

Smart Farmer - IoT Enabled Smart Farming Application
(TEAM ID: PNT2022TMID52627)

PROJECT REPORT

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In partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE AND ENGINEERING



COIMBATORE INSTITUTE OF TECHNOLOGY

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NOVEMBER 2022

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1.INTRODUCTION

1.1 PROJECT OVERVIEW

Agriculture is done manually from ages. As the world is trending into new technologies and implementations it is a necessary to trend up with agriculture also. Migration of people from rural to urban is a hindrance in agriculture. So to overcome this problem we have proposed an IOT and smart agriculture system. IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity. It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real-time observation.

Smart agriculture is taking over farms of all sizes by rapid speed. It is becoming a part of a movement that is known as the third green revolution. It involves the use of modern IOT devices such as security cameras, sensors, drones and actuators to manage agricultural yields. Smart agriculture has increased in profitability by providing help to both farmers and consumers.

1.2 PURPOSE

IoT in agriculture is designed to help farmers monitor vital information like humidity, air temperature and soil quality using remote sensors, and to improve yields, plan more efficient irrigation, and make harvest forecasts. Also it enables farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the amount of water used for irrigating a field. It further ensures that the farm produce is transported in the most optimal and transparent manner.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM:

- The most common challenge for the Internet of Things in agriculture is connectivity. Every area doesn't have proper internet connectivity.
- The second most common challenge for Internet of Things based Advanced Farming is the lack of awareness among consumers.
- Due to various service providers, it becomes really difficult to maintain interoperability between different IoT systems.

2.2 REFERENCES:

- 1) Smart agriculture management system using internet of things-Kaushik Sekaran¹ , Maytham N. Meqdad² , Pardeep Kumar³ , Soundar Rajan⁴ , Seifedine Kadry⁵
- 2) A RESEARCH PAPER ON SMART AGRICULTURE USING IOT- Ritika Srivastava¹, Vandana Sharma², Vishal Jaiswal³, Sumit Raj⁴
- 3) IoT in Agriculture : Smart Farming-Dr. S. Kanchana
- 4) Smart Agriculture System using IoT Technology-Adithya Vadapalli¹ , Swapna Peravali²& Venkata Rao Dadi³
- 5) Smart Agriculture Using IoT Multi-Sensors: A Novel Watering Management System-Tran Anh Khoa ^{1,2} , Mai Minh Man ¹,Tan-Y Nguyen ^{3,*} , VanDung Nguyen ⁴ and Nguyen Hoang Nam ²
- 6) SMART AGRICULTURE USING IoT-Jayakumar R, Karthikeyan S N, Naveen Perumal M, Methini M
- 7) Smart Farming using IoT, a solution for optimally monitoring farming conditions- Jash Doshi, Tirthkumar Patel, Santosh kumar Bharti
- 8) IoT Enabled Smart Farming and Irrigation System- M. Rohith, R Sainivedhana, Dr. N. Sabiyath Fatima
- 9) Smart Farming System using IoT for Efficient Crop Growth- Abhiram MSD, Jyothsnavi Kuppli, N.Alivelu Manga

10) IOT BASED SMART FARMING-Dr.C.Mageshkumar , Ms.
Sugunamuki.K.R

2.3 PROBLEM STATEMENT:

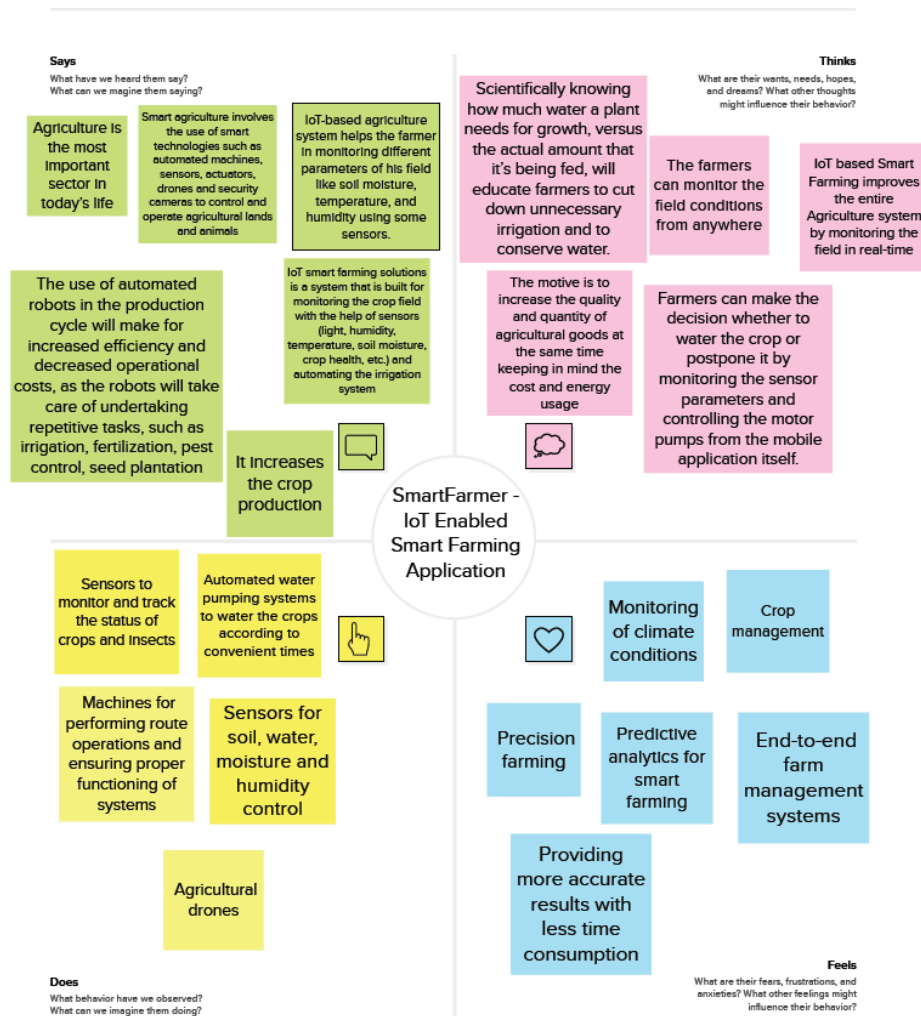
The traditional agriculture cannot meet the requirements of modern agriculture which requires high-yield, high quality and efficient output. Thus, it is very important to turn towards modernization of existing methods and using the information technology and data over a certain period to predict the best possible productivity and crop suitable on the very particular land. The adoptions of access to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning) are few key technologies characterizing the precision agriculture trend.

Customer Problem Statement Template:



3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS:



3.2 IDEATION AND BRAINSTORMING:

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts when it's not sitting in the same room.

- 1. No outside to pressure
- 2. Focus on solutions
- 3. 3-5 people recommended

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

- 1. **Team gathering**
Define who should participate in the session and what you will be doing together.
- 2. **Set the goal**
What about the problem you're looking to solving in brainstorming session?
- 3. **Brainstorming rules**
Use the following rules to ensure a safe and productive session.

Define your problem statement

What problem are you trying to solve? Frame your problem as a how might we statement. This will be the focus of your brainstorm.

How might we design an IoT based farming application with monitoring capabilities?

How can we develop this system in a cost effective and user-friendly manner?

How might we protect the crops from humidity and temperature changes?

How to monitor the crops from remote places?

Brainstorm

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

Overlapper S Software to generate alerts Sensors to detect humidity and temperature changes Cloud data storage for the device Device must be user friendly Providing basic info to the farmers Connecting using IoT and wireless technology	But IoT device must be designed to monitor the actual situation One sensor must be used to monitor the device If possible, groups should be used for the data Managing resources should be done in a way that is easy to use	With R Sensors to detect humidity and temperature changes The battery of the device must be user friendly The battery of the device must be user friendly Some additional sensors like light and air quality should be added Sensors to monitor and track the status of crops and insects
--	--	---

Group ideas

Start by sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is larger than six sticky notes, try and see if you can break it up into smaller subgroups.

- 1. 10 minutes

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

- 1. 10 minutes

After you collaborate

You can export the mind as an image or pdf to share with members of your company who might find it helpful.

- 1. 10 minutes

Automated water pumping systems to water the crops according to convenient times

Machines for performing route operations and ensuring proper functioning of systems

Providing more accurate results with less time consumption

End-to-end farm management systems

Precision farming

Predictive analytics for smart farming

Managing and tracking location using GPS and sensors

Regular monitoring of crops

User friendly interface to handle

Warning and alert system should be added to the system

Predictive analytics for smart farming

Export a claim if the crop are in bad condition

Quick add-ons

- 1. **Show the mind**
Export a copy of the mind as an image or pdf to share with members of your company who might find it helpful.
- 2. **Export the mind**
Export a copy of the mind as a PDF or PNG to which to easily include it in other documents.

Keep moving forward

- 1. **Strategy document**
Define the components of a new idea or strategy.
- 2. **Customer experience journey map**
Understand customer needs, motivations, and obstacles for an experience.
- 3. **Brainstorm, brainstorm, brainstorm**
Brainstorm, brainstorm, brainstorm. Repeat the process to generate more ideas.

3.3 PROPOSED SOLUTION

In olden days, Traditional farming methods were used where the soil and livestock were managed manually. These methods were time consuming and expensive. And also sometimes the predictions of human were not accurate also difficult to detect outbreaks at an early stage. The motive of smart farming is to increase the quality and quantity of agricultural goods at the same time keeping in mind the cost and energy usage. IoT is responsible for modernizing the agricultural field by using proficient methods and instruments to manage crops, soil and animals. This in turn has led to decrease in the waste generation and a phenomenal increase in productivity. This is smart agriculture using IoT.

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Farmers and land owners	6. CUSTOMER CONSTRAINTS CC Usage of large number of sensors and unlimited internet connection	5. AVAILABLE SOLUTIONS AS Traditional farming methods were time consuming and expensive. And also the predictions of human were not accurate and will be difficult to detect outbreaks at an early stage. The motive of smart farming is to increase the quality and quantity of agricultural goods and reducing the cost and energy usage. IoT is responsible for modernizing the agricultural field by using proficient methods to manage crops, soil and animals.	Explore AS, differentiate

Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS J&P Agriculture is done manually from ages. As the world is trending into new technologies and implementations it is a necessary to trend up with agriculture also. Migration of people from rural to urban is a hindrance in agriculture. So to overcome this problem we have proposed an IOT and smart agriculture system.	9. PROBLEM ROOT CAUSE RC Frequent changes and unpredictable weather and climate made it difficult for farmers to engage in agriculture. These factors play an important role in deciding whether to water your plants. Fields are difficult to monitor when the farmer is not at the field, leading to crop damage.	7. BEHAVIOUR BE Use a proper drainage system to overcome the effects of excess water from heavy rain. Use of hybrid plants that are resistant to pests	Focus on J&P, tap into BE, understand RC

3. TRIGGERS TR Farmers who are away from their land face difficulties. Farmers have a hard time predicting the weather. Random decisions result in low yield. So we collect accurate data and make correct decisions.	10. YOUR SOLUTION SL First, we collect data from various types of sensors and send the values to the main server. Then it collects humidity data, temperature data, soil moisture data and on/off condition of motor switch from the various sensors. Finally the farmer can do smart agriculture through a mobile app using the above data.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE Checking the humidity, temperature, soil moisture and motor switch 8.2 OFFLINE Conducting Awareness camps.
4. EMOTIONS: BEFORE / AFTER EM BEFORE: Lack of knowledge in weather forecasting → Random decisions → low yield. AFTER: Data from reliable source → correct decision → high yield		

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop diseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check details	Temperature details Humidity details
FR-6	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of <u>live stock</u> conditions

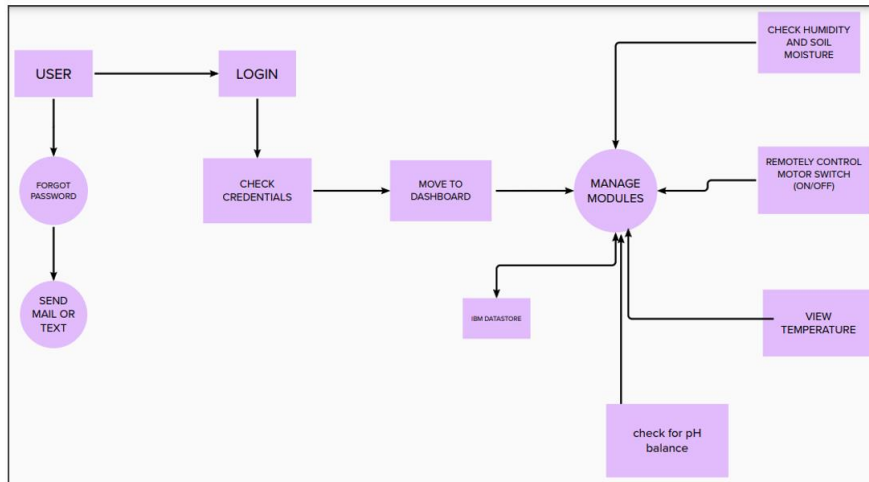
4.2 NON FUNCTIONAL REQUIREMENTS:

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

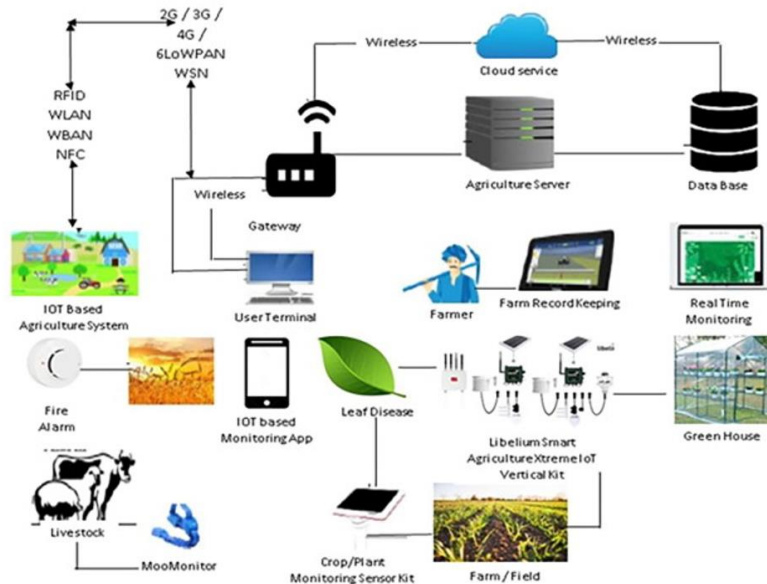
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	User friendly guidelines for users to avail the features. Most simplistic user interface for ease of use.
NFR-2	Security	All the details about the user are protected from unauthorized access. Detection and identification of any misfunctions of sensors.
NFR-3	Reliability	Implementing Mesh IoT Networks Building a Multi-layered defence for IoT Networks.
NFR-4	Performance	The use of modern technology solutions helps to achieve the maximum performances thus resulting in better quality and quantity yields.
NFR-5	Availability	This app is available for all platforms
NFR-6	Scalability	Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation.

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAM:



5.2 SOLUTION AND TECHNICAL ARCHITECTURE:



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, 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 Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer (Web user)	Dashboard	USN-5	As a User can view the dashboard, and this dashboard include the check roles of access and then move to the manage modules.	I can view the dashboard in this smart farming application system.	High	Sprint 2
		USN-6	User can remotely access the motor switch	In the smart farming app	High	Sprint 3
Administrator			As a user once view the manage modules this describes the Manage system Admins and Manage Roles of User and etc.			Sprint 2

6.PROJECT PLANNING & SCHEDULING

6.1Sprint Planning & Estimation:

The purpose of Sprint planning is to define what can be delivered in the sprint and how the work can be achieved. It kicks off the session by setting the agenda and focus.If done correctly,it also creates an environment where the team is motivated,challenged and can be successful.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Simulation creation	USN-1	Connects sensors and Arduino with python code	2	High
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform,workflow for IoT scenarios 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 the software.	2	High

6.2Sprint Delivery Schedule:

This consist of sprints with respective to their duration,sprint start and end date and the releasing data.

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		05 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Oct 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		15 Oct 2022

7.CODING AND SOLUTIONING

Connecting Sensors with Arduino using C++ code:

```
#include "Arduino.h"

#include "dht.h"

#include "SoilMoisture.h"

#define dht_apin A0

const int sensor_pin = A1; //soil moistureint pin_out = 9;
dht DHT; int c=0;

void setup()
{
  pinMode(2, INPUT); //Pin 2 as INPUT pinMode(3,
  OUTPUT); //PIN 3 as OUTPUTpinMode(9,
  OUTPUT); //output for pump
}

void loop()
{

  if (digitalRead(2) == HIGH)
  { digitalWrite(3, HIGH);      // turn the LED/Buzz ON
    delay(10000); // wait for 100 msecond digitalWrite(3, LOW);
                                // turn the LED/Buzz OFF

    delay(100);
  }

  Serial.begin(9600);
  delay(1000);
  DHT.read11(dht_apin); //tempraturefloat
  h=DHT.humidity;
  float t=DHT.temperature;
  delay(5000); Serial.begin(9600);
```

```

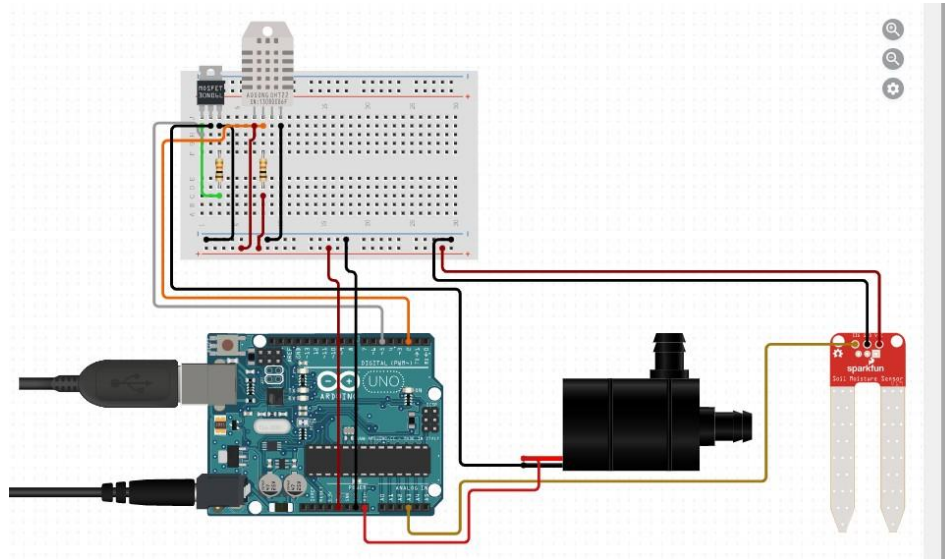
float moisture_percentage;int
sensor_analog;
sensor_analog = analogRead(sensor_pin);
moisture_percentage = ( 100 - ( (sensor_analog/1023.00) *100 ) );
float m=moisture_percentage;
delay(1000);
if(m<40)//pump
{
while(m<40)
{

digitalWrite(pin_out,HIGH);          //open pump
sensor_analog = analogRead(sensor_pin);
moisture_percentage = ( 100 - ( (sensor_analog/1023.00) *100 ) );
m=moisture_percentage;
delay(1000);
}
digitalWrite(pin_out,LOW);          //closepump
}
if(c>=0)
{
mySerial.begin(9600);
delay(15000); Serial.begin(9600);
delay(1000); Serial.print("\r");
delay(1000);

Serial.print((String)"update-
>" +(String)"Temprature="+t+(String)"Humidity="+h+(String
)"Moisture="+m);
delay(1000);
}

```

Circuit Diagram:



Sensor Connection:



Device Details:

BrowseActionDevice TypesInterfaces

Add Device

Browse Devices

All DevicesDiagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Search by Device ID

Device Simulator

	Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
>	pgs460_sensor	Disconnected	Ultrasonic	Device	Oct 25, 2022 1:19 PM	
>	sf_1018	Disconnected	smartfarmer	Device	Nov 5, 2022 10:39 PM	
>	smartfarmer_1	Connected	smartfarmer	Device	Nov 5, 2022 10:49 PM	

Items per page 50 | 1-3 of 3 items

1 of 1 page

1 Simulation running

Back

Device Drilldown - smartfarmer_1

Connection Information

Recent Events

State

Device Information

Metadata

Diagnostics

Connection Logs

Device Actions

Date Added

Added By

Connection Status

Nov 5, 2022 10:49 PM

820419205501@smartinternz.com

Connected

Connection Time: Nov 5, 2022 10:50 PM

Client Address: 42.109.128.85 SecureToken

Recent Events

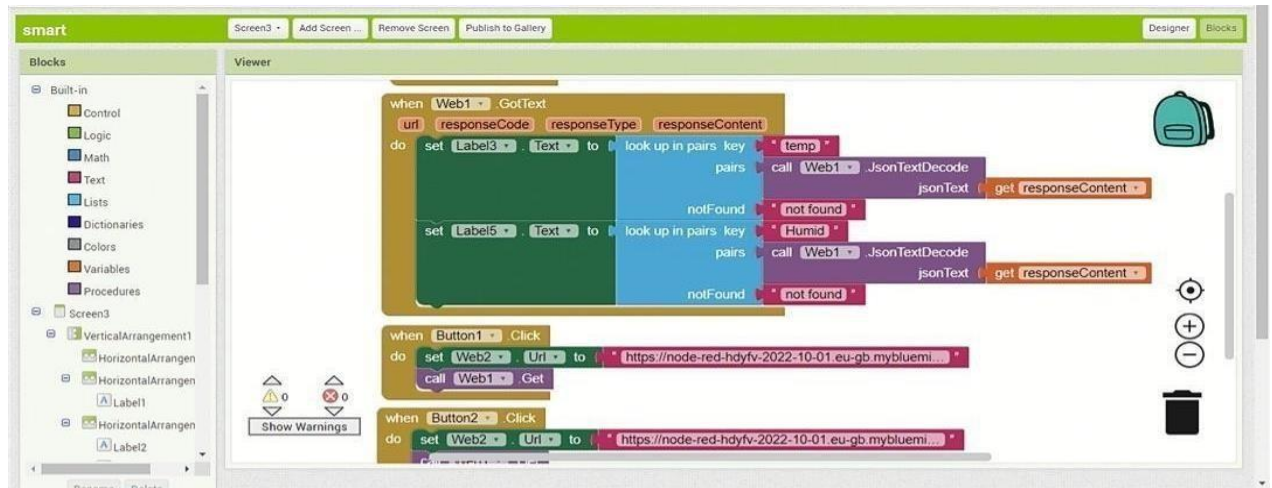
The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
IoTSensor	{"temp":15,"hum":78,"moist":66}	json	a few seconds ago
IoTSensor	{"temp":41,"hum":90,"moist":15}	json	a few seconds ago
IoTSensor	{"temp":54,"hum":29,"moist":61}	json	a few seconds ago
IoTSensor	{"temp":46,"hum":38,"moist":77}	json	a few seconds ago

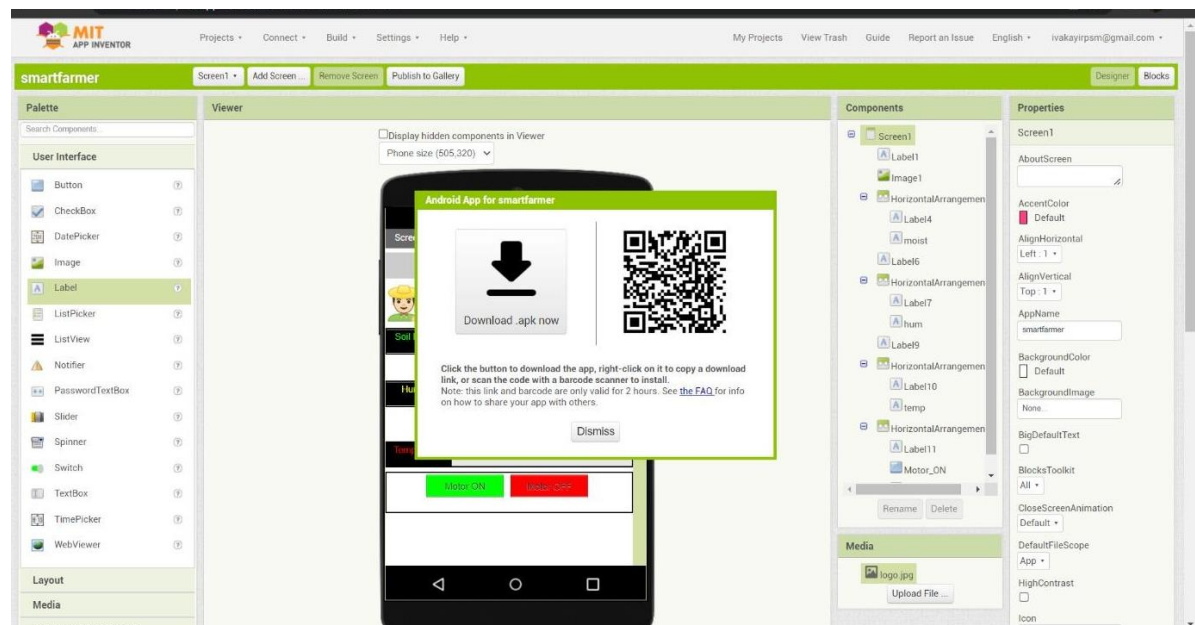
1 Simulation running

Creating Mobile app using MIT app

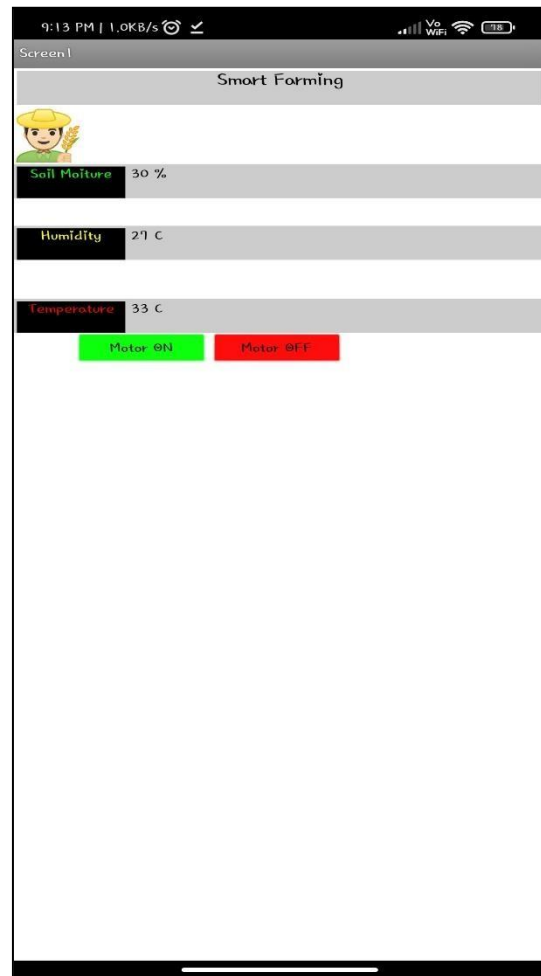
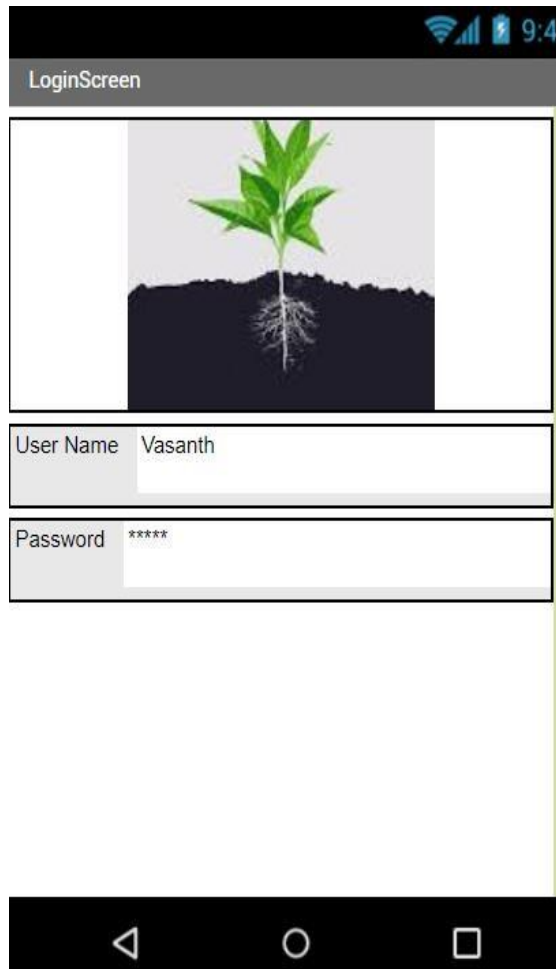
Inventor:



QR Code for APK download:

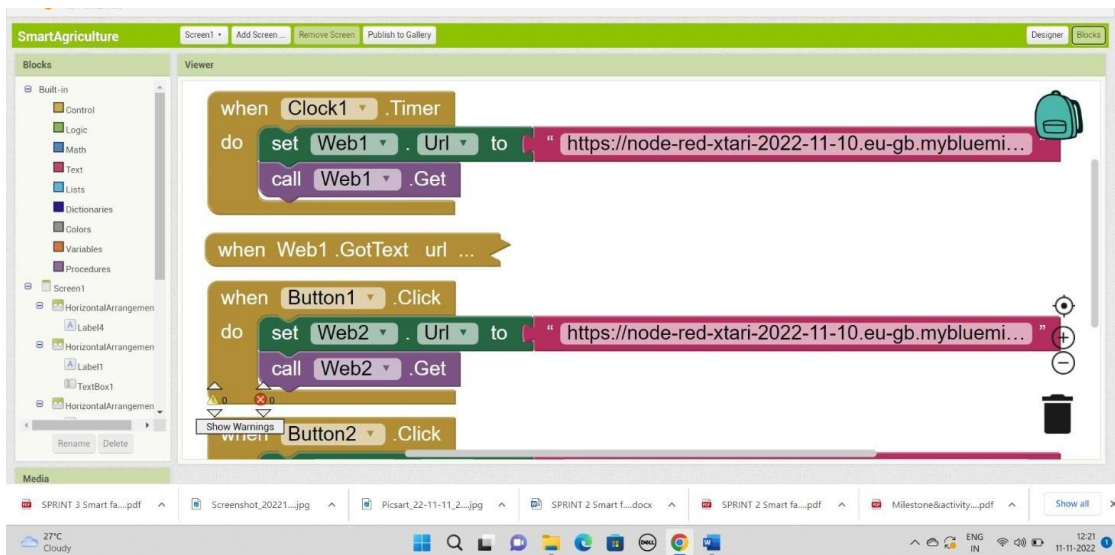
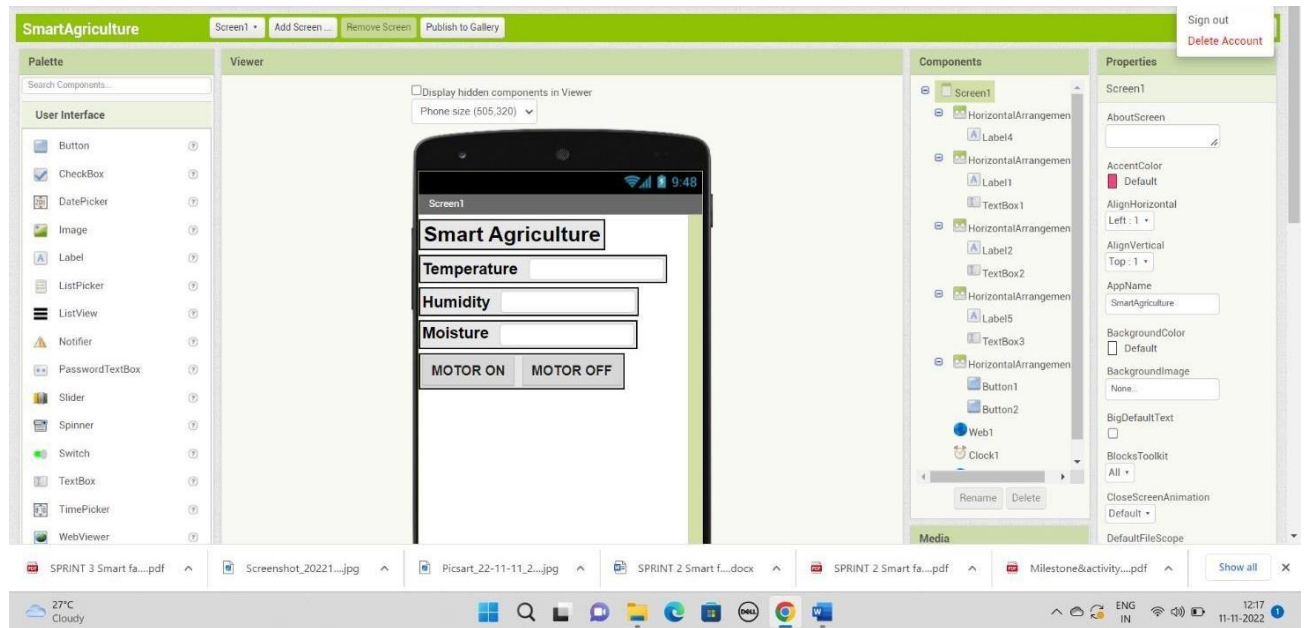


Output Screen in Mobile :

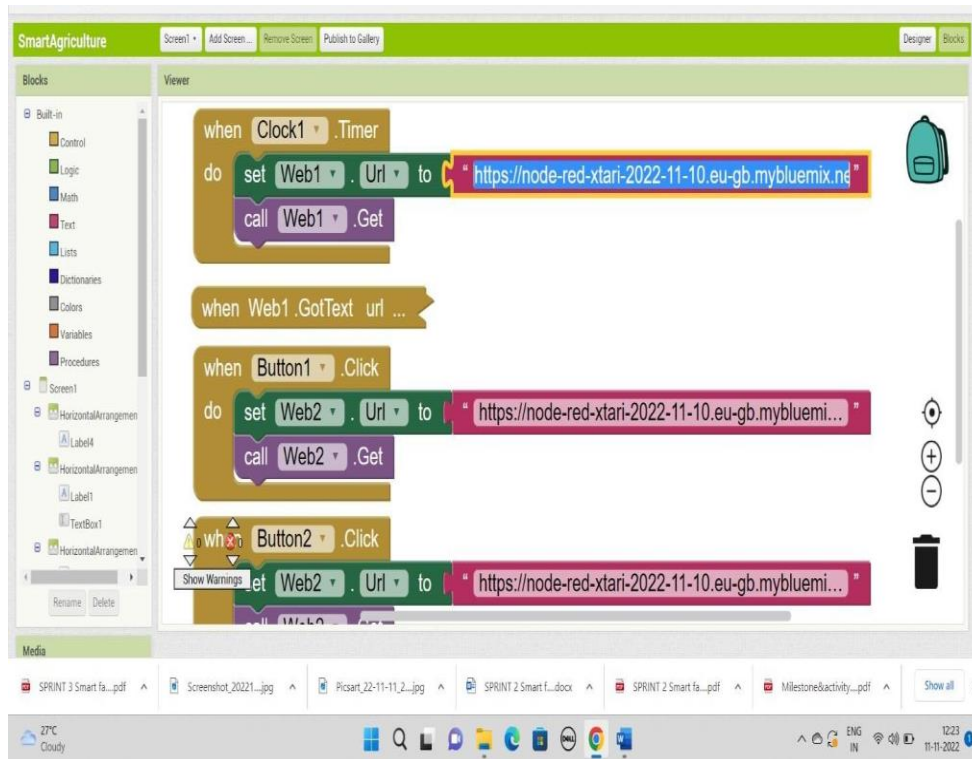


Creating a MIT Account

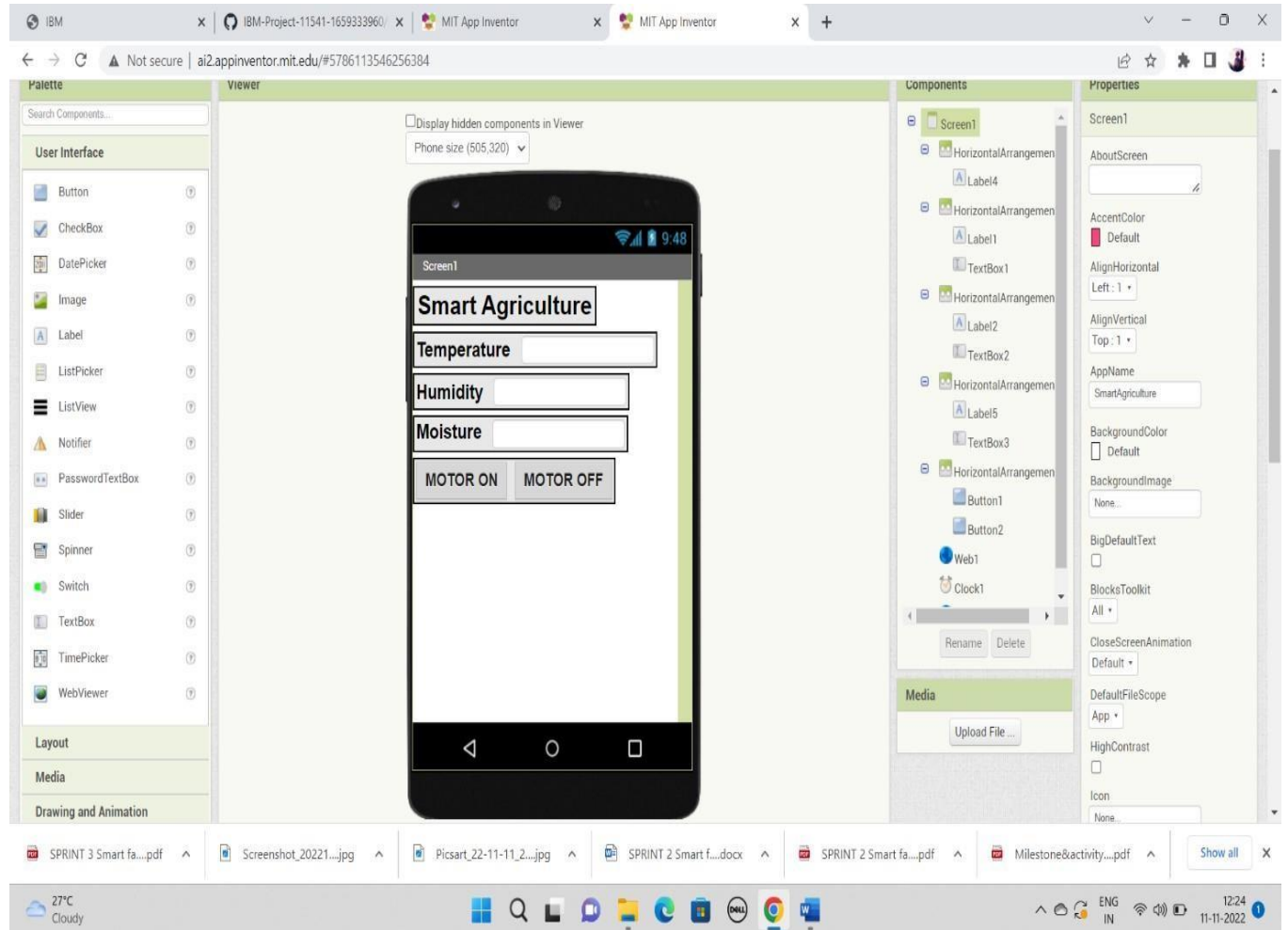
Creating Blocks to Build the Mobile Application



Configuring the Blocks with the Node Red Link:

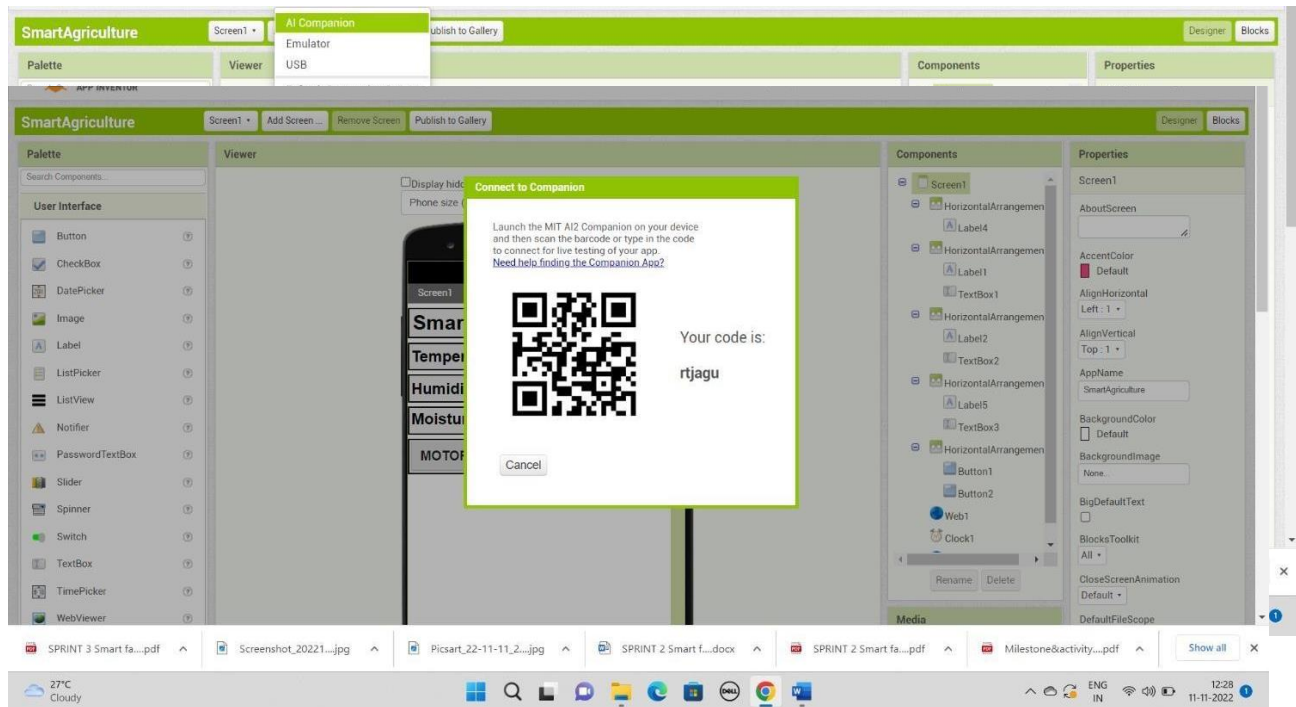


Creating the Mobile Interface:

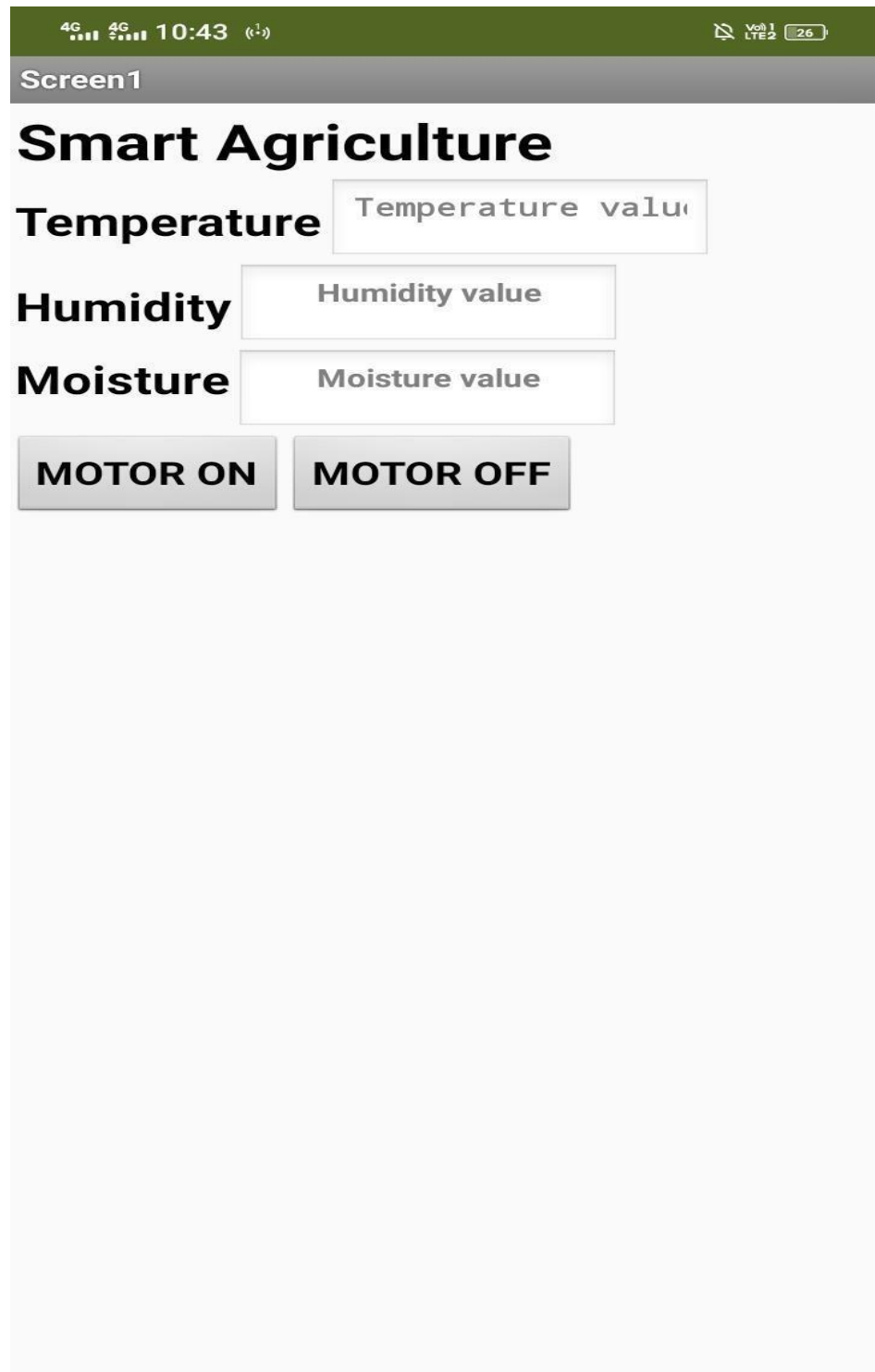


Connecting it to the AI Companion

QR Code to Connect with the Mobile



Mobile Connected Interface



Receiving Data:

Screen1

Smart Agriculture

Temperature69

Humidity54

Moisture45

MOTOR ONMOTOR OFF

Motor ON and Motor OFF Command and Output:



8.TESTING

8.1 TEST CASES:

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9.RESULTS

9.1 PERFORMANCE METRICS:

The system's performance is determined by its accuracy. It should detect leakage as soon as possible. It should be sensitive towards leakage and should be reliable.

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Increased work efficiency. One of the greatest things about Smart Farming is its potential to save valuable time. ...
- Improved fuel efficiency. Smart Farming allows farmers to be much more precise. ...

- Reduced consumables. ...
- Increased yields.

DISADVANTAGES

The main disadvantage is the time it can take to process the information.

Farmers are so busy with harvesting and caring for their crops that they may not have time to process data. There are also issues with the water supply, as well as issues with the cost of the technology, which can be quite expensive.

11.CONCLUSION

In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere.

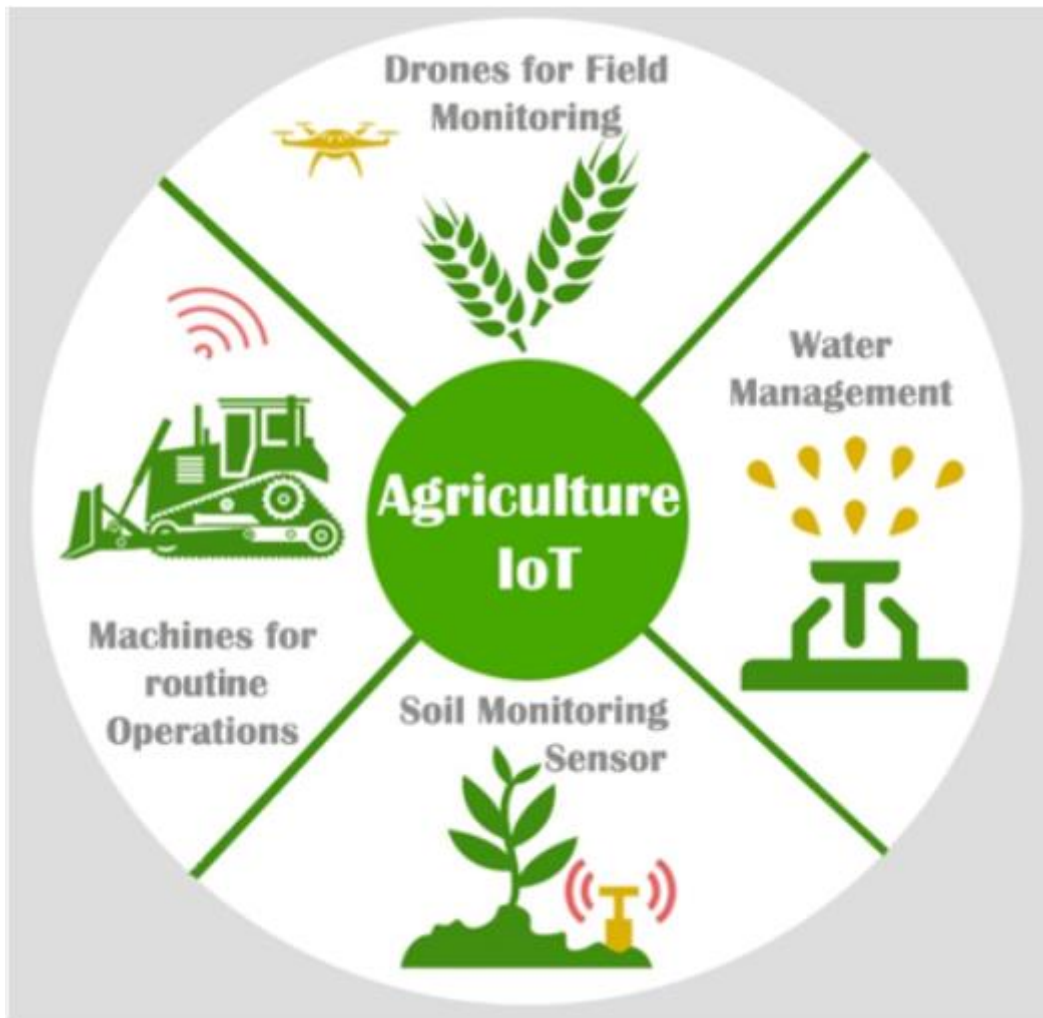
12.FUTURE SCOPE

Through collecting data from sensors using IoT devices, you will learn about the real-time state of your crops. The future of IoT in agriculture allows predictive analytics to help you make better harvesting decisions. Pattern forecasting can be used by farmers to predict weather patterns and crop harvesting.

13.APPENDIX

"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 optimizing the human labor required by production. The Internet of Things (IoT) has provided ways to improve nearly 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 about agriculture. What exactly is a smart farm, though? Here is a rundown of what smart farming is and how it's changing agriculture.



Github Link: <https://github.com/IBM-EPBL/IBM-Project-47963-1660803584>

Project Demo Link: <https://clipchamp.com/watch/Y4rvLRN3tfb>

