Smart Farmer - IoT Enabled Smart Farming Application

(TEAM ID: PNT2022TMID41919)

PROJECT REPORT

Submitted by

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In partial fulfilment for the award of the degree of

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INDEX

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

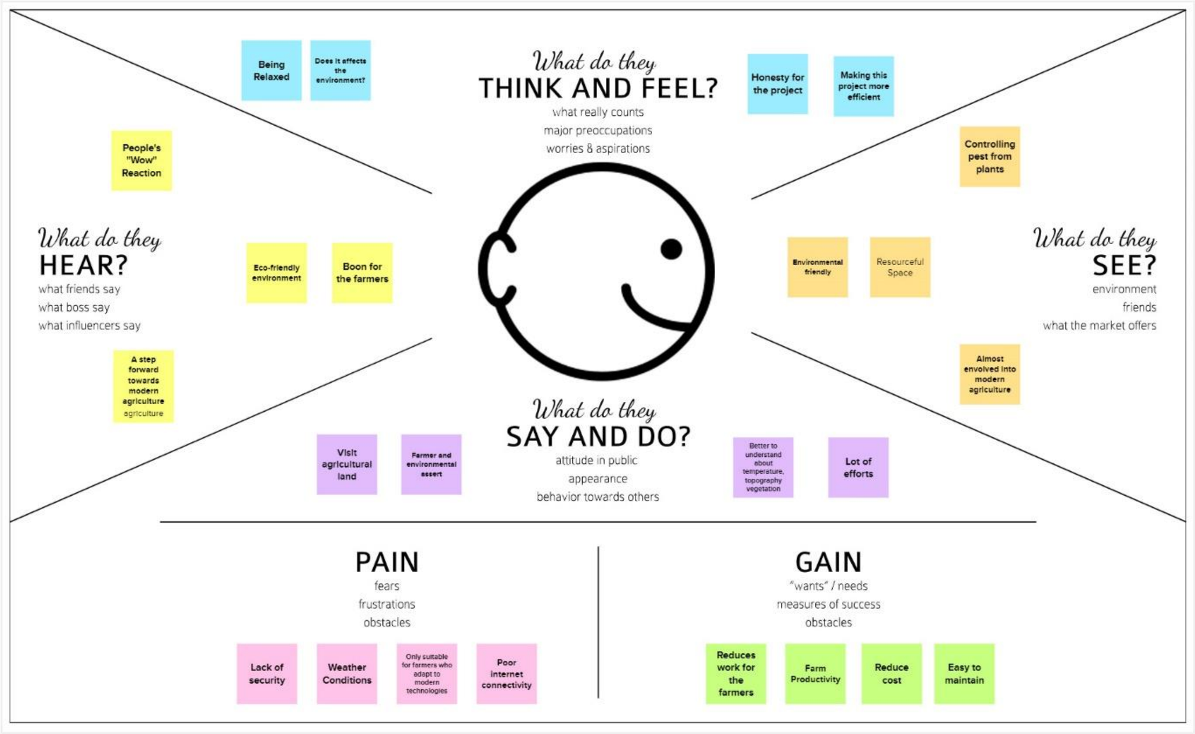
2.3 PROBLEM STATEMENT:

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.

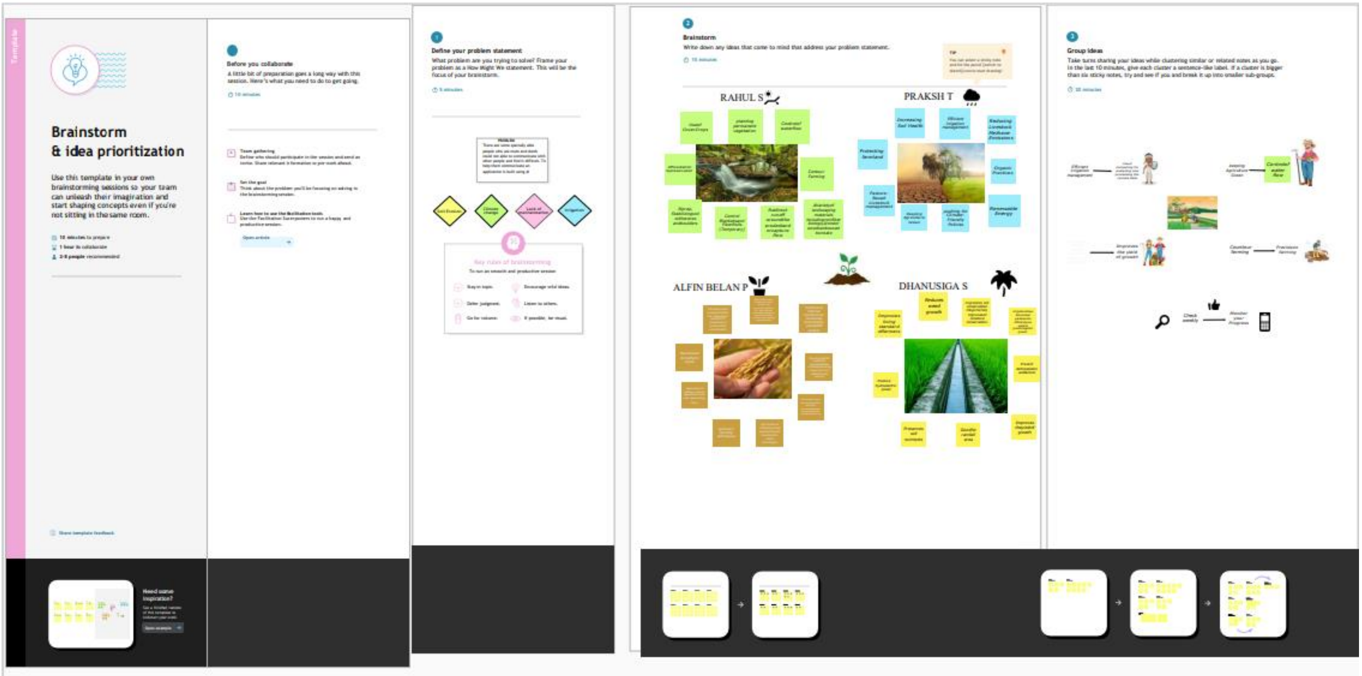
Customer Problem Statement Template:

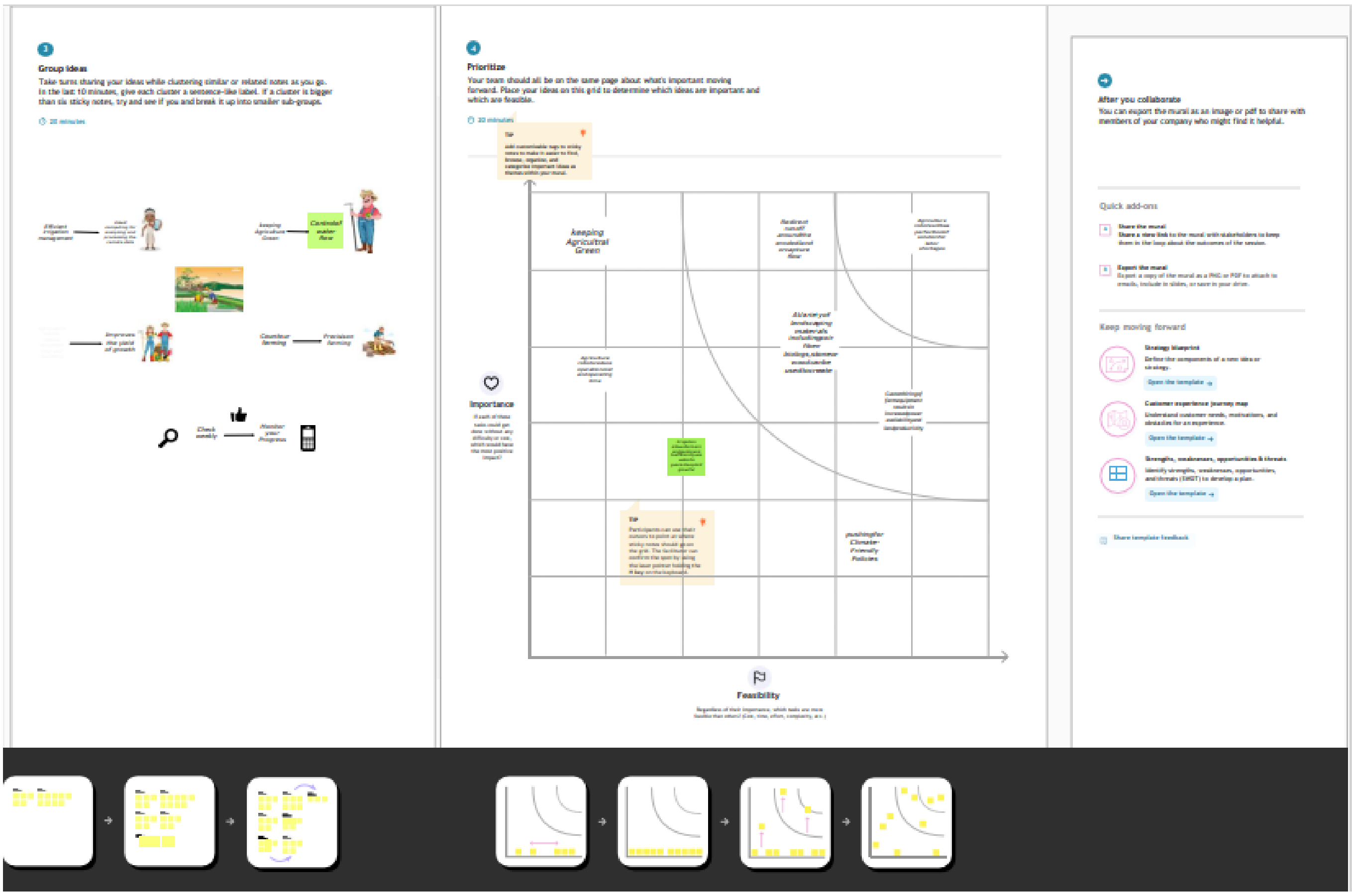
3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS:



3.2 IDEATION AND BRAINSTORMING:





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

1. CUSTOMERSEGMENT(S)
Whoisyourcustomer?

The customer are farmer

6.CUSTOMERLIMITATIONS EG.BUDGET,DEVICES
Whatlimitsyourcustomerstoactwhenproblemoccurs?

The biggest challenges faced by farmers in the agricultural sector are lack of information, high adoption costs, and security concerns, etc.

5.AVAILABLESOLUTIONS PLUSES&MINUSES
Whichsolutionsareavailabletothecustomerwhenhe/sheisfacingtheproblem?Whathad he/shetriedinthepast?Pluses&minuses?

Conventional farming which relies on chemical intervention is used. Recycling of water can be done.

ExploreAS,differentiate

2. JOBS-TO-BE-DONE/PROBLEMS PR
Which jobs-to-be-done(or problems) do you address for your customers?

Large consumption of natural resources in the agricultural sector need to be Redused. Proper monitoring of Weather conditions must be maintained

9. PROBLEMROOT/CAUSE RC
What is the real reason that this problem exists?

Poor soil quality results from inadequate fertilization.Because of population growth and rising standard of living, the demand for natural resources increases.

7.BEHAVIOR +ITSINTENSITY BE
What does your customer do to address the problem and get the job done?

Use a proper drainage system to overcome the effects of excess water from heavy rain. Use of hybrid plants that are resistant to pests.

FocusonPR,tapintoBE,understandRC

IdentifystrongTR&EM

3.TRIGGERS TR
Whattriggerscustomertoact?

Labour and energy cost is more expensive.

4. EMOTIONS BEFORE/AFTER EM
Whichemotionsdopeoplefeelbefore/afterthisproblemissolved?

BEFORE: lack of knowledge in monitoring and Manintenance>Random secisions>Low Yield
AFTER:Proper monitoring and maintenance>preventive

10.YOURSOLUTION SL

Use of IOT sensors enables to get accurate real time information such as temperature, humidity and soil condition.when and how much to fertilize, irrigate, and spray pesticides.

8. CHANNELSofBEHAVIOR CH

ONLINE
What kind of actions do customers take online?

Farmers seek information about weather conditions, preventive measures for crops through online.

OFFLINE

Awareness camps to be organized to teach the importance and advantages of the automation and IoT in the development of agriculture.

Extractonline&offlineCHofBE

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

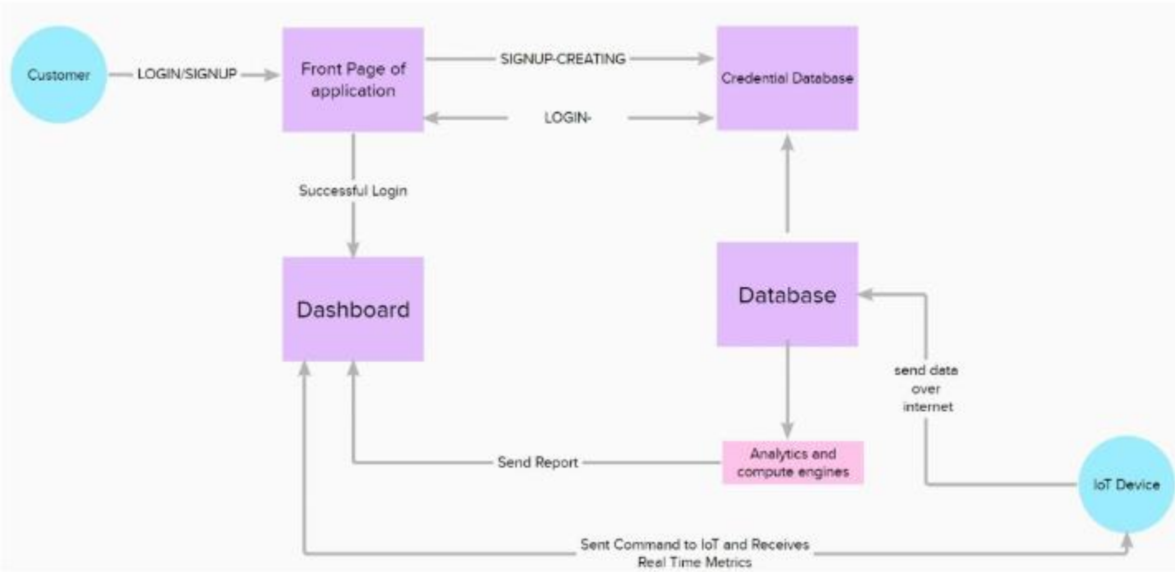
FRNo.	FunctionalRequirement(Epic)	SubRequirement(Story/Sub-task)
FR-1	IoTDevices	SensorsandWi-Fimodule.
FR-2	Software	WebUI, Node-red,IBMWatson,MITapp
FR-3	User registration	Register from registration through Gmail
FR-4	User conformation	❖ Conformation via mail ❖ Conformation via OTP
FR-5	System login	❖ Check authorization ❖ Check accesses

4.2 NON FUNCTIONAL REQIREMENTS:

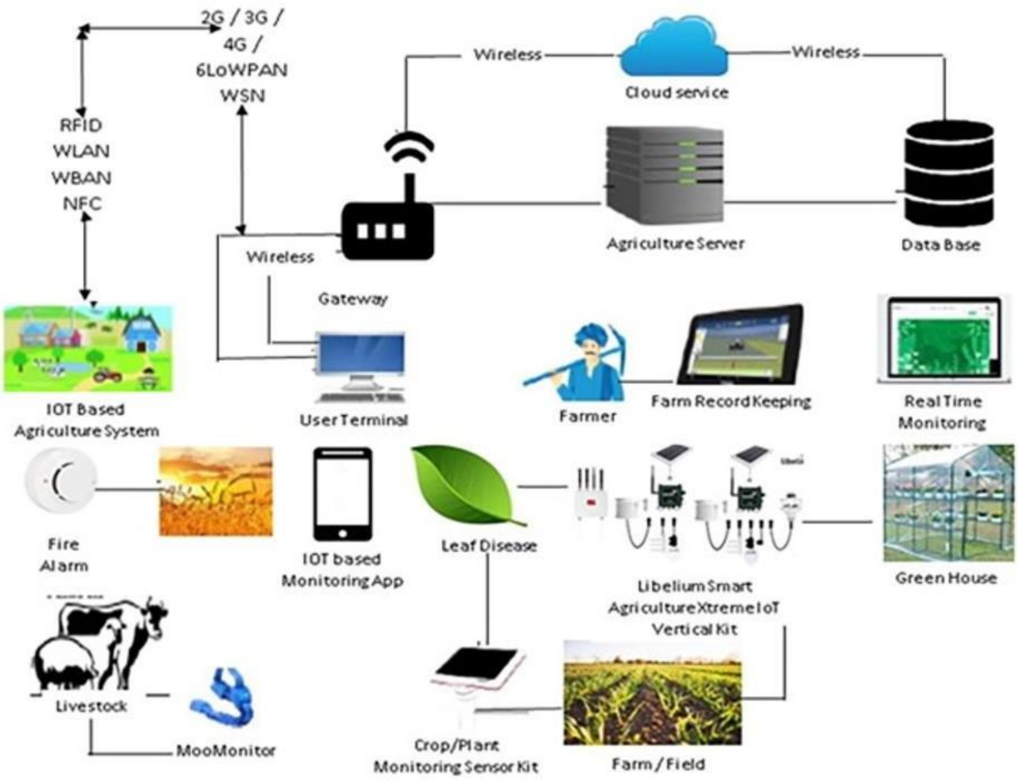
FRNo.	Non-FunctionalRequirements	Description
NFR-1	**Usability**	Usability specify the quality attributes of system. Timeconsumeabilityisless, Productivityishigh.
NFR-2	**Security**	Ithas lowlevelofsecurityfeaturesduetointegration Of sensor data.
NFR-3	**Reliability**	Accuracyofdataandhenceit is Reliable.
NFR-4	**Performance**	Performanceishighandhighlyproductive.
NFR-5	**Availability**	With permitted network connectivity the applicationisaccessible.
NFR-6	**Scalability**	Itis perfectlyscalablemanynewconstraints canbeadded.

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

6.1 Sprint 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

6.2 Sprint 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

PYTHON CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "5myh1a" #replace the ORG ID
deviceType = "iot_device"#replace the Device type wi
deviceId = "12344321"#replace Device ID
authMethod = "token"
authToken = "1234567890" #Replace the authtoken
# Initialize GPIO
#Receives Command from Node-red
def myCommandCallback(cmd):
    print ("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    elif status == "motoroff" :
        print ("motor is off")
try:
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-
method": authMethod, "auth-token":
    authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()
    # Connect and send a datapoint "hello" with value "world" into the cloud as an
event of type "greeting" 10 times
deviceCli.connect()
while True:
#Get Sensor Data from DHT11
    temp=random.randint(0,100)
    Humid=random.randint(0,100)
    soilmoisture=random.randint(0,100)
    data = { 'temp' : temp, 'Humid': Humid, 'soilmoisture': soilmoisture
 }
```

```
#print data
    def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "soilmoisture = %s %%"%soilmoisture, "to IBM Watson")
    success = deviceCli.publishEvent("devices", "json", data, qos=0, on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoTF")
    time.sleep(5)
    deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

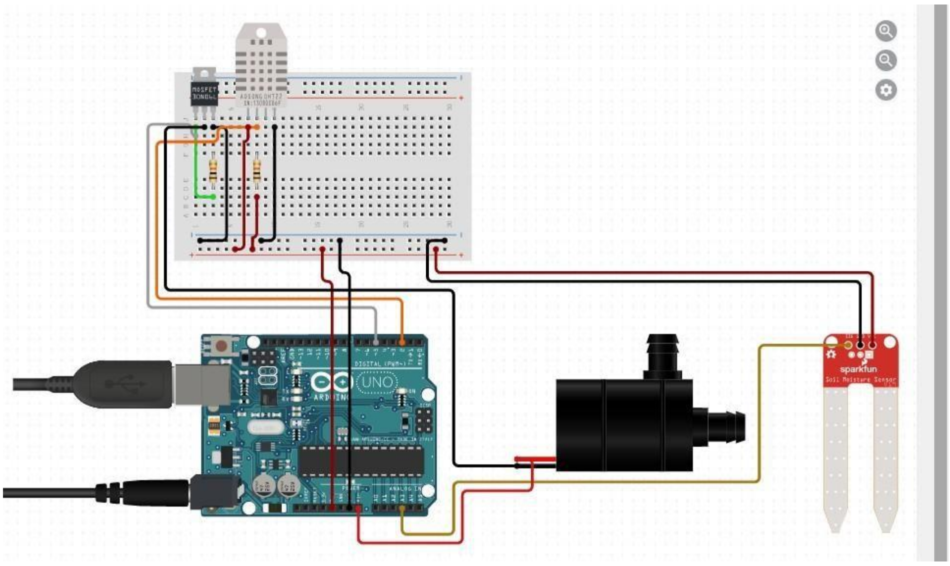
Connecting Sensors with Arduino using C++ code:

```
#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);
```

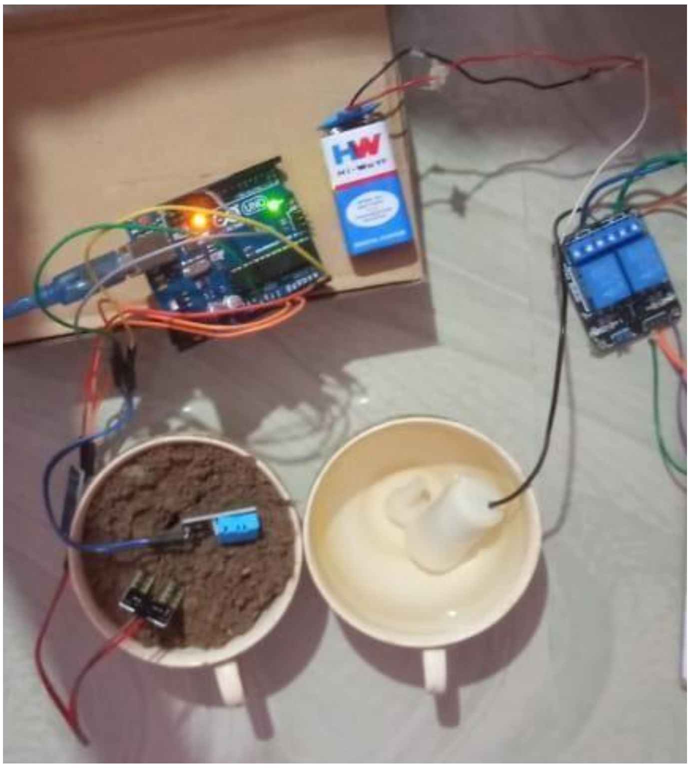
```
}
 Serial.begin(9600);
   delay(1000);
  DHT.read11(dht_apin); //tempraturefloat
h=DHT.humidity;
float t=DHT.temperature;
 delay(5000); Serial.begin(9600);
```

```
 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);
  }
```

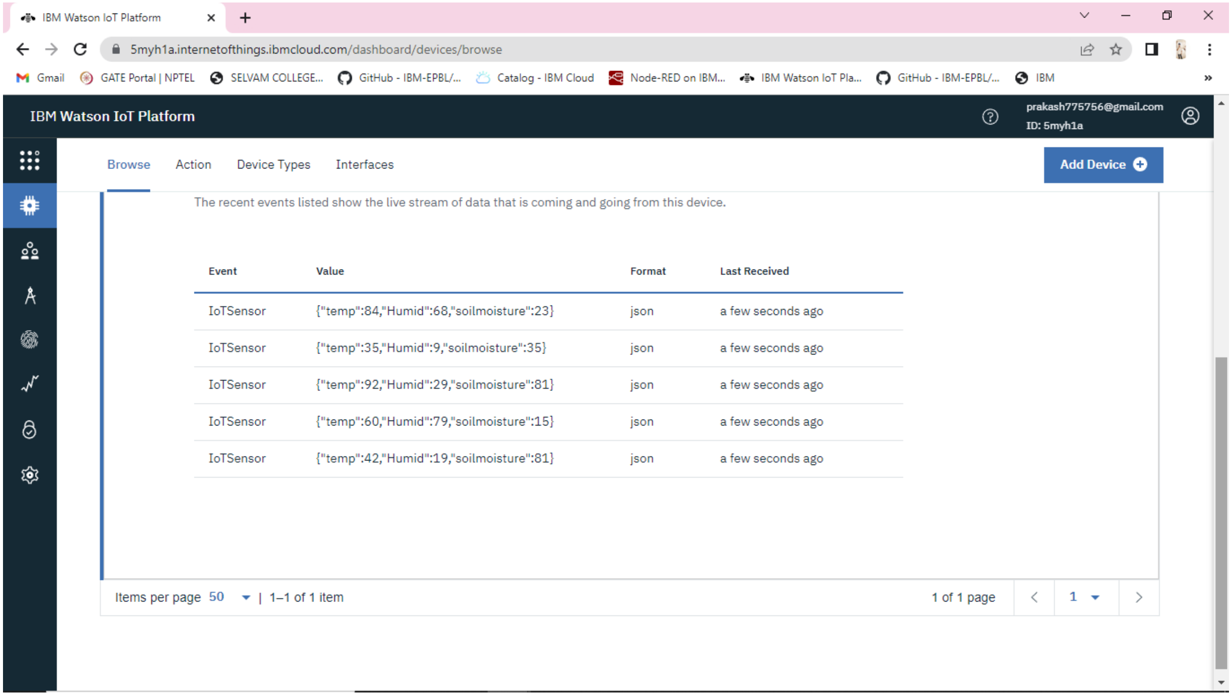
Circuit Diagram:

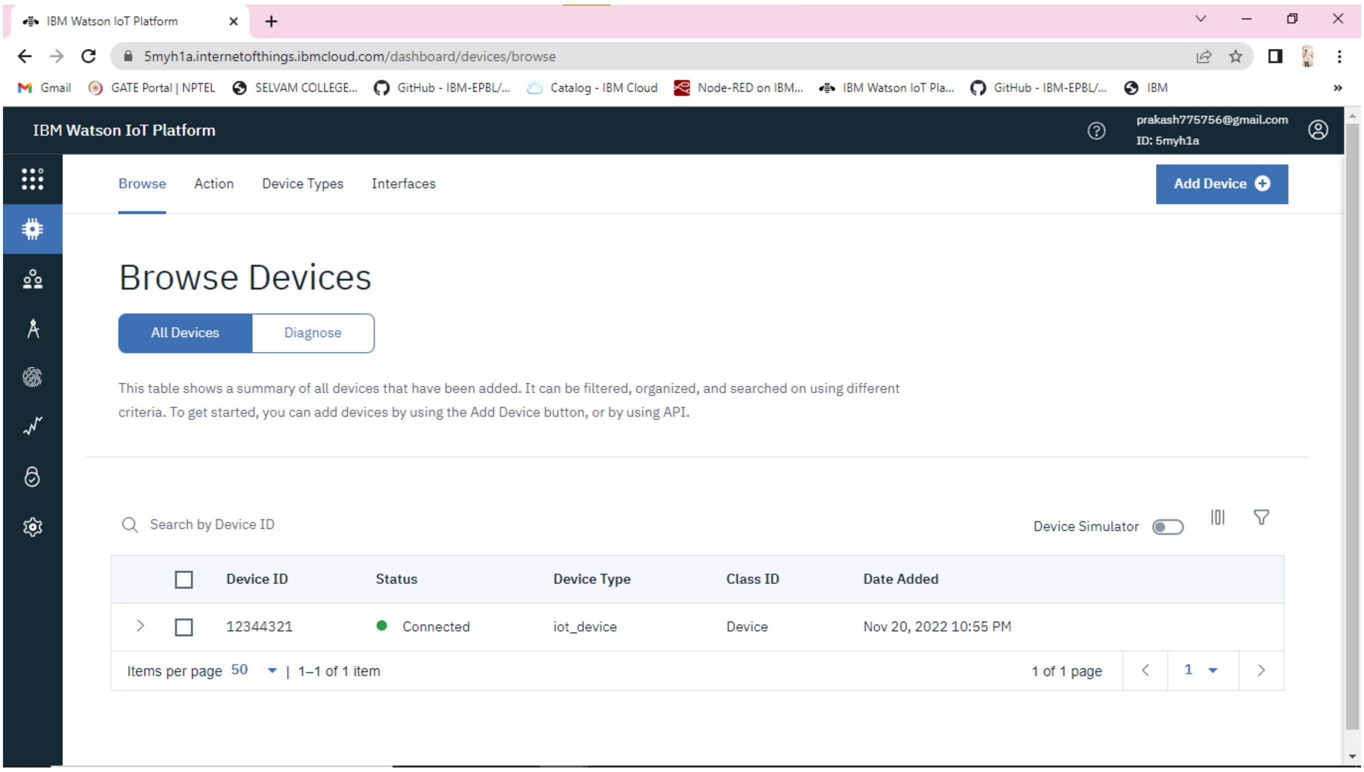


Sensor Connection:

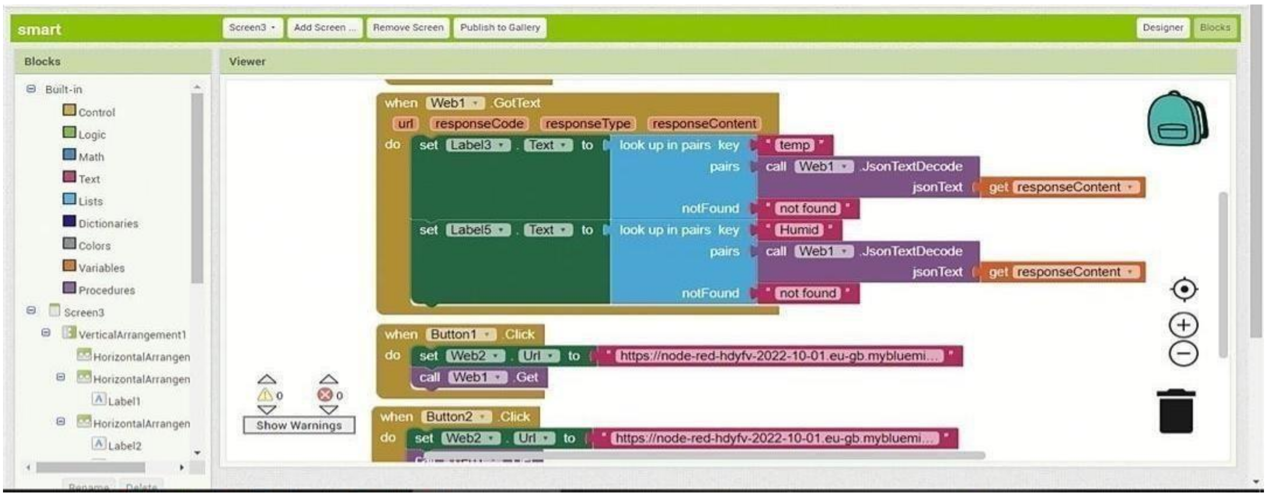


Device Details:

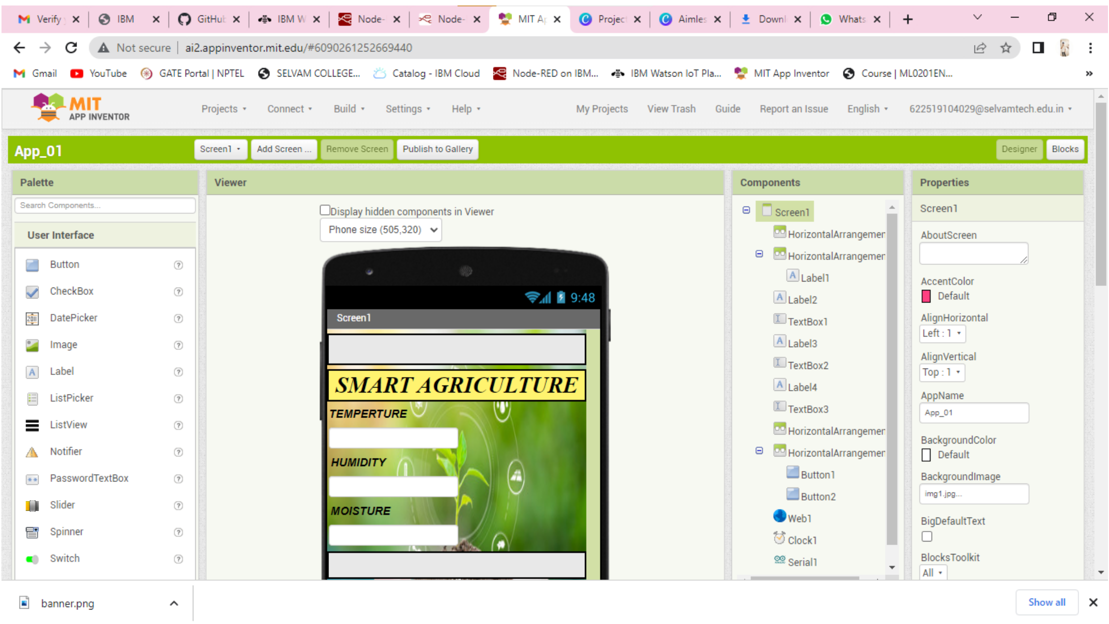




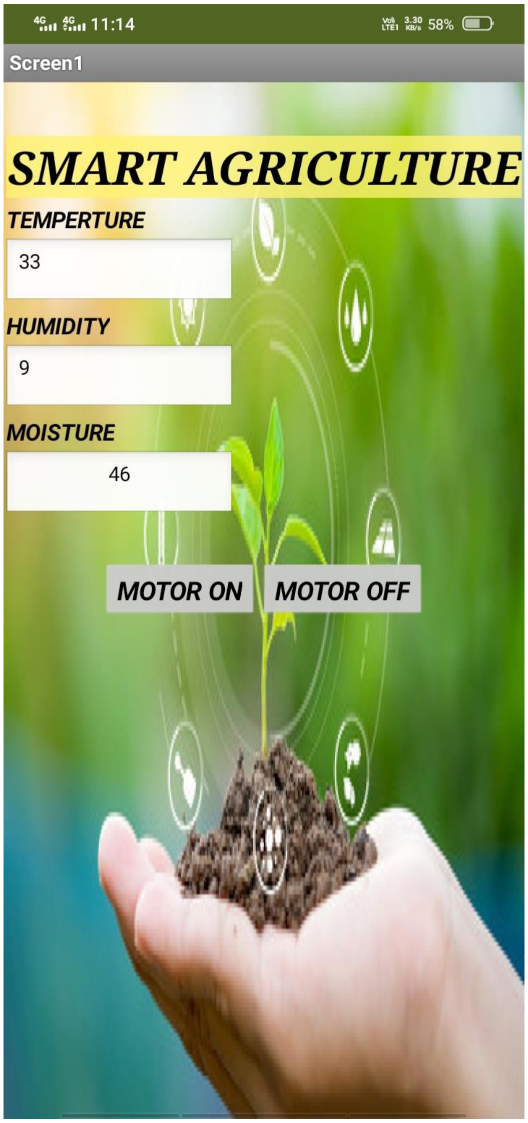
Creating Mobile app using MIT app Inventor:



QR Code for APK download:

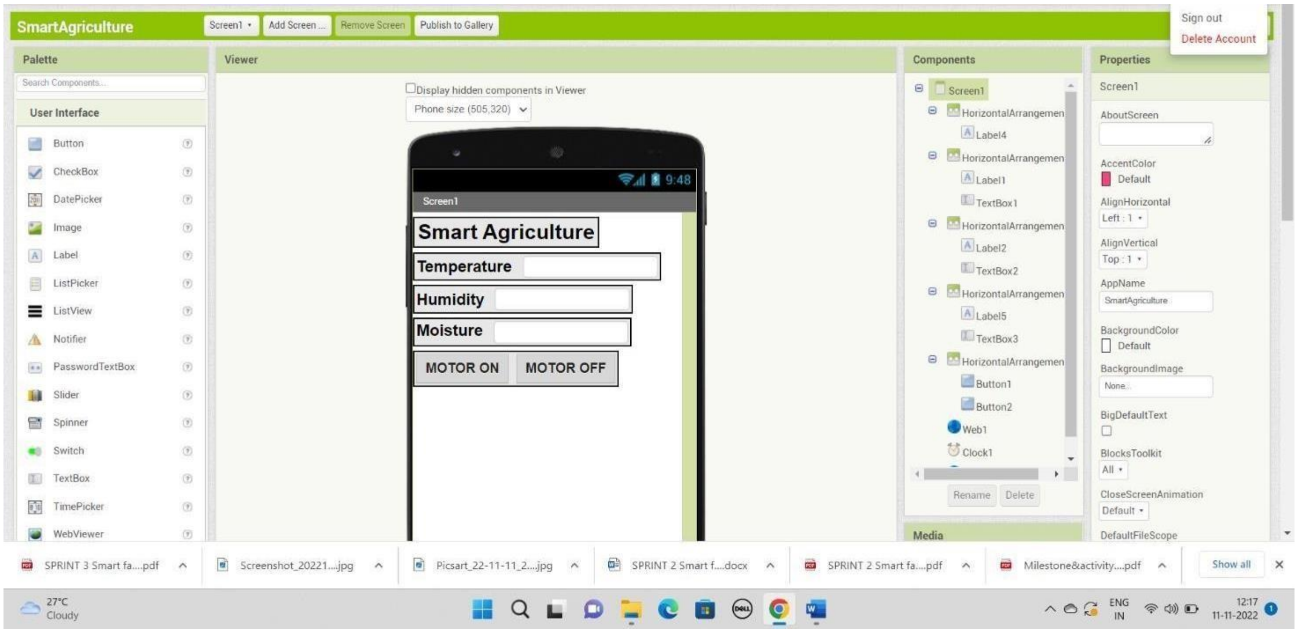


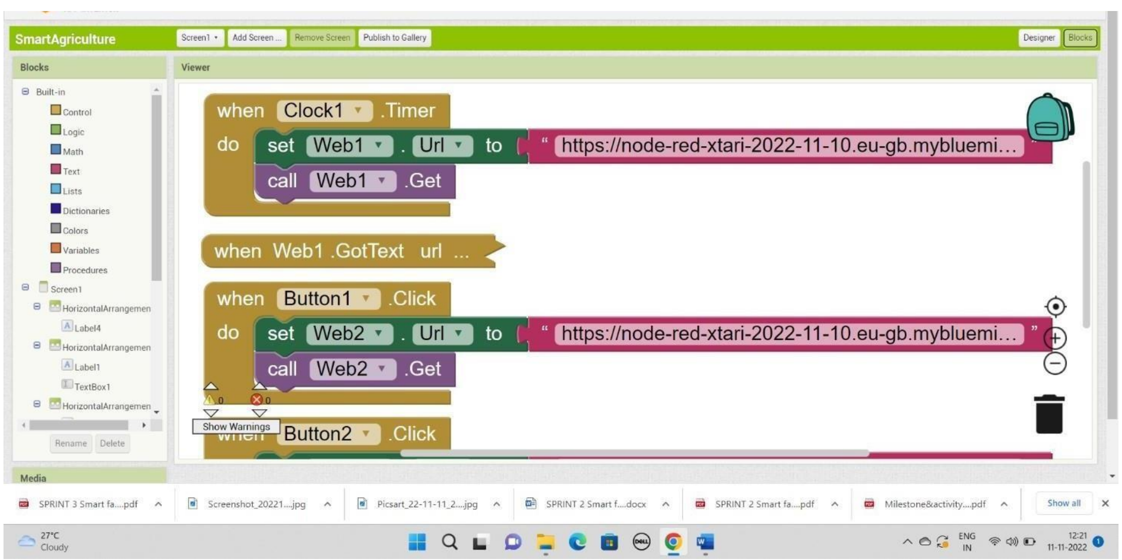
Output Screen in Mobile :



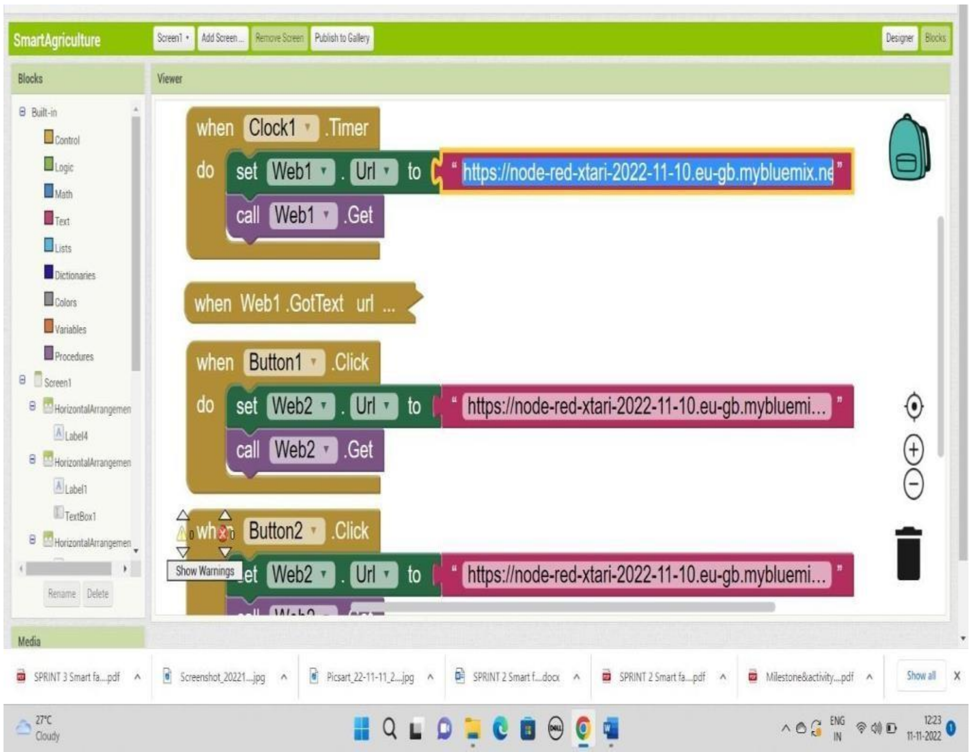
Creating a MIT Account

Creating Blocks to Build the Mobile Application

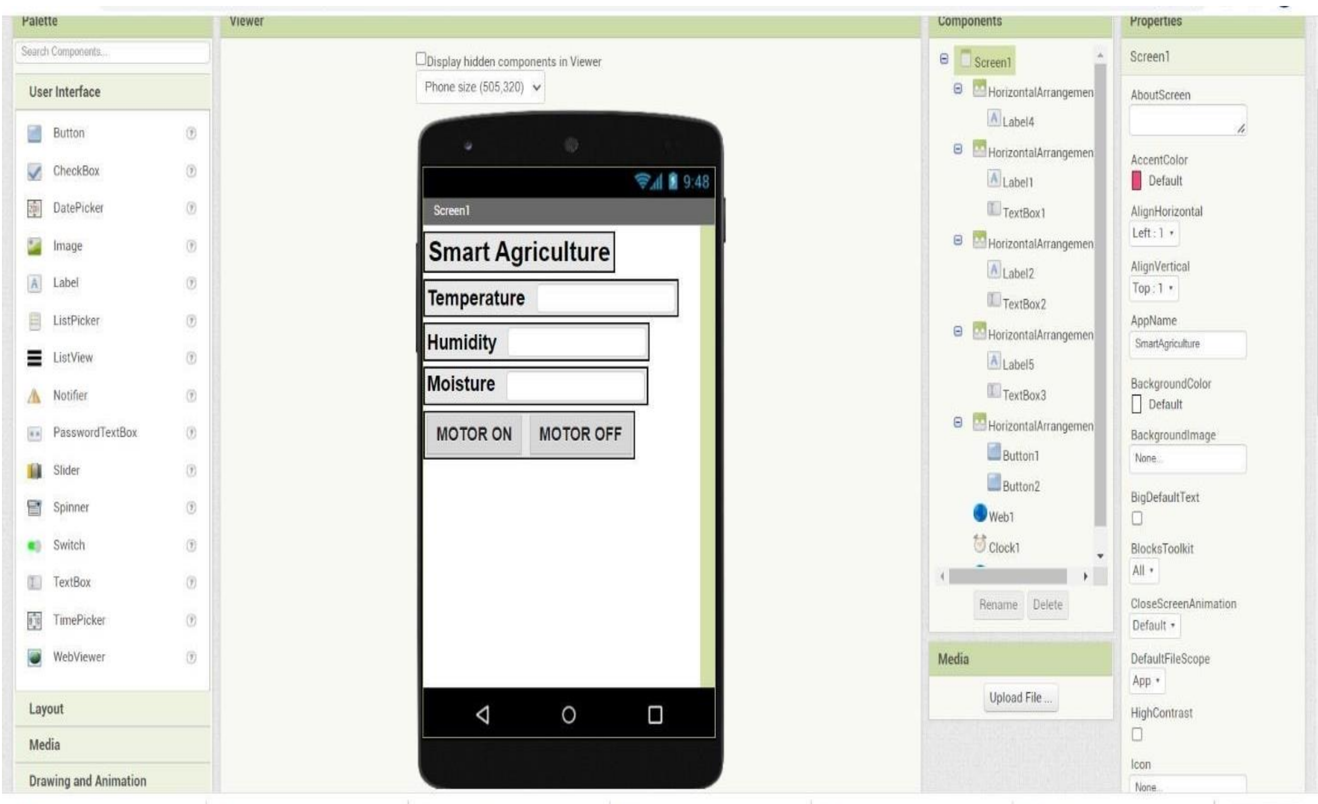




Configuring the Blocks with the Node Red Link:

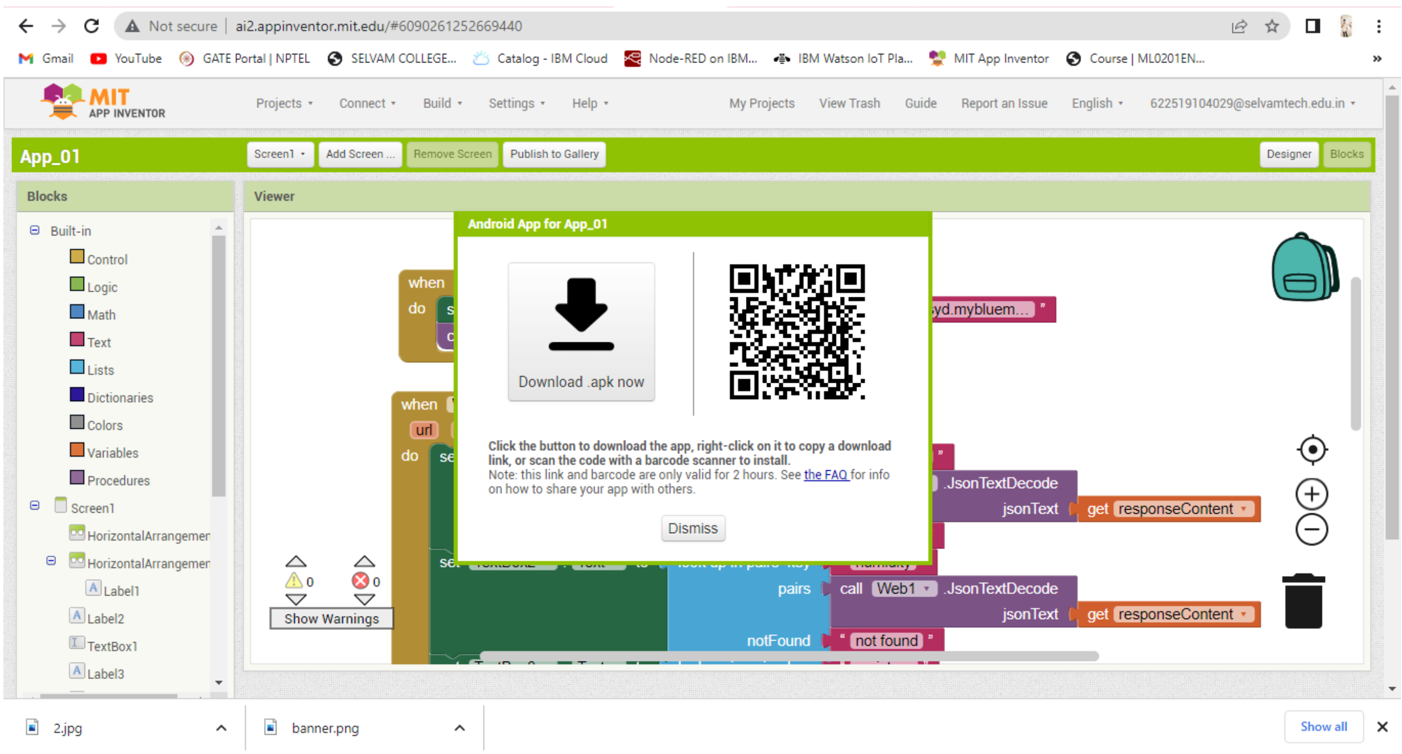


Creating the Mobile Interface:

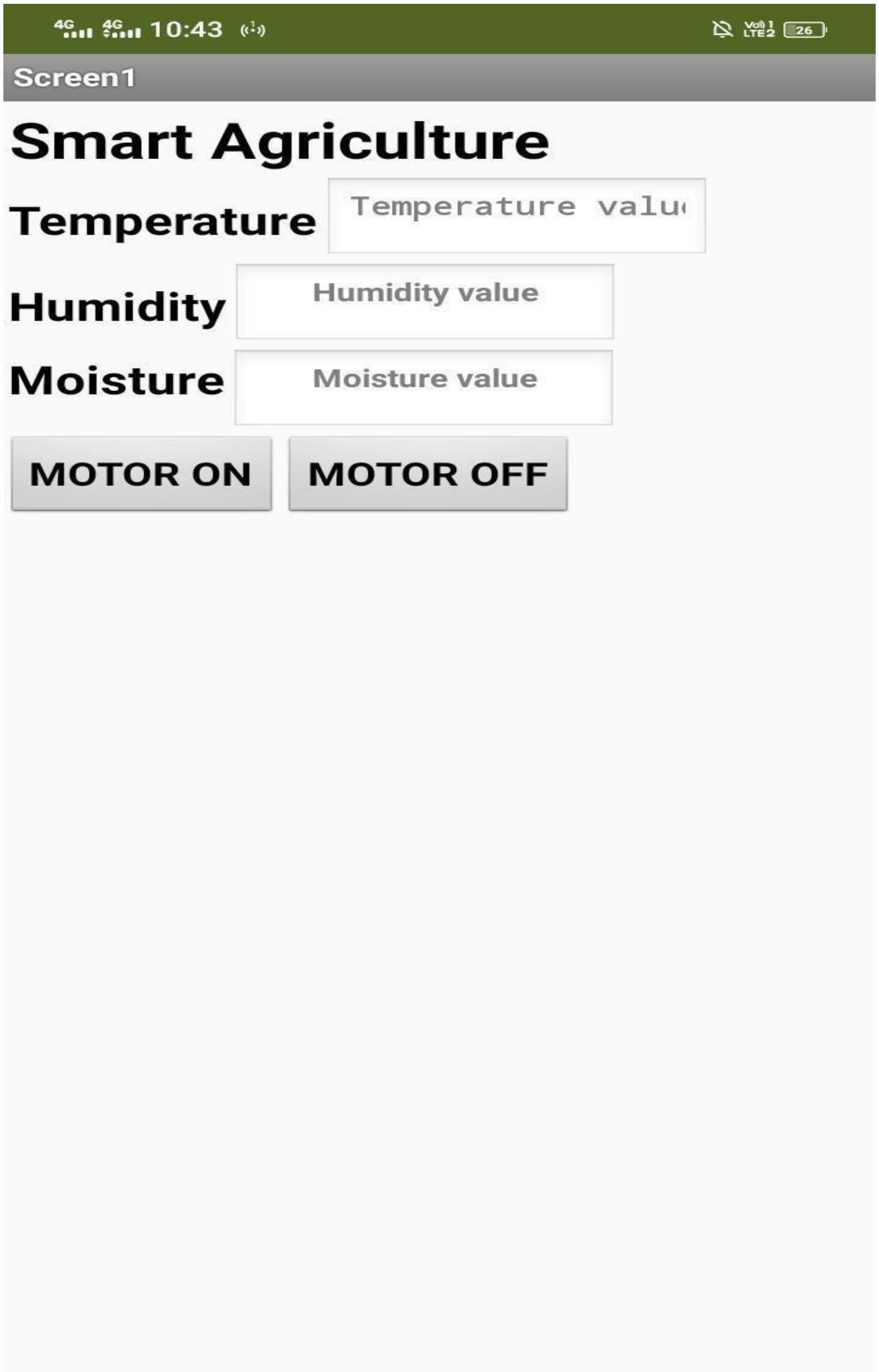


Connecting it to the AI Companion

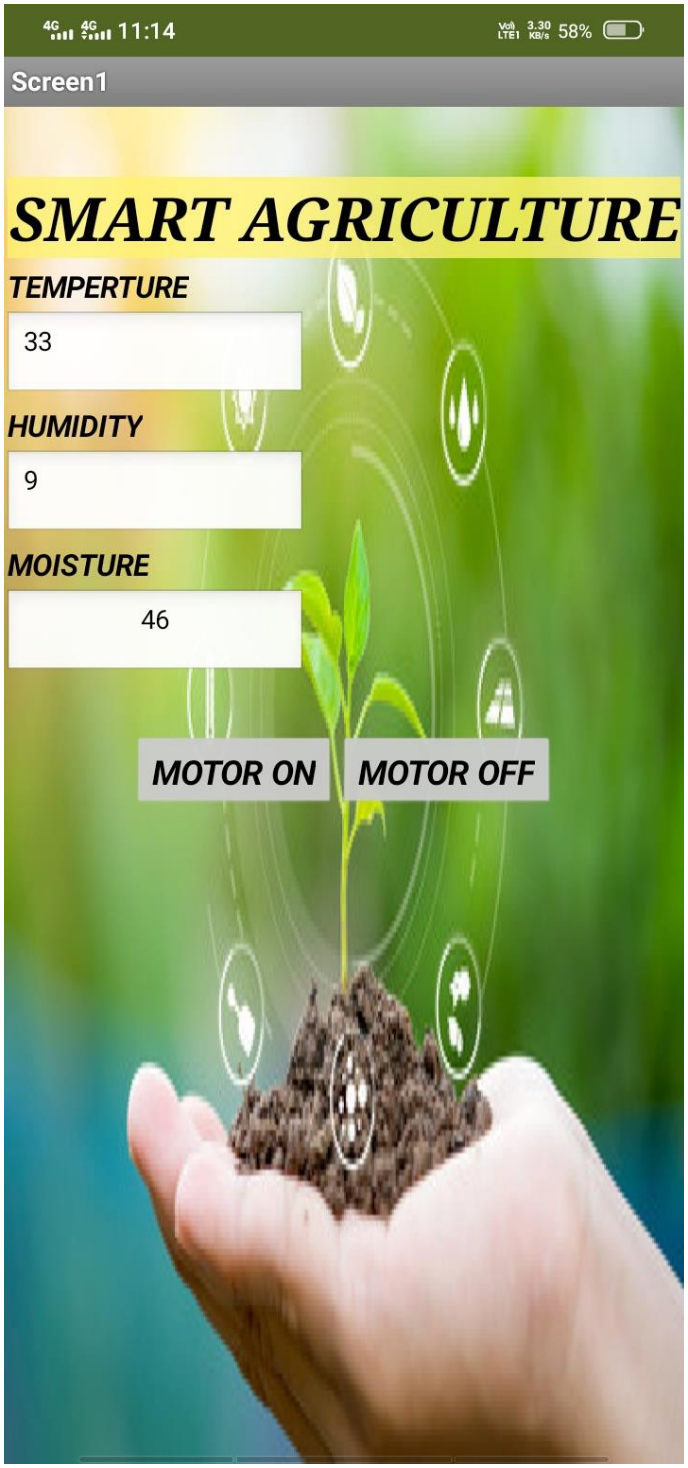
QR Code to Connect with the Mobile:



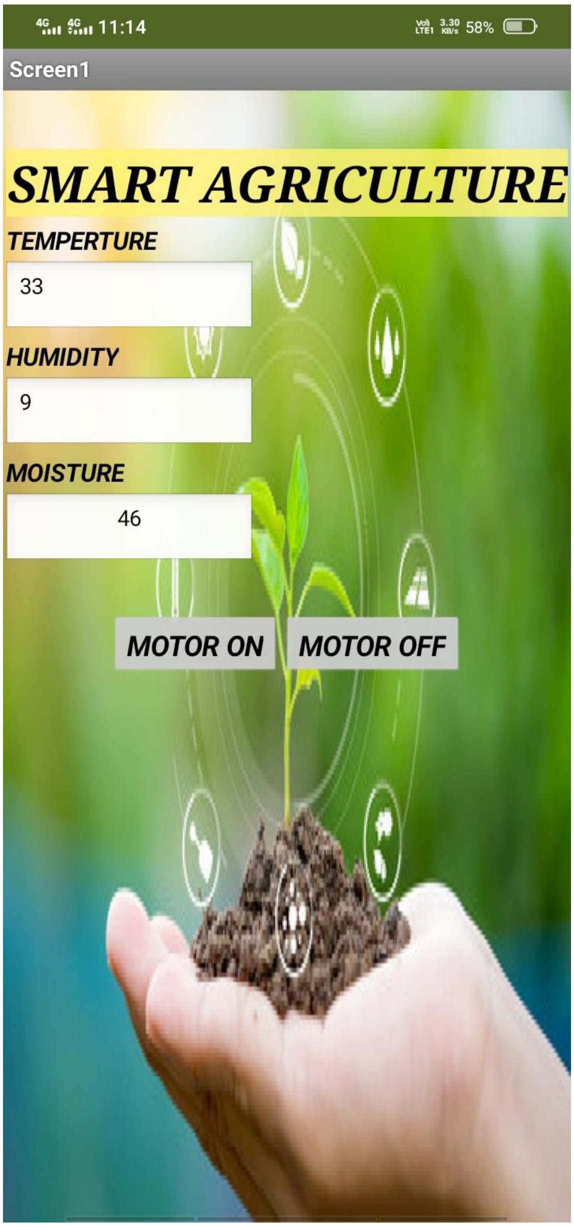
Mobile Connected Interface

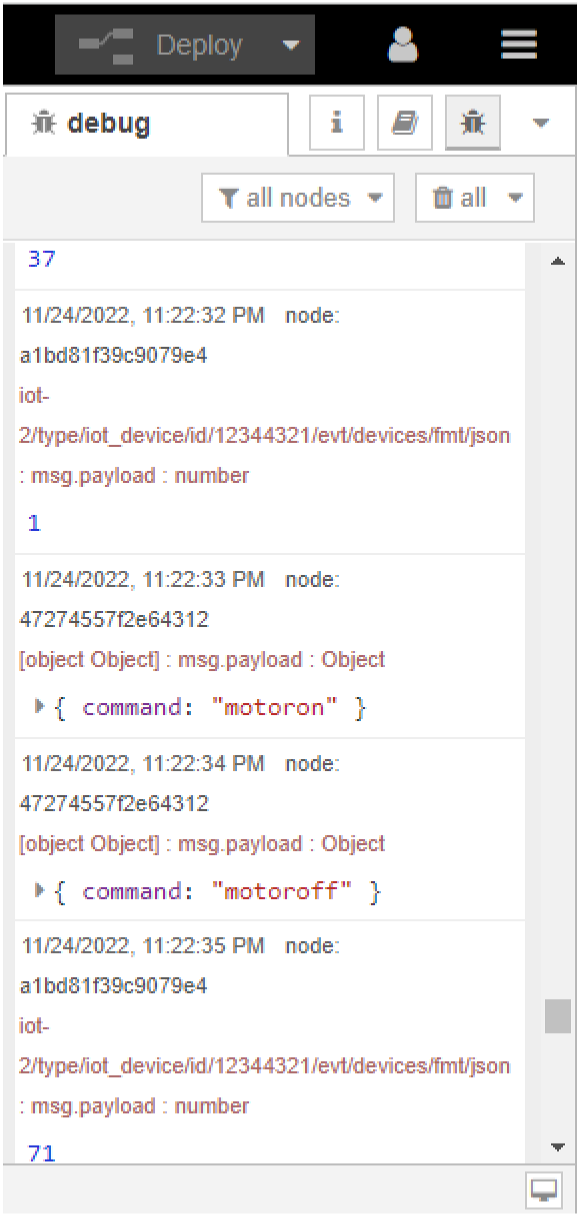


Receiving Data:



Motor ON and Motor OFF Command and Output:




Deploy
debug
all nodes
all
37
11/24/2022, 11:22:32 PM node:
a1bd81f39c9079e4
iot-2/type/iot_device/id/12344321/evt/devices/fmt/json
: msg.payload : number
1
11/24/2022, 11:22:33 PM node:
47274557f2e64312
[object Object] : msg.payload : Object
{ command: "motoron" }
11/24/2022, 11:22:34 PM node:
47274557f2e64312
[object Object] : msg.payload : Object
{ command: "motoroff" }
11/24/2022, 11:22:35 PM node:
a1bd81f39c9079e4
iot-2/type/iot_device/id/12344321/evt/devices/fmt/json
: msg.payload : number
71

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

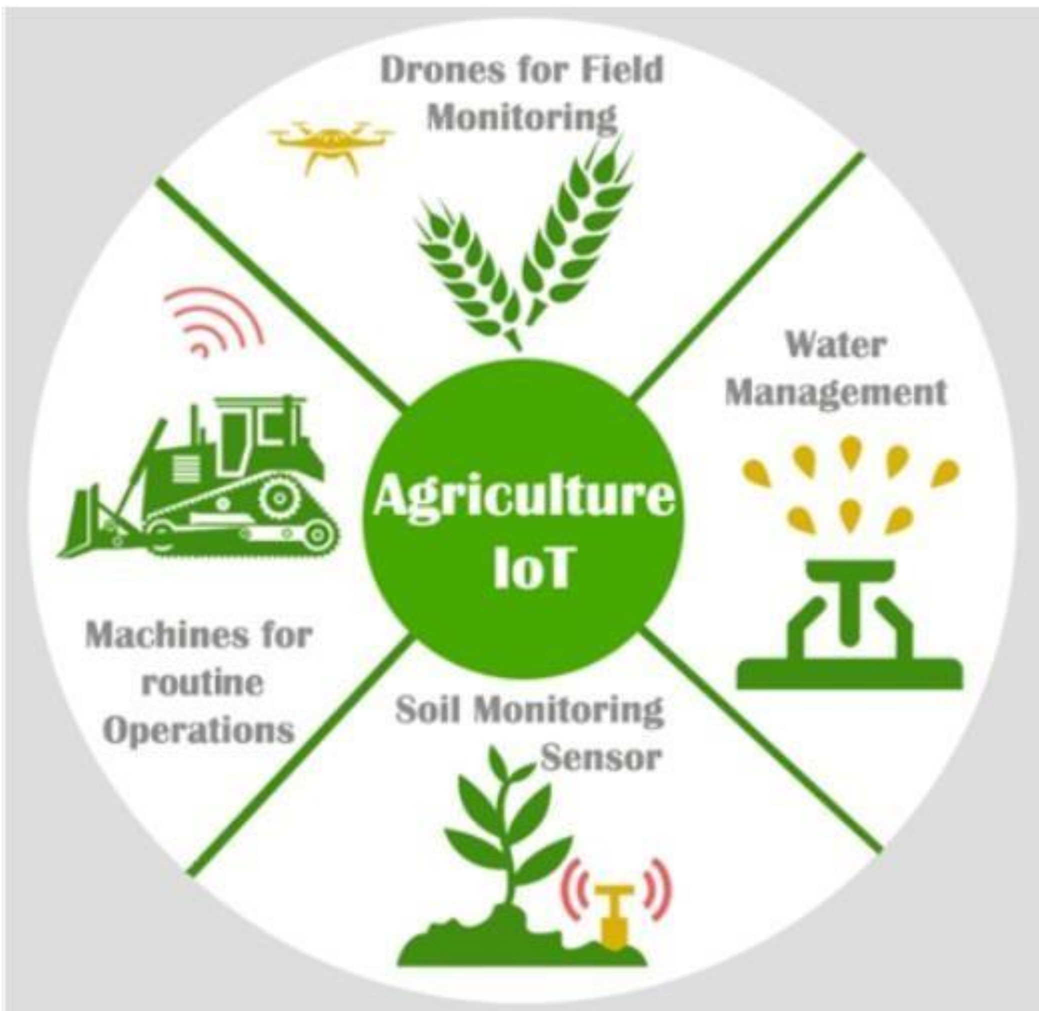
In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere.

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 tedioustasks 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-45261-1660729123

Video Link: https://youtu.be/RQEC9vjCYMY