SmartFarmer - IoT Enabled Smart Farming Application

A IBM PROJECT REPORT

Submitted by

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10. **ADVANTAGES & DISADVANTAGES**
11. **CONCLUSION**
12. **FUTURE SCOPE**

ABSTRACT:

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors.Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasksfor the farmers.They can make the decision whether to water the crop or postpone it by monitoring thesensor parameters and controlling the motor pumps from the mobile application itself.

1. CHAPTER

INTRODUCTION

OVERVIEW

The objectives of this report is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done. The structure of the report is as follows: chapter I will cover over of overview of IoT Technology and agriculture-concepts and definition, IOT enabling technologies, IOT application in agriculture, benefits of IOT in agriculture and IOT and agriculture current scenario and future forecasts. Chapter II will cover definition of IOT based smart farming system , the components and modules used in it and working principal of it. Chapter III will cover algorithm and flowchart of the overall process carried out in the system and its final graphical output. Chapter IV consist of conclusion, future scope and references.

PURPOSE :

1. IoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps,cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the parties concerned.
2. IoT is regarded as key component for Smart Farming as with accurate sensors and smart equipment's, farmers can increase the food production by 70% till year 2050 as depicted by experts.
3. With IoT productions costs can be reduced to a remarkable level which will in turn increase profitability and sustainability.
4. With IoT, efficiency level would be increased in terms of usage of Soil, Water, Fertilizers, and Pesticides etc.
5. With IoT, various factors would also lead to the protection of environment.

2. EXISTING SYSTEM

GENERAL

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. Irrigated farms typically deploy a single pump to irrigate 80 to 100 acres of land. Many large farms, therefore, require 40 to 80 or more irrigation pumps spread over hundreds of square miles. Most are pumping ground water for irrigation purposes, most operate in remote fields, and trucks must roll to tend to them. Ideally, each field should get just the right amount of water at just the right time. Underwatering causes crop stress and yield reduction. Overwatering can also cause yield reduction and consumes more water and fuel than necessary and leads to soil erosion and fertilizer, herbicide, and pesticide runoff. Agricultural operations waste 60% of water consumed each year. Now more than ever, new technologies for water conservation must be adopted.
According to U.S. government statistics, however, only 10% of irrigated farms use advanced water management decision tools, including precision irrigation controls and soil moisture/water level sensing devices. There are both state and federal incentive plans now in place to help increase those percentages, and we were recently awarded an Arkansas Conservation Stewardship Grant to do advanced research in soil and water level monitoring.

METHODOLOGY

Perhaps the greatest disadvantage of GSM is that multiple users share the same bandwidth. With enough users, the transmission can encounter interference. Therefore, faster technologies, such as 3G, have been developed on different types of networks than GSM, such as CDMA, in order to avoid such bandwidth limitations.

EXPLANATION

Another disadvantage of GSM is that is can interfere with certain electronics, such as pace makers and hearing aids, according to Inc. Technology. Com. Such interference is due to the fact that GSM uses a pulse-transmission technology. As a result, many locations such as hospitals and airplanes require cell phones to be turned off.

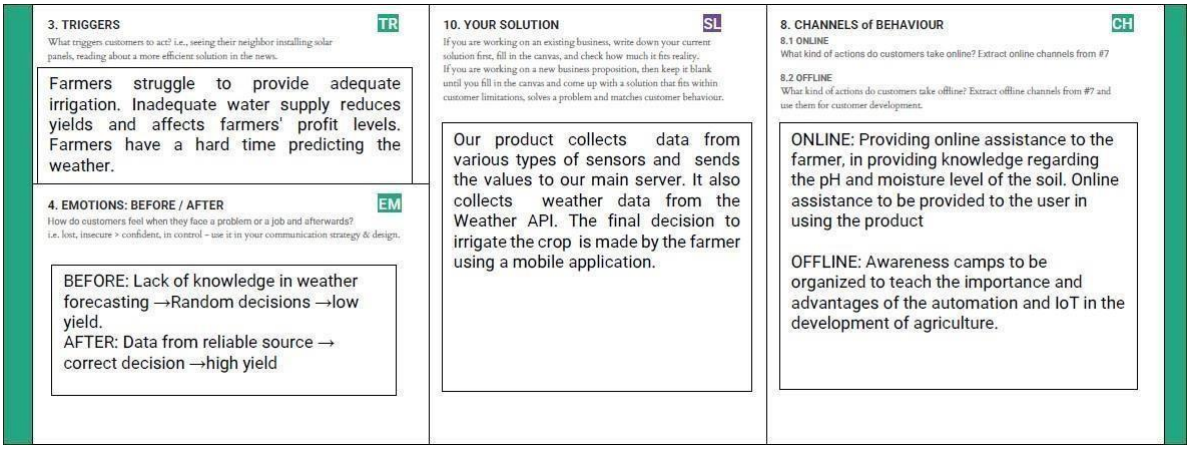
PROBLEM IDENTIFICATION

Agriculture is the strength of Indian Economy. However, for agriculture water consumption is more than rainfall every year. Improving farm yield is essential to meet the rapidly growing demand of food for population growth across the world.
An automated irrigation system is needed to optimize water use for agricultural crops. The technique can be used for application of accurate amount of water. By forming sensor network, good monitoring of water regulation in the agriculture field can be achieved. Advanced tools and

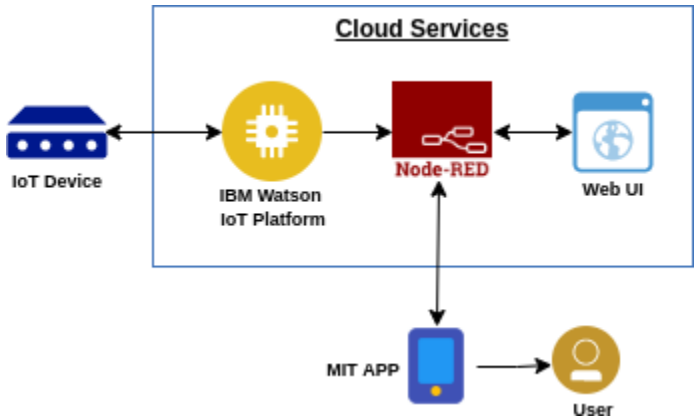
technology can be used to increase farm yield. The microcontroller from the node controls relay switching unit and watering subsystem accordingly

3. PROPOSED SYSTEM

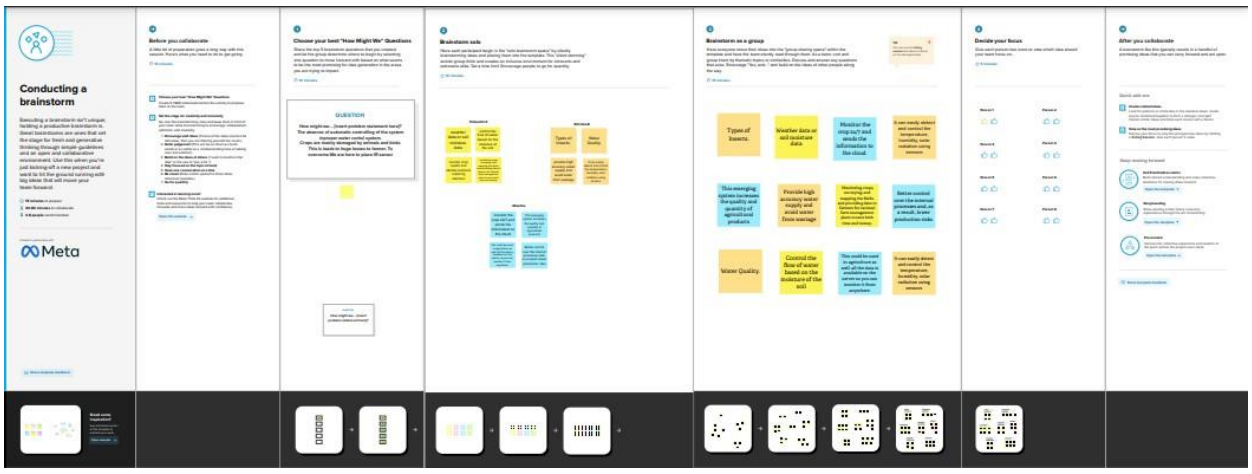
GENERAL



METHODOLOGY AND SYSTEM ARCHITECTURE



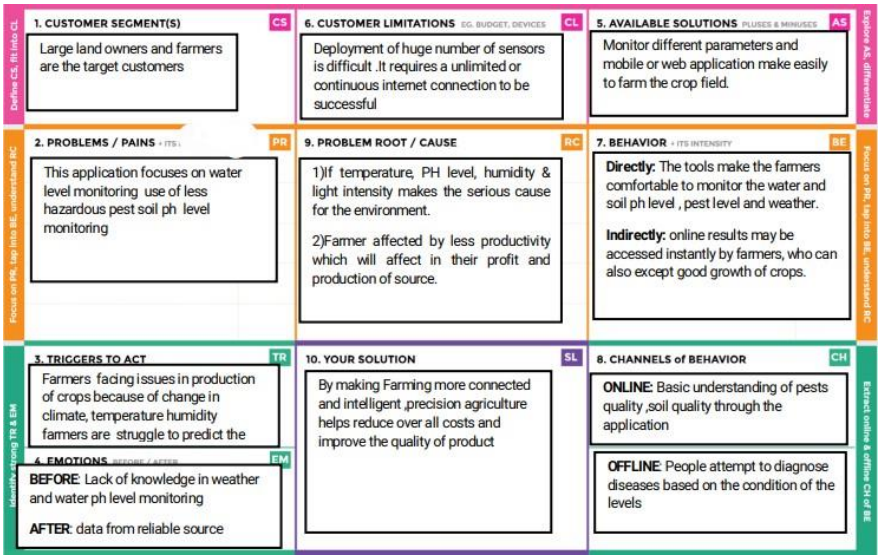
IDEATION AND BRAINSTROMING



MODULE EXPLANATION

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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.
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 analyze real-time data in order to make informed decisions.
3.	Novelty / Uniqueness	Various eminent researchers have been making efforts for smart farming by using IoT concepts in agriculture. But, a bouquet of unfolded challenges is still in a queue for their effective solution. This study makes some efforts to discuss past research and open challenges in IoT based agriculture.
4.	Social Impact / Customer Satisfaction	Reduces the wages for labors 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	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.

PROBLEM SOLUTION FIT



4. SYSTEM REQUIREMENT

FUCTIONAL REQUIREMENTS

FR No	Non-Functional Requirement	Description
NFR-1	Usability	Mobile assistance. Given the capabilities of mobile devices, users must be able to interact in the same roles and tasks on PCs and mobile devices when practicable.
NFR-2	Security	Authorized users of the system who share information must be able to register and communicate securely on devices with data.
FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	➢ Sensing animals near the crop field, the device sends the farmer an SMS and plays an alert to scare them away.
FR-2	User Reception	➢ Data such as sensor readings for temperature, humidity, and soil moisture are received by SMS.
FR-3	User Understanding	➢ Based on the sensor data value to get the information about present of farming land.
FR-4	User Action	➢ Actions that must be taken by the user include crop residue destruction, deep ploughing, crop rotation, fertiliser application, strip cropping, and scheduled planting operations.

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

NFR-3	Reliability	➢ It has the ability to detect disturbances close to the field and doesn't issue an erroneous warning signal.

NFR-4	Performance	➢ Regardless of the amount of data that is saved and the background analytics, it must offer users acceptable response speeds. ➢ Communications that are bidirectional and nearly real-time must be supported. The necessity to support industrial and device protocols at the edge is connected to this requirement.
NFR-5	Availability	➢ For 24x7 operations, IOT solutions and domains require highly available systems. is not a vital production application, thus if the IoT solution goes down, neither operations nor production are affected.
NFR-6	Scalability	➢ System must manage increasing load and data retention requirements based on the scalability of the solution, such as additional buildings and manufacturing facilities.

5. IMPLEMENTATION AND RESULTS

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.

1. The different soil parameters temperature, soil moistures and then humidity aresensed using different sensors and obtained value is stored in the Ibm cloud.

2. Arduino UNO is used as a processing Unit that process the data obtained fromthe sensors and whether data from the weather API.

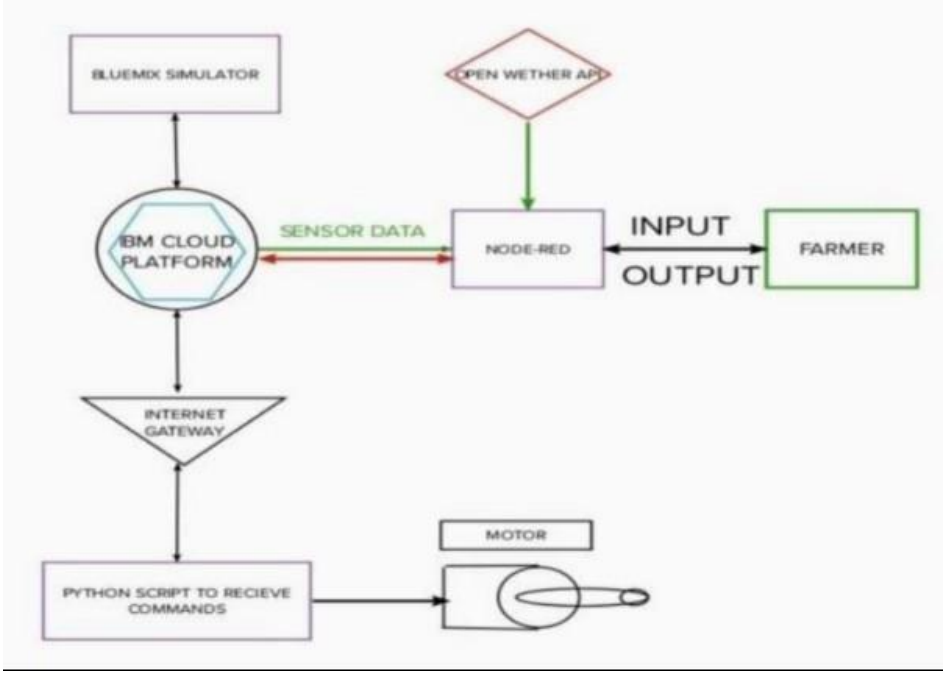
3. NODE-RED is used as a programming tool to write the hardware, software andAPIs. The MQTT protocol is followed for the communication.

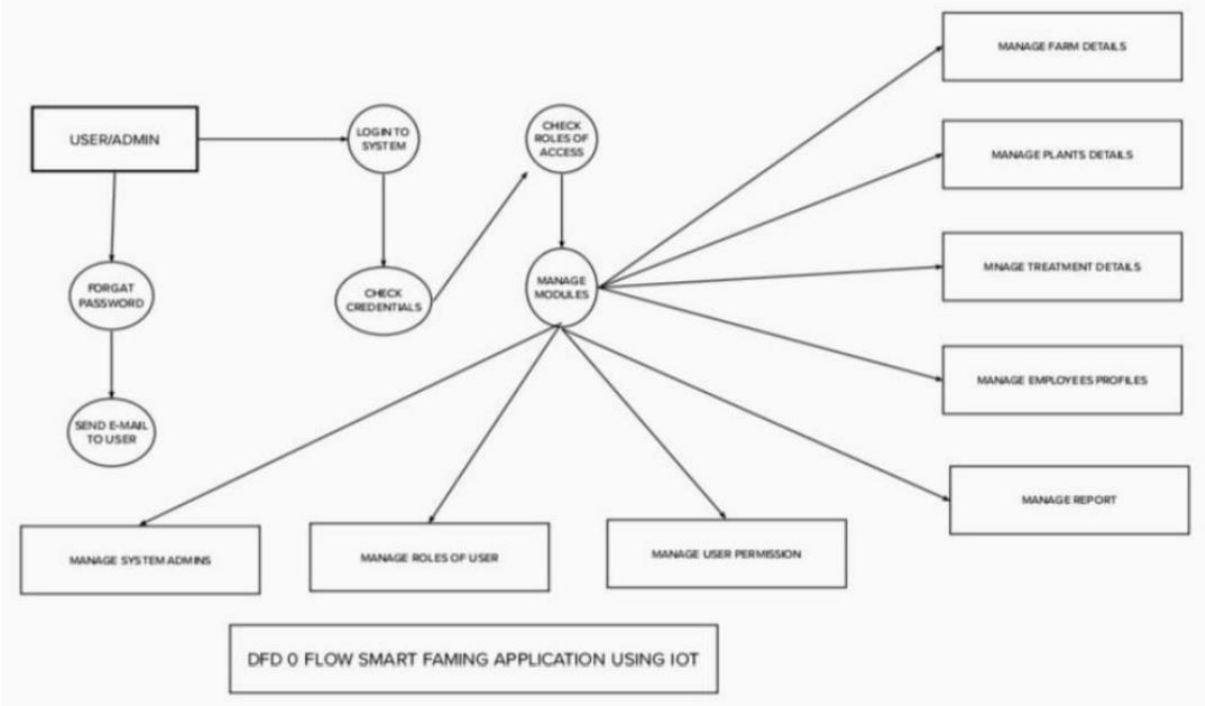
4. All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could make a decision through an app, weather to water the crop or not depending upon the sensor values. By using the app they can remotely operate to the motor switch.

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

User type	Functional Requirement(Epic)	User Story Number	User Story / Task	Acceptancecriteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and	I can access my account / dashboard	High	Sprint-1

			confirming my password.			
Customer (Web user)	Dashboard	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Registration	USN-3	As a user, I can register for the application through Facebook		Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)						
Customer Care Executive	Help	USN-1	As a user,if I have any queries or issues , I can reachout to the Support team	I will receive a reply from the support team that my message is accepted and later my queries or issues will be resolved	Medium	Sprint-3
Administrator	Management	USN-1	As a user, I need the resource management teamto use quality products at the reasonable price	I get a warranty card and details about the product	Medium	Sprint-4
		USN-2	As a user ,if I didn't receive a quality product ,I want a refund.	I can receive a free serviceor a change of product	Medium	Sprint-4





SOLUTION & TECHNICAL ARCHITECTURE

- 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 decide through an app, weather to water the crop or not depending upon the sensor values. By using the app, they can remotelyoperate the motor switch.

6. SPRINT DELIVERY PLAN

Sprint	FunctionalRequirement(Epic)	UserStoryNumber	UserStory/Task	Story Points	Priority	TeamMember
Sprint-1	Registration(FarmerMobil eUser)	UNS-1	As a user, I can registerfor the application by entering my email,password, and confirming my password.	2	High	S.Thilagavathi(Leader)
Sprint-1	Login	UNS-2	As a user, I will receiveconfirmation email once I have registered For the application	1	High	B.Shirisha (Member 1)
Sprint-2	User Interface	UNS-3	As a user, I can registerfor the application through Facebook	3	Low	M.Mamtha (Member 2)
Sprint-1	DataVisualization	UNS-4	As a user,I can register for the application through GMAIL	2	Medium	B.shirisha (Member 1)
Sprint-3	Registration(Farmer - WebUser)	USN -1	As a user, I can log intothe application by entering email and password	3	High	M.Mamtha (Member 2)
Sprint -2	Login	USN -2	As a registered user, Ineed to easily login into my registered account via the webpage in minimum time	3	High	S.Thilagavathi(Leader)

Sprint -4	WebUI	USN -3	As a user,I need to havea friendly user interfaceto easily view and access the resources	3	Medium	B.Shirish a (Member 1)
Sprint -1	Registration(C hemicalManuf acturer -Web user)	USN -1	As a new user, I want tofirst register using my organization email and create a password for theaccount.	2	High	M.Mamt ha (Member 2)

Sprint	**Total StoryPo ints**	**Duratio n**	**Sprint StartD ate**	**SprintEndD ate(Planned)**	**Story Poi nts Completed (ason PlannedEn dD ate)**	**SprintReleaseD ate(Actual)**
Sprint-1	12	6Days	24Oct2022	29Oct2022	20	29OCT2022
Sprint-2	6	6Days	31Oct2022	05Nov2022	20	30OCT2022
Sprint-3	6	6Days	07Nov2022	12Nov2022	20	15NOV2022
Sprint-4	6	6Days	14Nov2022	19Nov2022	20	18NOV 2022

CODING & SOLUTIONING

Coding :

```
import time

import sys

import ibmiotf.application # to install pip install ibmiotf

import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "72gvat" #replace the ORG ID
deviceType = "lenova"#replace the Device type wi
deviceId = "744905"#replace Device ID
authMethod = "use-token-auth"
authToken=”12345678”


def myCommandCallback(cmd): # function for Callback
        print("Command received: %s" % cmd.data)
        if cmd.data['command']=='motoron':
                print("Motor on is RECEIVED”)

elif cmd.data['command']=='motoroff':
                print("Motor Off IS RECEIVED")

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)
```

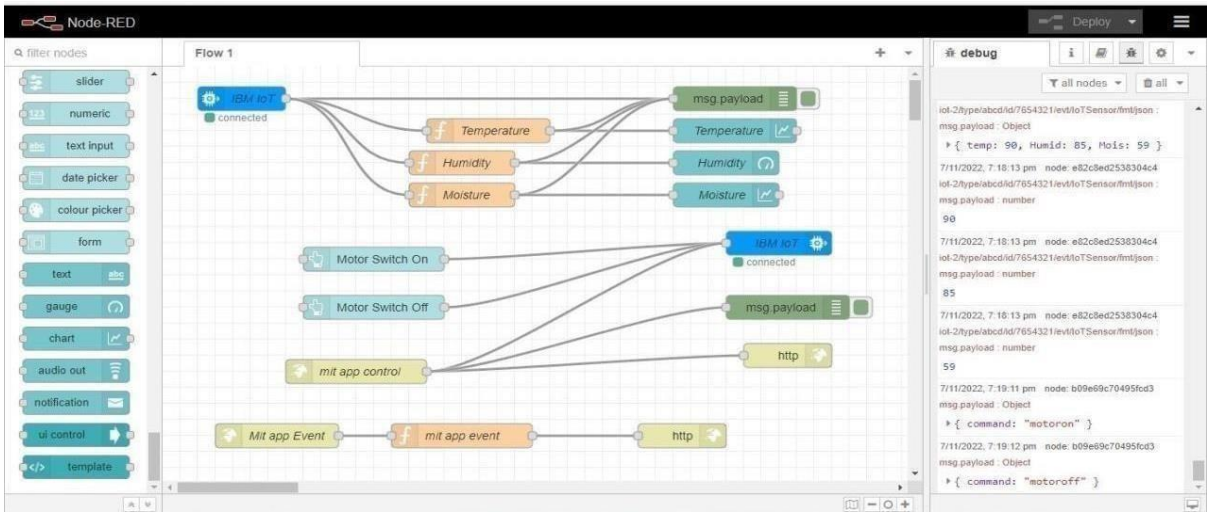
```
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #.....................................

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:

    deviceCli.commandCallback = myCommandCallback

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

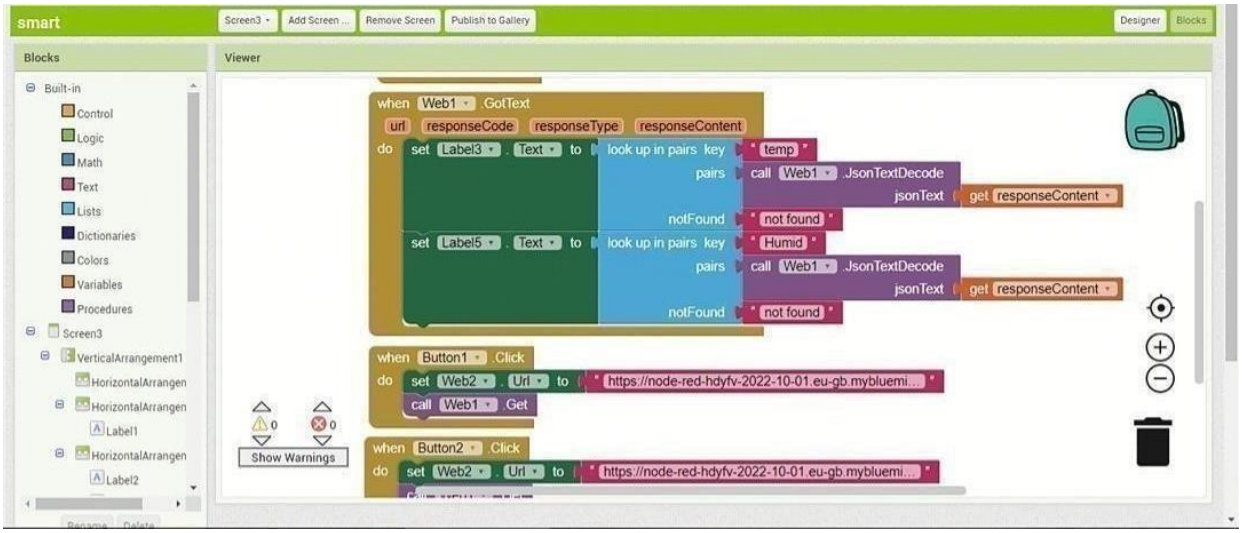
chapter 8

TESTING

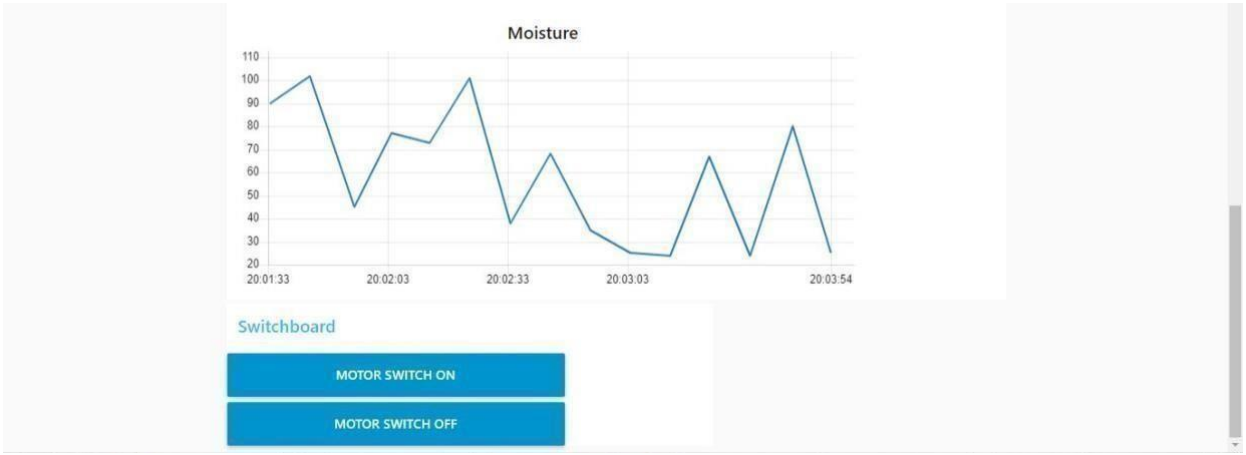
Test case

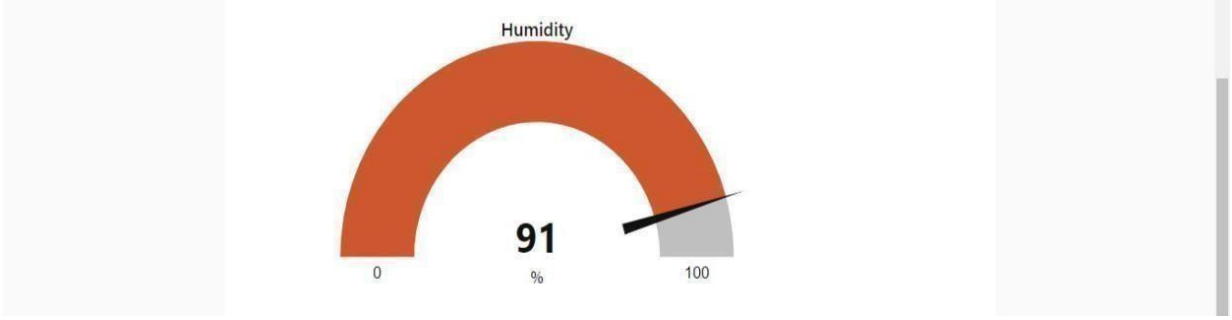
Web application using Node Red





User Acceptance Testing :





Advantages

Disadvantages

Advantages:

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

Disadvantages:

- Lack of internet/connectivity issues.
- Added cost of internet and internet gateway infrastructure.
- Farmers wanted to adaptthe use of Mobile App.

CHAPTER-9

11. CONCLUSION

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

12. Future scope

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

REFERENCE & SOURCES :

1. https//:www.researchgate.net
2. https//:www.wikipedia.org
3. https//:www.rapidonline.com
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