IoT-ENABLED SMART FARMER APPLICATION

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "IoT-ENABLED SMART FARMER APPLICATION" is the Bonafede work of "ASHOKKUMAR M (711619104004), ASHWIN S (711619104005), MANIKANDAN S(711619104025), AJAY K (711619104701)" who carried out the project work under my supervision.

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ABSTRACT

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture, Humidity) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. 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 the farmers. 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 itself.

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13.1 SOURCE CODE

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CHAPTER 1

INTRODUCTION

Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of Things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants.

The aim is to propose a technology which can generate messages on different platforms to notify farmers. The product will assist farmers by getting live data (Temperature, humidity, soil moisture) from the farmland to take necessary steps to enable them to do smart farming by also increasing their crop yields and saving resources (water, fertilizers).

PROJECT OVERVIEW

Smart farming era has already begun and its societal and environmental implications are expected to be huge. We have basically introduced an application both web and android application so that agriculture can be automated and benefits the farmers. Our application monitors real time sensor data including Temperature, humidity and soil moisture. 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 the farmers. 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 itself. This majorly helps farmers for farming conveniently.

CHAPTER 2

LITERATURE SURVEY

PAPER -1

TITLE: Internet-of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk

AUTHOR: Muhammad Ayaz

YEAR: 2019

This article highlights the potential of wireless sensors and IoT in agriculture, as well as the challenges expected to be faced when integrating this technology with traditional farming practices. IoT devices and communication techniques associated with wireless sensors encountered in agriculture applications are analyzed in detail. Sensors are available for specific agriculture applications, like soil preparation, crop status, irrigation, and insect and pest detection are listed. This technology helps the growers throughout the crop stages, from sowing to harvesting, packing and transportation.

PAPER-2

TITLE: IoT-Equipped and AI-Enabled Next Generation Smart

Agriculture and Critical Review, Current Challenges, and Future Trends.

AUTHOR: Sameer Qazi and Bilal and A. Khawaja

YEAR: 2022

Smart agriculture techniques have recently seen widespread interest from farmers. This is driven by several factors, which include the widespread availability of economically-priced, low-powered Internet of Things (IoT) based wireless sensors to remotely monitor and report conditions of the field, climate, and crops. This enables efficient management of resources like minimizing water requirements for irrigation and minimizing the use of toxic pesticides. Furthermore, the recent boom in Artificial Intelligence can enable farmers to deploy autonomous farming machinery and make better predictions of the future based on present and past conditions to minimize crop diseases and pest infestation.

PAPER-3

TITLE: Internet of Things for the Future of Smart Agriculture: A Comprehensive Survey of Emerging Technologies.

AUTHOR: Othmane Friha; Mohamed Amine Ferrag; Lei Shu; Leandros Maglaras; Xiaochan Wang.

YEAR: 2021

This paper presents a comprehensive review of emerging technologies for the internet of things (IoT)-based smart agriculture. We begin by summarizing the existing surveys and describing emergent technologies for the agricultural IoT, such as unmanned aerial vehicles, wireless technologies, open-source IoT platforms, software defined networking (SDN), network function virtualization (NFV) technologies, cloud/fog computing, and middleware platforms. We also provide a classification of IoT applications for smart agriculture into seven categories: including smart monitoring, smart water management, agrochemicals applications, disease management, smart harvesting, supply chain management, and smart agricultural practices. Moreover, we provide taxonomy and a side-by-side comparison of the state-of-the-art methods toward supply chain management based on the blockchain technology for agricultural IoT.

PAPER-4

TITLE: Recent Developments of the Internet of Things in Agriculture

AUTHOR: Vippon Preet Kour, Sakshi Arora

YEAR: 2020

This paper contributes towards the recent IoT technologies in the agriculture sector, along with the development of hardware and software systems. The public and private sector projects and startup’s started all over the globe to provide smart and sustainable solutions in precision agriculture are also discussed.

2.1 EXISTING PROBLEM:

According to a report by the UN, by 2050 the earth's population is expected to reach 9.7 billion people. This means considerably increased demand for food, within the same natural resources we have. It is evident that without innovations that increase the productivity and efficiency of agriculture, while optimizing the key resources used, there is no way that this increased demand would be met. The need for more agricultural produce leads to increased demand for farming land. Forests get cut so the land can be used for agriculture. The lack of natural cooling factors leads to increased temperatures, which negatively impacts the humans, but to a much bigger extent impacts the plants and their growth processes. Deforestation for the sake of sourcing farming land has another negative consequence: the carbon in the atmosphere cannot get consumed. By deploying sensors transmitting data for the condition of the soil and air farmers can get accurate data for the state of the soil, temperature and humidity etc – for different crops and different locations.

2.2 REFERENCES:

1. Quy, V.K.; Nam, V.H.; Linh, D.M.; Ngoc, L.A.; Gwanggil, J. Wireless Communication Technologies for IoT in 5G: Vision, Applications, and Challenges. Wirel. Commun. Mob. Comput. 2022, 2022, 3229294. [Google Scholar] [CrossRef]
2. Sinche, S.; Raposo, D.; Armando, N.; Rodrigues, A.; Boavida, F.; Pereira, V.; Silva, J.S. A Survey of IoT Management Protocols and Frameworks. IEEE Commun. Surv. Tutor. 2020, 22, 1168–1190. [Google Scholar] [CrossRef]

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Benefits and Challenges. IEEE Internet Things J. 2018, 5, 3758–3773. [Google Scholar] [CrossRef]
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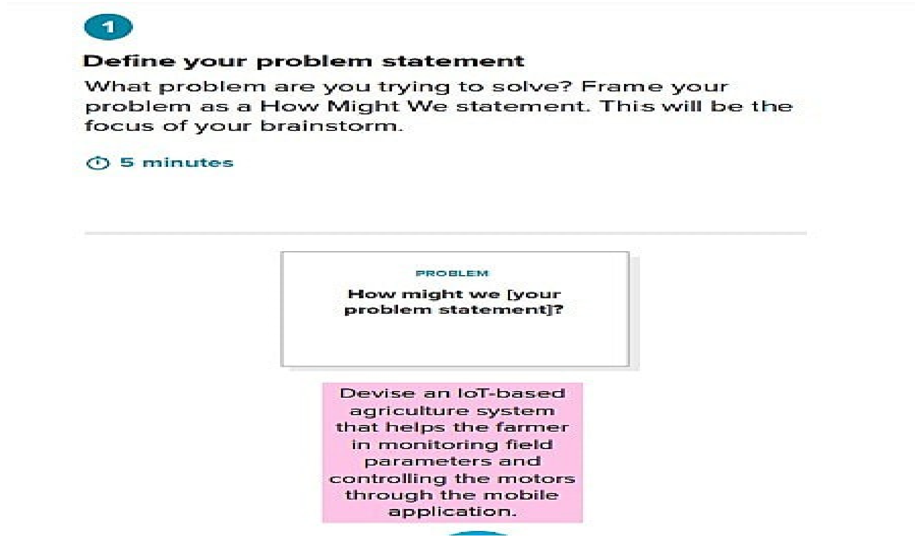
2.3 PROBLEM STATEMENT DEFINITION:

IoT-based agriculture systems must assist the farmer in monitoring different parameters of his field with sensors controlled with the help of mobile applications. There should be a huge turnover for farmers in every aspect**.** Farmers need to maintain correct level of water supply, soil moisture etc., Farmers doesn't have enough knowledge on using this application n proper training session has not been provided for the farmers to work with the system Stressed because farmers can't use the system until he gets enough training to use the system. It must reduce the work load of a farmer.

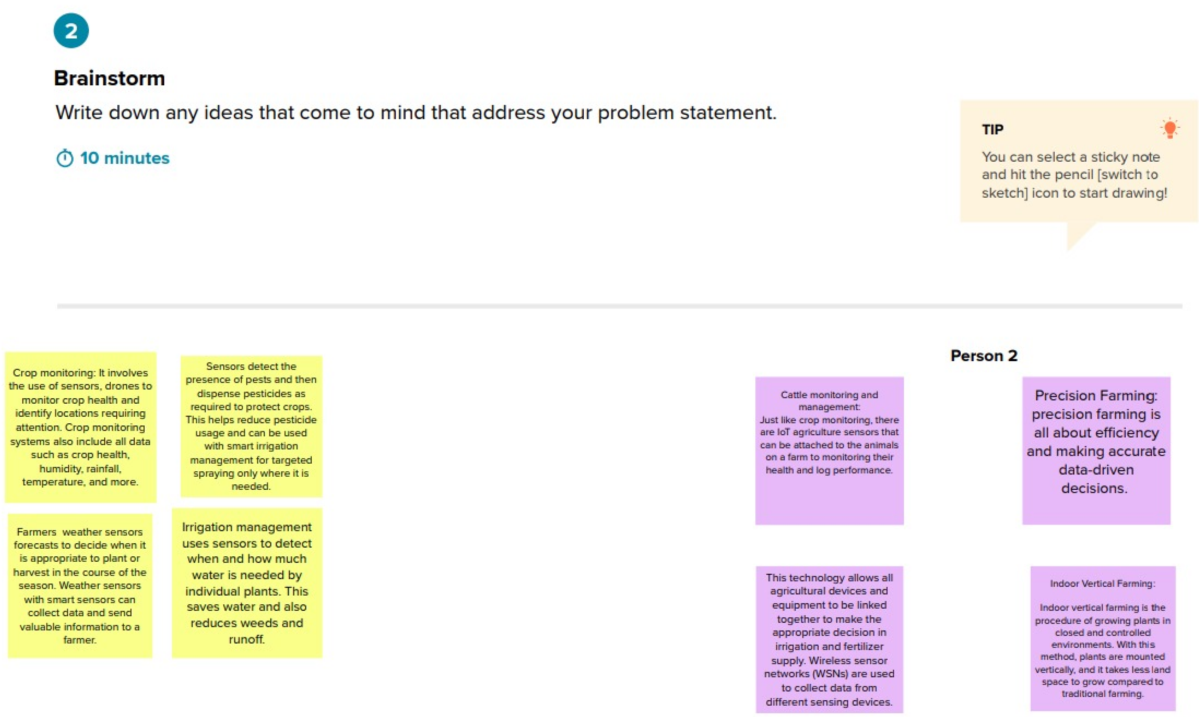
CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



Person 3

IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.)

Smart greenhouse solves these issues by use of IoT systems by monitoring and controlling aspects such as temperatures, luminosity, soil and mineral content, and humidity. Using the collected data, optimal plant growth conditions can be maintained to ensure maximum production.

The developed system is capable of monitoring temperature, humidity, soil moisture type using NodeMCU and different sensors connected to the microcontroller. Also, a notification is shown in farmer's phone using Wi-Fi about environmental condition and water levels of the crop field

precision farming can be thought of as anything that makes farming practice more controlled and accurate when it comes to raising livestock and growing crops. In this approach of farm management, a key component is the use of IT and various items like sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology.

Precision farming is the practice of making agricultural processes more accurate and controlled for rearing livestock and crop growing. The main components of precision farming are the IT systems, sensors, control systems, automated hardware, and autonomous vehicles, among others. IoT introduces the idea of connecting these systems and devices using the internet for better data storage and analytics.

Person 4

Major objective is to collect real time data of agriculture production environment that provides easy access for agricultural facilities such as alerts through Short Messaging Service (SMS) and advices on weather pattern, crops.

Reliable weather forecasts to maximize resource usage and minimize losses. Automation of tasks increases productivity and time- and cost efficiency.

Smart farming is a big leap from traditional farming as it brings certainty and predictability to the table which is the Future of Agriculture.

The data is organized, accessible all the time, and full of data on every aspect of finance and field operations that can be monitored from anywhere in the world.

Early detection and application of inputs only in the affected region, saving costs.Uses satellite imagery to detect the different zones in farms.

Implementation

Crop monitoring: It involves the use of sensors, drones to monitor crop health and identify locations requiring attention. Crop monitoring systems also include all data such as crop health, humidity, rainfall, temperature, and more.

Irrigation management uses sensors to detect when and how much water is needed by individual plants. This saves water and also reduces weeds and runoff.

Cattle monitoring and management:
Just like crop monitoring, there are IoT agriculture sensors that can be attached to the animals on a farm to monitoring their health and log performance.

Indoor Vertical Farming:

Indoor vertical farming is the procedure of growing plants in closed and controlled environments. With this method, plants are mounted vertically, and it takes less land space to grow compared to traditional farming.

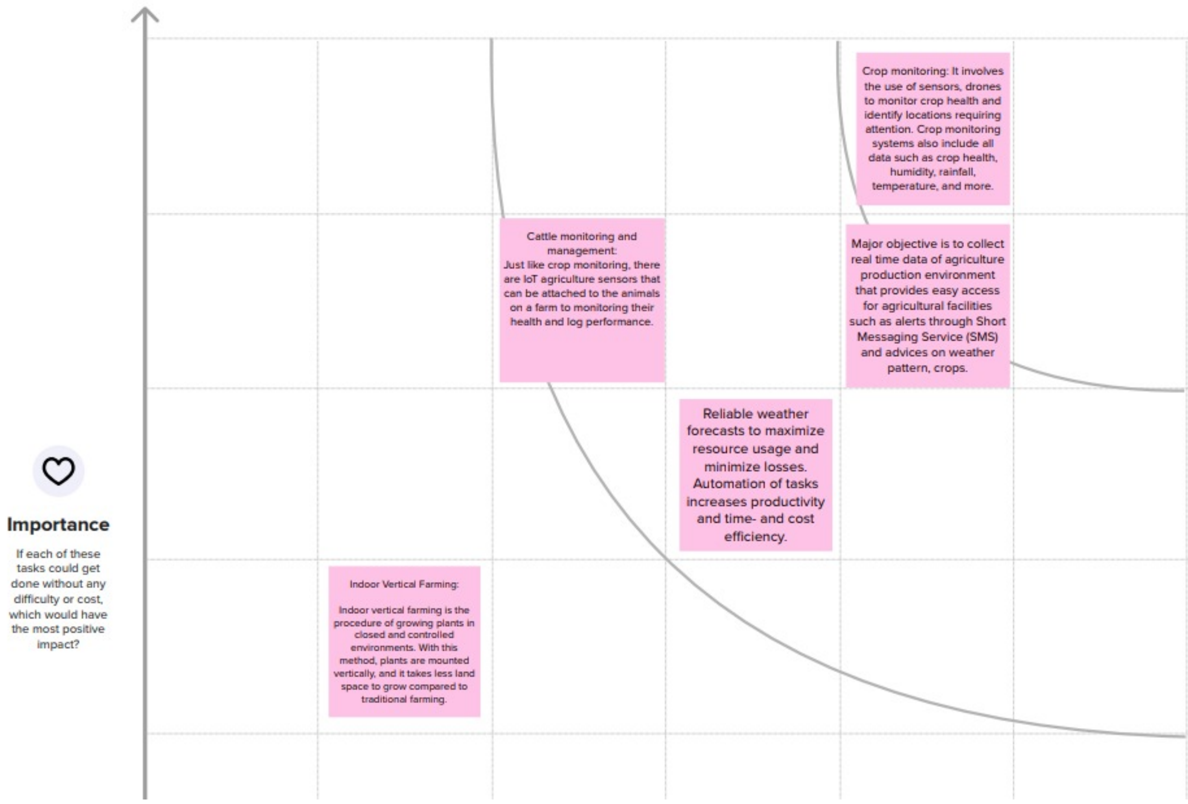
Precision Farming: precision farming is all about efficiency and making accurate data-driven decisions.

Usage

Early detection and application of inputs only in the affected region, saving costs.Uses satellite imagery to detect the different zones in farms.

Reliable weather forecasts to maximize resource usage and minimize losses. Automation of tasks increases productivity and time- and cost efficiency.

Major objective is to collect real time data of agriculture production environment that provides easy access for agricultural facilities such as alerts through Short Messaging Service (SMS) and advices on weather pattern, crops.



3.3 PROPOSED SOLUTION

We have proposed a solution to the day-to-day problems faced by farmers, we will be controlling sensors and water supply with the help of a mobile phone without going to the field. Every sensor can be controlled with a mobile application, even if the land is uneven, we can measure the soil moisture and water can be supplied. This creates a huge impact on agriculture. It increases work efficiency and better resource management. This system can be connected to wireless networks and real-time data is stored in the cloud as well as displayed on mobile phones. Simplified and Robust Supply Chain, since sensors are abundant and it's a one-time investment. It increases revenue and reduces the workload of farmers.

3.4 PROBLEM SOLUTION FIT

IoT-ENABLED SMART FARMER APPLICATION
TEAM ID:PNT2022TMID42737

1. CUSTOMER SEGMENT(S) CS

- Customer segmentation is important when comes to marketing the product
- An effective way to sell the product increases the overall profit and increases the revenue of the company

6. CUSTOMER CONSTRAINTS CC

- Basically, limits the customers on supply of Sensors, total Orders placed for sensors and
- because production of sensors are less compared to irrigation systems

5. AVAILABLE SOLUTIONS AS

- Smart logistics and warehousing.
- Predictive analytics for crops and livestock.
- Remote crop monitoring.

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

- Constant Support
- Product Efficiency
- Educating Farmers on how to use the application and use the product.
- Constant Updates for the application.
- Weekly maintenance

9. PROBLEM ROOT CAUSE RC

- Remote Location support
- Network Connectivity

7. BEHAVIOUR BE

- Data is secure in cloud
- Once the moisture level of crops is reduced it automatically refills water up to the required level.
- The process will be on time

Focus on J&P, tap into BE, understand

3. TRIGGERS TR

- Subsidies provided by the government help farmers invest on sensors and this will be a one-time investment
- Our application is completely free. This covers major problems like efficiency and cost

10. YOUR SOLUTION SL

- Creating a system that monitors water flow on different varieties of crops and monitoring all aspects of crops using sensors with a single system.

8. CHANNELS of BEHAVIOUR CH

- Updates the soil data automatically.
- Maintaining the water level.
- Information about the crops is updated to farmers on regular basis.

Extract online & offline

4. EMOTIONS: BEFORE / AFTER EM

Before:

Work load is increased and cost of labour is also increase.

After :

Comparatively less work load and Effective monitoring of Crops.

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

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

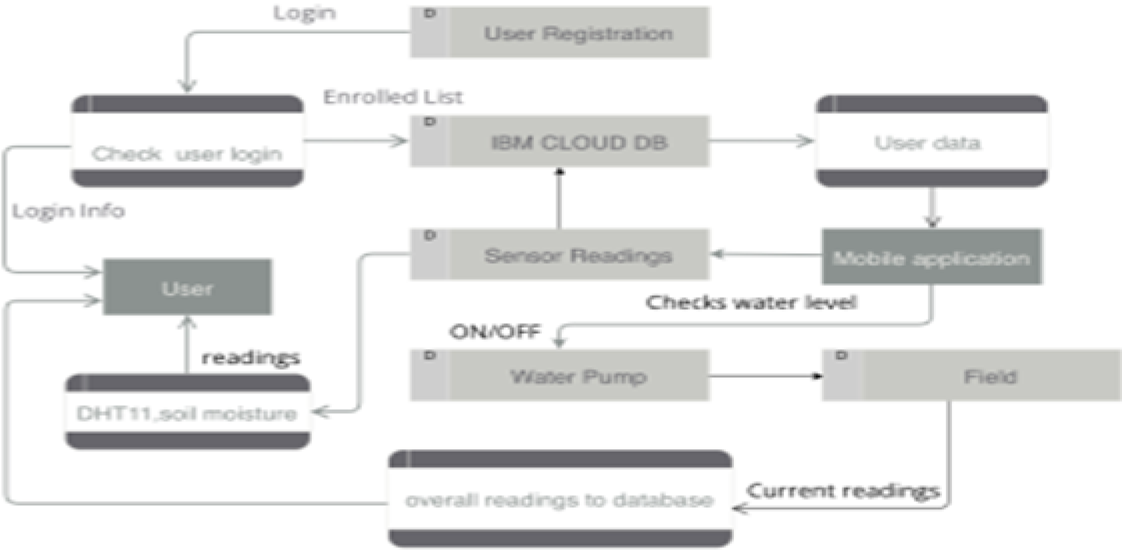
4.2 NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Usability includes easy learn ability, efficiency in use, remember ability, lack of errors in operation and subjective pleasure.
NFR-2	Security	Sensitive and private data must be protected from their production until the decision-making and storage stages.
NFR-3	Reliability	The shared protection achieves a better trade-off between costs and reliability. The model uses dedicated and shared protection schemes to avoid farm service outages.
NFR-4	Performance	the idea of implementing integrated sensors with sensing soil and environmental or ambient parameters in farming will be more efficient for overall monitoring.
NFR-5	Availability	Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
NFR-6	Scalability	Scalability is a major concern for IoT platforms. It has shown that different architectural choices of IoT platforms affect system scalability and that automatic real time decision-making is feasible in an environment composed of dozens of thousand.

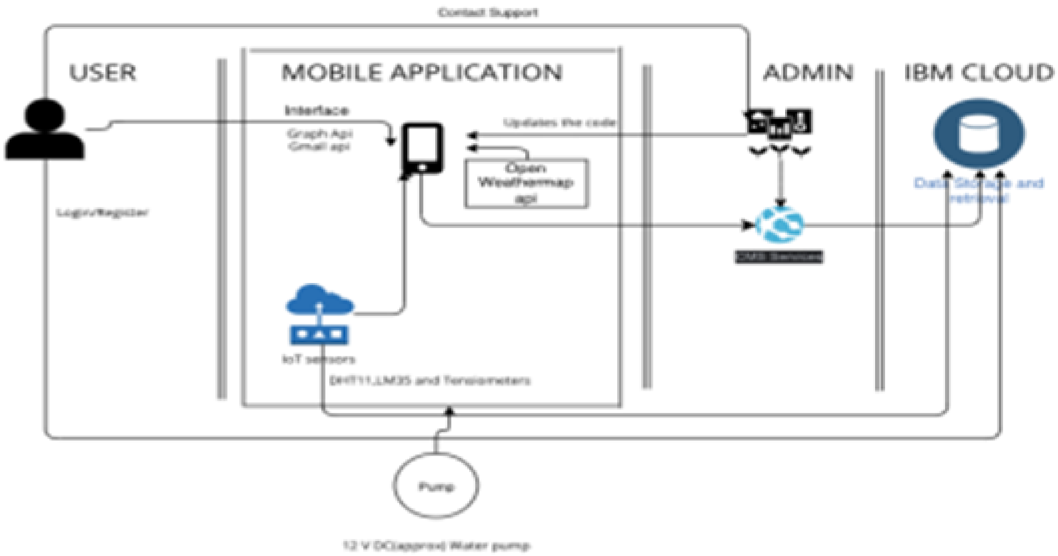
CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION AND TECHNOLOGY 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, and 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 Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register with Gmail and access the dashboard	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can register with email and password.	High	Sprint-1
	Dashboard		As a user, I can view the sensor readings and water pump status.	I can manually switch it on/off or can be done automatically.	High	Sprint-1
Vendors	Sellers		As a Seller, I can provide the required hardware materials.	To provide sensors that monitor the field (all parameters included).	High	Sprint-1

Customer Care Executive	Technical Support		Request for the crop to be planted and takes care of Connectivity issues.	The user must contact support to adjust the minimum soil moisture readings	High	Sprint-1
Administrator	Creator		Supervise the overall process.	Inform about sensor maintenance	Medium	Sprint-2
			Make changes in the code.	Optimizes the code and updates the Application to improve user experience.	High	Sprint-1

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

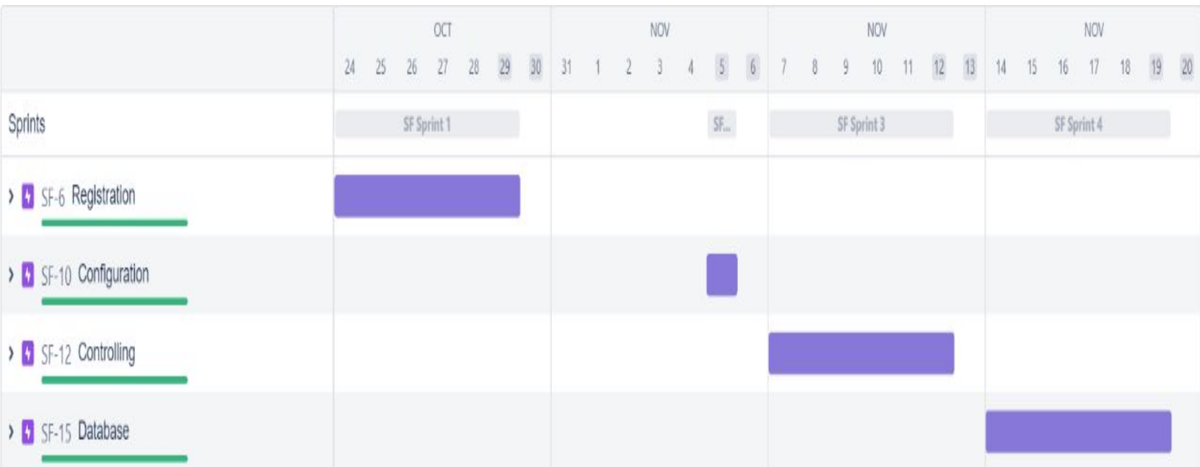
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, and password, and confirming my password.	2	High	4
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	4
Sprint-4		USN-3	As a user, I can click on the OTP registration	2	Medium	4
Sprint-2		USN-4	As a user, I can register for the application through Gmail	2	Medium	4
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	4
Sprint-1	Dashboard	USN-6	As a user, I can read sensor readings	3	High	4
Sprint-1		USN-7	As a user, I can manually turn the ON/OFF water pump, and also can be automated.	2	High	4
Sprint-2		USN-8	As a user, I can Contact support for any queries.	1	High	4
Sprint-3		USN-9	As a user, I can select crops to be planted soil moisture readings are adjusted automatically.	2	High	4
Sprint-2		USN-10	As a user, Checking weather information which includes water safety information.	3	Medium	4
Sprint-4	Database	USN-11	As a user, I can view and access database information.	2	High	4

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Hardware	USN-12	Connect Sensors and wi-fi module with python code	2	High	4
Sprint-2	Software	USN-13	IBM Watson IoT platform, Workflows for IoT scenarios using Node-red	2	High	4
Sprint-3	Android Application	USN-13	MIT application, To develop a mobile application.	2	High	4

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	05 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	12 Nov 2022	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	19 Nov 2022

6.3 REPORTS FROM JIRA



CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE 1

In this application we added specific crops [paddy] – if the soil moisture level is less than 80(<80%), automatically the motor will on same as if the moisture level is greater than 80 or equal to 80 (>=80%) automatically the motor will get stop (moto off)

[Sugar cane] – if the soil moisture level is less than 50(<50%), automatically the motor will on same as if the moisture level is greater than 50 or equal to 50 (>=50%) automatically the motor will get stop (moto off) which is used for controlling soil moisture level properly every time

WOKWI AUDRINO CODING:

```
#include <WiFi.h>//library for wifi

#include <PubSubClient.h>//library for MQtt

#include "DHT.h"// Library for dht11

#define DHTPIN 15     // what pin we're connected to

#define DHTTYPE DHT22   // define type of sensor DHT 11

#define LED 2

DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr

of dht connected void callback(char* subscribetopic, byte* payload, unsigned int

payloadLength);

//-------credentials of IBM Accounts------

#define ORG "bjj5tn"//IBM ORGANITION ID
```

```
#define DEVICE_TYPE "FIRE"//Device type mentioned in ibm watson IOT Platform

#define DEVICE_ID "WATER"//Device ID mentioned in ibm watson IOT Platform

#define TOKEN "16431653"

//Token String data3; float h,

t;

//-------- Customise the above values -------- char server[] =

ORG ".messaging.internetofthings.ibmcloud.com";// Server

Name

char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform
and format in which data to be send

char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT
command type AND COMMAND IS TEST OF FORMAT STRING

char authMethod[] = "use-token-auth";// authentication method

char token[] = TOKEN; char clientId[] = "d:" ORG ":"

DEVICE_TYPE ":" DEVICE_ID;//client id

//-----------------------------------------

WiFiClient wifiClient; // creating the instance for wificlient

PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client
id by passing parameter like server id,portand wificredential void setup()// configureing
the ESP32

{

  Serial.begin(115200);

dht.begin();

  pinMode(LED,OUTPUT);
```

```
  delay(10);
Serial.println();
wificonnect();
mqttconnect();
} void loop()//
Recursive Function
{   h =
dht.readHumidity(
);   t =
dht.readTemperatu
re();
  Serial.print("temp:");
  Serial.println(t);
  Serial.print("Humid:");

Serial.printl
n(h);
PublishData
(t, h);
delay(1000
);   if
(!client.loop
```

```
()) {

mqttconnect

();


  }

}
/*....................................retrieving to Cloud...............................*/
void PublishData(float temp, float humid) {

mqttconnect();//function call for connecting to ibm

  /*      creating the String in in form JSon to update

the data to ibm cloud

  */

  String payload =

"{\"temp\":";

payload += temp;

payload += ","

"\"Humid\":";

payload += humid;

payload += "}";

  Serial.print("Sending payload: ");

Serial.println(payload);   if

(client.publish(publishTopic, (char*)

payload.c_str())) {
```

```
    Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it will print publish ok in Serial monitor or else it will print publish failed

  } else {

    Serial.println("Publish failed");

  }



}



void

mqttconnect() {

if

(!client.connecte

d()) {

Serial.print("Rec

onnecting client

to ");

Serial.println(ser

ver);     while

(!!!client.connec

t(clientId,

authMethod,

token)) {

Serial.print(".");
```

```
delay(500);

    }

     initManagedDevice();

     Serial.println();

  } } void wificonnect() //function

defination for wificonnect

{

  Serial.println();

  Serial.print("Connecting to ");

  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish

the connection   while (WiFi.status() != WL_CONNECTED) {

    delay(500);


Serial.print(

".");   }

  Serial.println("");

  Serial.println("WiFi connected");

  Serial.println("IP address: ");

  Serial.println(WiFi.localIP());

}


void initManagedDevice()

{   if
```

```
(client.subscribe(subscribet

opic)) {

Serial.println((subscribetop

ic));

   Serial.println("subscribe to cmd OK");
  } else {
   Serial.println("subscribe to cmd FAILED");
  } } void callback(char* subscribetopic, byte* payload,

unsigned int payloadLength)

{
 Serial.print("callback invoked

for topic: ");

Serial.println(subscribetopic);

for (int i = 0; i < payloadLength;

i++) {

//Serial.print((char)payload[i]);

data3 += (char)payload[i];

  }
 Serial.println("data: "+ data3);

if(data3=="lighton")

  {
Serial.println(data3);
```

```
digitalWrite(LED,HIGH);
  }
e
l
s
e
  {
Serial.println(data3);
digitalWrite(LED,LOW);
  }
data=
"";
}
```

CHAPTER 8

TESTING

8.1 TEST CASES

8.2 USER ACCEPTANCE TESTING

1. PURPOSE OF DOCUMENT

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	3	2	0	10
Duplicate	0	0	0	1	1
External	2	0	0	1	3
Fixed	6	2	0	0	8
Not Reproduced	0	1	1	0	2
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	13	6	3	2	24

The purpose of this document is to briefly explain the test coverage and open issues of the

3. TEST CASE ANALYSIS

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	2	0	0	2
Security	1	0	0	1
Outsource Shipping	1	0	0	1
Exception Reporting	1	0	0	1
Final Report Output	2	0	0	2
Version Control	2	0	0	2

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS

Team ID	PNT2022TMID42737
Project Name	Smart farmer – IoT enabled smart Farming Application

NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Risk Score	Justification
1	Smart farmer – IoT enabled smart Farming Application	New	No Changes	No Changes	GREEN	As we have completed the project successfully

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test Approach
1	This project proposes a model to check soil temperature, humidity, moisture through smartphones that can track the changes and give the precise output of the farm in real-time anywhere.	Load Test

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	Approvals/SignOff
1	The application aside from conceding you to track down the soil temperature, moisture, humidity, also functions when there is any change in the physical parameters. This farming will be the next generation of farming.	Load Test	Nil	Respone time meet the actual Result	Approved

CHAPTER 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1. Increases Quality and Quantity of production.
2. On the positive side, this system helps in reducing overall manpower and managing time efficiently.
3. Sensor readings are made available in this application so water level can be easily
4. Maintained.
5. The IoT device helps to track the land constantly so that steps can be taken early.
6. It increases efficiency, decreases manual labour, decreases time and allows productive farming.
7. The monitoring of the crop can be done easily by using IoT to track crop production.
8. Intelligent data collection. Sensors installed on IoT devices are able to collect a large volume of useful information for farmers.

DISADVANTAGES:

1. IoT – smart farming continually requires internet connectivity.

2. Given any security measures, the system offers little power and can lead to various kinds of network attacks.

3. It is very complicated to plan, build, manage and allow the broad technology to IoT framework.
4. In places where internet connections are frustratingly slow, smart farming will be an impossibility.
5. If where we have mass crop production, it is difficult to operate this farming method.
6. Each alert message costs 3.50 rupees it might not be convenient for farmers to recharge every time.
7. smart farming makes use of high techs that require technical skill and precision to make it a success.

CHAPTER 11

CONCLUSION

IoT based Smart Farming Application for Live Monitoring of Temperature and Soil Moisture has been proposed using ESP-32 and IBM Cloud. The System has high efficiency and accuracy in fetching the live data of above-mentioned constraints. The IoT based smart farming System being proposed via this application will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture. thus, we have developed application which can be used from mobile phone as well as personal computers.

CHAPTER 12

FUTURE SCOPE

a. Sensors: soil, water, light, humidity, temperature management in the agriculture field, in a closed environment.

b. Smart farming techniques enable farmers better to monitor the needs of individual crops and to adjust their nutrition accordingly, thereby preventing disease and enhancing crops health.

c. Drones collect multispectral, thermal, and visual imagery while flying, the data they gather provide farmers with insights into a whole array of metrics: plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water pond mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping, and so on.

d. For 24/7 monitoring the field, we can give access to camera, by which a user can observe everything with his mobile device.

e. In the future, this smart farming revolution depicts, pesticide and fertilizer use will drop while overall efficiency will rise. IoT technologies will enable better food traceability, which in turn will lead to increased food safety. It will also be beneficial for the environment, though, for example, more efficient use of water, or optimization of treatments and inputs.

CHAPTER 13

APPENDIX

13.1 SOURCE CODE

Python code for random values generator:

```
import wiotp.sdk.device

import time

import os

import datetime

import random

myConfig = {

    "identity":{

        "orgId": "bjj5tn",

        "typeId": "FIRE",

        "deviceId": "WATER"

},

   "auth": {

        "token": "16431653"

}

 }

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.randint(0,100)
    temp=random.randint(0,100)
    hum=random.randint(0,100)
        myData={'soil_moisture':soil, 'temperature':temp, 'humidity':hum}
                    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    time.sleep(3)
    client.commandCallback = myCommandCallback
client.disconnect()
```

WOKWI CODE:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
```

```
#include "DHT.h"// Library for dht11

#define DHTPIN 15     // what pin we're connected to

#define DHTTYPE DHT22   // define type of sensor DHT 11

#define LED 2

DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr

of dht connected void callback(char* subscribetopic, byte* payload, unsigned int

payloadLength);

//-------credentials of IBM Accounts------

#define ORG "bjj5tn"//IBM ORGANITION ID

#define DEVICE_TYPE "FIRE"//Device type mentioned in ibm watson IOT Platform

#define DEVICE_ID "WATER"//Device ID mentioned in ibm watson IOT Platform

#define TOKEN "16431653"

//Token String data3; float h,

t;

//-------- Customise the above values -------- char server[] =

ORG ".messaging.internetofthings.ibmcloud.com";// Server

Name

char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform
and format in which data to be send

char subscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT
command type AND COMMAND IS TEST OF FORMAT STRING

char authMethod[] = "use-token-auth";// authentication method

char token[] = TOKEN; char clientId[] = "d:" ORG ":"

DEVICE_TYPE ":" DEVICE_ID;//client id
```

```
//-----------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client
id by passing parameter like server id,portand wificredential void setup()// configureing
the ESP32
{
  Serial.begin(115200);
dht.begin();
  pinMode(LED,OUTPUT);
  delay(10);
Serial.println();
wificonnect();
mqttconnect();
} void loop()//
Recursive Function
{   h =
dht.readHumidity(
);   t =
dht.readTemperatu
re();
  Serial.print("temp:");
  Serial.println(t);
  Serial.print("Humid:");
```

```
Serial.printl

n(h);

PublishData

(t, h);

delay(1000

);   if

(!client.loop

()) {

mqttconnect

();

  }

}
/*.....................................retrieving to Cloud...............................*/

void PublishData(float temp, float humid) {

mqttconnect();//function call for connecting to ibm

  /*      creating the String in in form JSon to update

the data to ibm cloud

  */

  String payload =

"{\"temp\":";

payload += temp;
```

```
payload += ","

"\"Humid\":";

payload += humid;

payload += "}";

  Serial.print("Sending payload: ");

Serial.println(payload);   if

(client.publish(publishTopic, (char*)

payload.c_str())) {

    Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it will
print publish ok in Serial monitor or else it will print publish failed

  } else {

    Serial.println("Publish failed");

  }



}



void

mqttconnect() {

if

(!client.connecte

d()) {

Serial.print("Rec

onnecting client
```

```
to ");
Serial.println(ser
ver);     while
(!!!client.connec
t(clientId,
authMethod,
token)) {
Serial.print(".");
delay(500);
    }
     initManagedDevice();
     Serial.println();
  } } void wificonnect() //function
defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting to ");
  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish
the connection   while (WiFi.status() != WL_CONNECTED) {
    delay(500);

Serial.print(
```

```
"."); }

  Serial.println("");

  Serial.println("WiFi connected");

  Serial.println("IP address: ");

  Serial.println(WiFi.localIP());

}


void initManagedDevice()

{   if

(client.subscribe(subscribet

opic)) {

Serial.println((subscribetop

ic));


    Serial.println("subscribe to cmd OK");

  } else {

    Serial.println("subscribe to cmd FAILED");

  } } void callback(char* subscribetopic, byte* payload,

unsigned int payloadLength)

{

  Serial.print("callback invoked

for topic: ");

Serial.println(subscribetopic);
```

```
for (int i = 0; i < payloadLength;

i++) {

//Serial.print((char)payload[i]);

data3 += (char)payload[i];

  }

  Serial.println("data: "+ data3);

if(data3=="lighton")

  {

Serial.println(data3);

digitalWrite(LED,HIGH);

  }

e

l

s

e

  {

Serial.println(data3);

digitalWrite(LED,LOW);

  }

data3

="";

}
```

13.2 GITHUB & PROJECT DEMO LINK

GitHub: https://github.com/IBM-EPBL/IBM-Project-13197-1659513780

Project demo link:
https://drive.google.com/file/d/15ikqTxLg85bB6yKo54F6KAl7etoT6Cpi/view?usp=drivesdk