SMART FARMER – IOT ENABLED SMART FARMING APPLICATION

PROJECT REPORT

SUBMITTED BY

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In partial fulfilment for the award of the degree

Of

BACHELOR OF TECHNOLOGY

In

INFORMATION TECHNOLGY

V.S.B. ENGINEERING COLLEGE, KARUR

(Approved by AICTE & Affiliated by Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this project report titled **"SMART FARMER – IOT ENABLED SMART FARMING APPLICATION"** is the bonafide record work by **S. PEMALATHA (922519205076), SELENA CLARA M (922519205098), SNEHA L (922519205106)** and **SUBIKA M (922519205112)** for **IBM – NALAYATHIRAN** in VII semester of **B.Tech.,** degree course in **INFORMATION TECHNOLOGY** branch during the academic year of 2022-2023.

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INTRODUCTION

1.1 Project Overview

Internet of Things (IoT) devices and cutting-edge technology like cloud technology, smart farming has significantly changed the way that farming is done. Data analytics, technology, and fog computing. It permits farmers.to be informed about the farm in real time and assist them in making shrewd and well-informed choices. In this essay, we suggest a Model based on Distributed Data Flow (DDF) for smart farming an application made up of interconnected modules. We two deployments are used to assess the proposed application paradigm. fog-based and cloud-based approaches, depending on the application modules are installed in the cloud and fog data centre respectively. We contrast the fog- and cloud-based. Using Internet of Things (IoT) devices and cutting-edge technology like cloud technology, smart farming has significantly changed the way that farming is done. We contrast the fog- and cloud-based approach for network use and endto-end latency.

1.2 PURPOSE

The application of modern IOT technology in agricultural areas has been intensively investigated and the subject of innumerable exploits One of the biggest areas for IoT innovation is precision agriculture, a discipline that employs analytical metrics to optimise farming operations. Enhanced crop yields are now more important than ever for global food security. This crop production maximisation is made possible by cloud-connected, wireless technology, which automate routine agricultural chores and provide real-time monitoring for daily intelligent decision-making. To assist farmers in analysis and for better management of the agricultural field, from companies own various GPS connections, monitors, and controls. Most of the food and farming sectors would adopt expanded production once the organic business becomes more well-known in order to acquire effective and affordable pesticide substitutes. It is essential to pay close attention to all large-scale solutions.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

PROBLEM STATEMENT

Farmers are under the pressure to boost food production while using less water and energy. Farmers will be better able to handle these pressures with the aid of a remote monitoring and control system. A single pump is often used by irrigated fields to water 80 to 100 acres of land. Thus, hundreds of square miles of huge farms require 40 to 80 or more irrigation pumps. Most operate in isolated fields, producing ground water for agriculture, and require trucks to roll to them. Every area should, in theory, receive the ideal quantity of water at the ideal moment. Under watering stresses crops and lowers yields. Additionally, overwatering reduces yield and uses more freshwater and fuel than is necessary, which leads in runoff from pesticides, herbicides, and fertilisers damages the soil.

2.2 REFERENCE

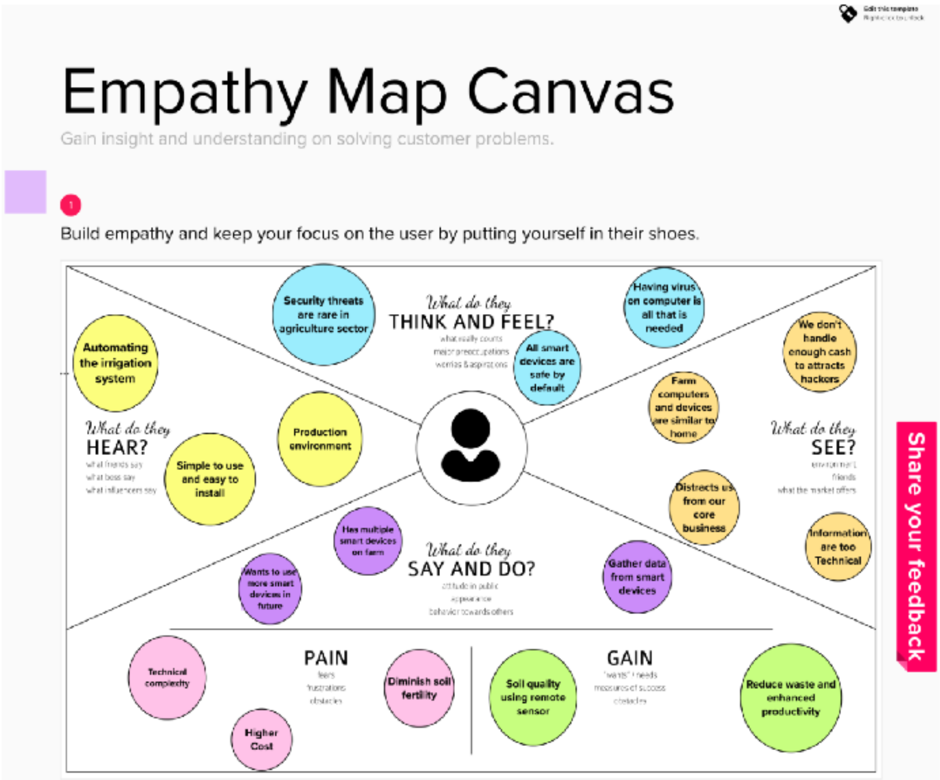
- Laura Garcia, Lorena Parra, Jose M. Jimenez, Jaime Lloret and Pascal Lorenz,
- "IoT -Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture", *Sesnors*, 2020.
- 2.Akey Sungheetha and Rajesh Sharma, "Real Time Monitoring and Fire Detection using Internet of Things and Cloud based Drones", *Journal of Soft Computing Paradigm (JSCP)*, vol. 2, no. 03, pp. 168-174, 2020.
- 3. G. Shruthi, B. Selva Kumari, R. PushpaRani and R. Preyadharan, "A- real time smart sprinkler irrigation control system", *2017 IEEE International Conference on Electrical Instrumentation and Communication Engineering (ICEICE)*, 2017.
- 4. I.D. Ighodaro, A. Mushunje, B.F. Lewul and B.E. Omoruvi, "Climate-Smart Agriculture and Smallholder Farmers' Income: The Case of Soil Conservation Practice-Adoption at Qamata Irrigation Scheme South Africa", *JHE*, 2020.

2.3 PROBLEM STATEMENT

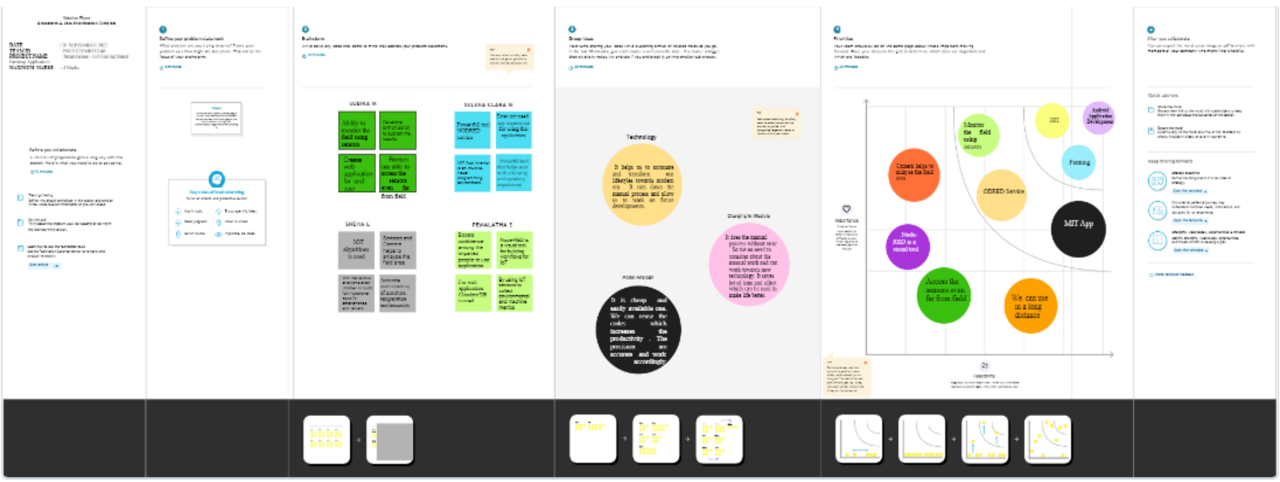
Farmers are under the pressure to boost food production while using less water and energy. Farmers will be better able to handle these pressures with the aid of a remote monitoring and control system. A single pump is often used by irrigated fields to water 80 to 100 acres of land. Thus, hundreds of square miles of huge farms require 40 to 80 or more irrigation pumps. Most operate in isolated fields, producing ground water for agriculture, and require trucks to roll to them. Every area should, in theory, receive the ideal quantity of water at the ideal moment. Under watering stresses crops and lowers yields. Additionally, overwatering reduces yield and uses more freshwater and fuel than is necessary, which leads in runoff from pesticides, herbicides, and fertilisers damages the soil.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



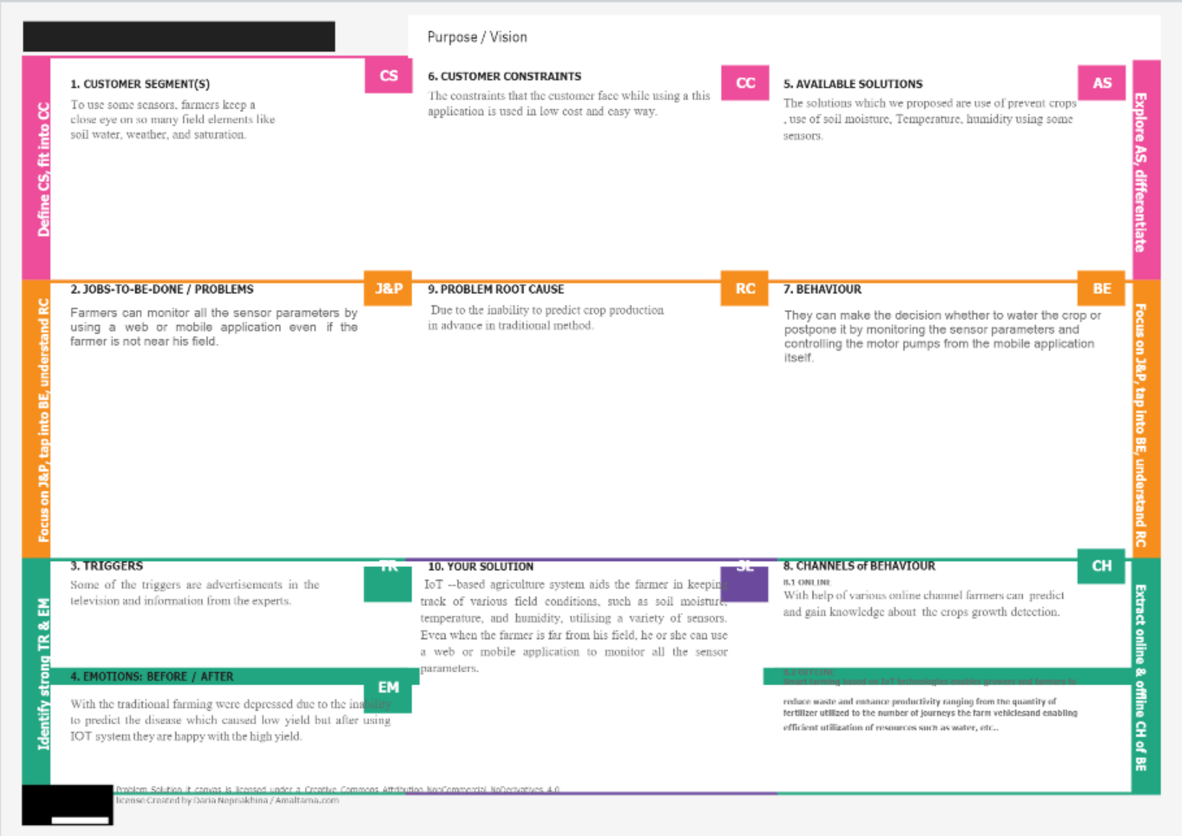
3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

S.NO	Parameter	Description
1	Problem Statement (Problem to be solved)	Overuse of fertiliser and insecticides in agricultural fields damages crops and decreases field productivity, making the soil more susceptible to pest infestations.
2	Idea / Solution description	We can offer a solution using the Smart Farming Application system, which was created for monitoring the irrigation system and using sensors to monitor the agricultural area.
3	Novelty / Uniqueness	We can use IoT gadgets can be effectively used to offer answers to the issue. To determine the real moisture content of the soil, we employ a soil moisture level sensor
4	Social Impact / Customer Satisfaction	This Application will help to Customers and farmers will benefit from this application's improved understanding of key farming components like water, vegetation, and soil kinds.
5	Business Model (Revenue Model)	This application will give a revenue or profit about 40% of yearly expenditure.
6	Scalability of the Solution	Our project is capable to grow in the market as smart farming is an emerging technology now a days.

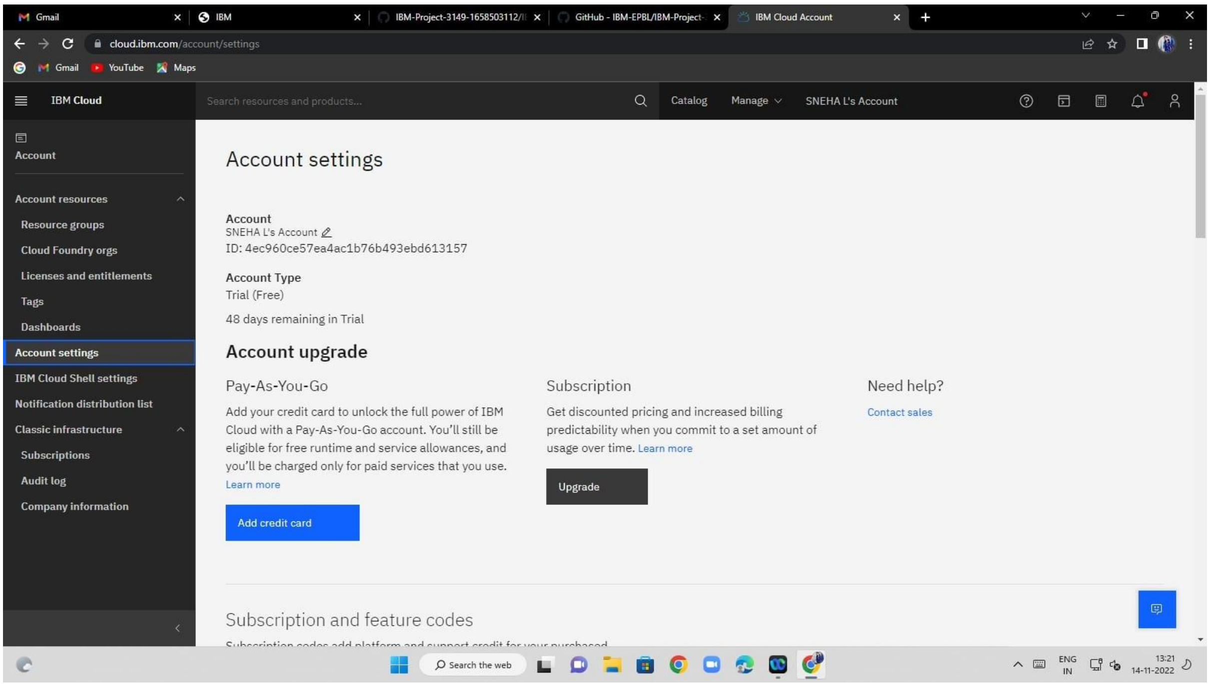
3.4 PROBLEM SOLUTION FIT



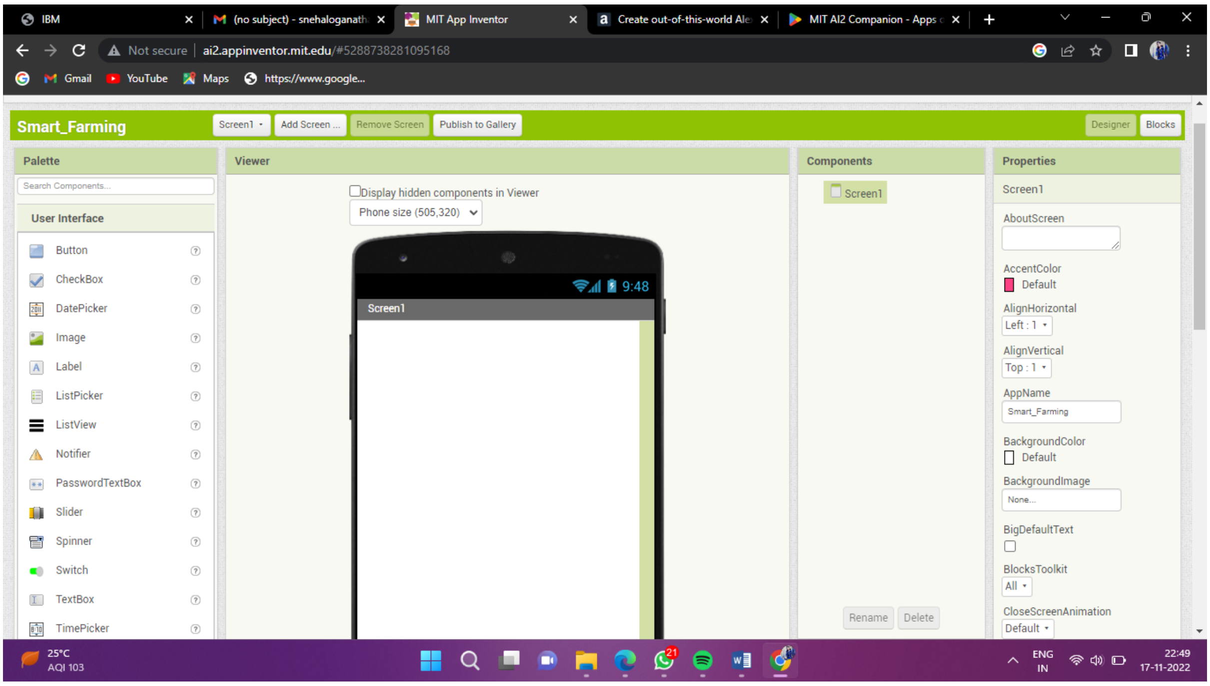
4. PRE REQUISITES

4.1 IBM Cloud Services

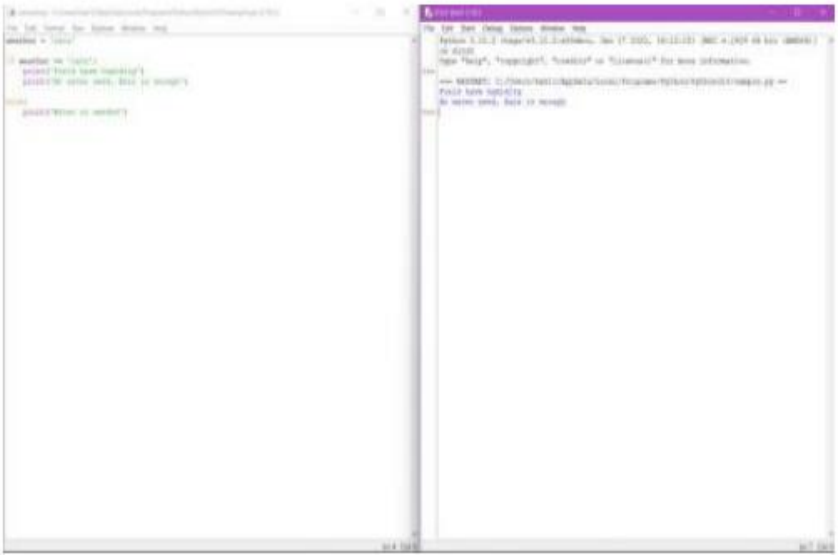
Cloud Account Creation



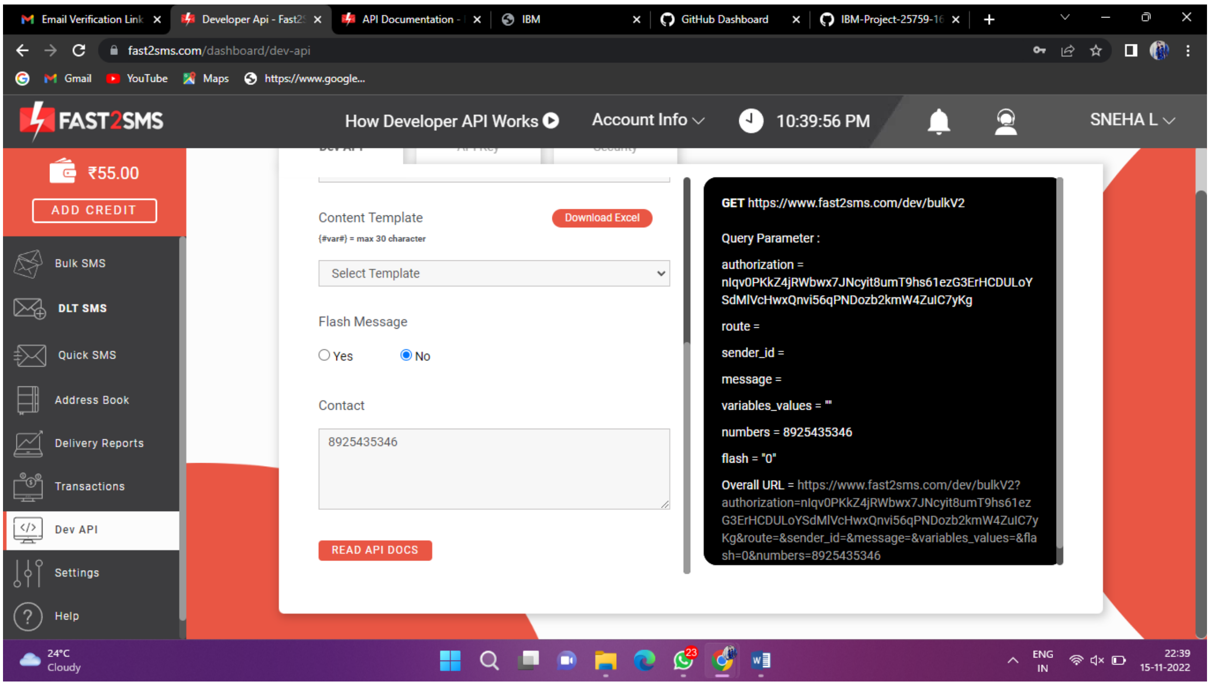
4.2 MIT App Inventor



4.3 Software



4.4 Create An Account In Fast2sms Dashboard



5. REQUIREMENT ANALYSIS

5.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Log in to system	Check Roles of Access. Check Credentials
FR-4	Manage Modules	Manage System Admins Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Log out	Exit

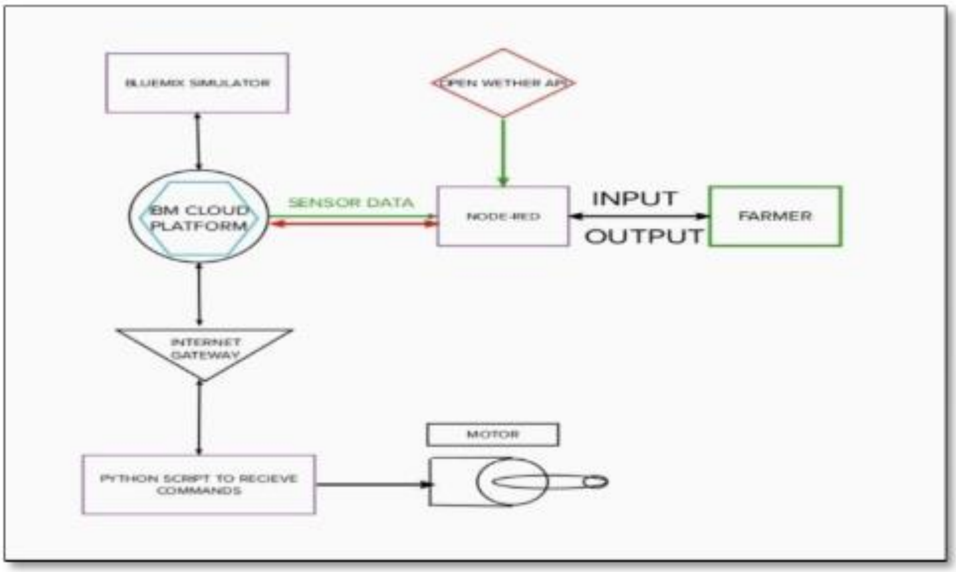
5.2 Non-functional Requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Usability is defined as the ability to learn quickly, use something effectively, remember something, operate something without making a mistake, and enjoy something.

NFR-2	Security	Private and confidential information must be kept secure at all times, including during collection, processing, and storage.
NFR-3	Reliability	A superior cost-to-reliability trade-off is achieved with shared protection. To prevent agricultural service interruptions, the approach employs specialised and shared protection methods.
NFR-4	Performance	It will be more effective to monitor farming operations overall if integrated sensors are used to measure soil and ambient characteristics.
NFR-5	Availability	By tying information about crops, weather, and equipment together, it is feasible to automatically alter temperature, humidity, and other factors in farming equipment.
NFR-6	Scalability	For IoT platforms, scalability is a big challenge. It has been demonstrated that different IoT platform architectural decisions impact system scalability and that automatic real-time decision-making is possible in a setting with thousands of users.

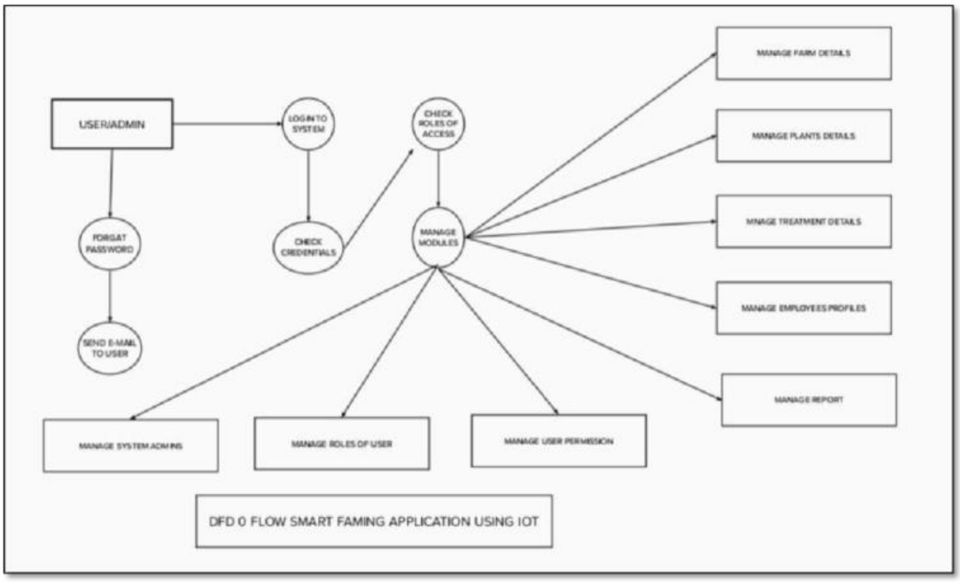
6. PROJECT DESIGN

6.1 DATA FLOW DIAGRAM



A Data flow diagram (DFD) is a common visual representation of how information moves through a system. A clean and understandable DFD can graphically represent the appropriate quantity of the system need. It displays how information enters and exits the system, what modifies the data, and where information is kept. Using various sensors, the various soil parameters, including temperature, moisture content and humidity are measured. The results are then stored in the IBM cloud. The Arduino UNO is utilised as a processing unit to process the data from the sensors and weather API. To write the hardware, software, and APIs. NODE-RED is employed as a programming tool. In order to communicate, the MQTT protocol is used. A mobile application created with MIT App Inventor makes all the collected data available to the user. Depending on the sensor results, the user might decide whether or not to irrigate the crop using an app. They can control the motor switch remotely by utilising the app.

6.2 Solution & Technical Architecture



Guidelines:

- Include all the processes (As an application logic / Technology Block)
- Provide infrastructural demarcation (Local / Cloud)
- Indicate external interfaces (third party API's etc.)
- Indicate Data Storage components / services
- Indicate interface to machine learning models (if applicable)

- Temperature, soil moisture, and humidity are three separate soil parameter measurements that are made using various sensors and recorded in the IBM cloud.
- The data from the sensors and weather API are processed using an Arduino UNO as a processing unit.
- NODE-RED is used as a programming tool to write the hardware, software and APIs. The MQTT protocol is followed for the communication.
- Through a smartphone application created with the aid of MIT App Inventor, the user is given access to all the collected data. Depending on the sensor results, the user might decide whether or not to irrigate the crop using an app. They can control the motor switch remotely by utilising the app.

6.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	1	Can register for the application by entering my email, password, and confirming my password.	Can access my account / dashboard	High	Sprint-1
		2	Will receive confirmation email once I have registered for the application	Receive confirmation email & click confirm	High	Sprint-1
		3	Can register for the application through Facebook	Can register & access the dashboard with Facebook	Low	Sprint-2
		4	Can Register for the application through Gmail		Medium	Sprint-1
	Login	**5**	Can Log into the application		High	Sprint-1

			by entering email & password			
	Dashboard					
Customer (Web user)						
Customer Care Executive						
Administrator						

7. PROJECT PLANNING AND SCHEDULING

7.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Subika M
Sprint 2	Software	USN-2	Creating devices in the IBM Watson IoT platform, workflow for IoT scenarios using node-Red	2	High	Pemalatha S
Sprint 3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Selena Clara M

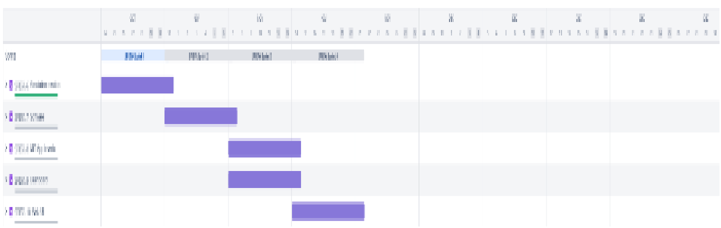
Sprint 3	Dashboard	USN-3	Design the Modules and test the app	2	High	Subika M Pemalatha S
Sprint 4	Web UI	USN-4	To make the user interact with software	2	High	Selena Clara M Sneha L

7.2 SPRINT DELIVERY SCHEDULE

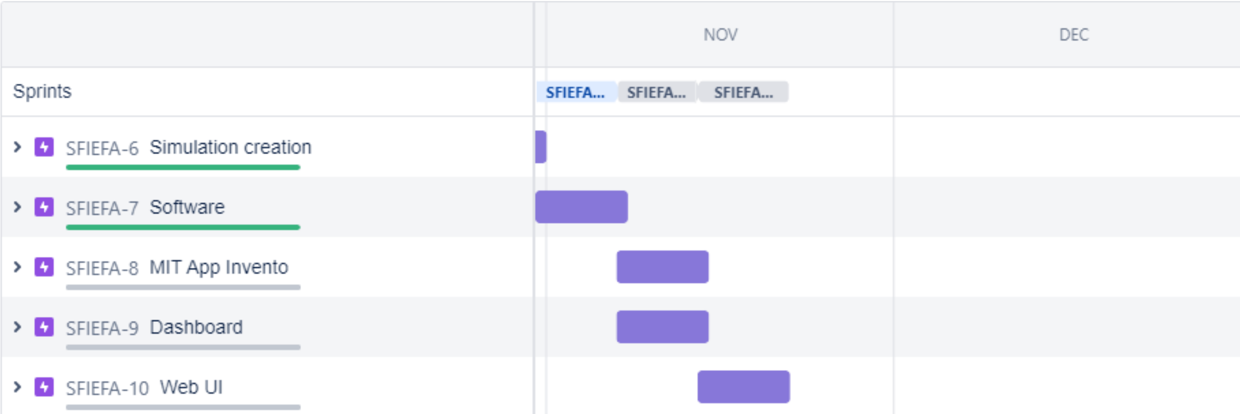
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Point Completed (as on Planned Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Oct 2022	35	31 Oct 2022
Sprint-3	20	6 Days	07 Oct 2022	12 Oct 2022	45	05 Oct 2022
Sprint-4	20	6 Days	14 Oct 2022	19 Oct 2022	50	07 Oct 2022

7.3 REPORTS FROM JIRA

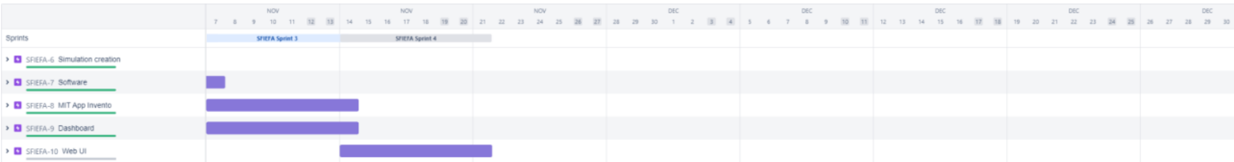
SPRINT 1



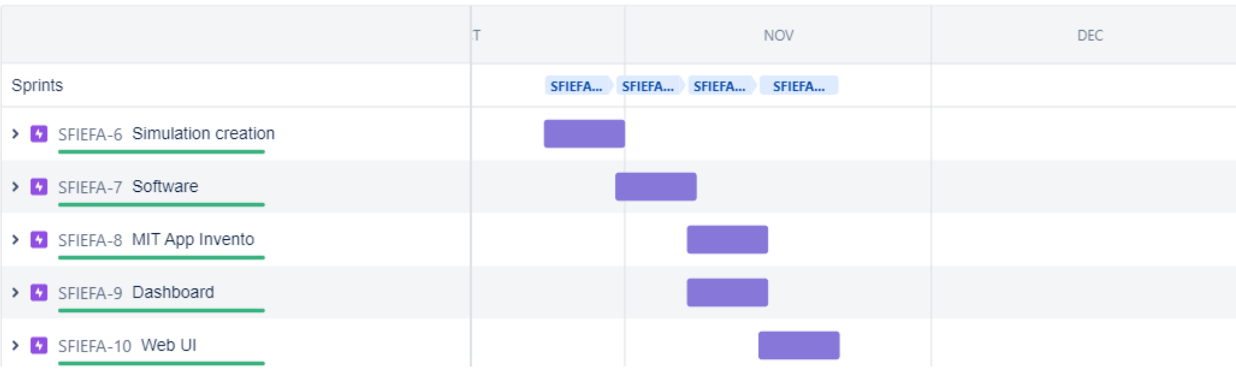
SPRINT 2



SPRINT 3

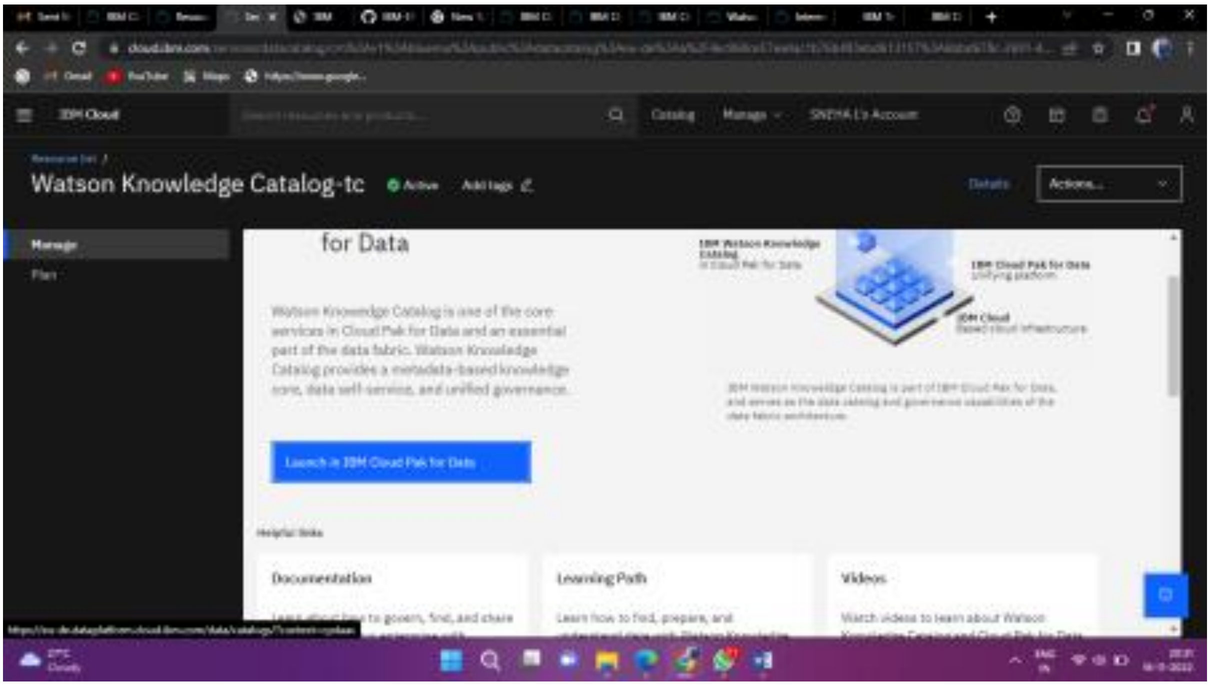


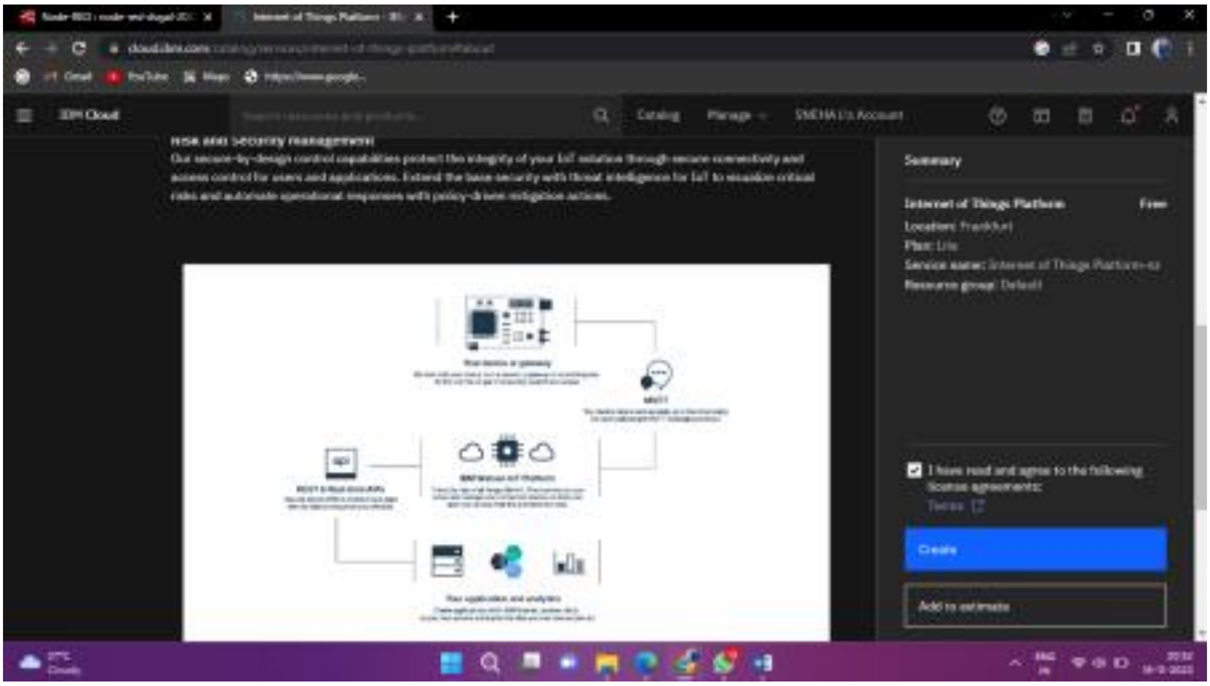
SPRINT 4



8. CREATE AND CONFIGURE IBM CLOUD SERVICE

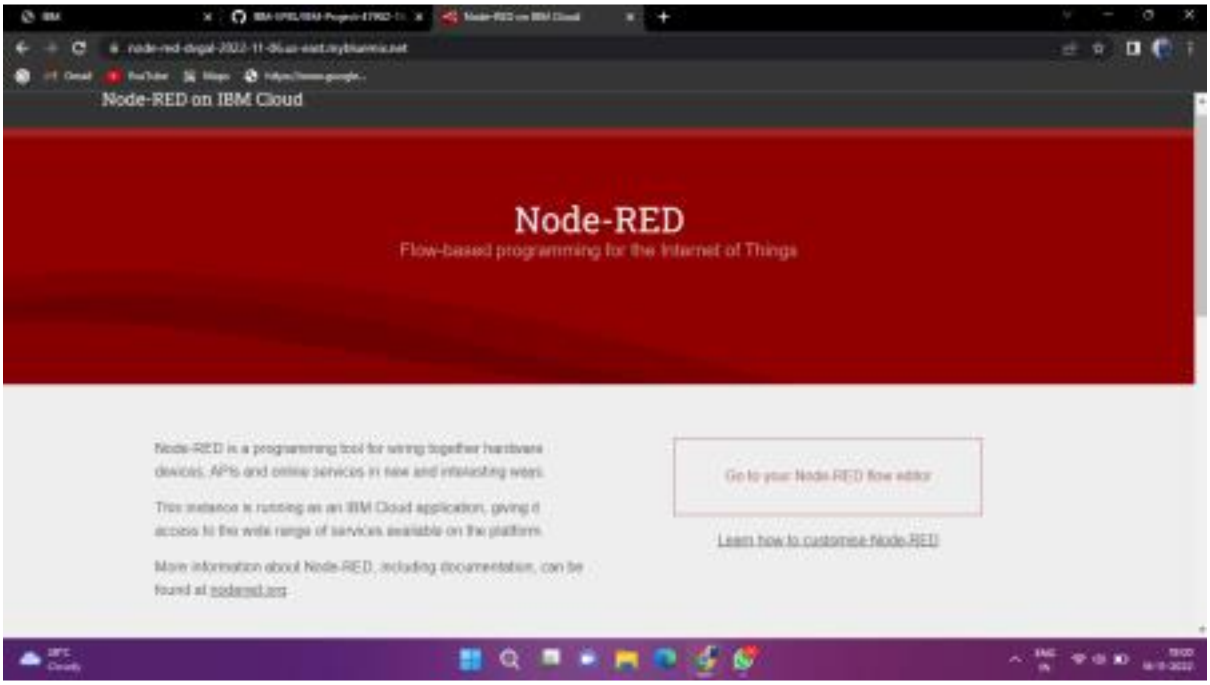
8.1 CREATE THE IBM WATSON IOT PLATFORM AND A DEVICE



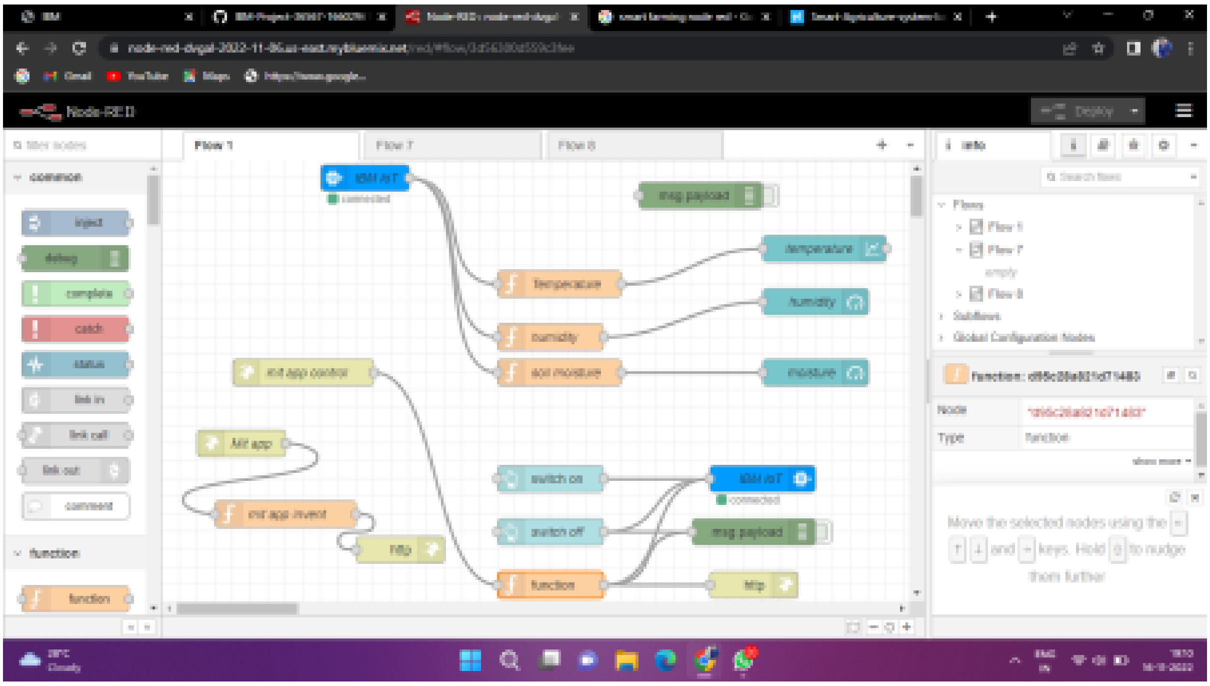


8.2 CREATE NODE – RED SERVICE

➢ Node – RED is deployed in the IBM cloud



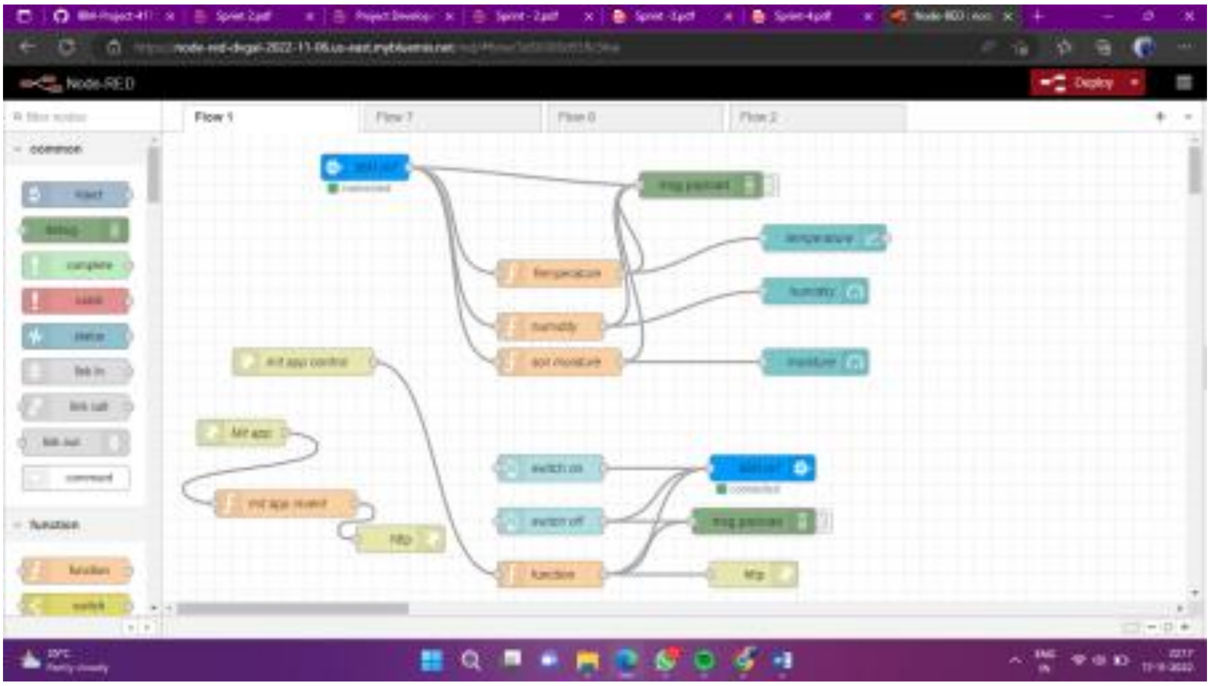
➢ Go to your Node – RED flow editor



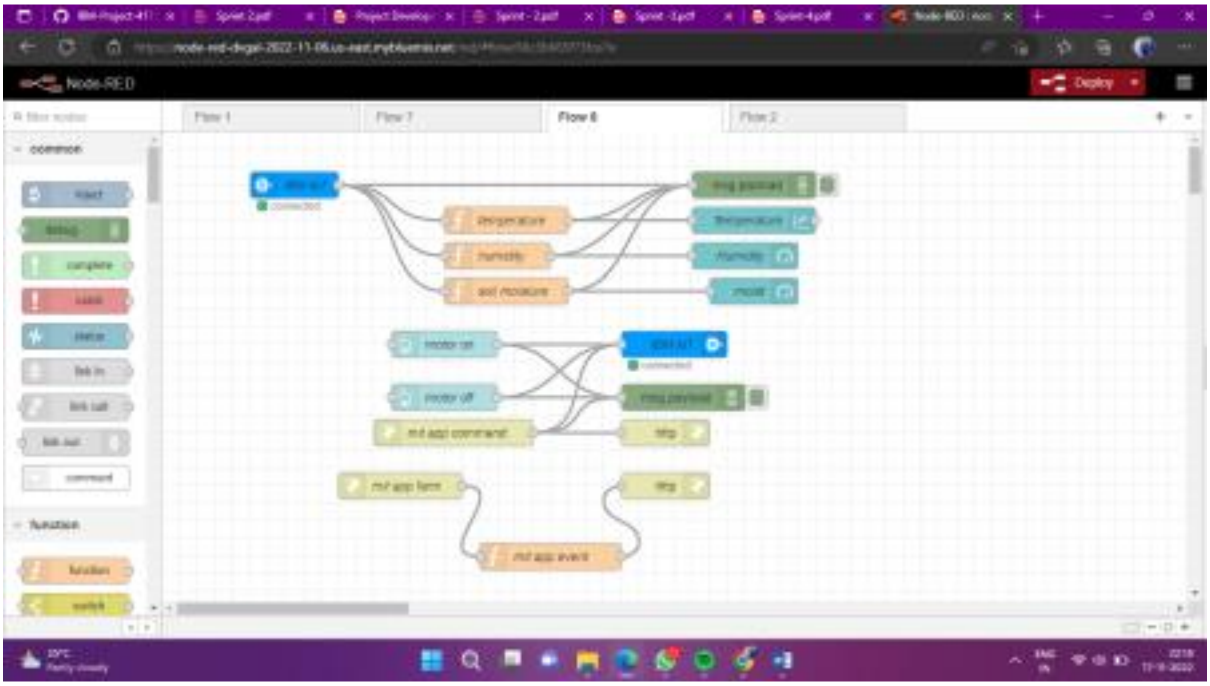
9. BUILD A WEB APPLICATION USING NODE – RED SERVICE

BUILD A WEB APPLICATION USING NODE – RED SERVICE

- FLOW – 1



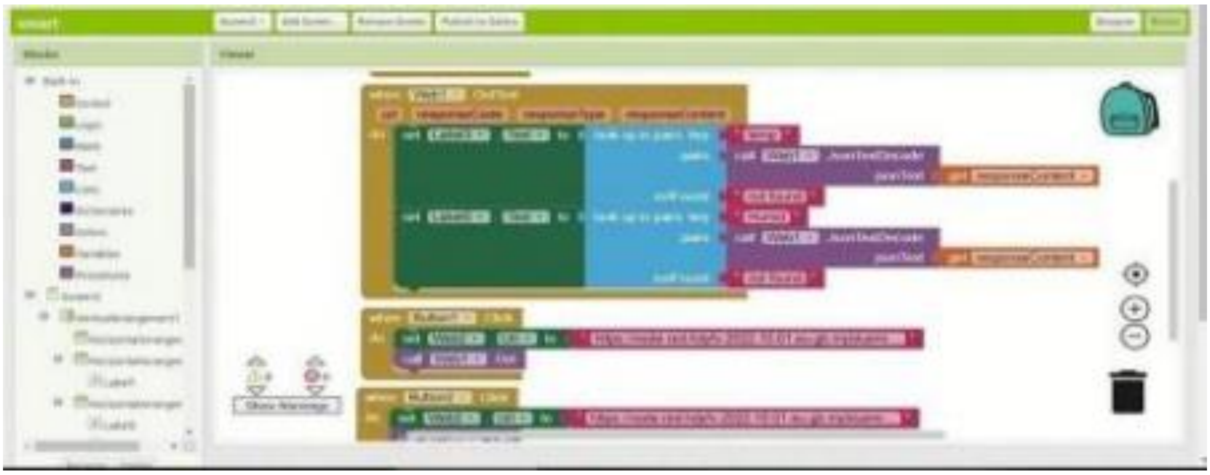
- FLOW – 2



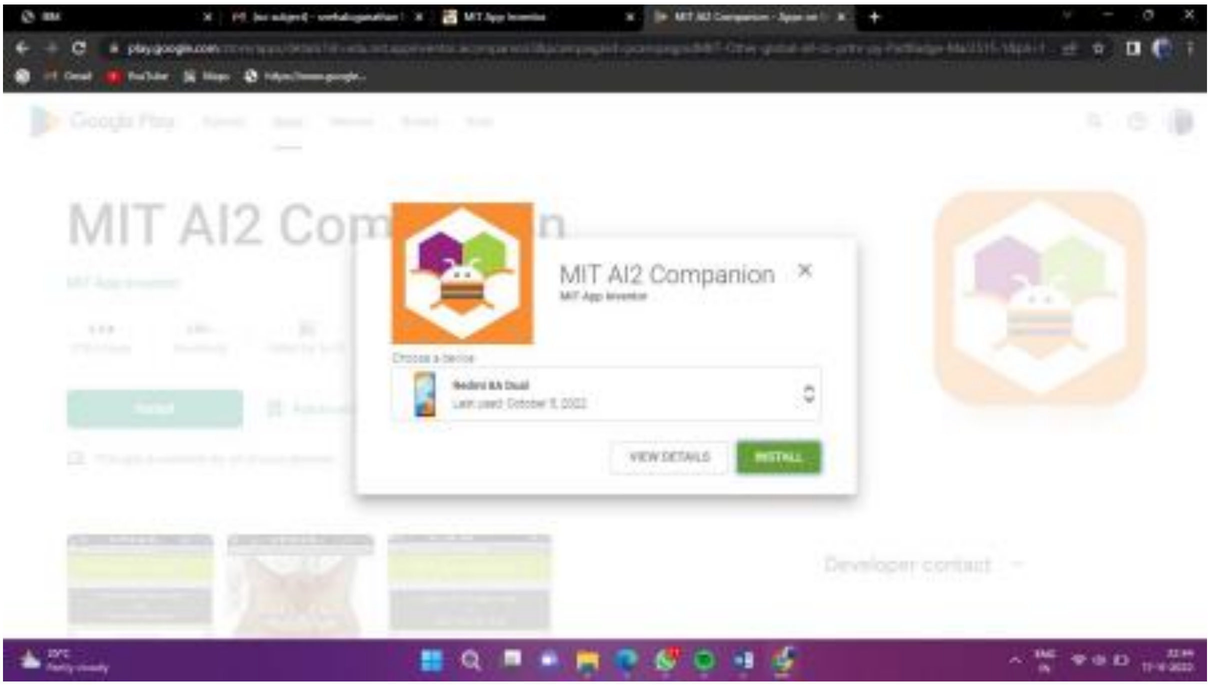
10. DEVELOP A MOBILE APPLICATION

DEVELOP A MOBILE APPLICATION

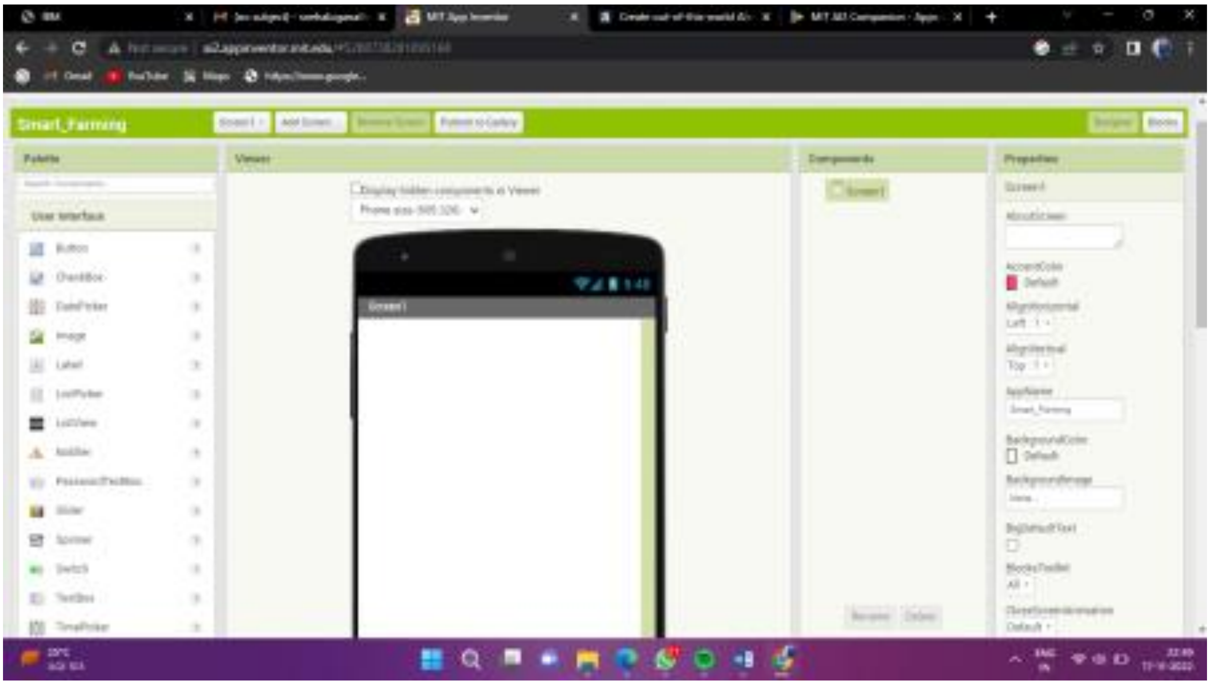
➢ **QR Code for APK download:**



➢ Install the MIT app inventor

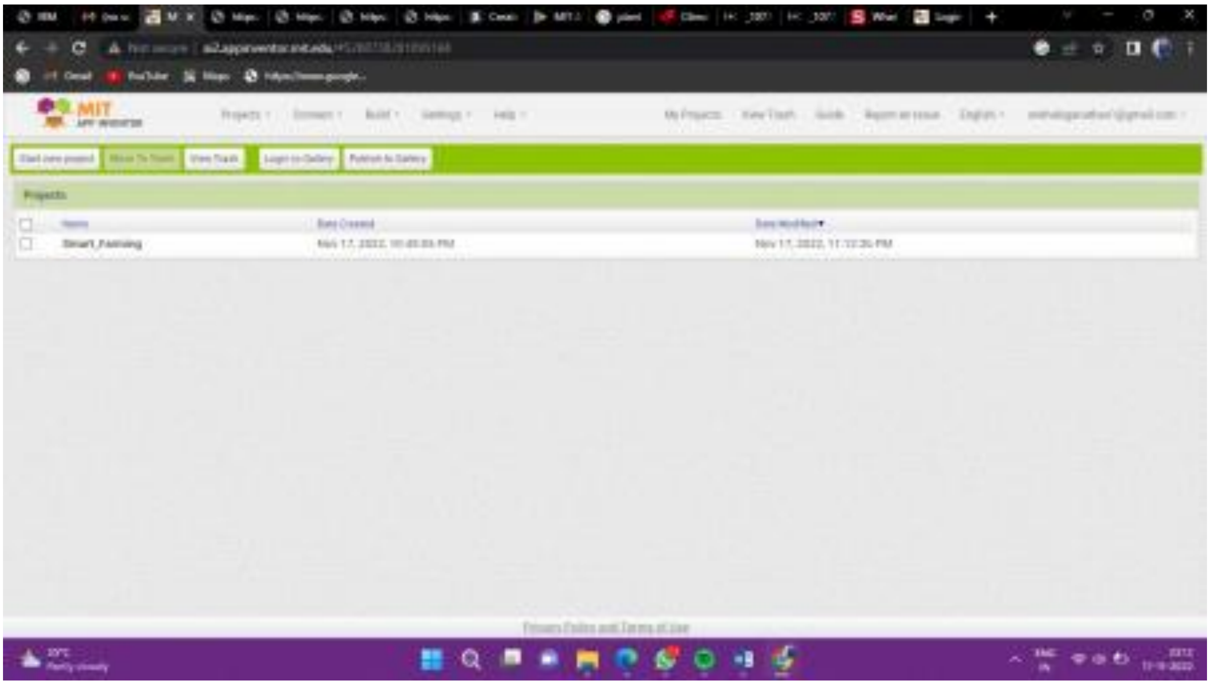


- Start a new project.

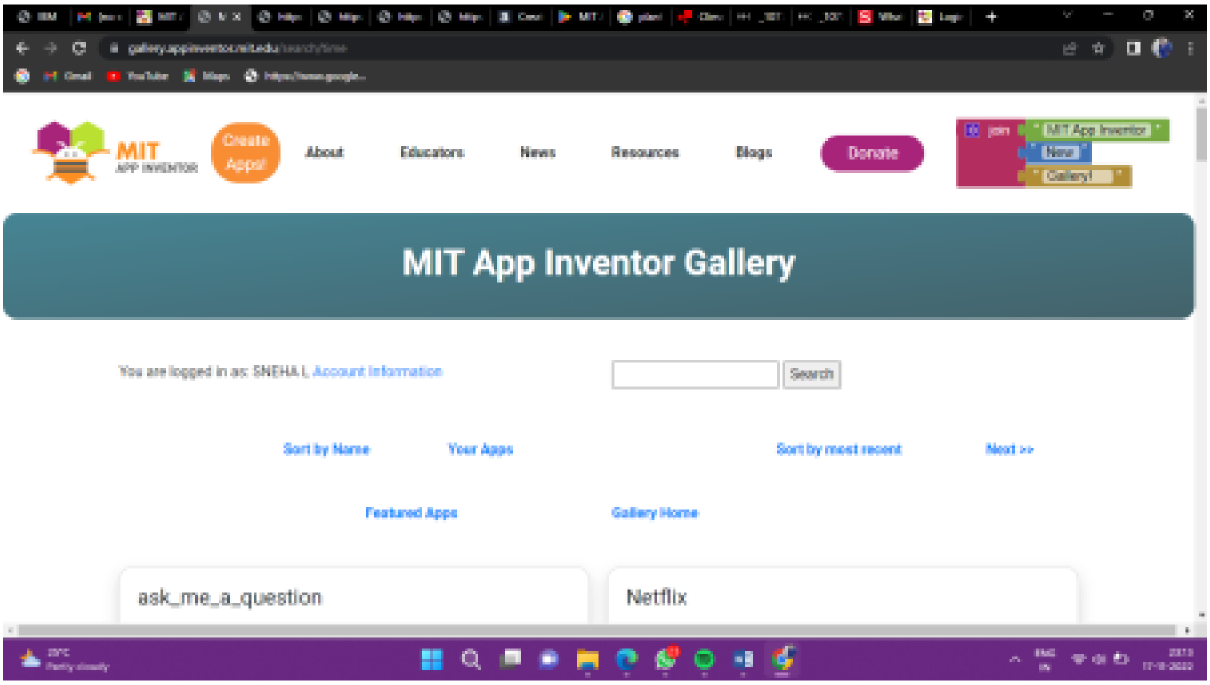


- Scan QR code in the mobile application

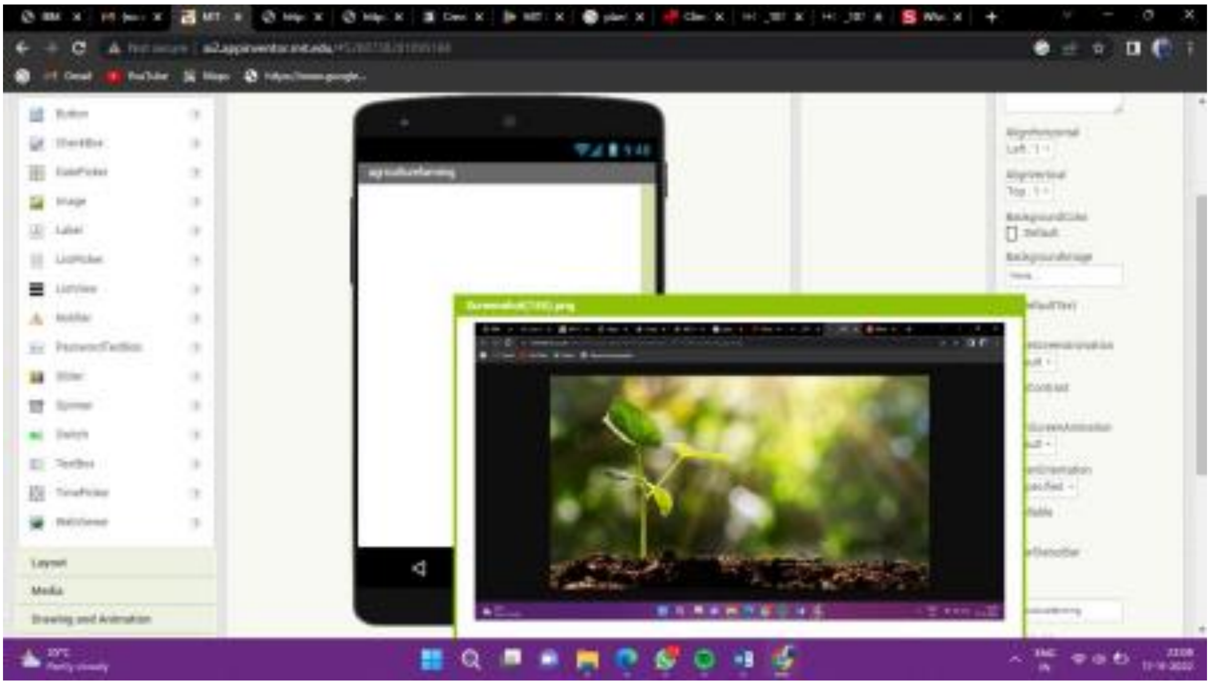
➢ Create a project name “Smart Farming”



➢ In the new tab, open MIT app and log in to the gallery



➢ Smart farming Application



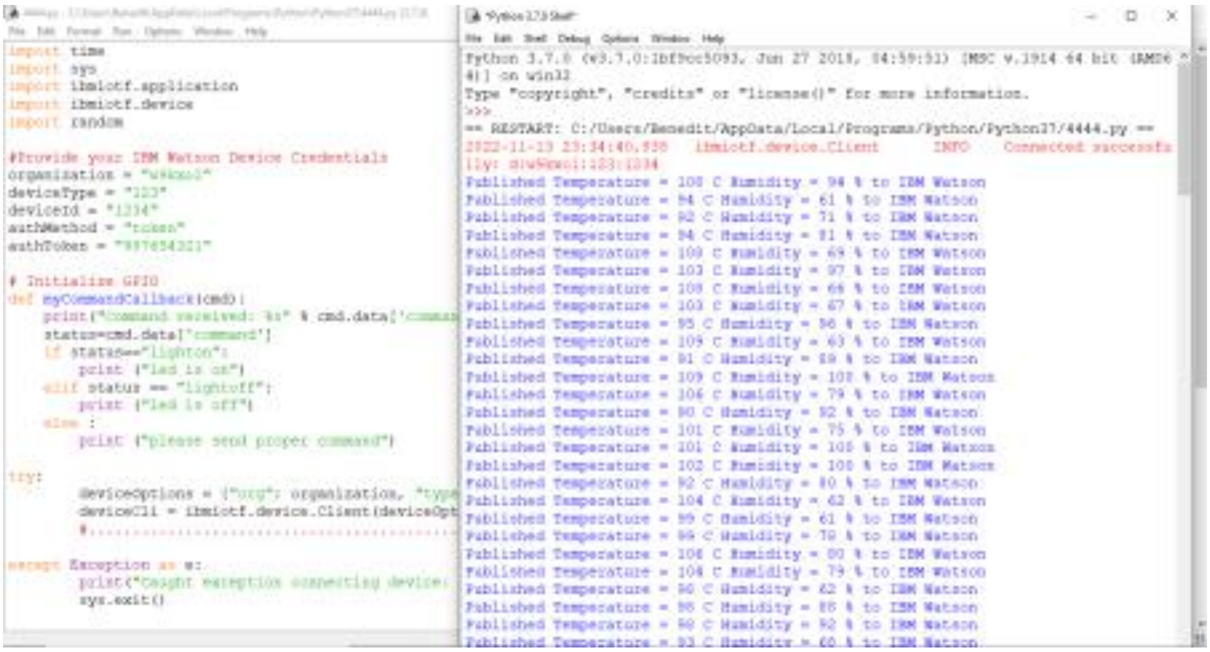
11. CODING AND SOLUTION

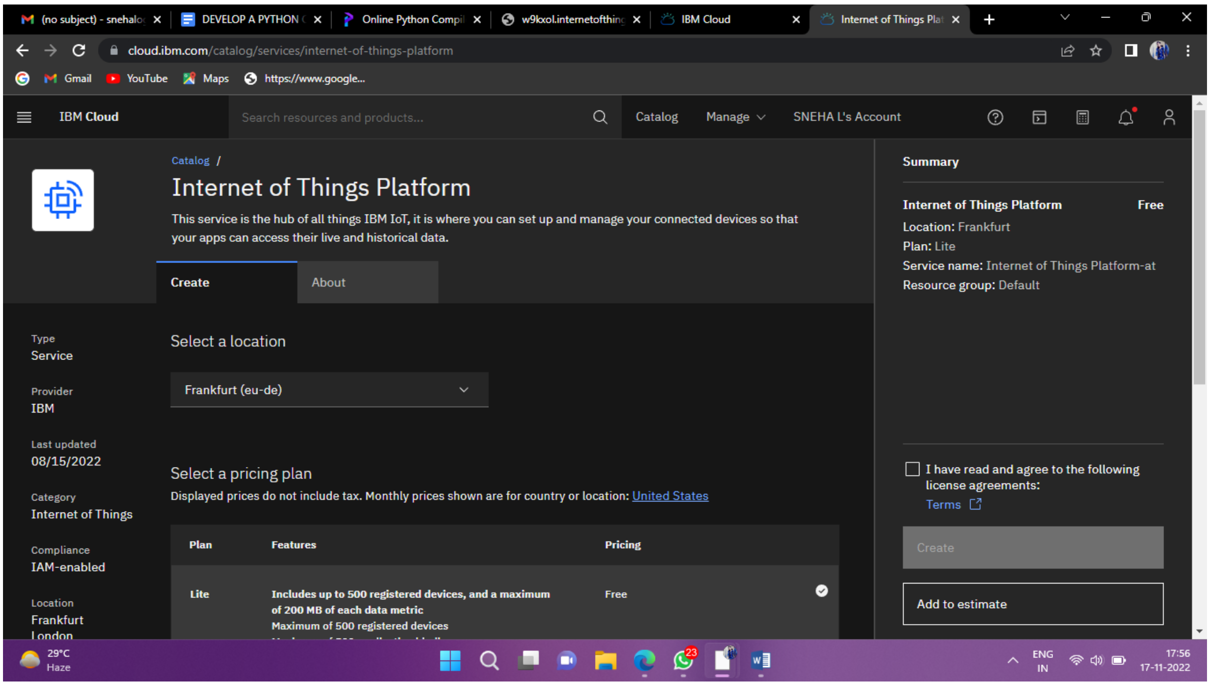
PYTHON CODING:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = "w9kxol"
deviceType = "123"
deviceId = "1234"
authMethod = "token"
authToken = "8925435346"

# Initialize GPIO
def myCommandCallback(cmd):
 print("Command received: %s" % cmd.data['command'])
 status=cmd.data['command']
 if status=="lighton":
 print ("led is on")
 elif status == "lightoff":
 print ("led is off")
 else :
 print ("please send proper command")

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(90,110)
Humid=random.randint(60,100)

data = { 'temp' : temp, 'Humid': Humid }
#print data
def myOnPublishCallback():
print ("Published Temperature = %s C" % temp, "Humidity = %s %%"
% Humid, "to  IBM Watson")

success = deviceCli.publishEvent("IoTSensor", "json",
data, qos=0,  on_publish=myOnPublishCallback)
if not success:
print("Not connected to IoTF")
time.sleep(10)

deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

OUTPUT:





12. TESTING

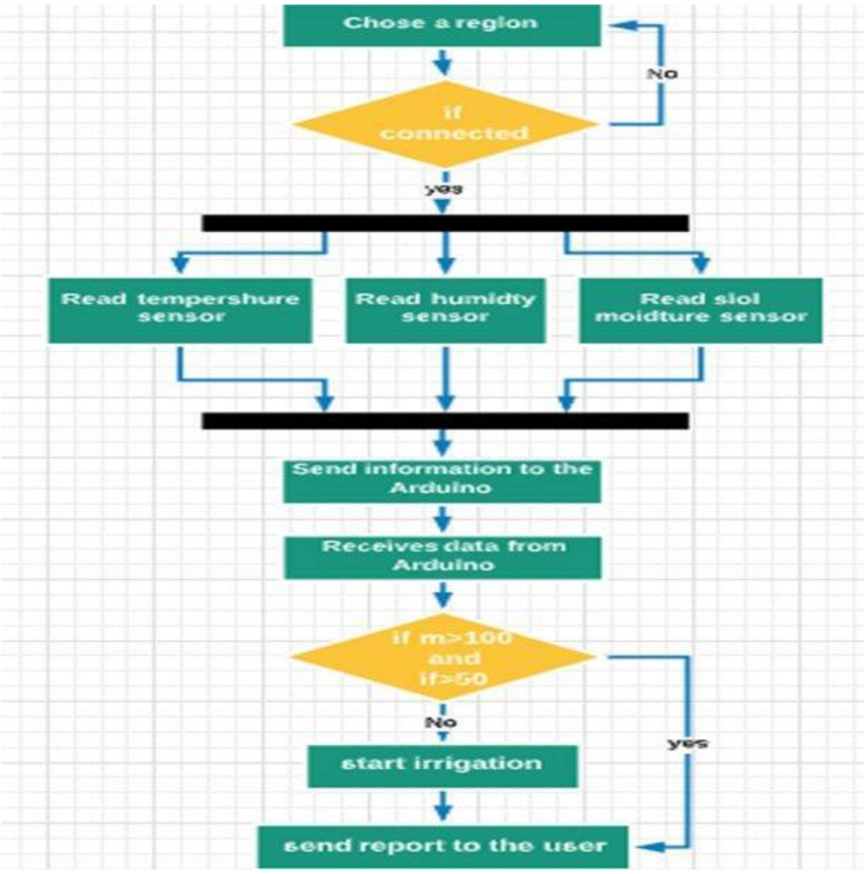
12.1TEST CASES

We present our main approach for testing IOT mobile applications using activity diagrams with data flow information. It can be a good question asking how testing IOT applications are different from other applications .

Therefore we , think that before introducing the activities in our main approach , it would be better to point out some of the characteristics of the IOT applications which make them different from the other applications .IOT applications are more data intensive, means dealing with huge amounts of data generated by a large number of sensors, so that we have to manage and visualize the collected data as well as responding to them in real-time.

Smart Farming is a hi-tech and effective system of doing agriculture and growing food in a sustainable way. It is an application of implementing connected devices and innovative technologies together into agriculture. Smart Farming majorly depends on IOT thus eliminating the need of physical work of farmers and growers and thus increasing the productivity in every possible manner.

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.



12.2 USER ACCEPTANCE TESTING

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing are done.

In the agriculture sector, external environment (e.g. market and weather fluctuation) is more variable and unpredictable than in any other sector; and therefore the need to reduce uncertainties in e.g. food quality and safety is more urgent (Verdouw, Sundmaeker, Tekinerdogan, Conzon, & Montanaro, 2019).

IoT applications in agriculture allow monitoring, controlling, planning and optimization of processes in a virtual way in addition to relying on only physical observations. Agriculture supply chain partners can use IoT to build self-adaptive systems in which smart objects operate, decide and learn autonomously. The agriculture sector is expected to benefit from IoT in dealing with major sustainability challenges, such as food waste, variable harvest, unpredictable supply, food safety, and agriculture sustainability. Additionally, IoT solutions improve safety systems and support making informed decisions, e.g. by providing warning systems in case of incidents, allowing re-considering decisions in case of unexpected change in external environments.

Testing user acceptance is usually the final step of technology development where end users accept the final product. In IoF2020, however, user acceptance is an important tool during all development stages to understand end users' experience. Questions, such as how end users experience the working process with IoT products starting from the installation of sensors until the fully functioning automated systems, what compatibility issues between systems are encountered are highly relevant. End user needs may change over time

Technology innovation can be driven from a business or technology perspective. A new technology solution is aimed at end users, who are the driving force of user acceptance with respect to their needs, concerns and expectations. Data from end users are gathered through 'user acceptance tests' that focus on:

- Usefulness
- Usability / Ease of use
- Technology (including mobile connection)

- Cost-efficiency / economic value

13. RESULTS

13.1 PERFORMANCE METRICS

- The Smart Irrigation System is integrated into the mobile application system to enable the user to easily monitor and control the irrigation of the farm field.
- On the mobile application system, there is an interface to view data collected directly from the sensors via the help of the Firebase, which is the cloud that creates a bridge between hardware and the cloud database.
- The main interface of the mobile application is the main menu that displays the login page of the system. This is to create a secured login for each user and to prevent others from knowing data owned by another client.
- Once the user successfully login to the app, there is another menu display the options control the irrigation system. The user has to select any of the options to go about the system.
- The control option leads the user to control the water pump to either force “ON” or “OFF”, or just set it to the AUTO mode where it navigates the pump's control based on the sensor's value that set in the system. Then, the control system leads the user to access the ThingSpeak.com.
- This process is to display graphs of all the sensors which display the report of the status of the farm field's soil. Figure 6 illustrates the flow of the Smart Irrigation System that integrated into the mobile application system.

14. ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Water Conservation
- Increased Production
- Real-Time Data and Production Insight
- Lowered Operation Costs
- Accurate Farm and Field Evaluation
- Improved Livestock Farming
- Reduced Environmental Footprint
- Remote Monitoring
- Equipment Monitoring
- Efficient resource utilization
- Minimize human effort
- Enhance Data Collection

DISADVANTAGES

- Security
- Complexity
- Risks to human health
- Excessive use of agro-chemicals

15. CONCLUSION

According to our project, the Smart Irrigation System meets the objective to monitor and control the irrigation system of the farm field. It is based on the technology of Internet of Things which is integrated with few sensors: humidity sensor, soil moisture sensor, and pressure sensor to control the status of the farm field's soil. In the meantime, these sensors are connected to the Internet via the Wi-Fi module. This interconnected activity is to give additional sensitivity to the irrigation system. The data collected on the cloud (ThingSpeak and Firebase) will be downloaded and displayed in graphical form. The user can monitor the irrigation system via the report displayed from the application system on the mobile platform. The application works to display readings from sensors and control the water pump in case of an emergency. This is to alert the user and make the system easy to use. IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing . The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

16.FUTURE SCOPE

According to our project, the Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product. Soil moisture sensors smartly measure the soil moisture and based on that data, field is get irrigated automatically with less human interventions.

17. APPENDIX

17.1 GIT REPOSITORY LINK

https://github.com/IBM-EPBL/IBM-Project-39564-1665471451

DEMO LINK:

https://drive.google.com/file/d/1i2K7iKi7lgyhlMMuUg39Mk7FWUQ-qlTe/view?usp=share_link