IBM PROJECT

SMARTFARMER - IOT ENABLED SMART FARMING APPLICATION

Batch : B2-2M4E

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CONTENT

1.INTRODUCTION

1.1 Project Overview:

1. IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using sensors.
2. Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field and also controlling the motor pump. Watering the crop is one of the important tasks for the farmers.

1.2 Purpose:

They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application.

2. LITERATURE SURVEY

2.1 Existing problem :

Farmers cannot know if the application does not work properly. If the farmer is far from the crop field, it is difficult for him to monitor and control. Farmers cannot detect if any sensors are damaged.

2.2 References:

[1] Zuraida Muhammad,Muhammad Azri Asyraf Mohd Hafez,Nor Adni Mat"Smart Agriculture Using Internet of Things with Raspberry Pi." 2020. [2] Divya J., Divya M.,Janani V."IoT based Smart Soil Monitoring System for Agricultural Production" 2017. [3] H.G.C.R.Laksiri, H.A.C.Dharma Gunawardhana, J.V.Wijayakulasooriya "Design and Optimization of IoT Based Smart Irrigation System in Sri Lanka"2019 [4] Anushree Math, Layak Ali, Pruthviraj U "Development of Smart Drip Irriga-tion System Using IoT"2018. [5] Dweepayan Mishra1 ,Arzeena Khan2 Rajeev Tiwari3 , Shuchi Upadhay,"Automated Irrigation System-IoT Based Approach",2018. [6] R. Nageswara Rao, B.Sridhar,"IOT BASED SMART CROP-FIELD MONI- TORING AND AUTOMATION IRRIGATION SYSTEM". 2018 [7] Shweta B. Saraf, Dhanashri H. Gawal,"IoT Based Smart Irrigation Monitoring And Controlling System".2017 [8] Shrihari M, "A Smart Wireless System to Automate Production of Crops and Stop Intrusion Using Deep Learning" 2020. [9] G. Sushanth1, and S. Sujatha, "IOT Based Smart Agriculture System"2018. [10] Vaishali S, Suraj S, Vignesh G, Dhivya S and Udhayakumar S, "Mobile Integrated Smart Irrigation Management and Monitoring System Using IOT",2017 [11] Anurag D, Siuli Roy and SomprakashBandyopadhyay, "Agro-Sense: Precision Agriculture using Sensor-based

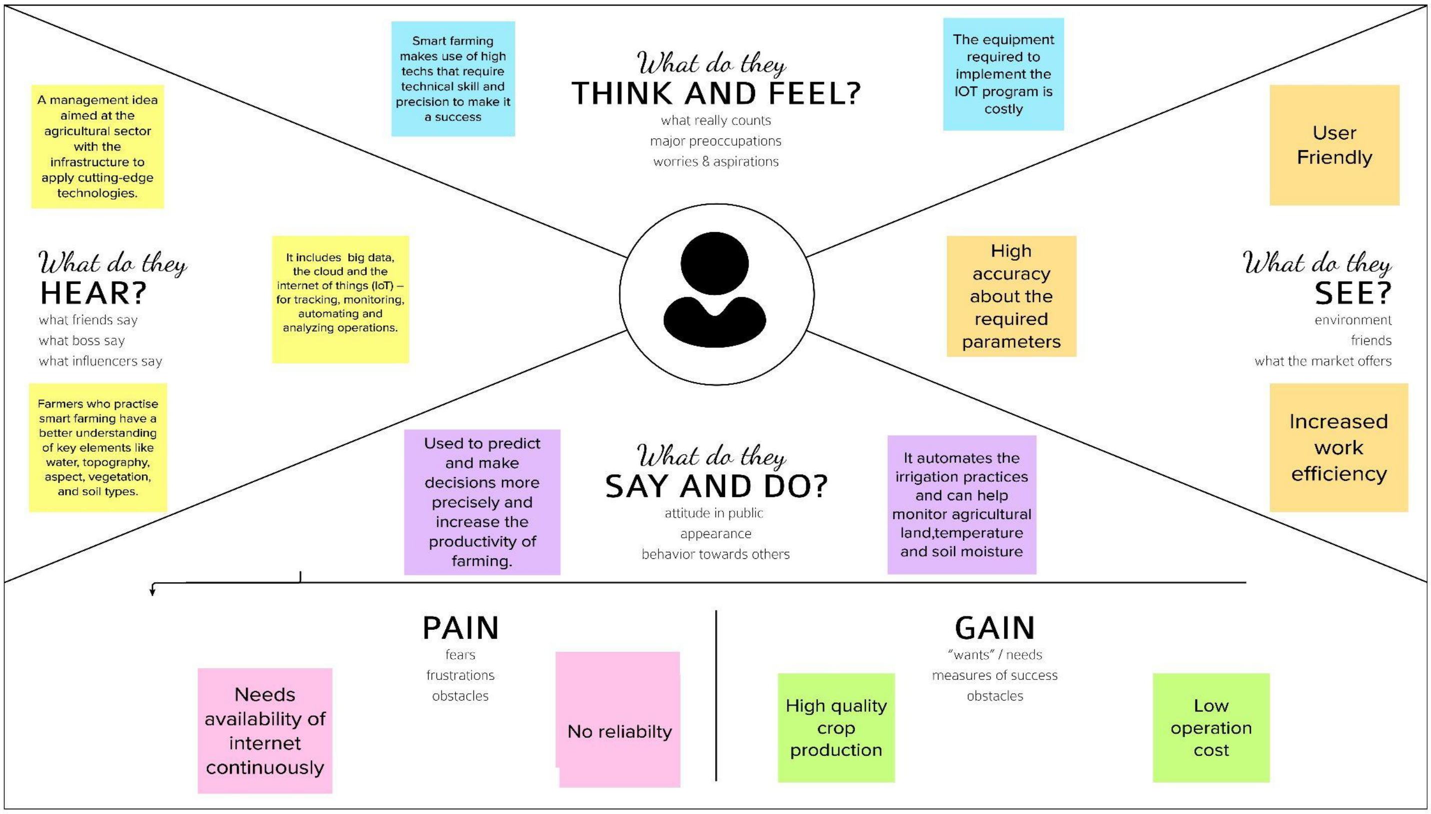
Wireless Mesh Networks”, ITU-T “Innovation in NGN”, Kaleidoscope Conference, Geneva 12-13 May 2008. [12] C. Arun, K. Lakshmi Sudha “Agricultural Management using Wireless Sensor Networks – A Survey”2nd International Conference on Environment Science and Biotechnology IPCBEE vol.48 (2012) © (2012) IACSIT Press, Singapore 2012. [13] Bogena H R, Huisman J A, OberdEˆ rster C, etal. Evaluation of a low cost soil water content sensor for wireless network applications [J].Journal of Hydrol ogy, 2007. [14] R.Hussain, J.Sehgal, A.Gangwar, M.Riyag“ Control of irrigation automati-cally by using wireless sensor network” International journal of soft computing and engineering, vol.3, issue 1, march 2013. [15] Izzatdin Abdul Aziz, MohdHilmiHasan, Mohd Jimmy Ismail, MazlinaMehat, NazleeniSamihaHaron, “Remote Monitoring in Agricultural Greenhouse Us- ing Wireless Sensor and Short Message Service (SMS)”, 2008. [16] IoT based Smart System for Enhanced Irrigation in Agriculture. Bhanu K.N. 1, Mahadevaswamy H.S.2, Jasmine H.J.3 Department of Computer Science, Amrita School of Arts Sciences, Mysuru Amrita Vishwa Vidyapeetham, India E-mail: knbhanu@asas.mysore.amrita.edu girishhs231@gmail.com jasminehj02@gmail.com Bhanu K.N. 1, [17] Mahadevaswamy H.S.2, Jasmine H.J.3 Department of Computer Science, Amrita School of Arts Sciences, Mysuru Amrita Vishwa Vidyapeetham, India E-mail: knbhanu@asas.mysore.amrita.edu girishhs231@gmail.com jasminehj02@gmail.com IoT based Smart System for Enhanced Irrigation in Agriculture. [18] An Efficient Irrigation System for agriculture. 2018

2.3 Problem Statement Definition :

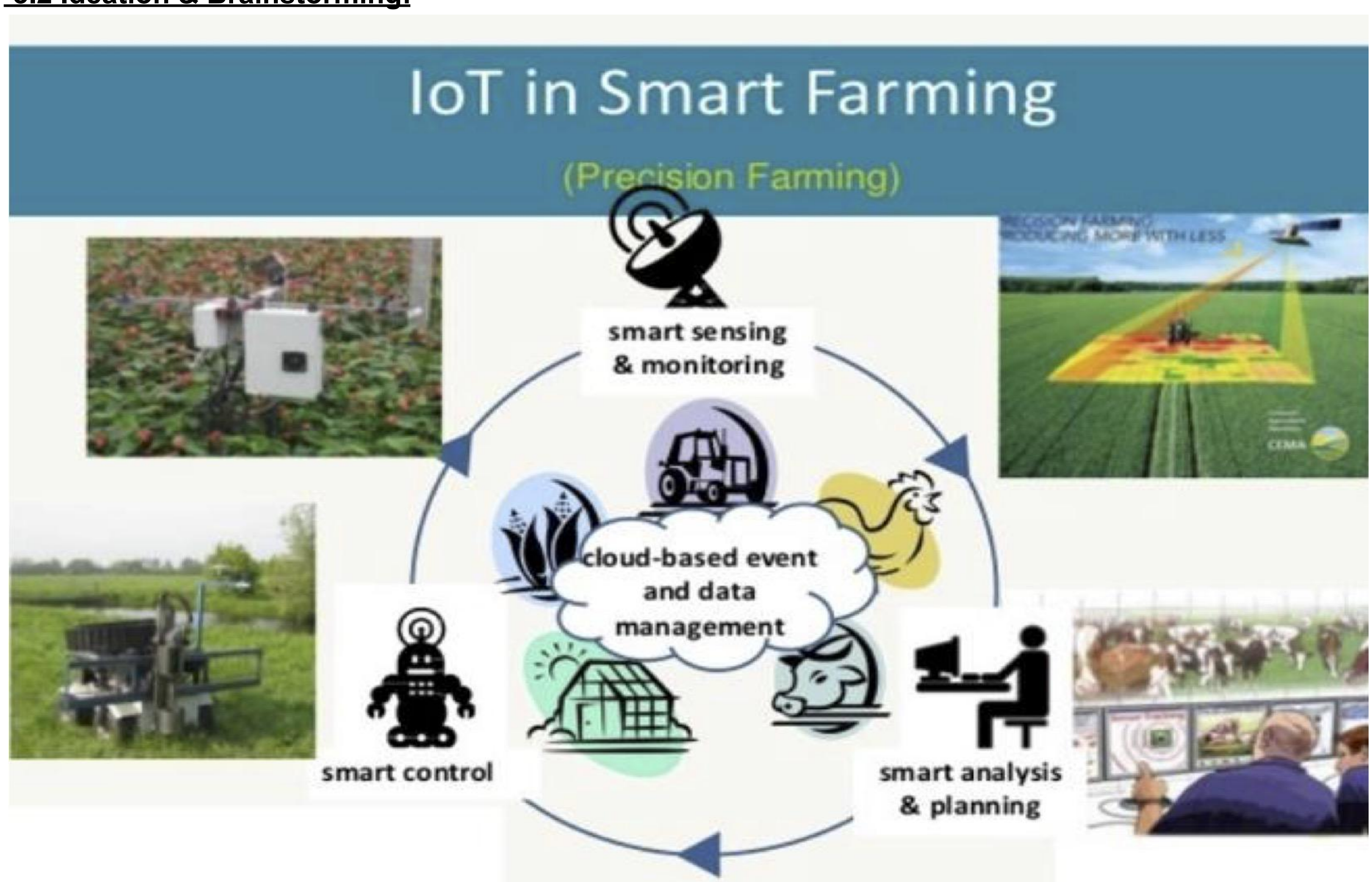
Farmers are under pressure to produce more food and use less energy and water in the process. A remote monitoring and control system will help farmers deal effectively with these pressures.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas :



3.2 Ideation & Brainstorming:



GROUP IDEAS:

- ✓ soil moisture, temperature, humidity should be monitored.
- ✓ In farming, watering the plants is one of the difficult process and they have to wait for the whole field to pour water. He had to check the field for 30 min once.
- ✓ Intensive research on various plant diseases.
- ✓ It should operated in online mode only.
- ✓ Application should alert to monitor the crop field.

3.3 Proposed Solution :

S.No	Parameter	Description
1	Problem Statement (Problem to be solved)	The farmer needs to water their plants on time and to protect their plants from animals and birds for protecting the field.
2	Idea / Solution description	The device will detect the animals and birds.It generates an alarm and avoids animals from destroying the crop.
3	Novelty / Uniqueness	The unique of project is to monitor the soil moisture levels,temperature,humidity.
4	Social Impact / Customer Satisfaction	They can easily protect the field and yielding more profits.
5	Business Model (Revenue Model)	Farmers and cooperatives(minimize costs).Farming as a service(Faas). Commerce and Government. Pay per use. Performance based model. Additional sharing model.
6	Scalability of the Solution	In a field of IOT we proposed to deal with brilliant sensors and electrical equipment to achieve an “SMART CROP PROTECTION SYSTEM”.

3.4 Problem Solution fit:

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

The Customers of this product are the farmers who cultivate crops. Our aim is to assist, aid and help them to monitor the field parameters. This product saves the agriculture from extinction.

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions?

Deployment of huge number of sensors is difficult. It requires an unlimited or continuous internet connection to be successful.

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done?

The irrigation process is automated using IoT. Weather data and field parameters were obtained and processed to automate the process of irrigation. The drawbacks are high cost of installation, efficient only for short distance, difficulty in storing the data.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers?There could be more than one; explore different sides.

The objective of this product is to obtain the different field parameters using sensor and process it using a central processing system.

Cloud is used to store and transmit the data by using IoT.

Weather APIs are employed to assist the farmer in making decision through a mobile application.

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is the backstory behind the need to do this job?

The frequent change or unpredictable weather and climate, made it difficult for the farmers to do agriculture.

These factors play a major role in making decision whether to water the plant or not.

The monitoring of the field is hard when the farmer is out of station, thus leading to crop damage

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?

Using proper drain system to overcome the effects of excess water due to heavy rain. Using hybrid varieties of crop that are resistant to pests.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act?

Farmers facing issues in providing prover 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.

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 the weather API. The ultimate decision, whether to water the crop or not is taken by the farmer using mobile application.

8. CHANNELS of BEHAVIOUR CH

8.1 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.

8.2 OFFLINE

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

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?

BEFORE:

- Lack of knowledge in weather forecasting
- Random decisions
- Low yield
- Low income

AFTER:

- Data from reliable resource
- Correct decision
- High yield
- High income

4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

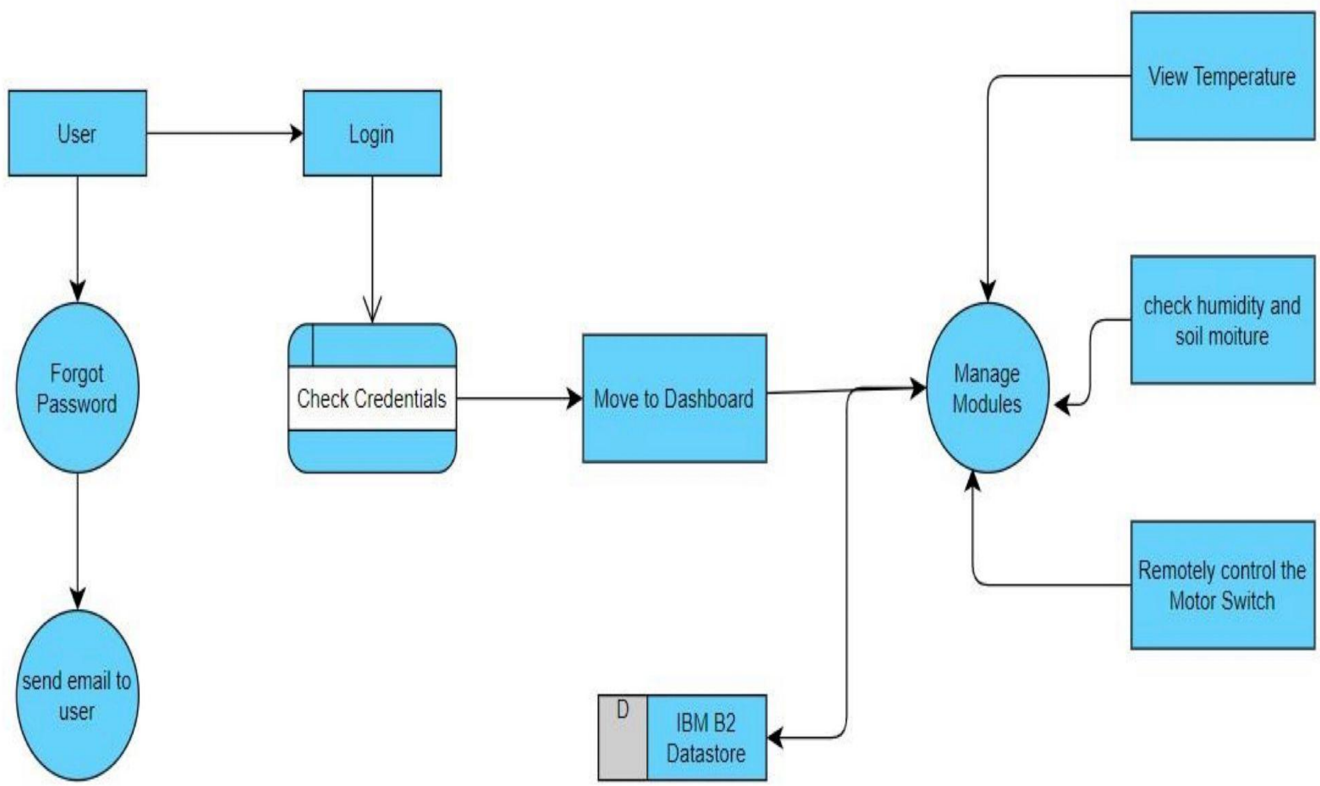
FR No.	Functional Requirement (Epic)	Sub Requirement (story / sub-Task)
FR-1	User Visibility	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop diseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of livestock conditions

4.2 Non-Functional requirements:

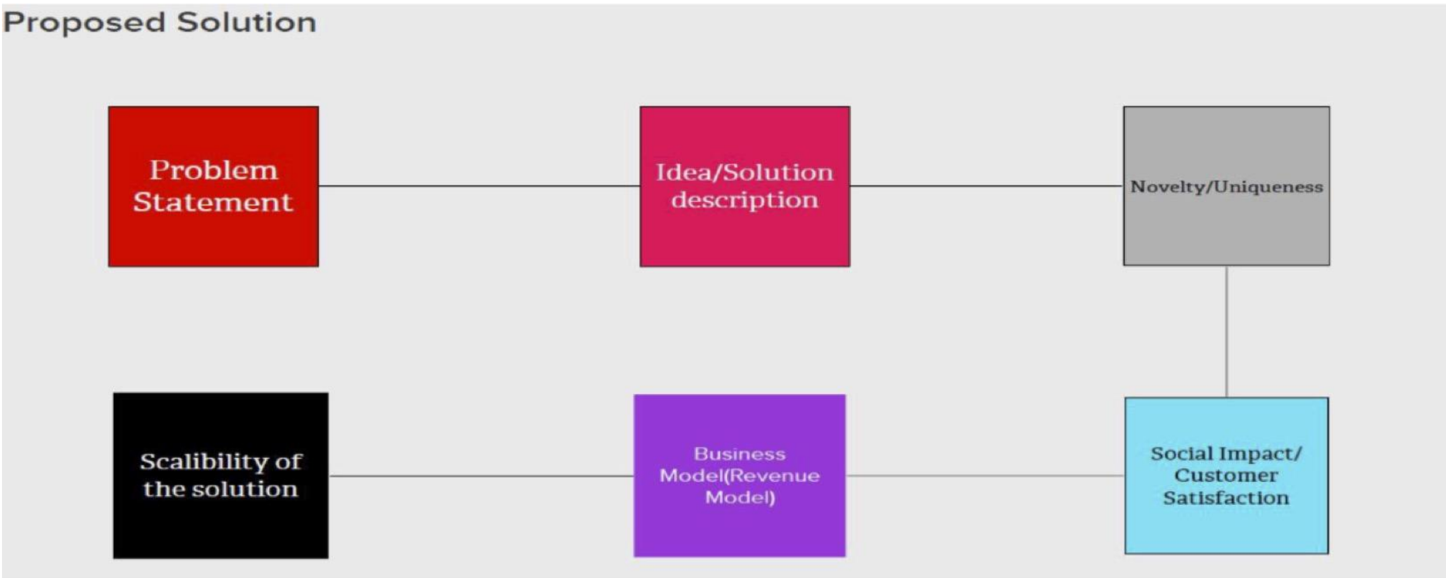
NFR No	Non-Functional Requirement	Description
NFR-1	Usability	User friendly guidelines for users to avail the features. Most simplistic user interface for ease of use.
NFR-2	Security	All the details about the user are protected from unauthorized access. Detection and identification of any malfunctions of sensors.
NFR-3	Reliability	Implementing Mesh IoT Networks Building a Multi-layered defense for IoT Networks.
NFR-4	Performance	The Use Of Modern Technology Solutions helps to achieve the maximum performances thus resulting in better quality and quantity yields.
NFR-5	Availability	This app is available for all platforms
NFR-6	Scalability	Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation.

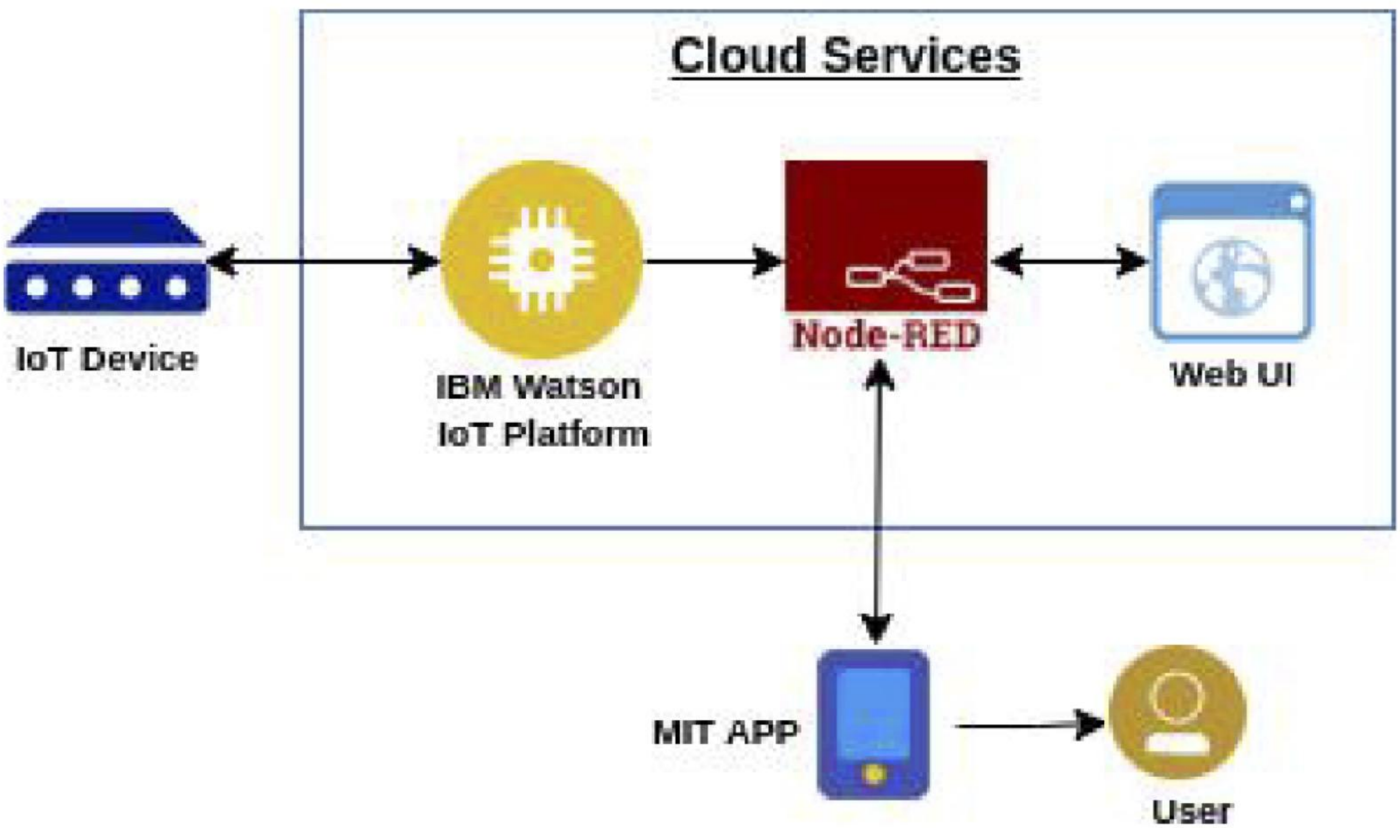
5. PROJECT DESIGN

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:





5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (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 / dashboard	High	Sprint-1
		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
		USN-3	As a user,I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer (Web user)	Dashboard	USN-5	As a User can view the dashboard, and this dashboard include the check roles of access and then move to the managed modules.	I can view the dashboard in this smart farming application system.	High	Sprint-2
		USN-6	User can remotely access the motor switch	In the smart farming app	High	Sprint-3
Administrator		USN-7	As a user once view the manage modules this describes the Manage system Admins and Manage Roles of User and etc	I will ensure efficiency,cost, etc	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation:

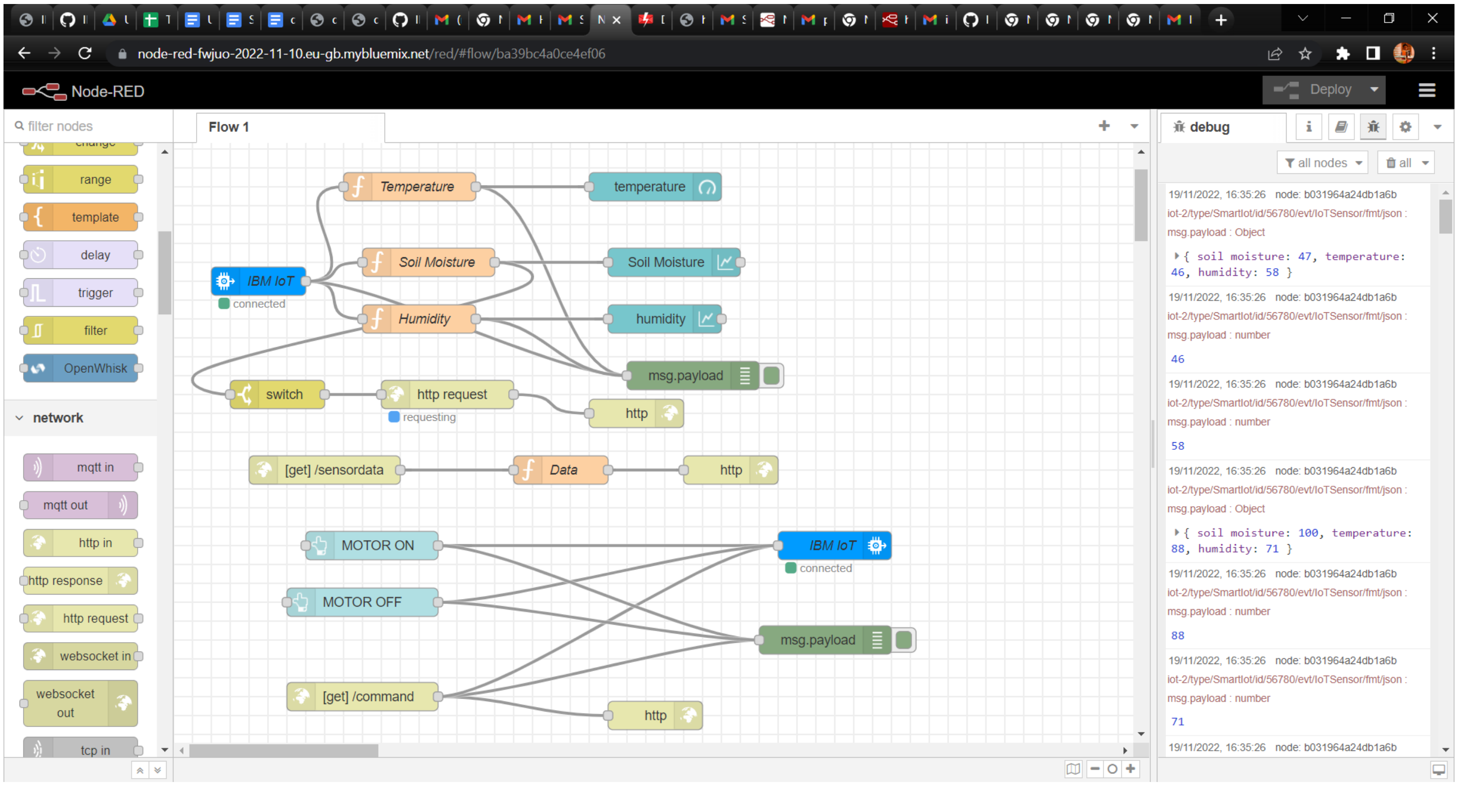
Sprint	Functional Requirement	User Story Number	User story /Task	Story Point	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with pythoncode	2	High	Keerthana, Peravali Bala Venkat, Mohamed Arshath, Dharsini
Sprint-2	Software	USN-2	Creating device in the IBMWatson,IoTplatform,work flow for IoT scenario using Node-Red	2	HIgh	Keerthana, Peravali Bala Venkat, Mohamed Arshath, Dharsini
Sprint-3	MITAppInventor	USN-3	Develop an application for the Smartfarmer project using MITApp Inventor	2	High	Keerthana, Peravali Bala Venkat, Mohamed Arshath, Dharsini
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Keerthana, Peravali Bala Venkat, Mohamed Arshath, Dharsini
Sprint-4	WebUI	USN-4	To make the user interact with software.	2	High	Keerthana, Peravali Bala Venkat, Mohamed Arshath, Dharsini

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

7. CODING & SOLUTIONING

7.1 Feature 1 (Node Red Output):



7.2 Feature 2: (Python code):

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random


 #Provide your IBM Watson Device Credentials

organization = "ld4vg3"

deviceType = "SmartIot"

deviceId = "56780"

authMethod = "token"

authToken = "axS)H_x70RGU*bswcB"
```

```
# 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


soil=random.randint(0,100)
temp=random.randint(0,100)
hum=random.randint(0,100)
```

data = { 'soil moisture': soil, 'temperature':temp, 'humidity':hum}

#print data

def myOnPublishCallback():

print ("Published Soil Moisture = %s %%" % soil,"Temperature = %s C" % temp, "Humidity = %s %%" % hum, "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()

7.3 Feature 3: (Python Output):

```
*Python 3.8.2 Shell*
File  Edit  Shell  Debug  Options  Window  Help
Python 3.8.2 (tags/v3.8.2:7b3ab59, Feb 25 2020, 23:03:10) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:/Users/MOHAMED ASHIK/AppData/Local/Programs/Python/Python38/new watson code.py
2022-11-19 13:27:37,658   ibmiotf.device.Client      INFO    Connected successfully: d:ld4vg3:SmartIot:56780
Published Soil Moisture = 36 % Temperature = 31 C Humidity = 58 % to IBM Watson
Published Soil Moisture = 45 % Temperature = 81 C Humidity = 48 % to IBM Watson
Published Soil Moisture = 47 % Temperature = 35 C Humidity = 95 % to IBM Watson
Published Soil Moisture = 17 % Temperature = 67 C Humidity = 81 % to IBM Watson
Published Soil Moisture = 34 % Temperature = 60 C Humidity = 19 % to IBM Watson
Published Soil Moisture = 46 % Temperature = 73 C Humidity = 97 % to IBM Watson
Published Soil Moisture = 21 % Temperature = 72 C Humidity = 19 % to IBM Watson
Published Soil Moisture = 94 % Temperature = 30 C Humidity = 5 % to IBM Watson
Published Soil Moisture = 94 % Temperature = 13 C Humidity = 77 % to IBM Watson
Published Soil Moisture = 35 % Temperature = 14 C Humidity = 39 % to IBM Watson
Published Soil Moisture = 22 % Temperature = 89 C Humidity = 39 % to IBM Watson
Published Soil Moisture = 81 % Temperature = 69 C Humidity = 70 % to IBM Watson
Published Soil Moisture = 41 % Temperature = 30 C Humidity = 10 % to IBM Watson
Published Soil Moisture = 28 % Temperature = 16 C Humidity = 99 % to IBM Watson
Published Soil Moisture = 47 % Temperature = 64 C Humidity = 43 % to IBM Watson
Published Soil Moisture = 53 % Temperature = 58 C Humidity = 49 % to IBM Watson
Published Soil Moisture = 74 % Temperature = 96 C Humidity = 44 % to IBM Watson
Published Soil Moisture = 79 % Temperature = 22 C Humidity = 87 % to IBM Watson
Published Soil Moisture = 58 % Temperature = 18 C Humidity = 7 % to IBM Watson
Published Soil Moisture = 20 % Temperature = 56 C Humidity = 44 % to IBM Watson
Published Soil Moisture = 82 % Temperature = 20 C Humidity = 8 % to IBM Watson
Published Soil Moisture = 31 % Temperature = 46 C Humidity = 4 % to IBM Watson
Published Soil Moisture = 83 % Temperature = 45 C Humidity = 69 % to IBM Watson
Published Soil Moisture = 11 % Temperature = 66 C Humidity = 36 % to IBM Watson
Published Soil Moisture = 17 % Temperature = 37 C Humidity = 86 % to IBM Watson
```

8. TESTING

8.1 Test Case:
8.2 User Acceptance Testing:

9. RESULTS

9.1 Performance Metrics:

10. ADVANTAGES AND DISADVANTAGES

Advantage:

1. They Can monitor from anywhere.
2. This project gives more profit and less work.
3. Easy to control and sense.
4. Real-time updates about the parameters.
5. Get immediate alerts about the parameters.
6. Measure the Soil Moisture , temperature, humidity levels immediately.

Disadvantage:

1. Sudden climate change cause soil erosion and biodiversity loss.
2. The farmers cannot know if the application does not work properly.

11. CONCLUSION:

Agriculture is an integral part of smart growth.Smart farming can make agriculture more profitable for the farmer. Decreasing resource inputs will save the farmer money and labor, and increased reliability of spatially explicit data will reduce risks.Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) – for tracking, monitoring, automating and analyzing operations.This paper presented about monitoring the plants and alert the farmers about the crops.This system is basic yet reliable.

12. FUTURE SCOPE:

The Internet of Things (IoT) has provided ways to improve nearly every industry imaginable. In agriculture, IoT has not only provided solutions to often time-consuming and tedious tasks but is totally changing the way we think about agriculture. What exactly is a smart farm, though? Here is a rundown of what smart farming is and how it's changing agriculture. Many believe that IoT can add value to all areas of farming, from growing crops to forestry. While there are several ways that IoT can improve farming, two of the major ways IoT can revolutionize agriculture are precision farming and farming automation.Importantly, IoT-based smart farming doesn't only target large-scale farming operations; it can add value to emerging trends in agriculture like organic farming, family farming, including breeding particular cattle and/or growing specific cultures, preservation of particular or high-quality varieties, and enhance highly transparent farming to consumers, society and market consciousness.

13. APPENDIX:

source code:

1.Python Source Code

GitHub

1.Github Link