SMARTFARMER - IOT ENABLED SMART FARMING APPLICATION

TEAM ID - PNT2022TMID12813

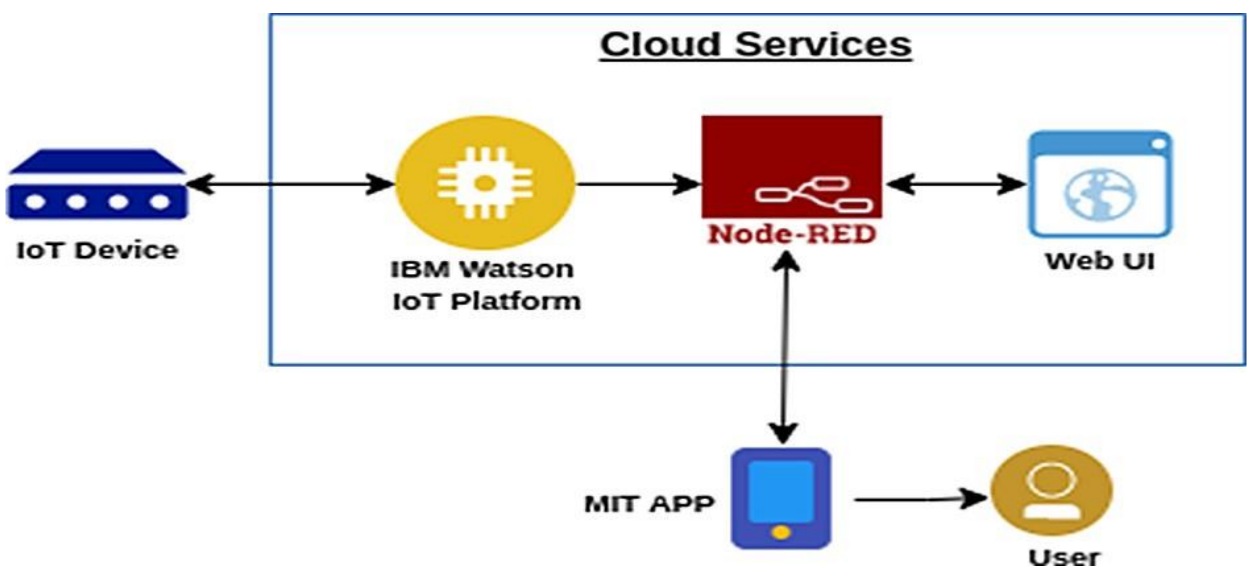
1. INTRODUCTION

The growth of the global population coupled with a decline in natural resources, farmland, and the increase in unpredictable environmental conditions leads to food security is becoming a major concern for all nations worldwide. These problems are motivators that are driving the agricultural industry to transition to smart agriculture with the application of the productivity. The IoT integrates a series of existing state-of-the-art solutions and technologies, such as wireless sensor networks, cognitive radio ad hoc networks, cloud computing, big data, and end-user applications. This study presents a survey of IoT solutions and demonstrates how IoT can be integrated into the smart agriculture sector. To achieve this objective, we discuss the vision of IoT-enabled smart agriculture ecosystems by evaluating their architecture (IoT devices, communication technologies, big data storage, and processing), their applications, and research timeline. In addition, we discuss trends and opportunities of IoT applications for smart agriculture and also indicate the open issues and challenges of IoT application in smart agriculture. We hope that the findings of this study will constitute important guidelines in research and promotion of IoT solutions aiming to improve the productivity and quality of the agriculture sector as well as facilitating the transition towards a future sustainable environment with an gynecological approach.

1.1 PROJECT OVERVIEW

This document delivers an overall assessment of the conceptual prototypes of the two SmartFarming sub-use cases “SmartGreenhouse” and “SmartSpraying The end user validation has been done separately for the SmartSpraying and the SmartGreenhouse pilot. The results of the final end user evaluation are described in detail in this document.

create learning possibilities and improve competences. The SmartGreenhouse pilot has been mainly evaluated in Greece, both in discussion panels and using questionnaires. A vast majority of respondents regard the pilot as useful or very useful. A number of additional functionalities are suggested. In order to evaluate the overall outcome of the SmartFarming sub use cases, their economic and environmental benefits, social aspects, and the technical evolution path were evaluated. In order to quantify the economic benefit of the FutureInternet technology to the farmer, a business case was analyzed. This analysis shows that even a minor decrease in costs in parallel with a moderate increase in earnings which is made possible by an improved response to the market requirements causes a significant improvement of the economic outcome of the farm. Considering the environmental aspects, SmartFarming can benefit by improving irrigation, site-specific pesticide application and lower energy consumption. These aspects are described in further detail. The examination of the social aspects shows that the highest benefit is seen in the possibility to learn and to develop new competencies for farmers. The technical evolution prospects of the pilots is analyzed regarding extensibility, flexibility, scalability (how big is big data), and portability. In the last section, the functionalities of both pilots are linked to the responsible providers. Finally, the future development plan is discussed. It would be very important to involve the policy, government, and regulatory aspects into the development work.



1.2PURPOSE

Till now the Industrial Internet of Things (IoT) has disrupted many industries and the Agriculture Industry isn't an exception. Till the end of 2018, the connected agriculture market stood at USD 1.8 billion globally and the change hasn't stopped yet. It is expected to grow to USD 4.3 billion by 2023 at a Compound Annual Growth Rate (CAGR) of 19.3%.The IoT technology has realized the smart wearable's, connected devices, automated machines, and driver less cars. However, in agriculture, the IoT has brought the greatest impact.Recent statistics reveal that the global population is about to reach 9.6 billion by 2050. And to feed this massive population, the agriculture industry is bounded to adopt the Internet of Things. Amongst the challenges like extreme weather conditions, climatic changes, environmental impact, IoT is eradicating these challenges and helping us to meet the demand for more food.

Throughout the world, mechanical innovations such as tractors and harvesters took place and brought into the agriculture operations in the late 20th century. And the agriculture Industry relies heavily on innovative ideas because of the steadily growing demand for food.The Industrial IoT has been a driving force behind increased agricultural production at a lower cost. In the next several years, the use of smart solutions powered by IoT will increase in the agriculture operations. In fact, few of the recent report tells that the IoT device installation will see a compound annual growth rate of 20% in the agriculture industry. And the no. of connected devices (agricultural) will grow from 13 million in 2014 to 225 million by 2024.Due to lack of constant and reliable communication network infrastructure, an IoT solutions provider as well as the business owners had faced implementation challenges in remote or less developed regions.

But, many network providers are making it possible by introducing satellite connectivity and expending cellular networks.Applications of IoT in Agriculture

How IoT in Agriculture took its footprints?It's been long since sensors were introduced in the agriculture operations. But the problem with the traditional approach of utilizing sensor technology was that we were not able to get the live data from the sensors. The sensors used to log the data into their attached memory and later on we were able to use it.With the introduction of Industrial IoT in

Agriculture, far more advanced sensors are being utilized. The sensors are now connected to the cloud via cellular/satellite network. Which lets us to know the real-time data from the sensors, making decision making effective.The applications of IoT in the agriculture industry has helped the farmers to monitor the water tank levels in real-time which makes the irrigation process more efficient. The advancement of IoT technology in agriculture operations has brought the use of sensors in every step of the farming process like how much time and resources a seed takes to become a fully-grown vegetable.Internet of Things in Agriculture has come up as a second wave of green revolution.

2. LITERATURE SURVEY

2.1EXISTING PROBLEM

To provide efficient decision web using wireless sensor network which handle different activities of farm and provides useful information associated with farm. Information associated with Soil moisture, Temperature and Humidity content.

Due to the atmospheric condition, water level increasing Farmers get lot of distractions which isn't good for Agriculture. Water level is managed by farmers in both Automatic/Manual using that mobile application. it'll make easier to farmers.

Performing agriculture is incredibly much time consuming. It should utilize minimum resources in terms of hardware and value. This overcomes the manual operations required to observe and maintain the agricultural farms in both automatic and manual modes. It should be able to measure the rise or decrease in level of water yet as moisture within the soil.

The challenges of a smart agriculture system include the integration of these sensors and tying the sensor data to the analytics driving automation and response activities. When integrated, the use of data analytics can reduce the overall cost of agriculture and contribute to higher production from the same amount of area through precise control of water, fertilizer and light. Smart methods allow for farming on smaller and more distributed lands through remote monitoring, whether indoor or outdoor.

To successfully deploy a smart agriculture system, consider setting up a communications network that can integrate a limited number of sensors across a large area of farmland. This will require third-party network provisioning or setting up a private network consisting of access points and up links to a private back haul network, which channels all the data traffic to centralized monitoring software or an analytics head-end system

- It is not a secure system.
- There is no motion detection for protection of agriculture field.
- Automation is not available

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2.3 PROBLEM STATEMENT DEFINITION

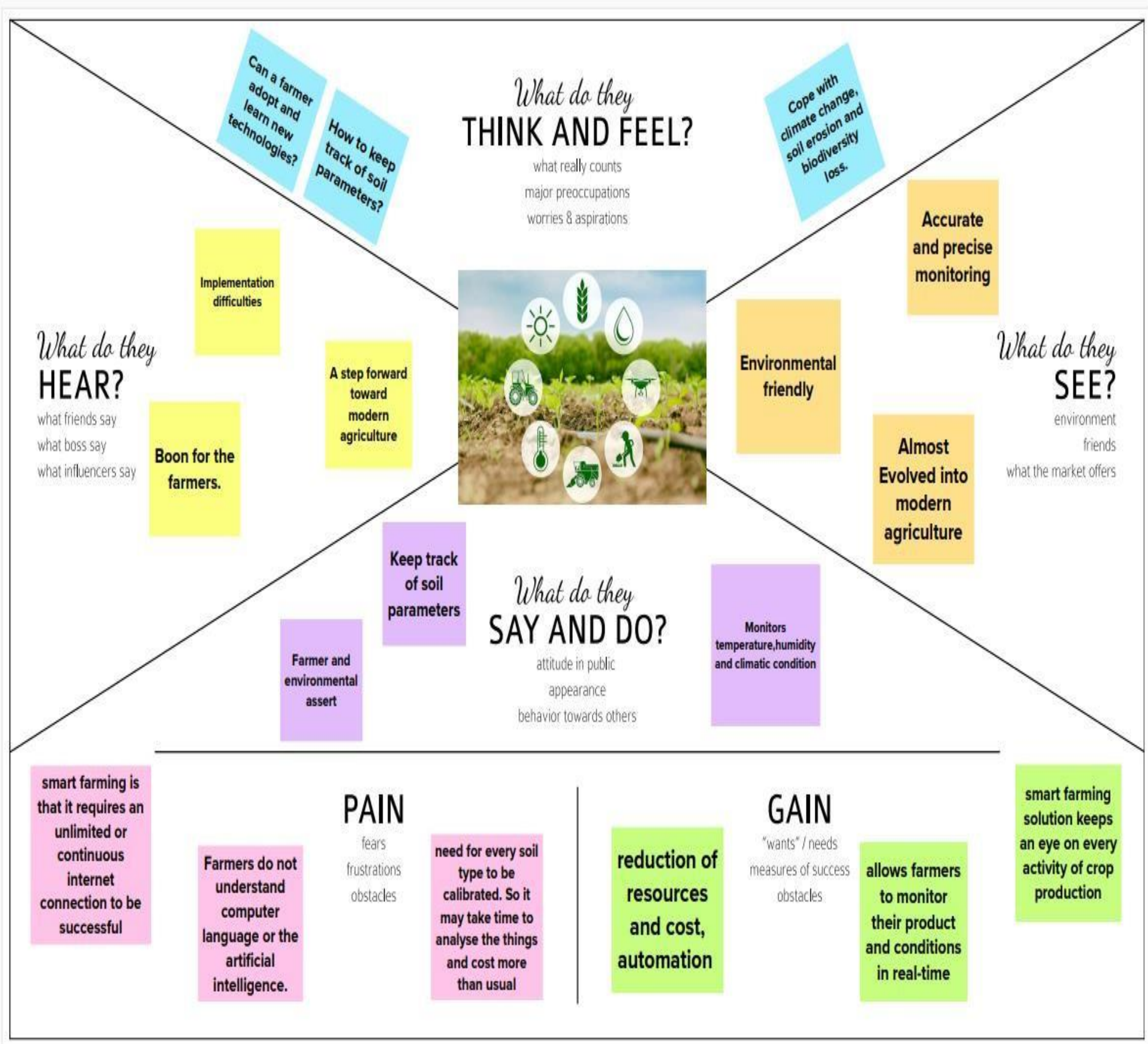
The soil moisture sensor measures wetness content in the soil. The Arduino UNO microcontroller used to receive input from a various sensors and it can be controlled automatically. When soil moisture sensor goes low the water pump will be on and it exceeds defined levels of the water motor will turn off automatically. We can constantly monitor the growth of a crop using ultrasonic sensor. PIR sensor detects the motion or unusual movement in the agricultural land. This device his very helpful to the former to monitor and control environmental parameters at their field. The farmers did not go to theirfield, they can remotely monitor and control using cloud

3. IDEATION & PROPOSED SOLUTION

3.1EMPATHY MAP CANVAS

An empathy map canvas is a more in-depth version of the original empathy map, which helps identify and describe the user's needs and pain points. And this is valuable information for improving the user experience.

Teams rely on user insights to map out what is important to their target audience, what influences them, and how they present themselves. This information is then used to create personas that help teams visualize users and empathize with them as individuals, rather than just as a vague marketing demographic or account number.



What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
Can a farmer adopt and learn new technologies?
How to keep track of soil parameters?
Cope with climate change, soil erosion and biodiversity loss.
What do they HEAR?
what friends say
what boss say
what influencers say
Implementation difficulties
A step forward toward modern agriculture
Boon for the farmers.
What do they SEE?
environment
friends
what the market offers
Accurate and precise monitoring
Environmental friendly
Almost Evolved into modern agriculture
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
Keep track of soil parameters
Farmer and environmental assert
Monitors temperature,humidity and climatic condition
PAIN
fears
frustrations
obstacles
smart farming is that it requires an unlimited or continuous internet connection to be successful
Farmers do not understand computer language or the artificial intelligence.
need for every soil type to be calibrated. So it may take time to analyse the things and cost more than usual
GAIN
"wants" / needs
measures of success
obstacles
reduction of resources and cost, automation
allows farmers to monitor their product and conditions in real-time
smart farming solution keeps an eye on every activity of crop production

3.2 IDEATION AND BRAINSTORMING

Introduction on Internet of Things (IoT), application of IoT in agricultural field to improve the yield and quality by reducing the cost is provided. The sensors which are used in the architecture are discussed briefly and the process of transmission of data from the agriculture field to the central system is explained. The proposed system advantages are included. In addition, open researchissues, challenges, and future of IoT in agricultural field are highlighted. The concept is basically developed on an idea, where there are numerous things or objects - such as Arduino, sensors, GSM models, LCD display, etc., that are connected with the Internet. Each of the objects has a different address and is able to interact with other items. The things or objects co-operate with each other to reach acommon goal.

We are going to construct a smart agricultural monitoring system which can collect crucial agricultural data and send it to an IoT platform called Thingspeak in real time where the data can be logged and analyzed. The logged data on Thingspeak is in graphical format, a botanist or a reasonably knowledged farmer can analyze the data (from anywhere in the world) to make sensible changes in the supplied resources (to crops) to obtain high quality yield.

Smart agriculture monitoring system or simply smart farming is an emerging technology concept where data from several agricultural fields ranging from small to large scale and its surrounding are collected using smart electronic sensors. The collected data are analyzed by experts and local farmers to draw short term and long-term conclusion on weather pattern, soil fertility, current quality of crops, amount of water that will be required for next week to a month etc.We can take smart farminga step furtherby automating severalparts of farming, for example smart irrigation and water management. We can apply predictive algorithms on microcontrollers or SoC to calculate the amount of water that will be required today for a particular agriculture field. Say, if there was rain yesterday and the quantity of water required today is going to be less. Similarly, if humidity was high the evaporation of water at upper ground level is going to be less, so water requiredwill be less than normal, thus reducing water usage.

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How might we able to come up with a better solution for sustainable farming using modern technologies?

PROBLEM

How might we able to create a better environment for farmers?

PROBLEM

How might we able to incorporate the modern technologies to have a better agriculture?

PROBLEM

How might we able to make the life of farmers easier by have a great yields and good nutritional produce?

Brainstorm

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

10 minutes

Person 1

- Automated drone inspection
- Soil moisture sensing
- Controlled irrigation
- Nutrition content

Person 2

- Pest notification
- Multi cropping recommendations
- Prior climate sensing
- Soil type identification

Person 3

- Identification of optimal growth condition
- Crop tracking
- Yield monitoring
- Real time nitrogen monitoring

Person 4

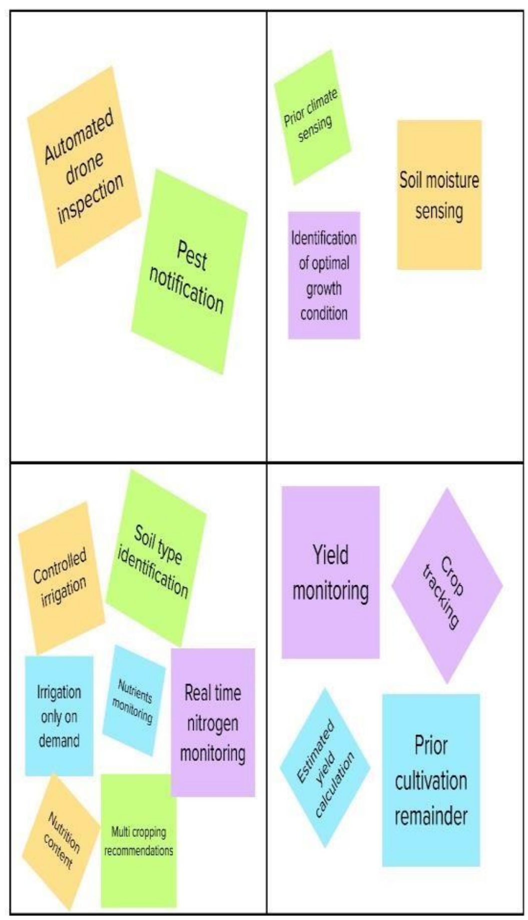
- Prior cultivation remainder
- Estimated yield calculation
- Irrigation only on demand
- Nutrients monitoring

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

Idea Grouping

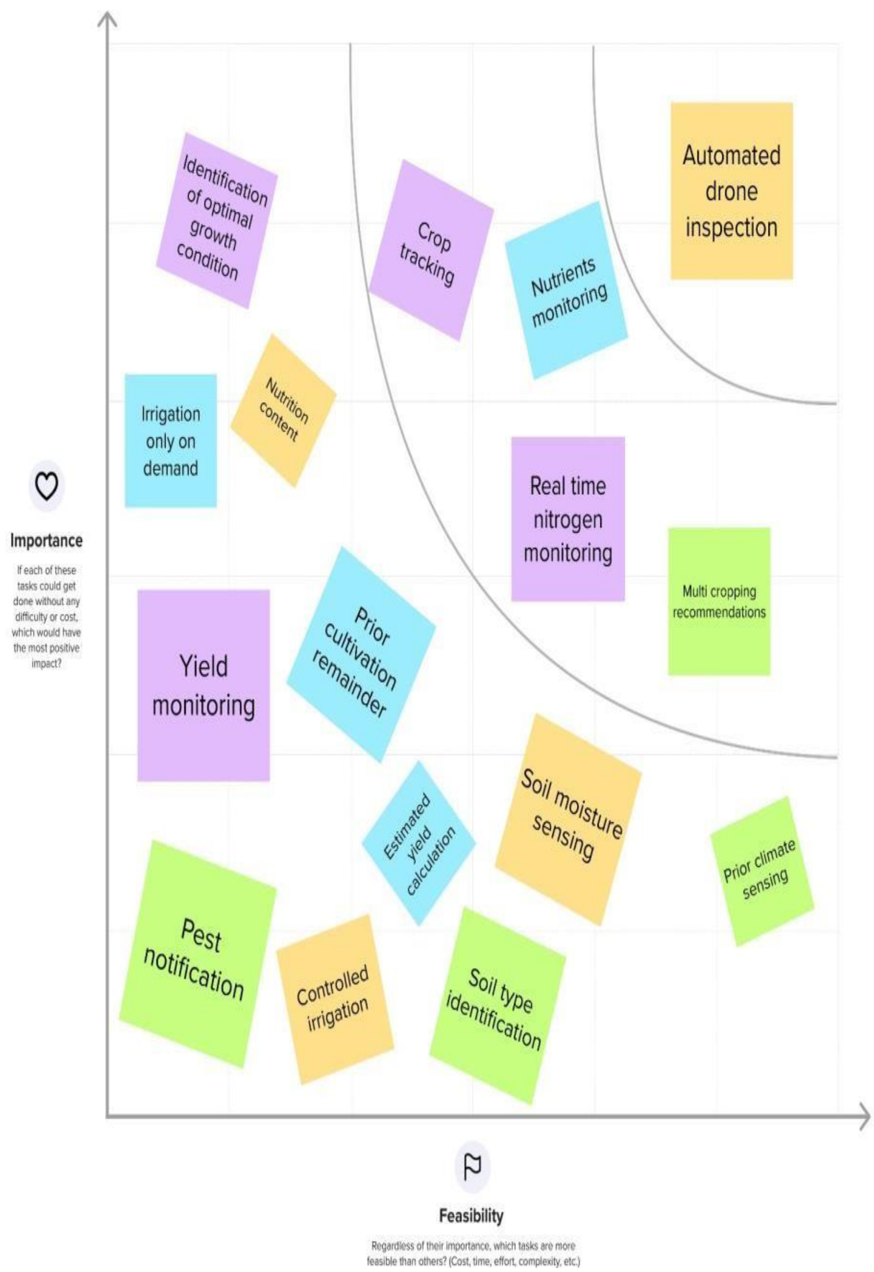


4

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



4

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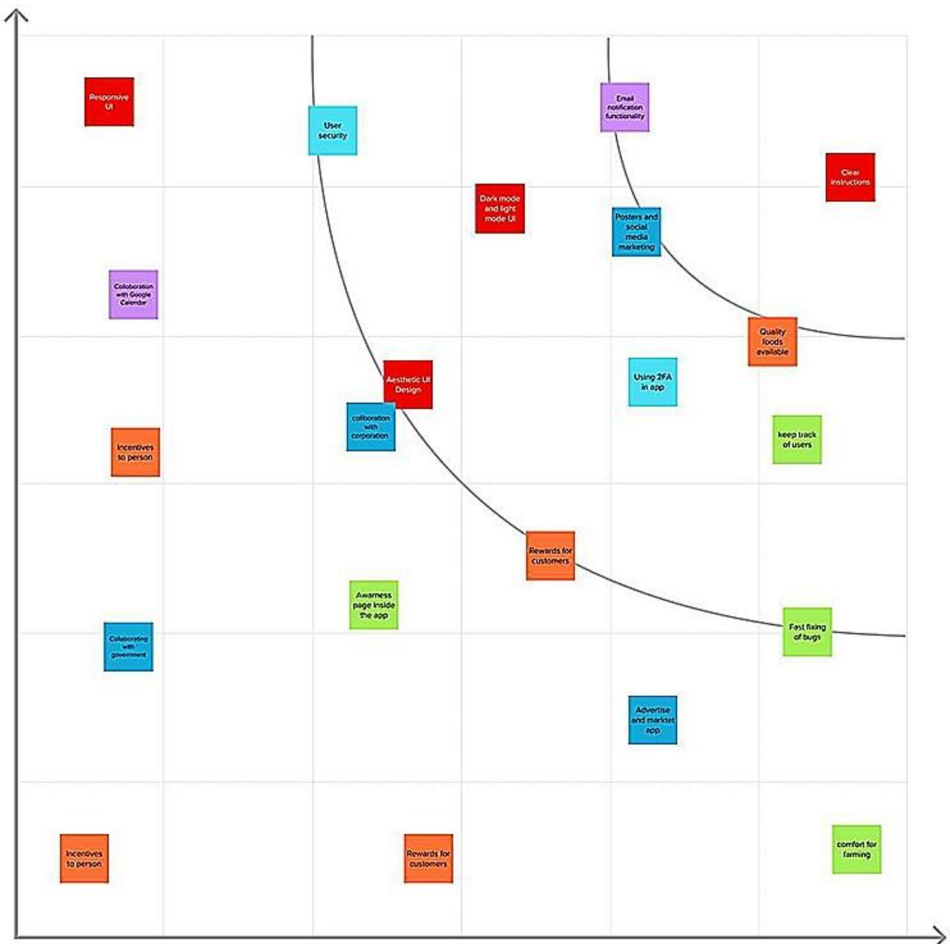
20 minutes



3.3 PROPOSED SOLUTION

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.

3.4 PROBLEM SOLUTIONFIT

1.Customer segments:- Types of Customers who are going to this project are • Large Scale Farmers • Remote Farmers	**6.Customer constrains:-** The customer needs a solution which will solve the problems in farming when he is in a remote location and that solution should fulfil the following needs. • Cost efficient • Low power consumption • Time efficient	**5. Available solutions :-** We can give solutions to this problem by using the Smart Farming Application which collects the Moisture level data from the field and operate in the basis of that moisture level.
2. Jobs to be done :- The Customers want to automate the irrigation process, reduce cost of manual workers and minimize the power consumption	**9. Problem route cause:-** The route cause for Smart farming Applica	**7. Behavior:-** The customer needs to make a revolutionary change in farming by means of modern technologies.
3. Triggers:- Farmers are facing many problems while farming in traditional manner. This triggers the Smart Farming Applications. **4. Emotions:-** Farmers feel very relaxed and feel stressless while working in field.	**10. Solution:-** Our solution for this project is to give environment sustainable Product for the farming in modern era with reduced cost and with best efficiency	**8.Channels of behaviour:-** The channels of behavior recombines the ration of the following • Online • Offline

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Log in to system	Check Credentials Check Roles of Access.
FR-4	Manage Modules	Manage System Admins Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Log out	Exit

4.2 NON-FUNCTIONAL REQUIREMENTS (NFRS)

Non-Functional Requirements (NFRs) can be defined as requirements that are not directly related with specific functionalities offered by the software. They can be related to the emerging properties of the system, such as Reliability and Security (Sommerville, 2011). According to (Wiegers and Beatty, 2013), quality characteristics are also known as a type of NFRs and they describe the product's characteristics in various dimensions considered important by the stakeholders, such as security and usability. Thus, the software quality assurance demands that quality characteristics (or NFRs) are specified, measured, and evaluated, whenever possible, using validated or widely accepted measures and measurement methods (ISO/IEC 25000, 2011). Another important point to stress in this paper concerning the evaluation of NFRs is that they can be correlated, which means that one NFRs can has a impact in another one. This impact could be positive (helps) or negative (hurts) (Wiegers and Beatty, 2013)

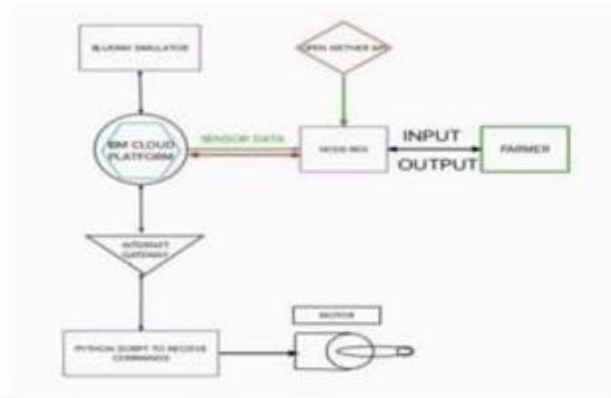
5. PRODUCT DESIGN

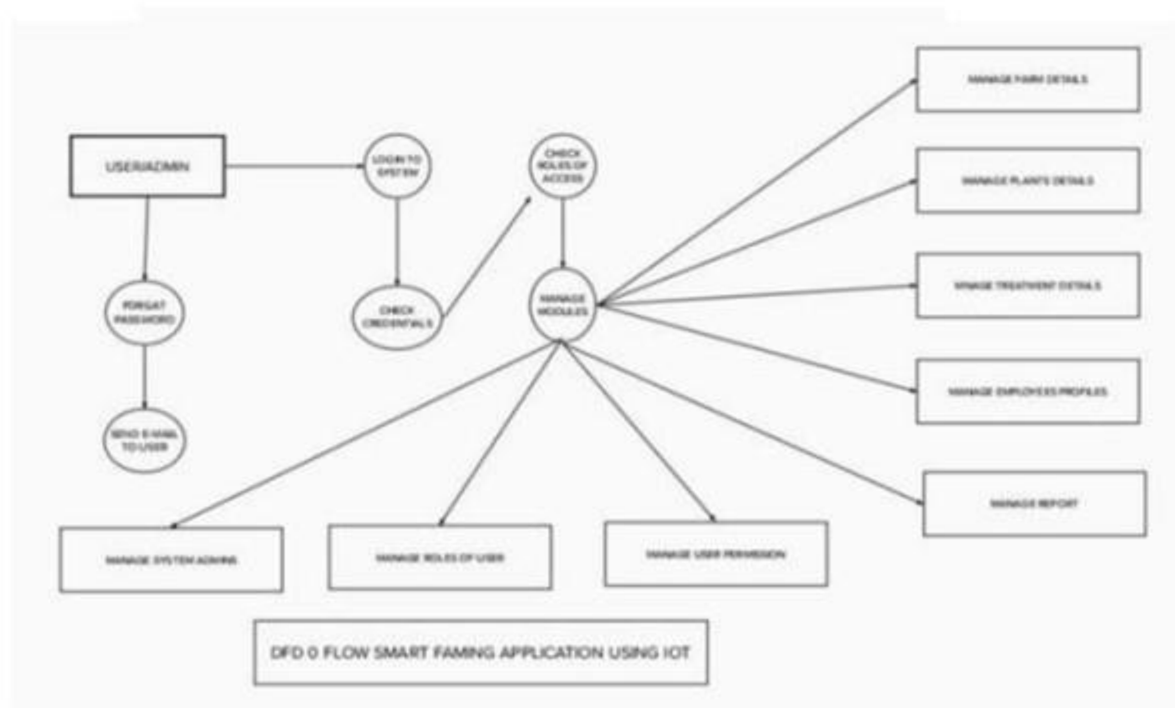
5.1DATA FLOW DIAGRAMS

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 change

the information, and where data is stored.

i. The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.
ii. Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.
iii. NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.
iv. All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could plan through an app, weather to water the crop or not depending upon the sensor values. By using the app they can remotely operateto the motor switch.





DFD 0 FLOW SMART FAMING APPLICATION USING IOT

5.2 SOLUTIONAND TECHNICAL ARCHITECTURE

The Deliverable shall include the architectural diagram as below and the information as perthe table1 & table 2 Guidelines:

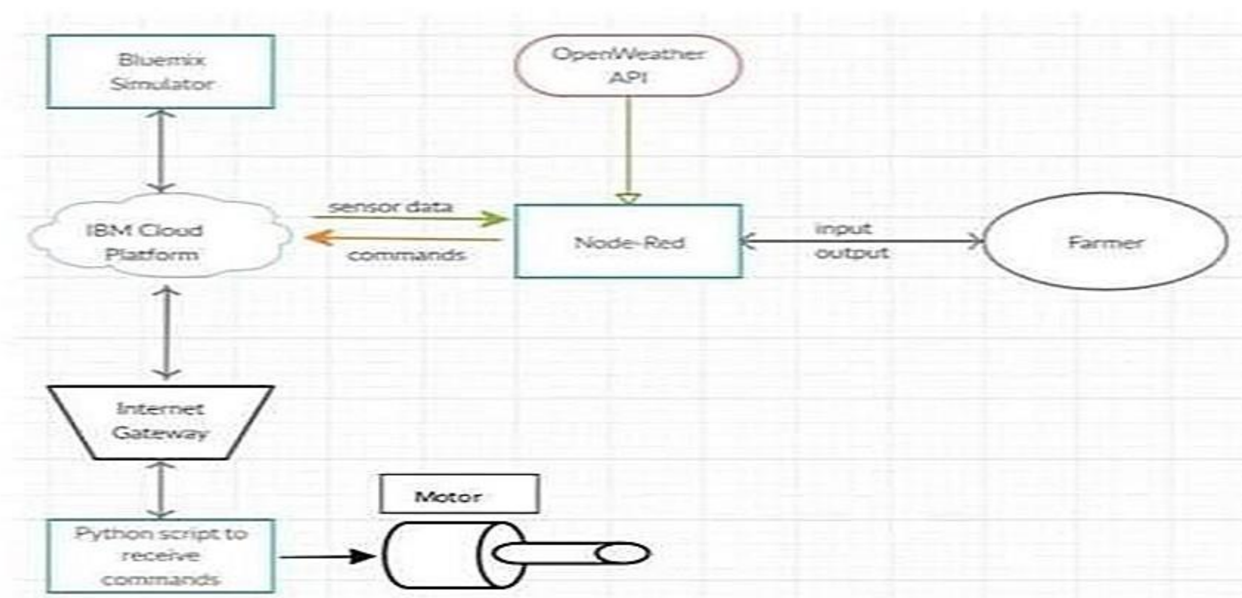
a. The different soil parameters temperature, soil moistures and then humidityare sensedusingdifferent sensors and obtained valueis stored in the IBM cloud.

b. Arduino UNO is used as a processing Unit that process the data obtained from the sensorsand whether data from the weather API.

c. NODE-RED is used as a programming tool to write the hardware,software, and APIs. TheMQTT protocol is followed forthe communication.

d. All the collected data are providedto the user througha mobile application that wasdeveloped using the MIT app inventor.The user could decidethroughan app, weatherto

water the crop or not dependingupon the sensor values. By using the app, they canremotelyoperate the motor switch.



5.3 USER STORIES:

The Internet of Things (IoT) is one of the fastest growing trends in technology. The growth is occurring in part because many different types of devices are being connected to the Internet. This includes everything from garbage barrels to home appliances, in the area known as the Consumer IoT (CIoT). It also includes many machines inside factories, and it affects all industries within the Industrial IoT (IIoT). The number of connected devices will nearly match the number of computers, tablets, and mobile phones combined within the next five years.

But the IoT isn't simply about connecting devices to the Internet. It's also about using the data received from the devices and controlling those devices in different ways. For software developers, this means it's critical to understand the many users stories that pertain to these devices and their data, or the value of connecting them can never be realized.

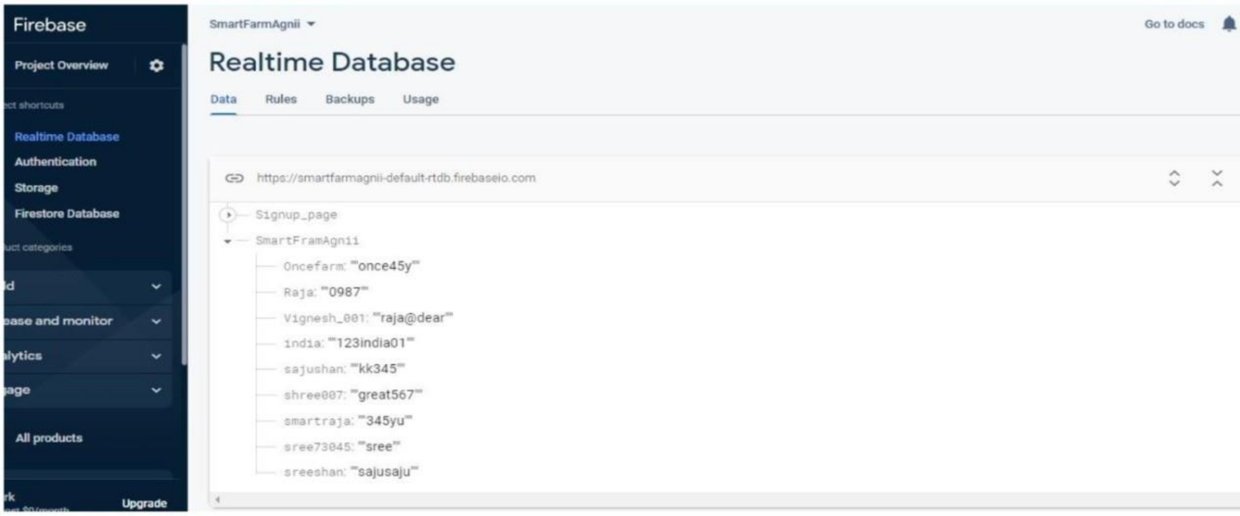
The growth of the IoT and the accompanying need for IoT software is rapidly creating opportunities for development, test, and deployment teams, which in turn is giving rise to whole-team agile as well as DevOps practices. Once strictly hardware-focused companies now need software developers. Many companies are adding IoT-specific divisions, and whole new businesses are popping up that are focused on developing software to meet IoT application needs. As noted above, the IoT divides into CIoT and IIoT. CIoT gets covered frequently (for example, the recent TechBeacon interview with Scott Amyx covers wearables in the CIoT space). So my focus here will be on the IIoT.

6. PROJECT PLANNING AND SCHEDULING

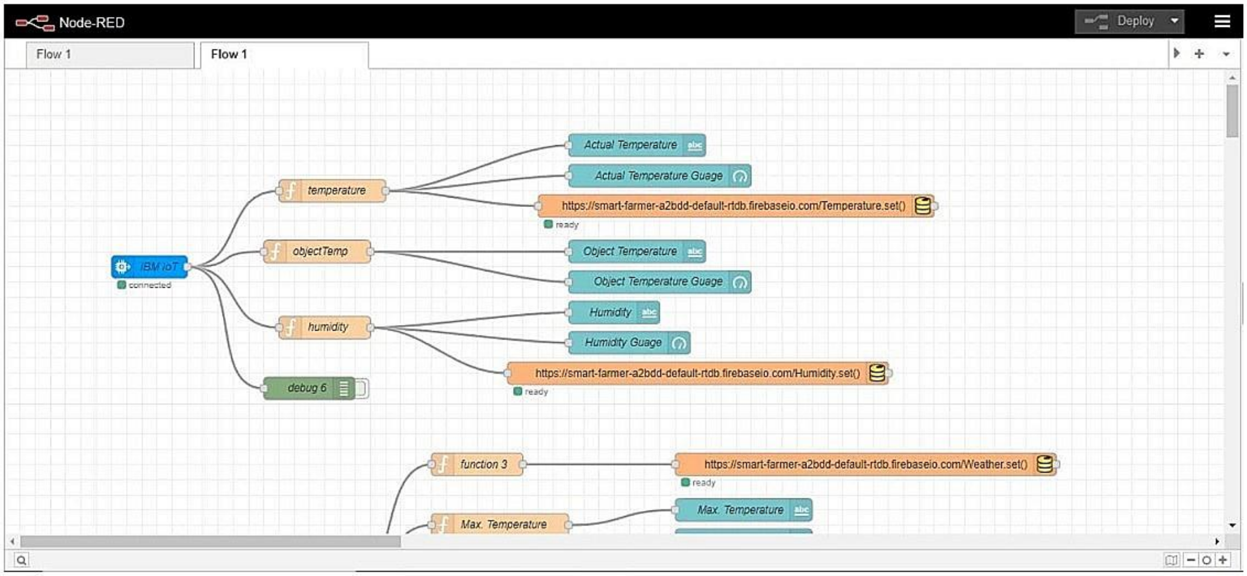
6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Premkumar K,Naveen K
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios usingNode-Red	2	High	Nandhakumar G, Naveen K, Lohit M
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmerproject using MIT App Inventor	2	High	Lohit M
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Nandha Kumar G
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Nandhakumar G, Naveen K, Lohit M

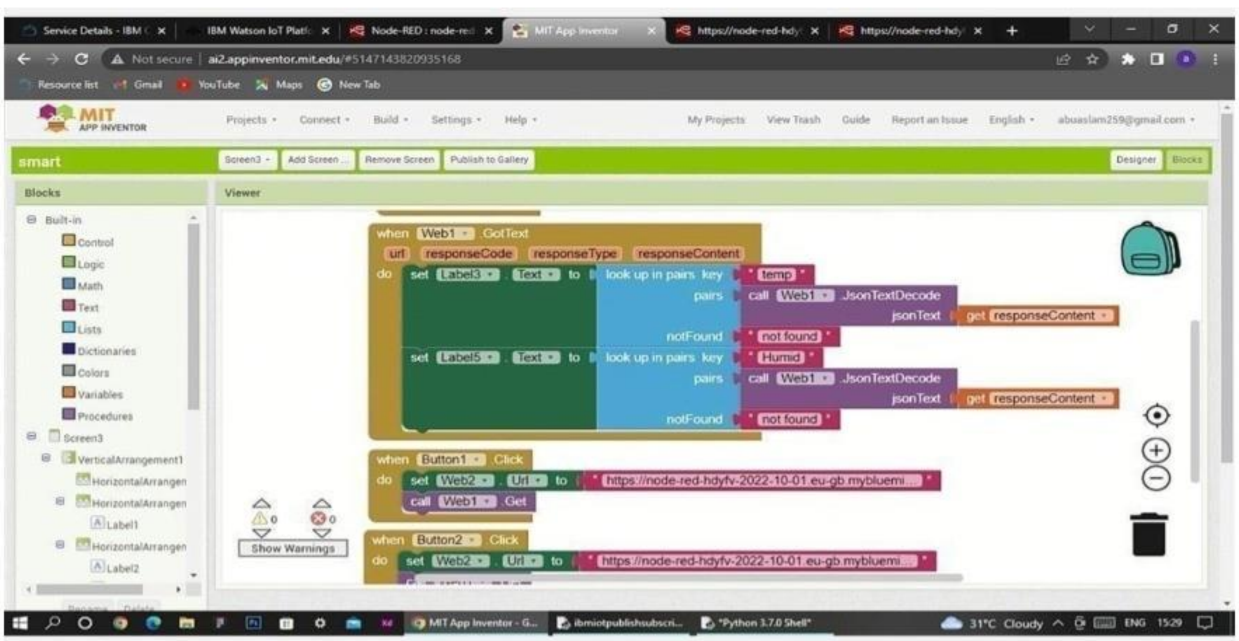
SPRINT 1:

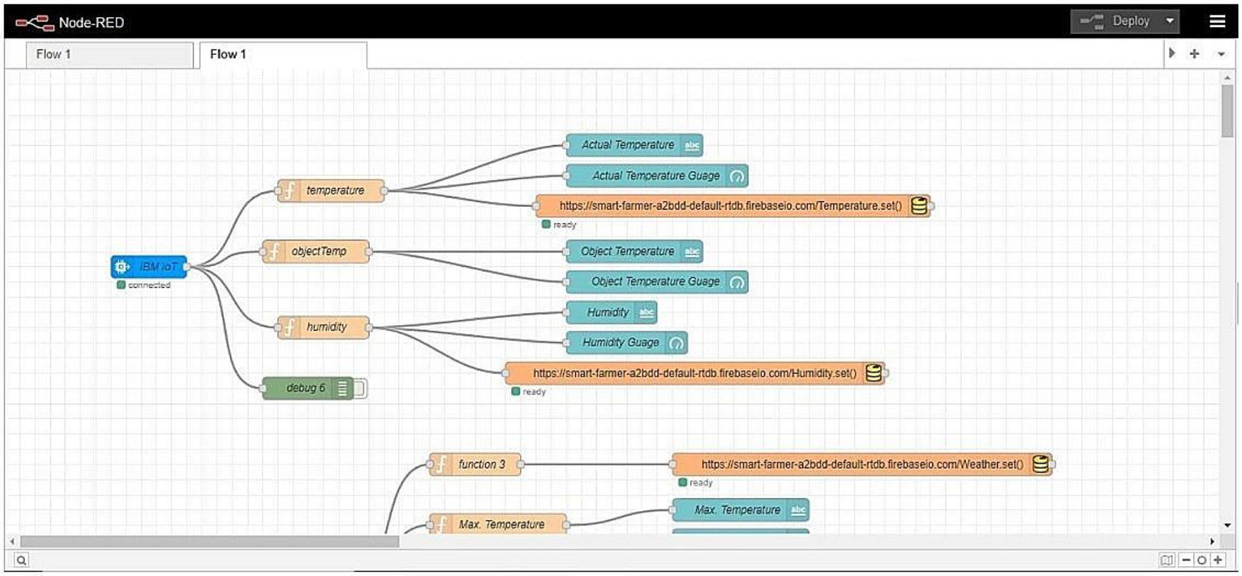


SPRINT 2:


Node-RED
Deploy
Flow 1
Flow 1
Actual Temperature
Actual Temperature Guage
temperature
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Temperature.set()
ready
objectTemp
Object Temperature
IBM IoT
connected
Object Temperature Guage
Humidity
humidity
Humidity Guage
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Humidity.set()
ready
debug 6
function 3
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Weather.set()
ready
Max. Temperature
Max. Temperature

SPRINT 3:


MIT APP INVENTOR
smart
Screen3
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen3
VerticalArrangement1
Label1
Label2
when Web1 .GotText
url responseCode responseType responseContent
do set Label3 . Text to look up in pairs key "temp"
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound "not found"
set Label5 . Text to look up in pairs key "Humid"
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound "not found"
when Button1 .Click
do set Web2 . Url to "https://node-red-hdyfv-2022-10-01.eu-gb.mybluemi..."
call Web1 .Get
when Button2 .Click
do set Web2 . Url to "https://node-red-hdyfv-2022-10-01.eu-gb.mybluemi..."
Show Warnings


Node-RED
Deploy
Flow 1
Flow 1
Actual Temperature
Actual Temperature Guage
temperature
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Temperature.set()
ready
objectTemp
IBM IoT
connected
Object Temperature
Object Temperature Guage
Humidity
humidity
Humidity Guage
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Humidity.set()
ready
debug 6
function 3
https://smart-farmer-a2bdd-default-rtdb.firebaseio.com/Weather.set()
ready
Max. Temperature
Max. Temperature

SPRINT 4:


Temperature
16°C

6.2 SPRINT DELIVERY SCHEDULE

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date(Planned)	Story Points Completed (ason Planned End Date)	Sprint Release Date(Actual)
Sprint-1	12	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	6	6 Days	31 Oct 2022	05 Nov 2022	20	30 OCT 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	20	6 NOV 2022
Sprint-4	6	6 Days	14 Nov 2022	19 Nov 2022	20	7 NOV 2022

7. CODING AND SOLUTIONING

7.1 FEATURE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "hzu4n4"
deviceType = "deepadharshini"
deviceId = "27092002"
authMethod = "token"
authToken = ")onRVxyT7sOrIDrGoh"
global y
# Initialize GPIO
def myCommandCallback(cmd):
 print("Command received: %s" % cmd.data['command'])
 status=cmd.data['command']
 if status=="motoron":
 print ("motor is on")
 if status=="motoroff" :
 print ("motor is off")
 if status=="manual" :
 print ("Motor Control is in Manual Mode")
 if status=="automatic" :
```

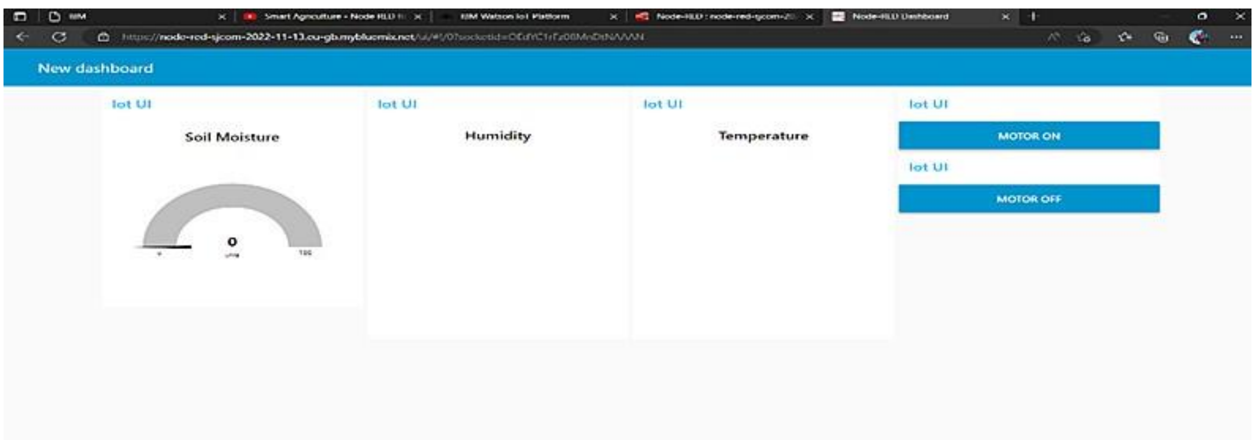
```
 print ("Motor control is in Automatic Mode")
 if soilmoisture > 600:
 print ("motor is on")

 #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)
 Humid=random.randint(0,100)
 soilmoisture=random.randint(0,1023)
 Phlevel=random.randint(0,14)
 y=soilmoisture

 data = { 'temp' : temp, 'Humid': Humid,'soilmoisture' : soilmoisture ,'Phlevel' : Phlevel }
 #print data
 def myOnPublishCallback():
 print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,"Soil Moisture
is
%s %%" % soilmoisture,"PH level is %s" %Phlevel ,"to IBM Watson")
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
 if not success:
 print("Not connected to IoTF")
```

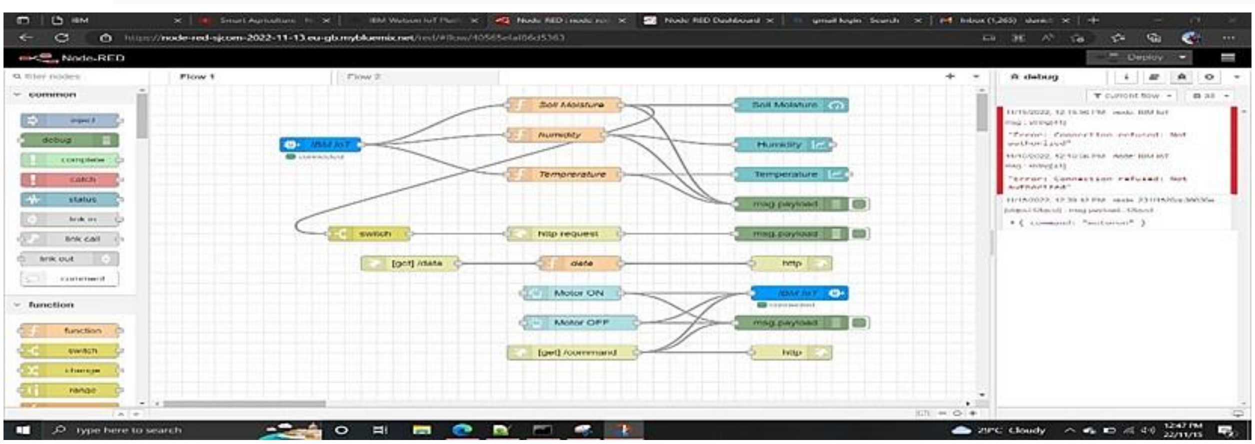
```
time.sleep(10)

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

8.TESTING

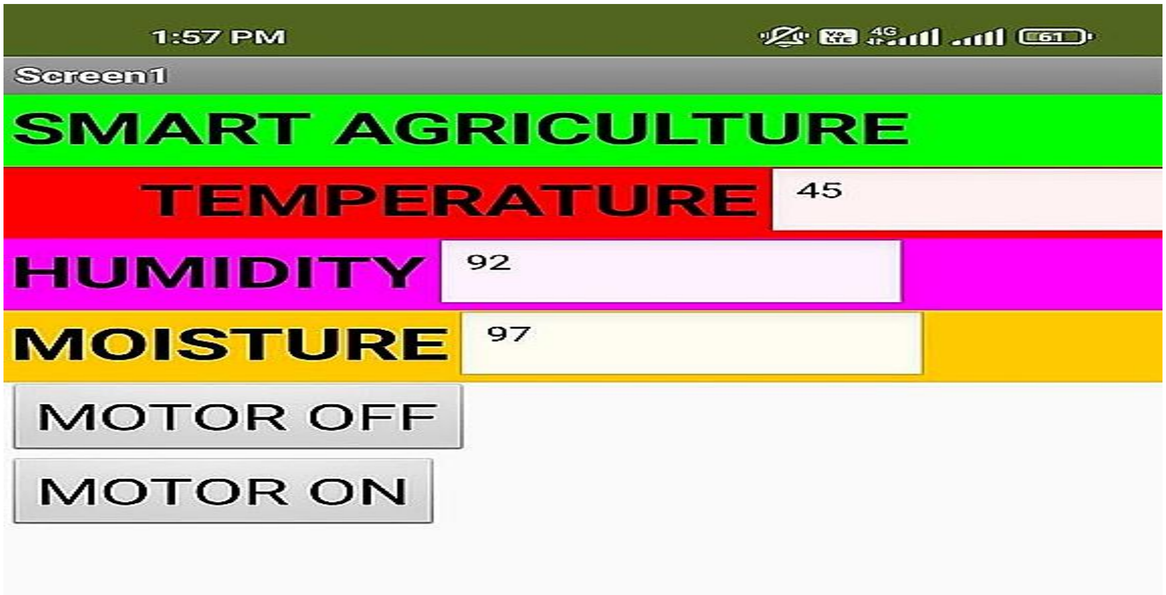
8.1 TEST CASE

Web application using Node Red





8.2 USER ACCEPTANCE TESTING



9. RESULTS

9.1 PERFORMANCE METRICS

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

1. A remote control system can helpin workingirrigation system valves dependent onschedule. Irrigating remote farm properties can be exceptionally troublesome and labor- intensive. It gets hard to comprehend when the valves were started and whether the idealmeasure of water was distributed.

2. For situations where a quick reaction is required, manual valve actuation may not beconceivable constantly. Thus, remote observing andcontrol of irrigation systems,generators or wind machines or some other motor-driven hardware become the next logical step.

3. Various solutions are available to monitor engine statistics and starting or stopping theengine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

4. Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependenton the tank orlake geometry after some time. Itconveysalarms dependent on various conditions.

DISADVANTAGES:

1. The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do notfulfil this requirement. Moreover internet connection isslower.
2. The smart farming based equipment require farmers to understand and learn the use of technology. This is majorchallenge inadoptingsmart agriculture farming atlarge scaleacross the countries.

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 adjusteddependent 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.

a. We can update the this project by using solar power mechanism. So that the powersupply from electric poles can be replaced with solar panels. It reduces the power linecost. It will be a onetime investment. Wecan add solar fencingtechnology to thisproject.
b. 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 internetissues.
c. We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

Internet of Things has emerged as a leading technology around the world. It has gained a lot of popularity in lesser time. Also, the advancements in Artificial Intelligence and Machine Learning have made the automation of IoT devices easy. Basically, AI and ML programs are combined with IoT devices to give them proper automation. Due to this, IoT has also expanded its area of application in various sectors. Here, in this section, we will discuss the applications and the future scope of IoT in healthcare, automotive, and agriculture industries.

13. APPENDIX

SOURCE CODE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "hzu4n4"
deviceType = "deepadharshini"
deviceId = "27092002"
authMethod = "token"
authToken = ")onRVxyT7sOrIDrGoh"
global y
# Initialize GPIO
def myCommandCallback(cmd):
 print("Command received: %s" % cmd.data['command'])
 status=cmd.data['command']
 if status=="motoron":
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 if status=="motoroff" :
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 if status=="manual" :
 print ("Motor Control is in Manual Mode")
 if status=="automatic" :
 print ("Motor control is in Automatic Mode")
 if soilmoisture > 600:
 print ("motor is on")
```

```
 #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)
 Humid=random.randint(0,100)
 soilmoisture=random.randint(0,1023)
 Phlevel=random.randint(0,14)
 y=soilmoisture

 data = { 'temp' : temp, 'Humid': Humid,'soilmoisture' : soilmoisture ,'Phlevel' : Phlevel }
 #print data
 def myOnPublishCallback():
 print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,"Soil Moisture
is
%s %%" % soilmoisture,"PH level is %s" %Phlevel ,"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 LINK:

https://github.com/IBM-EPBL/IBM-Project-27738-1660064476