FINAL PROJECT DELIVERABLE

Date	**09 November 2022**
Team ID	**PNT2022TMID41391**
Project	**Smart Farmer-IoT Enabled Smart Farming Application**

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1. **INTRODUCTION**
    a. Project Overview
    b. Purpose
2. **LITERATURE SURVEY**
    a. Existing problem
    b. References
    c. Problem Statement Definition
3. **IDEATION & PROPOSED SOLUTION**
    a. Empathy Map Canvas
    b. Ideation & Brainstorming
    c. Proposed Solution
    d. Problem Solution fit
4. **REQUIREMENT ANALYSIS**

1.INTRODUCTION

1.1 PROJECT OVERVIEW AND PURPOSE-SMART FARMER-IOT ENABLED SMART FARMING APPLICATION

IoT Based Smart Farming

Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of Things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants. It gives better control to the farmers for their livestock, growing crops, cutting costs, and resources.

The world's total population touched 6.60 billion in 2000 but is projected to grow to 9.32 billion by 2050. Hence, it is necessary to increase the yield on the limited farmland.

It is a high-tech system to grow crop cleanly and sustainably for the masses. It is the application of modern Information and Communication Technologies in agriculture.

Benefits of Smart Farming

- Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
- In large farmland, Internet of Things equipped drone helps to receive the current state of crops and send the live pictures of farmland.
- Analyzing farmland from the land using its Solutions you will know the current situation of fields and crops in.

2.LITERATURE SURVEY

Reference.No	Reference
[1]	Natthanan Promsuk, "Improving of the Interference Classification Techniques under the Smart Farming Environment using ISVM", 2022 19th International Joint Conference on Computer Science and Software Engineering (JCSSE), pp.1-5, 2022.
[2]	Smart farm and monitoring system for measuring the Environmental condition using wireless sensor network - IoT Technology in farming Year: 2020
[3]	Farm Easy- IoT based Automated Irrigation, Monitoring and Pest Detection using Thing Speak for Analysis of Ladies Finger Plant. 2020 International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT)Year: 2020
[4]	Implementation of Smart Farming using IoT Asian Journal of Applied Science and Technology (AJAST) Volume 5, Issue 2, Pages 58-67, April-June 2021
[5]	A control system in an intelligent farming by using arduino technology 2016 Fifth ICT

	International Student Project Conference (ICT-ISPC), p. 53 – 56, 2016

2.1 Problem Statement Definition

Customer Problem Statement:

Mr.Vasanth is a farmer with an engineering background. He's moved into agriculture with his father.
Since he is a beginner in farming, he needs someone to guide him in the initial years and he plan to
incorporate technology into farming to reduce the work and labour, improve productivity, more
yield, suggestions to improve soil, and next crop planting ideas. He is actively researching a few agro
products that solve his problem. These problems are common to many beginning and experienced farmers.

Who does the problem affect?	Persons who do Agriculture
What are the boundaries of the problem?	Labour cost, Cope with climate change, soil erosion and biodiversity loss.
What is the issue?	Loss of agricultural land and the decrease in the varieties of crops and livestock produced.
When does the issue occur?	Increasing pressures from climate change, soil erosion, its mostly starts from first day farming

Why is it important that we fix the problem?	It is required for the growth of better-quality food products. It is important to maximize the crop yield. It is important to maintain soil richness
What solution to solve this issue?	An application is introduced to know about various data about their land remotely, where they can schedule some events for a month or a day. It also provides suggestions to users based on the crop they planted.
What methodology used to solve the issue?	Some search results info from internet based on crop planted. Arduino microcontroller to control the process and various sensors for data. An alert message using GSM. An app built using MIT App Inventor.

Example:

3.IDEATION & PROPOSED SOLUTION

3.1 Proposed Solution

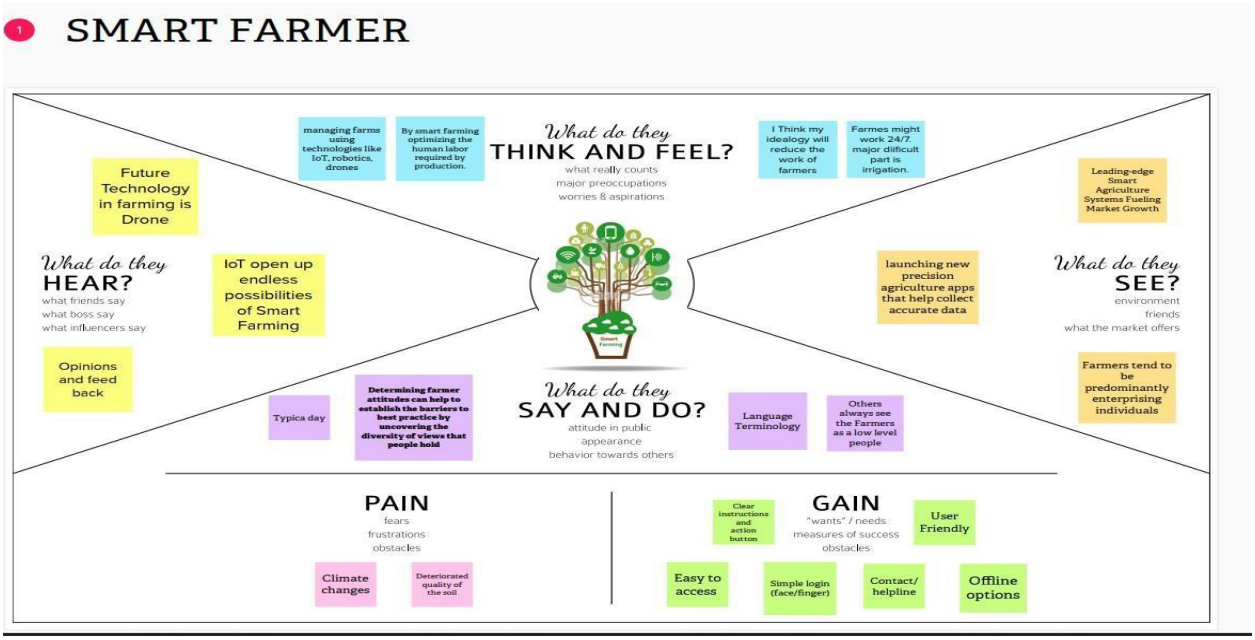
S.No	Parameter	Description
1	Problem Statement (Problem to be solved)	• Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. • Power Supply is also one of the problems. In Village Side, the power supply may vary. • The Biggest Challenges Faced by IoT in the Agricultural Sector are Lack of Information,

		High Adoption, Cost and Security Concerns, etc
2	Idea / Solution description	● As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. ● • The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitable crops.
3	Novelty / Uniqueness	**ALERT MESSAGE** –

		IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT backhaul devices. **REMOTE ACCESS** – It helps the farmer to operate the motor from anywhere.
4	Social Impact / Customer Satisfaction	• Reduces the wages for labors who work in the agricultural field. • It saves a lot of time. • IoT can help improve customer relationships by enhancing the customer's overall experience. • Easily identify maintenance needs, build better products, send personalized

		communications, and more. • IoT can also help e-commerce businesses thrive and increase sales. • It make a wealthy society
5	Scalability of the Solution	Scalability in smart farming refers to the adaptability of a system to increase the capacity, for example, the number of technology devices such as sensors and actuators, while enabling timely analysis.

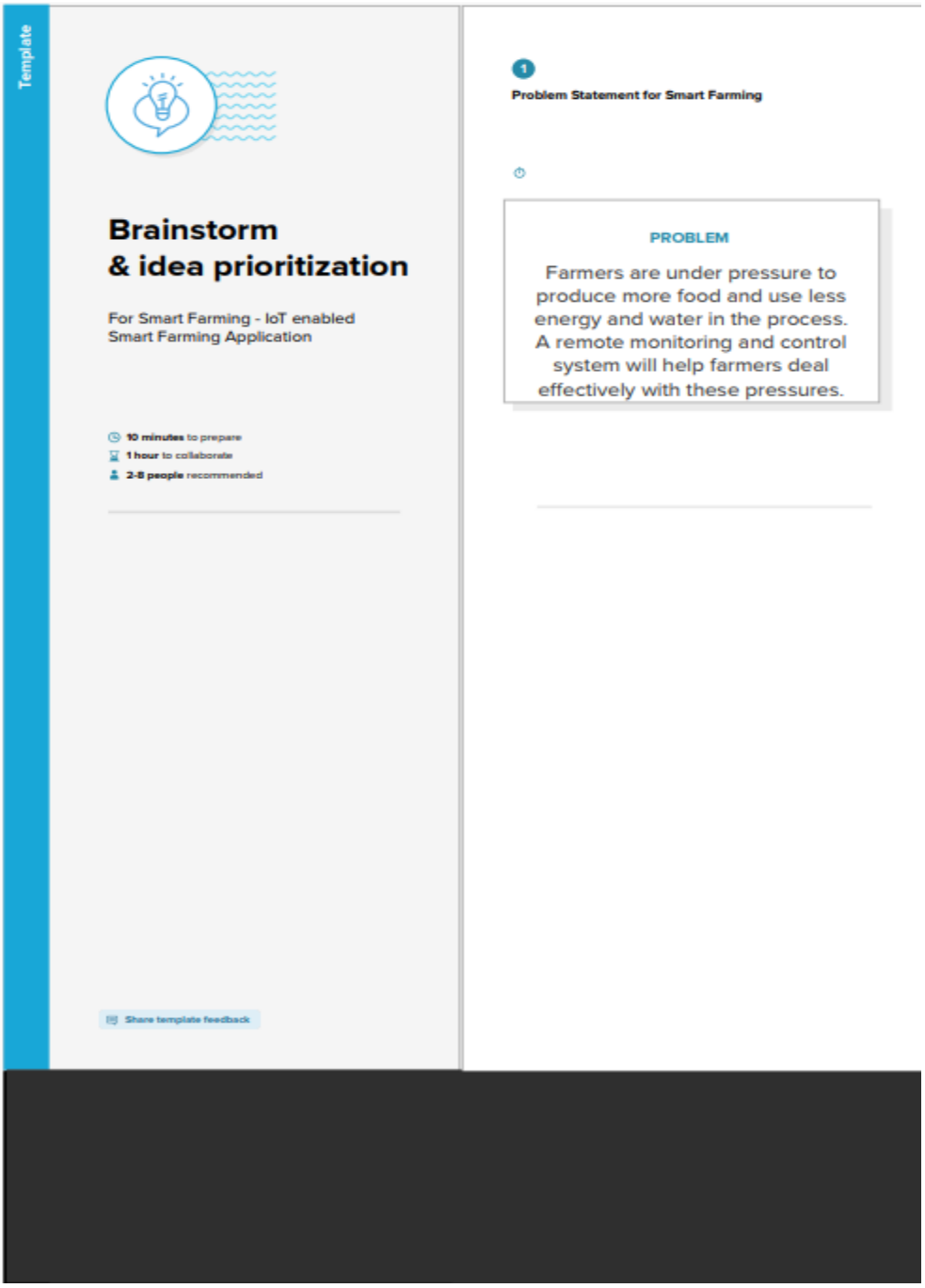
3.2 Empathy Map Canvas



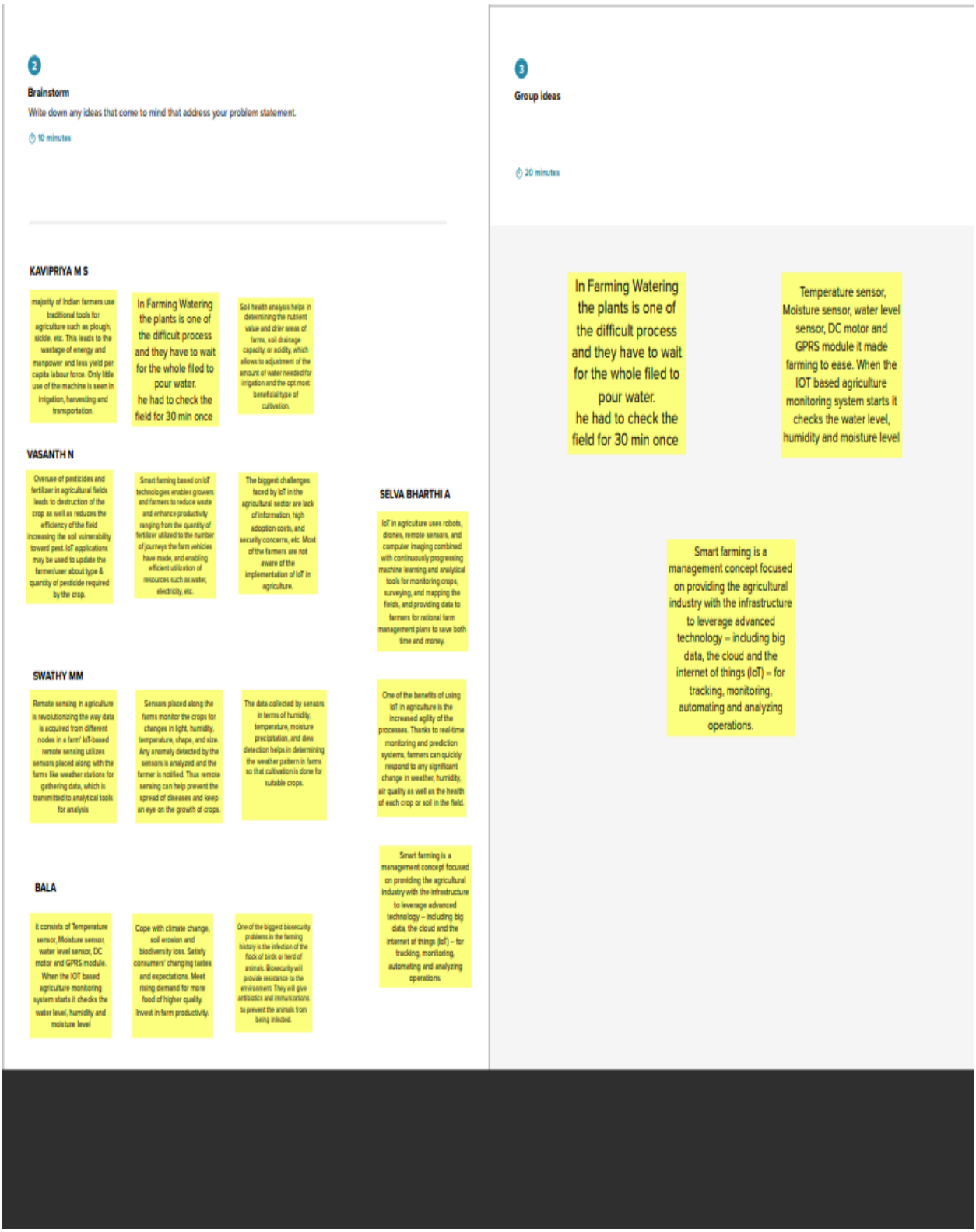
3.3 Ideation & Brainstorming

Step-1:

Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



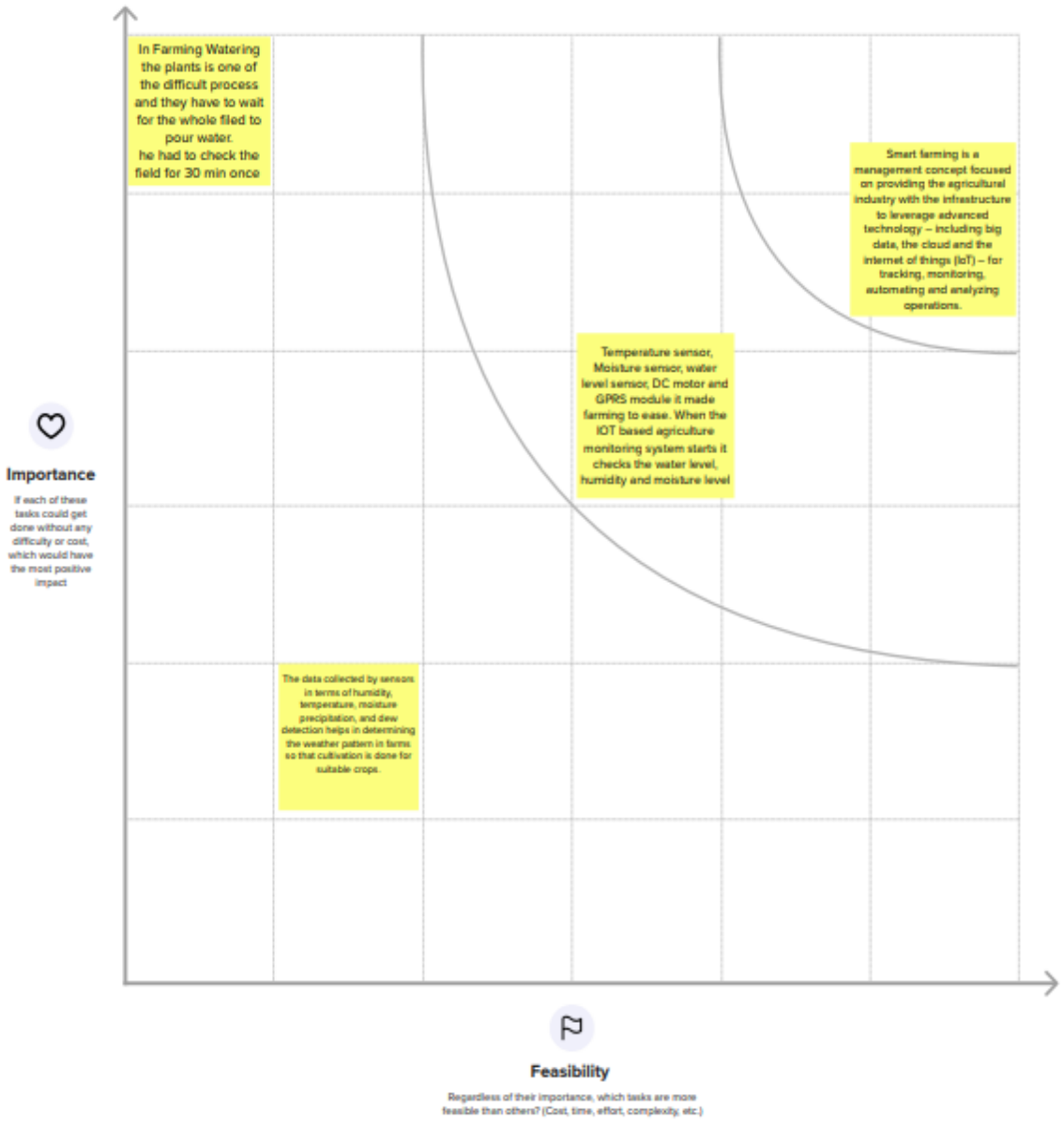
Step-3: Idea Prioritization

4

Prioritize

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

20 minutes



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub- Task)
FR- 1	**User Registration**	Registration through 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

4.2 Non-Functional requirements

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

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 tradeoff 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.

5. PROJECT DESIGN

5.1 Data Flow Diagram & User Stories

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.

• Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.

• NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.

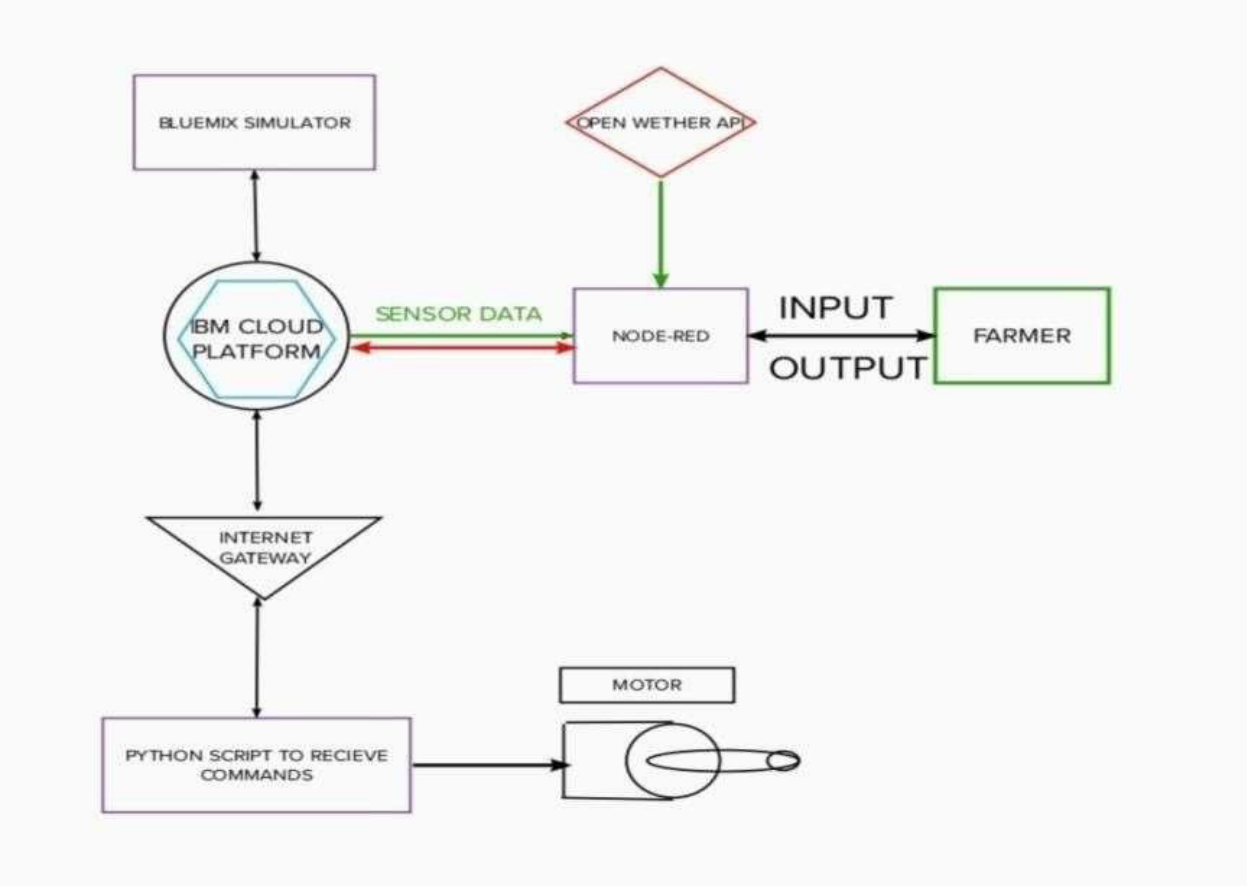
• The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.

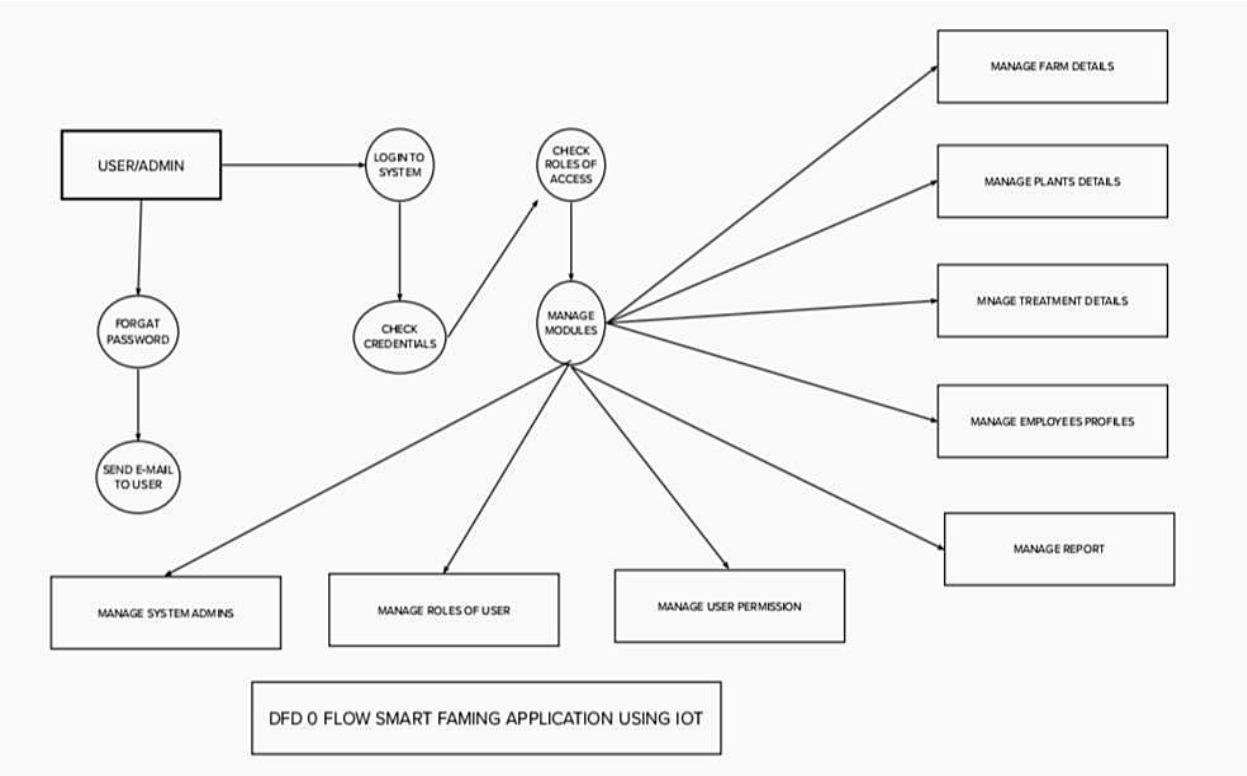
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email,	I can access my account / dashboard	High	Sprint-1

			password, and confirming my password.			
		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 Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application		Medium	Sprint-1

			through Gmail			
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)						
Customer Care Executive						
Administrator						

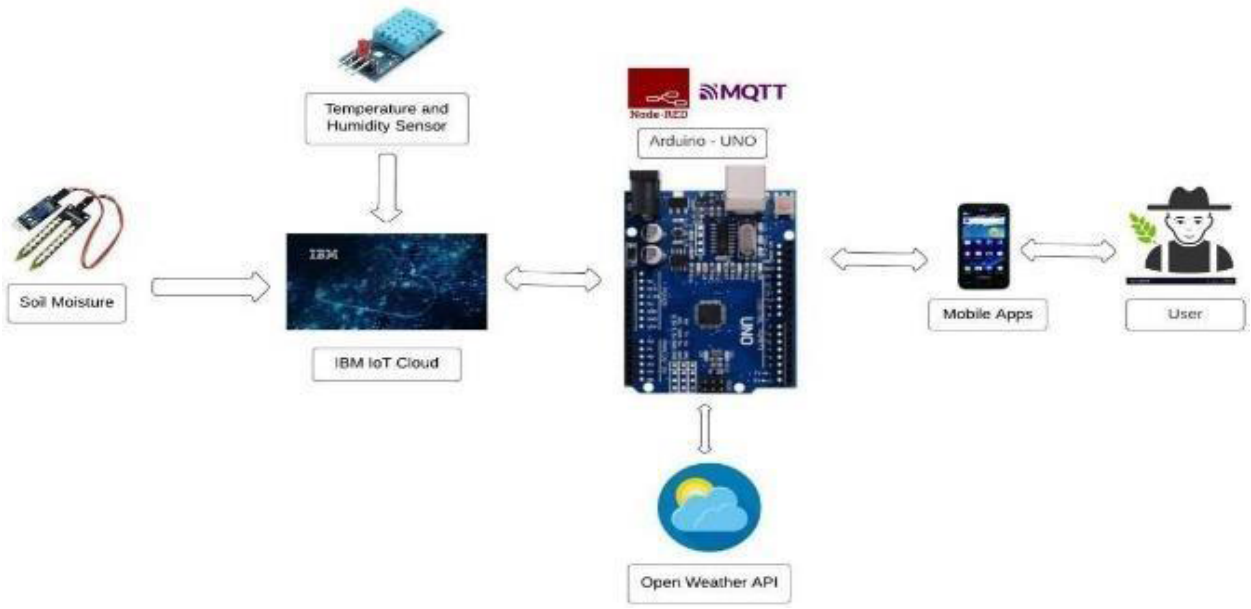
All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could plan through an app, weather to water the crop or not depending upon the sensor values. By using the app they can remotely operate to the motor switch.





DFD 0 FLOW SMART FAMING APPLICATION USING IOT

5.2 Solution & Technical Architecture



- The different soil parameters (temperature, humidity, Soil Moisture) are sensed using different sensors, and the obtained value is stored in the IBM cloud.

- Arduino UNO is used as a processing unit that processes the data obtained from sensors and weather data from weather API.

- Node-red is used as a programming tool to wire the hardware, software, and APIs.
  The MQTT protocol is followed for communication.

- All the collected data are provided to the user through a mobile application that was developed using the MIT

app inventor. The user could make a decision through an app, whether to water the crop or not depending upon the sensor values. By using the app, they can remotely operate the motor switch.

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	DHANALAKSHMI R AGALYA S ARUNMOZHI A SINDHU S
Sprint-1		US-1	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	DHANALAKSHMI R AGALYA S ARUNMOZHI A SINDHU

						S
Sprint-2		US-1	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	Medium	DHANALAKSHMI R AGALYA S ARUNMOZHI A SINDHU S
Sprint-2		US-1	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	5	High	DHANALAKSHMI R AGALYA S ARUNMOZHI A SINDHU S
Sprint-3		US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	10	High	DHANALAKSHMI R AGALYA S ARUNMOZHI A SINDHU S
Sprint-3		US-1	Create a Node-RED service.	10	High	DHANALAKSH

						MI R AGALYA S ARUNM OZHI A SINDHU S

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

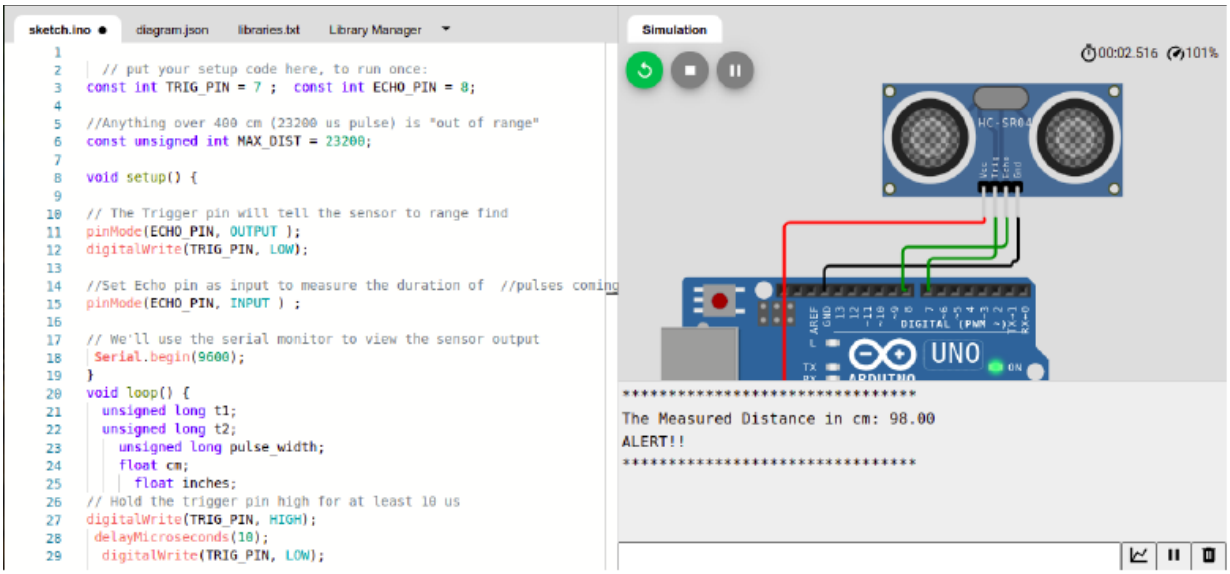
CODE:

```
// put your setup code here, to run once:
const int TRIG_PIN = 7 ;
const int ECHO_PIN = 8;


//Anything over 400 cm (23200 us pulse) is "out of range"
const unsigned int MAX_DIST = 23200;
void setup() {

// The Trigger pin will tell the sensor to range find
pinMode(ECHO_PIN, OUTPUT );
digitalWrite(TRIG_PIN, LOW);

//Set Echo pin as input to measure the duration of //pulses coming back from the distance sensor
pinMode(ECHO_PIN, INPUT ) ;

// We'll use the serial monitor to view the sensor output
Serial.begin(9600);
```

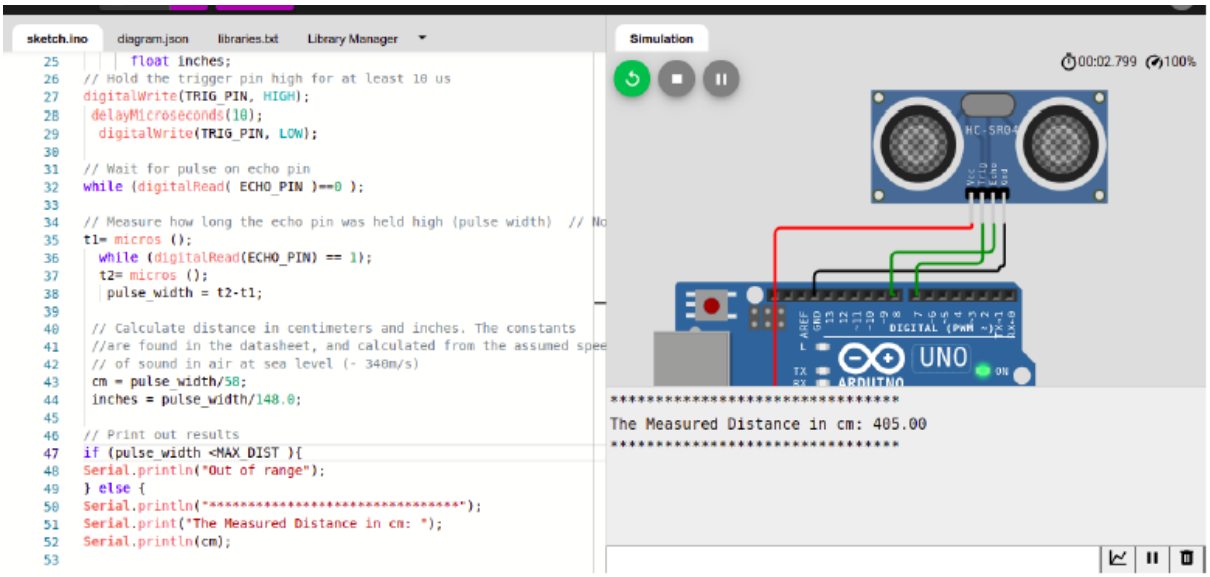
```
}
void loop() {
  unsigned long t1;
  unsigned long t2;
   unsigned long pulse_width;
   float cm;
    float inches;
// Hold the trigger pin high for at least 10 us
digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
    digitalWrite(TRIG_PIN, LOW);

// Wait for pulse on echo pin
while (digitalRead( ECHO_PIN )==0 );

// Measure how long the echo pin was held high (pulse width) // Note: the
micros() counter willoverflow after-70 min
t1= micros ();
   while (digitalRead(ECHO_PIN) == 1);
 t2= micros ();
   pulse_width = t2-t1;

// Calculate distance in centimeters and inches. The constants
//are found in the datasheet, and calculated from the assumed speed
// of sound in air at sea level (- 340m/s)
cm = pulse_width/238;
inches = pulse_width/34;

if (pulse_width <MAX_DIST ){
Serial.println("Out of range");

} else {
```

```
Serial.println("*********************************");
Serial.print("The Measured Distance in cm: ");
Serial.println(cm);

if( cm < 100 ){
Serial.println("ALERT!!");

}

Serial.print("*********************************");
}
//wait at least 1000ms before next measurement
delay(1000);
}
```

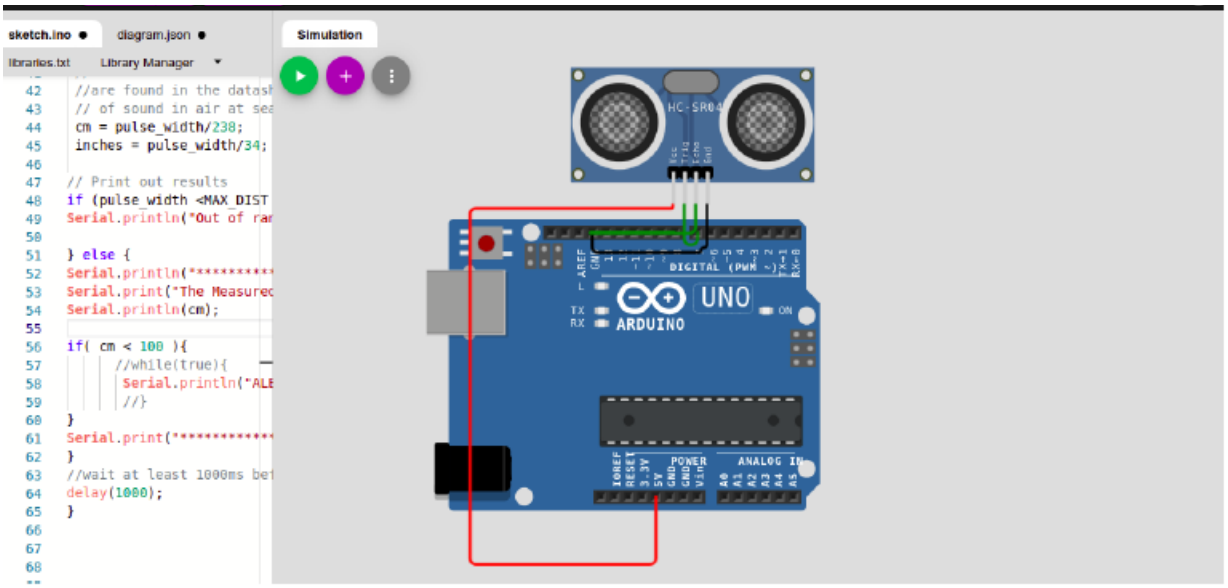
If the distance is less than 100 cms ,it Alerts.



If the distance is more than 100 cms,it won't Alert



CONNECTION :



8. TESTING

8.1 User Acceptance Testing

Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37

Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

Test Case Analysis

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

Performance matrices	**Condition output**
Human interference cut down	**good**
Reduction of wastage	**good**
Economical efficiency	**better**

reliablity	**excellent**

10.ADVANTAGES & DISADVANTAGES

10.1.ADVANTAGES

- ☑ With IoT, **farmers can monitor the health of farm animals closely, even if they are physically distant**.
- ☑ It can assist in the smarter control of homes and cities via mobile phones
- ☑ It enhances security and offers personal protection.
- ☑ By automating activities, it saves us a lot of time. Information is easily accessible, even if we are far away from our actual location, and it is updated frequently in real time.
- ☑ From reducing spray wastage to improving fuel economy. By reducing the number of passes needed to complete tasks and reducing turning on the headland soil compaction is minimised.

10.2.DISADVANTAGES

- ☑ Farms are located in remote areas and are far from access to the internet.
- ☑ A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.
- ☑ **High Cost**: Equipment needed to implement IoT in agriculture is expensive.
- ☑ Deforestation. Intensive farming causes soil degradation and leads to the expansion of new lands.
- ☑ Pest and weed resistance to chemicals.

11.CONCLUSION

- ☑ Smart farming **reduces the ecological footprint of farming**. Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases.
- ☑ **Agriculture is an integral part of smart growth**. The ability to feed one's own population is critical to the independence of any state. Ontario is blessed with resources that have facilitated the development of a worldclass agricultural industry that provides safe, nutritious, and reliable food.

12.FUTURE SCOPE

- ☑ Smart farming refers to **managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required**.
- ☑ Among the technologies available for present-day farmers are: Sensors: soil, water, light, humidity, temperature management.
- ☑ IOT TECHNOLOGIES IN AGRICULTURE. IoT smart agriculture products are designed to **help monitor crop fields using sensors and by automating irrigation systems**.
- ☑ As a result, farmers and associated brands can easily monitor the field conditions from anywhere without any hassle.

13.APPENDIX

SOURCE CODE:

IBM-EPBL/IBM-Project-47389-1660798841

GitHub & Project Demo Link

https://youtu.be/4sdOKiJosll