SMART AGRICULTURE

TEAMID:PNT2022TMID33827

BY

S.AJITHA

L.AUGUSTA BLESSY

V.JENIFER GLORIA DAPHNE

V.MAHESWARI

PROJECT REPORT

INTRODUCTION:

PROJECT OVERVIEW:

IoT is bringing revolution to almost every aspect of our lives by changing how we do things. The use of Smart IoT devices is on the rise with all the industries heavily investing in IoT. The main aims of investing in IoT are to improve operations efficiency, improve product quality, and reduce the costs of production. The Agricultural industry is among the industries seeking to reap the benefits of IoT.

PURPOSE:

The use of IoT in agriculture is commonly referred to as Smart Farming or Smart Agriculture. It uses various IoT sensors to send the farm's data, like humidity, temperature, soil moisture, etc. to the cloud which can be monitored and controlled from anywhere in the world.

2. LITERATURE SURVEY:

EXISTING PROBLEM:

Farmers need to deal with many problems, including how to: **Cope with climate change, soil erosion and biodiversity loss**. Satisfy consumers' changing tastes and expectations. Meet rising demand for more food of higher quality.

Other problems include,

1. Accidental deforestation
2. Soil erosion
3. High water usage
4. Energy wastage
5. Carbon emissions
6. Time consuming process
7. Poor outcomes of cultivation

2.2 REFERENCES:

INTERNET OF THINGS

SmartFarmer - IoT Enabled Smart Farming Application

Getting Young People to Farm: How Effective Is Thailand’s Young Smart Farmer Programme?

Para Jansuwan, Kerstin K Zander

Sustainability 13 (21), 11611, 2021:

Abstract:

In 2014, the Thai government initiated the Young Smart Farmer (YSF) programme to counter the decline in the number of young people involved in farming. The YSF programme has three desired outcomes: first, to increase participants’ financial independence; second, to enhance the adoption of innovative farming methods; and third, to retain participants in the

long-run by satisfying them. This study aimed to evaluate if these outcomes have been achieved. A Propensity Score Matching (PSM) method was applied to analyse the data collected from programme participants (61 responses) and non-participants (115 responses) through a survey in the Prachin Buri province in Thailand. Participation was determined by education, farmland size, farming experience, and challenges to farming. Most participants (~79%) stated that they were satisfied with the programme; however, the programme did not increase financial independence and the adoption of innovative farming methods. As such, the programme might not be very effective in motivating young people to continue, return to, or enter farming. We recommend that the programme can be improved by adjusting training and field trips to meet the needs of participants in different production systems. The programme should also be expanded beyond providing knowledge and information, and it could offer additional monetary and non-monetary support to participants, such as loans for technology investments needed for farm expansion and competitive advantages.

Social media for smart farmer-shared farming equipment model

Wuttipong Pongsuwan, Hongladda Pongsuwan

Information Management and Business Review 11 (2 (I)), 1-9, 2019:

This research offers a roadmap for creating a concept for building a collaborative and connected mobility model to share the agricultural machine. The study aims to adopt those models to create a collaborative and connected mobility model as a Shared Agricultural Machine Network for Smart Farmer. The fact that Thai farmers are facing the aging crisis, like all other industries and farming machinery has become a need for manpower replacement to keep their earning for livings. Unfortunately, these machines are often expensive, so they can own only a few, and when it comes to reaping the harvest season, and they often require different tools for specific

purposes. Our survey has shown that farmers have different ways of cultivating different crops at the same time this implies that in harvesting season there are unused agricultural pieces of equipment available to share among them. The model of shared farm equipment could lead to new farmersâ€™ way of life and itâ€™ s time to become smart-farmers. This paper will discuss important considerations, including the need for challenges, trends, and opportunities for farmers to have machinery when needed and to share what idle with others via a peer-to-peer network using mobile application platform.

Smart farmer application in monitoring and learning of android-based rice cultivation

Andysah Putera Utama Siahaan, Rian Farta Wijaya

Farmers are jobs that are done by planting crops and then harvesting crops for sale or consumption. Farmers must know the plants to be planted to get good harvests. Smart Farmer application is made to be a medium of help for young Farmers who do not have sufficient knowledge in conducting farming activities. The Smart Farmer application is created by presenting relevant information such as cultivation techniques, diseases, pests, and benefits related to rice plants. Rice plants were chosen as the subject matter because rice is the primary food choice needed by humans in Indonesia, and at this time farmers have also decreased in number.

2.3 PROBLEM STATEMENT DEFINITION:

The farmers are not able to predict the amount of temperature and water the plant

needs for their effective growth.Also the farmer is not able too measure the underwater table and this is leading to overwatering of crops and affecting the growth of plants.Also the crop needs contionous monitoring of crops so they have

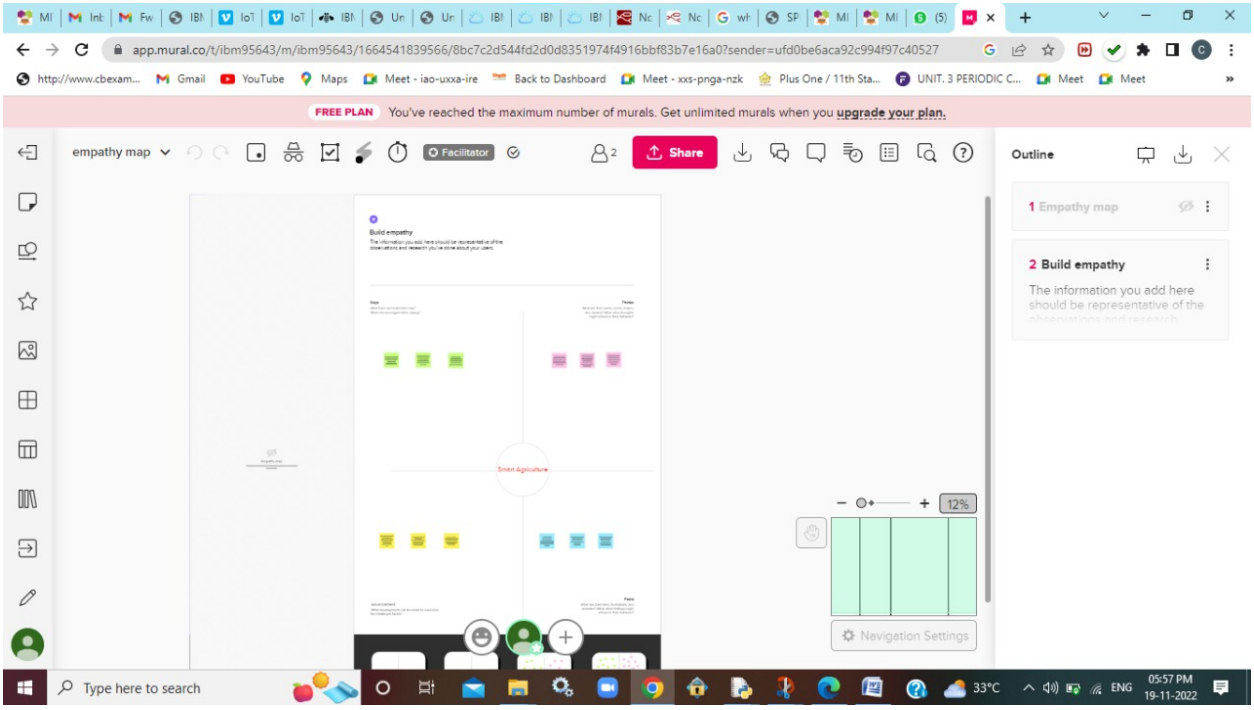
spend most of their time in the farm with the plants.

1. Who does the problem affect?

2. What are the boundaries of the problem?
3. What is the issue?
4. When does the issue occur?
5. Why is it important that we fix the problem?
6. What solution to solve this issue?

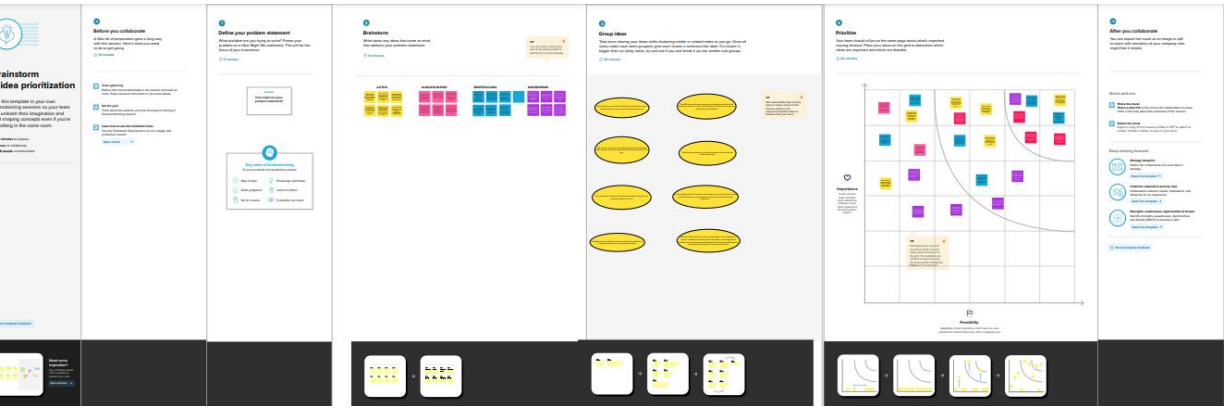
3.IDEATION AND PROPOSED SOLUTION:

3.1EMPATHY MAP CANVAS:



3.2 IDEATION AND BRAIN STORMING:

3.3 PROPOSED SOLUTION:



3.4 PROBLEM STATEMENT:

Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. Power Supply is also one of the problems. In Village Side, the power supply may vary. The

Biggest Challenges Faced by IoT in the Agricultural Sector are Lack of Information, High Adoption, Costand Security Concerns, etc

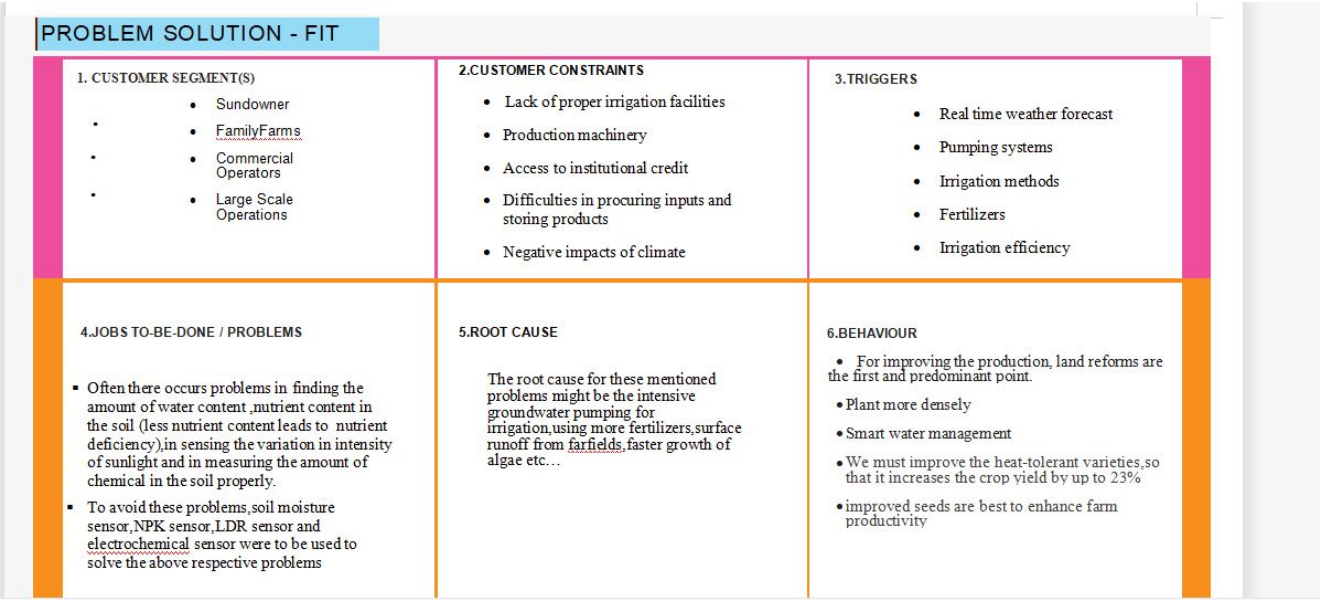
Idea / Solution description

As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in the weather pattern in Farms. So cultivation is done forsuitable crops.

NOVELTY:

It helps the farmers to know the temperature and amount of moisture in the soil without touching the soil and going outside.

3.5 PROBLEM SOLUTION FIT:



4. REQUIREMENT ANALYSIS:

FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed solution

FR NO.	FUNCTION REQUIREMENT (EPIC)	SUB REQUIREMENTS(STORY/SUB-TASK)
1	User Registration	EMAIL: Enter email address PASSWORD: Enter password
2	User Confirmation	Confirmation via email. Thanks for your email.
3	Log in to system	serve authenticated
4	Manage Modules	Manage system modules manage roles of user manage user permission
5	check the condion l	Temperature monitoring status Humidity monitoring status and the motor is turned on or off depending on the presence of humidity in the soil

NON-FUNCTIONAL REQUIREMENTS:

Following are the non functional requirements of the proposed solution,

FR-NO	NN	DESCRIPTION
NFR-1	Usability	Usability includes easy understanding and learn ability, efficiency in use,remember ability,

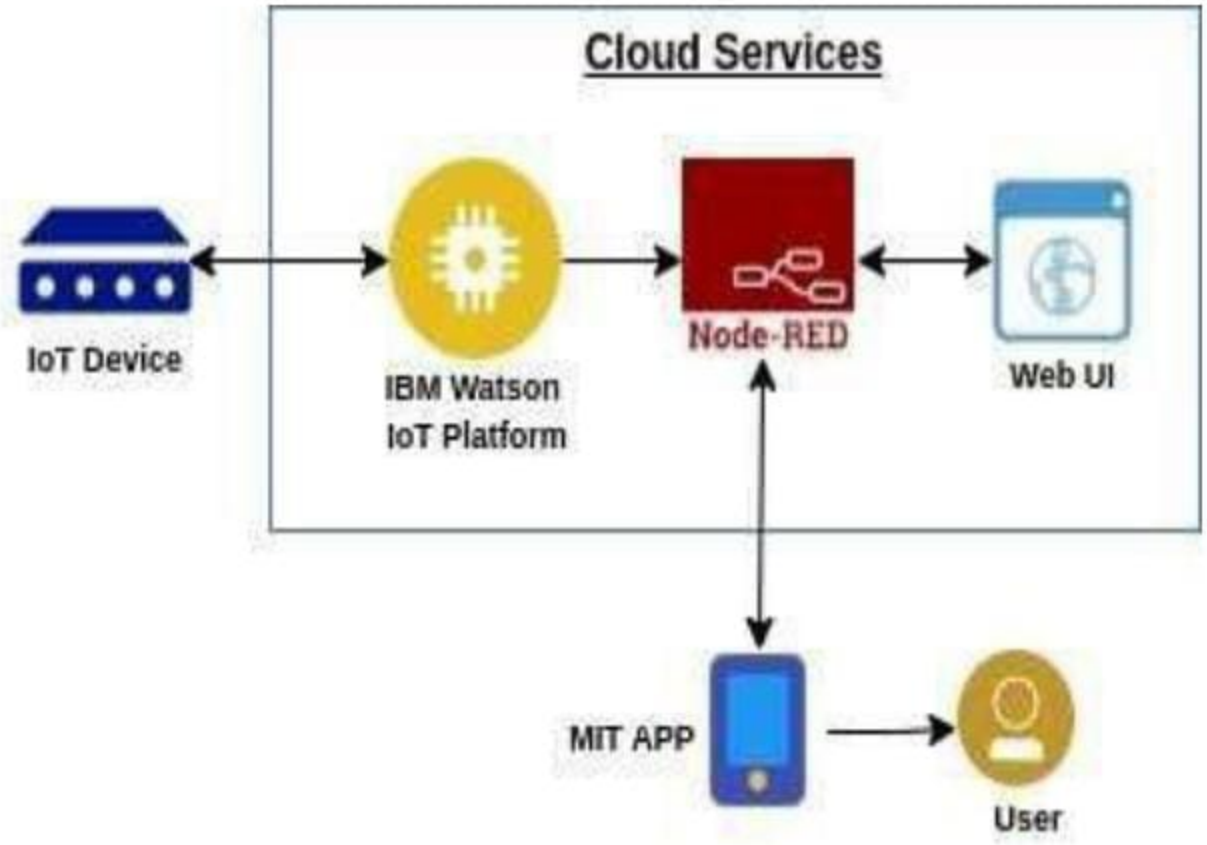
		lack of errors in operation and subjective pleasure
NFR-2	Security	Sensitive and private data must be protected from their production until the decision-making and storage stages.
NFR-3	Reliability	The shared protection achieves a better trade-off between costs and reliability. The model uses dedicated and shared protection schemes to avoid farm service outages.
NFR-4	Performance	The idea of implementing integrated sensors with sensing soil and environmental

		parametersin farming will be more efficient.
NFR-5	Availability	Automatic adjustment of farming equipment made possible by linking information like crops/weather andequipment 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,real time decision- making is feasible in an environment composed of dozens of thousand.

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 requirement graphically. It shows how data enters and leaves thesystem, what changes the information, andwhere data is stored.



The different soil parameters temperature and then humidity are sensed using different sensors and obtained value is storedin the IBM cloud.

- ESP32 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.
- Through which the farmer can know the information about the growth of plants and can water the crops and grow it accordingly.

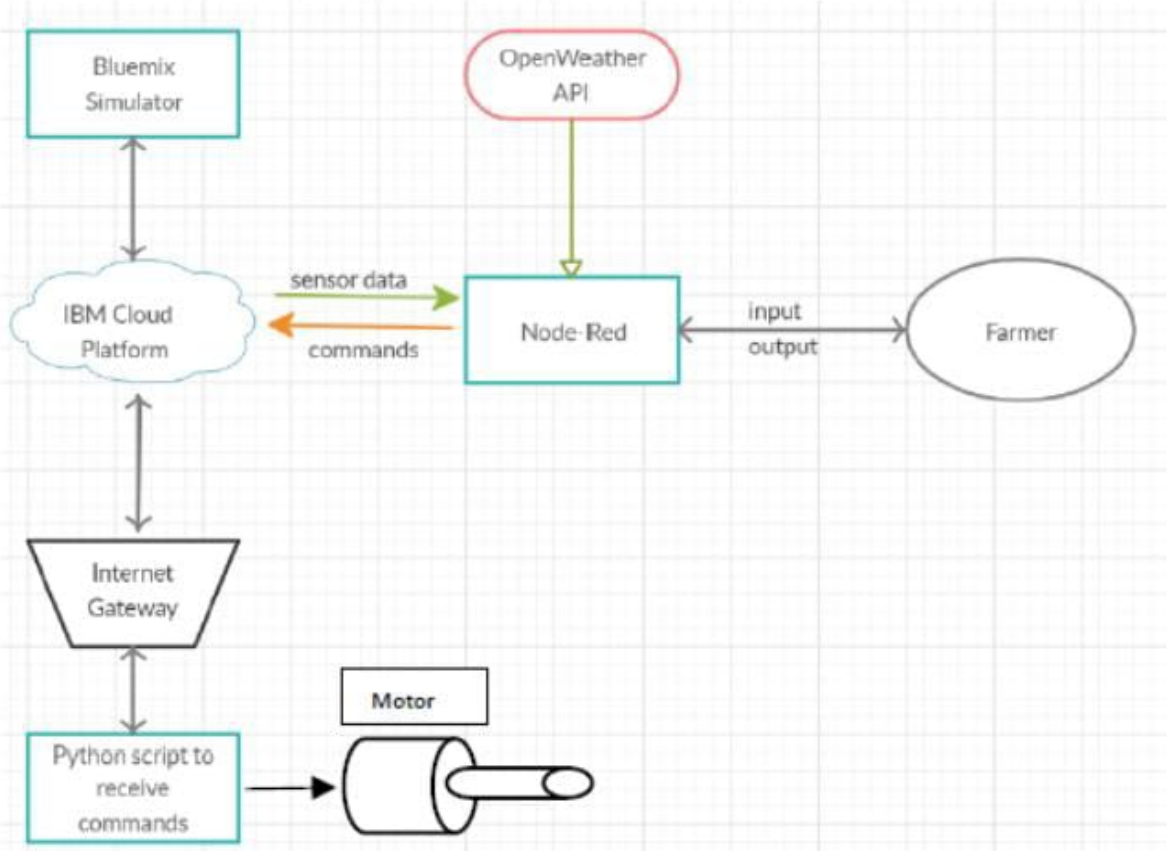
5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

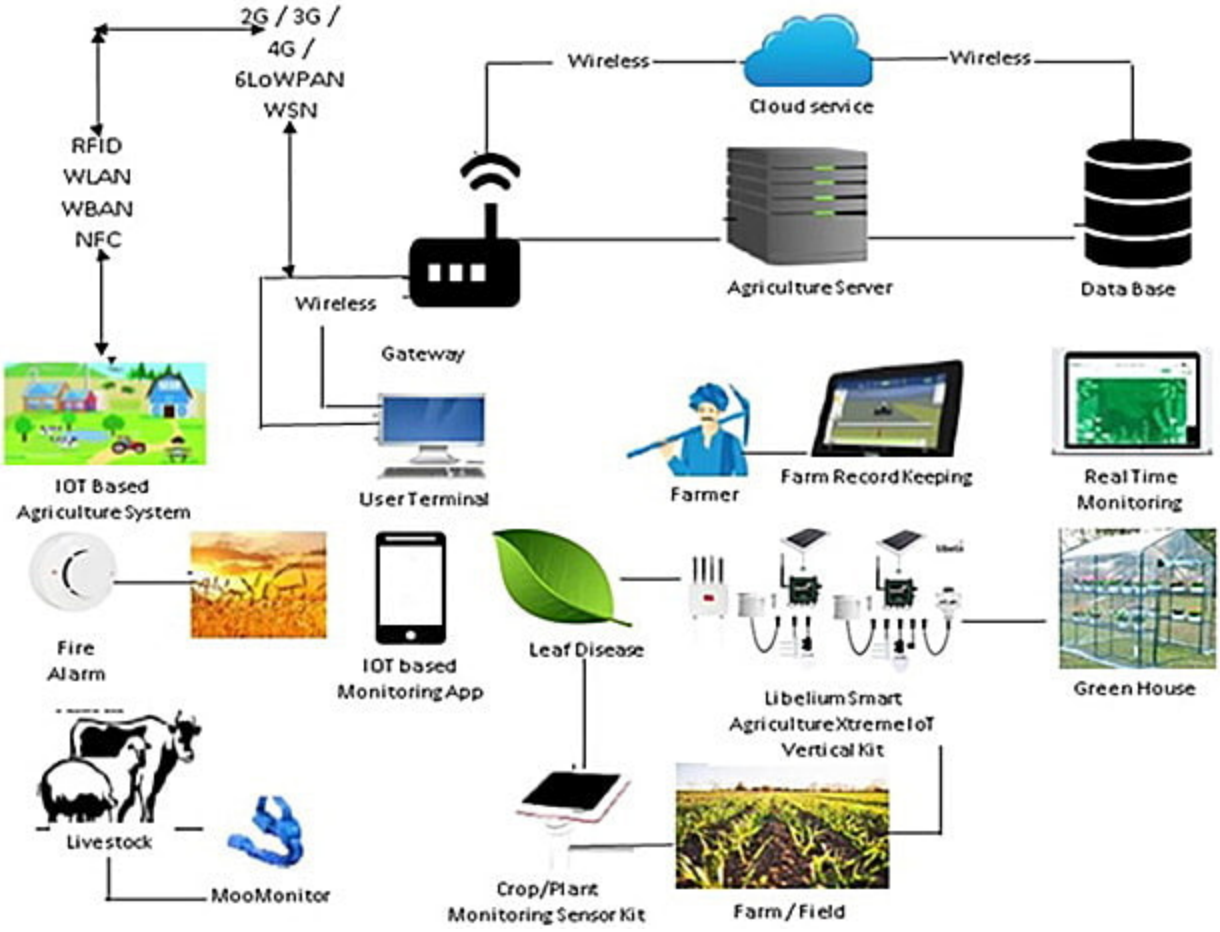
SOLUTION ARCHITECTURE:

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

1. Find the best tech solution to solve existing business problems.
2. Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
3. Define features, development phases, and solution requirements.
4. Provide specifications according to which the solution is defined, managed, and delivered.

FLOW CHART


Bluemix
Simulator
OpenWeather
API
IBM Cloud
Platform
sensor data
commands
Node-Red
input
output
Farmer
Internet
Gateway
Motor
Python script to
receive
commands



5.3 USER STORIES:

5. PROJECT PLANNING AND SCHEDULING:

5.1 SPRINT PLAN NING 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 MobileUser)	UNS-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Ajitha S (leader)
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Augusta Blessy L
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	Jenifer Gloria Daphne v
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	medium	Maheswari v
Sprint3-	Registration (Farmer -Web User)	UNS-1	As a user, I can log into the application by entering email	3	high	Ajitha S

			and password			
Sprint-2	Login	UNS-2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	high	Augusta Blessy L
Sprint-4	Web UI	UNS-3	As a user, I need to have a friendly user interface to easily view and access the resources	3	medium	Jenifer Gloria Daphne V
Sprint-1	Registration (Chemical Manufacturer - Webuser)	UNS-1	As a new user, I want to first register using my organization email and create a password for the account.	2	high	Maheswari V
Sprint-4	Login	UNS-2	As a registered user, I need to easily log	3	high	Ajitha S

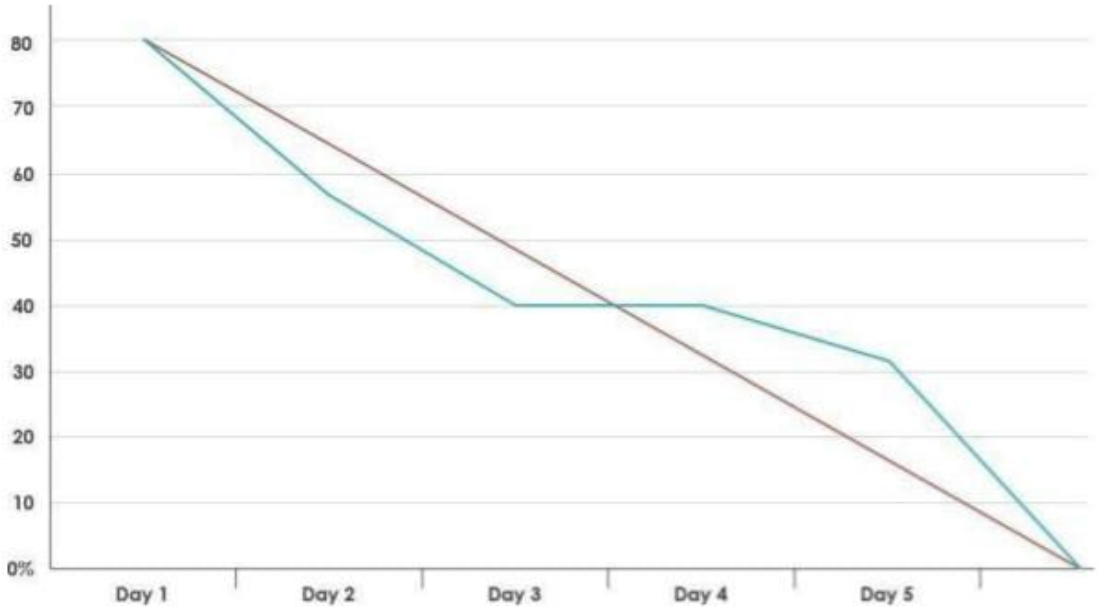
			in using the registered account via the web page.			
Sprint-3	Web UI	UNS-3	As a user, I need to have a user friendly interface to easily view and access the resources.	3	medium	Augusta Blessy L
Sprint-1	Registration (Chemical Manufacturer - Mobile User)	UNS-1	As a user, I want to first register using my email and create a password for the accoun	1	high	Jenifer Gloria Daphne V
Sprint-1	Login	UNS-2	As a registered user, I need to easily log in to the application.	2	low	Maheswari V

Project Tracker, Velocity & Burndown Chart:

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

BRUNDOWN CHART:

Burndown Chart:



6.CODING & SOLUTIONING (Explain the features added in the project along with code)

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHT.h"// Library for dht11
#include <ESP32Servo.h>
#define DHTPIN 15     // what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 11
#define LED 2
const int servoPin = 13;
```

```
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht connected
Servo motor;
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

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

#define ORG "5jveu7"//IBM ORGANITION ID
#define DEVICE_TYPE "abcdef"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "123456"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "123456789"     //Token
String data3;
float h, t;
int pos;


//-------- 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);
  motor.attach(servoPin,500,2400);
  Serial.println();
  wificonnect();
  mqttconnect();
}

void loop()// Recursive Function
{

  h = dht.readHumidity();
  t = dht.readTemperature();
  Serial.print("temp:");
  Serial.println(t);
```

```
  Serial.print("Humid:");
  Serial.println(h);
  condition(h);
  PublishData(t, h);
  delay(2000);
  if (!client.loop()) {
    mqttconnect();
  }
}
void condition(float h)
{
  if(h>30)
  {
    digitalWrite(LED,LOW);
    Serial.println("Humidity Normal,No need of Water");
    delay(500);
  }
  else
  {
    digitalWrite(LED,HIGH);
    Serial.println("Alert!!! Humidity Low, Required Water ");
    delay(500);
  }
}
```

/.....retrieving to Cloud...../

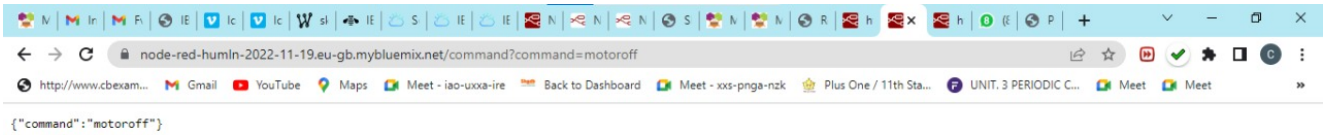
```
void PublishData(float temp, float humid) {
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String payload = "{\"temp\":";
  payload += temp;
  payload += "," "\"Humid\":";
  payload += humid;
  payload += "}";

  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.connected()) {
    Serial.print("Reconnecting client to ");
```

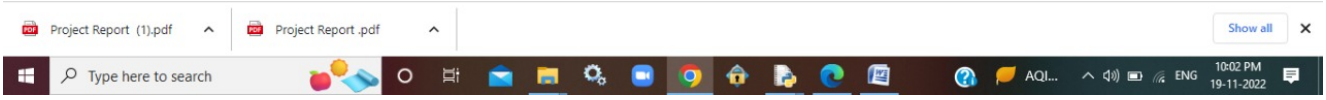
```
    Serial.println(server);
    while (!!!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(500);
    }
     initManagedDevice();
     Serial.println();
  }
}
void wificonnect() //function defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting 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() {
```

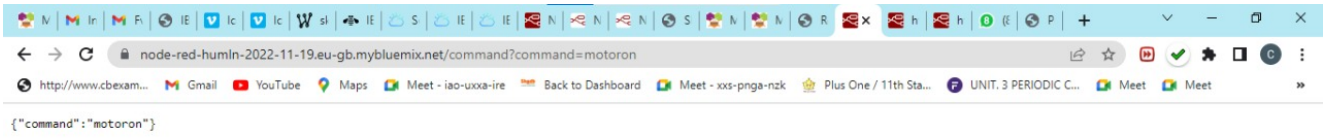
```
  if (client.subscribe(subscribetopic)) {
    Serial.println((subscribetopic));
    Serial.println("subscribe to cmd OK");
  } else {
    Serial.println("subscribe to cmd FAILED");
  }
}

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=="motoron")
  {
Serial.println(data3);
pos = 180;
motor.write(pos);
  }
  else
  {
  Serial.println(data3);
```

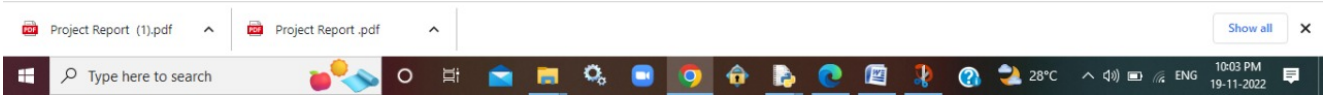
```
  pos=0;
  motor.write(pos);
  }
data3="";
}
```

7.TESTING:



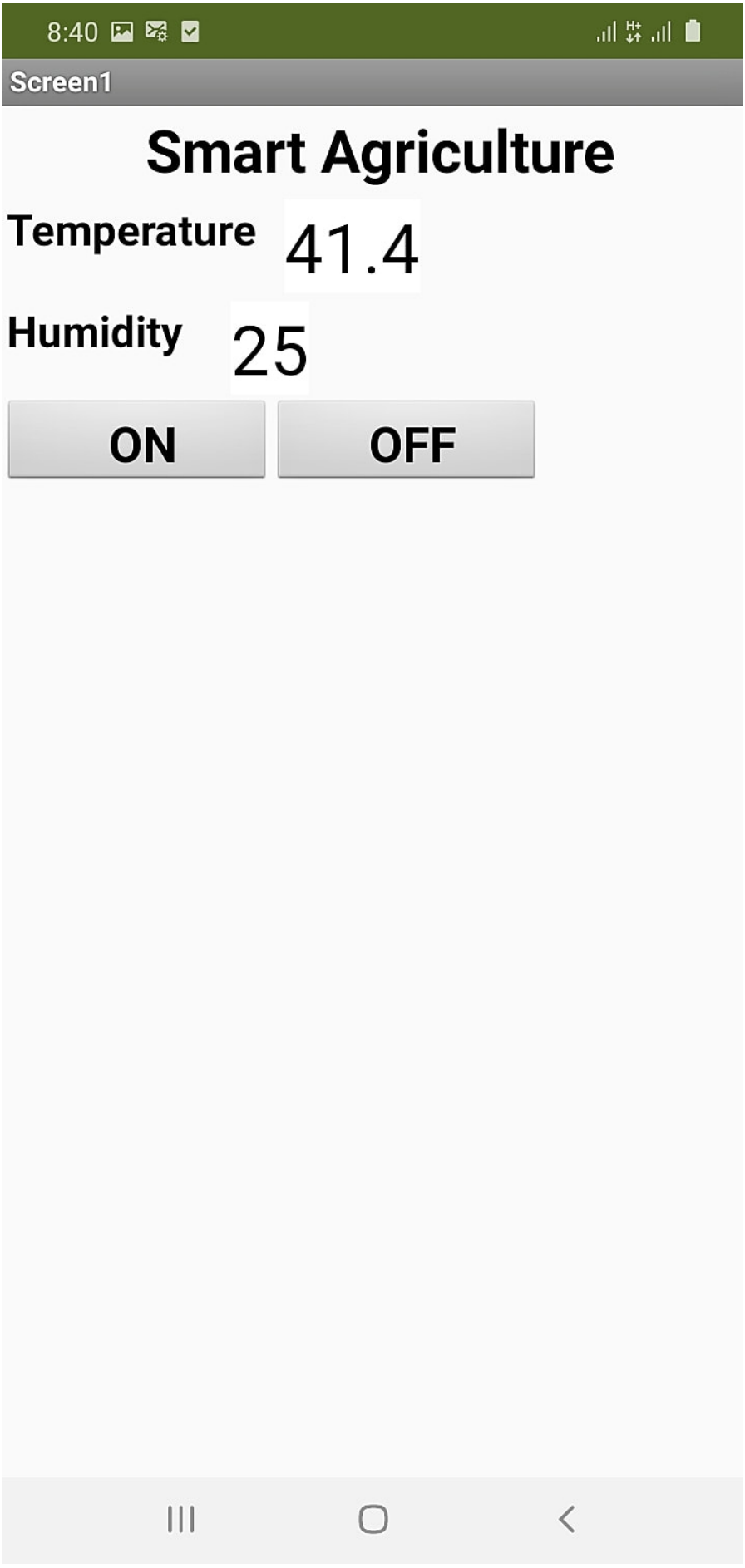






7.RESULTS:

7.1PERFORMANCE METRICS:


8:40
Screen1
Smart Agriculture
Temperature
41.4
Humidity
25
ON
OFF

8.ADVANTAGES:

- All the data like climatic conditions and changes in them can be monitored without the presence of farmers and the motor can be switched on without farmers.
- Risk of crop damage can be lowered to a greater extent.
- Many difficult challenges can be avoided making the process automated and the quality of cropscan be maintained.
- The process included in farming can be controlled using the web applicationsfrom anywhere, anytime.

DISADVANTAGES:

- Smart Agriculture requires internet connectivity continuously, but rural partscannot fulfil this requirement.
- Any faults in the sensors can cause great loss in the agriculture, due to wrongrecords and the actions of automated processes.
- IOT devices need much money to implement.

9. CONCLUSION:

An IOT based smart agriculture system using Watson IOT platform, Watson simulator, IBM cloud and Node-RED are developed by this project whichbecomes the conclusion of the project.

10.FUTURE SCOPE

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places.

11.APPENDIX

SourceCode

Github link :https://github.com/IBM-EPBL/IBM-Project-32181-1660208503

Demo video link:https://clipchamp.com/watch/BQ2jpLF3HVZ