SMART FARMER - IOT ENABLED SMART FARMING APPLICATION

NALAIYA THIRAN PROJECT

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Project Report

1. INTRODUCTION

1.1.Project 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. One of the major purpose of the irrigation system is to provide and maintain the ideal environment in terms of temperature and soil moisture for the optimum growth of crops. With the usage of smartphones and computers, users can access the data stored in the cloud. User can keep track on the crops and able to control the water, pumps and fans in the control panel of the user interface. The primary aim of smart irrigation system is to provide and maintain the optimum conditions for the crops. Through cultivating in an environment with sufficient water supply and ideal temperature, growth of plants can be improved and thus the productivity of the agriculture field will increase as well. By using this technology, we can increase productivity and can feed more people in future. The benefits which farmers are obtaining by adapting the IoT program are innumerable. It has helped farmers to reduce costs and increase crop yields.

1.2. Purpose

IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity. It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real-time observation.

LITERATURE SURVEY

2. LITERATURE SURVEY

2.1. Existing problem

Agriculture is a substantial source of revenue for Indians and has a huge impact on the Indian economy. Crop development is essential for enhanced yield and higher-quality delivery. As a result, crop beds with ideal conditions and appropriate moisture can have a big influence on output. Traditional irrigation systems, such as stream flows from one end to the other, are usually used. As a result of this delivery, the moisture levels in the fields can alter. A designed watering system can help to enhance the management of the water system. This research proposes a terrain-specific programmable water system that will save human work while simultaneously improving water efficiency and agricultural productivity. The setup is made up of an Arduino kit, a moisture sensor, and a Wi-Fi module. Data is acquired by connecting our experimental system to a cloud framework. After then, cloud services analyse the data and take the necessary actions.

In the existing system of agriculture the crops are being monitored with the help of Arduino boards and GSM technology where in Arduino boards acts as a microcontroller but not as a server. Here the set up cost is bit high which may pose problems for the installation. Hence in order to overcome all these features Arduino boards or renesas microcontrollers are being replaced with the Raspberry Pi 3 which is a latest version and also which acts both as a microcontroller as well as server.

Main feature of this methodology is its cheap cost for installation and multiple advantages. Here one can access as well as control the agriculture system in laptop, cell phone or a computer.

2.2. References:

- **Divya J., Divya M.,Janani V**
- **H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana**
- **Anushree Math, Layak Ali, Pruthviraj**
- **Dweepayan Mishra, Arzeena Khan, Rajeev Tiwari, Shuchi Upadhaye**
- **R. Nageswara Rao, B.Sridhar**
- **Shweta B. Saraf, Dhanashri H. Gawali**
- **G. Sushanth, and S. Sujatha**
- **Vaishali S, Suraj S, Vignesh G, Dhivya S and Udhayakumar S**

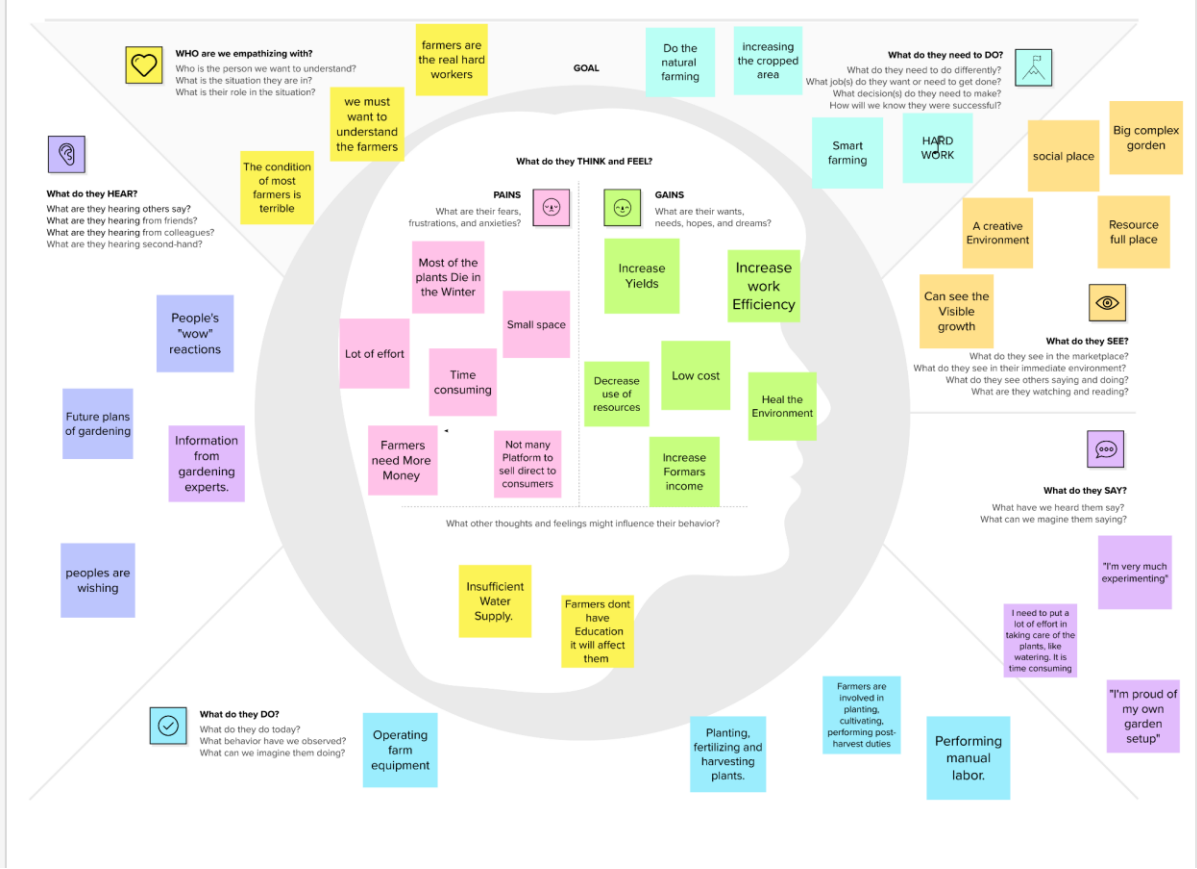
2.3. Problem Statement Definition

Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology, the cloud and the internet of things . for tracking, monitoring, automating and analyzing operations. Also known as smart farming is software managed and sensor-monitored. Smart farming is growing in importance due to the combination of the expanding global population, the increasing demand for higher crop yield, the need to use natural resources efficiently, the rising use and sophistication of information and communication technology and the increasing need for climate-smart agriculture

IDEATION & PROPOSED SOLUTION

3. IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas



3.2. Ideation & Brainstorming

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Benedit

- The quick collection of data allows farmers to get insights fast and predict issues even before they happen
- It reduce the amount of waste generated and minimize the damage to the environment
- Smart farming use IoT and cellular wireless technologies for remote connectivity
- It enables growers and farmers to reduce waste and enhance productivity
- Ground-based and aerial-based drones are being used in agriculture in order to enhance various agricultural
- PIR sensor is used in burglar system also to detect if thieves have entered into an infrastructure

Ganesh

- Soil moisture sensors are used to detect the water content in the soil
- Monitoring climatic condition allows predictive analytics to help you make better harvesting decisions
- It helps in maximizing operational efficiency and minimizing labor costs
- It involves accurate weather predictions along with real-time alerts
- Farmers could monitor and apply fertilizer and weed treatments only to required areas
- Less Consumption of Water and Energy

Sivanesh kumar

- It triggers instant alerts about its health, condition, and temperature requirement, and displays all the details on the interconnected smart
- Accurate soil data is one of the most valuable resources for farmers to grow quality crops
- The farmers can monitor the field conditions from anywhere
- It will use technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology
- Reduced Operation Costs due to automated processes
- Temperature-humidity sensors are used to monitor the weather conditions in the fields

vignesh

- Water Level sensors are used to detect the level of substances that can flow
- Solar powered and mobile operated pumps save cost of electricity
- Sensors help in mapping fields to understand their micro-scale in order to conserve resources such as water, fertilizer etc.
- It simplifies and automate the functioning of farmers
- Farmers can able to identify the condition for their fields, and quickly identify pests or disease before it can damage their yield
- Low Usage of Chemicals and better food quality

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

3.3. Proposed Solution:

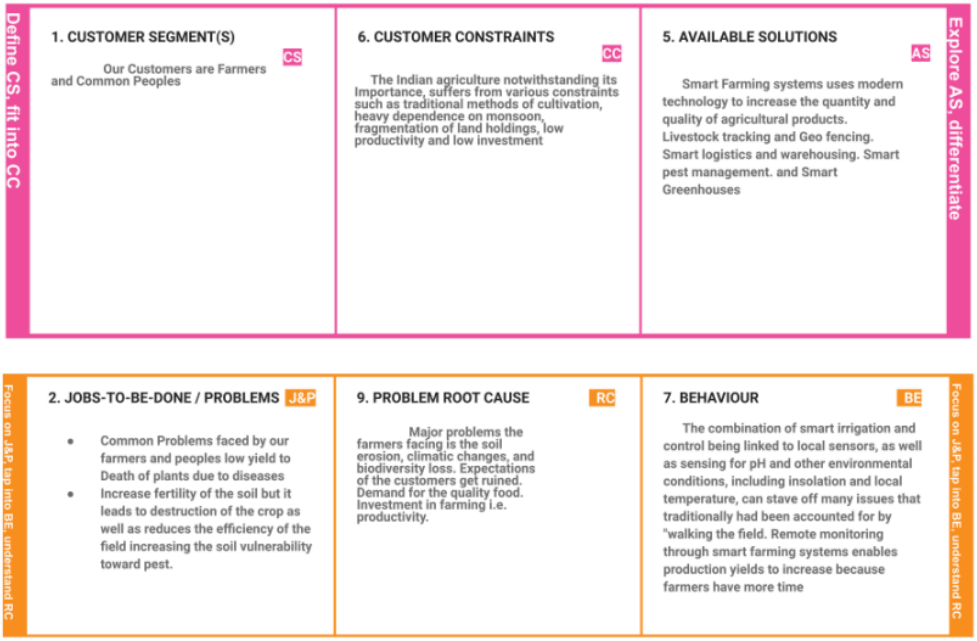
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Farmers need to increase the cultivation because their income remains very low due to low productivity
2.	Idea / Solution description	❖ An (IoT) based smart irrigation system automatically shuts off the water-pump when the soil moisture in the field rises above a set threshold level, thus preventing excessive waterlogging, thereby preventing disease and crop damage. ❖ Over-fertilizing reduces soil fertility so apply the right amount of fertilizer so It also increases the yield of crops ❖ Climate change negatively affects crop growth and yield hence by adopting modern technological methods Crops can be protected from destruction by knowing the climate
3.	Novelty / Uniqueness	Agriculture sensors provide data that helps farmers to monitor and optimize crops with environmental conditions and challenges. These sensors in agriculture installed and fixed in weather stations, drones, and robots used in the agriculture industry.

4.	Social Impact / Customer Satisfaction	❖ Monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money. ❖ Smart farming is designed to help farmers monitor vital information like humidity, air temperature and soil quality using remote sensors, and to improve yields, plan more efficient irrigation, and make harvest forecasts
5.	Business Model (Revenue Model)	❖ Key activity ➢ Develop Website ➢ Develop Smartphone Application ➢ Develop SMS Messaging Platform ❖ Key resources ➢ Website developer ➢ Apps developer ➢ Patent right ❖ Value proportion ➢ Linking the smallholder farmers to the existing and new buyers ➢ disease tips ❖ Customer Relationships ➢ Smallholder farmers ➢ Agricultural product exporters ➢ Agricultural processing firms ❖ Revenue Streams ➢ Commission from agricultural produce exporters and processors ➢ Selling of data to agricultural researchers

6.	Scalability of the Solution	The ability to support an increasing number of connected devices, users, application features, and analytics capabilities, without any degradation in the quality of service. The IBM cloud services makes the solution more scalable.

3.4. Problem Solution fit:

Project Title: SmartFarmer - IoT Enabled Smart Farming Application **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMID52158



3. TRIGGERS

TR

Farmers know the condition of the cropsin advance and correct it with the help of technology to get good yield

4. EMOTIONS: BEFORE / AFTER

EM

At present people are very dissatisfied due to low yield. But After using our crop tracking app, they are satisfied.

10. YOUR SOLUTION

SL

We propose a crop monitoring app that uses the latest technology

8.CHANNELS of BEHAVIOUR

CH

8.1 ONLINE

People shares post and awareness regarding the Smart farming

8.2 OFFLINE

Through training and Awareness programs farmers knows how to monitor crops remotely

REQUIREMENT ANALYSIS

4. REQUIREMENT ANALYSIS

4.1. Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Registration and Login	❖ User needs to login the app by using their Gmail. ‘ ❖ Registration needs to be done by giving their Name,Mobile Number and their locality.This is the required Field.
FR-2	sensor and camera	❖ Small devices to collecting environment data, such as humidity , temperature,water level,soil moisture,weather monitor,etc…
FR-3	Actuator	❖ Devices or systems for changing the environment state such us, sprinkler, ventilation, and irrigation systems,etc..
FR-4	GPS	❖ A System that provides geolocation of sensors, agricultural machinery and farm resources
FR-5	Connection Technologies	❖ Devices and technologies to interconnecting remote devices and transferring data via router, access points, protocols.
FR-6	Security Features	❖ Security protocols and schemes for ensuring the availability, integrity, and confidentiality of the system and data.
FR-7	In-Out Interface	❖ Software and hardware interface for communication beyond the local area.

FR-8	Gateway	❖ System located at the edge of the network, connected with farm devices and the cloud. This system can process data, store small amount of data and communicate with the cloud.
FR-9	Data Base	❖ System for storing data produced by the smart system.
FR-10	Web tools	❖ Resources for exchanging data between the remote application and provide access to the end-user application on the Internet.

4.2. NON-FUNCTIONAL REQUIREMENTS

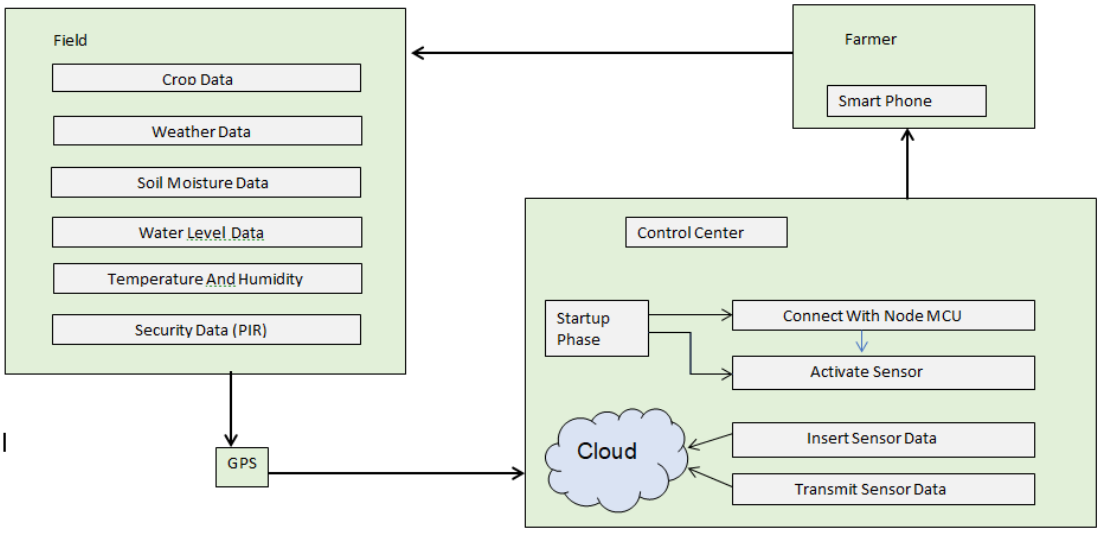
FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	❖ Usability is a method for improving ease-of-use during the design process. Smart farming prototype was built using loT sensors and Cloud based Server running with custom software incorporating specialized algorithms and a graphical user interface. So it assesses how easy user interfaces are to use
NFR-2	**Security**	❖ Security incidents may be accidental or intentional. ❖ Animals, farm working, and machinery can easily access farming environments and cause incidents. ❖ Smart communication technologies introduce a vast exposure to cybersecurity threats and

		vulnerabilities in smart farming environments.
NFR-3	**Reliability**	❖ It monitor the crop field with the help of sensors ❖ It provides transparency and real-time crop monitoring, which results in better yield. ❖ Farmers can able to identify the condition for their fields, and quickly identify pests or disease before it can damage their yield.
NFR-4	**Performance**	❖ Data collected by smart sensors allows farmers to better control processes. ❖ Smart agriculture sensors can notify farmers of possible changes in weather, air and soil quality, humidity and other factors affecting crop growth.
NFR-5	**Availability**	❖ IoT in smart farming uses robots, drones, remote sensors, and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money.
NFR-6	**Scalability**	❖ Scalability in smart farming is the adaptability of a system to increase the capacity ❖ The ability to support an increasing number of connected devices, users, application features,and analytics capabilities, without any degradation in the quality of service.The IBM cloud services makes the solution more scalable.

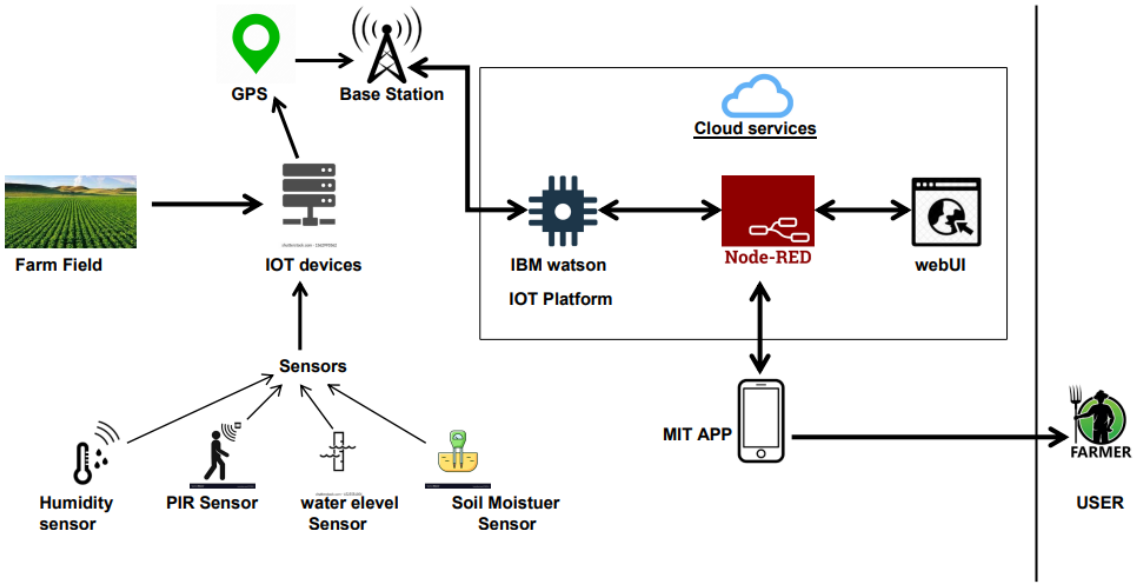
PROJECT DESIGN

5. PROJECT DESIGN:

5.1. Data Flow Diagrams



5.2. Solution & Technical Architecture



5.3. User Stories:

User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Mobile user	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account	High	Sprint
Admin	Registration and Login	USN-2	As a admin, I will manage the details entered by the user	Manage the account	High	Sprint
Co-Admin	Login	USN-3	As a Co-admin, I will manage the sensor data And send the information to the user	I can handle sensor data	High	Sprint

PROJECT PLANNING & SCHEDULING

6. PROJECT PLANNING & SCHEDULING:

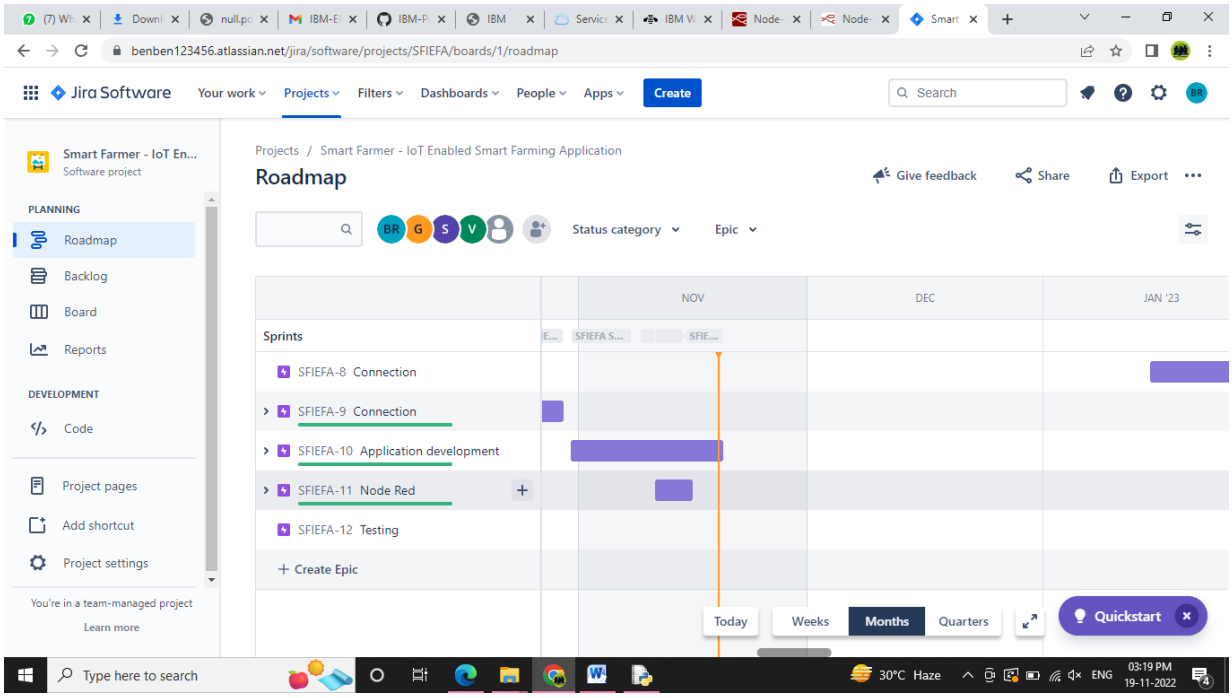
6.1. Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation Creation	USN-1	Connect sensors, Arduino and esp8266	2	High	Benedit, Ganesh
Sprint-1	Software	USN-2	Develop an application with MIT Appinventor (Login page with firebase)	2	High	Benedit, Sivaneh Kumar
Sprint-2	Software and Hardware	USN-3	Connect the hardware with IBM Cloudand API Integration	2	Medium	Benedit, Vignesh
Sprint-2	Software	USN-4	Application development for project	2	High	Benedit, Ganesh, Sivanesh Kumar
Sprint-3	Software	USN-5	Establishing Node-Red connection	2	Medium	Benedit, Sivaneh Kumar, Vignesh
Sprint-3	Software	USN-6	Connecting application with Node-Redand further application development	2	High	Benedit, Ganesh, Vignesh
Sprint-4	Testing	USN-7	Testing developed application andworking model of hardware	2	High	Benedit, Ganesh, Vignesh, Sivanesh Kumar

6.2. Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date (Actual)
Sprint-1	16	5 Days	25 Oct 2022	29 Oct 2022	16	30 Oct 2022
Sprint-2	16	8 Days	31 Oct 2022	07 Nov 2022	16	08 Nov 2022
Sprint-3	16	6 Days	09 Nov 2022	13 Nov 2022	16	14 Nov 2022
Sprint-4	8	6 Days	15 Nov 2022	17 Nov 2022	8	17 Nov 2022 – 18 Nov 2022

6.3. Reports from JIRA



CODING & SOLUTIONING

7. CODING & SOLUTIONING:

7.1. FEATURE 1

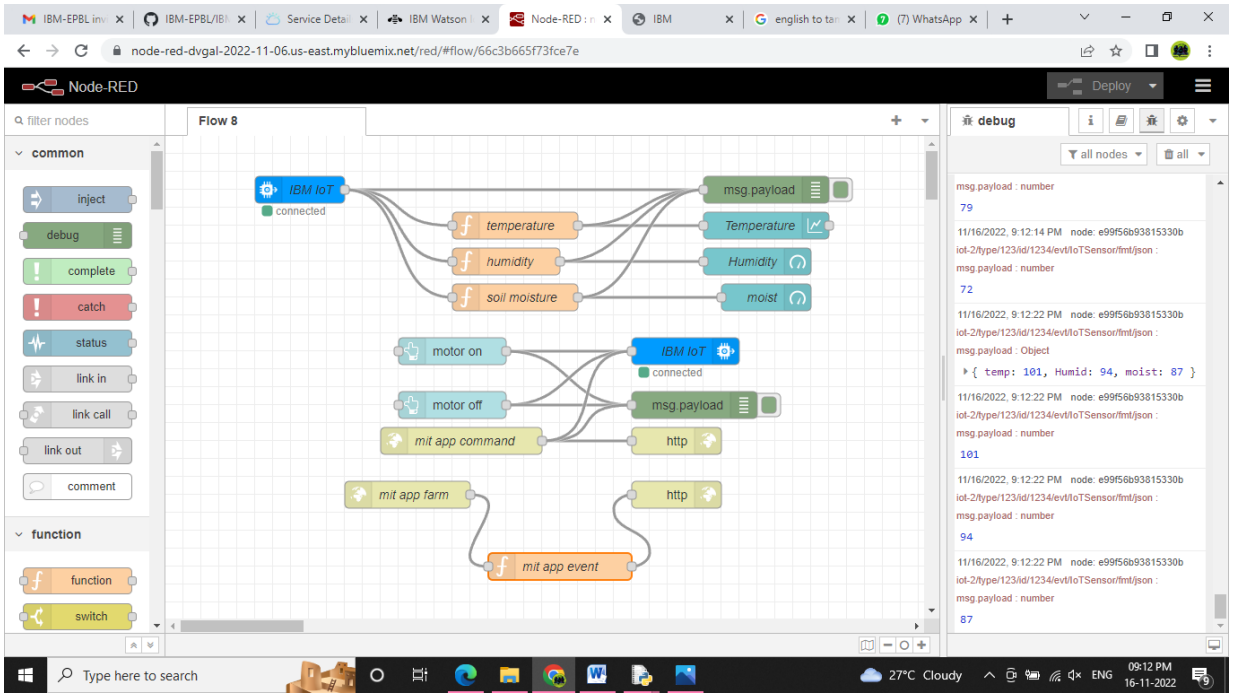
- IOT device
- IBM Watson platform
- Node red
- Web UI
- MIT App
- Python code

7.2. FEATURE 2

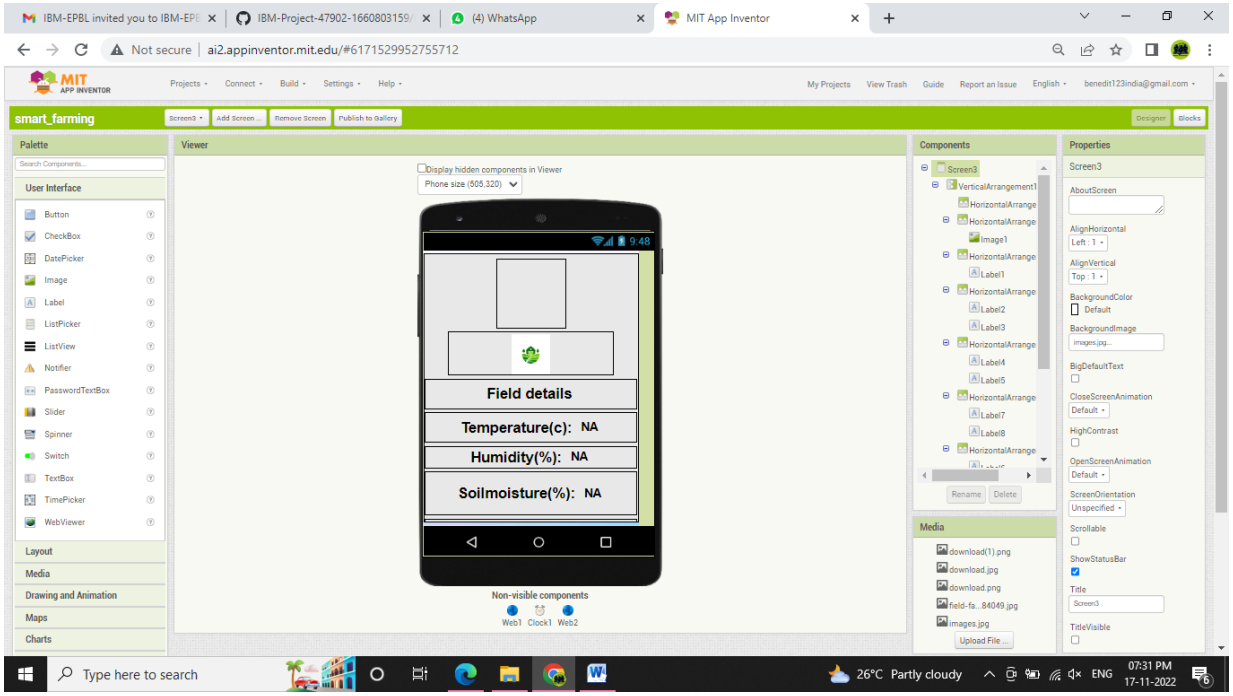
- Registration
- Login
- Verification
- view temp,humid,moist
- Switch Board
- Motor on
- Motor off

TESTING

8. TESTING:



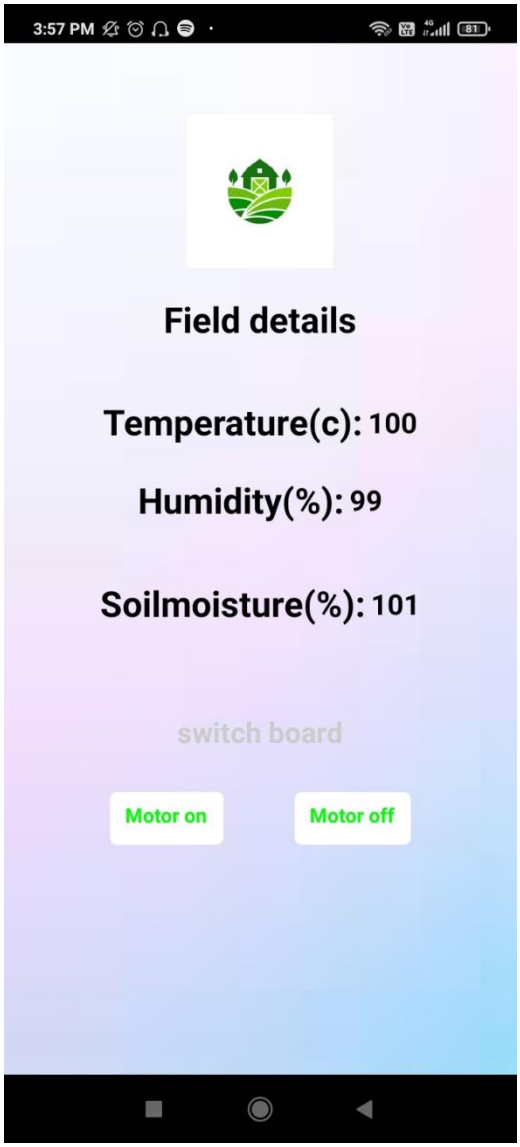
Test the node red connection



RESULTS

9. RESULTS:

9.1. Performance Metrics:



ADVANTAGES & DISADVANTAGES

10. ADVANTAGES & DISADVANTAGES:

Advantage:

- Increased work efficiency. One of the greatest things about Smart Farming is its potential to save valuable time.
- Irrigation helps to maintain the condensation of the loam. It provides mineral as well as other nutrition by the assimilation from the mold. Irrigation is one of the most feasible ways to grow cash crops like sugarcane, tobacco, etc. At many places, the irrigation serves as the only water source

Dis advantage:

- smart watering system is a bit expensive. Depending on the size of your property, you will need more systems. Of course saving on water bills will lead to less cost. If you want to use this system for lawn watering, it's better to fix it under the ground before planting.

11. CONCLUSION:

- With the incorporation of IoT, we can upgrade the agriculture farm.
- These systems enable to check the quality of the soil and growth of the crop in the soil.
- It can also able to check the soil, temperature, humidity etc with the help of IoT.

12. FUTURE SCOPE:

- Smart farming is certainly a leading enabler in producing more food with less for an increasing world population.
- The robotic system will allow farms to be more profitable, efficient, safe, and eco-friendly.
- With the advanced farming tech, the agricultural industry can reach an unprecedented level of productivity.

13. APPENDIX:

Source Code:

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

#Provide your IBM Watson Device Credentials
organization = "w9kxol"
deviceType = "123"
deviceId = "1234"
authMethod = "token"
authToken = "987654321"
```

```
# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %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")

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(90,110)
        Humid=random.randint(60,100)
        moist=random.randint(50,120)
        data = { 'temp' : temp, 'Humid': Humid ,'moist':moist}
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%"
    % Humid,"soilmoisture=%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()
```

➢ GitHub & Project Demo Link:

Project Demo Link: https://youtu.be/8XyKJReIyMU

GitHub Link: https://github.com/IBM-EPBL/IBM-Project-47902-1660803159