innovative technologies. Therefore, they use IoT innovation and SMS notification to address the critical part of farming. The past method of incorporating a keen water supply system with smart ideas. This undertaking is a follow up to a past method whose highlight features incorporates a keen water system with excellent control and insightful basic leadership in terms of exact continuous field information which regulates temperature, moisture and soil dampness of a particular crop. Controlling of every one of these activities will be monitored by PC with Internet and the tasks being performed by interfacing sensors and Arduino. With the observation results decisions are to be made.

The author describes [3] Internet of Things (IoT) technology has brought revolution to each and every field of the 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 an 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 from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds.

The author describes[4] Today's different types of technologies, techniques and tools are used in the agriculture sector. To improve productivity, efficiency and reduce the time, cost and human intervention, there is a need for a new technology called the Internet of Things. To automate the agricultural activities like water management, soil monitoring, crop management, livestock monitoring etc. different types of sensor are used. Smart Greenhouses protect the plants from extreme weather. To control all these operations remote smart devices, computers connected with the internet, sensor, camera, micro-controller etc. are used. Growth in the agriculture sector affects the economic condition of the country. This paper focuses on the Role of IoT in Agriculture that defines Smart Farming.

REFERENCES :

[1] Adithya Vadapalli (2021). Internet-of-Things (IoT) based Smart Agriculture in India-An Overview. International Journal of Advance Research in Science and Engineering (2319-8354)

[2] Dahane, A., Benameur, R., Kechar, B., & Benyamina, A. (2020, October). An IoT based smart farming system using machine learning. In 2020 International Symposium on Networks, Computers and Communications (ISNCC) (pp. 1-6). IEEE.

[3] Farooq, M. S., Riaz, S., Abid, A., Abid, K., & Naeem, M. A. (2019). A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming. Ieee Access, 7, 156237-156271.

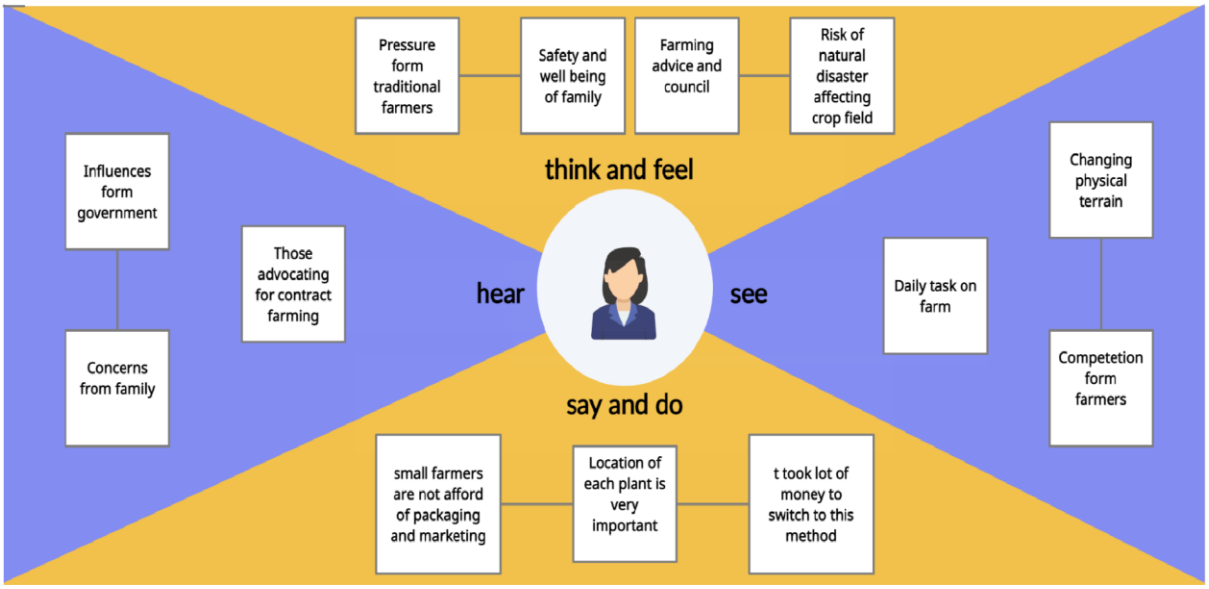
[4] Farooq, M. S., Sohail, O. O., Abid, A., & Rasheed, S. (2022). A survey on the role of iot in agriculture for the implementation of smart livestock environment. IEEE Access, 10, 9483-9505.

2.2 Problem Statement Definition :

The soil moisture sensor measures wetness content in the soil. The Arduino UNO microcontroller used to receive input from a various sensors and 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 monitor and control environmental parameters at their field. The farmers did not go to theirfield, they can remotely monitor and control using cloud.

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas :



3.2.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 of IoT 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 Thing speak in real time where the data can be logged and analyzed. The logged data on Thing speak is in graphical format, a botanistor a reasonably knowledged farmer can analyze the data (from anywhere in the world) to make sensible changes in the supplied resources (to crops) to obtain high quality yield.

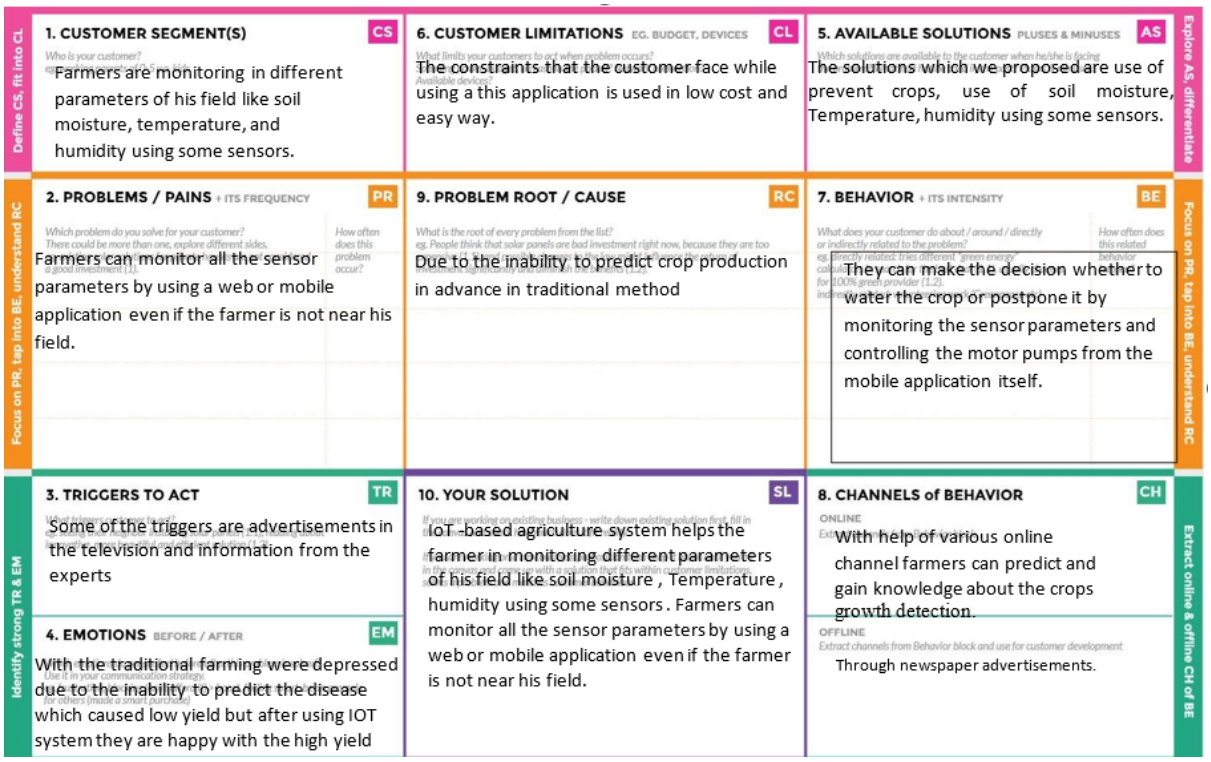
Smart agriculture monitoring system or simply smart farming is an emerging technology concept where data from several agricultural fields ranging from small to large scale and its surrounding are collected using smart electronic sensors. The collected data are analyzed by experts and local farmers to 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 amonth etc.

We can take smart farming a step further by automating several parts of farming, forexample 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 for a particular agriculture field. Say, if there was rain yesterday and the quantity of water requiredtoday 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.

3.2 Proposed Solution :

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Farmers are under pressure to produce more food and use less energy and water in the process. A remote monitoring and control system will help farmers deal effectively with these pressures.
2.	Idea / Solution description	Smart farming systems uses modern technology to increase the quantity and quality of agricultural products.
3.	Novelty / Uniqueness	Monitoring of climate conditions, green house automation and crop management.
4.	Social Impact / Customer Satisfaction	By the project that we have done will help to produce more food and use less energy and water. Remote monitoring will help them in a effective way.
5.	Business Model (Revenue Model)	Smart farming envisages the harnessing of Information and Communication Technologies as an enabler of more efficient, productive, and profitable farming enterprises. Such technologies do not suffice on their own; rather they must be judiciously combined to deliver meaningful information in near real-time.
6.	Scalability of the Solution	Smart Farming 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.

3.3 Problem solution fit :



4.Requirement Analysis

4.1 Functional Requirement :

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

4.2 Non-Functional Requirement :

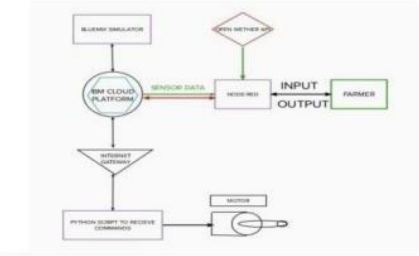
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Time consumability is less, Productivity is high.
NFR-2	**Security**	It has low level of security features due to integration of sensor data.
NFR-3	**Reliability**	Accuracy of data and hence it is Reliable.
NFR-4	**Performance**	Performance is high and highly productive.
NFR-5	**Availability**	With permitted network connectivity the application is accessible
NFR-6	**Scalability**	It is perfectly scalable many new constraints can be added

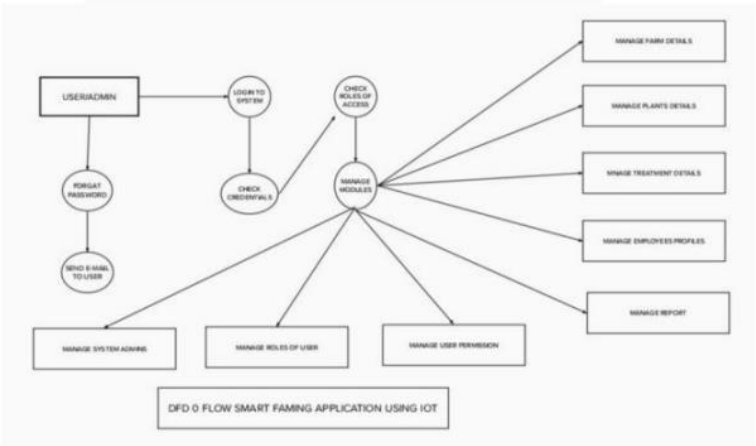
5. PRODUCT DESIGN

5.1Data 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 requirementgraphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

- The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.
- Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.
- NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.
- All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could plan through an app, weather to water the crop or not depending upon the sensor values. By using the app they can remotely operateto the motor switch.





5.2 Solution and Technical Architecture :

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2 Guidelines:

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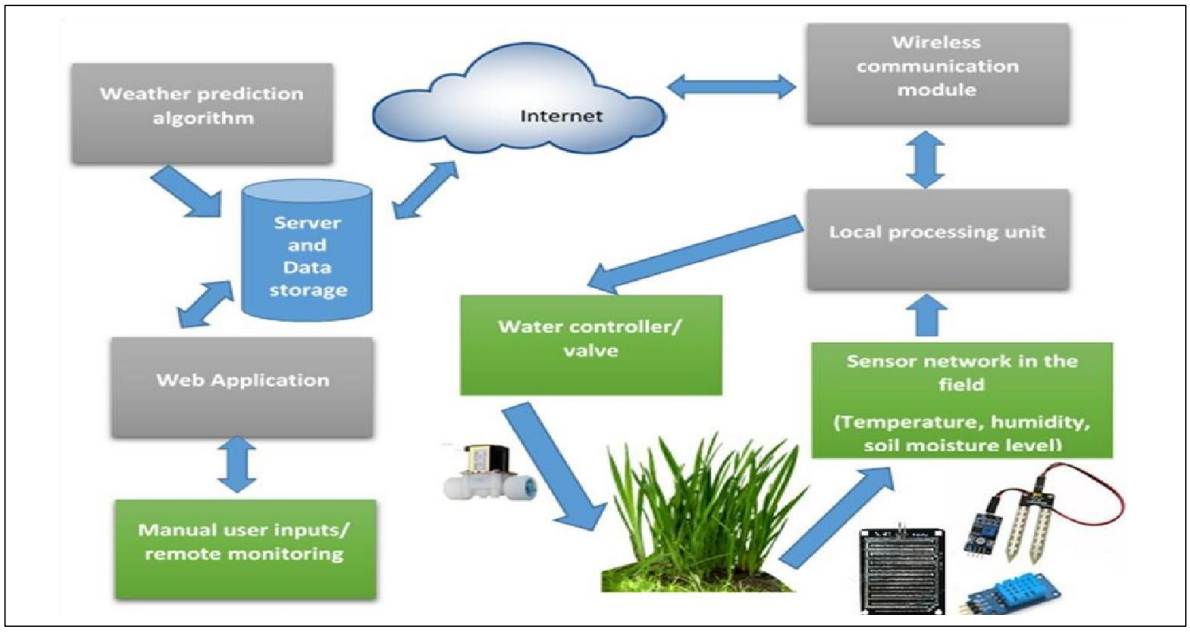


6.PROJECT PLANNING AND SCHEDULING :

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Sunilkumar, Santhosh kumar,
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Sunilkumar, Santhosh Kumar, Thulasinathan, Vibin.
Sprint-3	MIT AppInventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Thulasinathan, Vibin.
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Sunilkumar, Thuasinathan.
Sprint-4	Web UI	USN-4	To make the user to interact withsoftware.	2	High	Sunilkumar, Santhosh kumar, Thulasinathan, Vibin

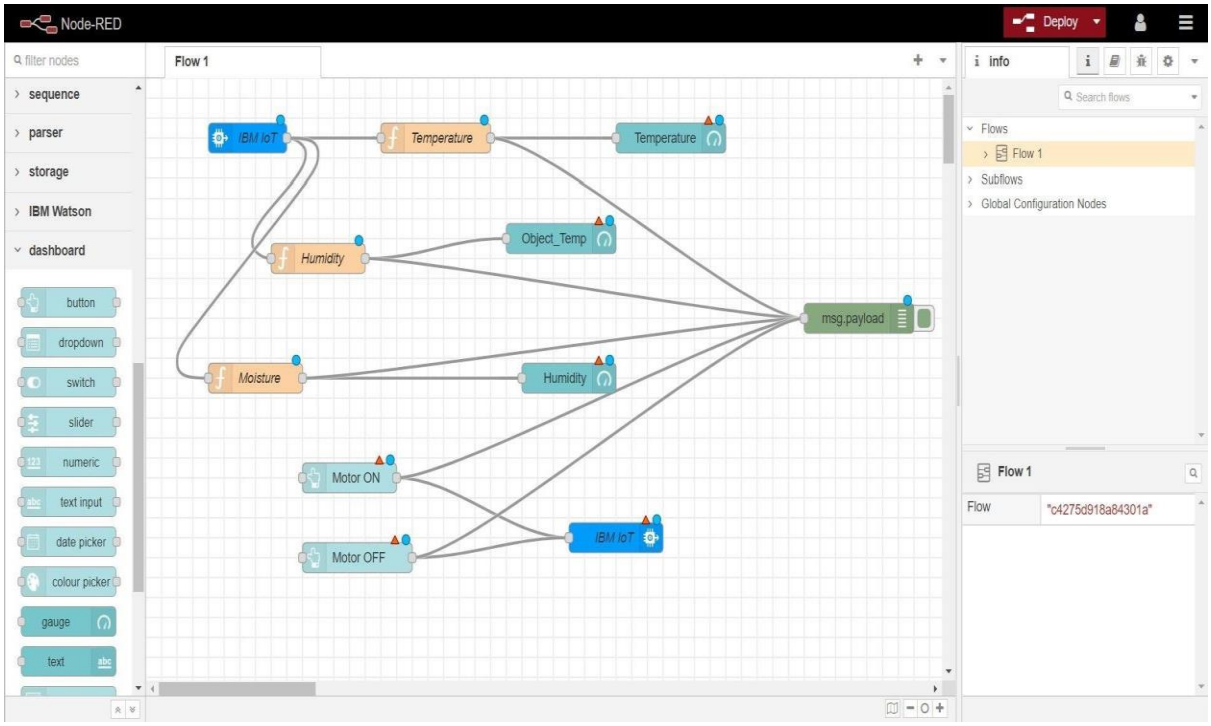
7.CODING AND SOLUTIONING :

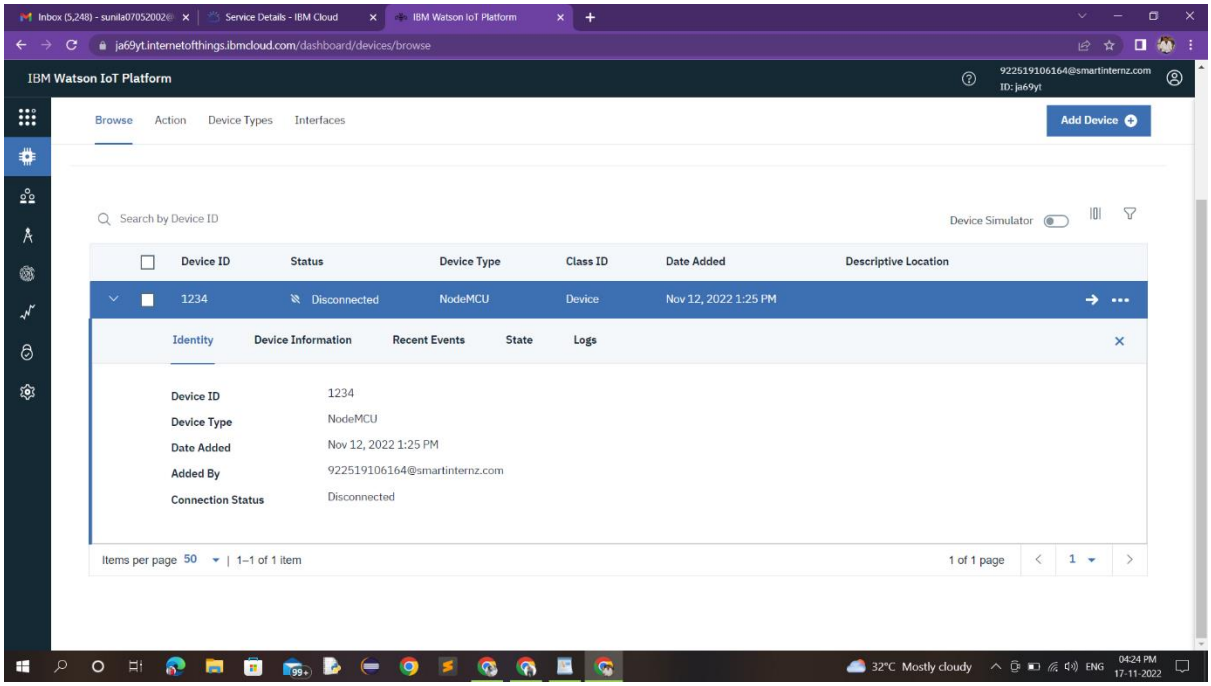
```
import wiotp.sdk.device
import time
import os import
datetimeimport
random
myConfig = {
"identity": {
"orgId": "hjSfmy",
"typeId": "Devicelk",
"deviceId": "67890"
},
"auth": {
"token": "87654321"
}
}
client = wiotp.sdk.device.DeviceClient (config=myConfig,
logHandlers=None)
client.connect ()
def 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.commandCallback = myCommandCallbackclient.disconnect
()
```

8.TESTING

8.1 Test case :

Web application using Node Red :





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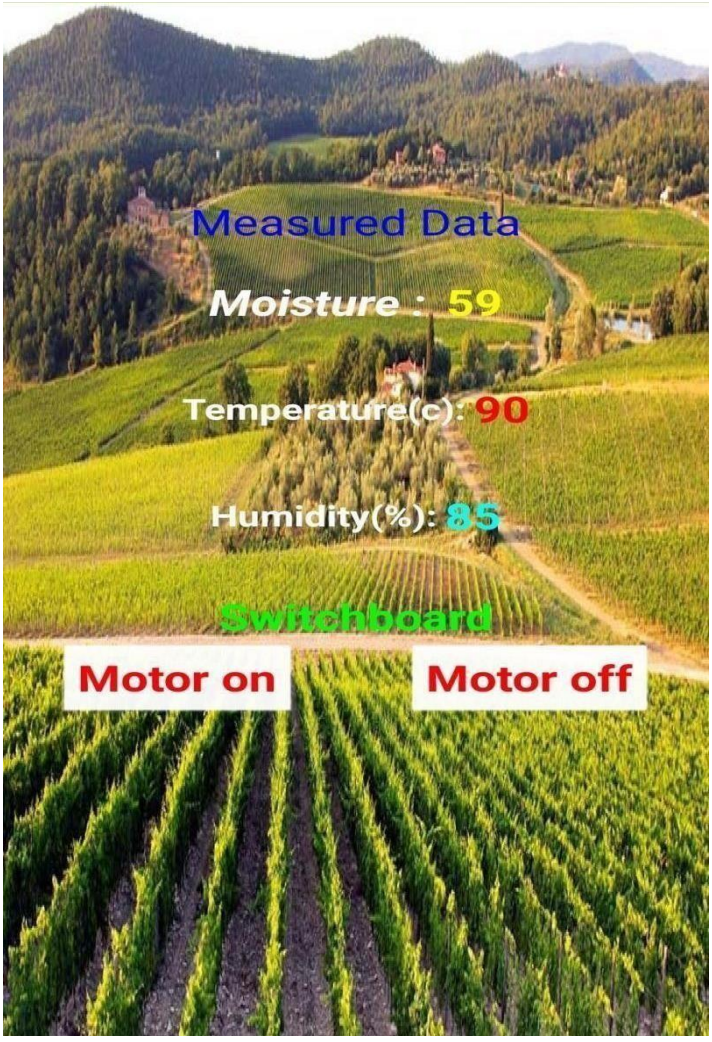
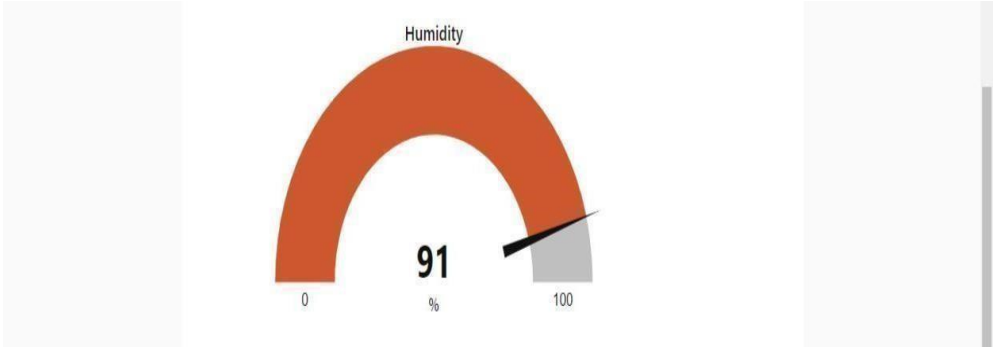
    time.sleep (2)
    client.commandCallback =myCommandCallback
client.disconnect ()
```

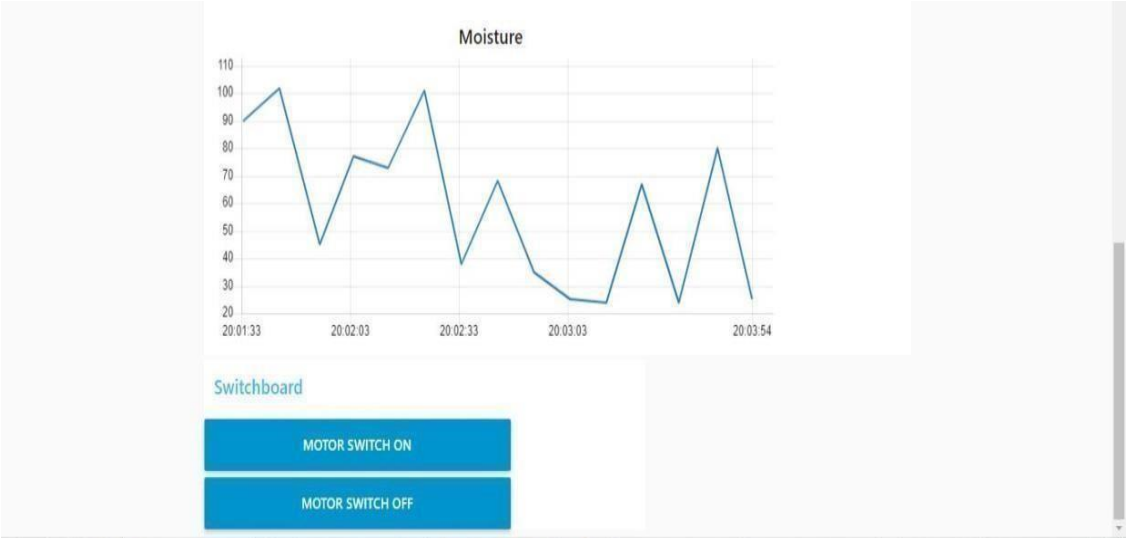
8.2User Acceptance Testing :



9.RESULTS

9.1 Performance Metrics :





10.Advantages and disadvantages

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 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 sign to the unit within seconds by means of a mobile phone system.

- 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 conveys alarms dependent on various conditions.

Disadvantages:

- 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.

- The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scaleacross 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. Thistechnology 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 farmer phone.

12.Future scope

In the current project we have implemented the project that can protect and maintain the crop. In this project the farmer monitor and control the field remotely. In future we can add or update few 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.
- 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 thisproject.
- 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.
- 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 wiotp.sdk.device
import time
import os
import datetime
import random
 myConfig = { "identity": {"orgId": "hjSfmy", "typeId": "DeviceIk","deviceId": "67890"},
"auth": {"token": "87654321"}}
client = wiotp.sdk.device.DeviceClient (config=myConfig,logHandlers=None)
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def myCommandCallback (cmd) :
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client.commandCallback = myCommandCallbackclient.disconnect ()
```

Github link: https://github.com/IBM-EPBL/IBM-Project-33444-1660221170