SMART FARMER - IoT ENABLED SMART FARMING APPLICATION

IBM NAALAIYA THIRAN

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A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "**SMART FARMER – IoT ENABLED SMART FARMING APPLICATION"** is the bonafide work of **POTU GANGA MANOJ KUMAR (311819106016), HASHIM ASLAM T (311819106008), AVULA SUNEEL (311819106005) , CHEMDUGUNTA AJAY KUMAR(311819106007)**Who carried out the **IBM NAALAIYA THIRAN** project work under our supervision.

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

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 are to opt for modernized agriculture. Agriculture can be made smart by using Internet of Things (IoT) technologies. Smart Agriculture increases quality, quantity, sustainability and cost- effectiveness 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.

1.2 Purpose

The Smart Agriculture System is a hi-tech and effective system of doing cultivation and growing food in a sustainable way. 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.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing Problem

Farmers are to be present at farm for its maintenance irrespective of the weather conditions. They have to ensure that the crops are well watered and the farm status is monitored by them physically. Farmer have to stay most of the time in field in order to get a good yield. In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country.

2.2 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. "SmartFarmer - IoT Enabled Smart Farming Application"

based on IoT" is regarded as the IoT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and Humidity of atmosphere and the plant/crop. The system provides the concept of "Plug and Sense" in which farmers can directly implement smart farming by such as putting the System on the field and getting Live Data feeds on various electronic devices using Web Application. The system allows to turn the pumping motor ON and OFF on sensing the moisture content of the soil. The Farmer can also use "Run Motor for 30 minutes " Button , where the Motor runs for 30 minutes and turns off automatically with Audio of Motor turning ON, OFF and Run.

CHAPTER-3

IDEATION & PROPOSED SYSTEM

3.1 Empathy Map Canvas

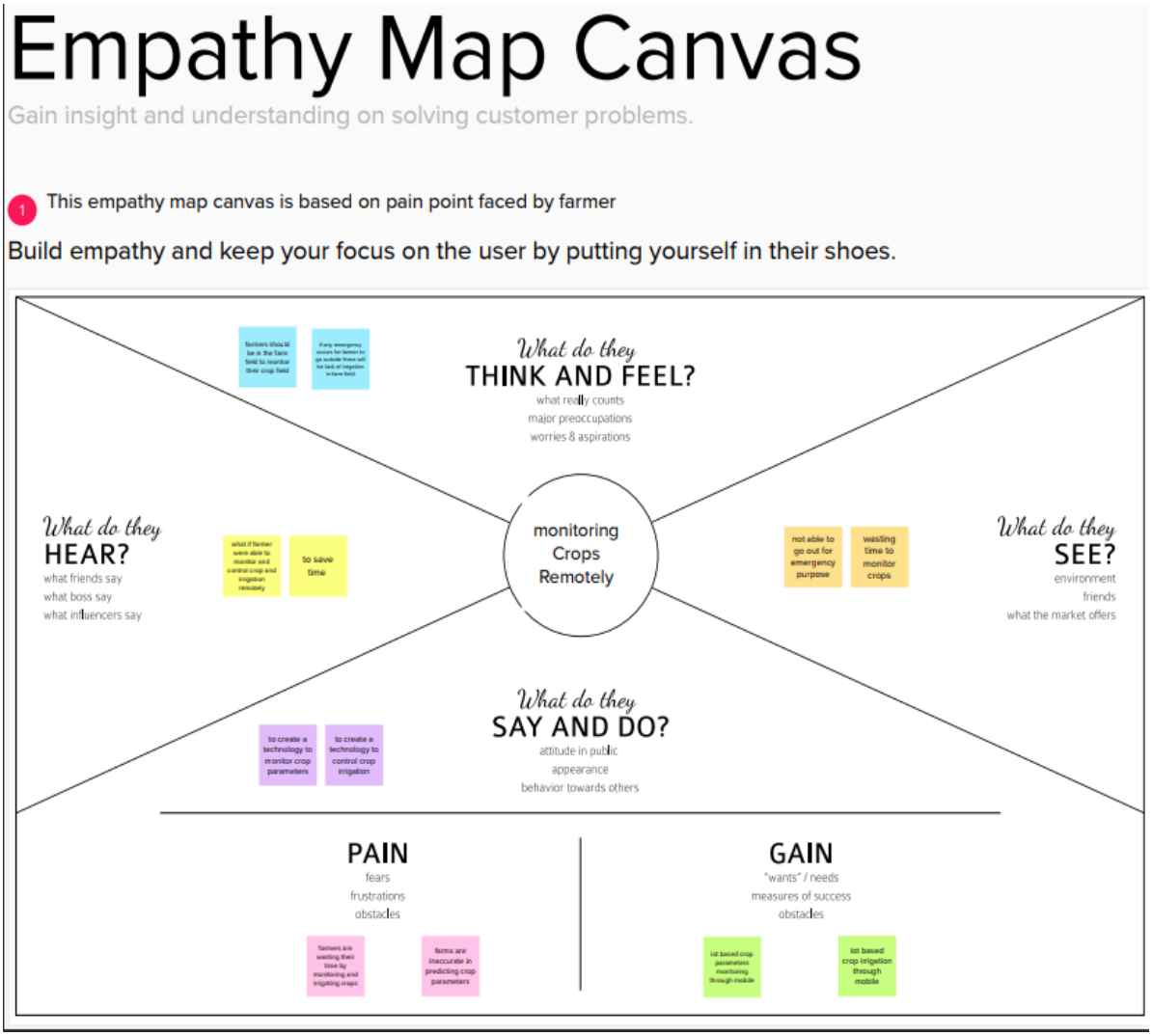


Fig 3.1: Empathy map

3.2 Ideation & Brainstorming

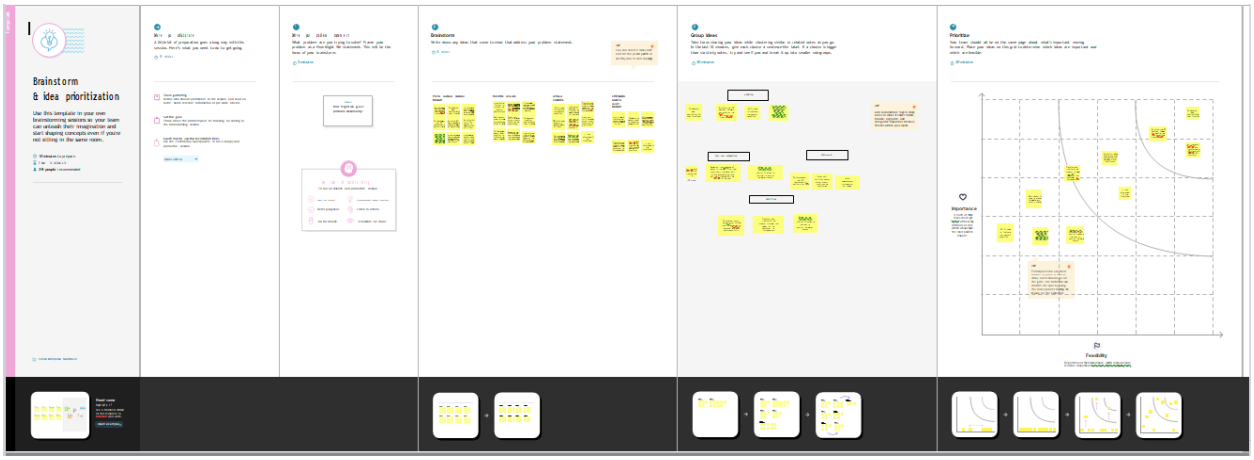


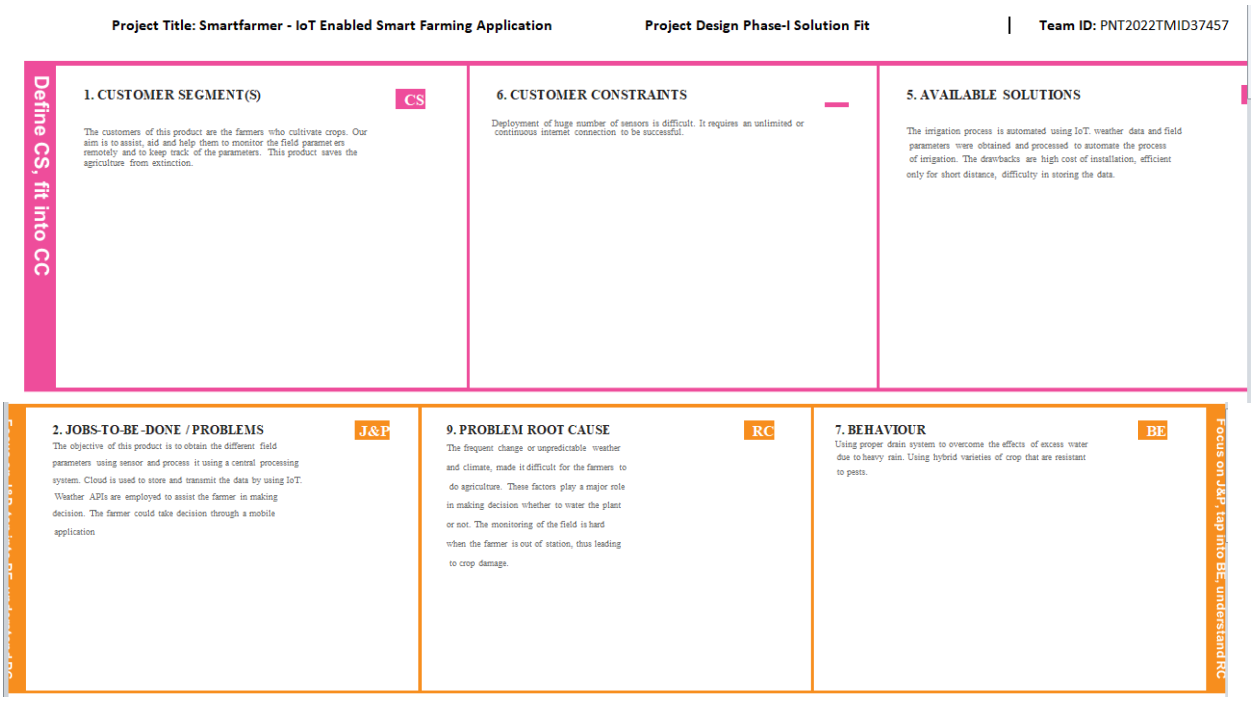
Fig 3.2: Ideation and Brainstorming

3.3 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.

3.4 Problem Solution fit



3. TRIGGERS

TR

Farmers facing issues in providing proper irrigation. No proper supply of water leads to reduced production which affects the profit level of the farmer. Farmer's struggle to predict the weather.

4. EMOTIONS: BEFORE / AFTER

EM

BEFORE: Lack of knowledge in weather forecasting

→Random decisions →low yield.

AFTER: Data from reliable source

→ correct decision →high yield

10. YOUR SOLUTION

SL

Our product collects the data from different types of sensors and it sends the value to the main server. It also collects the weather data from API. The ultimate decision whether to water the crop or not is taken by the farmer using a mobile application.

8. CHANNELS of BEHAVIOR

CH

ONLINE: Providing online assistance to the farmer, in providing knowledge regarding the pH and moisture level of the soil. Online assistance to be provided to the user in using the product

OFFLINE: Awareness camps to be organized to teach the importance and advantages of automation and IoT in the development of agriculture.

CHAPTER-4

REQUIREMENT ANALYSIS

4.1 Functional requirement

Software

Node-RED is a flow-based development tool for visual programming developed originally byIBM for wiring together hardware devices, APIs and online services as part of the Internet of Things.

Node-RED provides a web browser-based flow editor, which can be used to create JavaScript functions.

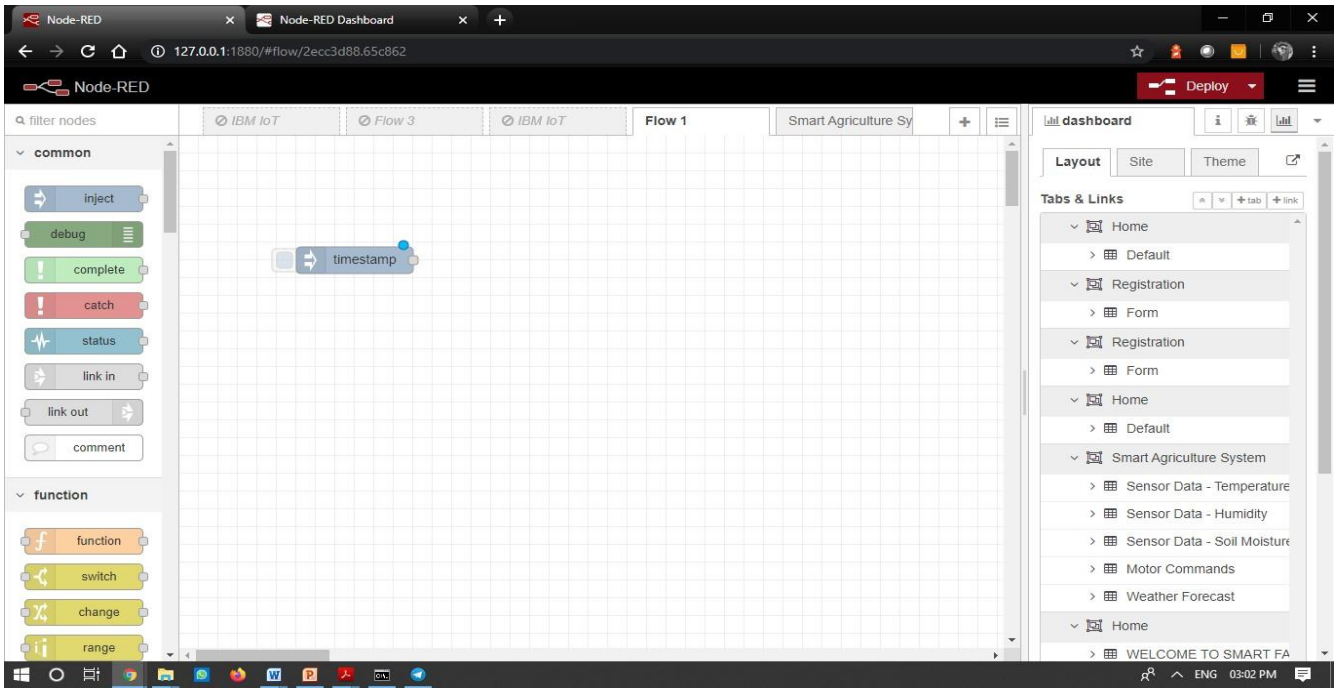


Fig 4.1: Node Red tool

MIT APP inventer

MIT App Inventor is a free, open source web app that anyone can use to build mobile apps. It has been used by over 8 million people worldwide who have built more than 30 million apps. It is available in twelve different languages and used by people from ages 13 and up.

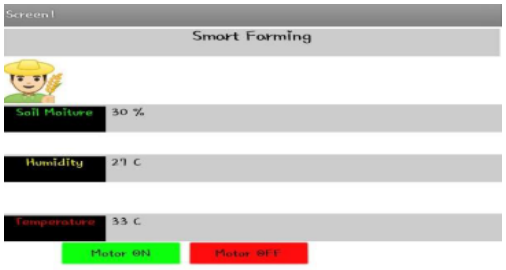


Fig 4.2:MIT app Inventor

4.2 NON- Functional requirement

FAST2SMS

The messaging Industry absolutely simple and less costly. Our simple platform helps you to Send DLT SMS, Promotional, Marketing, OTP & API SMS.

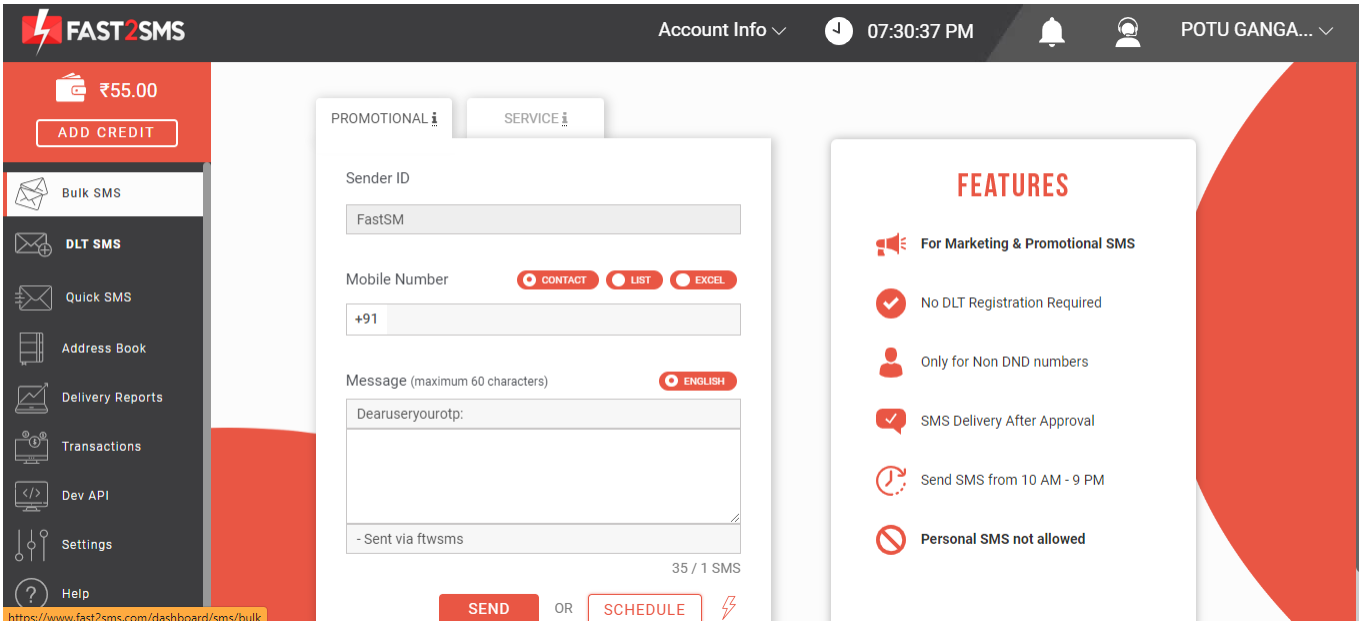


Fig 4.3: Fast 2 sms

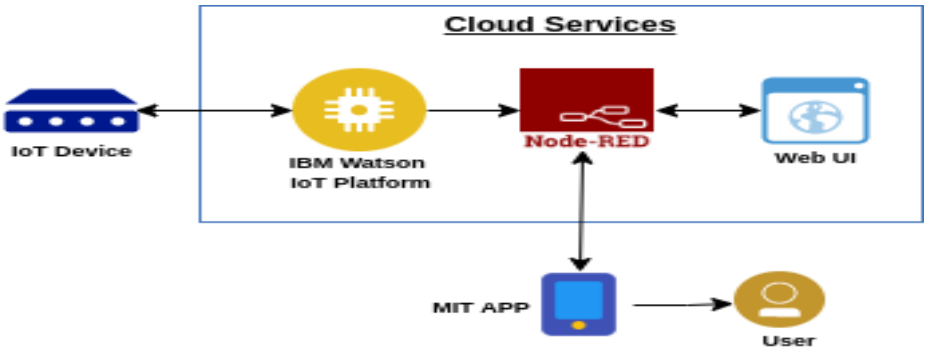
CHAPTER-5

PROJECT DESIGN

5.1 Data Flow Diagram

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

Example: (Simplified)



Example: DFD Level 0

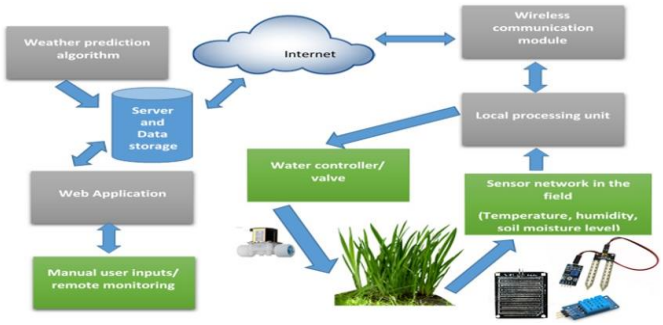


Fig 5.1: Data flow diagram

5.2 Solution &amp.Technical

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	MIT app
2.	Application Logic-1	Logic for a process in the application	Node red/IBM Watson/MIT app
3.	Application Logic-2	Logic for a process in the application	Node red/IBM Watson/MIT app
4.	Application Logic-3	Logic for a process in the application	Node red/IBM Watson/MIT app
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM cloud.
7.	Temperature sensor	Monitors the temperature of the crop	
8.	Humidity sensor	Monitors the humidity	
9.	Soil moisture sensor (Tensiometers)	Monitors the soil temperature	
10.	Weather sensor	Monitors the weather	.
11.	RTC module	Date and time configuration	
12.	Relay	To get the soil moisture data	

5.3 User Stories

Use the below template to list all the user stories for the product.

Functional Requirement (Epic)	**User Story Number**	**User Story / Task**
IoT devices	USN-1	Sensors and wi-fi module
Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios using Node-red
MIT app	USN-3	To develop an application using MIT
Web UI	USN-4	To make the user to interact with the software.

CHAPTER-6

PROJECT PLANNING&SCHEDULING

6.1 Sprint Planning&Estimation

Product Backlog, Sprint Schedule, and Estimation

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	1.Potu ganga manoj kumar 2.,Avula suneel
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Hashim Aslam
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Chemudugunta ajay kumar
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Avula suneel
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Potu ganga manoj kumar

6.2 Sprint Delivery Schedule

Sprint Delivery	Prepare the Sprint delivery on Number of Sprint planning meetingsorganized, Minutes of meeting recorded.	14 NOVEMBER 2022

CHAPTER-7

CODING & SOLUTION

7.1 Feature 1

This is the Python code to receive commands from cloud to any device like Raspberry Pi in the farmimport time

```
import sys

import ibmiotf.application

import ibmiotf.device

import random

#Provide your IBM Watson Device

organization = "r8cpvf"

deviceType = "farming"

deviceId = "12345"

authMethod = "token"

authToken ="87654321"

# Initialize GPIO
```

```
def myCommandCallback(cmd):

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

status=cmd.data['command']

if status=="motoron":

print ("motor is on")

elif status == "motoroff":

print("motor is off")

else :

print ("please send proper command")

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
```

```
aneventof type "greeting" 10 times

deviceCli.connect()

while True:

#Get Sensor Data fromDHT11

temp=random.randint(90,110)

Humid=random.randint(60,100)

Mois=random. randint(20,120)

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

#print data

def myOnPublishCallback():

print ("Published Temperature = %s C" % temp, "Humidity

= %s %%" %Humid, "Moisture =%s deg c" % 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(10)
```

deviceCli.commandCallback = myCommandCallback

#Disconnect the device and application from the cloud

deviceCli.disconnect()

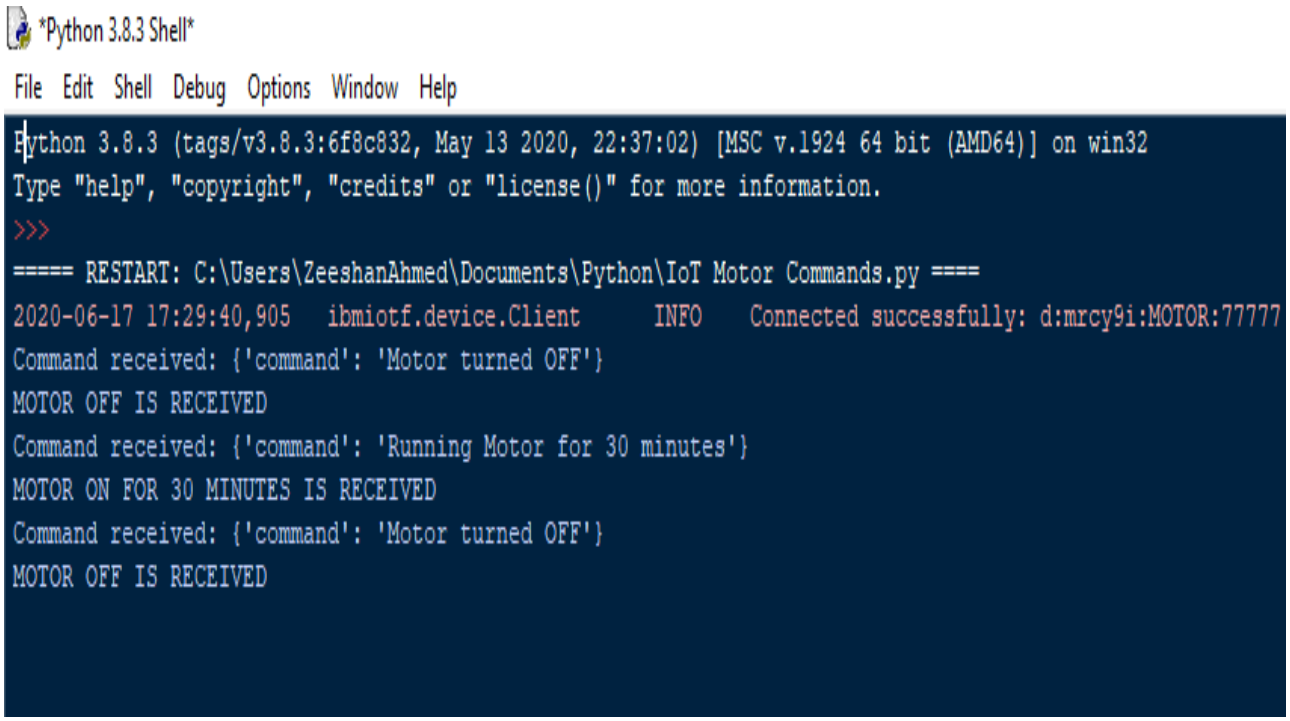


Fig 7.1: Python Shell

CHAPTER-8

TESTING

8.1 Test Cases

A Survey on Soil Monitoring and Testing In Smart Farming Using IoT And Cloud Platform

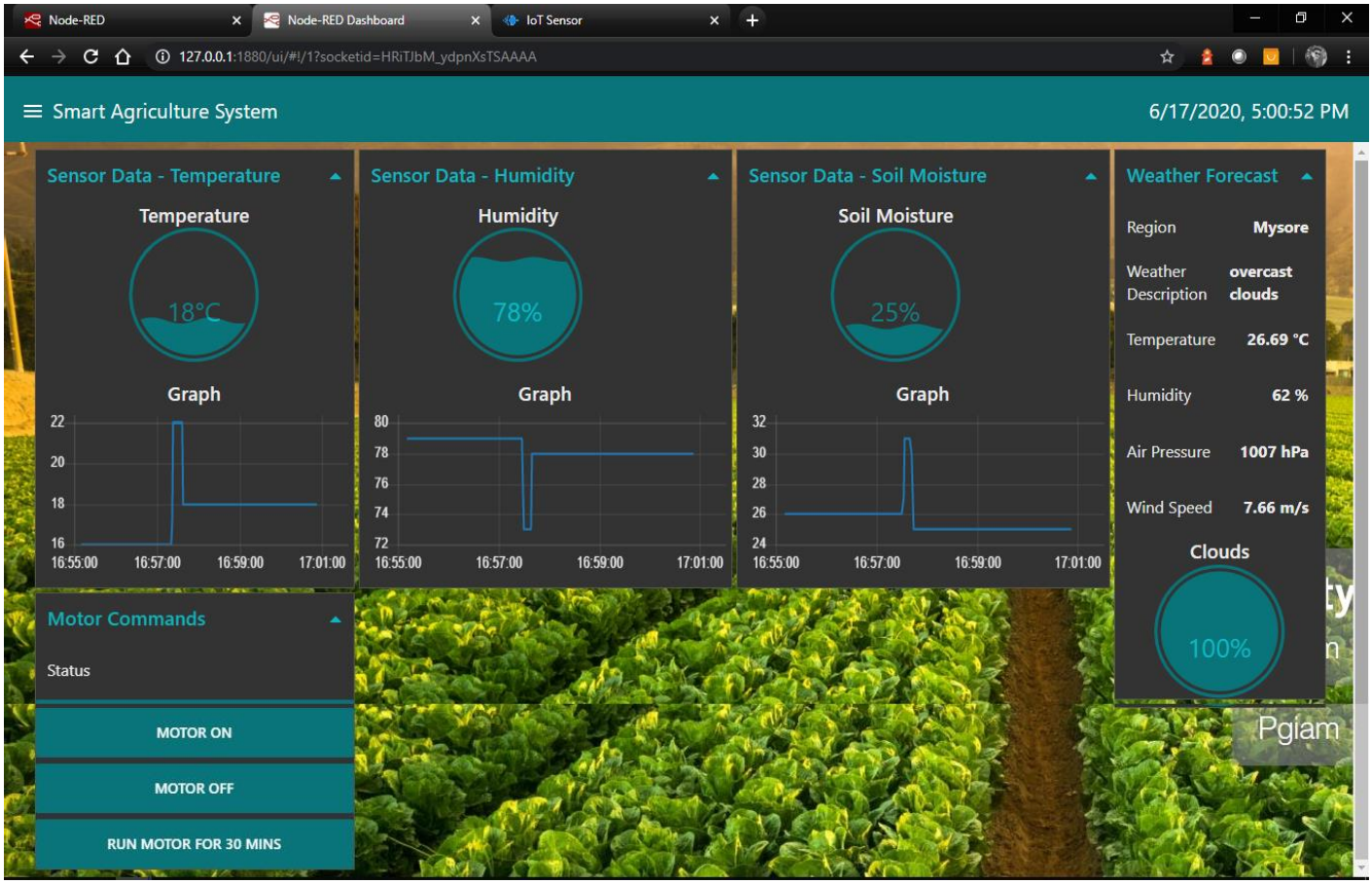
There are three different methods has been carried to test the soil, they are moisture test, respiration test and bulk density test.Soil moisture test is to be performed first because it plays a key role in exchange of water and heat energy between the land surface and the atmosphere, through evaporation and plant transpiration. By considering the soil moisture test results we can perform the further tests like soil respiration test.Soil breathes! Soil respiration is an indicator of biological activity or soil life. This activity is as important to the soil ecosystem as healthy lungs are to us. However, more activity is not always better; it may indicate an unstable system (i.e., after tillage). For efficient sampling, the soil respiration test is performed. The best time to run the soil respiration test is when soil moisture is at field capacity.

The bulk density measurement should be performed at the soil surface and/or in a compacted zone. Measure the bulk density near the site of the respiration tests. Bulk density is the weight of soil for a given volume. The greater the density, the less pore space for water movement, root growth and penetration and seedling germination. After the completion of the three tests on the soil the results obtained by them are used to decide which crop is suitable for that particular soil. This can be done by using decision tree algorithms

CHAPTER-9

RESULTS

9.1 Performance Metrics



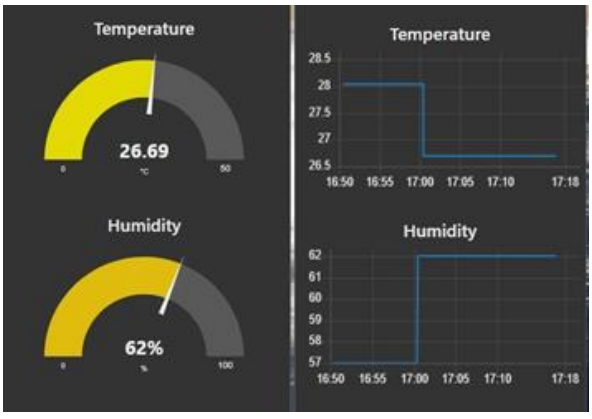


Fig 9.1: Performance Metrices

CHAPTER-10

ADVANTAGES&DISADVANTAGES

10.1 Advantages

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

10.2 Disadvantages

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

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 fastesttime 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.

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.

APPENDIX

GIT REPO: https://github.com/IBM-EPBL/IBM-Project-41348-1660641443

YOUTUBE: https://youtu.be/XgpBt3WVfr4