Smart Farmer - IOT Enabled Smart Farming Application

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CHAPTER-1

Introduction

Internet of Things Smart technology enables newdigital agriculture. Today technology has become a necessity to meetcurrent 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.

1.1 Project Overview

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using somesensors. 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 isone of the important tasks for the farmers. They can make the decision whetherto water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

1.2 Purpose

We have tried to focus on different scientific applicationswhich could be put together in the agricultural field for better accuracy with better productivity using less manpower. Moreover, weinclude 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 and it also contains the open weather for knowing current weather in our current location.

CHAPTER-2

LITERATURE SURVEY

2.1 Existing problem

Agriculture is the foundation of our Nation. In thepast, 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 climateconditions 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 lastphase of the harvest on which agriculturists depend.

2.2 References

1. Offical Mobile application for Smart Agriculture
   CropX : https://play.google.com/store/apps/details?id=com.cropx.adaptive&hl=en
2. Offical Mobile application for Smart Farming
   Gramophone : https://play.google.com/store/apps/details?id=agstack.gramophone&hl=en
3. S. R. Prathibha, A. Hongal, and M. P. Jyothi, “IOT BASED MONITORING SYSTEM IN SMART AGRICULTURE,” pp. 5–8, 2017.
4. Tien Cao Huang and Can Nguyen Duy, “Environment Monitoring for Agricultural Application Based on Wireless Sensor Network.”, April 16-17.

2.3 Problem Statement Definition

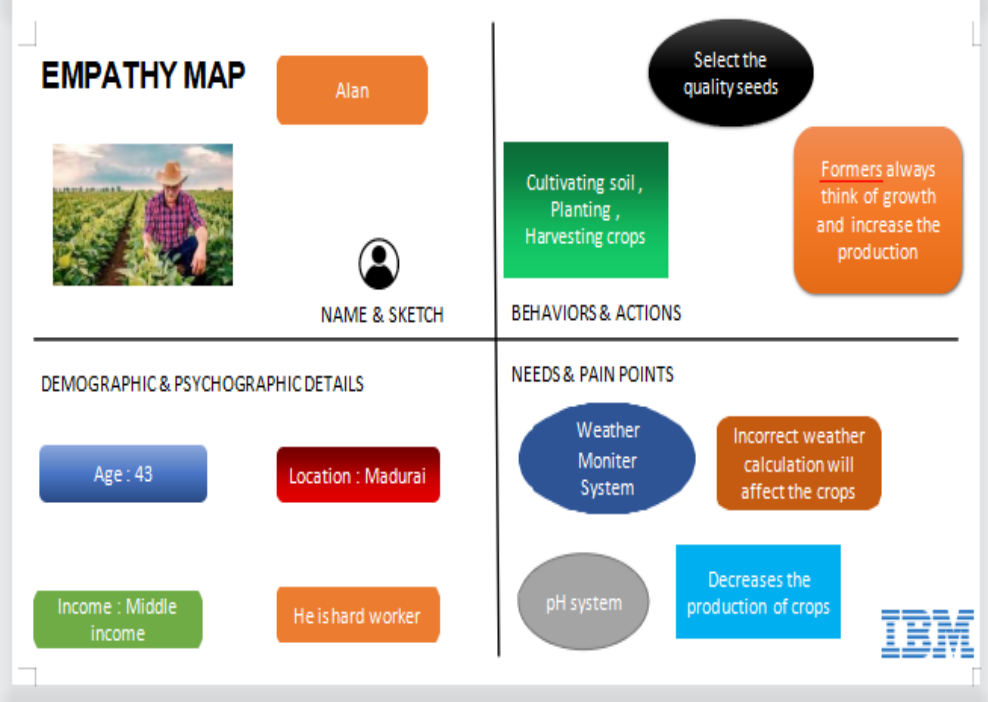
The researcher is supposed to implementan "IoT Based Smart Farming System" with various sensors, which willhelp to collect the data and analyse it. The proposed system collects information about different agricultural parameters (temperature,humidity, moisture) using an IoT sensor. It shows Open weather values also. Farmers can view all the parameters required for a smart farming system through the webpage and Mobile Application.

CHAPTER-3

IDEATION AND PROPOSED SOLUTION

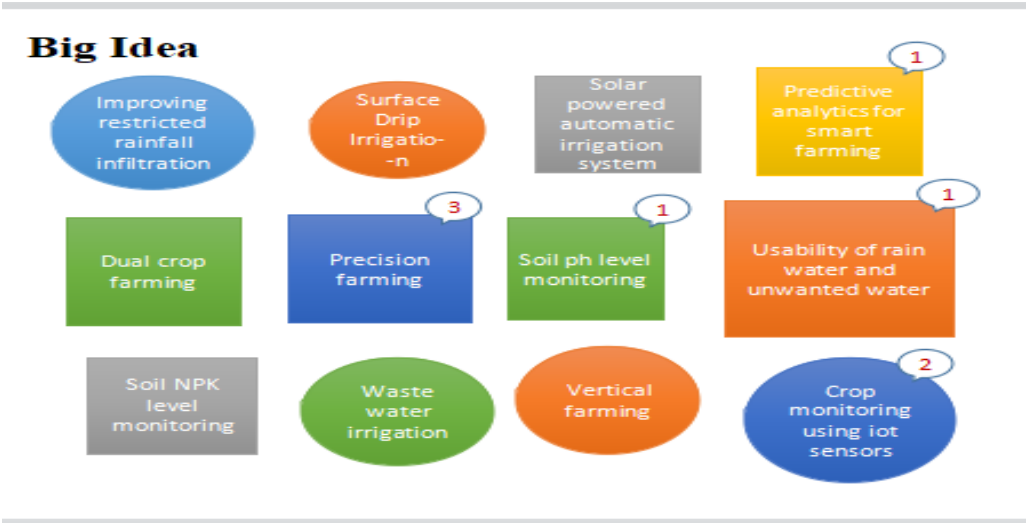
3.1 Empathy Map Canvas

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment.



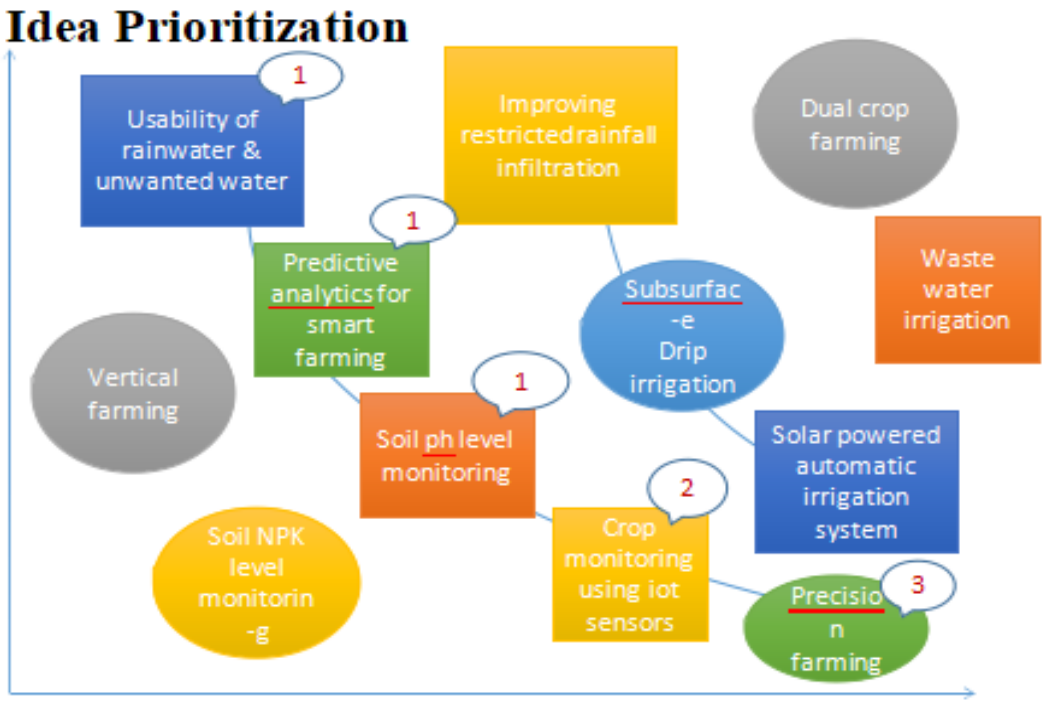
3.2.1 Big Ideas

It consists of all the ideas of instruments and equipments that we are going to implement in this project.

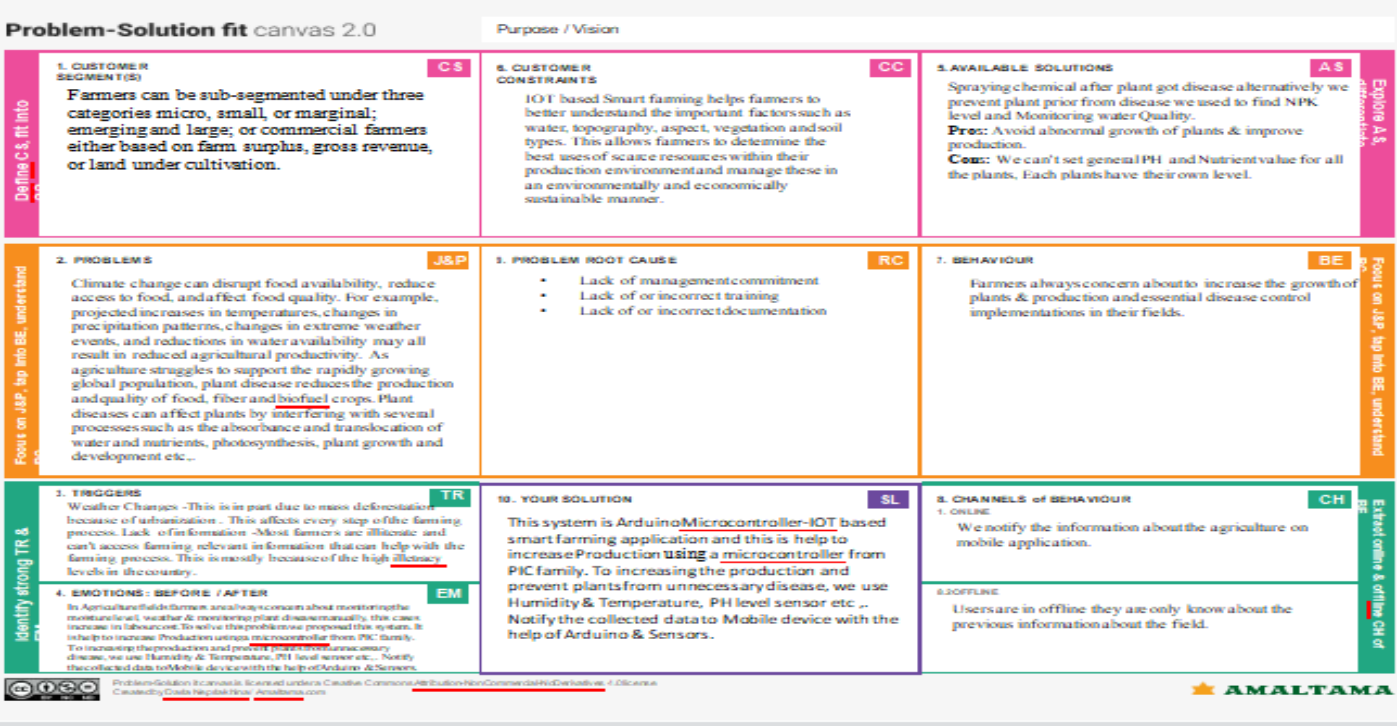


3.2.2 Idea Prioritization

It deals with the prioritizing of the big ideas in order of highest to lowest likes.



3.3 Problem Solution Fit



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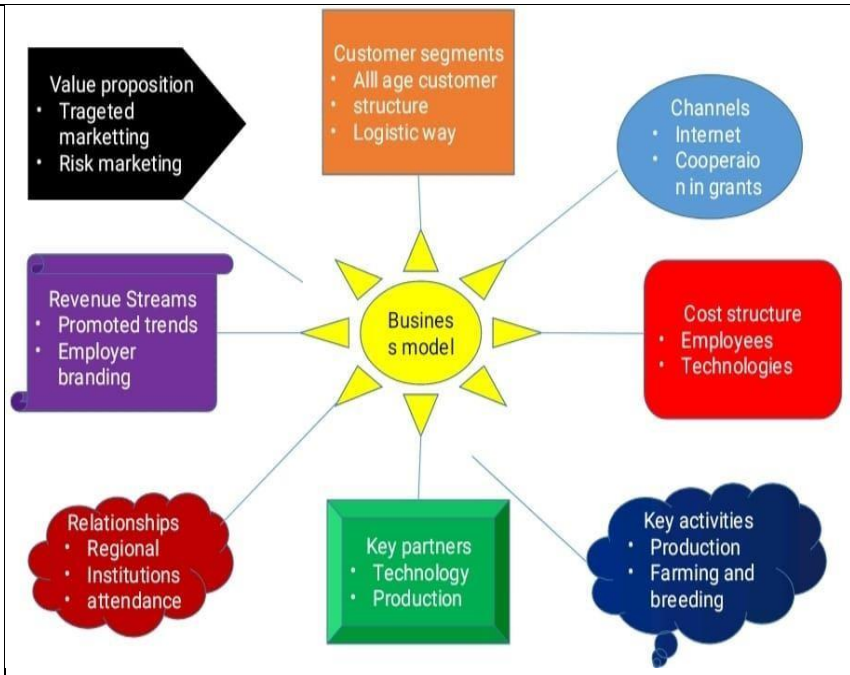
3.4 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Smart Farmer – IoT Enabled Smart Farming Application
2.	Idea / Solution description	This system is Arduino Microcontroller-IOT based smart farming application and this is help to increase Production using a microcontroller from PIC family. To increasing the production and prevent plants from unnecessary disease, we use Humidity & Temperature, PH level sensor etc ,. Notify the collected data to Mobile device with the help of Arduino & Sensors.
3.	Novelty / Uniqueness	Prevent plant prior from disease and abnormal growth we need to find NPK level and Monitoring water Quality.
4.	Social Impact / Customer Satisfaction	In order to meet the needs of consumers and increase profit value, farms need to demonstrate that products offered to the market are clean products also, it helps to track and trace agrifood supply chains production process and trace the origin of agricultural products. This solution has successfully supported the tracing of food and agricultural products through QR codes, improving product quality and ensuring the clear traceability of products, thereby allowing consumers to know the product's entire history.

5.	Business Model (Revenue Model)	
6.	Scalability of the Solution	Using IoT sensors, prevent the plants from abnormal growth and unnecessary disease & Monitoring the air humidity and temperature to Improve quality and production of the crop, its beneficial for both Consumers and Farmers.

CHAPTER-4

REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement(Epic)	Sub Requirement(Story/Sub-Task)
FR-1	User registration	Registration using username and password Follow the instructions
FR-2	User Confirmation	Confirmation via Username Confirmation via Password
FR-3	Interface sensor	Interface sensors and the applications are used to monitor the crops activities like soil moisture, temperature & humidity and send information to farmers
FR-4	Accessing data sets	Data sets are retrieved from Cloudant DB
FR-5	Mobile application	Motors and sprinklers in the field can be controlled by mobile application.

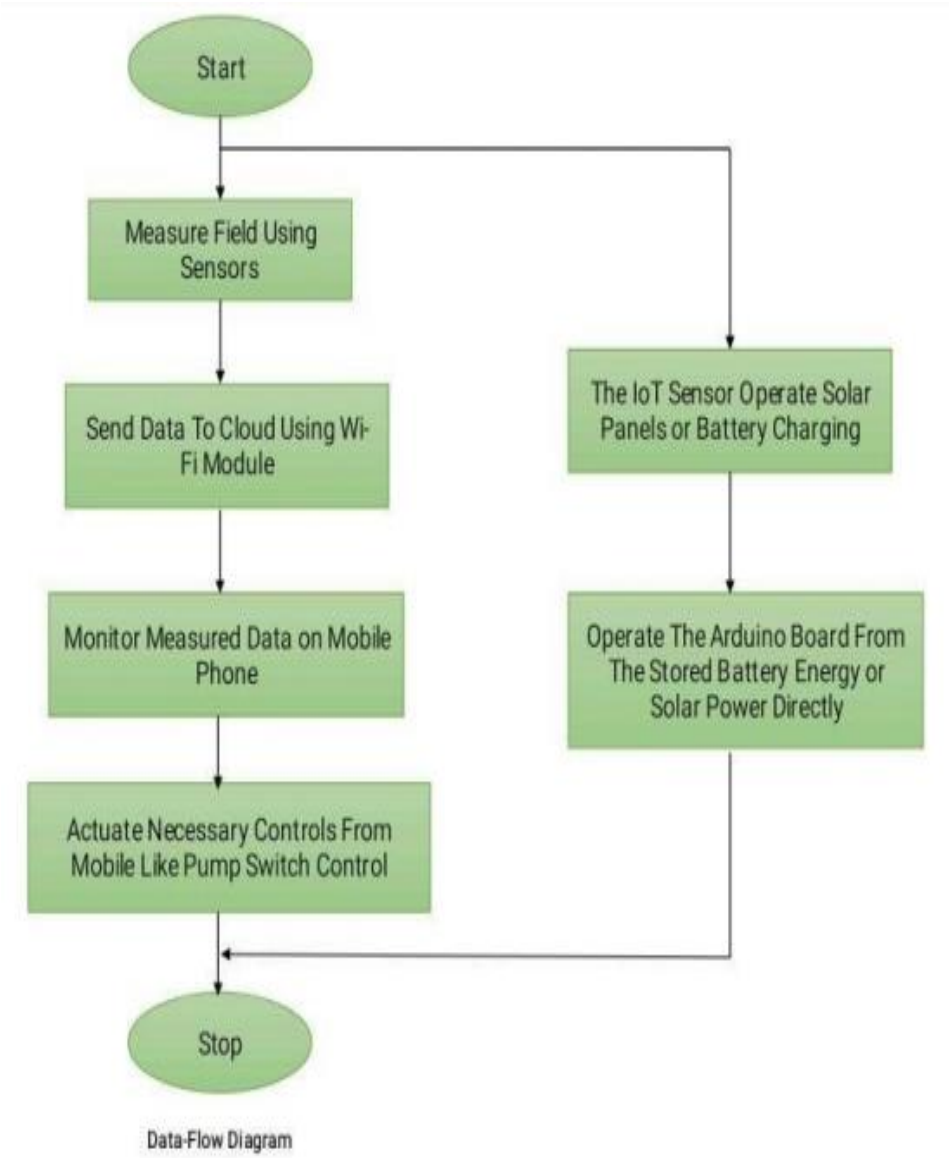
4.2 Non-Functional Requirements

FRNo.	Non-FunctionalRequirement	Description
NFR-1	**Usability**	Use of fertilizers, Irrigation, and scheduled planting operation
NFR-2	**Security**	Crops could be protected from these diseases use pesticides and biocontrol agents.
NFR-3	**Reliability**	This project will help farmers with high production of crops and prevent the crops from abnormal growth. This will also help them in achieving better crop yields thus leading to their economic well being
NFR-4	**Performance**	Agricultural productivity depends on the quality of the seeds with which farmers show their fields.
NFR-5	**Availability**	Farming methods require growers' appropriate plant protection strategy and training
NFR-6	**Scalability**	Since this system uses computer vision techniques integrated with IBM cloudant services helps efficiently to retrieve images in large scale thus improving scalability

CHAPTER-5

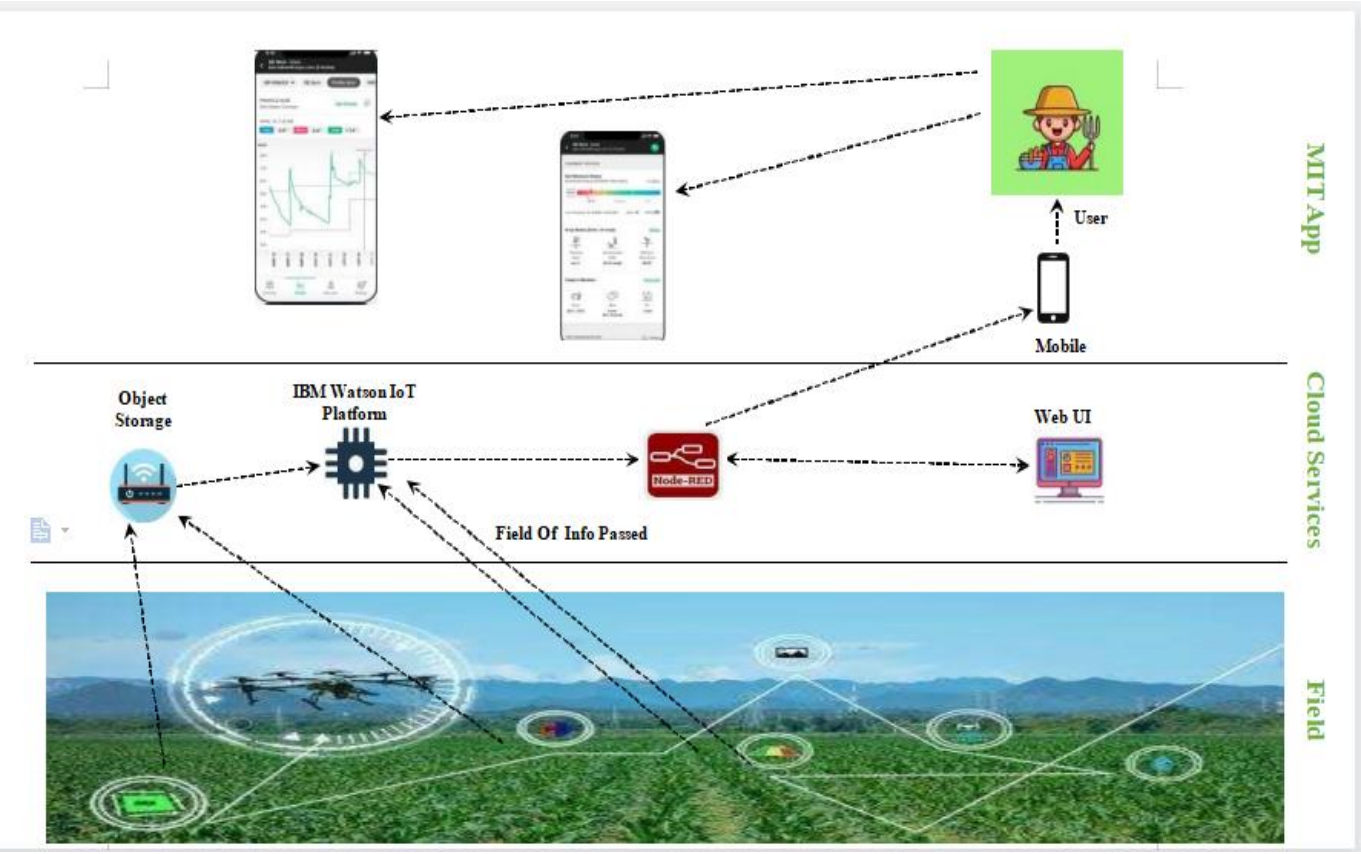
PROJECT DESIGN

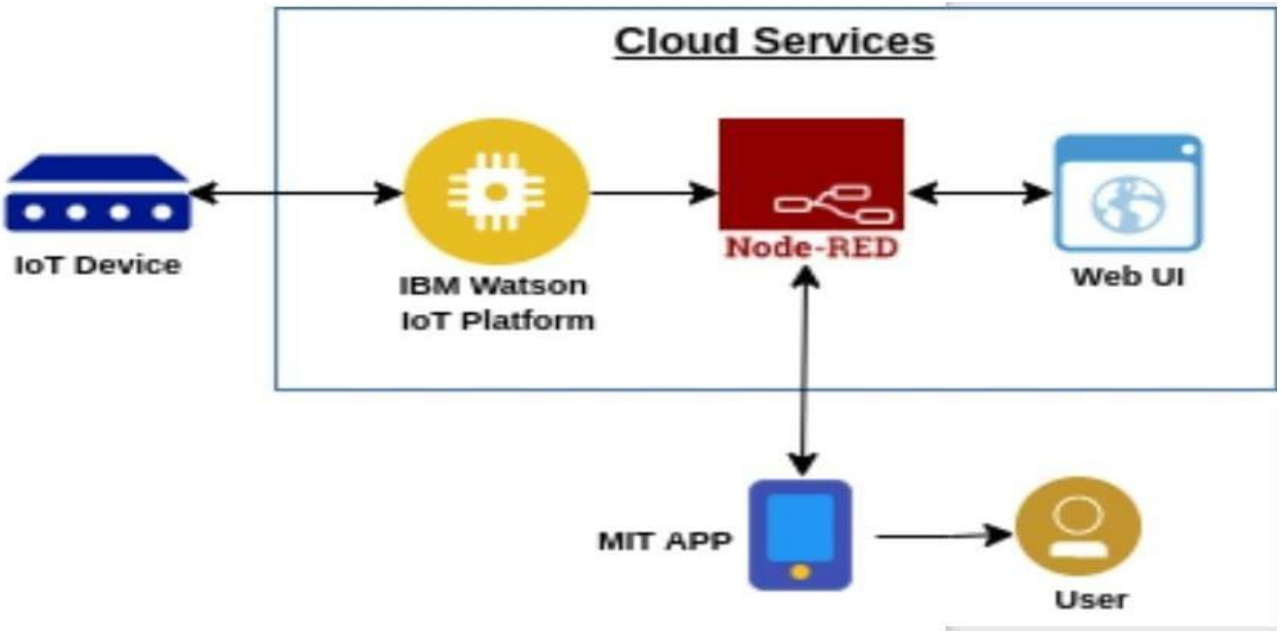
5.1 Data Flow Diagram



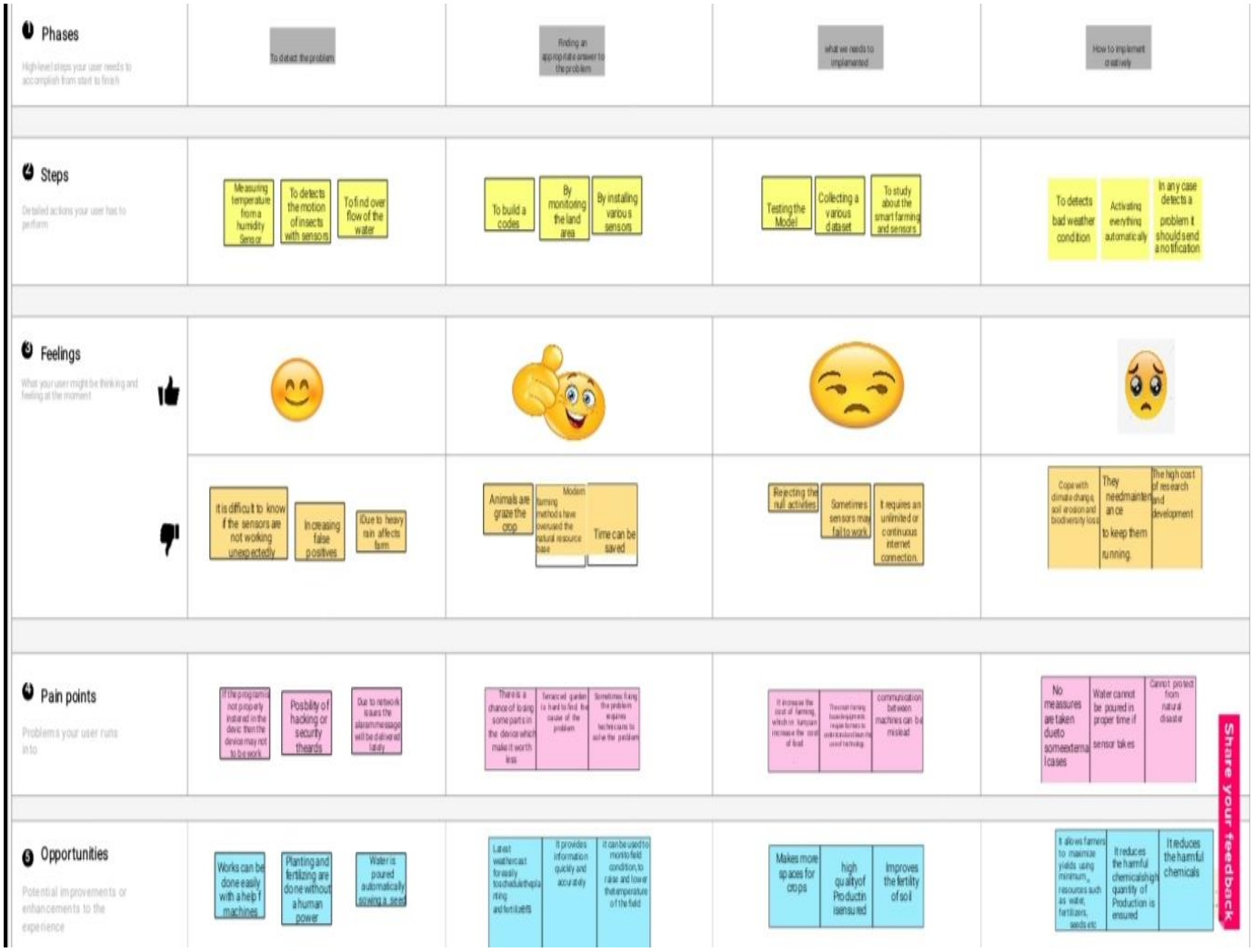
Data-Flow Diagram

5.2 Solution & Technical Architecture





5.3 Customer Journey Map



CHAPTER-6

PROJECT PLANNING PHASE

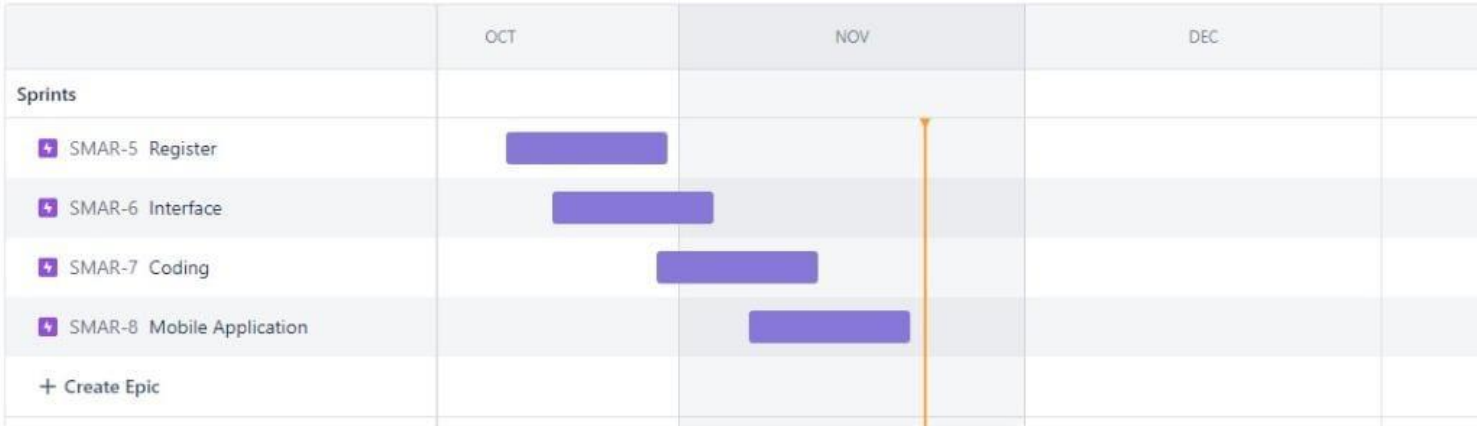
6.1 Sprint Planning, Schedule & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a farmer, I can register for the application by entering my Username and password.	2	High	S Gunaseelan
Sprint-1	User Confirmation	USN-2	As a farmer, I will enter the Username and password. I have registered for the application.	1	Medium	M Surya Prakash
Sprint-1	Login	USN-3	As a farmer, I can log into the application by entering Username and password.	2	High	T Varun Pandiyan
Sprint-2	Interface Sensor	USN-1	A sensor interface is a bridge between a device and any attached sensor. The interface takes data collected by the sensor and outputs it to the attached device.	2	High	R Rajadurai S Gunaseelan
Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	T Varun Pandiyan S Gunaseelan M Surya Prakash R Rajadurai
Sprint-4	Mobile Application	USN-1	As a Farmer, I will show thecurrent Information of the Field.	1	Medium	T Varun Pandiyan M Surya Prakash

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**	**4 Days**	**24 Oct 2022**	**27 Oct 2022**	**20**	**29 Oct 2022**
Sprint-2	**20**	**5 Days**	**28 Oct 2022**	**01 Nov 2022**	**20**	**04 Nov 2022**
Sprint-3	**20**	**8 Days**	**02 Nov 2022**	**09 Nov 2022**	**20**	**11 Nov 2022**
Sprint-4	**20**	**9 Days**	**10 Nov 2022**	**18 Nov 2022**	**20**	**19 Nov 2022**

6.3 Reports From JIRA



CHAPTER-7

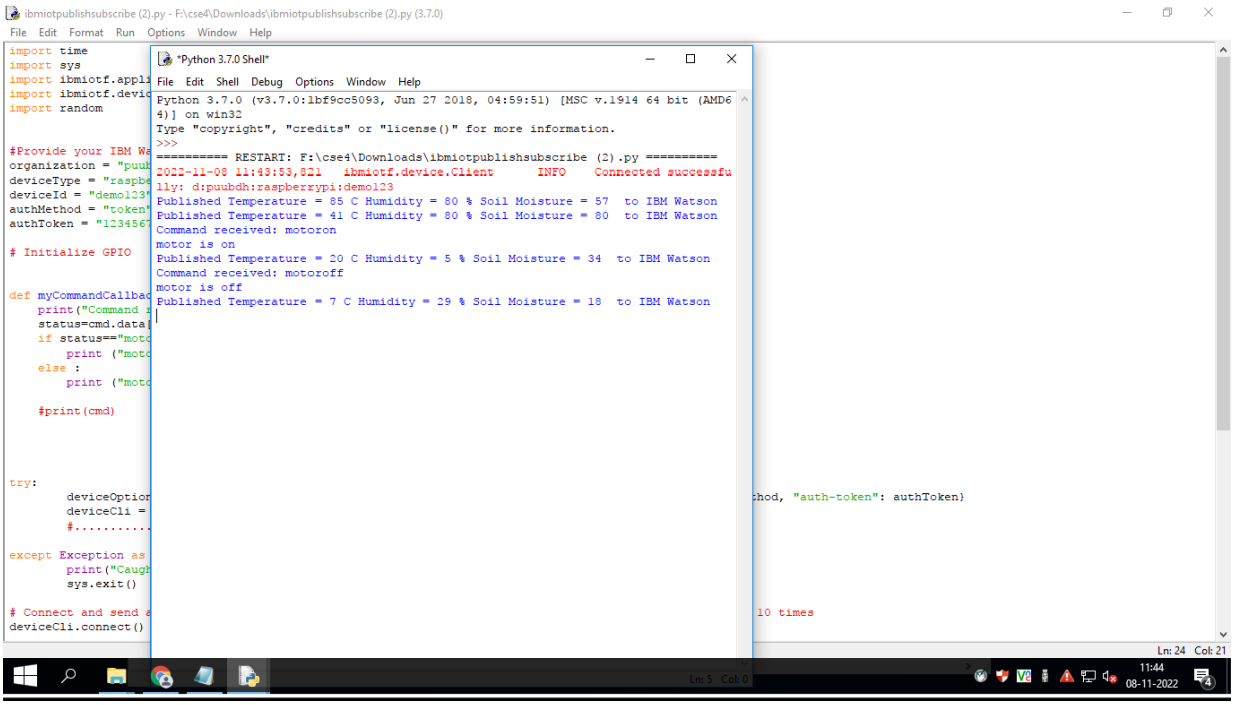
CODING & SOLUTION

7.1 Feature

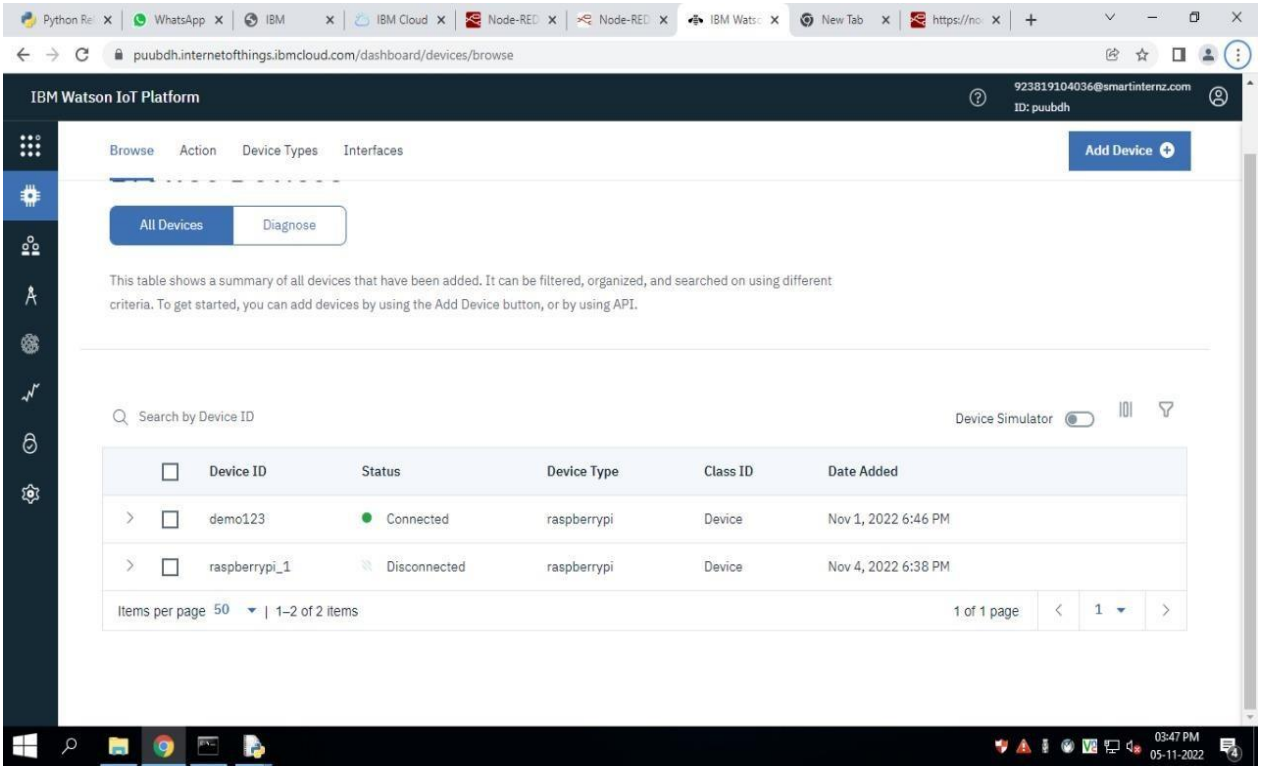
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


#Provide your IBM Watson Device Credentials
organization = "puubdh"
deviceType = "raspberrypi"
deviceId = "demo123"
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")
    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()

while True:
      #Get Sensor Data from DHT11

      temp=random.randint(0,100)
      hum=random.randint(0,100)
      moist=random.randint(0,100)

      data = { 'temp' : temp, 'hum': hum, 'moist' : moist }#print
      data
      def myOnPublishCallback():
          print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % hum, "Soil 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()
```

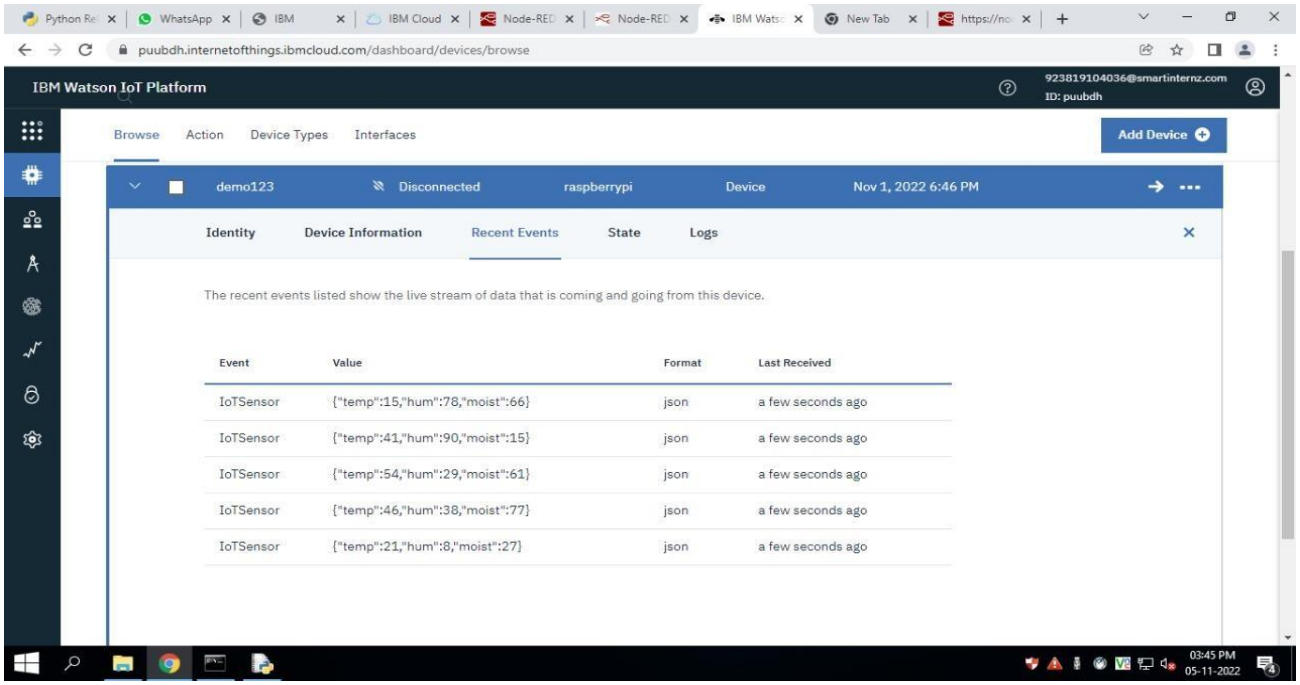
Output:



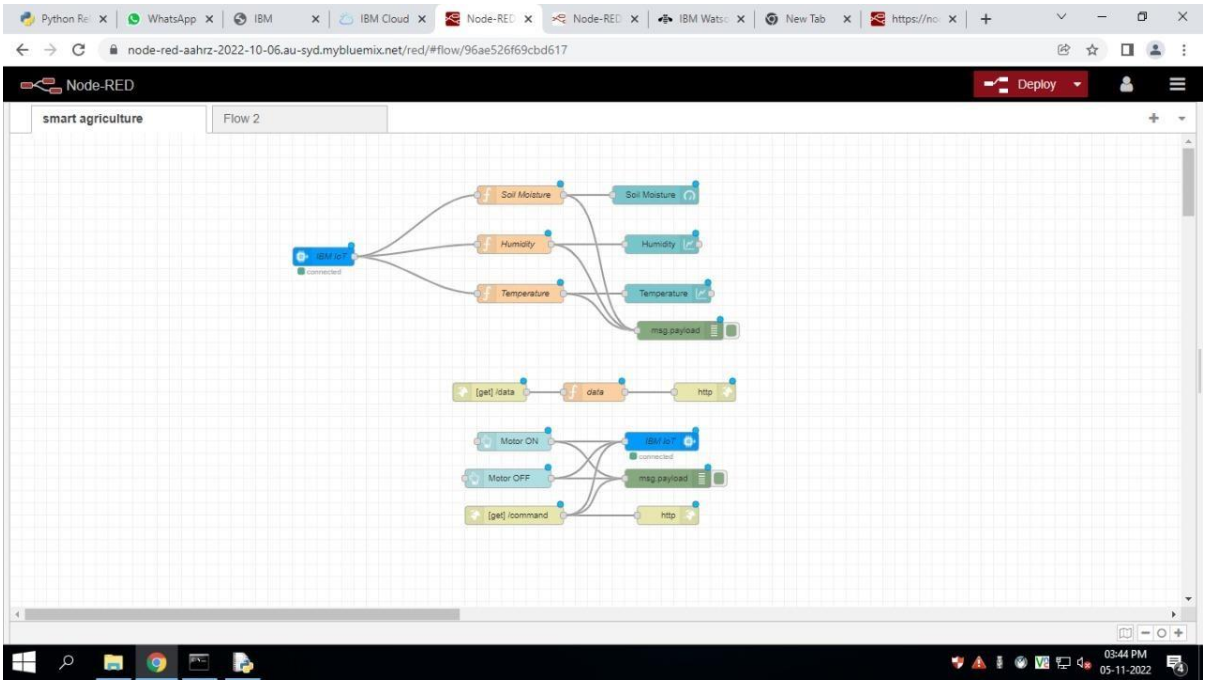
Device Details:

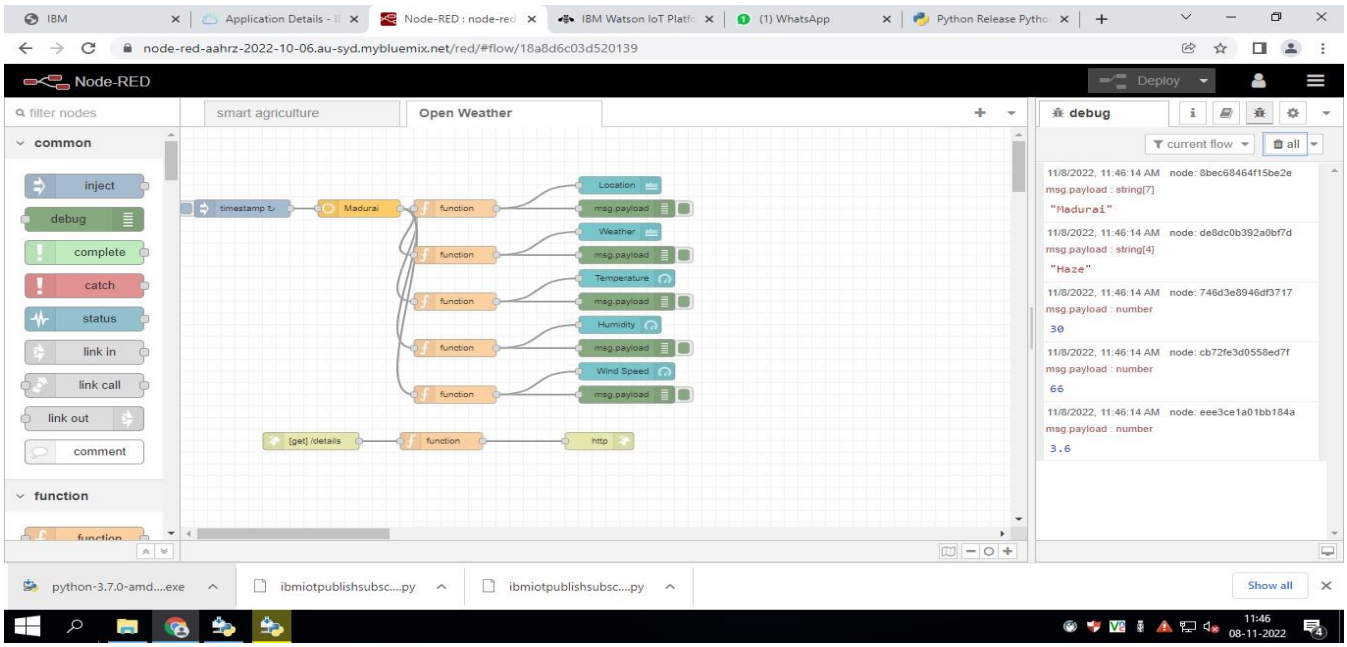


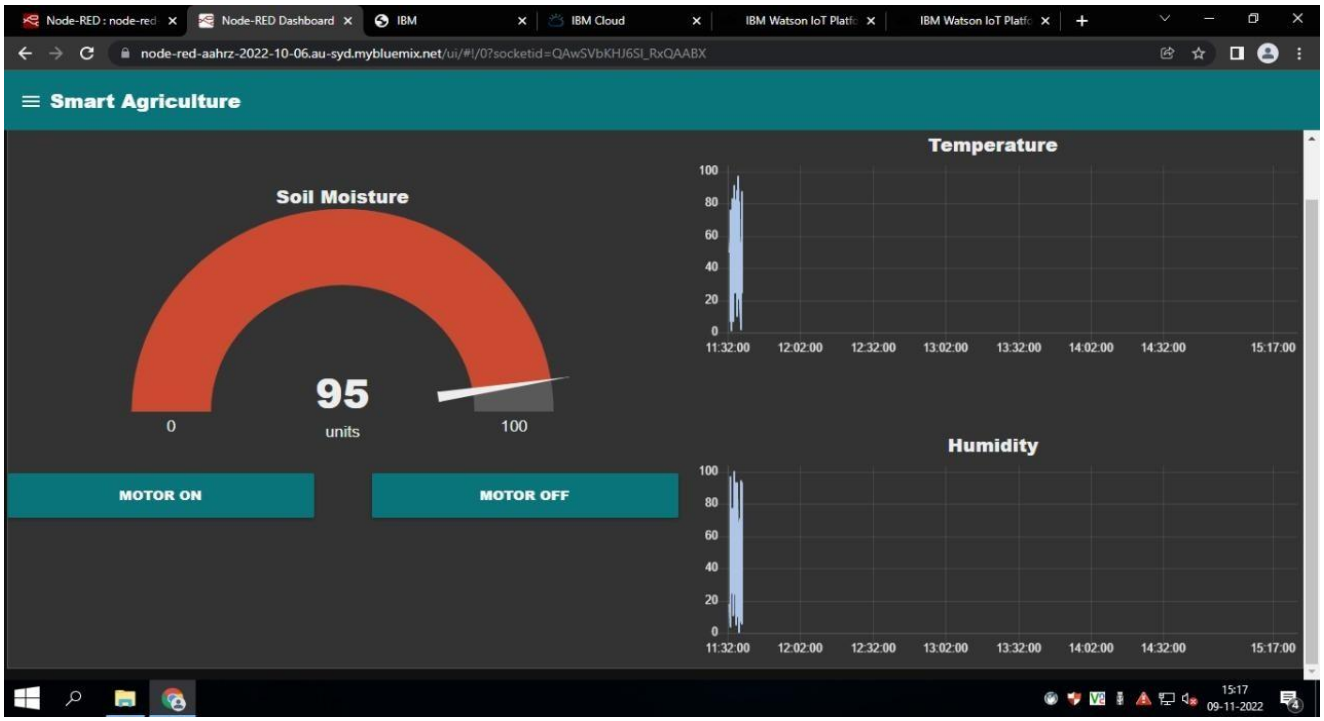
Recent Events:

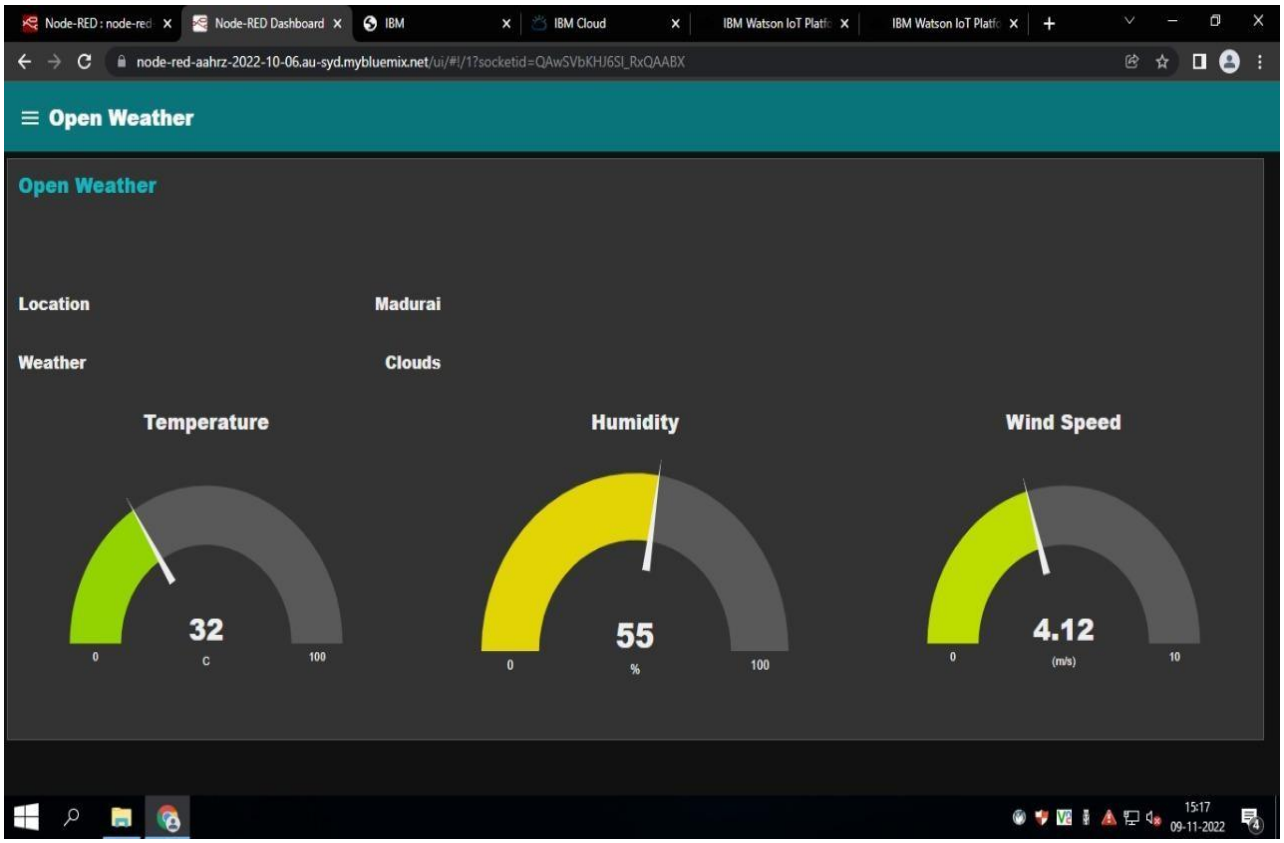


Node-Red Connection and Dashboard Design:

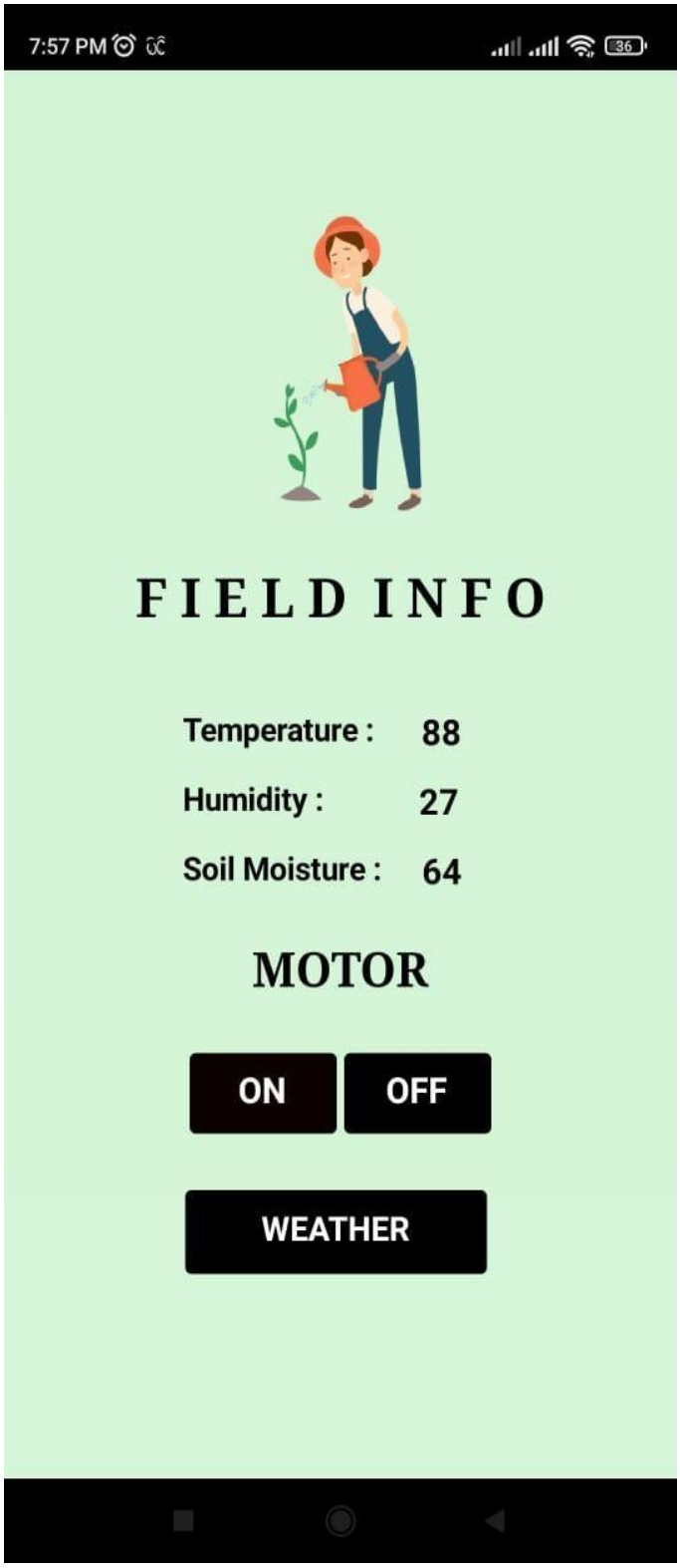


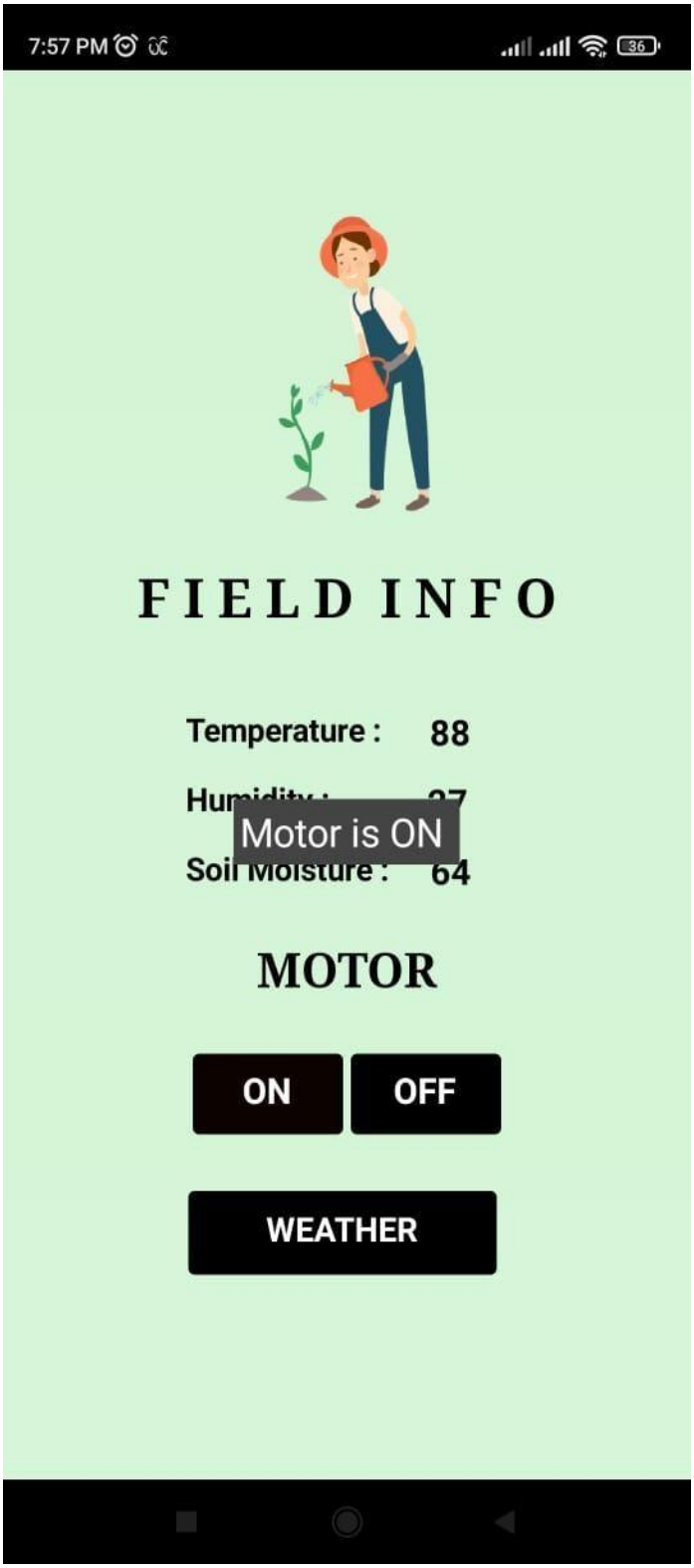

Node-RED
smart agriculture
Open Weather
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
timestamp
Madurai
function
Location
Weather
Temperature
Humidity
Wind Speed
msg.payload
[get] /details
http
11/8/2022, 11:46:14 AM node: 8bec68464f15be2e
msg.payload : string[7]
"Madurai"
11/8/2022, 11:46:14 AM node: de8dc0b392a0bf7d
msg.payload : string[4]
"Haze"
11/8/2022, 11:46:14 AM node: 746d3e8946df3717
msg.payload : number
30
11/8/2022, 11:46:14 AM node: cb72fe3d0558ed7f
msg.payload : number
66
11/8/2022, 11:46:14 AM node: eee3ce1a01bb184a
msg.payload : number
3.6
Show all
11:46
08-11-2022

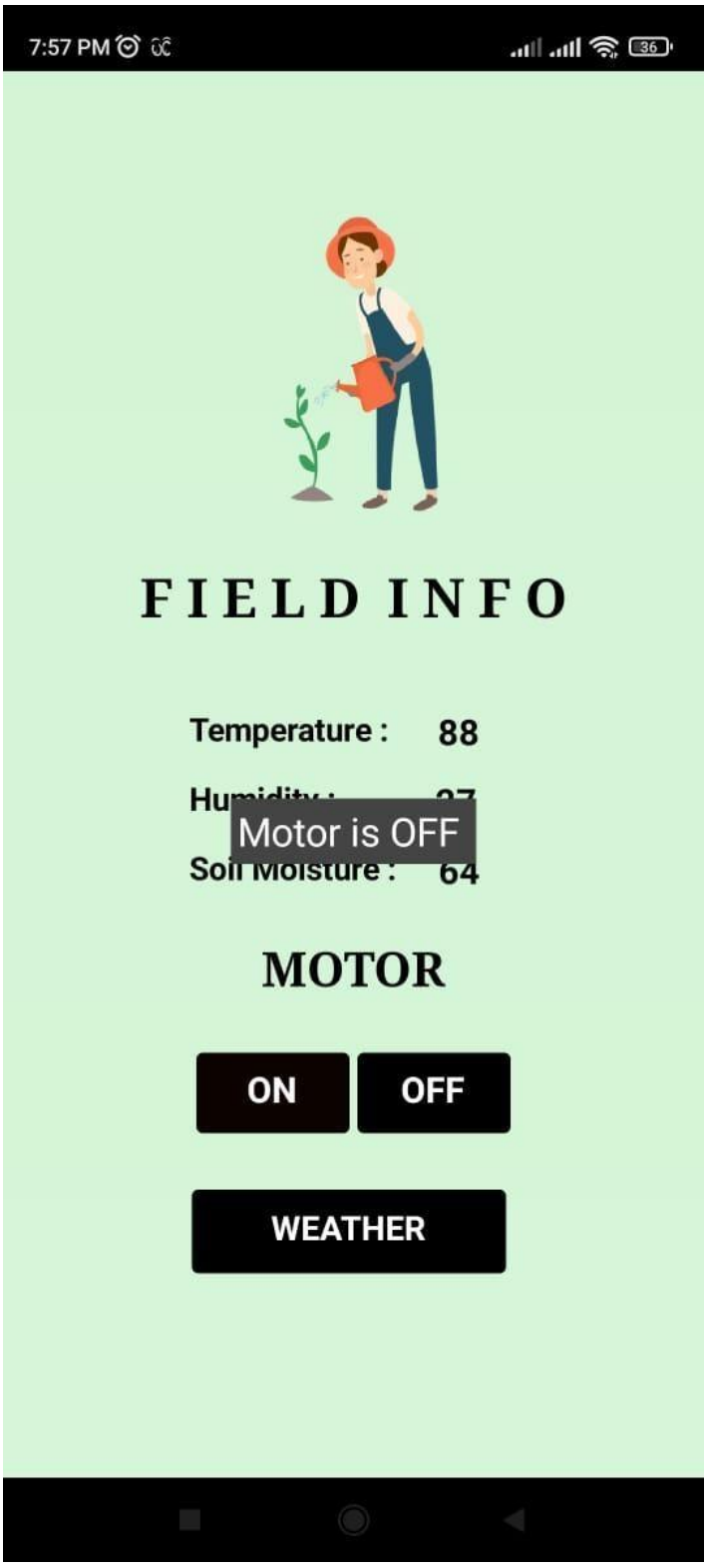

Smart Agriculture
Soil Moisture
95
units
0
100
MOTOR ON
MOTOR OFF
Temperature
Humidity
100
80
60
40
20
0
11:32:00
12:02:00
12:32:00
13:02:00
13:32:00
14:02:00
14:32:00
15:17:00
15:17
09-11-2022


Node-RED : node-red
Node-RED Dashboard
IBM
IBM Cloud
IBM Watson IoT Platfo
IBM Watson IoT Platfo
node-red-aahrz-2022-10-06.au-syd.mybluemix.net/ui/#!/1?socketid=QAwSVbKHJ6SI_RxQAABX
Open Weather
Open Weather
Location
Madurai
Weather
Clouds
Temperature
32
0
C
100
Humidity
55
0
%
100
Wind Speed
4.12
0
(m/s)
10
15:17
09-11-2022

Mobile Application:


7:57 PM
FIELD INFO
Temperature : 88
Humidity : 27
Soil Moisture : 64
MOTOR
ON
OFF
WEATHER


7:57 PM
FIELD INFO
Temperature : 88
Motor is ON
Soil Moisture : 64
MOTOR
ON
OFF
WEATHER


7:57 PM
FIELD INFO
Temperature : 88
Motor is OFF
Soil Moisture : 64
MOTOR
ON
OFF
WEATHER


7:57 PM
OPEN-WEATHER
Location : Madurai
Weather : Clouds
Temperature : 24.8
Humidity : 81
Wind Speed : 2.99
Back

CHAPTER – 8

TESTING

8.1 Test cases

Test Case	Test Scenario	Test Data	Status	Comments	Executed by
TC_OO1	Create the IBM Cloud services which are being used in this project	https://cloud.ibm.com /login	Pass	Results verified	Rajadurai R
TC_OO2	Configure the IBM Cloud services which are being used in completing this project.	https://cloud.ibm.com /login	Pass	Results verified	Gunaseelan S
TC_OO3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform	https://puubdh.internetofthings.ibmcloud.com/dashboard/devices /browse	Pass	Results verified	VarunPandiyan T
TC_OO4	In order to connect the IoT device to the IBM cloud create a device in the IBM Watson IoT platform	Temperature, Humidity , Soil moisture sensor values are generated randomly in simulation	Pass	Results verified	VarunPandiyan T
TC_OO5	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT platform	https://cloud.ibm.com /developer/appservice /create- app?starterKit=59c9d5 bd-4d31-3611-897a- f94eea80dc9f&default	Pass	Results verified	Suryaprakash M
TC_OO6	Create a Node-RED service.	Values of sensors and button for Motor ON/OFF is displayed	Pass	Results verified	Suryaprakash M
TC_OO7	publish random sensor data such as temperature, humidity level, soil moisture to the IBM IoT platform	https://www.python.org/ downloads/release /python-370/	Pass	Results verified	Gunaseelan S

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [SmartFarmer IoT Enabled Smart Farming Application] project at the time of the release toUser Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	7	3	6	5	21
Duplicate	4	0	3	0	7
External	1	2	0	1	4
Fixed	14	1	3	8	26
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	4	2	0	6
Totals	26	11	18	19	67

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	30	0	0	30
Security	2	0	0	2
Outsource Shipping	1	0	0	1
Exception Reporting	7	0	0	7
Final Report Output	9	0	0	9
Version Control	1	0	0	1

CHAPTER-9

RESULTS

9.1 Performance Metrics

1. Requirement Identification
   a. Functional Requirements
   b.Non Functional Requirements
2. Implementation result
   a.System Implementation results
   b.Results of web application
   c.Result of mobile application
3. Resource utilization results
   a. Foreground activities results
   b. Memory usage
   c. Energy usage
4. Background activities result

CHAPTER-10

ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGE:

- 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.
- Monitoring parameters like temperature, humidity etc. will playan important role in improving the growth of the plant.
- Integrating the weather station to the web browser will providethe details of status of the cloud, wind speed etc. It will allow the farmer to protect their plants from natural calamities.

10.2 DISADVANTAGE:

- Since the real time sensor will be connected to the controller, the controller requires continuous supply of the internet to transfer the data.
- Non availability of weather prediction for a long period of time. Since the long weather prediction requires additional payment to open weather.

CHAPTER-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 smartfarming 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, theproject proposes a thought of consolidating the most recentinnovation into the agrarian field to turn the customary techniques forwater systems to current strategies in this way making simple profitable and temperate trimming.

CHAPTER-12

FUTURE SCOPE

The project has vast scope in developing the system and making itmore 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 thepeople 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 easyfor the farmers who are aware of only their regional language..

CHAPTER-13

APPENDIX

Github : http://bitly.ws/wYdM

Demo Link : http://bitly.ws/wYb5