SMART FARMER IOT ENABLED SMART FARMING APPLICATION

PROJECT REPORT

Submitted By

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NOVEMBER 19, 2022

PROJECT REPORT

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Project Report

1. INTRODUCTION

1.1 Project Overview

Smart Agriculture System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop.The farmer can also get the realtime weather forecasting data by using external platforms like Open Weather API.Farmer is provided a mobile app using which he can monitor the temperature,humidity and soil moisture parameters along with weather forecasting details.Based on all the parameters he can water his crop by controlling the motors using the mobile application.Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere.Here we are using the Online IoT simulator for getting the Temperature,Humidity and Soil

Agriculture plays a critical role in the entire life of a given economy. Agriculture is the key development in the rise of a sedentary human civilization. There are various issues that are hampering the development of the country. The possible solutions for the problems faced is to opt for modernized agriculture. Agriculture can be made smart by using Internet of Things (IoT) technologies. Smart Agriculture increases quality, quantity, sustainability and costeffectiveness of crop production and also analyses the weather conditions. This paper proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The paper aims at making agriculture smart using automation and IoT technologies. Agriculture is the root to country's economic development. In recent times, huge scientific advancement has been implemented in various agricultural fields for the betterment of the future. Despite of various researches, proper assessment and productivity couldn't be reached.

1.2 Purpose

This is the project from the motivation of farmers working in the farmlands are solely depends on the rains and bore wells of irrigation of their lands.In the recent times,the farmers have been using irrigation system manually by water pumping on/ off that when they are required. It majorly depends on IoT thus eliminating the need of physical work of farmers and growers and thus increasing the productivity in every possible manner. IoT based Smart Agriculture System improves the entire Agriculture system by monitoring the field in real-time. Several great uses for agriculture IoT in this space:

- Sensing for soil moisture and nutrients.
- Controlling water usage for optimal plant growth.
- Reporting weather conditions.

With the help of sensors and interconnectivity, the IoT in Agriculture has not only saves the time of the farmers but also reduces the extravagant use of resources such as water and

electricity.It keeps various factors like Humidity, Temperature, Soil Moisture etc. under check and gives a crystal-clear real-time observation.

2. LITERATURE SURVEY

2.1 Existing problem

2.1.1 Title: A Reserch Paper On Smart Agriculture Using IOT
Author Name : Ritika Srivastava, Vandana Sharma, Vishal Jaiswal, Sumit Raj

To provide efficient decision support system using wireless sensor network which handle different activities of farm and gives useful information related to farm. Information related to Soil moisture, Temperature and Humidity content. Due to the weather condition, water level increasing Farmers get lot of distractions which is not good for Agriculture. Water level is managed by farmers in both Automatic/Manual using that mobile application. It will make more comfortable to farmers. Performing agriculture is very much time consuming

2.1.2 Title : Smart Agriculture System Using IoT Technology
Author Name : Adithya Vadapalli, Swapna Peravali & Venkata Rao Dadi

The majority of rural people, agricultural activities continue to be one of their main livelihood strategies. Production of food crops is not dependent on any formally acquired knowledge of farming but is solely based on indigenous agricultural knowledge passed from generation to generation through experience and careful observations. Resource-poor farmers, especially in rural areas, follow traditional farming methods to produce their food crops and these are specifically tailored to suit their environments.Household members are the main source of farm labour with men mainly responsible for ploughing activities while the bulk of planting, weeding and harvesting activities is the responsibility of women. Crop protection against pests is done through traditional methods where farmers mix some combinations of pest control made from locally available resource in order to minimise losses. However there are no weather monitoring, moisture dampness and water management, they depend on rains and flow of water upstream to downstream and canal watering system. As the agriculture hasturned to more labour intensive, and skilled people have migrated to urban community for livelihood and comfort living, left the traditional agriculture farmers much more expensive and risky. We heard yield versus suicidal of farmer. To convert loss making traditional farming into high crop yielding and profit making proposed smart agriculture system is brought out.

2.2 References

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2.3 Problem Statement Definition

It should utilize minimum resourses. This overcomes the manual operations required to monitor and maintain the agricultural farms . It should be able to measure the increase or decrease in level of water as well as moisture in the soil.

The User need to monitor the field Continuously,Build a Fertilizer management,To fix the labour shortage , control the insects and bugs ,avoid suicide of farmers,Fix a good price for his yields, save the Fields from birds,to save the water increase the income , avoid power cut maintains the fields at anytime at anywhere so he can monitor the plant growths and healths So he need a smart Farming Application.

3. IDEATION & PROPOSED SOLUTION

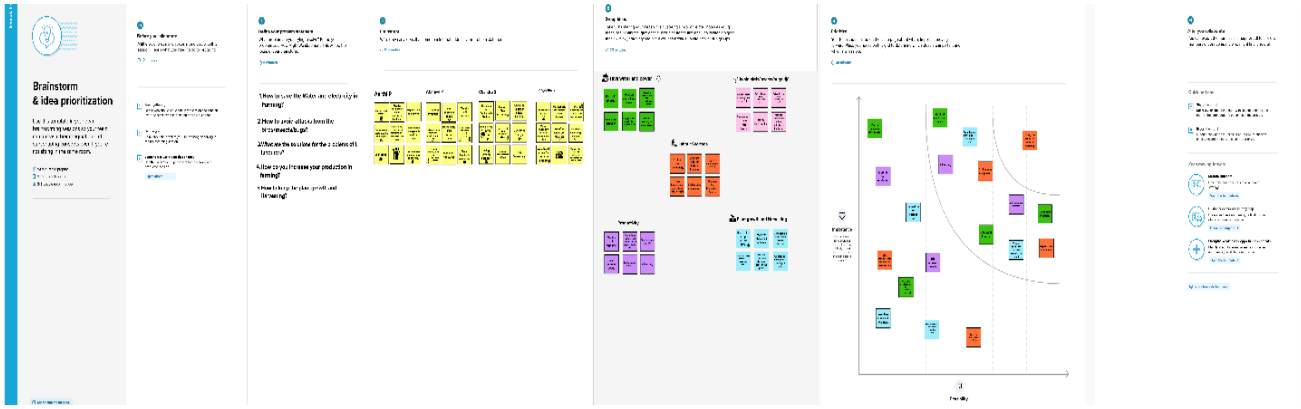
3.1 Empathy Map Canvas

This map can help to understand farmers think,emotions and pains. We can create a better application to concerned to their problems. We are getting surveys from farmers what they truly required.

Aside from actually growing the crop, independent research has concluded that by 2040, the amount of US population in the farming community is set to be cut in half down from 3 million to merely 1.5 million farming roughly the same amount of land.

3.2 Ideation & Brainstorming

Agriculture is the most important aspect in our country. Most of the farmers are frustrated in their yields because they are not able to accurately monitoring their fields. So they need the more ideas to improve their agriculture system.



3.3 Proposed Solution

In order to improve the farmer's working conditions and make them easier, we introduce IoT services to him in which we use cloud services and internet to enable farmer to continue his work remotely via internet. He can monitor the field parameters and control the devices in farm.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 To improve the efficiency of the product there by supporting both rancher and country we need to utilize the innovation which appraises the nature of harvest and giving recommendations. The Internet of things (IOT) is revamping the agribusiness engaging the farmers by the 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 agriculture field area and are being logged and stored online using cloud computing and Internet of Things. By using wireless transmission, the sensed data forwarded towards to web server database.

Problem Statement (Problem to be solved)

- Monitoring the field often it's deficult to the farmers they are unable to do their personal works.
- watering the field is more time taken process for farmers because they are waited until the water fully cover the whole land.
- soil moisture, temperature level and humidity levels are need to know because it affect the plant growth and crop yield.
- Power consumption process for motor. Electricity is available only fewer times in villages.

Idea / Solution description

- We can use the some sensors used to collect the values of temperature, humidity,soil moisture,ect and give this values to the farmers ,it can easily increase the effective efficiency of plants.
- we can use time control systems for motor on, off and irrigation system on ,off.
- precision farming use the drones to monitoring the crop condition and intimate which one requires a nutrition and water,ect.

Novelty / Uniqueness

Remote access:

- It helps the farmers to monitor the motor and irrigation system on, off in anywhere.

Alert messages:

- IOT sensors like temperature, humidity,soil moisture, motion detector ,they are collected the information from the farming environment and given to the controller unit (ex;Arduino UNO) it give information to the communication device to reach the farmers (customer)

Social Impact / Customer Satisfaction

- It saves the lot of times.
- It reduces the need of more labours.
- Iot can in increase the production effeciency.
- Provide the clean and green foods.
- Iot can also helps in e-commerce business and increase sales.It makes a wealthy society

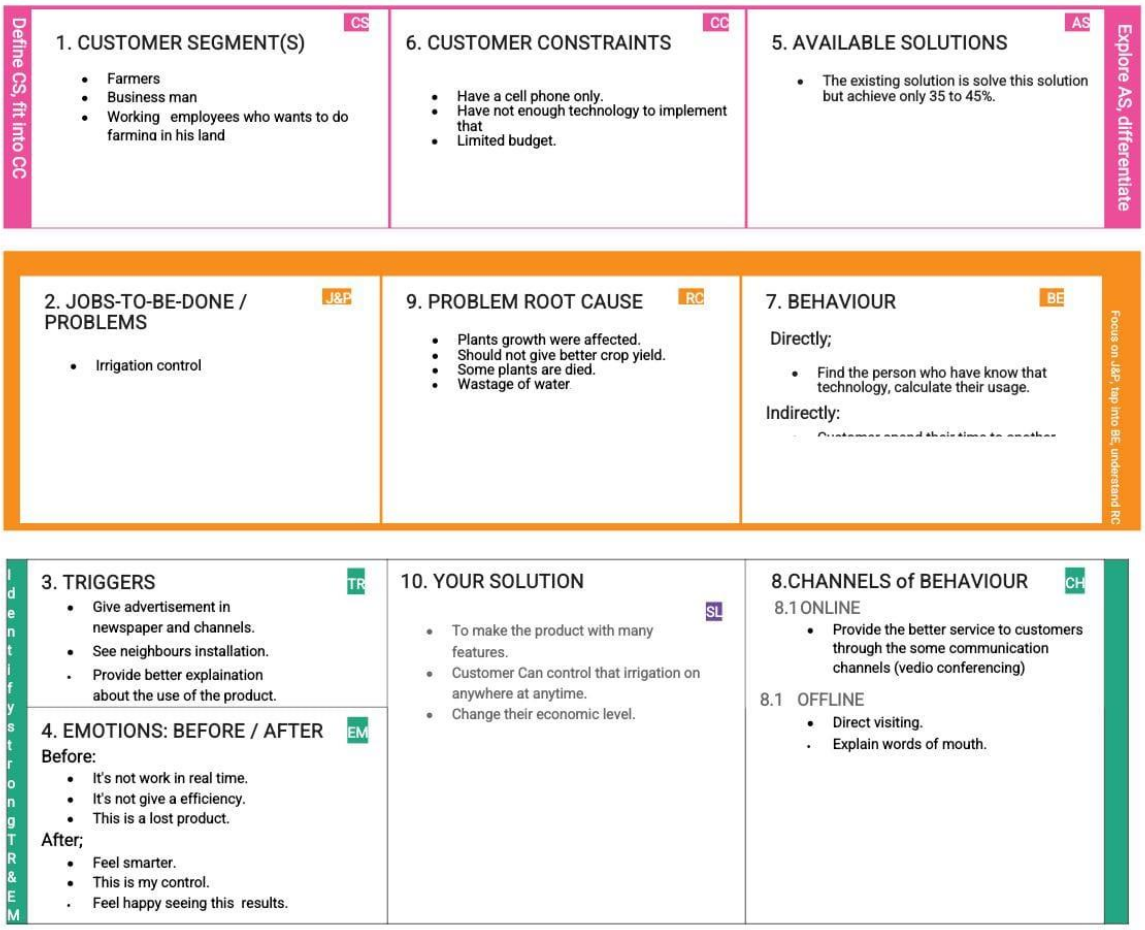
.

Scalability of the Solution

- Scalability in smart farming refers to the adaptability of a system to increase the capacity, for example, the number of technology devices such as sensors and actuators, while enabling timely analysis.

3.4 Problem Solution fit

This establish the who are the customers,what is the problem and its root cause,which is triggers to use this product,what is customers emotion about this application and solution for the problems.



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR-1 User Registration

- The system must allow the user to register by leaving their email

FR-2 User Confirmation

- The system must send a confirmation email to the User

FR-3 User Login

- The system must allow the registered user to login by using their email

FR-4 Dashboard

- The system will show the apps features in the dashboard to the user

FR-5 Weather Monitoring

- The system shall provide the following weather parameters: Temperature pressure, Wind speed & direction , rain fall and humidity .

FR-6 Motor Controls

- The system must provide when user give the Motor ON command then the system provide Motor ON to the User
- The system must provide when user give the Motor OFF command then the system provide Motor OFF to the User

FR-7 User feedbacks

- The system must allow the user to submit the feedback through a contact in the application

4.2 Non-Functional requirements

NFR-1 Usability

- An user friendly and simple web application .
- It is simply used by the help of tutorials .

NFR-2 Security

- Only registered person can access the web application.
- User can only share the data to another,no one can stolen their data.

Data's are more secured.

NFR-3 Reliability

- If a data collection is slow for user it will check immediately to resolve that problem.
- Provide accuracy of data to the user

NFR-4 Performance

- Fast to monitoring the field
- It is used to turn on /turn off the motor within a second
- It shows the values of temperature , humidity , weather conditions at every time.

NFR-5 Availability

- Every where at any time available on the web application.
- It can be found on search engines like google,youtube etc….

NFR-6 Scalability

- It can be multiple command is given to act at a time it perform priority based.
- Reduced traffic in case of multiple user interaction

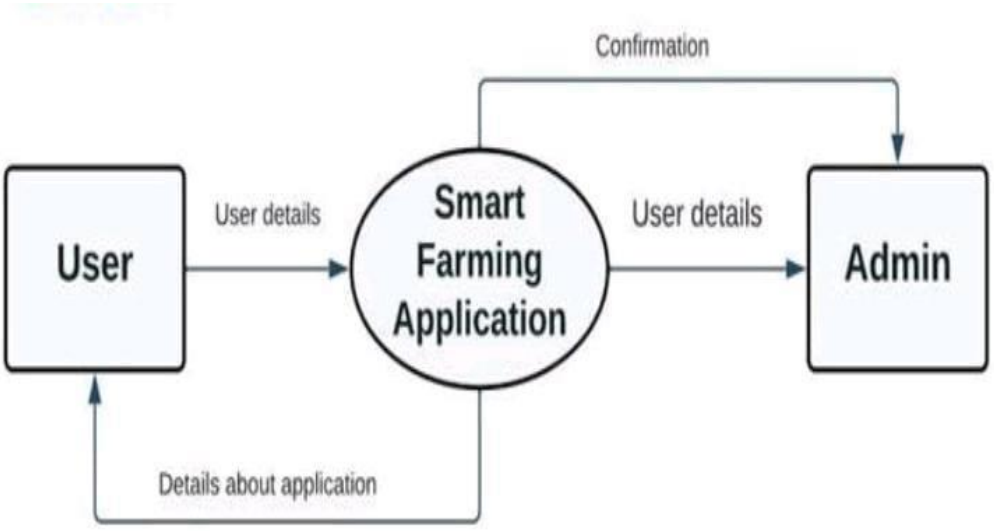
5. PROJECT DESIGN

5.1 Data Flow Diagrams

DFD is a tradional visual representaion of the information flows within system.It shows how the data enters and leaves the system ,what changes the information and where the data are stored.
A two-dimensional diagram explains how data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improve certain aspects

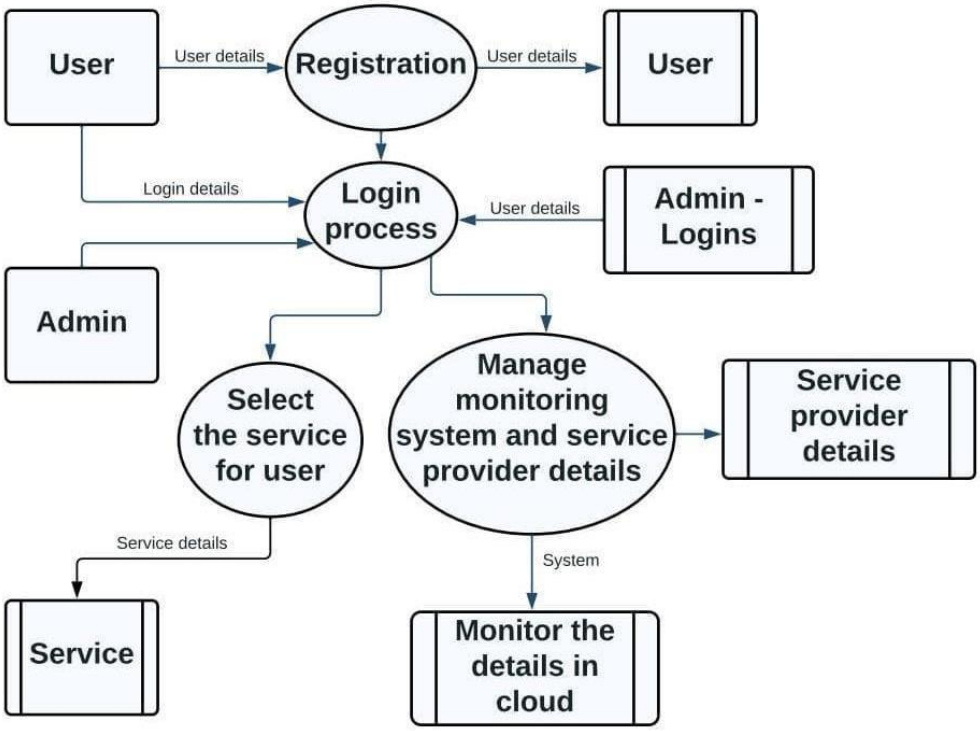
LEVEL 0

The Level 0 DFD shows how the system is divided into 'sub-systems' (processes), each of which deals with one or more of the data flows to or from an external , and which together provide all of the functionality of the system as a whole. It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.



LEVEL 1

The next stage is to create the Level 1 Data Flow Diagram. This highlights the main functions carried out by the system. As a rule, to describe the system was using between two and seven functions - two being a simple system and seven being a complicated system. This enables us to keep the model manageable on screen or paper.

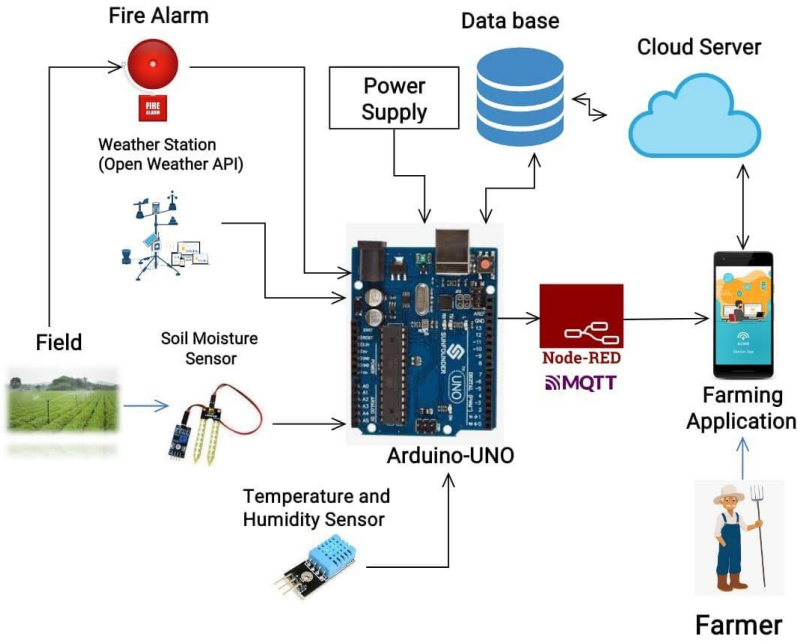


The User First register the application by entering their email id and password and then login to the application dashboard he can see the available services like monitor the temperature , humidity Moisture, weather Fore cast.

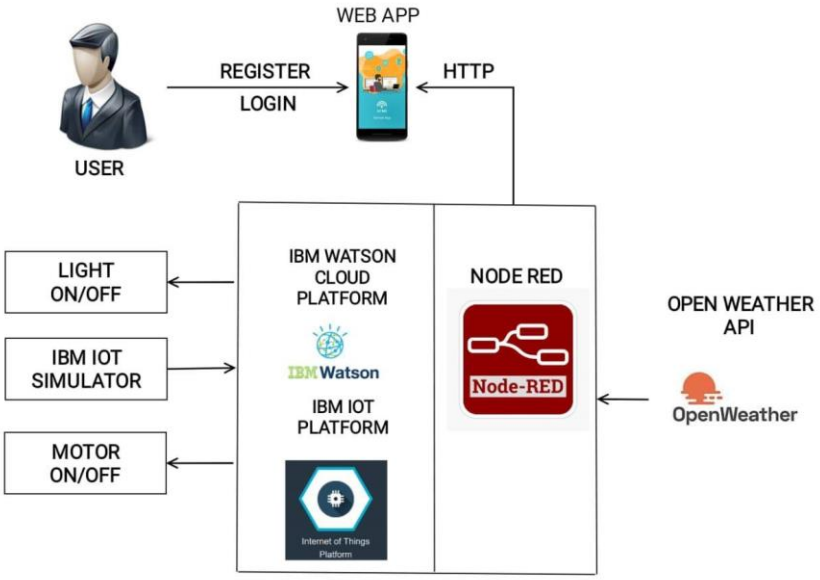
5.2 Solution & Technical Architecture

A system architecture or systems architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. System architecture can comprise system components, the externally visible properties of those components, the relationships (e.g. the behavior) between them. It can provide a plan from which products can be procured, and systems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture, collectively these are called architecture description languages (ADLs).

Solution Architecture

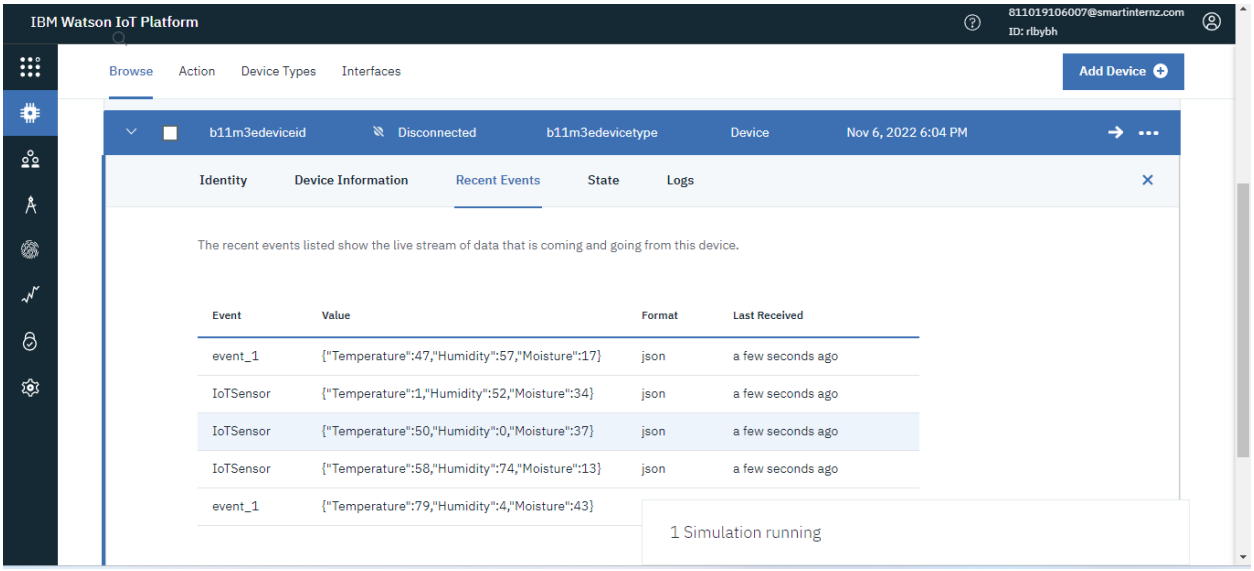


Technical Architecture



Watson IoT Platform

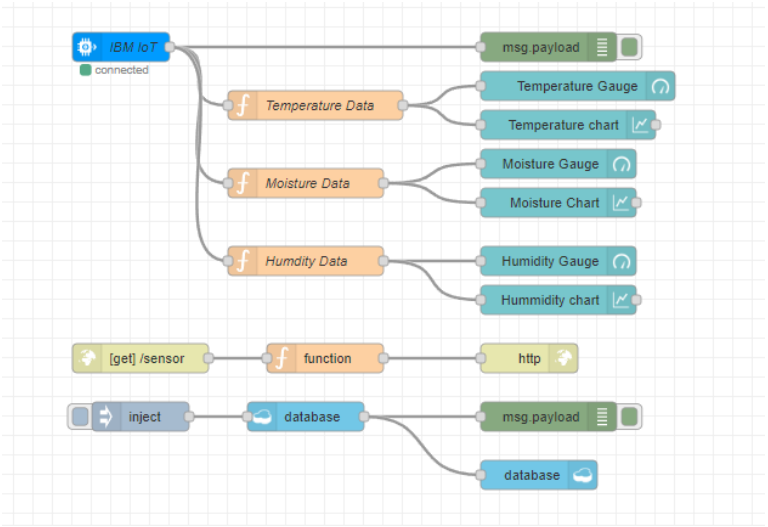
Two devices have been created in Watson IoT Platform. One for sending command to the User and another to receive the data from an IoT simulator (Temperature, humidity & soil moisture) and Open Weather API (recent weather information of the farm). Device is connected to the IoT Simulator to get the simulator data.



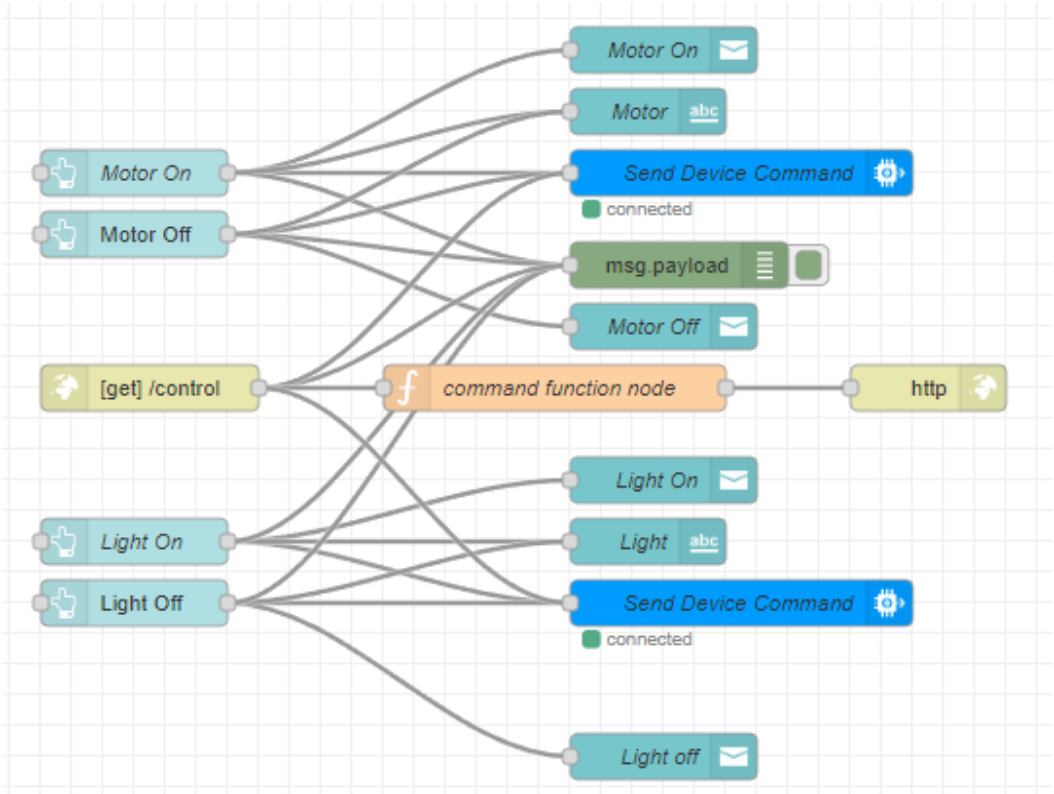
Node Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. Device is connected to Node red is installed on the PC and required nodes is installed in the node red to configure the device to display the received data from simulator and open weather api to user interface dashboard.

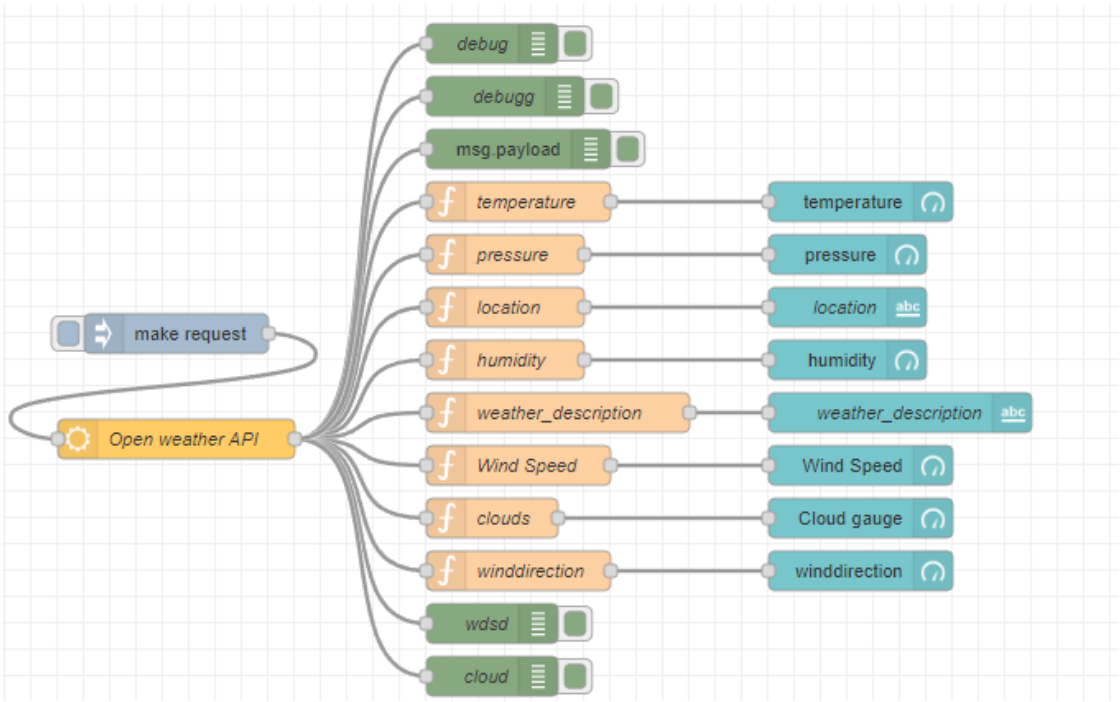
Simulator Data Flows



Motor & Light Control Flows



Open Weather API Flow



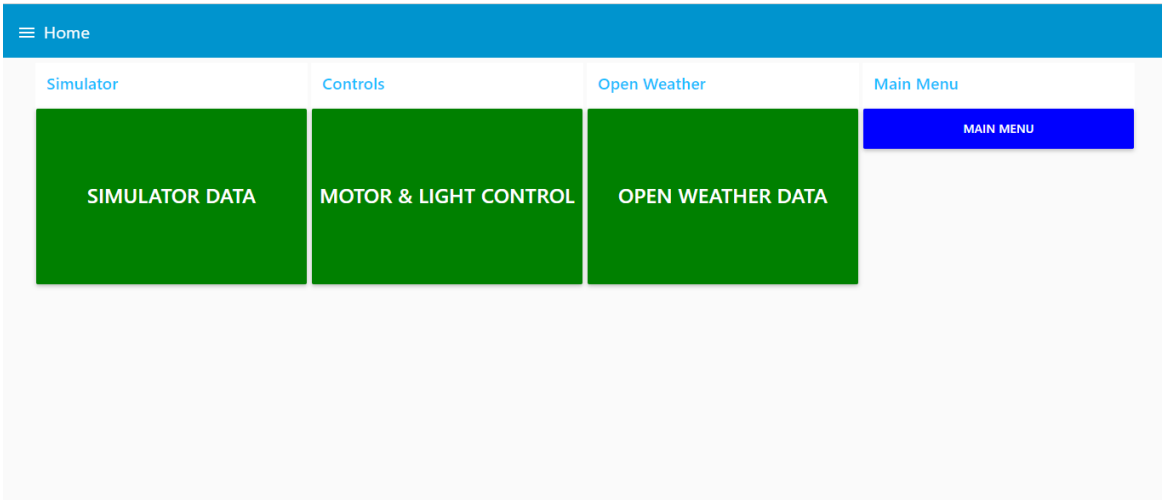
Web App

A web application is created which displays the temperature, humidity, and soil moisture data of past one hour that is received by the device from the IoT simulator. It also displays live weather parameters of the farm using open weather api. There are 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. A python code is written to track down the commands (like turning motor and light ON/OFF) that are being sent by the user through web application.

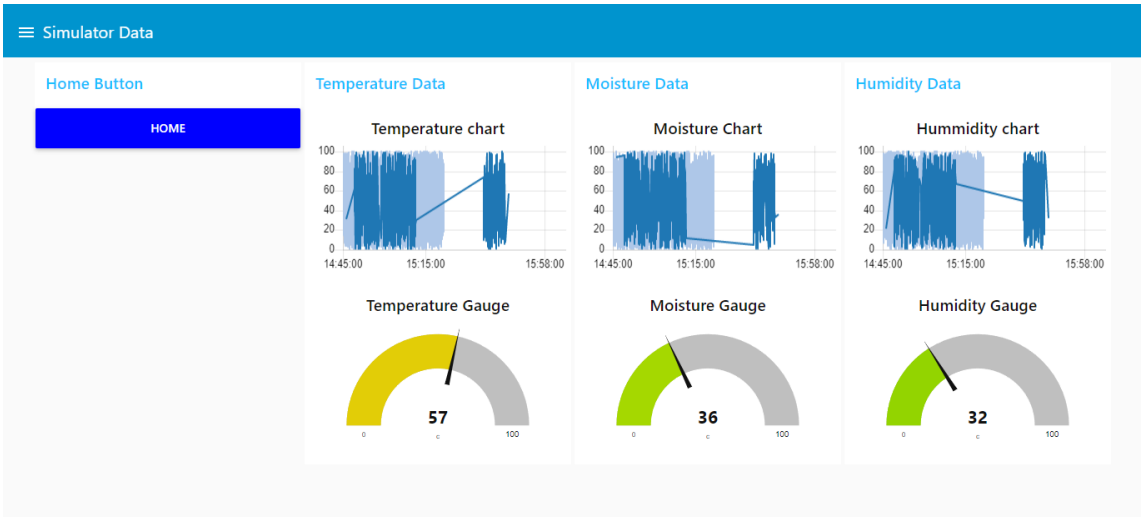
Web Application Link

https://node-red-undcc-2022-10-04.eu-gb.cf.appdomain.cloud/ui

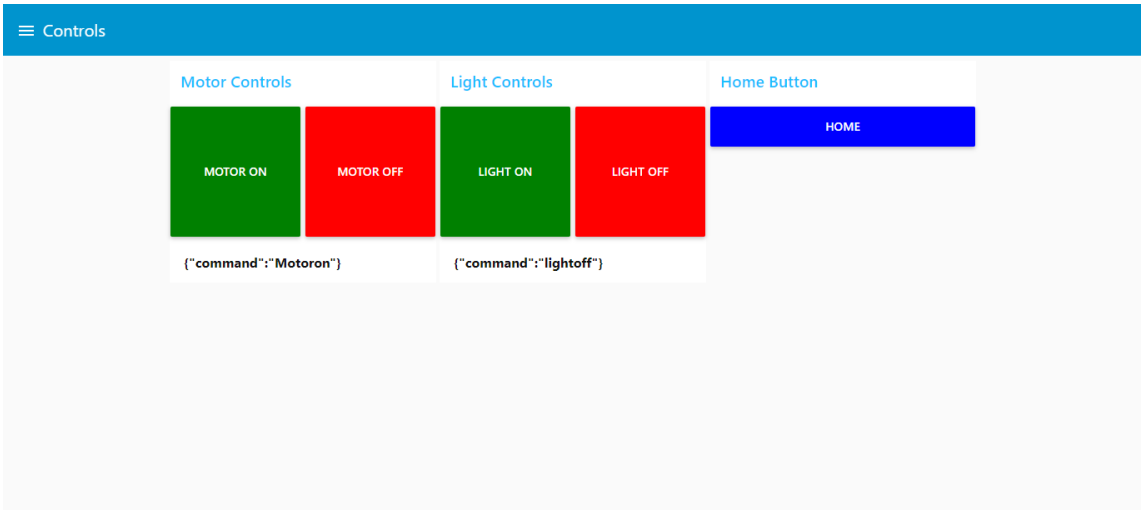
Home Page



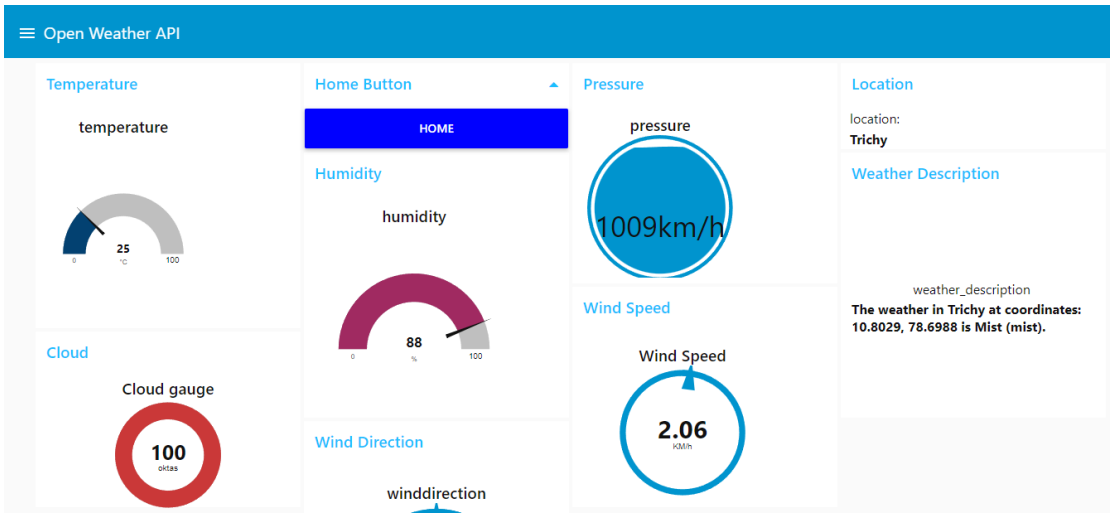
Simulator Data



Motor And Light Controls



Open Weather API



5.3 User Stories

User stories are gathered from the farmers what they really wanted.
Users(farmers) are face on the most issues in Farming.More time is spend on monitoring fields and irrigated on land these are done by physically,lot of labours are required to cultivate their lands. They are more worried and frustrated about their fields. So they wants to improve their lifestyle. They can't travel to another places because of their fields. They wants a smart Farming application to can easily monitoring the fields anywhere at anytime,automatically control system (light,motor).This help to reduce the labour shortage, increase the productivity and efficiency,save their time and electricity.

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Mobile/web user Registeration	USN-1	As a user I can register the application by entering my email, password so that feel good	0	High	Chandru S
Sprint-1		USN-2	As a user I want confirmation mail for registration	0	Medium	Aarthi P
Sprint-2	Mobile/web user Login	USN-3	As a user I can login the application by entering my email and password so that am entering the application	0	High	Abinaya P
Sprint-2		USN-4	As a user I can login to the application by entering my phone number so can easily enter into the dashboard	0	Low	Sangeetha S
Sprint-3	Monitoring and Controlling	USN-5	As a user I want smart application so that monitor the fields		High	Chandru S
Sprint-3		USN-6	As a user I want to know the temperature level so that easily know irrigation timing		High	Aarthi P
Sprint-3		USN-7	As a user I want to check the humidity so that helpful to put water		Low	Abinaya P
Sprint-3		USN-8	As a user I wants smart application so that monitor anywhere at anytime		Low	Sangeetha S

Sprint-3		USN-9	As a user I want motor control so that stop water wastage		High	Abinaya P
Sprint-4	Software connection	USN- 10	As a admin I want to satisfy their users so that connect & store in Ibm iot		Medium	Chandru S
Sprint-4		USN- 11	As a admin I want to make software (node red, ibm Watson) connection so that simulate the values		Medium	Abinaya P
Sprint-4		USN- 12	As a admin I want to test the application so that know it's work or not	0	High	Chandru S

6.2 Sprint Delivery Schedule

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	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA

Sprint	Commitment	Completed
Sprint 1	0	20
Sprint 2	0	20
Sprint 3	20	20
Sprint 4	0	20

7. CODING & SOLUTIONING

(Explain the features added in the project along with code)

7.1 Feature 1

Sign Up And Login Feture

New User Click Sign Up

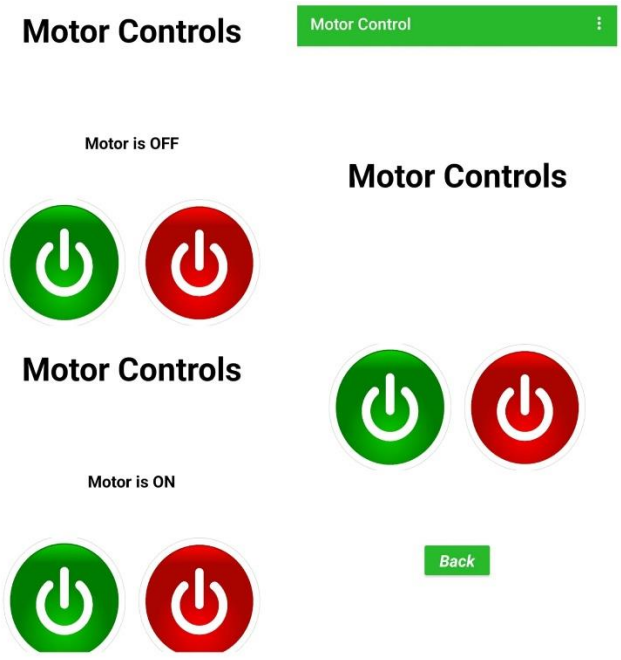
Sign Up

Already a User

Login

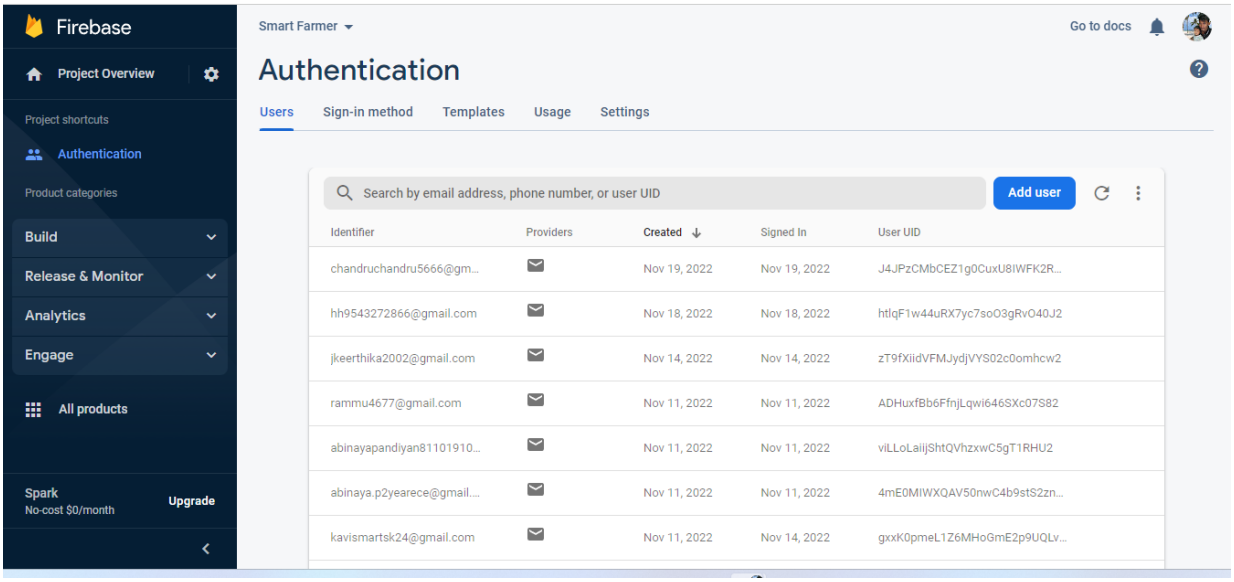
7.2 Feature 2

A Farmer Can be controlled his motor through our Application



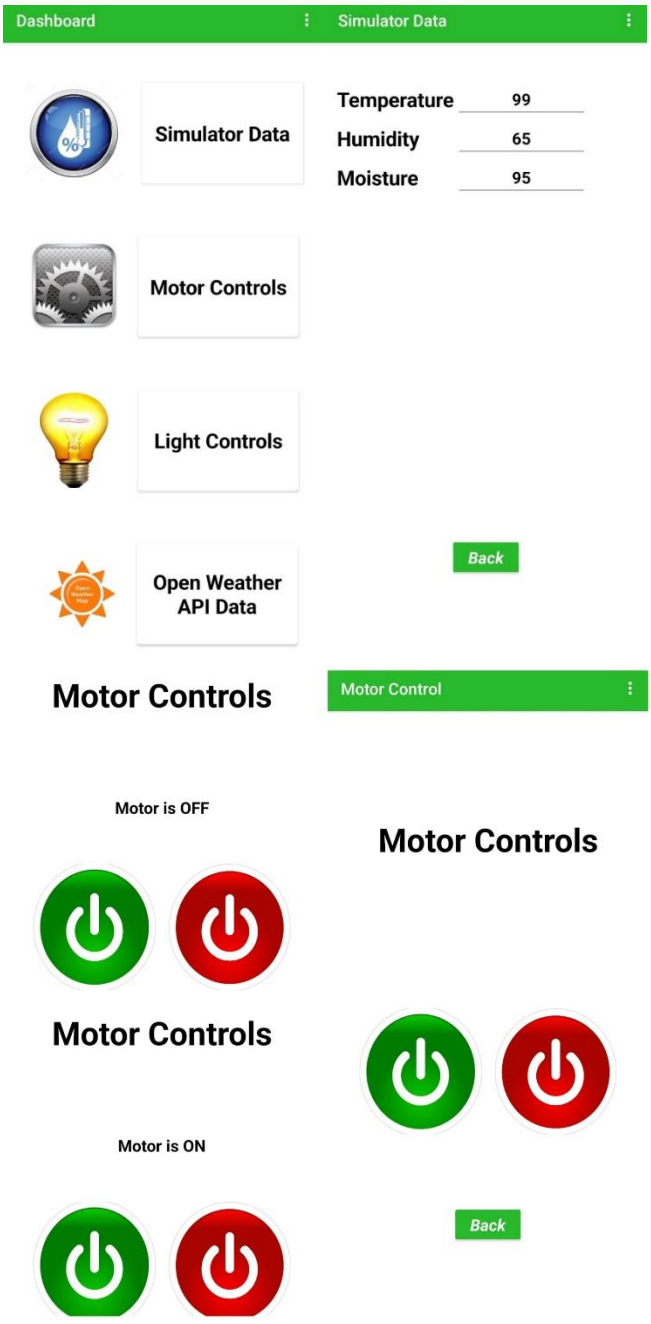
7.3 Database Schema (if Applicable)

Smart Farmer Application Database

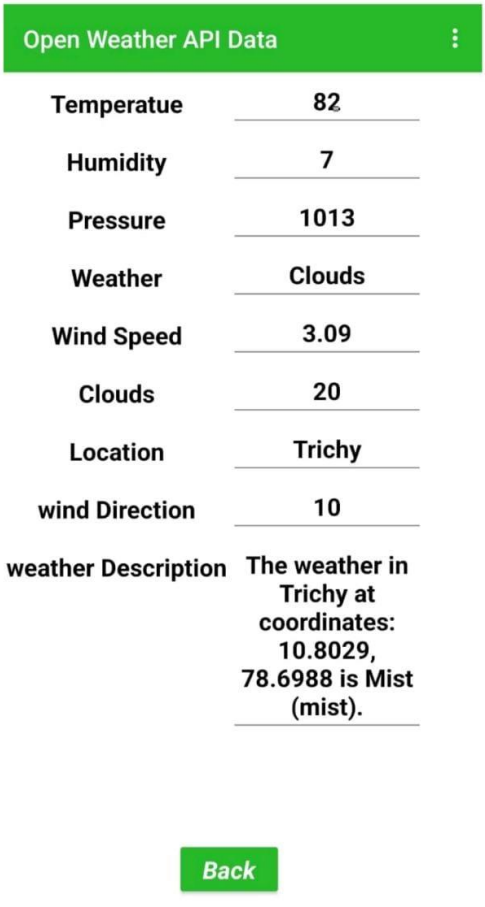


8. TESTING

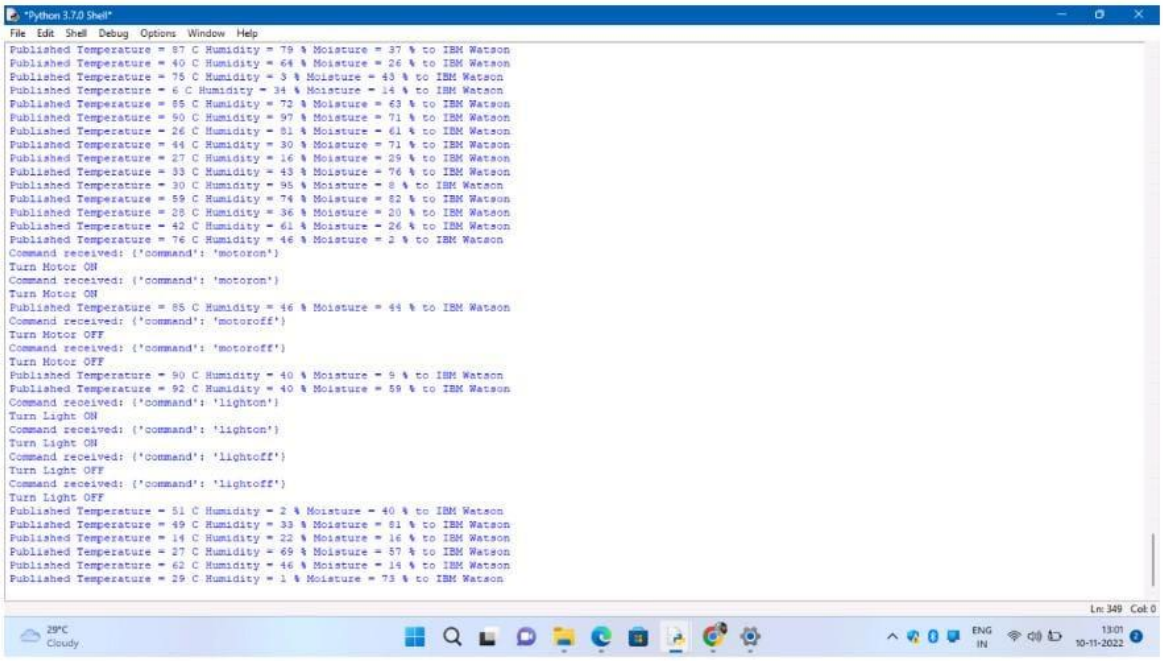
Mobile Application Testing



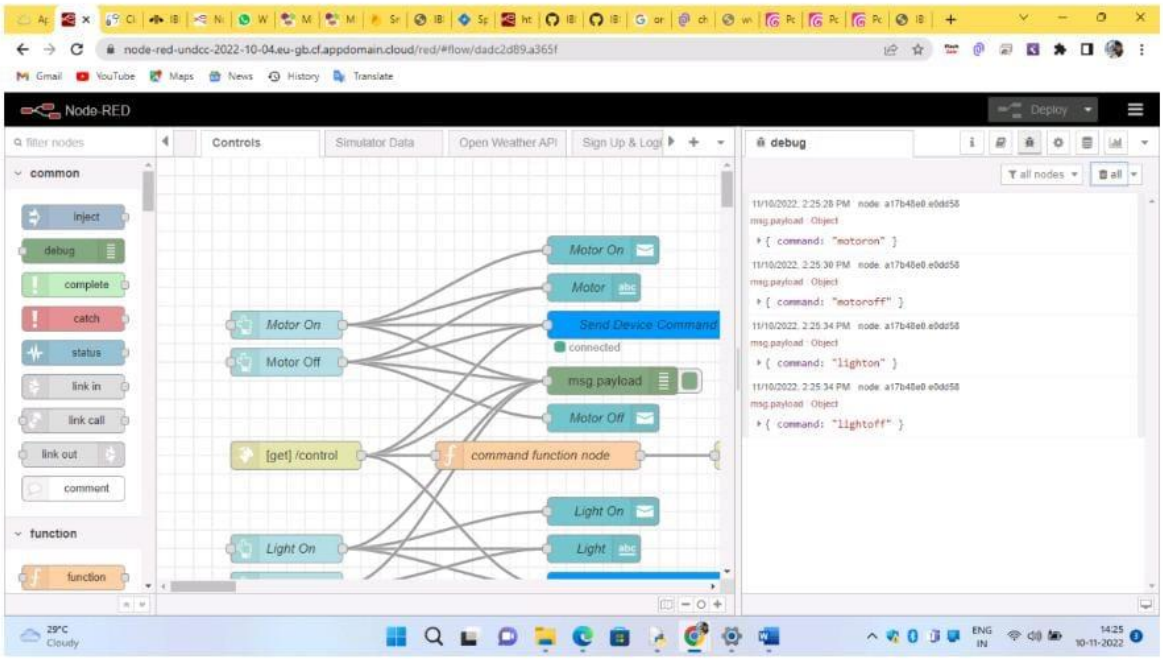
Open Weather API Data



Output - Python



Node-RED Output



8.1 Test Cases

A test case has components that describe input, action and an expected response, in order to determine if a feature of an application is working correctly. A test case is a set of instructions on "HOW" to validate a particular test objective/target, which when followed will tell us if the expected behavior of the system is satisfied or not. Characteristics of a good test case:

- Accurate: Exacts the purpose.
- Economical: No unnecessary steps or words.
- Traceable: Capable of being traced to requirements.
- Repeatable: Can be used to perform the test over and over.
- Reusable: Can be reused if necessary.

8.2 User Acceptance Testing

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing is done.

1. PurposeofDocument

The purpose of this document is to briefly explain thetestcoverageandopenissuesofthe [Smart Farmer Application] project at the time of the release to User Acceptance Testing (UAT).

2. DefectAnalysis

Thisreportshowsthenumberofresolvedor closed bugs at each severity level, and how they were resolved

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	10	4	2	3	19
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	5	2	4	2	13
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won'tFix	0	0	0	0	0
Totals	18	9	11	7	45

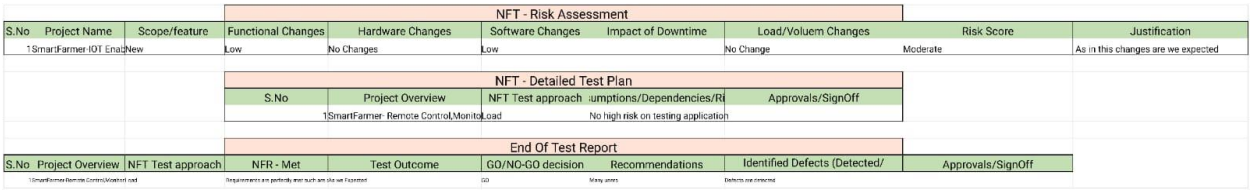
3. TestCaseAnalysis

Thisreportshowsthenumberoftestcasesthathavepassed,failed,anduntested

Section	TotalCases	Not Tested	Fail	Pass
Motor control	2	0	0	2
Light Control	2	0	0	2
Security	4	0	0	4
outsourceshipping	3	0	0	3
ExceptionReporting	6	0	0	6
FinalReportOutput	2	0	0	2
VersionControl	1	0	0	1

9. RESULTS

9.1 Performance Metrics



			NFT - Risk Assessment						
S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	SmartFarmer-IOT Enab	New	Low	No Changes	Low		No Change	Moderate	As in this changes are we expected

	NFT - Detailed Test Plan			
S.No	Project Overview	NFT Test approach	umptions/Dependencies/Ri	Approvals/SignOff
1	SmartFarmer- Remote Control,Monito	Load	No high risk on testing application	

			End Of Test Report					
S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/	Approvals/SignOff
1	SmartFarmer-Remote Control,Monitori ood		Requirements are partially met such as we Expected		GO	Many users	Defects are detected	

10. ADVANTAGES , DISADVANTAGES & APPLICATIONS

Advantages:

- ✓ Farms can be monitored and controlled remotely.
- ✓ Increase in convenience to farmers.
- ✓ Lowered labor and operating cost.
- ✓ Better standards of living.
- ✓ Water Conservation.

Disadvantages:

- ✓ Lack of internet/connectivity issues.
- ✓ Added cost of internet and internet gateway infrastructure.
- ✓ Farmers wanted to adapt the use of WebApp.

Applications:

The common applications of the Smart Agriculture are:

- ✓ Sensor based systems for monitoring crops, soil, fields, livestock, storage facilities, or basically any important factor that influences the production.
- ✓ Smart agriculture vehicles, drones, autonomous robots and actuators.
- ✓ Connected agriculture spaces such as smart greenhouse or hydroponics.
- ✓ Data analytics, visualization and management systems.
- ✓ Crop water management.
- ✓ Pest management and control works.
- ✓ Precision agriculture.
- ✓ Food production and safety, etc

11. CONCLUSION

IoT enabled agriculture has helped implement modern technological solutions to time tested knowledge. This has helped bridge the gap between production and quality and quantity yield. Data Ingested by obtaining and importing information from the multiple sensors for real time use or storage in a database ensures swift action and less damage to the crops. With seamless end to end intelligent operations and improved business process execution, produce gets processed faster and reaches supermarkets in fastest time possible. Thus the objective of the project to implement an IoT system in order to help farmers to control and monitor their farms has been implemented successfully.

12. FUTURE SCOPE

Future development will be focused more on increasing sensors on this system to fetch more live data regard to pest control, food production, etc also by integrating with the GPS to enhance the Agriculture IoT technology to full fill Agriculture Precision ready product. We can use it as a home automation controller. We can remotely operate or perform the jobs. Also combining with solar panels to conserve power. So the entire system is going to be eco-friendly.

13. APPENDIX

Source Code

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


#Provide your IBM Watson Device Credentials
organization = "rlbybh"
deviceType = "b11m3edevicetype"
deviceId = "b11m3edeviceid"
```

```
authMethod = "token"
authToken = "gkoK69otVQCOglahYg"

# Initialize GPIO


def myCommandCallback(cmd): # function for Callback
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='Motoron':
                print("Turn Motor ON")

        elif cmd.data['command']=='Motoroff':
                print("Turn Motor OFF")
        if cmd.data['command']=='lighton':
                print("Turn Light ON")
        elif cmd.data['command']=='lightoff':
                print("Turn Light OFF")


        if cmd.command == "setInterval":

                if 'interval' not in cmd.data:
                        print("Error - command is missing required information: 'interval'")
                else:
                        interval = cmd.data['interval']
        elif cmd.command == "print":
                if 'message' not in cmd.data:
                        print("Error - command is missing required information: 'message'")
                else:
                        output=cmd.data['message']
                        print(output)




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(0,100)
        Humid=random.randint(0,100)
        mois=random.randint(0,100)

        data = { 'Temperature' : temp, 'Humidity': Humid ,'Moisture':mois}
        #print data
        def myOnPublishCallback():
           print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,"Moisture = %s %%" % mois, "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

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

GitHub & Project Demo Link

Github Link

https://github.com/IBM-EPBL/IBM-Project-6353-1658827043.git

Project Demo Link

https://youtu.be/yX4NKOuk95w