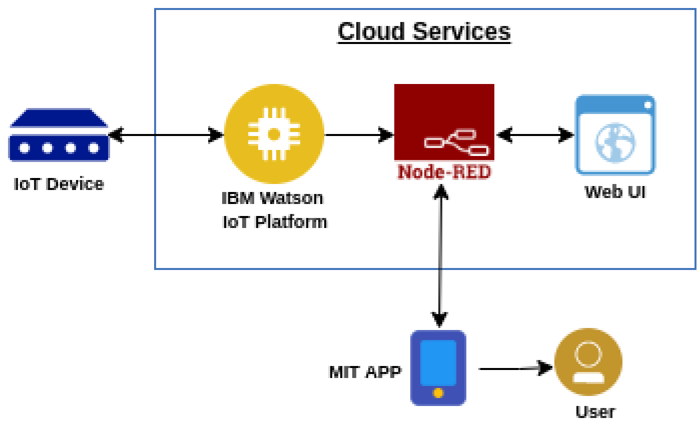
Project Report

Team id - PNT2022TMID31852
Project title - SmartFarmer - IoT Enabled Smart Farming Application

1. INTRODUCTION

1.1 Project Overview



- IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, humidity using some sensors.
- 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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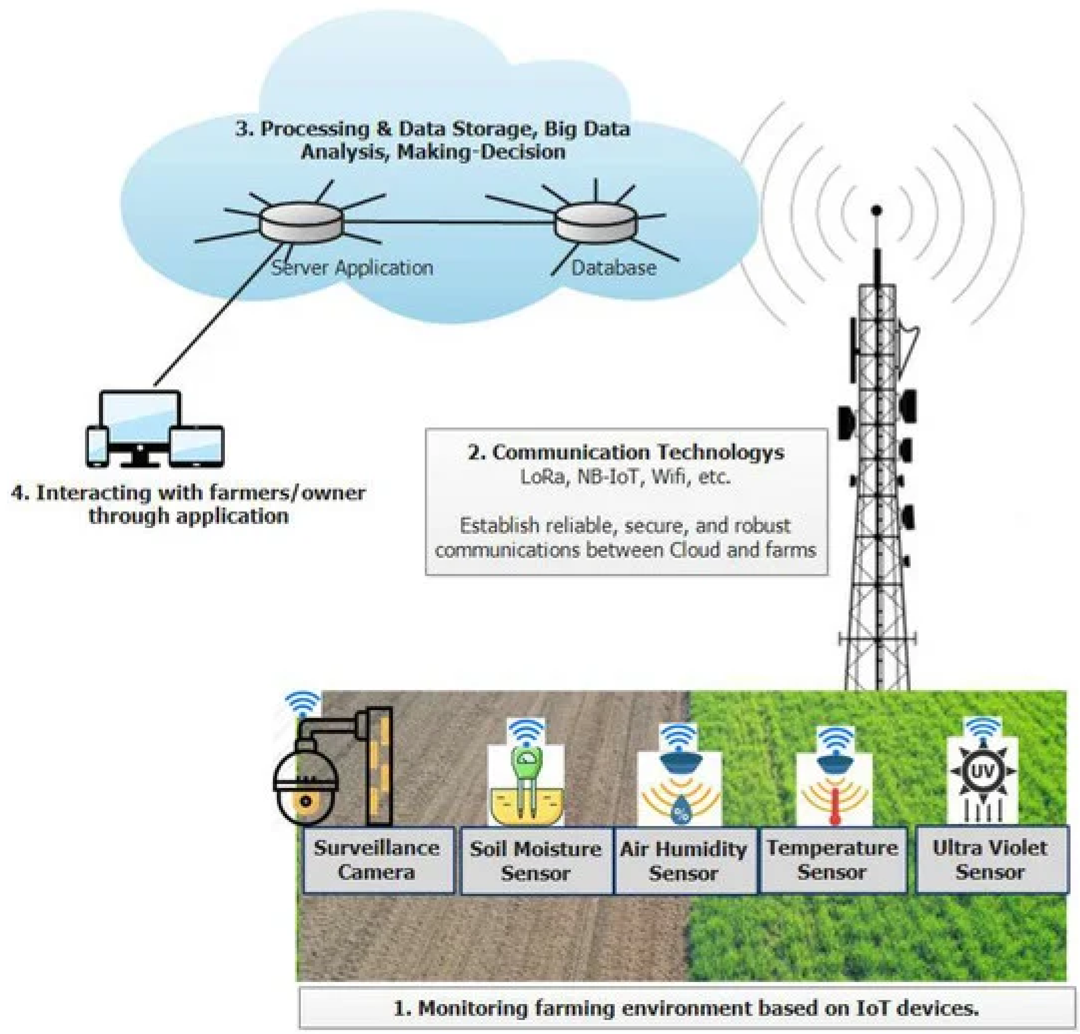
1.2 Purpose



Access to clean, reliable energy enables farmers and agribusinesses to increase food production and engage in value-added processing. It also allows farmers living in off-grid areas to replace expensive diesel generators with new and cleaner technologies, such as solar food dryers and solar water irrigation. The solar agricultural market is still in the early stages of development and barriers include the relatively high technology costs, limited awareness of the benefits, lack of appropriate policy incentives and limited access to finance for farmers and suppliers to make solar technologies more affordable.

We support enterprises that adopt, develop and market sustainable, cost-effective solutions for agricultural production, post-harvest and storage processing, including solar pumping, cooling, chilling and drying. These technologies result in saved costs, increased yields and local value capture for farmers or local agro enterprises. Our advice to businesses includes markets entry, product pricing, sales strategies, market assessments, payment solutions, route-to-market strategies and the agricultural value chain.

2. LITERATURE SURVEY

2.1 Existing problem

- Growing Global Demand. This issue is evolving across the globe. ...
- Climate Change. ...
- Energy Cost. ...
- The Labor Sorrow. ...
- The Trade and Investment. ...
- The critical issue in Water. ...
- Rate and Impact of the Development in Technology. ...
- The Safety and Security on Farms.

2.2 References

- 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. [CrossRef]
- 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. [CrossRef]
- Elijah, O.; Rahman, T.A.; Orikumhi, I.; Leow, C.Y.; Hindia, M.N. An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges. IEEE Internet

Things J. 2018, 5, 3758–3773. [CrossRef]

- Li, W.; Logenthiran, T.; Phan, V.; Woo, W.L. A Novel Smart Energy Theft System (SETS) for IoT-based Smart Home. IEEE Internet Things J. 2019, 6, 5531–5539. [CrossRef]
- Shin, D.; Yun, K.; Kim, J.; Astillo, P.V.; Kim, J.-N.; You, I. A Security Protocol for Route Optimization in DMM-Based Smart Home IoT Networks. IEEE Access 2019, 7, 142531–142550. [CrossRef]
- An, J.G.; Le Gall, F.; Kim, J.; Yun, J.; Hwang, J.; Bauer, M.; Zhao, M.; Song, J.S. Toward Global IoT-Enabled Smart Cities Interworking Using Adaptive Semantic Adapter. IEEE Internet Things J. 2019, 6, 5753–5765. [CrossRef]
- Cirillo, F.; Gomez, D.; Diez, L.; Maestro, I.E.; Gilbert, T.B.J.; Akhavan, R. Smart City IoT Services Creation through Large-Scale Collaboration. IEEE Internet Things J. 2020, 7, 5267–5275. [CrossRef]

2.3 Problem Statement Definition

- Farmers are under pressure to produce more food AND use less energy and water in the process. A remote monitoring and control system will help farmers deal effectively with these pressures.
- Irrigated farms typically deploy a single pump to irrigate 80 to 100 acres of land. Many large farms, therefore, require 40 to 80 or more irrigation pumps spread over hundreds of square miles. Most are pumping ground water for irrigation purposes, most operate in remote fields, and trucks must roll to tend to them.
- Ideally, each field should get just the right amount of water at just the right time. Under-watering causes crop stress and yield reduction. Overwatering can also cause yield reduction and consumes more water and fuel than necessary and leads to soil erosion and fertilizer, herbicide, and pesticide runoff.

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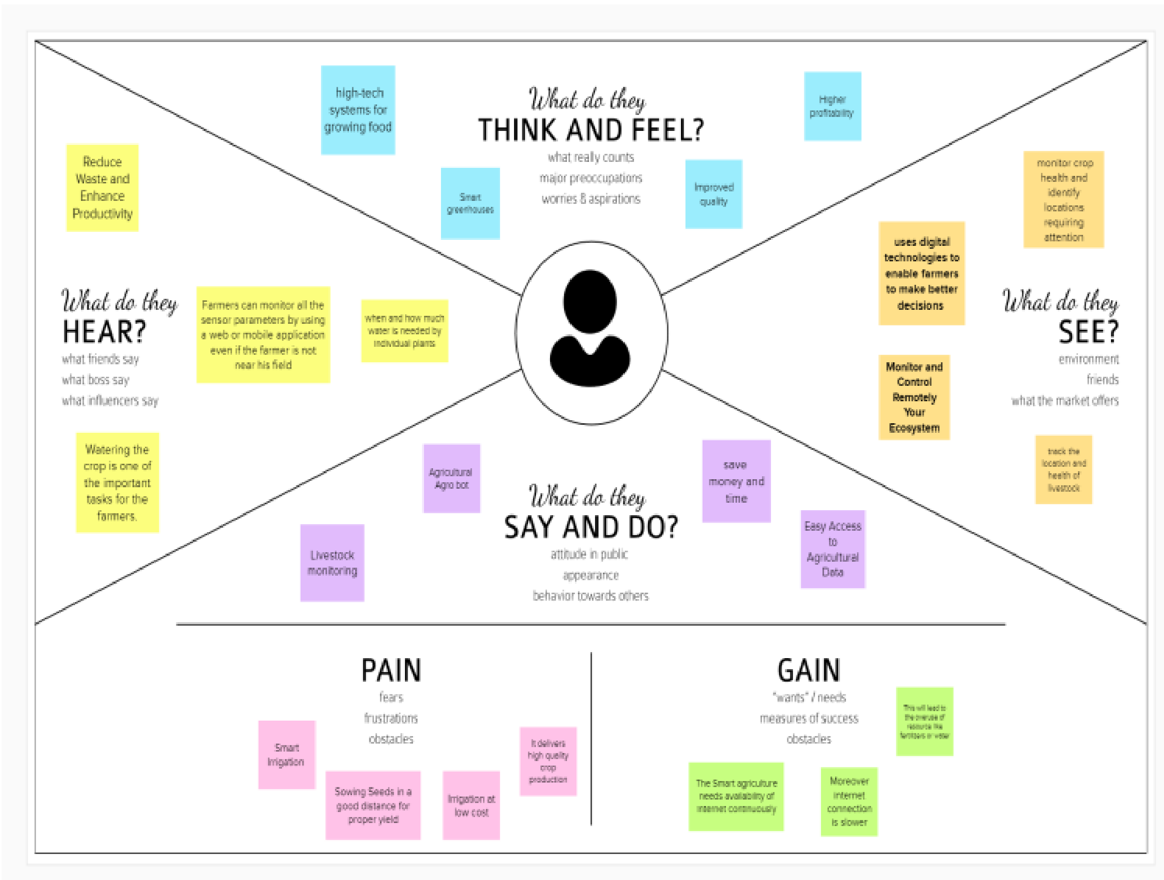
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



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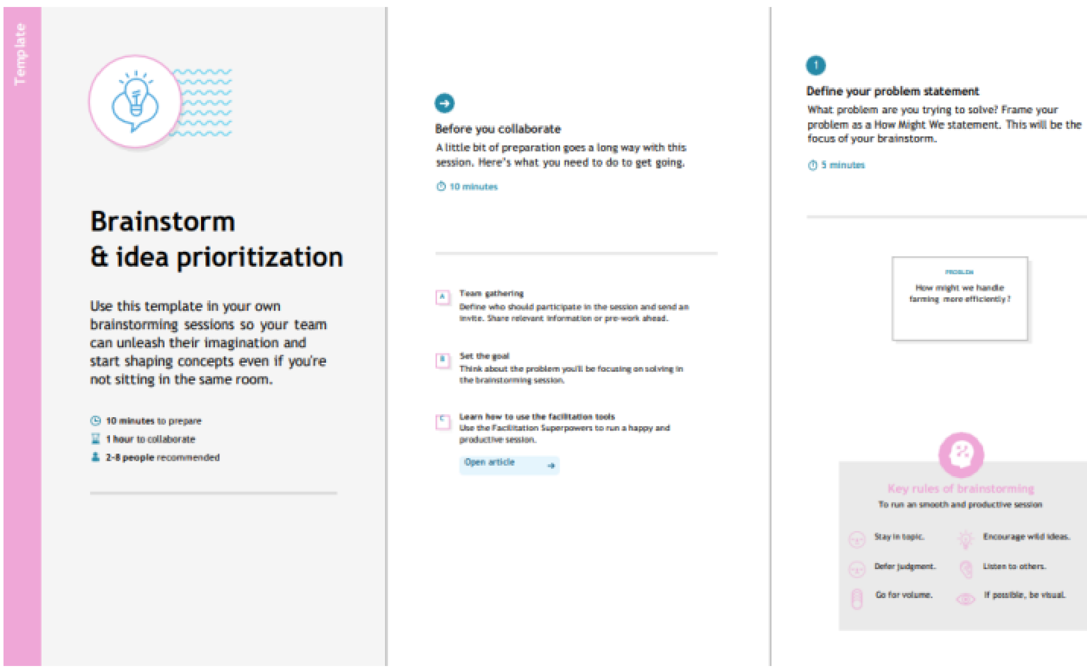
3.2 Ideation & Brainstorming

Step-1: Team Gathering, Collaboration and Select the Problem Statement



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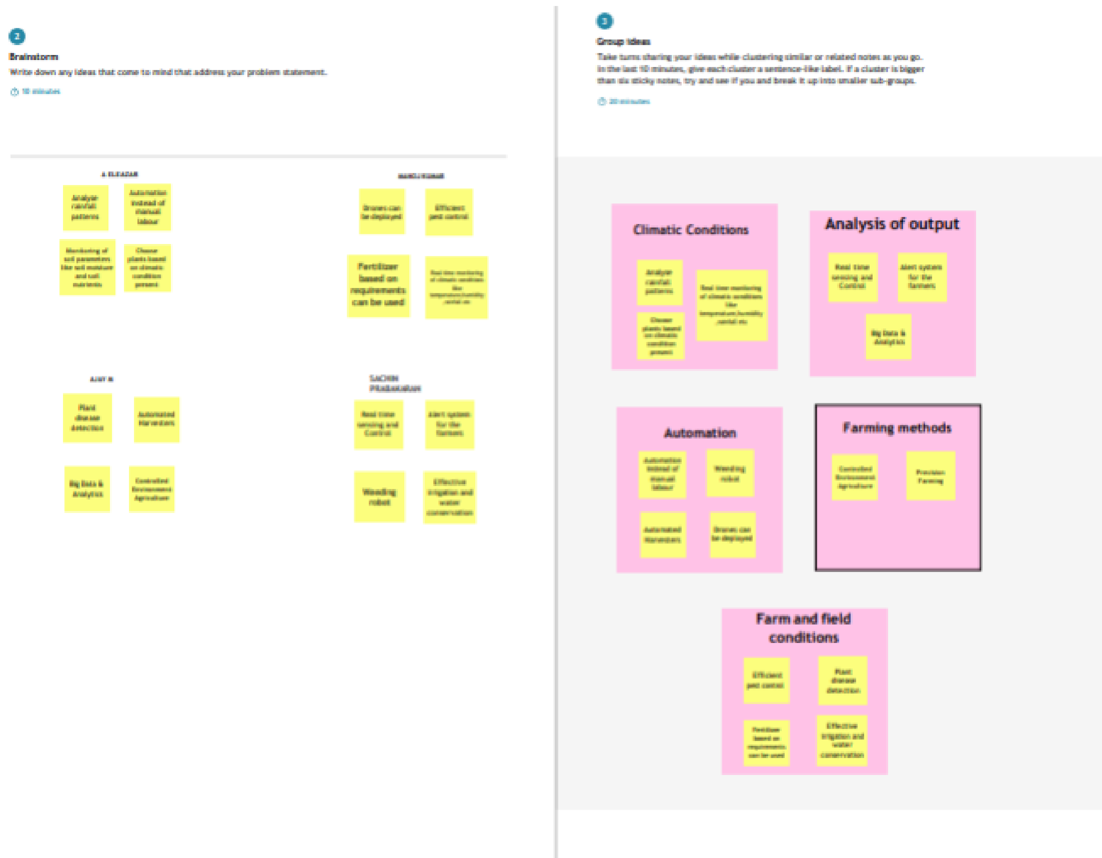
Step-2: Brainstorm, Idea Listing and Grouping



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Step-3: Idea Prioritization

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3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Farmers are under pressure to produce more food using less energy and water in the process along with efficient monitoring of environment and field parameters without use of too much manpower and they also want their solution to be cost effective to gain overall profit after implementing it.
2.	Idea / Solution description	Smart farming refers to managing farms using technologies like IoT and AI to monitor environmental and field parameters using various sensors and use analysis to efficiently use resources like water and energy with additional reduction of manpower.
3.	Novelty / Uniqueness	Though all smart farming projects have information obtained from sensors, analysis and display of results, our project's uniqueness lies in displaying of results as a user-friendly web page and mobile application and also sending alert messages during emergency situations so that user gets adequate information at all the time.
4.	Social Impact / Customer Satisfaction	Our project has widespread social impact in improving farming and equipping farmers with results of advanced scientific analysis which helps them to reduce cost and also save manpower while having a better yield thereby providing utmost customer satisfaction.
5.	Business Model (Revenue Model)	Business model will be a SaaS model where information will be hosted as an application on cloud where users need to pay a certain reasonable and affordable amount to get access to it leading to a mutual benefit for both users and the organization.
6.	Scalability of the Solution	Solution would provide enough room for addition of further nodes and also improve its overall performance based on the further information provided without having too many changes in implementation.

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3.4 Problem Solution fit

Define CS, fit into CC

1.Customer segments:-
Farmers can be sub-segmented under three categories. CS

- ¬ Micro, small, or marginal
- ¬ Emerging and large
- ¬ Commercial Farmer

Based on farm:

- ¬ Surplus
- ¬ Gross revenue
- ¬ Land under cultivation

6. CUSTOMER CONSTRAINTS

The country's sustainable agricultural development has many obstacles. These includes

- ¬ Agricultural water-use shortage
- ¬ Cultivated land loss
- ¬ Inappropriate usage of fertilizers and pesticides
- ¬ Environmental degradation

5. AVAILABLE SOLUTIONS

IoT in agriculture uses robots, drones, remote sensors, and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money

Explore AS, differentia

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

2. JOBS-TO-BE-DONE / PROBLEMS

Smart farming involves providing training to farmers and local village based trained persons for using technology and incorporating data guided decisions with their traditional agriculture practices.

9. PROBLEM ROOT CAUSE RC

Farmers are under pressure to produce more food and use less energy and water in the process. The main problem is to feed an increasing global population while at the same time reducing the environmental impact and preserving natural resources for future generation. Agriculture can have significant impact on environment

7. BEHAVIOUR BE

The behavioral approach focuses on the nature of decision making by farmers and on the many influences which affect such decisions. Agriculture has been mainly of an economic nature but the quite different social approach has grown more recently.

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

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4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Sign Up with help of Gmail and the password as a user
FR-2	User Confirmation	User gets a confirmation Mail once he/she has successfully Signed Up.
FR-3	Login	Login Credentials are checked at the time of Logging in.
FR-4	Dashboard	Once the credentials are checked, dashboard will be visible. It has the details of Atmospheric Temperature, Humidity, Soil Moisture and Motor ON/OFF function.
FR-5	Sensor function	Measure Temperature, humidity and soil moisture.
FR-6	Logout	When user clicked the log out button the user will be signed out.

4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Simplicity in accessing the details of temperature sensor measure, humidity sensor measure and weather conditions by the farmer. Easy controlling of the motor and irrigation system through application.
NFR-2	**Security**	Only the authenticated user can access the irrigation system and monitor the crop. Information of one user will not be shared to the other user or any other persons.
NFR-3	**Reliability**	This crop monitoring, Irrigation control and weather monitoring results in better trade-off between cost and reliability. It reduces time and yields more profit to the farmers.
NFR-4	**Performance**	The concept of integrating sensors with environment, soil and farming parameters will be more efficient for overall supervision.
NFR-5	**Availability**	The details of all the sensors will be displayed in the application at any time.
NFR-6	**Scalability**	Scalability is an important for IOT platforms. It has been demonstrated that different architectural choices of IoT platforms affect system scalability and that automatic real-time decision making is possible in an environment composed of thousands of devices

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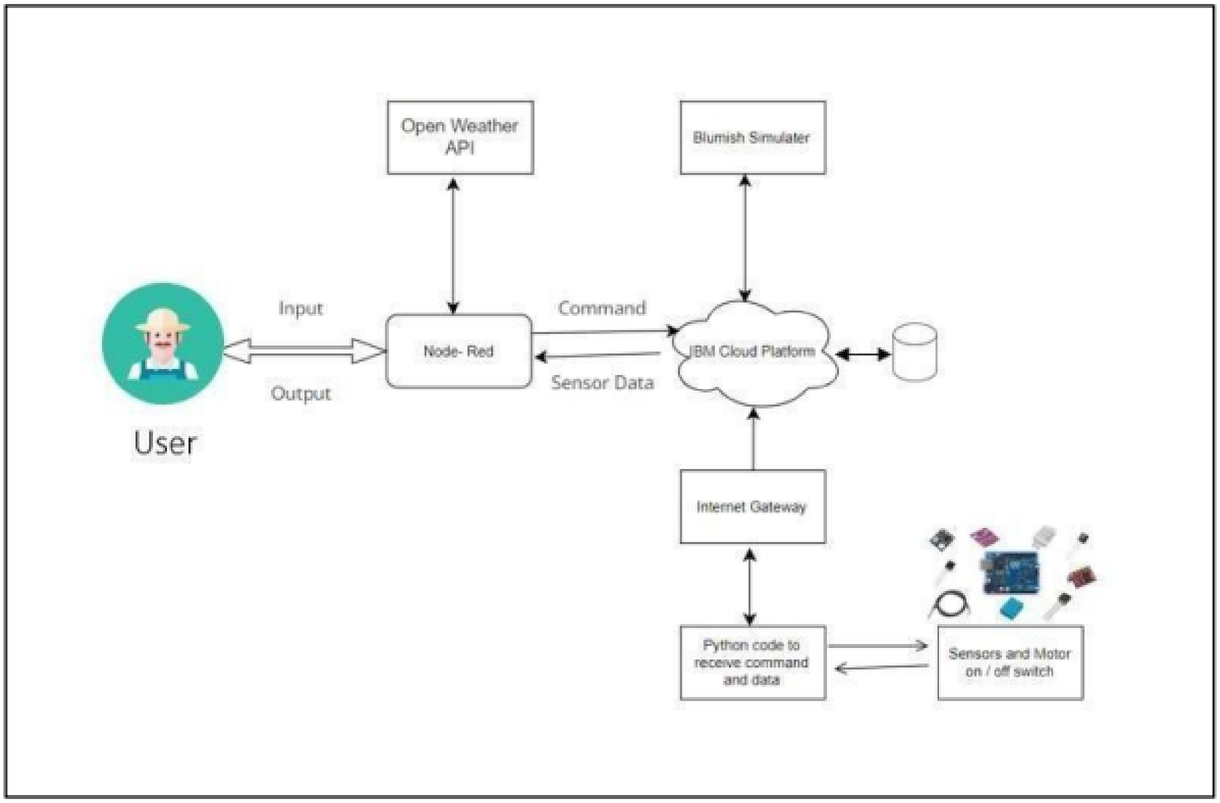
5. PROJECT DESIGN

5.1 Data Flow Diagrams

Flow Diagram



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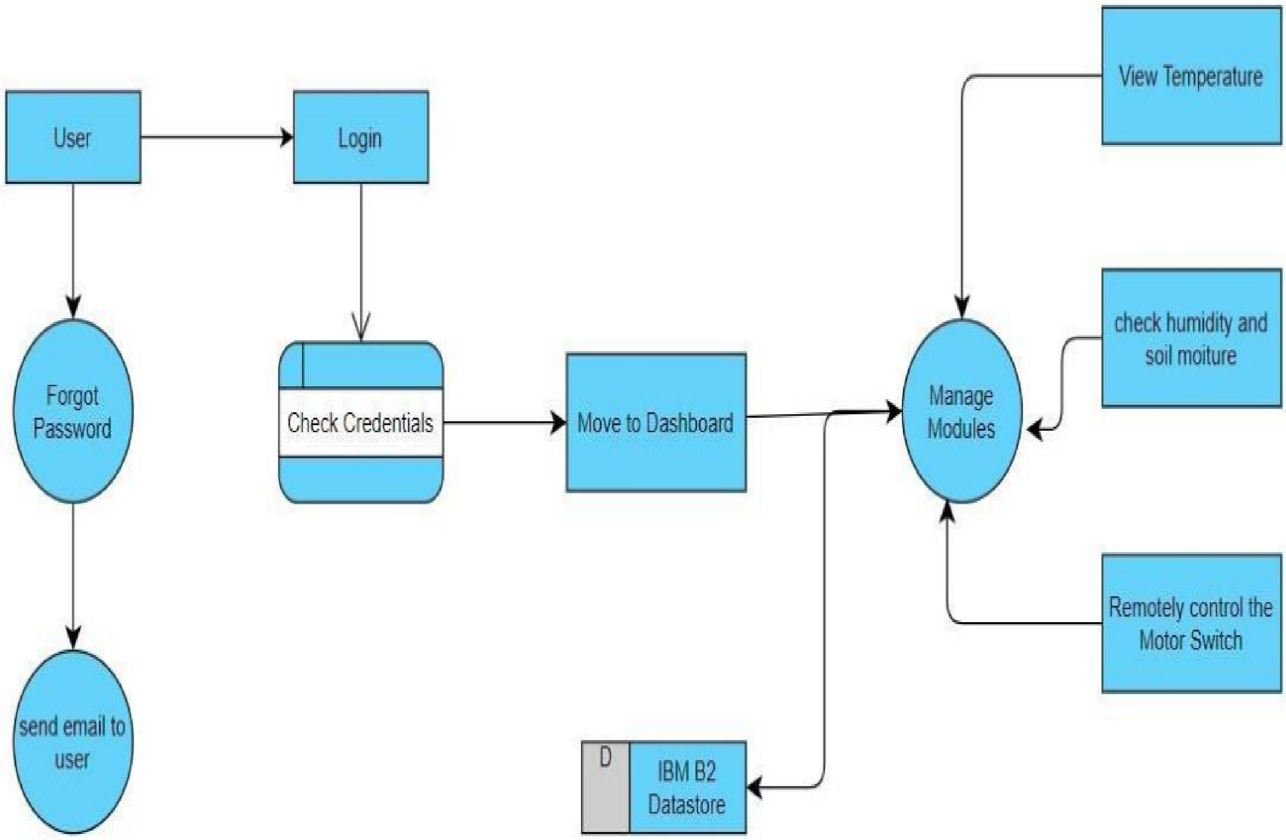
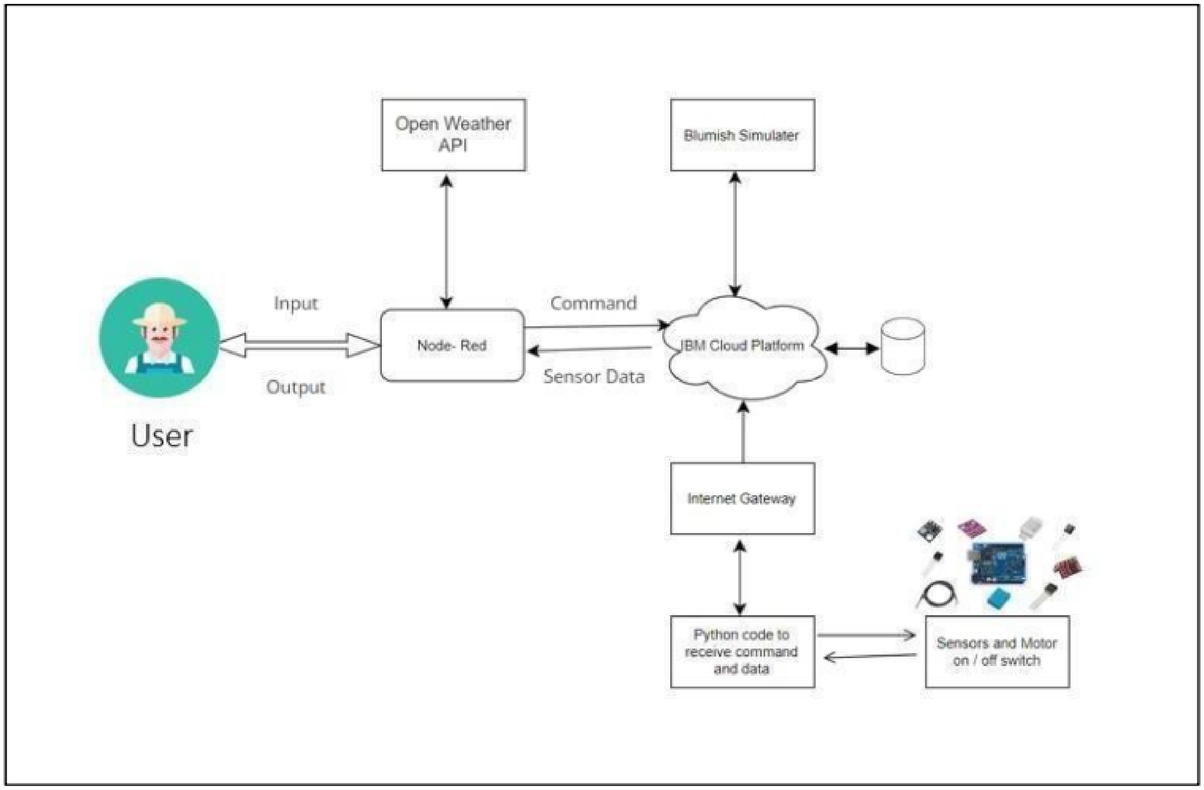
Data Flow Diagrams:



5.2 Solution & Technical Architecture



- The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM B2 cloud.

- Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.

- NODE-RED is used as a programming tool to write the hardware, software and APIs. The MQTT protocol is followed for the communication.

- All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could make a decision through an app, weather to water the field or not depending upon the sensor values. By using the app they can remotely operate the motor switch.

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5.3 User Stories

- Smart Farming is a development that emphasizes the use of information and communication technology in the cyber-physical farm management cycle.
- New technologies such as the Internet of Things and Cloud Computing are expected to leverage this development and introduce more robots and artificial intelligence in farming.
- This is encompassed by the phenomenon of Big Data, massive volumes of data with a wide variety that can be captured, analysed and used for decision-making.
- This review aims to gain insight into the state-of-the-art of Big Data applications in Smart Farming and identify the related socio-economic challenges to be addressed.
- Following a structured approach, a conceptual framework for analysis was developed that can also be used for future studies on this topic.
- The review shows that the scope of Big Data applications in Smart Farming goes beyond primary production; it is influencing the entire food supply chain.
- Big data are being used to provide predictive insights in farming operations, drive real-time operational decisions, and redesign business processes for game-changing business models.
- Several authors therefore suggest that Big Data will cause major shifts in roles and power relations among different players in current food supply chain networks.
- The landscape of stakeholders exhibits an interesting game between powerful tech companies, venture capitalists and often small start-ups and new entrants.
- At the same time there are several public institutions that publish open data, under the condition that the privacy of persons must be guaranteed.

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6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement(Epic)	User Story Number	User Story/Task	Story Points	Priority
01Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, work flow for IoT scenario using Node-Red	2	High
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High

6.2 Sprint Delivery Schedule

Sprint	Total StoryPoints	Duration	Sprint Start Date	Sprint End Date(Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	20	6Days	31Oct2022	05Nov2022	20	05Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	12Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	19Nov2022

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.3 Reports from JIRA

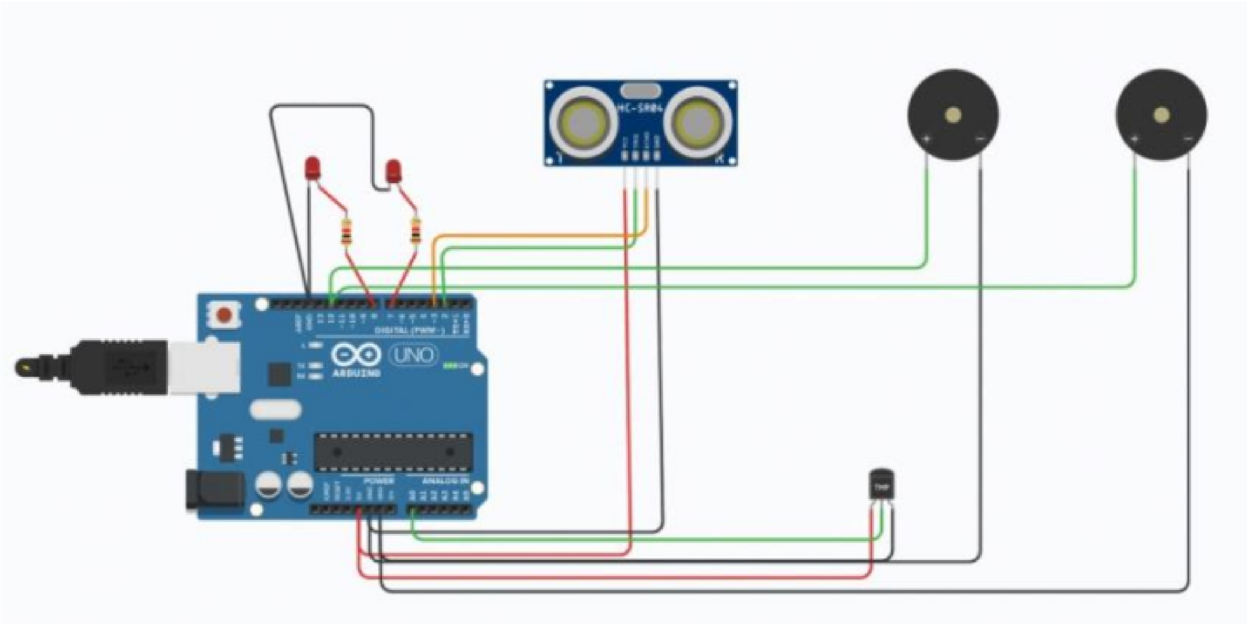
Jira **helps teams plan, assign, track, report, and manage work and brings teams together for everything from agile software development and customer support to start-ups and enterprises**. Software teams build better with Jira Software, the tool for agile teams.

Applications of JIRA

- Jira Software. Project and issue tracking.
- Jira Service Management. Service management and customer support.
- Jira Core. Manage any business project.
- Confluence. Document collaboration.
- Bitbucket. Git code management.

7. CODING & SOLUTIONING

7.1 Feature 1



code;

```
int t=2;
 int e=3;
 void setup() {
 Serial.begin(9600);
```

```
 pinMode(t,OUTPUT);
 pinMode(e,INPUT);
 pinMode(12,OUTPUT); }
void loop() {
 digitalWrite(t,LOW);
 digitalWrite(t,HIGH);
 delayMicroseconds(10);
 digitalWrite(t,LOW);
 float dur=pulseIn(e,HIGH);
 float dis=(dur*0.0343)/2;
 Serial.print("Distance is: ");
 Serial.println(dis); }
 if(dis>=100)//(in terms of centimeter) { digitalWrite(8,HIGH);
digitalWrite(7,HIGH); }
 if(dis>=100) {
 for(int i=0; i<=30000; i=i+10)
{ tone(12,i);
delay(1000);
 noTone(12);
delay(1000);
}
 }
double a= analogRead(A0);
 double t=(((a/1024)*5)-0.5)*100;
 Serial.print("Temp Value: ");
 Serial.println(t); delay(1000); //LED ON if(t>=100)//(in terms of celsius) {
digitalWrite(8,HIGH);
 digitalWrite(7,HIGH); }
 if(t>=100) {
for(int i=0; i<=30000; i=i+10) {
tone(12,i);
 delay(1000);
 noTone(12);
delay(1000);
}
 }
if(t<100) { digitalWrite(8,LOW);
 digitalWrite(7,LOW);
 }
}
```

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7.2 Feature 2

program:

```
import random temp=random.randint(0,100)
humid=random.randint(0,100) print("Note:")
print ("Normal Temperature Level is 50°C")
print ("Normal Humidity Level is 50%")
print (" ")
if (temp>=50):
print ("Temperature is High",temp,"°C")
else:
print ("Temperature is Normal",temp,"°C")
if (humid>=50):
print ("Humidity is High",humid,"%")
else:
print ("Humidity is Normal",humid,"%"
```

7.3 Database Schema (if Applicable)
Simulation;

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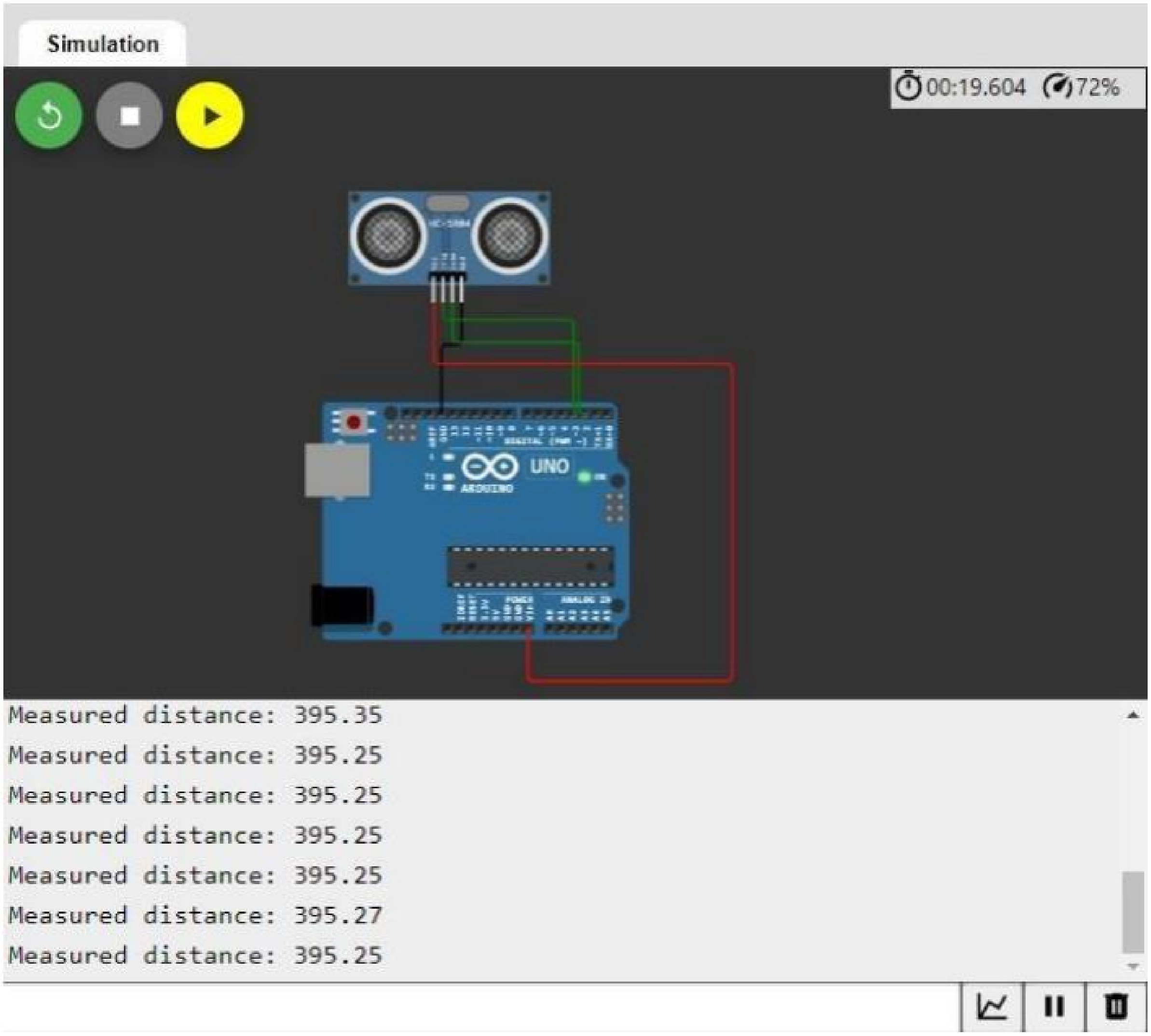


code

```
#define ECHO_PIN 2
 #define TRIG_PIN 3
 void setup()
 {
 Serial.begin(9600);
 pinMode(TRIG_PIN, OUTPUT);
 pinMode(ECHO_PIN, INPUT);
 }
 float readDistanceCM()
{
 digitalWrite(TRIG_PIN, LOW);
 delayMicroseconds(2);
 digitalWrite(TRIG_PIN, HIGH);
```

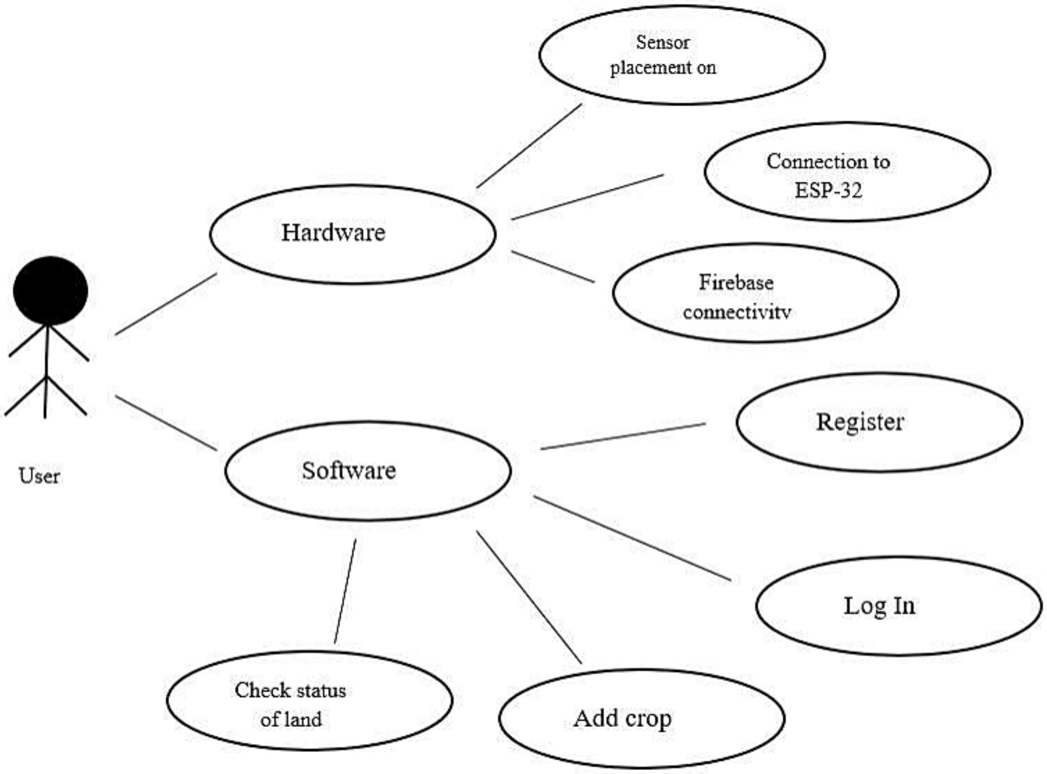
```
delayMicroseconds(10);
 digitalWrite(TRIG_PIN, LOW);
 int duration = pulseIn(ECHO_PIN, HIGH);
 return duration * 0.034 / 2; } void loop()
 {
 float distance = readDistanceCM();
 if(distance <= 100)
 {
 Serial.println("person detected ");
 }
 else{ Serial.print("Measured distance: ");
 Serial.println(readDistanceCM());
 }
 delay(1000);
 }
```

8. TESTING

Software Testing is a method to check whether the actual software product matches expected requirements and to ensure that software product is Defect free. It involves execution of software/system components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps or missing requirements in contrast to actual requirements. Some prefer saying Software testing definition as a White Box and Black Box Testing. In simple terms, Software Testing means the Verification of Application Under Test (AUT). This Software Testing course introduces testing software to the audience and justifies the importance of software

8.1 Test Cases

A Use Case Diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which atr Roles of the actors in the system can be depicted. A use case diagram is a type of behavioral diagram created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases



A strategy for system testing integrates system test cases and design techniques into a wellplanned series of steps that results in the successful construction of software. The testing strategy must cooperate test planning test case design, test execution, and the resultant data collection and evaluation. A strategy for is testing must accommodate low-level tests that are necessary to verify that a small source segment has been correctly implemented as well as high level tests that validate major system functions against user requirements.

8.2 User Acceptance Testing

➤ In the agriculture sector, factors affecting the farming and production process can be monitored and collected, such as soil moisture, air humidity, temperature, pH level, etc. These factors depend on the considered agricultural sector. Some smart agricultural sectors are applying the following monitoring solutions:

➤ Crop Farming: In this sector, some vital factors that affect the farming process and production efficiency include air temperature, precipitation, air humidity, soil moisture, salinity, solar radiation, pest status, soil nutrient ingredients, etc. In [81], the authors designed an IoT device called FarmFox. This device allows real-time collection and analysis of the composition of the farming soil and transmits the information to farmers/owners via the Internet. The results demonstrate the health of the soil is monitored in real time to provide timely recommendations to farmers aiming to increase productivity and farming efficiency.

- Furthermore, in [82], the authors proposed an IoT device to allow intelligent control of temperature and humidity factors, called a weather radar. This device will automatically turn on the warning mode using the light signal and send messages to the farmer when the temperature or humidity exceeds a pre-installed threshold. In [83], the authors introduced an IoT system based on Web GIS to monitor pest status and provide early warnings. In addition, this study also proposes a predictive model based on monitoring the habitat of pests and diseases.

9. RESULTS

Smart farming **reduces the ecological footprint of farming**. Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases.

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes. A block diagram containing the parts of a typical power supply and the voltage at various points in the unit.

10. ADVANTAGES

- The monitoring data of water, feed, and animal health for livestock in the farming process helps farmers set up livestock plans, reduce labour costs, and enhance production efficiency.

- While a series of solutions has been provided for monitoring large-scale farms, their application in small and medium-sized farms is very limited, especially in developing countries.

- This can be attributed to the high cost and the lack of knowledge needed to set up, manage, and operate IoT systems.

- Therefore, effective and low-cost solutions for agricultural IoT have much potential.

DISADVANTAGES

- In agricultural economics, one of the most important characteristics is a low rate of profit of an investment project, which presents many risks from natural conditions.

- The benefit–cost of a new technology seeking deployment in agriculture should be carefully calculated to ensure a trade-off between the cost of technology implementation and the profit potential.

- Therefore, we discuss the economic aspects related to IoT implementation in smart agriculture.

- Service providers need to reduce the service costs, more effectively exploiting the information collected from the farm.

- On the other hand, farmers need to improve their skills to be able to apply IoT solutions on their farm to enhance productivity and farming efficiency.

- Researchers need to continually study and propose optimal solutions and technologies to ensure IoT systems' privacy and security and improve the durability of IoT devices

11. CONCLUSION

In this study, we presented an overview of IoT and big data for the smart agriculture sector. Several issues related to promoting IoT deployment in the agriculture sector have been discussed in detail. Survey results indicate that many studies have been performed to apply IoT for smart agriculture, aiming to enhance productivity, reduce human labour, and improve production efficiency. The benefits of applying IoT and big data in agriculture were discussed. In addition, we also pointed out the challenges we need to overcome to be able to accelerate the deployment of IoT in smart agriculture. However, there are still some challenges that need to be addressed for IoT solutions to be affordable for the majority of farmers, including small- and medium-scale farm owners. In addition, security technologies need to be continuously improved, but in our opinion, the application of IoT solutions for smart agriculture is inevitable and will enhance productivity, provide clean and green foods, support food traceability, reduce human labour, and improve production efficiency. On the other hand, this survey also points out some interesting research directions for security and communication technologies for IoT. We think that these will be very exciting research directions in the future.

12. FUTURE SCOPE

Smart farming is certainly a leading enabler in producing more food with less for an increasing world population. In particular, smart farming enables increased yield through more efficient use of natural resources and inputs, and improved land and environmental management.

13. APPENDIX

Source Code

```
#include <ESP8266WiFi.h>

#include <WiFiClient.h>

#include <PubSubClient.h>

#include "DHT.h"


const char* ssid = "SMART-G";

const char* password = "10112019";


#define DHTPIN D6

#define G D0

#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);
```

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```
#define ID "0t9jrj"

#define DEVICE_TYPE "ESP8266"

#define DEVICE_ID "TEST"

#define TOKEN "TEST-12345"


char server[] = ID ".messaging.internetofthings.ibmcloud.com";

char publish_Topic1[] = "iot-2/evt/Data1/fmt/json";

char publish_Topic2[] = "iot-2/evt/Data2/fmt/json";

char publish_Topic3[] = "iot-2/evt/Data2/fmt/json";

char authMethod[] = "use-token-auth";

char token[] = TOKEN;

char clientId[] = "d:" ID ":" DEVICE_TYPE ":" DEVICE_ID;


WiFiClient wifiClient;

PubSubClient client(server, 1883, NULL, wifiClient);


void setup() {

 pinMode(D0,OUTPUT);

 digitalWrite(D0,HIGH);

  Serial.begin(115200);

  dht.begin();

  Serial.println();

  WiFi.begin(ssid, password);

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

   delay(500);
```

```
  Serial.print(".");
 }
 Serial.println("");
 Serial.println(WiFi.localIP());

 if (!client.connected()) {
   Serial.print("Reconnecting client to ");
   Serial.println(server);
   while (!client.connect(clientId, authMethod, token)) {
     Serial.print(".");
     delay(500);
   }
   Serial.println("Connected TO IBM IoT cloud!");
 }
}

long previous_message = 0;
void loop() {
 client.loop();
 long current = millis();
 if (current - previous_message > 3000) {
   previous_message = current;
    float hum = dht.readHumidity();
    float temp = dht.readTemperature();
    float MOI =  map(analogRead(A0), 0, 1023, 100, 0);
```

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```
    if (isnan(hum) || isnan(temp)  ){
  Serial.println(F("Failed to read from DHT sensor!"));
  return;
}


Serial.print("Temperature: ");
Serial.print(temp);
Serial.print("°C");
Serial.print(" Humidity: ");
Serial.print(hum);
Serial.print("%");
Serial.print("SOIL MOITURE: ");
Serial.print(MOI);
if(MOI<=10)
{
   digitalWrite(D0,LOW);
   delay(100);
   digitalWrite(D0,HIGH);
 }
 else
 {
   digitalWrite(D0,HIGH);
 }
```

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```
String payload = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
    payload += ",\"Temperature\":";
    payload += temp;
    payload += "}}";


 Serial.print("Sending payload: ");
 Serial.println(payload);


 if (client.publish(publish_Topic1, (char*) payload.c_str())) {
   Serial.println("Published successfully");
 } else {
   Serial.println("Failed");
 }
 String payload1 = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
    payload1 += ",\"Humidity\":";
    payload1 += hum;
    payload1 += "}}";
    Serial.print("Sending payload: ");
    Serial.println(payload1);
    Serial.println('\n');


  if (client.publish(publish_Topic2, (char*) payload1.c_str())) {
   Serial.println("Published successfully");
 } else {
   Serial.println("Failed");
```

```
      }



      String payload3 = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
        payload3 += ",\"Moiture\":";
        payload3 += MOI;
        payload3 += "}}";

      Serial.print("Sending payload: ");
      Serial.println(payload3);

      if (client.publish(publish_Topic3, (char*) payload3.c_str())) {
        Serial.println("Published successfully");
      } else {
        Serial.println("Failed");
      }

    }
  }
```

GitHub

IBM-EPBL/**IBM-Project-24809-1659949242**

Project Demo Link

https://drive.google.com/file/d/1axqznuNT-P4SpCAjtS3Bckp9YU268bX1/view?usp=drivesdk

Project Report