SMARTFARMER - IOT ENABLED SMART FARMING APPLICATION

BATCH : B3-3M5E

TEAM ID: PNT2022TMID47167

Submitted by

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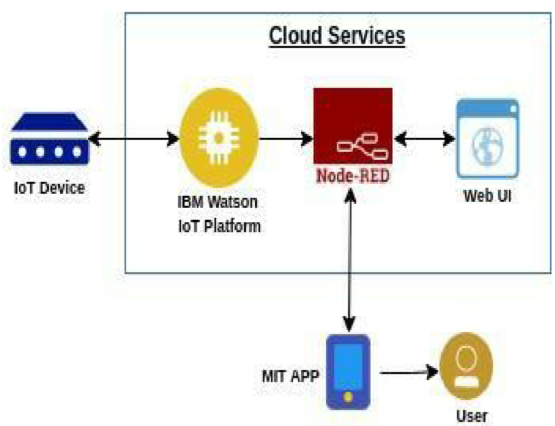
1. INTRODUCTION

✓ Smart farming refers to a farm management concept that uses modern technology with the aim of increase the quality and quantity of agricultural products. This approach includesaspects such as the Internet of Things (IoT), data management, soil scanning, as well as the access to GPS among other smart technologies.

1.1 Projectoverview

❖ IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture,temperature, and humidity using somesensors.

❖ 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 tasks for thefarmers.



1.2Purpose

❖ The smart agriculture model main aim to avoid water wastagein the irrigationprocess.

❖ It is low cost and efficientsystem

- ❖ It includes NodeMCU, Arduino Nano, sensors like soil moisture and Dht11, solenoid valves,relays.

2. LITERATURE SURVEY

- ✓ Idea behind the project is to create a smart agriculture system that is connected to the internet of things. The technology is combined with an irrigation system to deal with Malaysia’s variableweather. This system’s microcontroller is a Raspberry Pi 4 Model B. The temperature and humidity in the surrounding region, as well as the moisture level of the soil, are monitored using the DHT22 and soil moisture sensor. The data will be available on both a smartphone and a computer. As a result, Internet of Things (IoT) and Raspberry Pi-based Smart Agriculture Systems have a significant impact on how farmerswork.

2.1 Existing problem

- ❖ The challenges of a smart agriculture system include the integration of these sensors and tying the sensor data tothe analytics driving automation and responseactivities.
- ❖ It should utilize minimum resources in terms of hardwareand 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 levelof water yet as moisture within thesoil.

2.2References

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- ❖ Izzatdin Abdul Aziz, MohdHilmiHasan, Mohd Jimmy Ismail, MazlinaMehat, NazleeniSamihaHaron, “Remote Monitoringin Agricultural Greenhouse Us- ing Wireless Sensor and Short Message Service (SMS)”,2008.
- ❖ H.G.C.R.Laksiri, H.A.C.Dharmagunawardhana, 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 UsingIoT”2018.
- ❖ Dweepayan Mishra1 ,Arzeena Khan2 Rajeev Tiwari3 ,Shuchi Upadhay,”Automated Irrigation System-IoT Based Approach”,2018.
- ❖ Anurag D, Siuli Roy and SomprakashBandyopadhyay, “Agro- Sense: Precision Agriculture using Sensor-based WirelessMesh Networks”, ITU-T “Innovation in NGN”, Kaleidoscope Conference, Geneva 12-13 May2008.
- ❖ 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, Singapore2012.
- ❖ Bogena H R, Huisman J A, OberdEˆ rster C, etal. Evaluation of a low cost soil water content sensor for wireless network applications[J].

2.3 Problem statementdefinition

- ❖ To build an IoT solution for agriculture, You need to choosethe sensors for your Device (or create a customone).

- ❖ Your choice will depend on the types of Information you wantto collect and the Purpose of your solution ingeneral.
- ❖ Need a solid internalinfrastructure.
- ❖ Internal systems have to besecure.
- ❖ The safe and timely delivery, and sharing of This data is one ofthe current smart Farmingchallenges.

3. IDEATION AND PROPOSED SOLUTION

3.1Empathy mapcanvas

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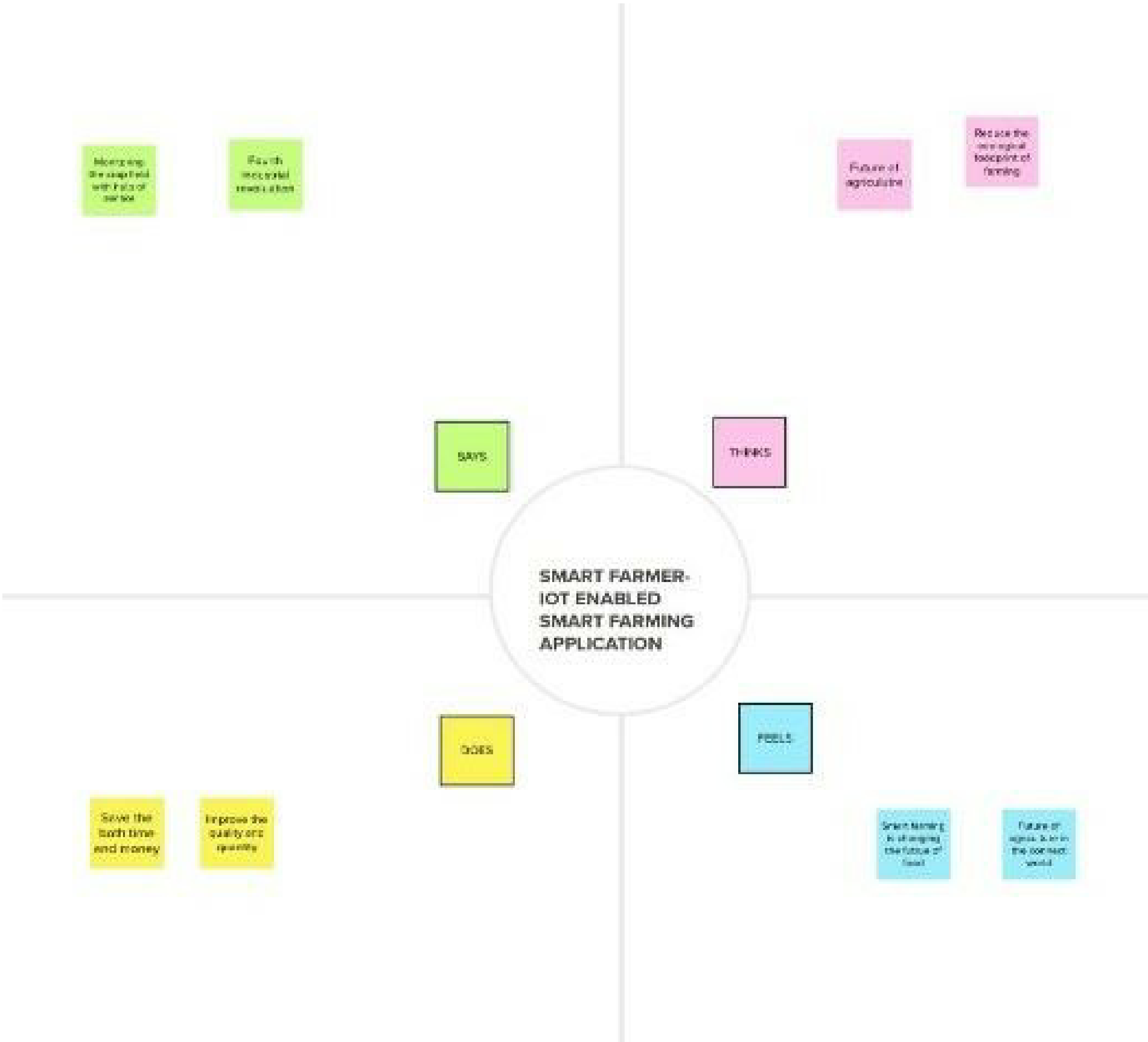


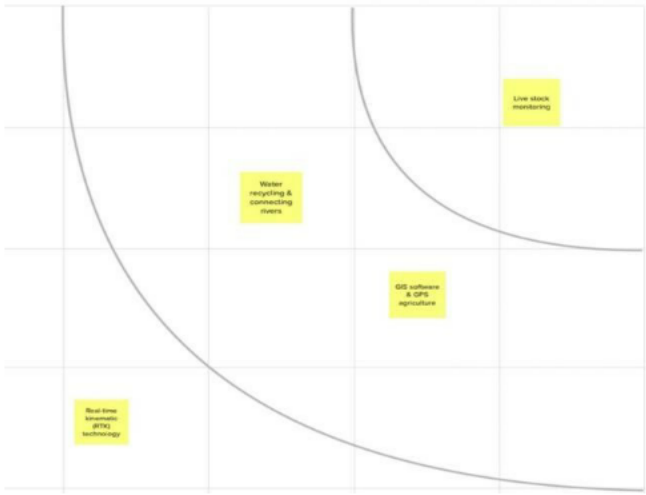
3.2 Ideation and Brainstorming

In our system,we automatically monitor the farming in real time using following idea’s

1. Smart greenhouses
2. Live stockMonitoring
3. Mini chromosometechnology

4. Precisionfarming
5. Indoorfarming
6. Urbanfarming
7. Agri-banking
8. Water recycling and connecting rivers
9. Farming software and onlinedata
10. Drone and other aerialimagery
11. Satellite imagery
12. GIS software and GPSAgriculture
13. Real-time kinematic (RKT)technology
14. Laserscarecrows
15. Bee vectoringtechnologies
16. Mergingdatasets

Polarization



3.3 Proposed solution

1. Problem Statement (Problem to Besolved)

- ❖ Farmers are under pressure to produce more food AND useless energy and water in the process.
- ❖ A remote monitoring and control system will help farmersdeal effectively with these pressures.

2. Idea / Solution description

- ❖ Smart farming refers to managing farms using modernInformation and communication technologies to increase the quantity and quality of products while optimizing the human laborrequired.
- ❖ Among the technologies available for present day farmers are: Sensors: soil, water, light, humidity, temperaturemanagement.

3. Novelty /Uniqueness

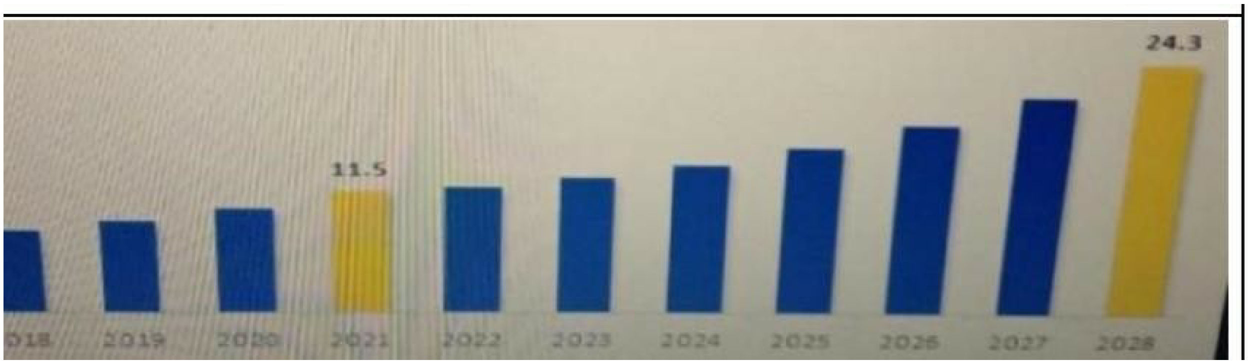
- ❖ Smart farming combines concepts (precision agriculture, land management), scientific fields (earth observation, climatescience) and cutting-edge technologies (image processing, GIS,UAV, multispectral/hyperspectral imaging) that could improve the agricultural production.

- Each one of the aforementioned subfields involves different techniques and methods that offer the capability of beingexplored indepth.

4. Social Impact / CustomerSatisfaction

- Major tech innovations in farming such as automation and robotics, livestock technology, modern greenhouse practices, precision agriculture and artificial intelligence and blockchainare enabling the shift towards modern farmingpractices.
- The journey from the farmer to the consumer in a food business is paramount to ensuring quality and taste for the consumer while empowering farmers.

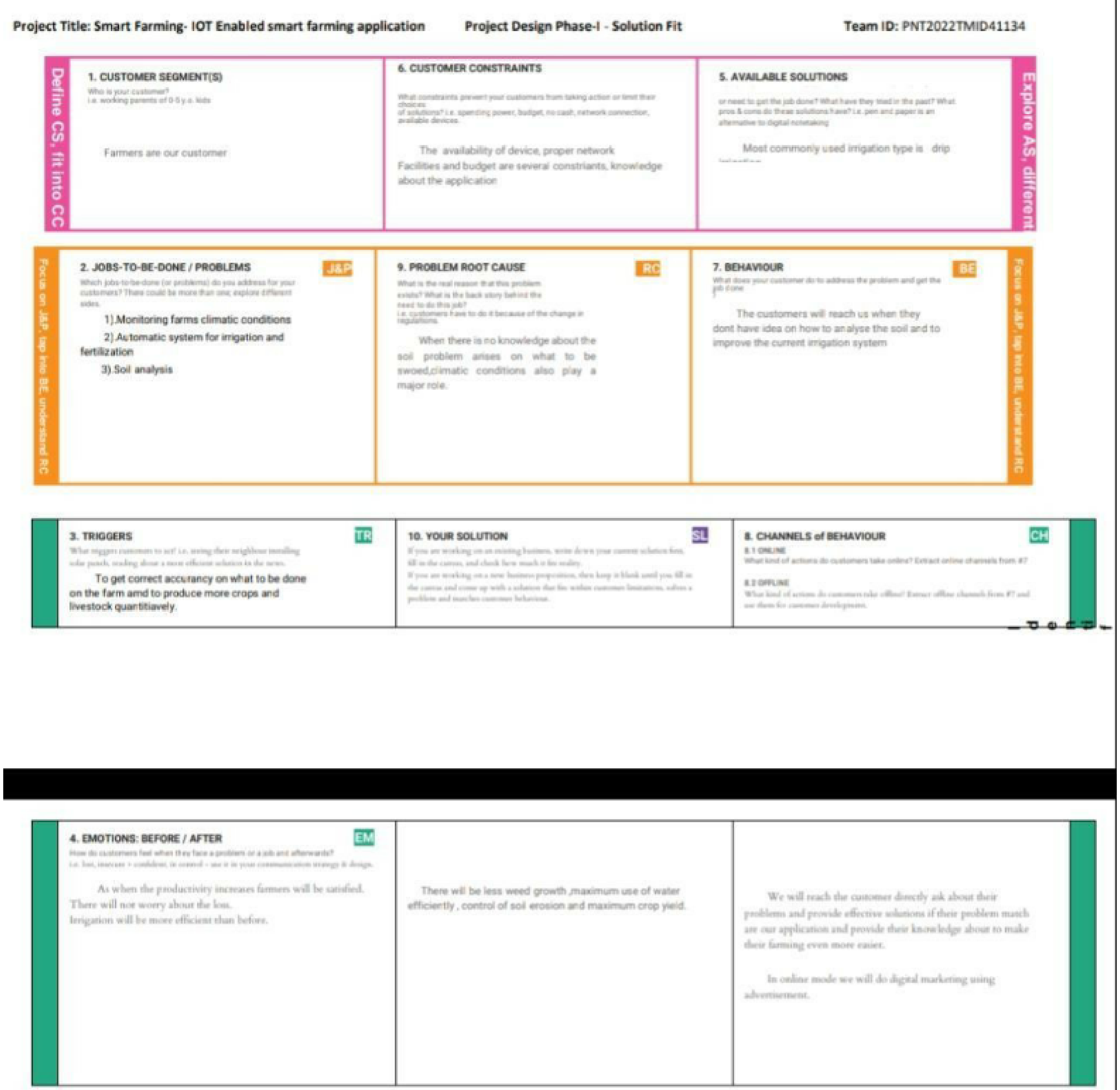
5. Business Model (RevenueModel)



6. Scalability of theSolution

- Scalability in smart farming refers to the adaptability of asystem to increase the capacity,the number of technology device such as sensor andactuators.

3.4 Problem solution fit



Project Title: Smart Farming- IOT Enabled smart farming application   Project Design Phase-I - Solution Fit   Team ID: PNT2022TMID41134

Define CS, fit into CC

1. CUSTOMER SEGMENT(S)

Who is your customer?
i.e. working parents of 0-5 y.o. kids

Farmers are our customer

6. CUSTOMER CONSTRAINTS

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

The availability of device, proper network Facilities and budget are several constriants, knowledge about the application

5. AVAILABLE SOLUTIONS

or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

Most commonly used irrigation type is drip

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.

1).Monitoring farms climatic conditions

2).Automatic system for irrigation and fertilization

3).Soil analysis

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

When there is no knowledge about the soil problem arises on what to be swoed,climatic conditions also play a major role.

7. BEHAVIOUR BE

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

The customers will reach us when they dont have idea on how to analyse the soil and to improve the current irrigation system

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

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

To get correct accurancy on what to be done on the farm amd to produce more crops and livestock quantitiavely.

10. YOUR SOLUTION SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7

8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

As when the productivity increases farmers will be satisfied. There will not worry about the loss. Irrigation will be more efficient than before.

There will be less weed growth ,maximum use of water efficiently , control of soil erosion and maximum crop yield.

We will reach the customer directly ask about their problems and provide effective solutions if their problem match are our application and provide their knowledge about to make their farming even more easier.

In online mode we will do digital marketing using advertisement.

4. REQUIREMENT ANALYSIS

4.1FunctionalRequirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	IOT devices	Sensor and WiFi module
FR-2	Software	Web UI, Node-red, IBN Watson, MIT app

4.2Non-Functional Requirements

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Time consumability is less, Productivity is High
NFR-2	Security	It has low level of security features due to integration of

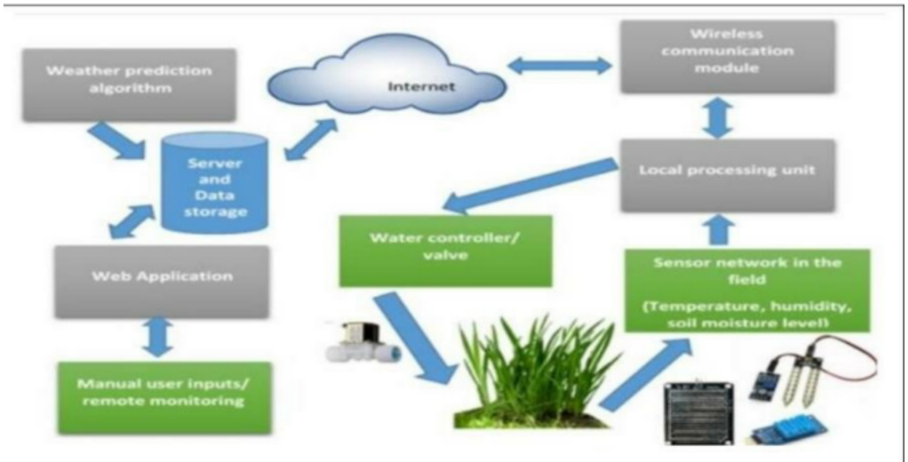
		sensor data

NFR-3	Reliability	Accuracy of data and hence it is reliable
NFR-4	Performance	Performance is High and highly productive
NFR-5	Availability	With permitted network connectivity the application is accessible
NFR-6	Scalability	It is perfectly scalable many new constraints can be added.

5. PROJECT DESIGN

5.1 Data flow diagram

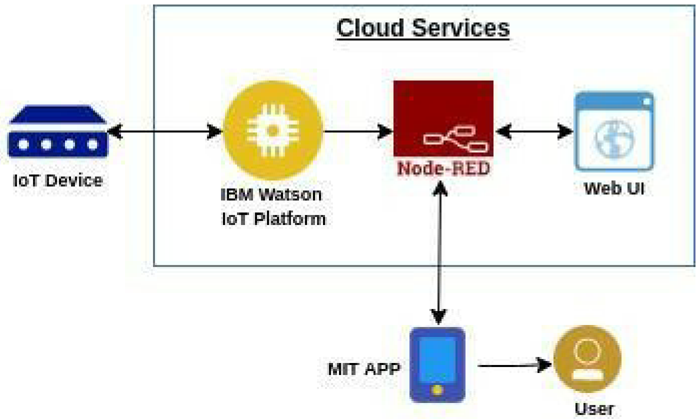
- ✓ A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirementgraphically. It shows how data enters and leaves the system, what changes the information, and where data isstored.



5.2 Solution and technical architecture Solution Architecture

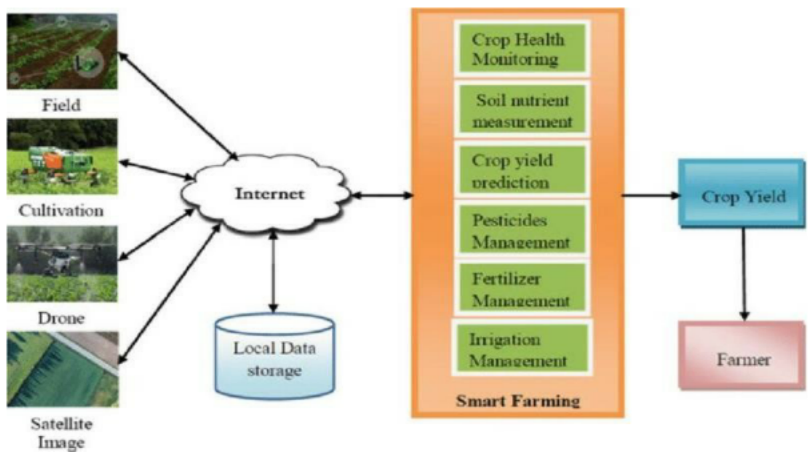
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- ❖ Find the best tech solution to solve existing businessproblems.
- ❖ Define features, development phases, and solutionrequirements.
- ❖ Provide specifications according to which the solution isdefined, managed, and delivered.



Technical Architecture

The Deliverable shall include the architectural diagram



5.3 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	Acceptance criteria	Priority	Release
Custom er	IOT devices	USN-1	Sensor and WiFi module		High	Sprint -1

Customer	Software	USN-2	IBM Watson,IOT platform, workflows for IOT scenarios using node - red		High	Sprint -2
Customer	MIT app	USN-3	To develop an application using MIT		High	Sprint -3
Customer	Web UI	USN-4	To make the user to interact with the software	To make the user to interact with the software	High	Sprint -4

6. PROJECT PLANNING ANDSCHEDULING

6.1 Sprint planning and estimation

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Story Points	Priority	Team Member
Sprint-1	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the	2	High	J.SriHarini (Leader)

			application by entering my email,password, and confirming my password.			
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	J.Muthulakshmi (Member 1)
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	M.Madhumitha (Member 2)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	S.Priyadharshini (Member 3)
Sprint-3	Registration (Farmer - Web User)	USN - 1	As a user, I can log into the application by entering emailand password	3	High	J. SriHarini (Leader)
Sprint - 2	Login	USN - 2	As a registered user, I need to easily login log into my registered account viathe web page in minimumtime	3	High	J.Muthulakshmi (Member 1)
Sprint - 4	Web UI	USN - 3	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	M.Madhumitha (Member 2)
Sprint - 1	Registration(Chemical Manufacturer Web user)	USN - 1	As a new user, I want to first register using my organization email and create a password forth ccount.	2	High	S. Priyadharshini (Member 3)
Sprint - 4	Login	USN - 2	As a registered user, I need to easily log in using the registered account via the webpage.	3	High	J. SriHarini (Leader)

Sprint - 3	Web UI	USN - 3	As a user, I need to have a user friendly interface to easily view and access the resources.	3	Medium	J.Muthulakshmi (Member 1)
Sprint - 1	Registration (Chemical Manufacturer -	USN - 1	As a user, I want to first	1	High	M. Madhumitha (Member 2)

	Mobile User)		register using my email and create a password for the account.			
Sprint - 1	Login	USN - 2	As aregistered user, I need to easily log into theapplication	2	Low	S. Priyadharshini (Member 3)

6.2 Sprint deliveryschedule

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	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 ANDSOLUTIONING

Import wiotp.sdk.device

Import time import os

Import datetime import

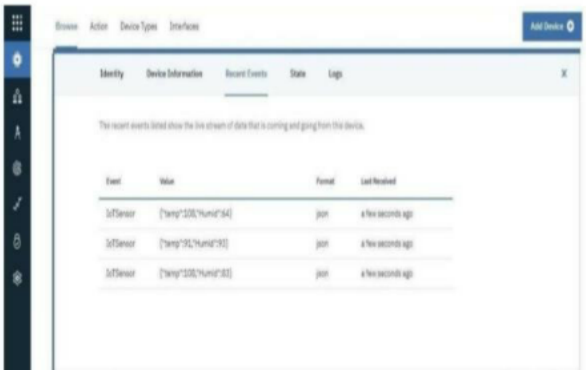
Random myConfig = {

```
“identity”: {
“orgId”:“3j2gcg”,
“typeId”: “ultrasonic”,
“deviceId”:“1407”
},
“auth”: {
“token”: “14073008”
} }
Client = wiotp.sdk.device.DeviceClient (config=myConfig,
logHandlers=None) client.connect () def
myCommandCallback (cmd) :
print (“Message received from IBM IoT Platform: %s” %
cmd.data[‘command’]) m=cmd.data[‘command’] if
(m==”motoron”):
Print (“Motor is switched on”)
elif (m==”motoroff”):
Print (“Motor is switched
OFF”) Print (“ “) while
True:
Soil=random.ra
Ndint (0,100)
Temp=random.r
Andint (-20,
```

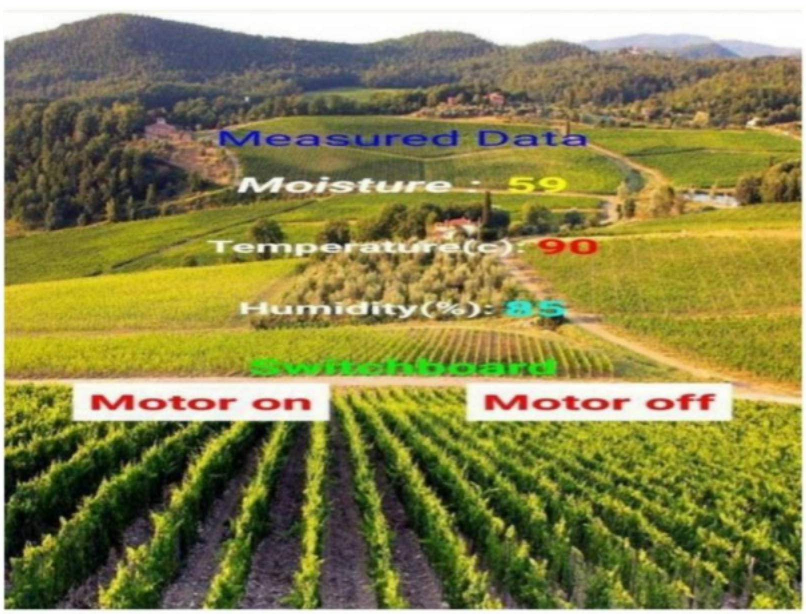
```
125)
Hum=random.r
Andint (0, 100)
myData={‘soil
moisture’: soil,
‘temperature’:te
Mp,
‘humidity’:hum
}
Client.publish
E Vent
(eventId=”stat
u S”,
msgFormat=”
js on”,
data=myData,                qos=0               ,
onPublish=None)print   (“Published   data
Successfully: %s”, myData) Time.sleep(2)
Client.commandCallback
=myCommandCallback Client.disconnect()
```

8. TESTING

8.1 Test case

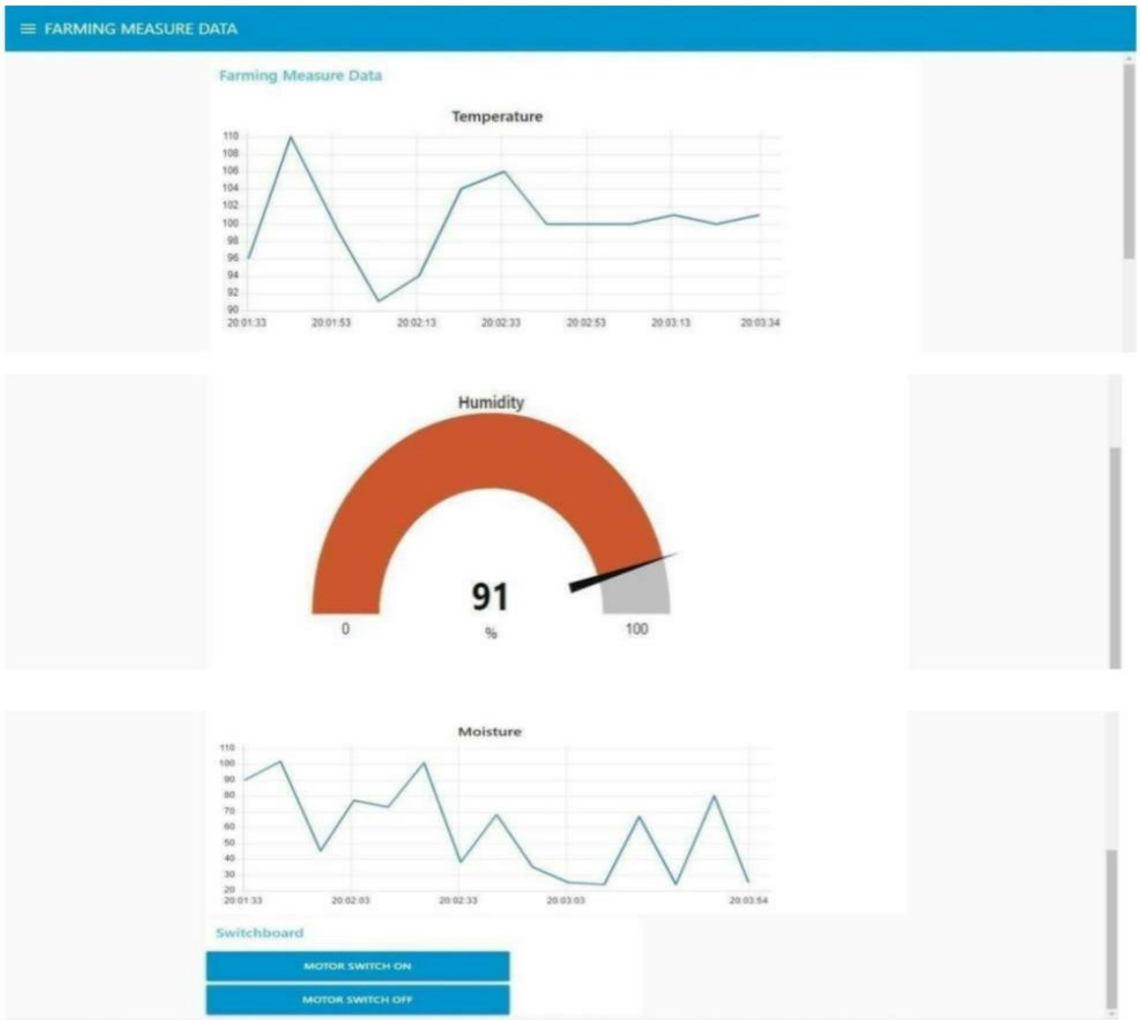


8.2 User Acceptance Testing



9. RESULTS

9.1 Performance Metrices



10. ADVANTAGES ANDDISADVANTAGES

Advantages

- All conservation efforts such as water usage and increased production per land unit directly affect the environmentalfootprint positively.
- Analyzing production quality and results in correlation totreatment can teach farmers to adjust processes to increase quality of the product.
- Accurately tracking production rates by field over time allowsfor detailed predicting of future crop yield and value of afarm.
- Automating processes in planting, treatment and harvestingcan reduce resource consumption, human error and overallcost.
- Farmers can visualize production levels, soil moisture, sunlight intensity and more in real time and remotely to acceleratedecision makingprocess.
- Weather predictions and soil moisture sensors allow for wateruse only when and whereneeded.

Disadvantages

- The Cost Involved in SmartAgriculture
- There could be wrong Analysis of WeatherConditions
- Farmers are not used to these high-end technologies. They donot understand computer language or the artificialintelligence.
- In the case of equipment like robots and computer-based intelligence for running the devices, it is highly unlikely thata normal farmer will be able to possess this knowledge or even developthem.
- The use of technology in farming and agriculture making itsmart agriculture, is of course, a good initiative and a much-neededone with the present increasing demand in the foodsupply.

11. CONCULSION

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.The envisaged smart farming the coming years is not just a rudimentary vision, but a path for research, technological development and most importantly for innovation. New IoT based solutions that are making an optimal usage of digital devices and the virtual world in challenging as well as harsh environments are promising a huge impact for agri-food business, technology providers and finally for all of us as consumers.

12. FUTURESCOPE

- Smart farming" is an emerging concept that refers to managing farms using technologies like IoT, robotics, drones and AI to increase the quantity and quality of products while optimizingthe human labor required byproduction.
- The Internet of Things (IoT) has provided ways to improvenearly 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 aboutagricultu

13.APPENDIX

Source code

```
Import wiotp.sdk.device
Import time import os
Import datetime import
Random myConfig = {
“identity”: {
“orgId”: “3j2gcg”,
“typeId”: “ultrasonic”,
“deviceId”: “1407”
},
“auth”: {
“token”: “14073008”
} }
Client = wiotp.sdk.device.DeviceClient
(config=myConfig, logHandlers=None) client.connect
() def myCommandCallback (cmd) :
print (“Message received from IBM IoT Platform: %s” %
cmd.data[‘command’]) m=cmd.data[‘command’] if
(m==”motoron”):
Print (“Motor is switched on”) elif
(m==”motoroff”):
Print (“Motor is switched OFF”)
```

```
Print (“ “)
while True:
Soil=random.ra
Ndint (0,100)
Temp=random.r
Andint (-20,
125)
Hum=random.r
Andint (0, 100)
myData={‘soil
moisture’: soil,
‘temperature’:te
Mp,
‘humidity’:hum
}
Client.publish
E Vent
(eventId=”stat
u S”,
msgFormat=”
js on”,
data=myData, qos=0 , onPublish=None) print
(“Published data Successfully: %s”, myData)
```

Time.sleep (2)

Client.commandCallback = myCommandCallback

Client.disconnect ()

Output

```
*Python 3.7.0 Shell*
File  Edit  Shell  Debug  Options  Window  Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD6
4)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
======== RESTART: C:\Users\ELCOT\Downloads\ibmiotpublishsubscribe.py ========
2022-11-07 20:01:24,074   ibmiotf.device.Client      INFO    Connected successfu
lly: d:157uf3:abcd:7654321
Published Moisture = 90 deg C Temperature = 96 C Humidity = 76 % to IBM Watson
Published Moisture = 102 deg C Temperature = 110 C Humidity = 68 % to IBM Watson
Published Moisture = 45 deg C Temperature = 99 C Humidity = 100 % to IBM Watson
Command received: motoron
motor is on
Published Moisture = 77 deg C Temperature = 91 C Humidity = 85 % to IBM Watson
Published Moisture = 73 deg C Temperature = 94 C Humidity = 86 % to IBM Watson
Command received: motoroff
motor is off
Published Moisture = 101 deg C Temperature = 104 C Humidity = 87 % to IBM Watson
```

GitHub link

https://github.com/IBM-EPBL/IBM-Project-48708-1660811875

Project demo link

https://drive.google.com/file/d/1fQaDdq4qISomLUDqZRzUJK2wfFr
X0
-bK/view?usp=drivesdk