IBM NALAIYA THIRAN PROJECT REPORT TEAM ID - PNT2022TMID02368

IBM NALAIYA THIRAN 2022-23 PROJECT REPORT

SmartFarmer - IoT Enabled Smart Farming Application

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Project Report Format

1.INTRODUCTION

1.1Project Overview

In this project I have developed a mobile application using which a farmer can monitor the temperature, humidity, and soil moisture parameters along with weather forecasting details. Based on these details he can water the crops by controlling the motors through the app and the app gives an alert message if temperature or humidity goes beyond a threshold value.

1.2Purpose

Agriculture plays a crucial role in the life of an economy. It is the backbone of our economic system, so improving the quality and way of production is crucial. Here comes the Smart Agriculture system. Smart agriculture helps in automated farming, collection of data from the field and then analyses it so that the farmer can make accurate decision in order to grow high quality crop.

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.

2.LITERATURE SURVEY

2.1Existing problem

Agriculture is extremely dependent on the climate. Temperature increases and carbon dioxide can boost some crop yields depending on the location; but other conditions must also exist, such as humidity, pressure, and water availability. Although slight warming and more carbon dioxide in the atmosphere could benefit some plants to grow faster, severe warming, floods, and drought would reduce yields. Farmer need to spend a lot of time to maintain these. Heat is not the only extreme weather. Extreme cold can benefit farmers by freezing the soil deep beneath the ground. In parts of the upper Midwest, frost depths exceed 40 inches. A deep frost depth can aid farmers in diverse ways. The cold helps nitrogen that is applied in the fall from vaporizing during the winter. The cycle of freezing and thawing of water helps soften the soil after the thaw. Extreme cold and frozen soils also reduce the survival rate of some insects.

Severe weather other than heat and cold can cause loss and devastation to a farm. Most farmers can't avoid the results of extreme weather. Diverse extreme weather can affect farms in different ways. Because of this, it's important that farmers have a proper system and need a mobile application to monitor the weather changes and to control the motor.

2.2References

"Smart Agriculture Monitoring and Control System Using IOT"

Authors: **Abhilash Lad, Sumitra Nandre, Krishna Raichurkar, Sumit Zarkhande, Dr. Priya Charles**

The IoT is a network of interconnected devices that can transmit and receive data over the internet and carry out tasks without human involvement. Agriculture provides a wealth of data analysis parameters, resulting in increased crop yields. The use of IoT devices in smart farming aids in the modernization of information and communication. For better crop growth moisture, mineral, light and other factors can be assumed. This research looks into a few of these characteristics for data analysis with the goal of assisting users in

making better agricultural decisions using IoT. The technique is intended to help farmers increase their agricultural output.

DOI Link: https://doi.org/10.22214/ijraset.2022.40512

"IoT Applications in Agriculture"

Author's**: Escuela de Ingeniería en Computación e Informática, Guayaquil, Ecuador.**

IoT technologies allow developing systems that support different agricultural processes. Some of these systems are remote monitoring systems, decision support tools, automated irrigation systems, frost protection systems, and fertilization systems, among others. Considering the aforementioned facts, it is necessary to provide farmers and researchers with a clear perspective of IoT applications in agriculture. In this sense, this work presents a systematic literature review of IoT-based tools and applications for agriculture. The objective of this paper is to offer an overview of the IoT applications in agriculture through topics such IoT-based software applications for agriculture available in the market, IoT-based devices used in the agriculture, as well as the benefits provided by this kind of technologies.

DOI Link: https://doi.org/10.1007/978-3-030-10728-4_8

"Smart Agriculture Using IOT"

Author: **Shweta A M*, Dr V. Nagaveni**

One of the important applications of Internet of Things is Smart agriculture. Smart agriculture reduces wastage of water, fertilizers and increases the crop yield. In the current agriculture system the specification such as temperature, moisture, humidity are detected manually which increases the labor cost, time and also monitoring cannot be done continuously. In this paper irrigation process is done automatically using different sensors which reduces the manual labor. Here a system is proposed to monitor crop-field using sensors for soil moisture, humidity and temperature. By monitoring all these parameters the irrigation can be automated.

https://zenodo.org/badge/DOI/10.5281/zenodo.2579857.svg

“IOT Based On Smart Agriculture”

Mr.N.Sivakumar, 2. Mr.P.Thiyagarajan, 3. Ms.R.Sandhiya

This paper is for internet of things in agriculture to be used by farmers in their Agriculture lands, they can use “soil moisture sensors”. This sensor system which monitors and maintains the desired soil moisture content via automatic water supply. It is used to get information’s about environmental conditions such as light, dust, humidity or sudden changes in temperature. The setup uses soil moisture sensors which measure the exact moisture level in soil. The value active the systems to use appropriate quantity of water avoids over/under irrigation. Usually the farmer pumps the water more or less to cultivate the land. This may result in wastage of water or insufficiency to the crops. Motion Sensors will create alert SMS/Text messages. That alert messages will be send to farmer’s phone when they detect motion. This model sends an alerting message to the farmer when the moisture level increases or decreases in the field

“SMART FARMING STICK”

Ankit Kumar Singh

Internet of Things (IOT) an emerging and revolutionary technology that has brought revolutions into many fields of common man’s life by making everything smart and intelligent. This project, propose an IoT based Smart Farming Agriculture Stick assisting farmers in getting live data of temperature, humidity, soil moisture, smoke detection, pH, etc. for efficient environment monitoring which will enable them to do smart farming and improve their overall yield and quality of products. The agriculture system proposed in this project is integrated with Node MCU technology consisting of various sensors which provide live on field data that can be obtained on android mobile phone.

“Smart Farming System Monitoring and Control of Some Agriculture Features”

Salwa Mitouilli

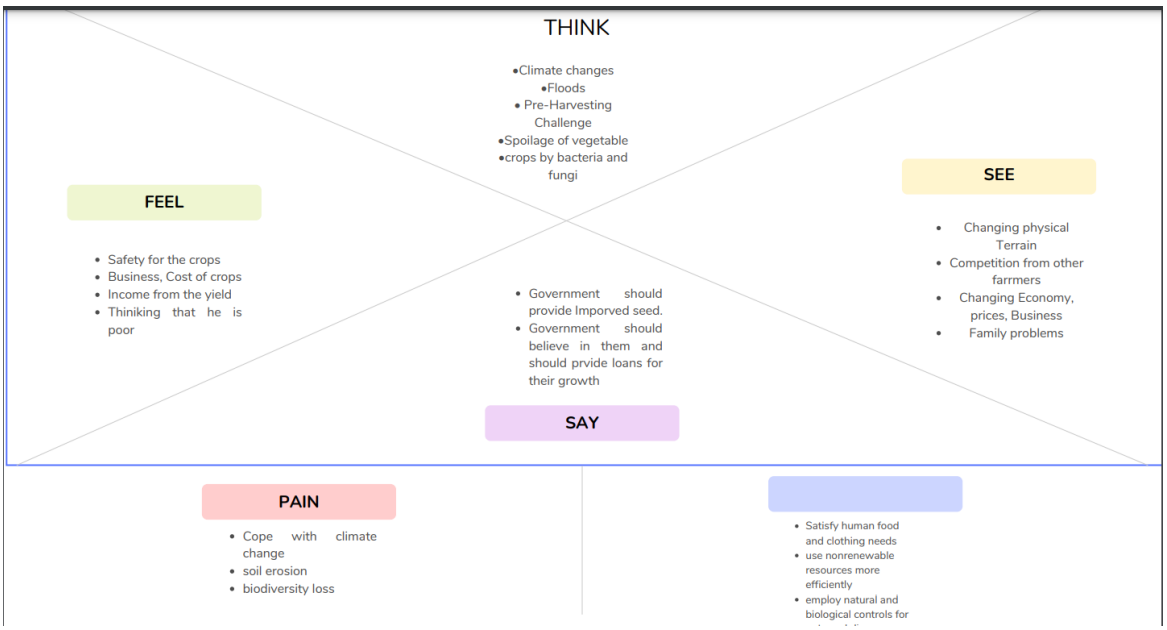
The main goal of my project is to use IoT in the agriculture field in order to collect data instantly (soil Moister, temperature…), which will help one to monitor some environment conditions remotely, effectively and enhance tremendously the production and therefore the income of farmers. The present prototype is developed using Arduino technology, which comprise specific sensors, and a Wifi module that helps to collect instant data online. Worth mentioning the testing of this prototype generated, highly accurate data because while we were collecting them remotely any environmental changes were detected instantly and taking in consideration to make decisions

Problem Statement Definition

Farmers are to be present at farm for its maintenance irrespective of the weather conditions. They have to ensure that the crops are well watered and the farm status is monitored by them physically. Farmer have to stay most of the time in field in order to get a good yield. In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation

IDEA

IoT smart connectivity uses an esp32 board that connects to the internet, to observe real-time parameters, for eg, humidity by using the sensor, we use that sensor in a particular zone. We give all info to the cloud. After data is in the cloud, we can use the data from the sensor to calculate the field condition and Indicate the framer of the condition of the field through the app and website. Then the framer uses the information from the app or website to make a decision on whether to turn on the water pump or not. For the extra innovation.

IDEA IN CROP MANAGEMENT

Weather stations should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health. you can monitor your crop growth and any anomalies to effectively prevent any diseases or infestations that can harm your yield.

CATTLE MANAGEMENT

There are IoT agriculture sensors that can be attached to the animals on a farm to monitor their health and log performance. Livestock tracking and monitoring help collect data on stock health, well-being, and physical location. For example, such sensors can identify sick animals so that farmers can separate them from the herd and avoid contamination. Using drones for real-time cattle tracking also helps farmers reduce staffing expenses.

SMART PEST CONTROL

Sensors detect the presence of pests and then dispense pesticides as required to protect crops. This helps reduce pesticide usage and can be used with smart irrigation management for targeted spraying only where it is needed.

SMART WATER CLOTTING CONTROL

Whenever water gets clotted between the crops during rainy seasons…here we can set a sensor to detect the water level by setting a threshold level. If the water level is more than the threshold level. Then the sensor notifies us about the level and hence we can use a pump to pull out the water so that the crops do not get spoiled.

SMART WEATHER PREDICTION

For predicting the weather of an area by getting the weather data from the internet and data of the previous year whether data we can combine it together to predict the weather pattern and update the app and website that have been created for the field condition.

3.3 Proposed Solution

S. No	Parameter	Description
1	Problem Statement (Problem to be solved)	To build an effective decision support system employing a wireless sensor network that handles various agricultural operations and provides important farm information. Soil moisture, temperature and humidity, and irrigation system content are all included several diversions.

2	Idea / Solution description	IoT smart connection employs an esp32 board that connects to the internet in order to monitor real-time characteristics such as humidity by utilising a sensor, which we utilise in a specific zone. We send all data to the cloud. After the data is in the cloud, we may utilise the sensor data to compute the field condition and indicate the framer of the field condition via the app and website.
3	Novelty / Uniqueness	Numerous prominent researchers have been researching on smart farming by integrating IoT technologies into agriculture. However, a number of underlying problems are still waiting for an effective solution
4	Social Impact / Customer Satisfaction	Smart farming has the potential to increase young participation in agriculture. When pursuing the fourth industrial revolution and 'agricultural 4.0,' the societal effect of new technology must be considered.
5	Business Model (Revenue Model)	Since APIs are used to actively monitor the customer's environment, this project employs a business strategy in which revenue will be generated on the basis of the length of time in which the customers actively interact with the product
6	Scalability of the Solution	In the future, if any update is required either on the hardware or software side, it can be easily implemented. The hardware components can be directly interfaced with the microcontroller and small modifications can be made in the programming of the existing product. In case of

		the software, the website application has to be updated with the additional functionality by creating a new section for the updated hardware

3.4 problem Fit

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Farmers who wants to understand the important factors such as water, topography, aspect, vegetation and soil types.

Farmers who wants to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically

6. CUSTOMER CONSTRAINTS

- Poor Internet Connectivity in Farms.
- High Hardware Costs.
- Disrupted Connectivity to the Cloud.

5. AVAILABLE

Smart Farming solutions provide an integrated IoT platform in agriculture that allows farmers to leverage sensors, smart gateways and monitoring systems to collect information, control various parameters on their farms and analyse real-time data in order to make informed decisions.

Explore AS, differentiate

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

2. JOBS-TO-BE-DONE / PROBLEMS

Maintenance of your hardware is a challenge that is of primary importance for IoT products in agriculture, as the sensors are typically used in the field and can be easily damaged.

The need to transmit data between many agricultural facilities still poses a challenge for the adoption of smart farming. Needless to say, the connection between these facilities should be reliable enough to withstand bad weather conditions and to ensure non-disruptive operations.

9. PROBLEM ROOT CAUSE RC

The effects of climate change affect farmers' ability to grow the food we all need. Increasingly volatile weather and more extreme events – like floods and droughts – change growing seasons, limit the availability of water, allow weeds, pests and fungi to thrive, and can reduce crop productivity.

Soil erosion is reducing the amount of land available for agriculture, and declining biodiversity affects the pollination of crops. At the same time, farmers are under pressure to conserve water and use fewer agricultural inputs.

7. BEHAVIOUR BE

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

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

3. TRIGGERS TR

helps farmers to better understand the important factors such as water, topography, aspect, vegetation and soil types. This allows farmers to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically sustainable manner.

10. YOUR SOLUTION SL

The focus on smarter, better, and more efficient crop growing methodologies is required in order to meet the growing food demand of the increasing world population . Additional features like create an awareness about where to get agricultural loans, government agriculture schemes and get the feedback of every farmers on every month end and if its related to government, then make it to reach the government.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

Using advanced technology like big data, the cloud, and the internet of things for tracking, monitoring, automating and analyzing operations.

8.2 OFFLINE

IoT-based smart farming is also beneficial in terms of environment issues. It can help the farmers to efficiently use water, optimize the inputs and treatments.

Tap into BE, understand RC

4. EMOTIONS: BEFORE / AFTER EM

Before

Less protection,lack of information and communication technologies,lack of analysation of environment.

After

- Crop protection
- Real time analysis
- Soil Testing and its quality
- Modern information and communication technologies

4 REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Linked In
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Profile	Log in Access the Profile
FR-4	Analyse	Data from smart sensors can be analysed for predictive analysis and automated decision-making.
FR-5	Recommend	Based on the farming the software recommends the automated irrigation practices.

4.2 Non-Functional requirements

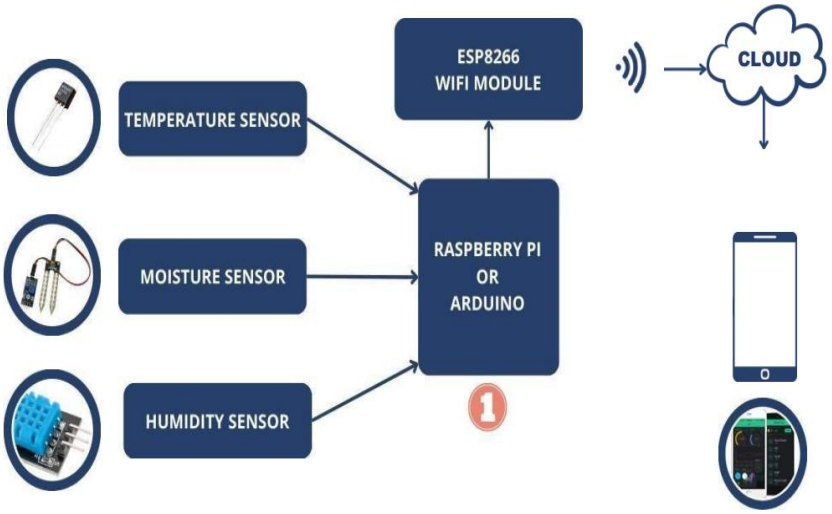
FR.NO	Non-Functional Requirement	Description
NFR-1	Usability	End users can monitor and control their connected farm using IOT applications on their smartphones or tablets.
NFR-2	Security	The software keeps the user's information more securely
NFR-3	Reliability	The smart farm, embedded

		with IOT systems, could be called a connected farm, which can support a wide range of devices from diverse agricultural device manufactures.
NFR-4	Performance	It is a user-friendly software and have high performance.
NFR-5	Availability	Available for every user, visible for all users and farmer.
NFR-6	Scalability	The proposed precision farming structure allows the implementation of a flexible methodology that can be adopted to different types of crops.

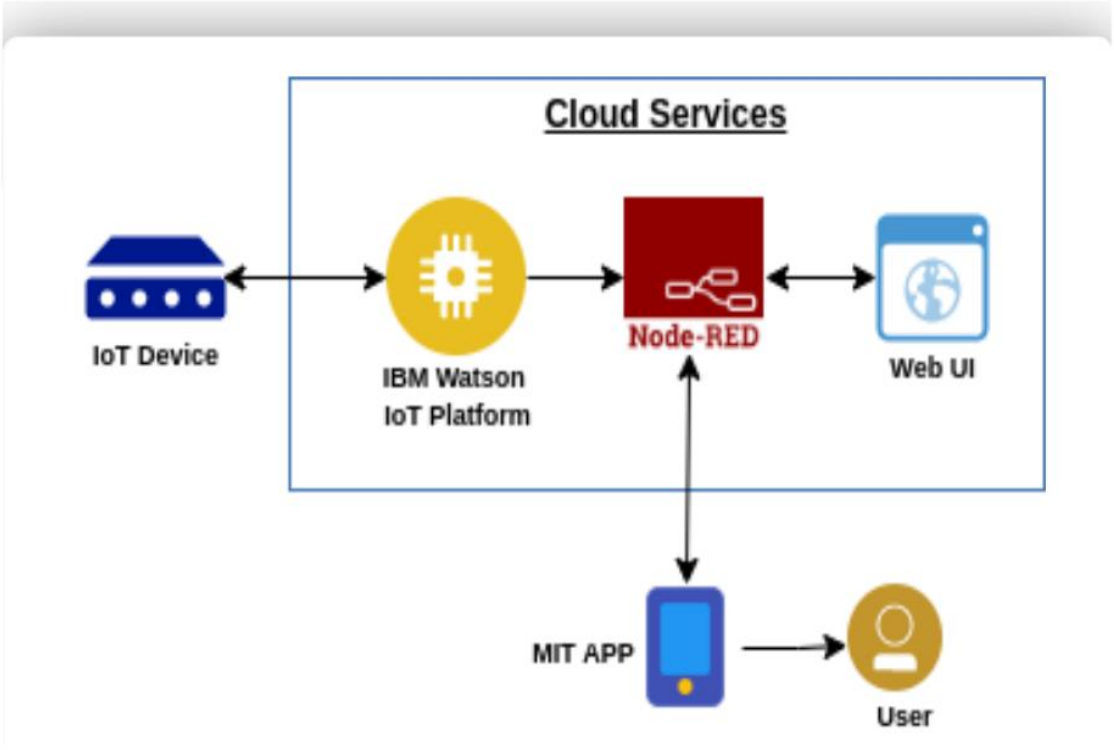
5 PROJECT DESIGN

5.1 Data Flow Diagrams

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 the system, what changes the information, and where data is stored. 1. Get the inputs from different sensors such as Moisture Sensor, Humidity Sensor, Temperature Sensor. Data from the sensors are given as inputs to the microcontroller - Arduino or Raspberry Pi 2. Data are feed into the cloud storage using wi-fi module. 3. MQTT-Message Queuing Telemetry Transport Protocol is used to order data in FIFO fashion. 4. App is Used to create our own to IOT software according to our specifications where we can ableto monitor and control the device.



5.2 Solution & Technical Architecture



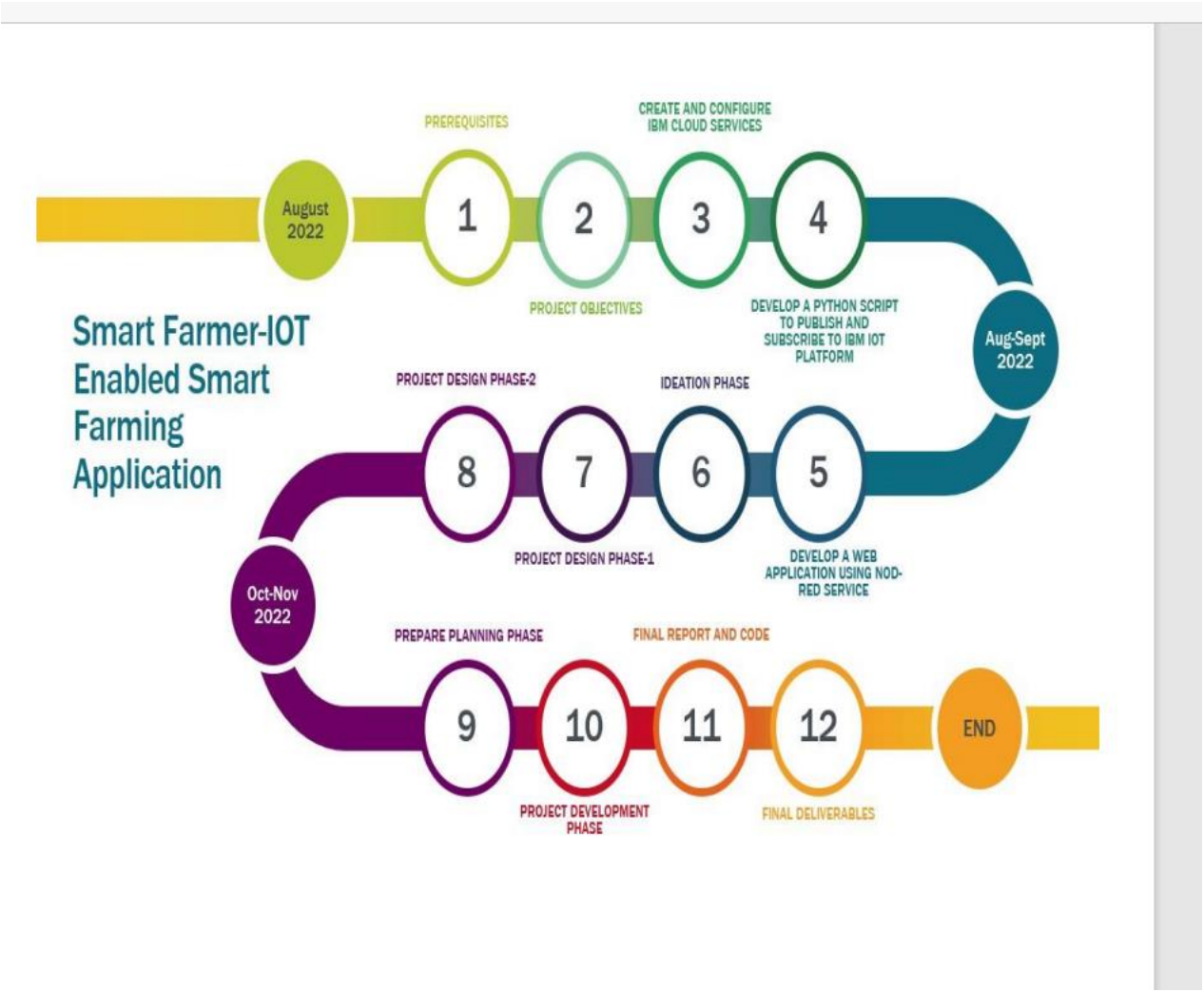
5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, 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 G-mail	I can receive confirmation email & click confirm to login	Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
		USN-5	If I forgot my password or username, I can reset it again through my email	I can receive reset Mail to the registered Email Id	High	Sprint-2
Customer (Web user)	Registration	USN-6	As a user, I can register by entering my email, password, and confirming my password	I can access my account / dashboard	High	Sprint-2
		USN-7	As a user, I will	I can	High	Sprint-2

			receive confirmation email once I have registered for the application	receive confirmation email & click confirm		
		USN-8	As a user, I can register for the application through G-mail	I can receive confirmation email & click confirm to login	Medium	Sprint-2
		USN-9	As a user, I can log into the application by entering email & password		High	Sprint-2
		USN-10	If I forgot my password or username, I can reset it again through my email	I can receive reset Mail to the registered Email Id	High	Sprint-3
Customer Care Executive		USN-11	If I have any doubt in using application or web, I can clarify it by clicking Help option in the dashboard.		High	Sprint-3
Administrator		USN-12	I Can give my feedback about the application and I can post my queries.	I can receive acknowledgement	Low	Sprint-4

6 PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

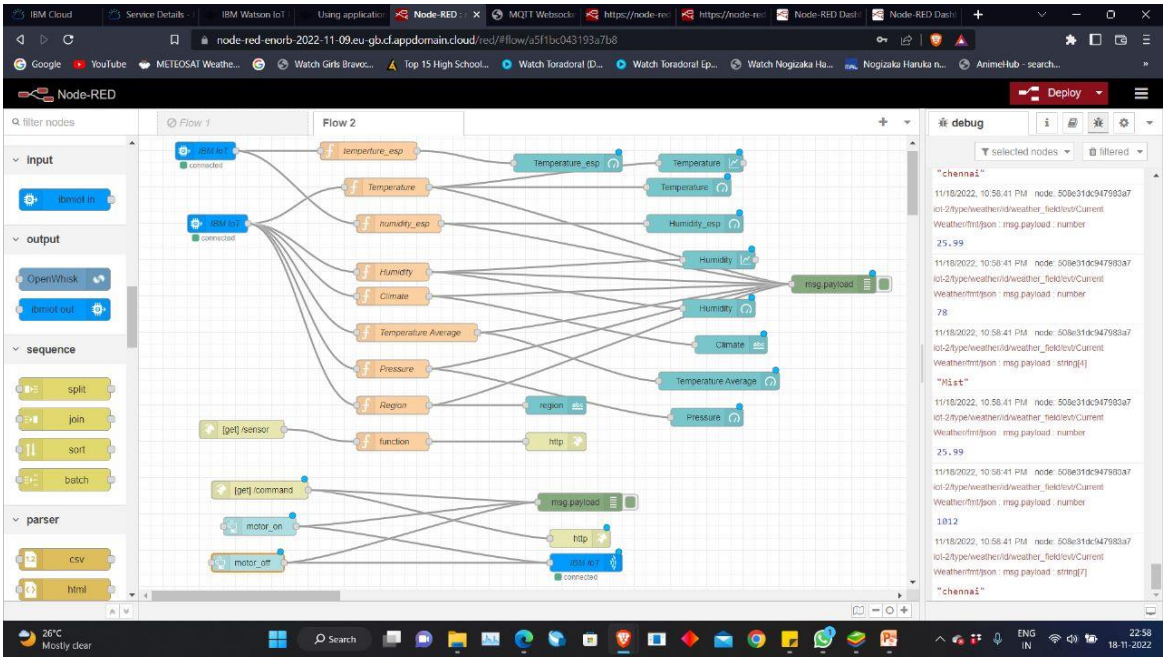


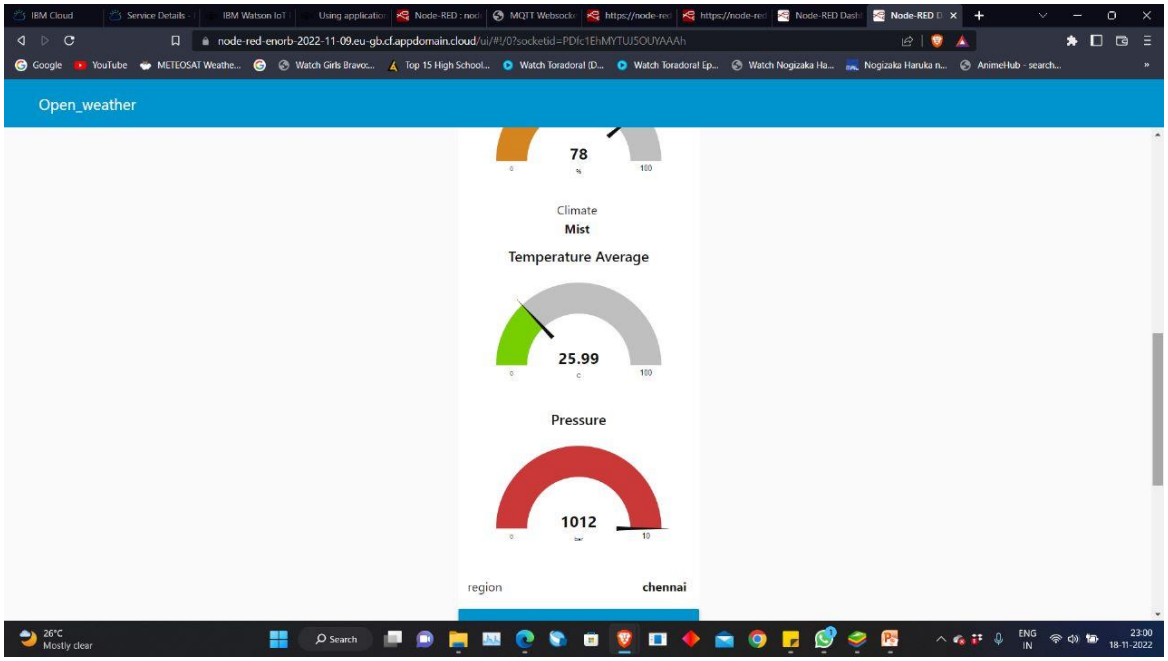
6.2 Sprint Delivery Schedule

6.3 Reports from JIRA

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

7.1 Node Red

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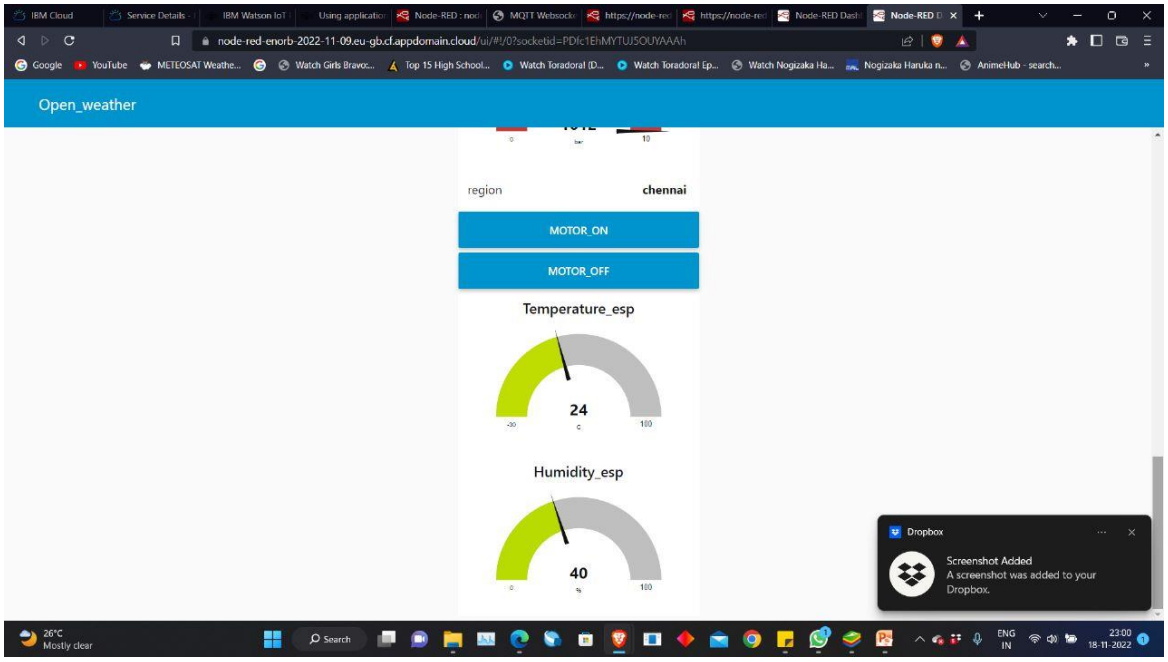
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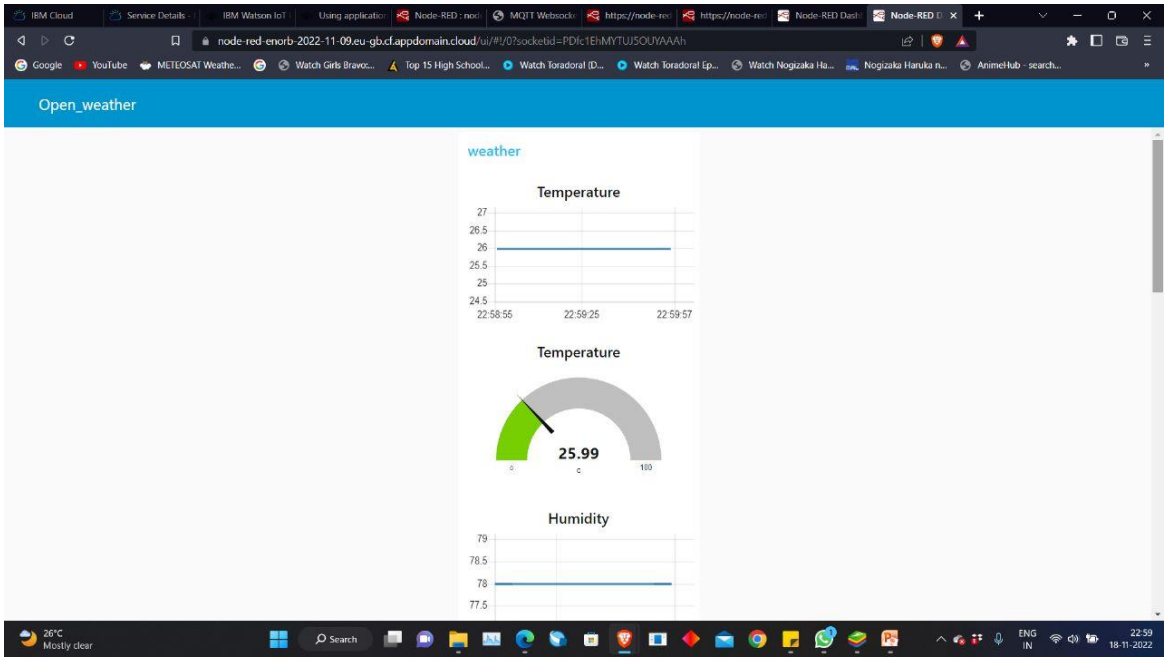
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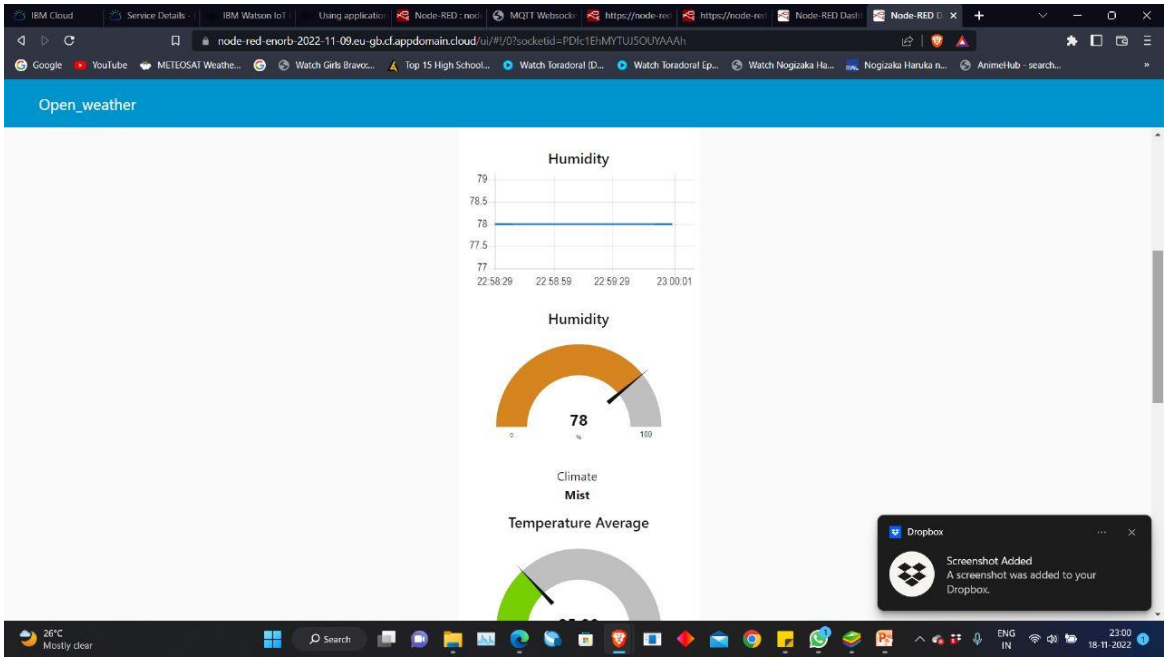
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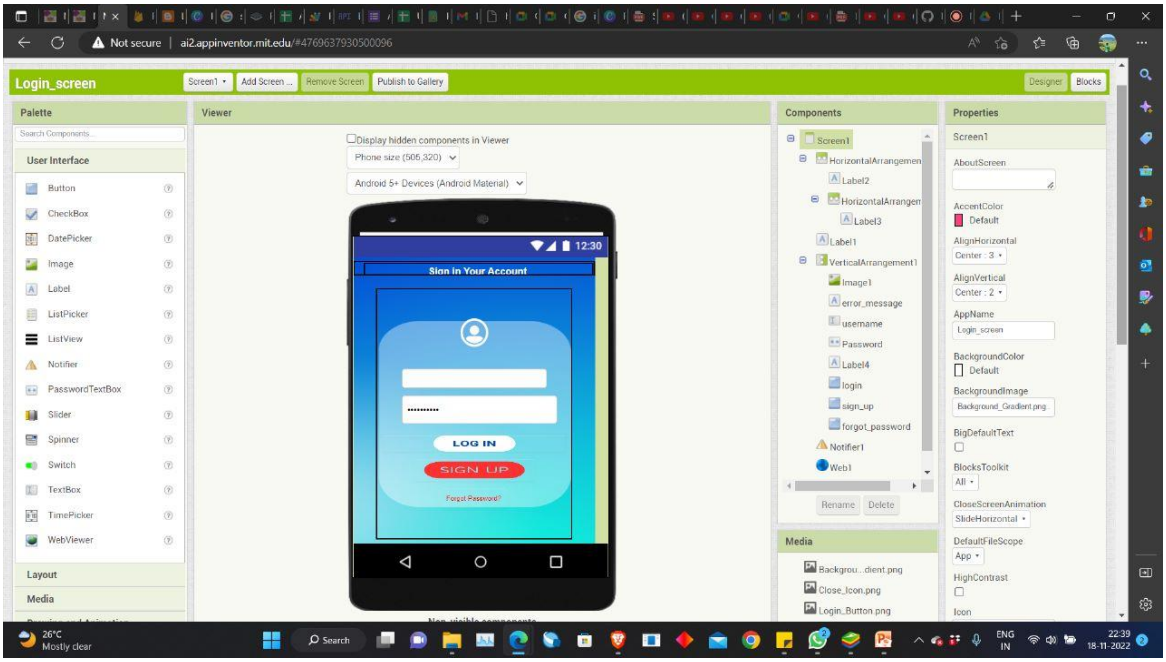
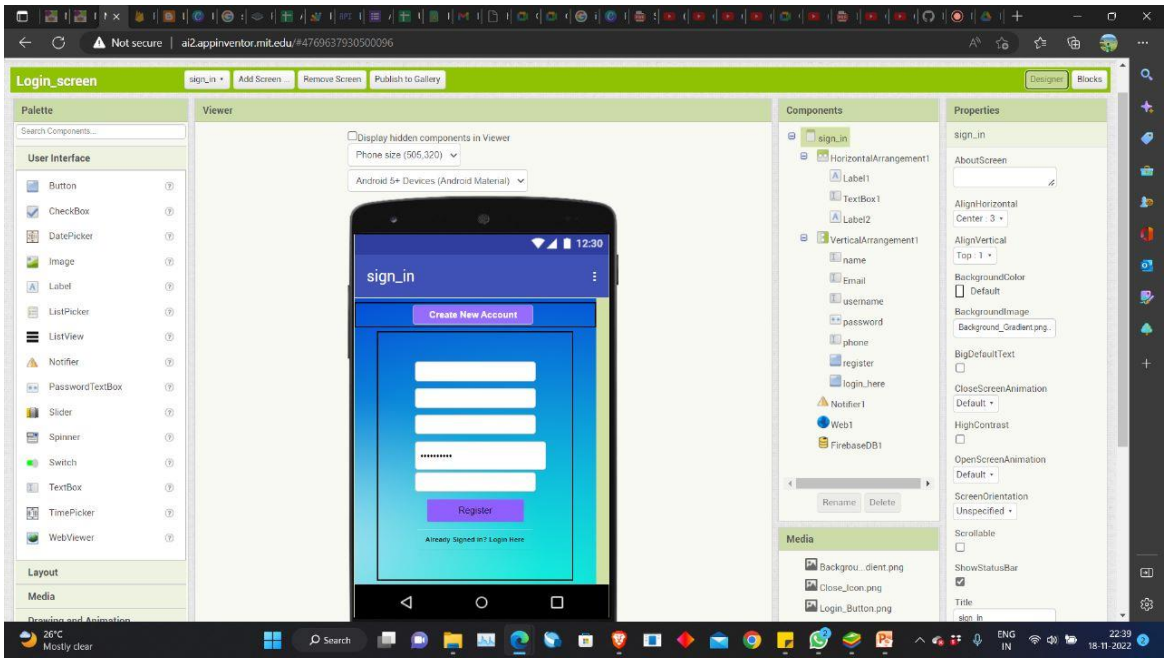
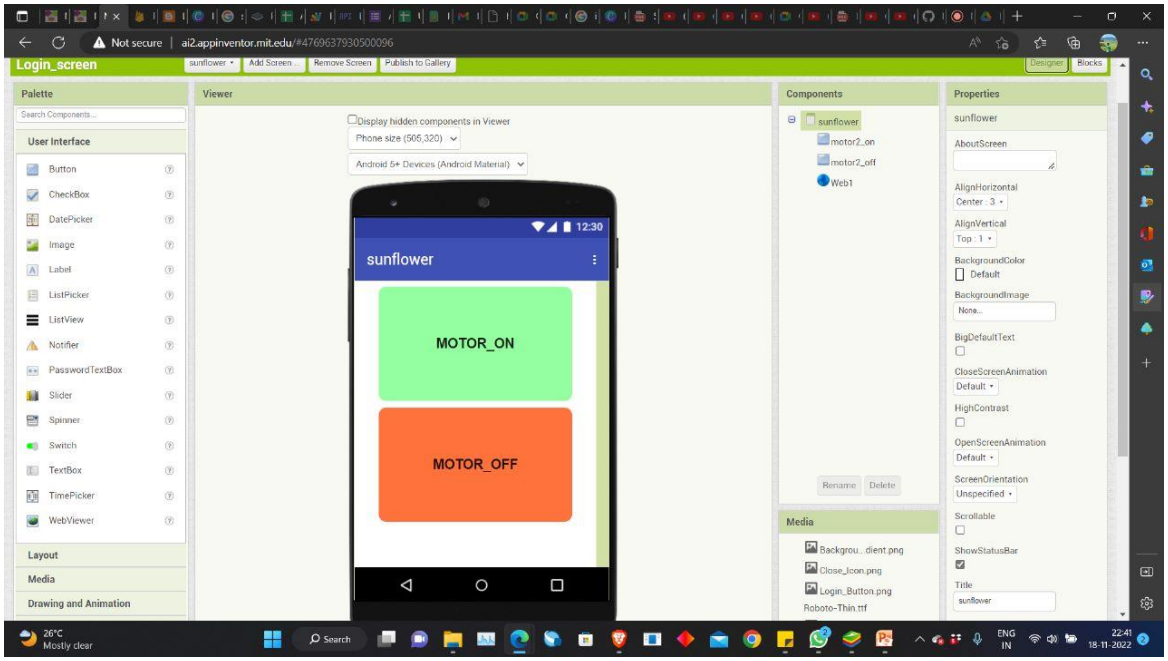
7.2 User interface



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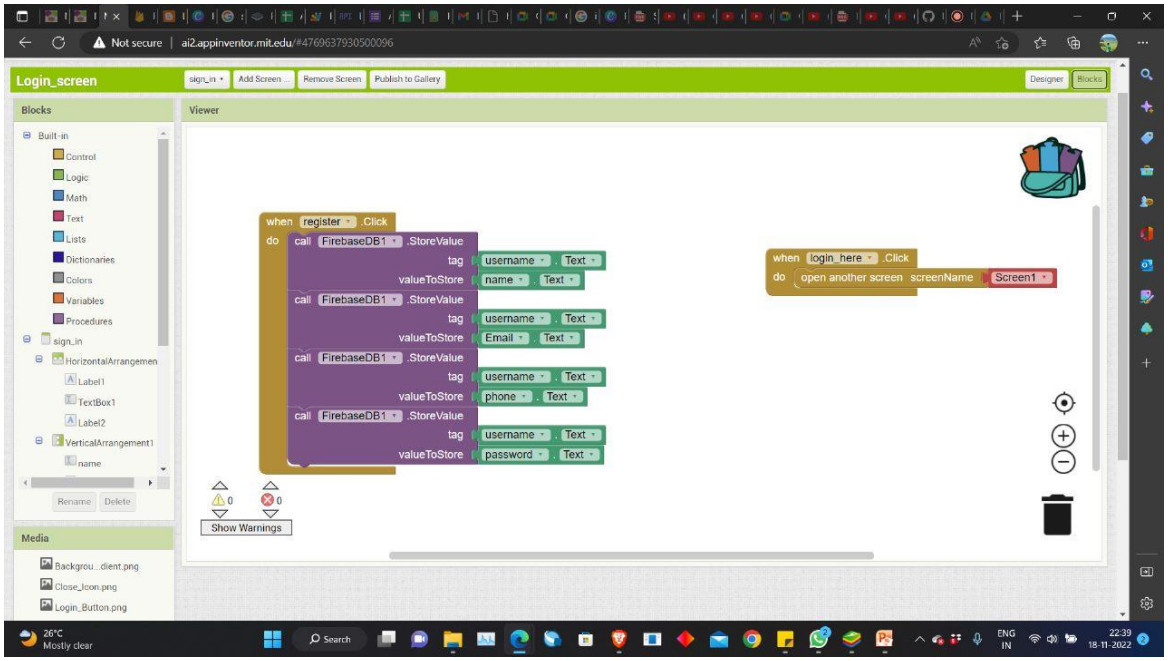
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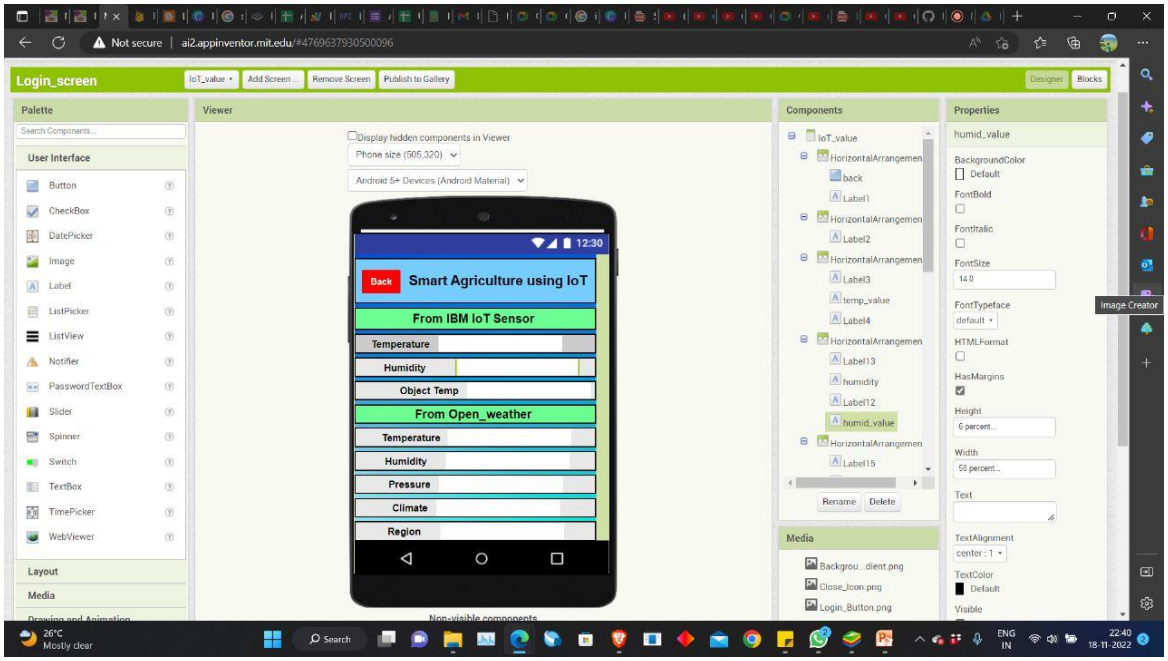
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TimePicker
WebViewer
Layout
Media
Viewer
Display hidden components in Viewer
Phone size (505,320)
Android 5+ Devices (Android Material)
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Smart Agriculture using IoT
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Temperature
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Object Temp
From Open_weather
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Humidity
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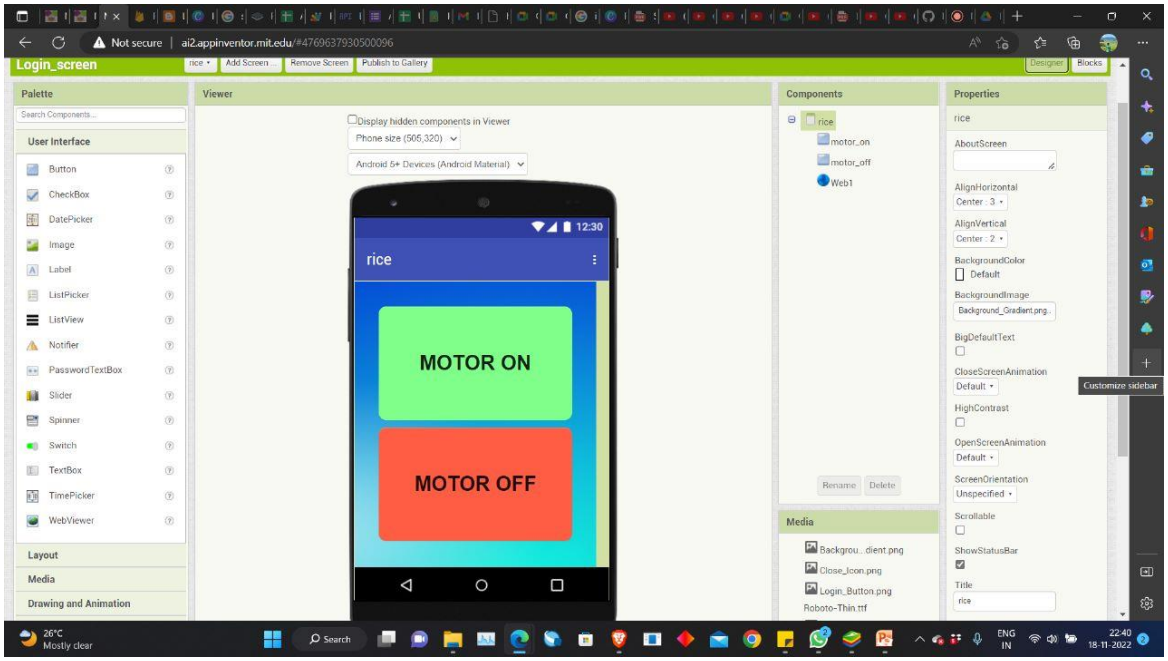
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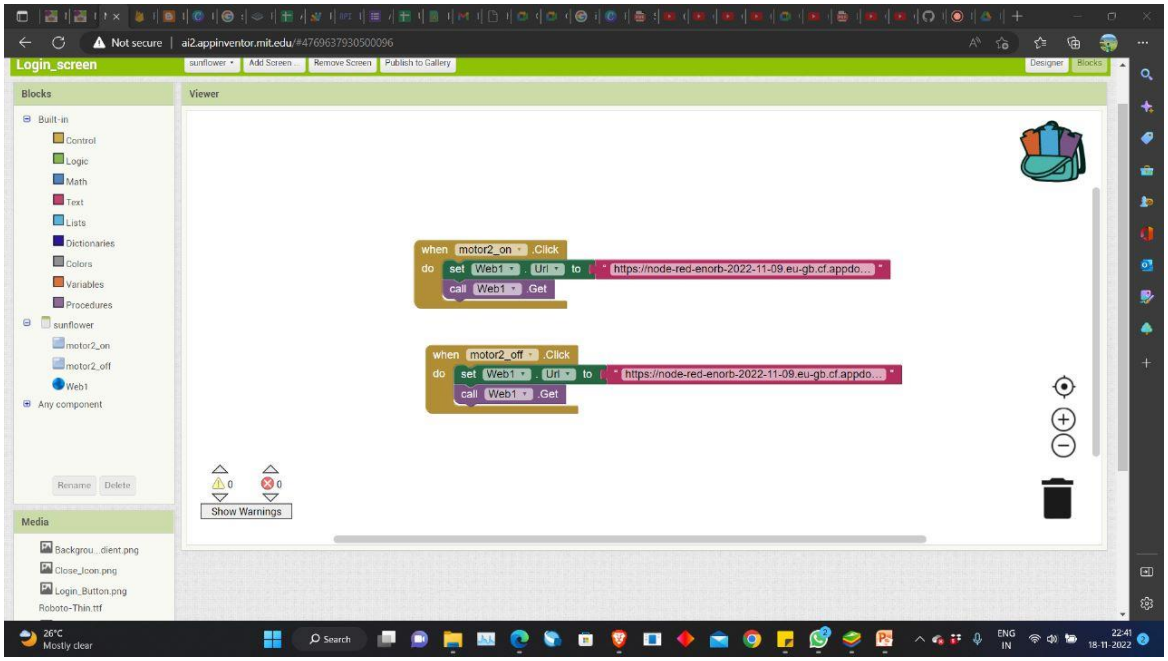
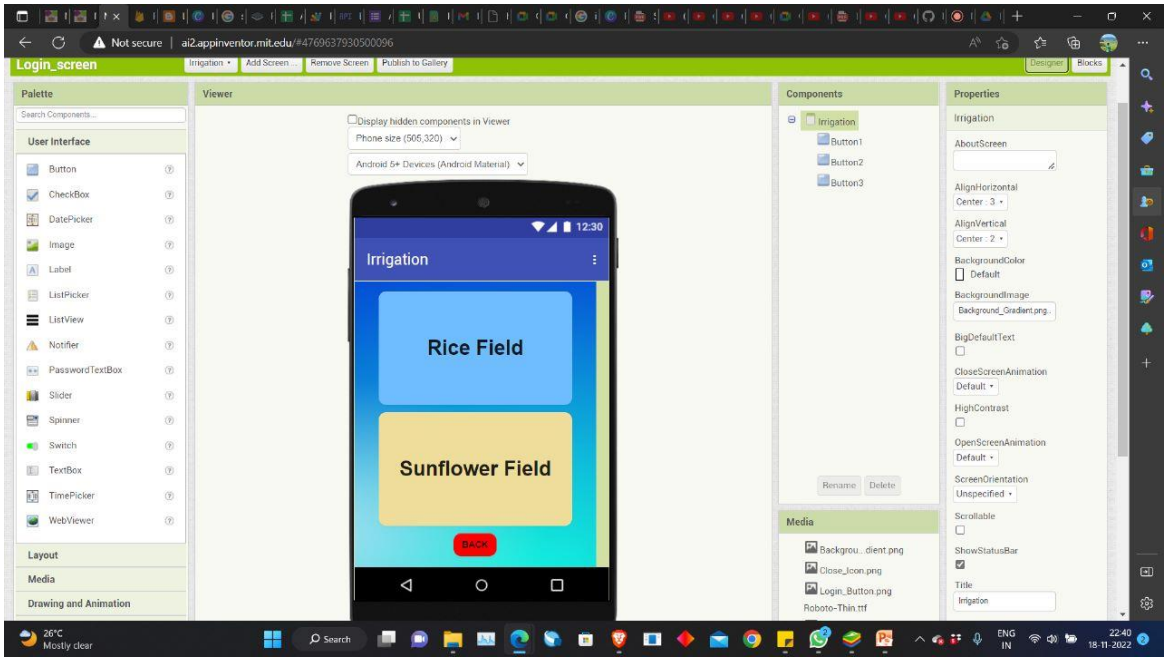
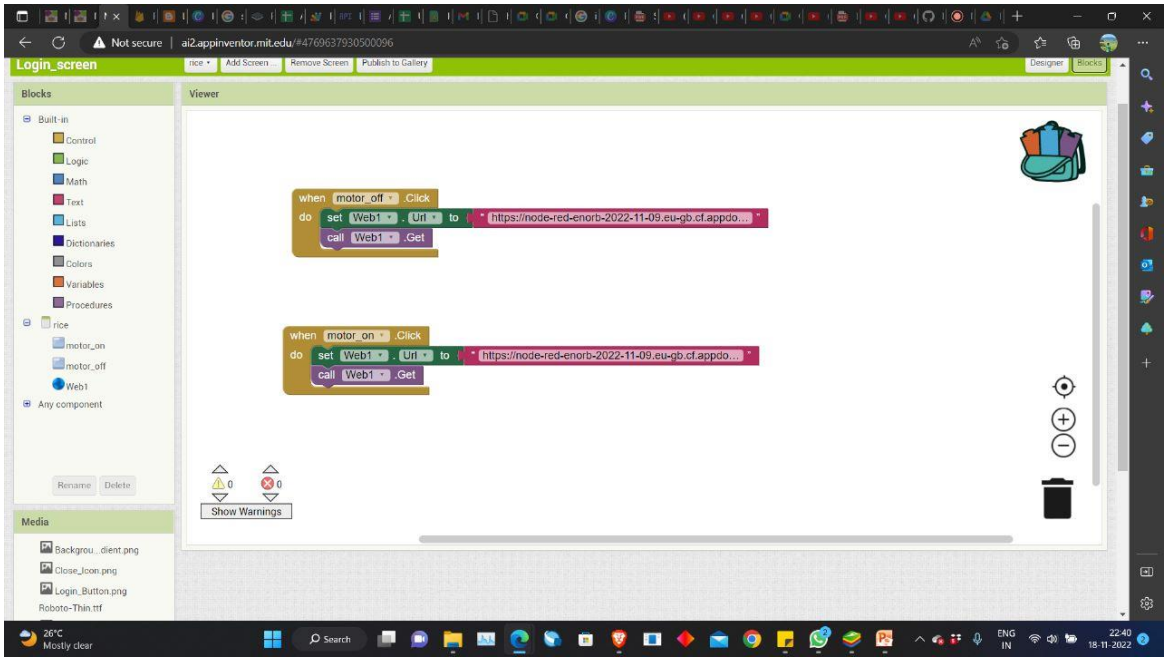
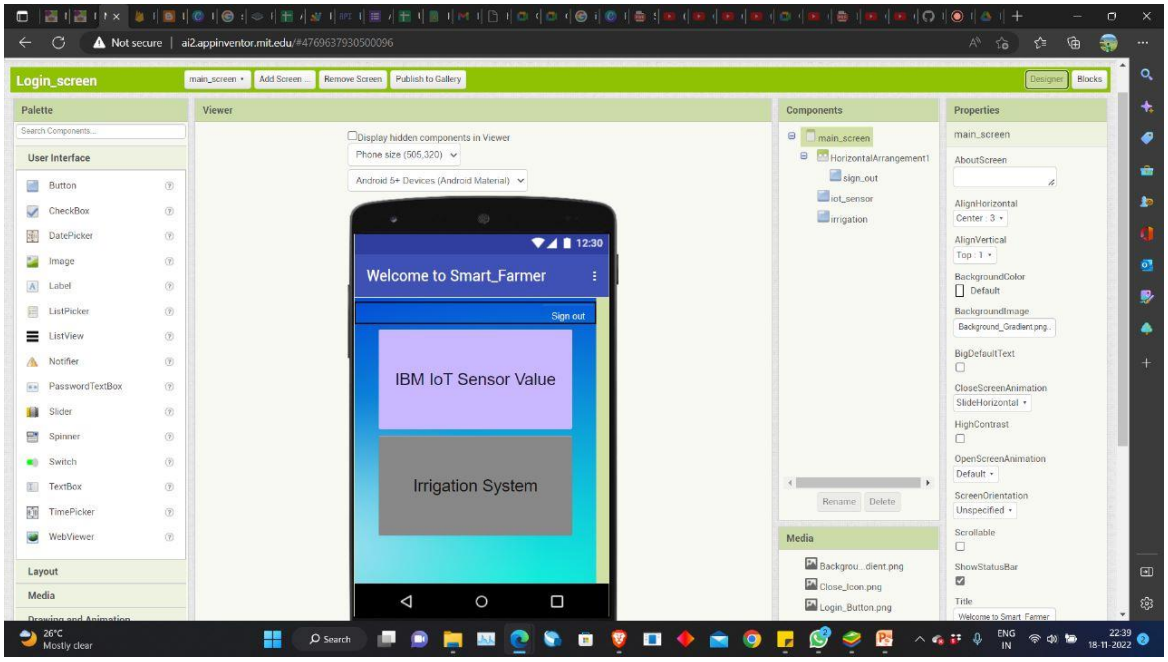
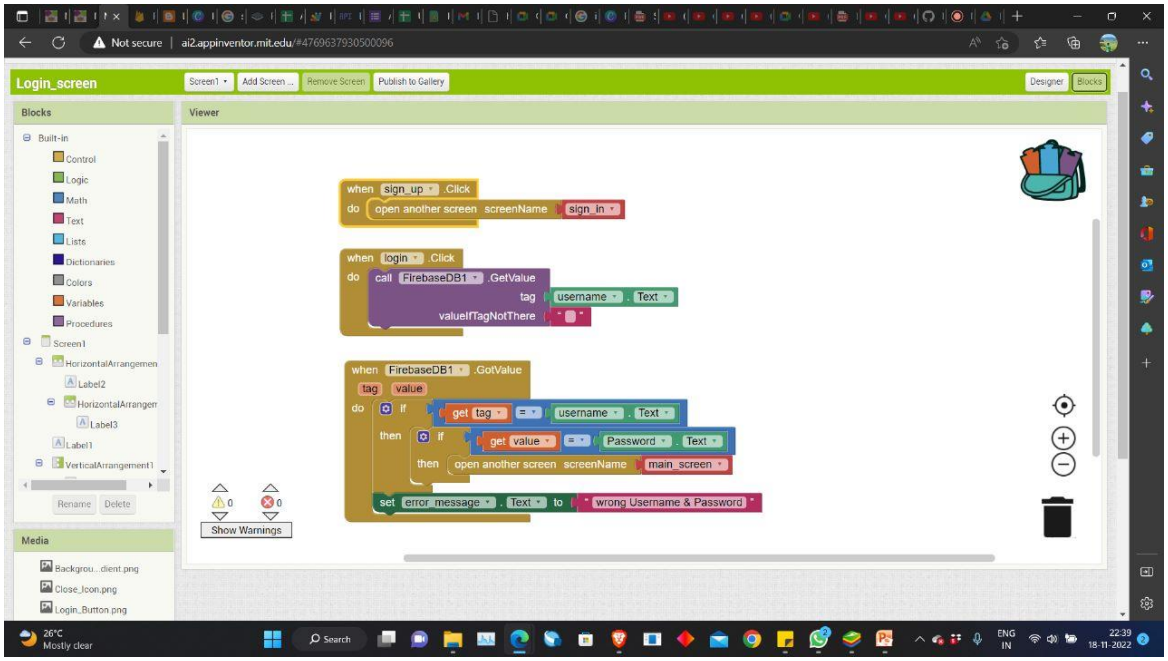
Components
rice
motor_on
motor_off
Web1
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Roboto-Thin.ttf
Properties
rice
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Center : 2
BackgroundColor
Default
BackgroundImage
Background_Gradient.png...
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar
Title
rice
Customize sidebar
26°C
Mostly clear
Search
ENG
IN
22:40
18-11-2022

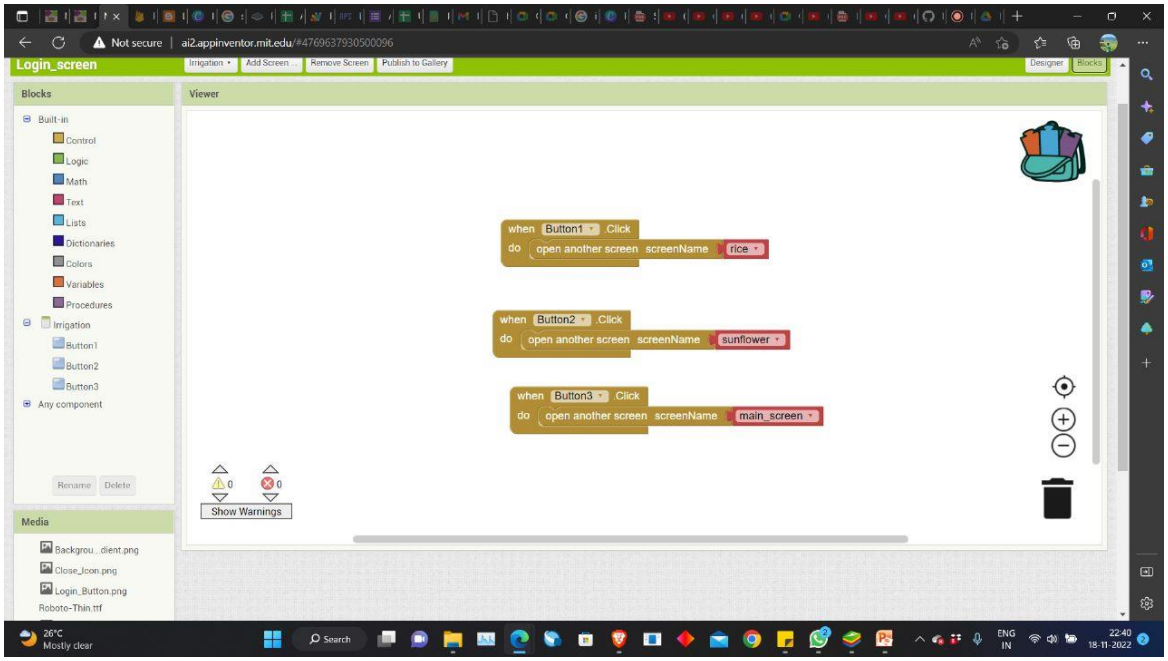

Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
sunflower
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
sunflower
motor2_on
motor2_off
Web1
Any component
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Roboto-Thin.ttf
Viewer
when motor2_on .Click
do set Web1 . Url to "https://node-red-enorb-2022-11-09.eu-gb.cf.appdo..."
call Web1 .Get
when motor2_off .Click
do set Web1 . Url to "https://node-red-enorb-2022-11-09.eu-gb.cf.appdo..."
call Web1 .Get
0
0
Show Warnings
26°C
Mostly clear
Search
ENG
IN
22:41
18-11-2022

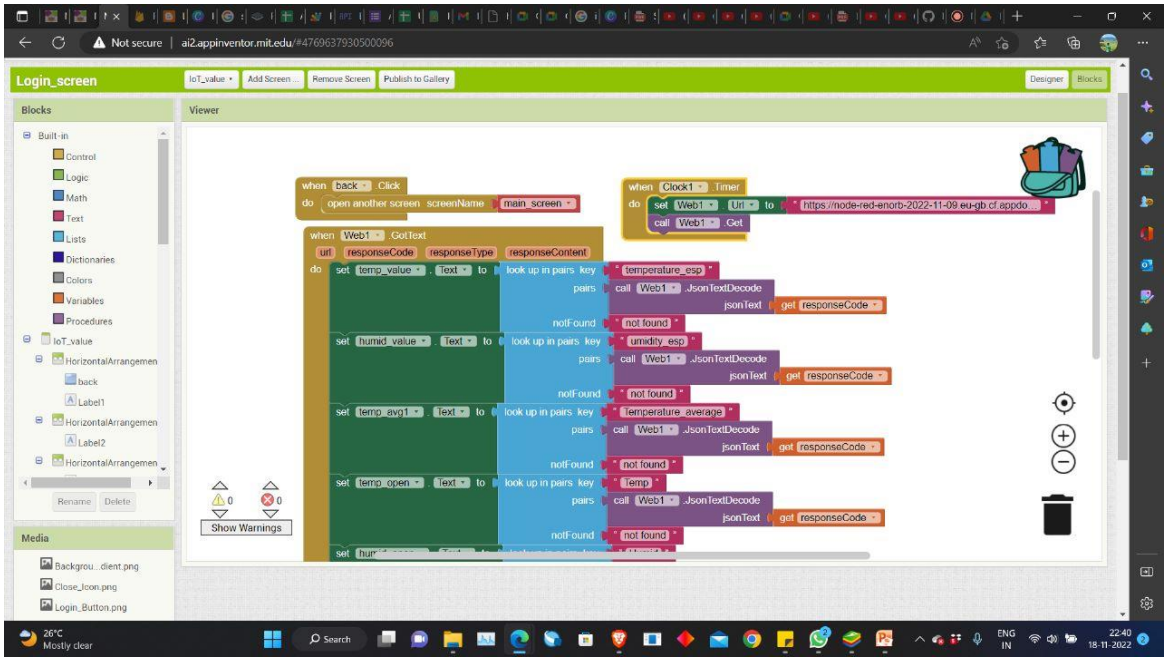

Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
Irrigation
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Drawing and Animation
Viewer
Display hidden components in Viewer
Phone size (505,320)
Android 5+ Devices (Android Material)
12:30
Irrigation
Rice Field
Sunflower Field
BACK
Components
Irrigation
Button1
Button2
Button3
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Roboto-Thin.ttf
Properties
Irrigation
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Center : 2
BackgroundColor
Default
BackgroundImage
Background_Gradient.png...
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar
Title
Irrigation
26°C
Mostly clear
Search
ENG
IN
22:40
18-11-2022

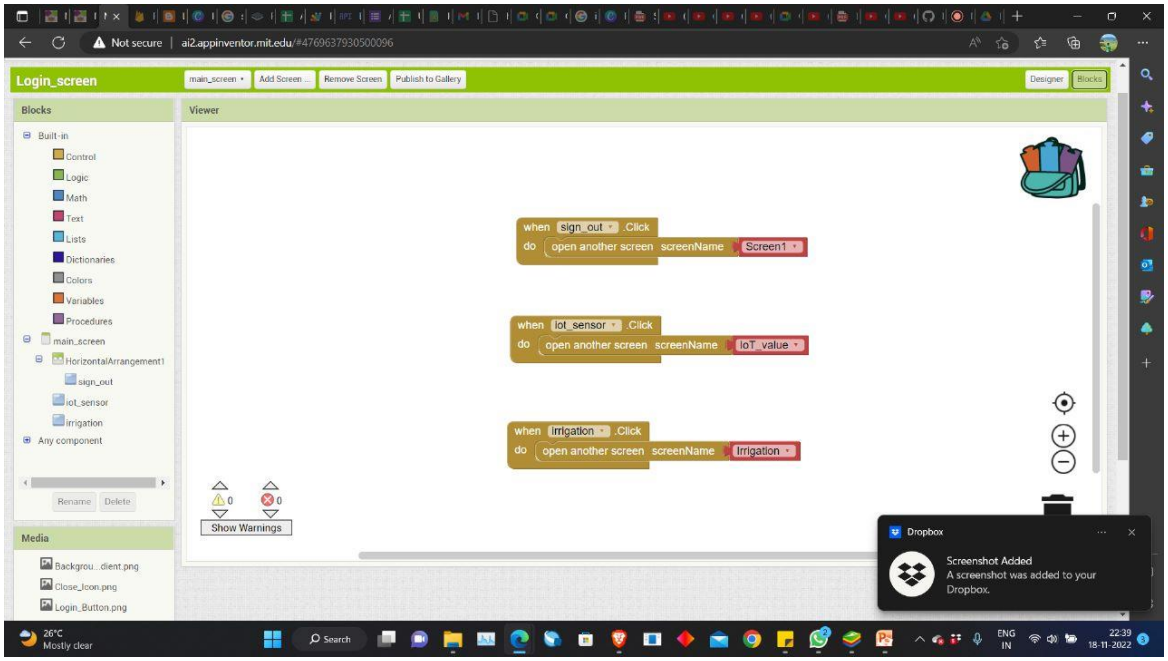

Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
when motor_off .Click
do set Web1 . Url to " https://node-red-enorb-2022-11-09.eu-gb.cf.appdo... "
call Web1 .Get
when motor_on .Click
do set Web1 . Url to " https://node-red-enorb-2022-11-09.eu-gb.cf.appdo... "
call Web1 .Get
Show Warnings
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
rice
motor_on
motor_off
Web1
Any component
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Roboto-Thin.ttf
26°C
Mostly clear
Search
ENG
IN
22:40
18-11-2022


Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
main_screen
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Palette
Search Components...
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Viewer
Display hidden components in Viewer
Phone size (505,320)
Android 5+ Devices (Android Material)
12:30
Welcome to Smart_Farmer
Sign out
IBM IoT Sensor Value
Irrigation System
Components
main_screen
HorizontalArrangement1
sign_out
iot_sensor
irrigation
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Properties
main_screen
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Top : 1
BackgroundColor
Default
BackgroundImage
Background_Gradient.png...
BigDefaultText
CloseScreenAnimation
SlideHorizontal
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar
Title
Welcome to Smart_Farmer
26°C
Mostly clear
Search
ENG
IN
22:39
18-11-2022


Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
HorizontalArrangemen
Label2
HorizontalArranger
Label3
Label1
VerticalArrangement1
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Viewer
when sign_up .Click
do open another screen screenName sign_in
when login .Click
do call FirebaseDB1 .GetValue
tag username . Text
valueIfTagNotThere
when FirebaseDB1 .GotValue
tag value
do if get tag = username . Text
then if get value = Password . Text
then open another screen screenName main_screen
set error_message . Text to wrong Username & Password
0
0
Show Warnings
26°C
Mostly clear
Search
ENG
IN
22:39
18-11-2022


Not secure | ai2.appinventor.mit.edu/#4769637930500096
Login_screen
Irrigation
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Blocks
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Irrigation
Button1
Button2
Button3
Any component
Rename
Delete
Media
Backgrou...dient.png
Close_Icon.png
Login_Button.png
Roboto-Thin.ttf
Viewer
when Button1 .Click
do open another screen screenName rice
when Button2 .Click
do open another screen screenName sunflower
when Button3 .Click
do open another screen screenName main_screen
0
0
Show Warnings
26°C
Mostly clear
Search
ENG
IN
22:40
18-11-2022





7.1Feature 1

//User Interface

//program for connecting open weather API to IBM cloud//

```
import requests as req
import json
import os
import ibmiotf.application
import ibmiotf.device
import time
import sys

# Weather Details
api_key = "ae3304d1ae3a8c4dc28ddc816b07b1a9"
city = "Chennai"
country = "IN"
url_w=f"https://api.openweathermap.org/data/2.5/weather?q=Chennai,IN&appid=ae3
304d1ae3a8c4dc28ddc816b07b1a9&units=metric"

#Cloud Details
org_id = "ml58t7"
device_type = "weather"
device_id = "weather_field"
auth_method = "token"
auth_token = "karan@2001"




def get_weather_details():
    weather_req = req.get(url = url_w)
    weather_data = weather_req.json()

    climate = weather_data['weather'][0]['main']
    humidity = weather_data['main']['humidity']
    pressure = weather_data['main']['pressure']
    temperature = weather_data['main']['temp']
    temperature_min = weather_data['main']['temp_min']
    temperature_max = weather_data['main']['temp_max']
    temperature_feel = weather_data['main']['feels_like']
    temperature_average = (temperature_max+ temperature_min)/2
    region="chennai"
    data =
{"climate":climate,"humidity":humidity,"temperature_average":temperature_average,
```

```
"temperature":temperature,"pressure":pressure,"region":region,"temperature_feel":tem
perature_feel}
    return data

def myonpublishcallback(data):
    print(f"Published Temperature_avg  = { data['temperature_average'] }, Humidity =
{data['humidity']}, Climate =
{data['climate']},Pressure={data['pressure']},Temperature={data['temperature']},Regi
on={data['region']},Temperature_feel={data['temperature_feel']}")

try:
    deviceOptions = {"org" : org_id,
                     "type" : device_type,
                     "id" : device_id,
                     "auth-method" : auth_method,
                     "auth-token" : auth_token
                    }
    deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
    print(f"Caught exception connecting device {str(e)}")
    sys.exit()
deviceCli.connect()
while True:
    data = get_weather_details()
    success = deviceCli.publishEvent("Current Weather","json",data,qos=1,on_publish
= myonpublishcallback(data))
    if not success:
        time.sleep(1)
```

7.3 Feature 2

```
// program for sensor values to IBM cloud from WOKWI
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#include "DHTesp.h"// Library for dht11
#define DHT_PIN 15
#define LED 5
DHTesp dhtSensor;// creating the instance by passing pin and typr of dht connected

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
```

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

#define ORG "ml58t7"//IBM ORGANITION ID
#define DEVICE_TYPE "weather"//Device type mentioned in ibm watson IOT
Platform
#define DEVICE_ID "esp_reading"//Device ID mentioned in ibm watson IOT
Platform
#define TOKEN "karan@2001"     //Token
String data3;
float data;


//-------- 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/test/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);
  dhtSensor.setup(DHT_PIN, DHTesp::DHT22);
  pinMode(LED,OUTPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}

void loop()// Recursive Function
```

```
{

 TempAndHumidity  data = dhtSensor.getTempAndHumidity();
  Serial.println("Temp: " + String(data.temperature, 2) + "°C");
  Serial.println("Humidity: " + String(data.humidity, 1) + "%");

  PublishData(data.temperature, data.humidity);
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}
```

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

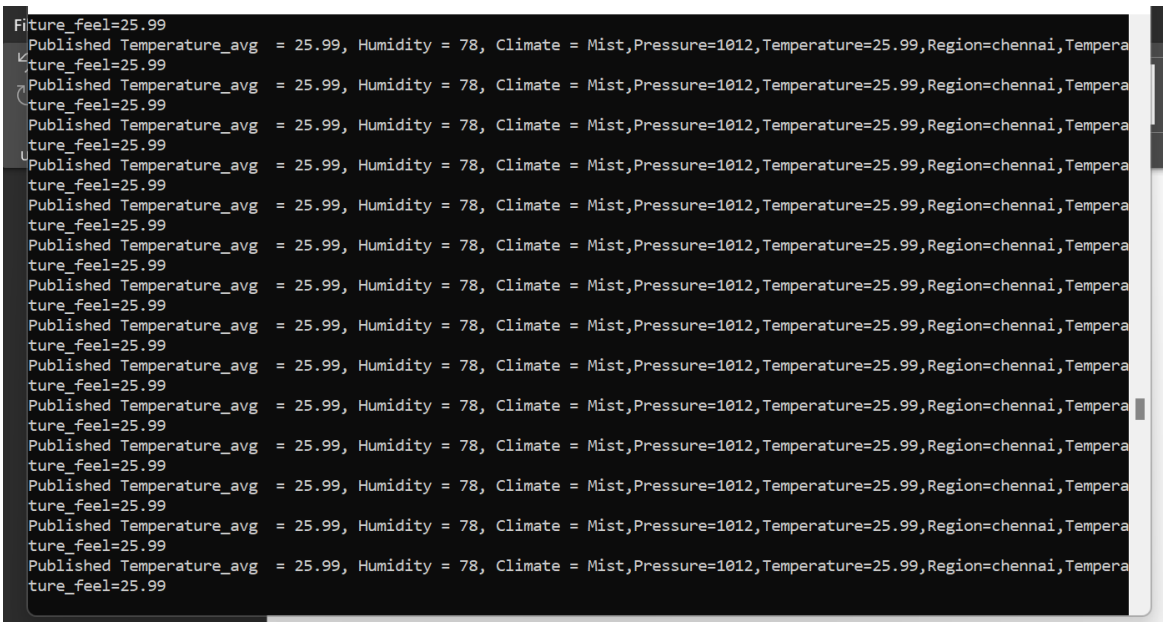
```
void PublishData(float temp, float humid) {
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String payload = "{\"temperature_esp\":";
  payload += temp;
  payload += "," "\"humidity_esp\":";
  payload += humid;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

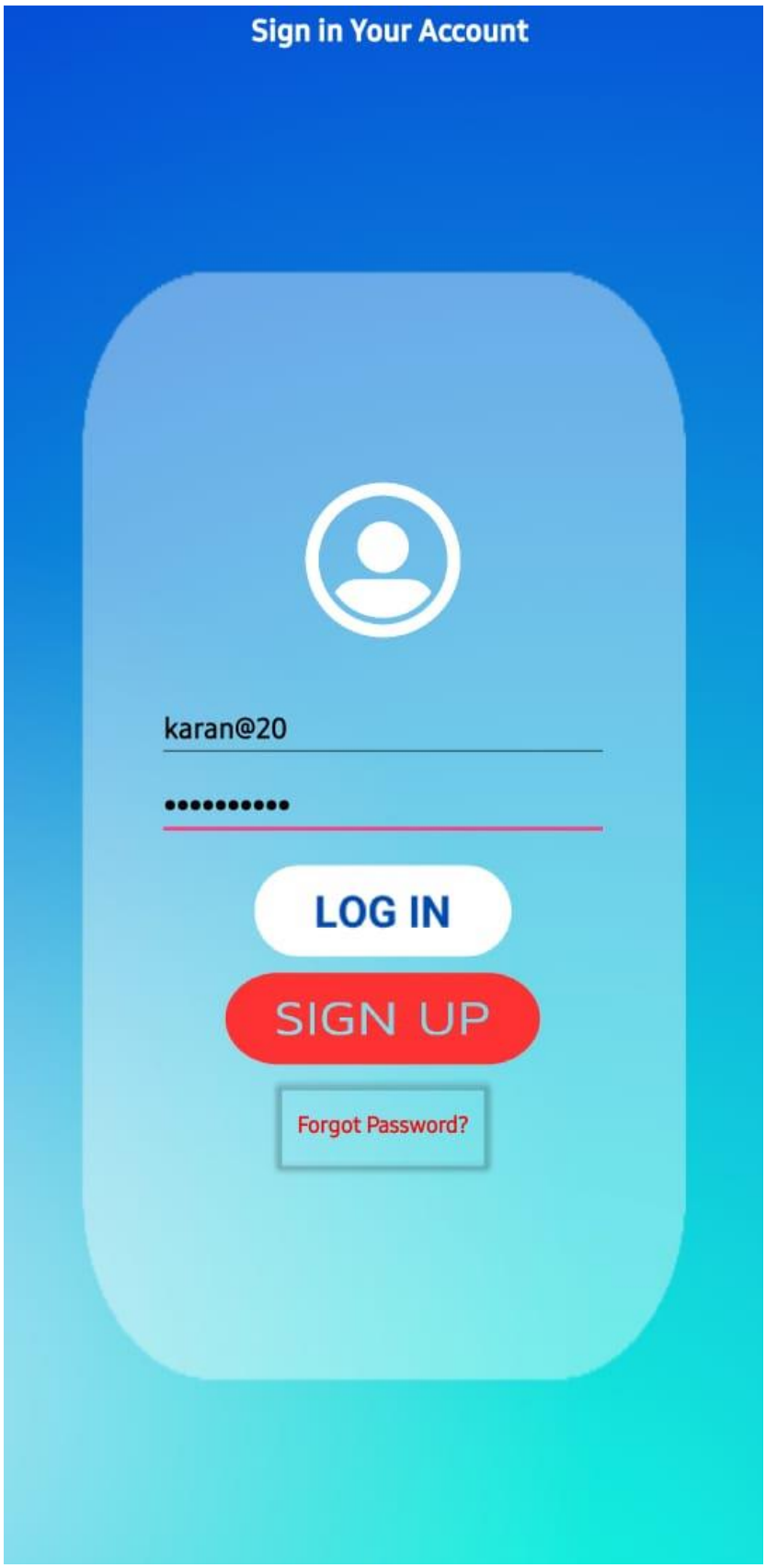
```
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{

  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=="motor_on&01" || data3=="motor_on&02")
  {
Serial.println(data3);
digitalWrite(LED,HIGH);

  }

  else
  {
Serial.println(data3);
digitalWrite(LED,LOW);

  }
data3="";


}
```

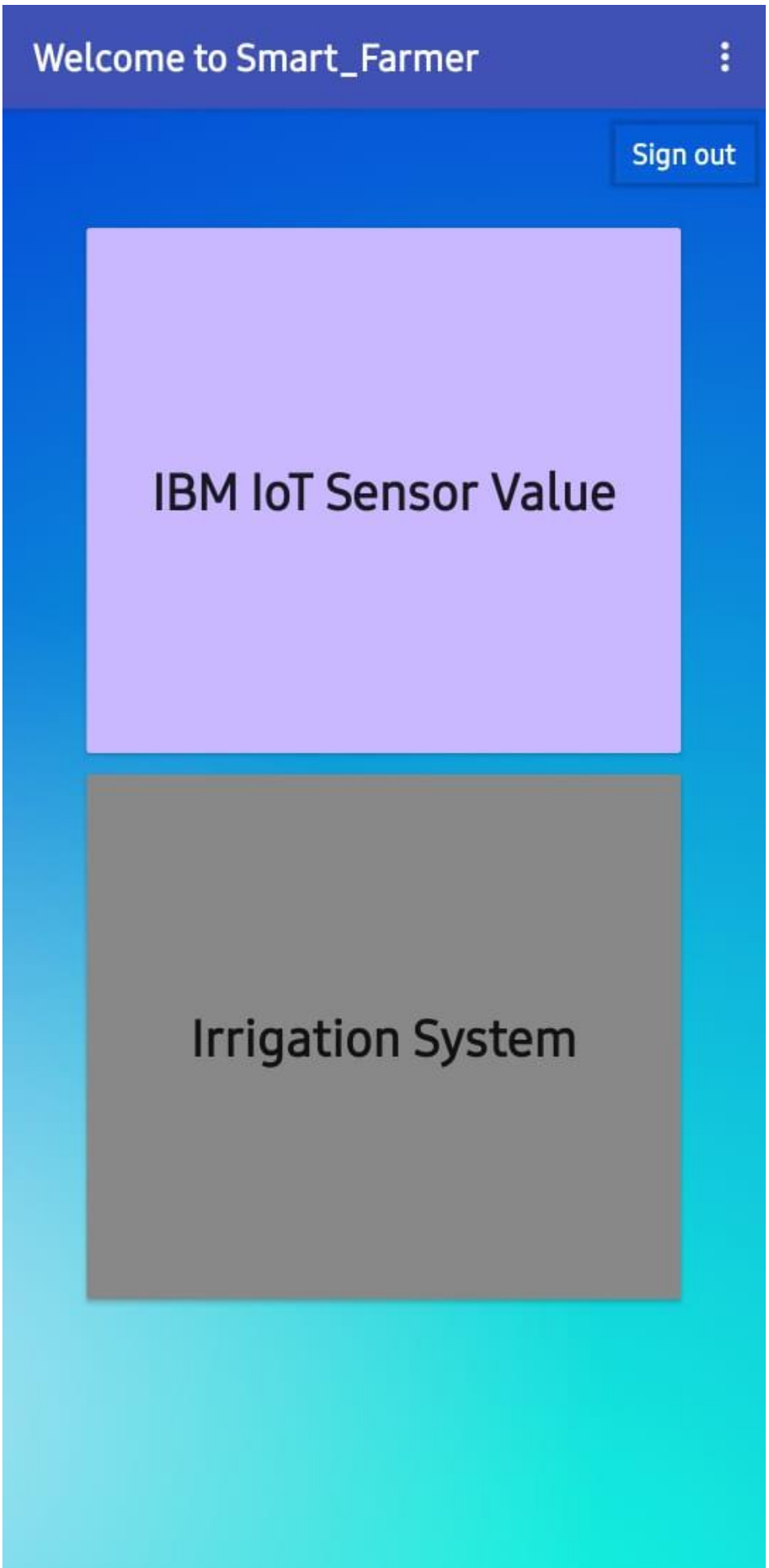
8. TESTING

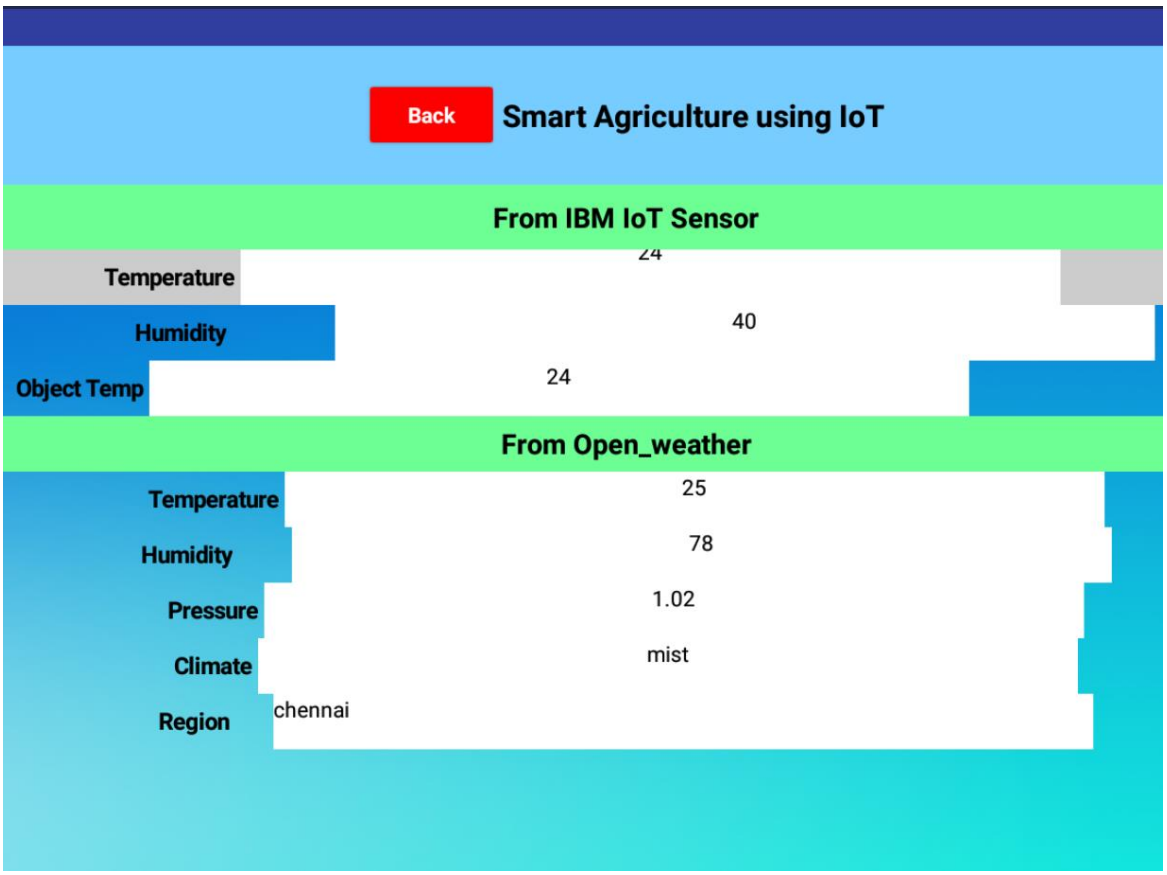
8.1 Test Cases

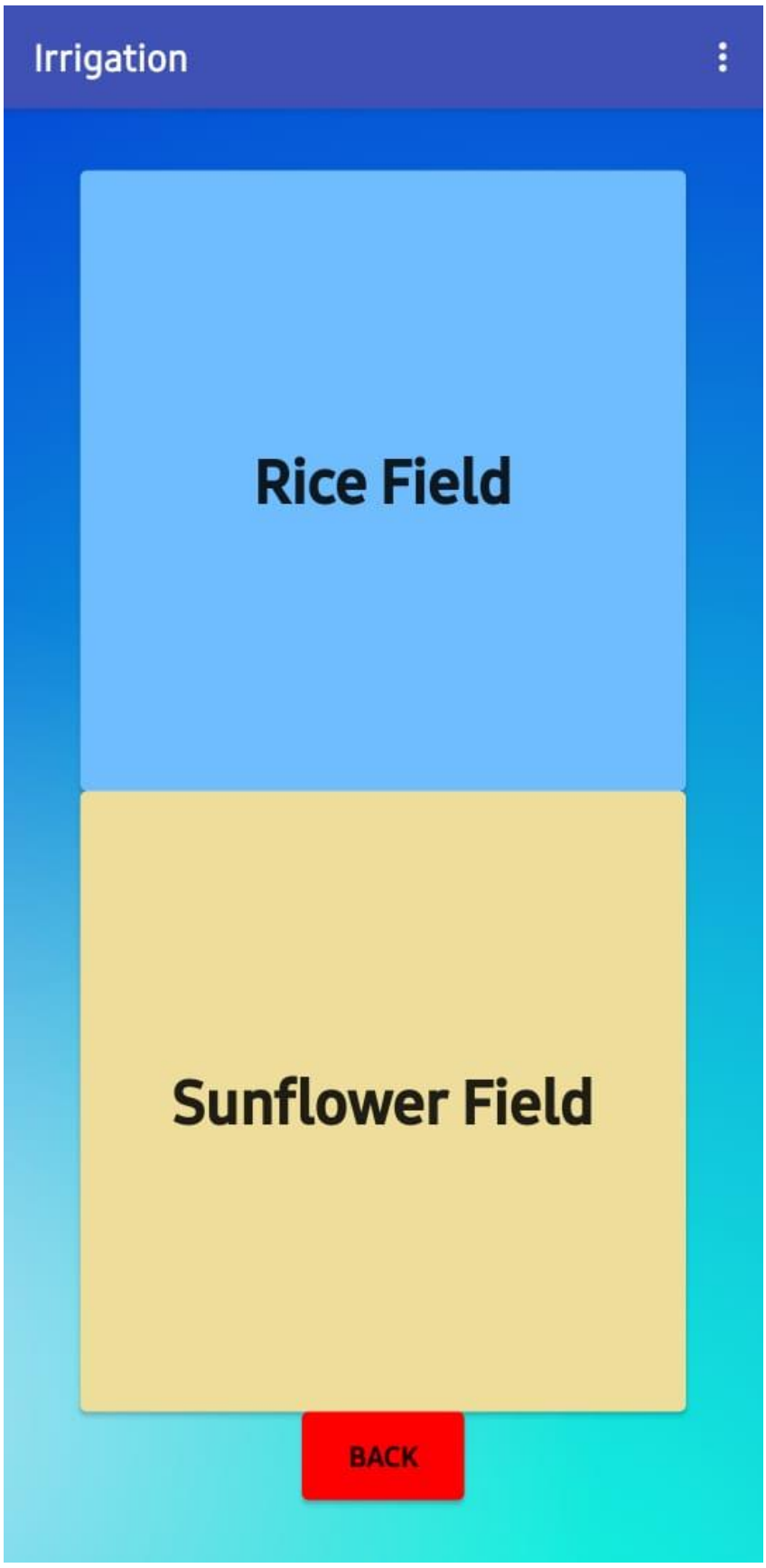


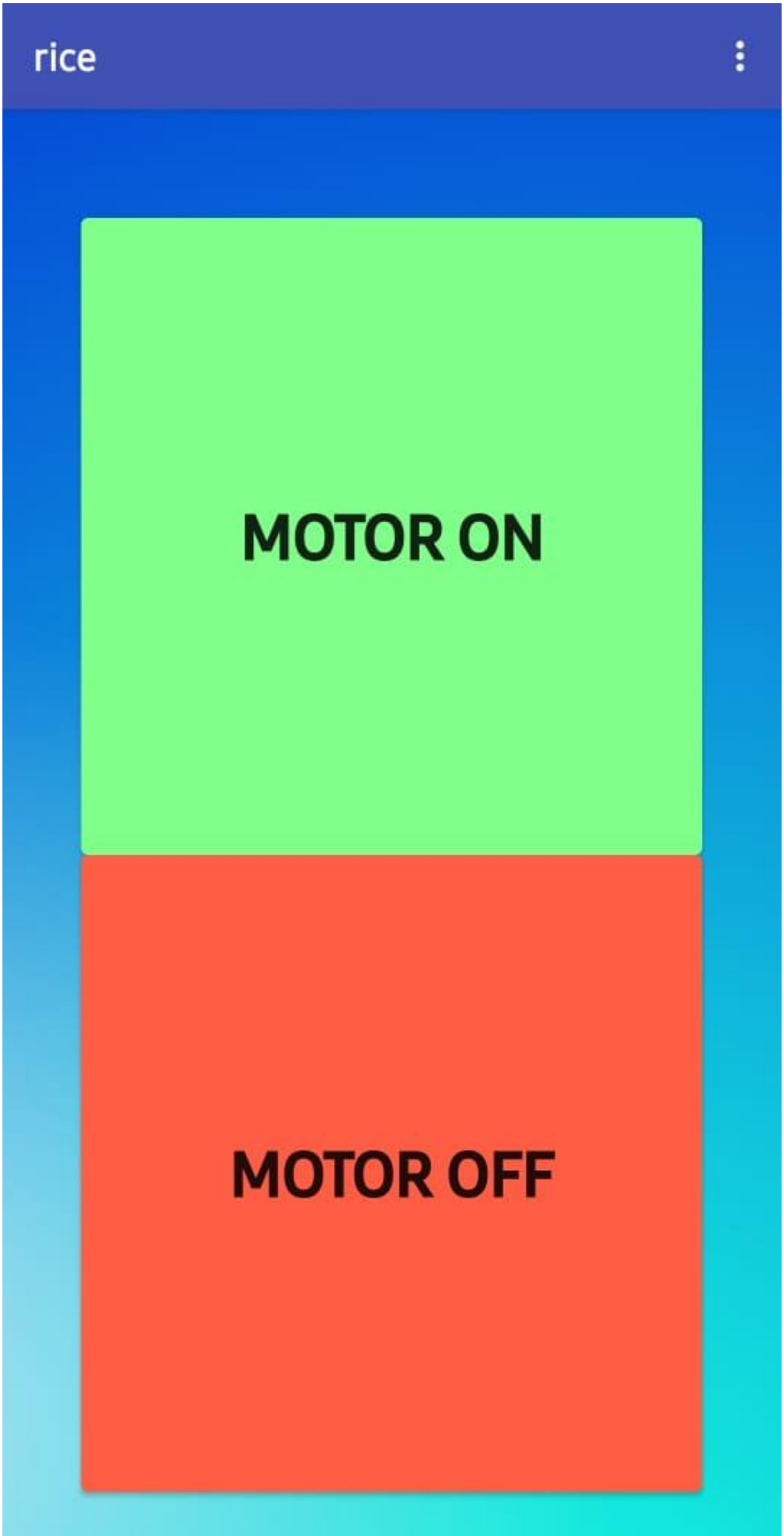
8.2 User Acceptance Testing

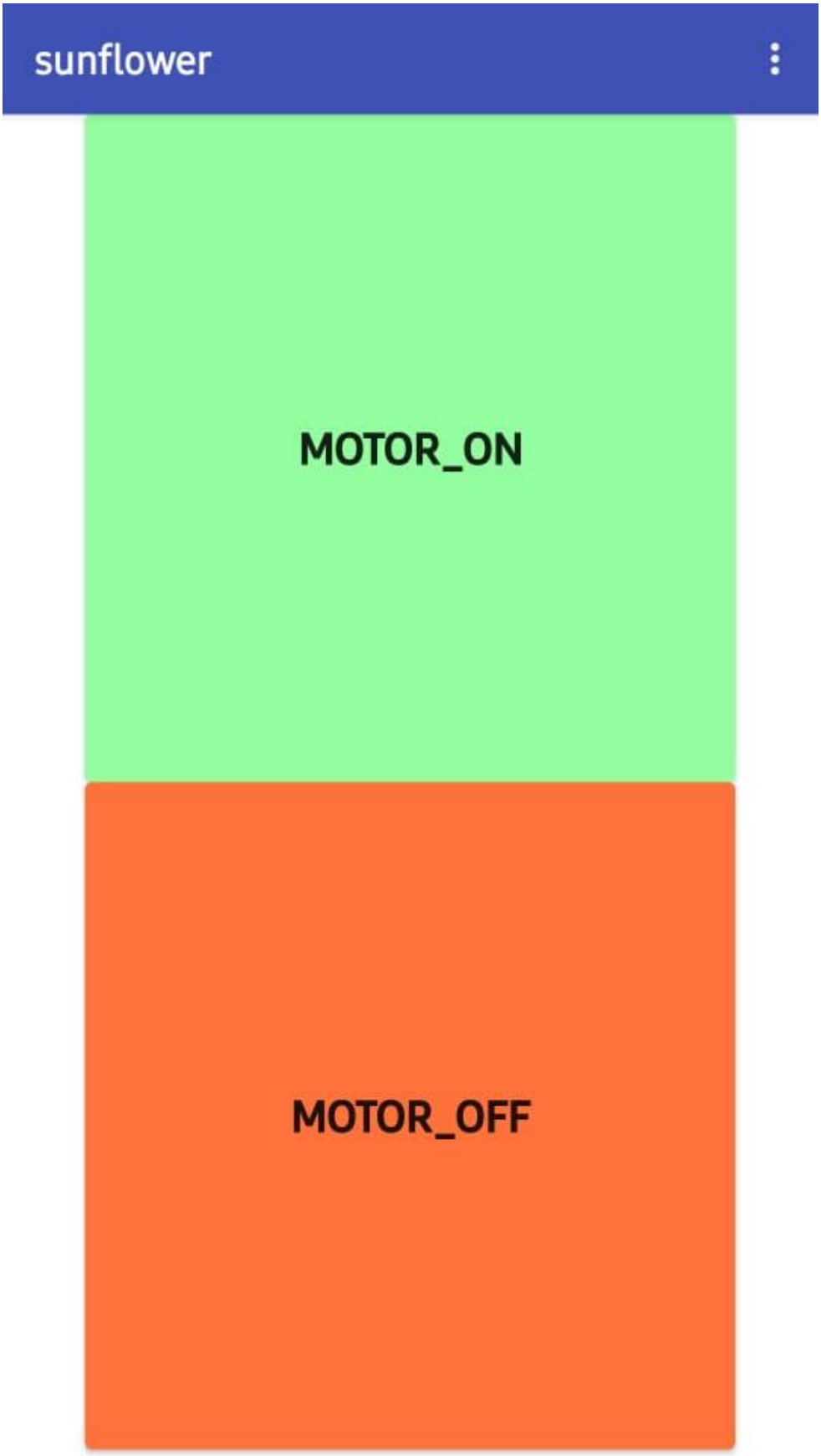

Sign in Your Account
karan@20
LOG IN
SIGN UP
Forgot Password?


Welcome to Smart_Farmer
Sign out
IBM IoT Sensor Value
Irrigation System


Back
Smart Agriculture using IoT
From IBM IoT Sensor
Temperature
24
Humidity
40
Object Temp
24
From Open_weather
Temperature
25
Humidity
78
Pressure
1.02
Climate
mist
Region
chennai


Irrigation
Rice Field
Sunflower Field
BACK


rice
MOTOR ON
MOTOR OFF


sunflower
MOTOR_ON
MOTOR_OFF

9. RESULTS

9.1Performance Metrics

Hence a helpful and useful system is built for farmers to assist them in farming and also prevent them from natural calamities. It also saves farmers time to maintain all these things as this is working on cloud he can turn on/off motor from anywhere so basically it helps farmers and make them relived thus helping our economy to grow.

10 ADVANTAGES & DISADVANTAGES

Advantage:

- Monitoring weather parameters such as temperature, pressure, humidity, soil moisture remotely.
- Controlling motors easily through buttons.
- farmers in case of any calamities.
- Threshold values are set any anomalies will be reported to the farmer.
- user friendly and efficient.
- Low cost.

Disadvantage:

- Sensors may sometime malfunction.
- Maybe inaccurate sometimes.
- Farmer needs internet connectivity.
- Farmer must have a phone and have basic knowledge to operate it.

11 **CONCLUSION**

Smart Farming and IoT-driven agriculture are paving the way for what can be called a Third Green Revolution.

The Third Green Revolution is taking over agriculture. That revolution draws upon the combined application of data-driven analytics technologies, such as precision farming equipment, IoT, “big data” analytics, Unmanned Aerial Vehicles (UAVs or drones), robotics, *etc*.

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

Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind.

12 **FUTURE SCOPE**

With the exponential growth of world population, according to the UN Food and Agriculture Organization, the world will need to produce 70% more food in 2050, shrinking agricultural lands, and depletion of finite natural resources, the need to enhance farm yield has become critical. Limited availability of natural resources such as fresh water and arable land along with slowing yield trends in several staple crops, have further aggravated the problem. Another impeding concern over the farming industry is the shifting structure of agricultural workforce. Moreover, agricultural labour in most of the countries has declined. As a result of the declining agricultural workforce, adoption of internet connectivity solutions in farming practices has been triggered, to reduce the need for manual labour.

IoT solutions are focused on helping farmers close the supply demand gap, by ensuring high yields, profitability, and protection of the environment. The approach of using IoT technology to ensure optimum application of resources to achieve high crop yields and reduce operational costs is called precision agriculture. IoT in agriculture technologies comprise specialized equipment, wireless connectivity, software and IT services.

13 **APPENDIX** Source Code

GitHub Repo Link:
https://github.com/IBM-EPBL/IBM-Project-20370-1659718065
IBM video link:
https://github.com/IBM-EPBL/IBM-Project-20370-1659718065/blob/main/Final%20Deliverables/IBM%20Video.mkv