PROJECT REPORT

SmartFarmer - IoT Enabled Smart Farming Application

TEAM ID: PNT2022TMID01130

TEAM MEMBERS: Roopmathi.G

Ria Simrin.J

Sujitha.S

S.Madhumitha

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ACKNOWLEDGEMENT

We the students of Final year, Electronics and Communication Engineering, have successfully completed a project under the guidance of our mentors From Nalaiyathiran.

I would like to thank Mr.R.Ashok (Professor of ECE department) for his valuable guidance, advise and invaluable direction in helping us complete our research and for giving us with all necessary support. He is a great motivator and supports us as we work on the project. He also gave us the books and journals we needed, for which we are grateful.

ABSTRACT

Every aspect of the average person's life has undergone change because to Internet of Things (IoT) technology, which has made everything smart and intelligent. The Internet of Things (IoT) is a network of autonomous devices. In addition to improving agriculture production, the development of intelligent smart farming IoT-based equipment is also lowering waste and increasing cost-effectiveness. The purpose of this paper is to suggest an IoT-based smart farming system that helps farmers obtain real-time data (temperature, soil moisture) for effective environment monitoring, allowing them to improve overall production and product quality.

This study proposes an IoT-based smart farming system that combines Arduino Technology with several sensors, a WiFi module, and a live data feed that can be accessed online at Thingsspeak.com. The suggested device has undergone testing on actual agricultural fields, providing data feeds with high accuracy of over 98%.

INTRODUCTION

The purpose of this paper is to propose an IoT-based smart farming system that will give farmers access to real-time information on soil moisture and environmental temperature at a very low cost, allowing for real-time monitoring. The report's organisational structure is as follows: I will provide an overview of IoT technology and agriculture, including ideas and definitions, IOT enabling technologies, IOT applications in agriculture, IOT benefits in agriculture, IOT and agriculture current scenario, and IOT and agricultural future forecasts. IOT-based smart agricultural system definition, components, modules, and operating principles. The algorithm and flowchart of the system's general process, as well as its final graphical output.

IOT: CONCEPT AND DEFINITION

Internet of things IOT consists of two words Internet and Things . The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing , actuating and live monitoring of certain sort of data. IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly , or collected data from other devices and process the data and send the data to various servers.The alternative definition of the term "internet" is a global communication network that links trillions of computers worldwide and permits the sharing of knowledge. As a result, the Internet of Things (IOT) can be defined as "A dynamic Global Network Infrastructure with self configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things have identities, physical attributes, and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network, often communicating data associated with users and their environment."

Each IoT-based gadget has the following parts:

- Sensor I/O interface.
- An Internet connection interface.
- Memory and storage interface.
- Video/Audio interface

IOT APPLICATIONS ON AGRICULTURE

With the adoption of IoT in various areas like Industry, Homes and even Cities, huge potential is seen to make everything Intelligent and Smart. Even the Agricultural sector is also adopting IoT technology these days and this in turn has led to the development of “AGRICULTURAL Internet of Things (IoT)”

Crop Water Management :

In order to perform agriculture activities in inefficient manner,
adequate water is essential. Agriculture IoT is integrated with Web
Map Service (WMS) and Sensor Observation Service (SOS) to

ensure proper water management for irrigation and in turn reduces
water wastage.

Precision farming:

In order to lower the likelihood of crop loss, high precision in meteorological information is essential. The Internet of Things in agriculture makes sure that farmers receive timereliable real- data about weather forecasts, soil quality, labour costs, and much more.

Integrated pest management control:

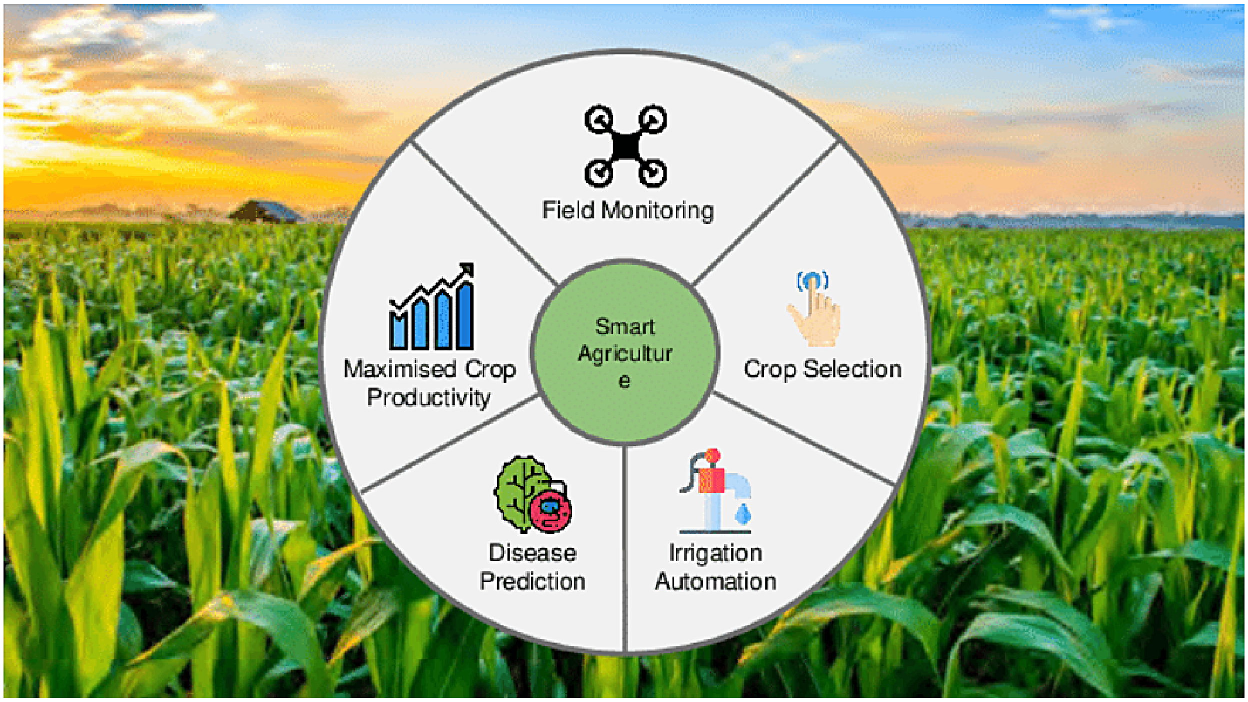
Using proper live data monitoring of temperature, moisture, plant development, and insect levels, agriculture IoT systems provide farmers with reliable environmental data assurance so that proper care may be taken during production.

Food production and safety:

Agriculture IoT systems incorporate cloud-based recording systems and accurately monitor a number of characteristics, including warehouse temperature and shipping transportation management systems.

PROJECT OVERVIEW

The IoT-based SMART FARMING SYSTEM is recognised as an IoT device that focuses on real-time environmental data monitoring, including temperature, moisture, and other sorts based on the sensors it has built in. The system offers the "Plug & Sense" concept, which enables farmers to immediately implement smart farming by placing the System in the field and receiving Live Data Feeds on various devices like Smart Phones, Tablets, etc. Additionally, the data produced by sensors can be easily shared and viewed by agriculture consultants wherever they are remotely via Cloud Computing technology integration. The system occasionally allows for the study of numerous types of data using big data analytics. The main line of work in developing nations like India is agriculture. A whopping 28% of people work in agriculture. The agricultural industry will contribute 19.9% of India's overall GDP in 2020–21. In this project, a Smart Farming Stick is created to assist farmers in creating irrigation schedules for their farms by utilising IoT, WSN, and cloud computing concepts.



PURPOSE

We have made an effort to concentrate on several scientific applications that can be combined in the sector of agriculture for higher accuracy with better productivity utilising less manpower. We also provide a means to monitor agricultural fields from any remote point and evaluate the fundamental state of the land.

This project was inspired by the farmers whose livelihoods in agricultural areas depend entirely on the rain and irrigation from bore wells. Farmers have been irrigating the ground manually in recent years by manually turning the water pump ON/OFF as needed. This practise allows farmers to irrigate the land at regular intervals.

LITERARURE SURVEY

The foundation for the development of the country is agriculture. India is known as an agricultural nation because of its exceptional agricultural areas and other resources. The recent expansion of agriculture, including productivity, diseases, and yield production, is influenced by elements such as temperature and soil moisture. The nation's development has been hampered by problems with agriculture. Modernizing the current accepted agricultural practises is necessary. In order to manage crops in a controlled environment, such as green houses, new trends in agriculture are required.

EXISTING PROBLEM

Lack of information, high adoption costs, security concerns, and other issues are the major obstacles for IoT in the agricultural sector. The majority of farmers are unaware of the use of IoT in agriculture.

There are many advantages to using IoT in the agriculture sector, but there are also some difficulties. Lack of information, high adoption costs, security concerns, and other issues are the major obstacles for IoT in the agricultural sector. The majority of farmers are unaware of the use of IoT in agriculture. The main issue is that some of them are reluctant to adopt new concepts, despite the fact that doing so would have many advantages. The greatest way to educate people about IoT's effects is to show farmers how to use IoT gadgets like drones, sensors, and other technologies and how they might make their jobs easier, accompanied by real-world examples.

1. Lack of Infrastructure: Even if the farmers adopt IoT technology they won’t be able to take benefit of this technology due to poor communication infrastructure. 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.

2. High Cost: Equipment needed to implement IoT in agriculture is expensive. However sensors are the least expensive component, yet outfitting all of the farmers’ fields to be with them would cost more than a thousand dollars. Automated machinery cost more than manually operated machinery as they include cost for farm management software and cloud access to record data. To earn higher profits, it is significant for farmers to invest in these technologies however it would be difficult for them to make the initial investment to set up IoT technology at their farms.

3. Lack of Security: Since IoT devices interact with older equipment they have access to the internet connection, there is no guarantee that they would be able to access drone mapping data or sensor readouts by taking benefit of public connection. An enormous amount of data is collected by IoT agricultural systems which is difficult to protect. Someone can have unauthorized access IoT providers database and could steal and manipulate the data.

REFERENCES

Source:Ijraset
Authors: Abhilash Lad, Sumitra Nandre, Krishna Raichurkar, Sumit Zarkhande, Dr. Priya Charles
Abstract: India is agriculture sector, on either side, is losing ground every day, affecting the ecosystem's output capacity

Authors:Simon X. Yang
Abstract: Improving farm productivity is essential for increasing farm profitability and meeting the rapidly growing demand for food that is fuelled by rapid population growth across the world.

Source:2016 IEEE 3rd World Forum on Internet of Things (WF-IoT)
Authors: 1.Andreas Kamilaris GIRO Joint Research Unit, IRTA-UPC, Barcelona, Spain 2.Feng Gao Insight Centre for Data Analytics, National University of Ireland, Galway, Ireland
3.Francesc X. Prenafeta-Boldu GIRO Joint Research Unit, IRTA-UPC, Barcelona, Spain
4.Muhammad Intizar Ali Insight Centre for Data Analytics, National University of Ireland, Galway, Ireland
Abstract: With the recent advancement of the Internet of Things (IoT), it is now possible to process a large number of sensor data streams using different large-scale IoT platforms.

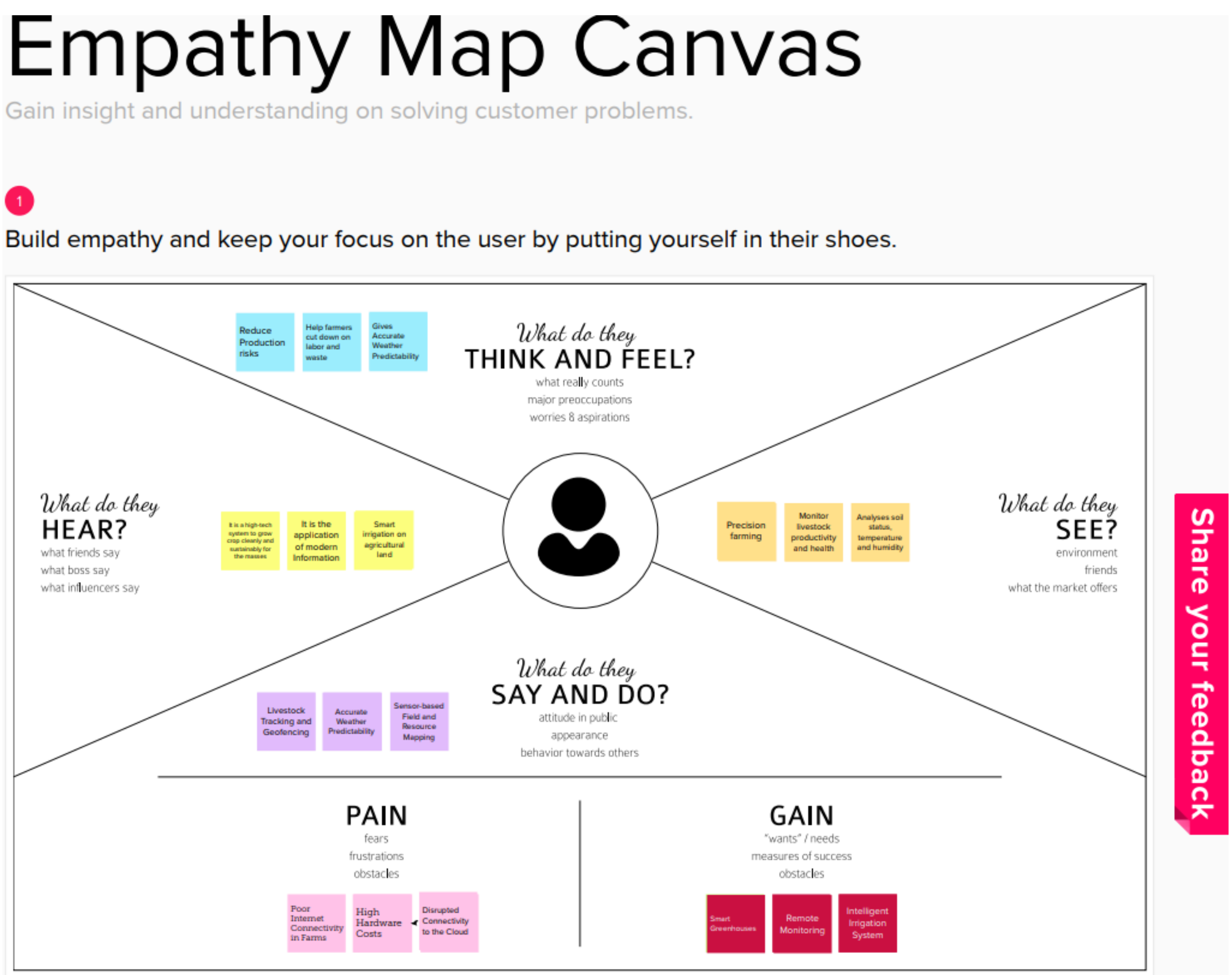
Authors:1.Anand Nayyar Assistant Professor, Department of Computer Applications & IT KCL Institute of Management and Technology, Jalandhar, Punjab
2.Er. Vikram Puri M.Tech(ECE) Student, G.N.D.U Regional Center, Ladewali Campus, Jalandhar
Abstract: Internet of Things (IoT) technology has brought revolution to each and every field of common man’s life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network.

IDEATION PHASE

The process of ideation entails coming up with new concepts and solutions through exercises like sketching, prototyping, brainstorming, writing in the head, coming up with the worst possible idea, and a variety of other ideation approaches. The third step of the Design Thinking process is also known as ideation.

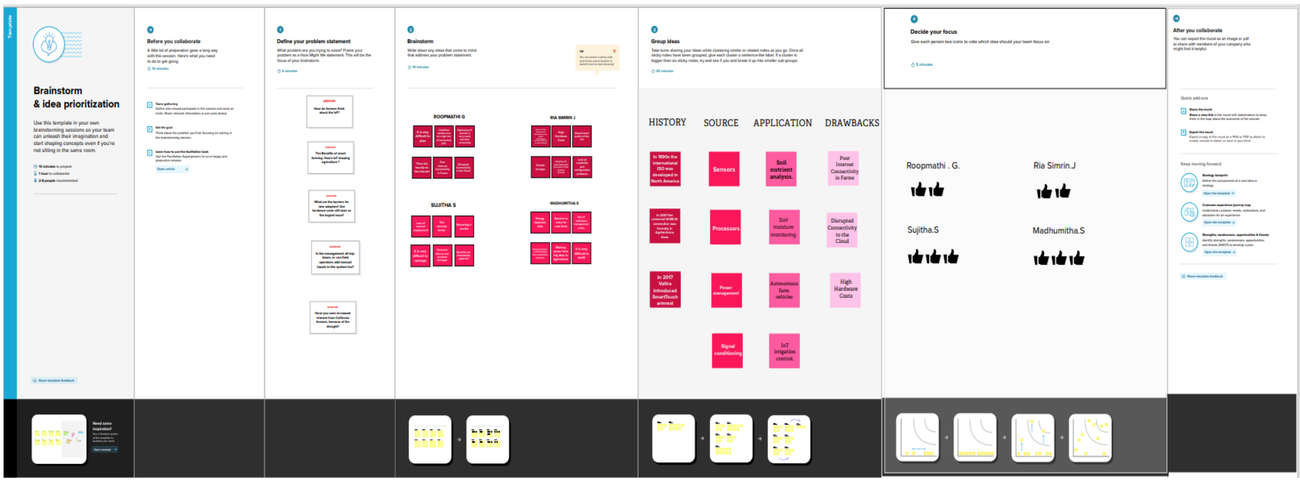
EMPATHY MAP

Teams can utilise an empathy map as a collaborative tool to learn more about their clients. An empathy map can depict a group of users, such as a consumer segment, in a manner similar to user personas. The agile community has embraced the empathy map, which was first developed by Dave Gray.



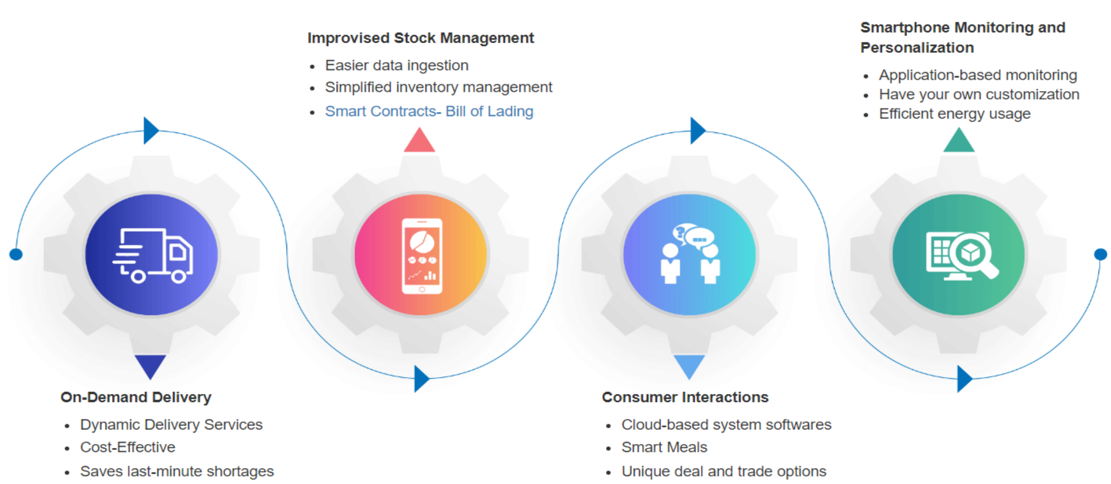
The Internet of Things (IoT) in agriculture is intended to assist farmers in monitoring crucial data such as humidity, air temperature, and soil quality via remote sensors, as well as to improve yields, plan more effective irrigation, and predict harvests.

BRAIN STROMING



A technique for generating ideas and exchanging knowledge to address a specific business or technical problem, brainstorming encourages participants to think freely. When brainstorming as a group, each person offers their ideas as they are thought of.
Robots, drones, remote sensors, computer imagery, and ever-evolving machine learning and analytical tools are used in IoT in agriculture to monitor crops, survey and map fields, and give farmers information they may use to make time- and money-saving farm management decisions.

PROPOSED SOLUTION



Project Design Phase-I
Proposed Solution Template

Date	12 October 2022
Team ID	PNT2022TMID01130
Project Name	Project – IOT Enabled Smart Farming
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Poor Internet Connectivity in Farms • High Hardware Costs • Disrupted Connectivity to the Cloud
2.	Idea / Solution description	• <u>Poor Internet Connectivity in Farms:</u> The Ultra High Frequency (UHF) and Very High Frequency (VHF) broadcast bands are also capable of multiplying the strength of Wi-Fi signals so this is best solution for poor internet connectivity • <u>High Hardware Costs:</u> Tethered Eye helium balloons are used These aerial sensors generate a stream of continuous images of the farm conditions, which are used to refine the data collected by sensors on the ground. As a result, this approach helps reduce hardware costs while facilitating more precise data collection. • <u>Disrupted Connectivity to the Cloud:</u> farmers need to embrace technologies that facilitate data-driven operations in order to improve yield, reduce operational costs, and ensure environmental sustainability. By helping farmers overcome these challenges for implementing IoT technology in rural areas, FarmBeats can help farmers realize all of the benefits of farming with data.
3.	Novelty / Uniqueness	• <u>Monitoring Soil Quality:</u> Farmers usually use a sampling method to calculate soil fertility, moisture content. Thus, this sampling doesn't give accurate results as chemical decomposition varies from location to location. Meanwhile, this not much helpful. To resolve this thing, it plays an essential role in Farming. Sensors can be installed at a uniform

		distance across the length and breadth of the farmland to collect the accurate soil data, which can be further used in the dashboard or mobile application for the farm monitoring. • Smart Irrigation on Agriculture Land: In smart irrigation, automated sprinkler systems or intelligent pumps are used. Soil moistures sensors are used in different areas to get the moisture of the soil in agricultural land. Based on the results from the soil moisture sensors, the intelligent pumps or intelligent sprinklers are turned On/Off.
4.	Social Impact / Customer Satisfaction	• Reduce the ecological footprint of farming. • Help feed the increasing global population. • Provide food security in climate change scenarios. • Achieve higher yields while reducing operating costs.
5.	Business Model (Revenue Model)	• Global smart agriculture market to grow $54,949.90 million in revenue
6.	Scalability of the Solution	The Ultra High Frequency (UHF) and Very High Frequency (VHF) broadcast bands are also capable of multiplying the strength of Wi-Fi signals so this is best solution for poor internet connectivity.in range of 3 to 30 megahertz it will work better

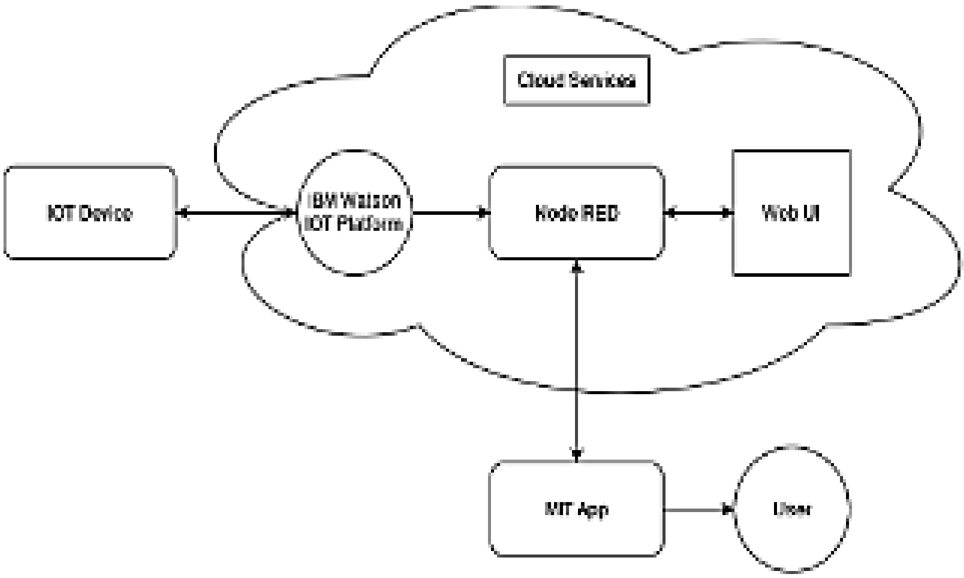
PROBLEM SOLUTION FIT

We must use innovation that assesses the nature of the harvest and makes recommendations in order to increase the product's efficiency and so help both ranchers and the nation. The Internet of Things (IOT) is revolutionising the agribusiness by involving farmers in a wide range of techniques, such as precision and conservative cultivation, to meet obstacles in the field. The management of a farm can efficiently monitor many environmental parameters utilising sensor devices including temperature, relative humidity, and soil moisture sensors in this project.

Define CS, fit into CC				Explore AS, differentiate
	1.CUSTOMER SEGMENT • Farmers • Grocery Stores • Restaurants	**6. CUSTOMER CONSTRAINTS** • Climate Change • Carbon footprint • Decrease in biological diversity	**5. AVAILABLE SOLUTION** • Poor internet connection: • Distributed connectivity to the cloud • Tethered Eye helium balloons	
Focus on J&P, tap into BE, understand RC	**2. JOBS-TO-BE-DONE / PROBLEMS** • Poor internet connection: The Ultra High Frequency (UHF) and Very High Frequency (VHF) broadcast bands are also capable of multiplying the strength of Wi-Fi signals. • High hardware cost: Tethered Eye helium balloons are used ,this approach helps reduce hardware costs while facilitating more precise data collection.	**9. PROBLEM ROOT CAUSE** • Poor internet connection in farms. • High hardware cost. • Distributed connectivity to the cloud	**7. BEHAVIOUR** • Distributed connectivity to the cloud farmers need to embrace technologies that facilitate data-driven operations in order to improve yield, reduce operational costs, and ensure environmental sustainability. By helping farmers overcome these challenges for implementing IoT technology in rural areas, FarmBeats can help farmers realize all of the benefits of farming with data.	Focus on J&P, tap into BE, understand RC
	3. TRIGGERS • Better soil health • Minimized application of inputs • Mitigate leaching problems • Increased reliability of spatially explicit data will reduce risks.	**10. YOUR SOLUTION** The technological dimension of vertical farming-and in particular, the adv 'smart' glasshouses-is likely to attract growers eager to work with emerging com and big-data technologies such as AI and the Internet of Things (IoT).	**8. CHANNELS of BEHAVIOUR** **8.1 Online** • Monitor the condition • Collect crucial data **8.2 Offline** • Live stock management • Sustainability	
	4. EMOTIONS: BEFORE / AFTER **4.1 Before** • Financially unstable • Stress about fields **4.2 After** • Stable profit • No frustration			

The sensors continuously (30 seconds) gather data about the agricultural field area, which is then documented and stored online utilising cloud computing and the Internet of Things. The sensed data is transmitted wirelessly in the direction of a database on a web server. If irrigation is automated, it means that if the temperature and moisture levels are below the desired range. With the use of an application that gives the user a web interface, the user can remotely monitor and control the system.

DATA FLOW DIAGRAM



USER STORIES

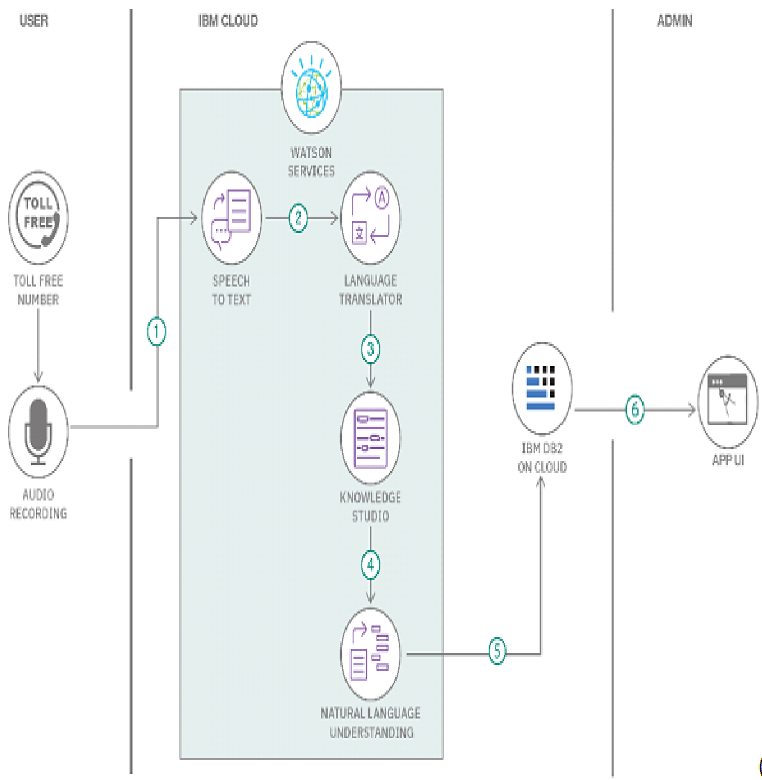
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, and password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application	I can receive a 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 through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)	Login page	USN-6	The user can log in to the web page using their password and user name.		High	Sprint-2
Customer Care Executive	Contact	USN-7	If there is any issue faced by the user, they can raise a quire in the contact or support section.		High	Sprint-1
Administrator	Admin Login	USN-8	The admin can login to see the activities of the website		Medium	Sprint-2

SOLUTION AND TECHNICAL ARCHITECTURE

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Example: Order processing during pandemics for offline mode



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)

Table-1 : Components & Technologies:

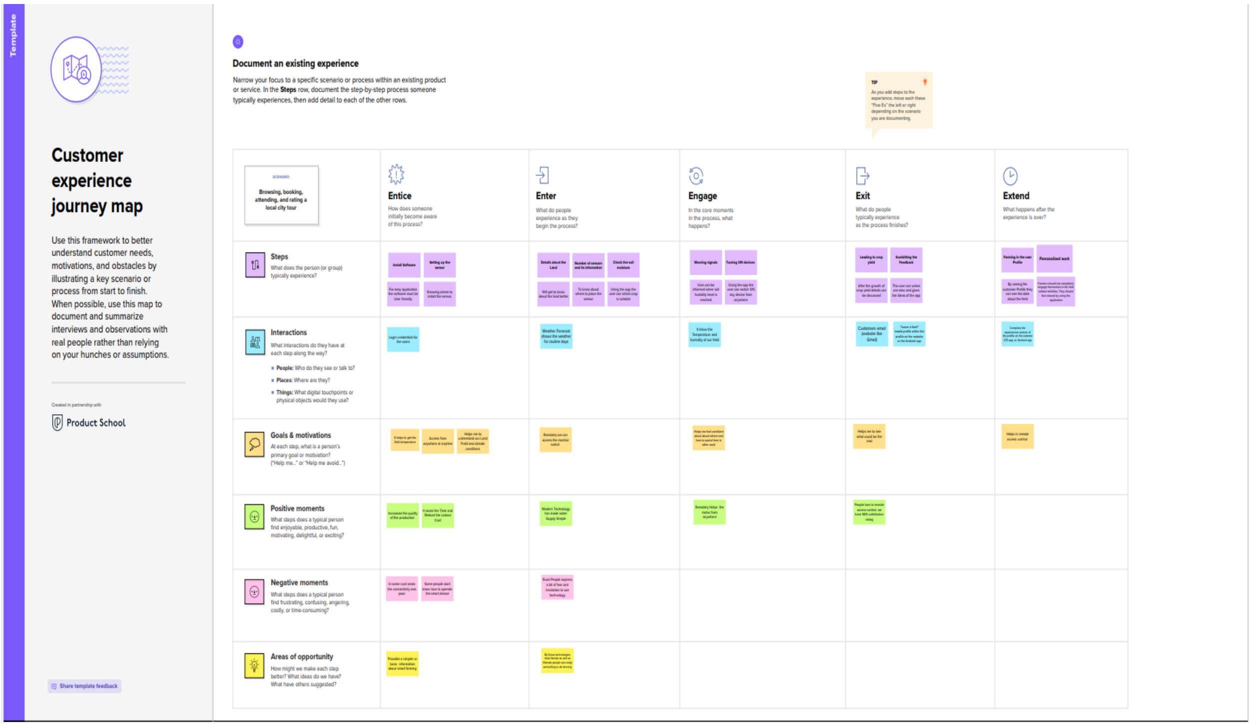
S.no	Characteristics	Description	Technology
1.	USER INTERFACE/USER DISPLAY	Hardware Output display to the user by means of Web UI, SMS and LCD Display	Embedded C++,Drones,automation and robotics,artificial intelligence
2.	(Application logic-1) Connection of Hardware between Arduino with required sensor.	Integrating the Pressure sensor along with the Arduino Uno and Node Red.	Arduino IDE ,Embedded C++
3.	(Application Logic-2)	Connecting Hardware Applications with Internet of Things through IBM cloud	IBM cloud source
4.	Server side Logic mechanism	Integrating with the Webhooks. (e.g) Select if the alert to be sent which condition exist or does not exist in the case	IBM DB2,IBM Watson STT service
5.	Integrating with the IBM cloud Monitoring	Configuring monitoring instance detail. Specifying the API Key with the function call.	CRUD operation, JSON file format , API function call
6.	SMS Sending application	Communication AT, IMEI in the mobile and Network	IBM Cloudant DB, Node RED service

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	OPEN SOURCE FRAMEWORKS	Django, which is an open source framework under python, has been used.	Technology used is python
2.	SECURITY IMPLEMENTATION	As a cloud-hosted service the IBM Watson IoT Platform service embeds security as an important aspect of its architecture	IBM Watson
3.	SCALABLE ARCHITECTURE	The browser-based GUI and REST APIs are fronted by HTTPS, so it can trust that they are connecting to the genuine Platform Service. Access to the web-based GUI is authenticated by your IBMid. Using the REST API requires an API key, generated through the GUI, can use this to make authenticated REST API calls against the organization.	
4.	AVAILABILITY	System uses GSM technique to send alert message to respective person if no one is there in the house and then gas leaks occurs, GSM module is there to send immediate messages to the respective person regarding the gas leak (GSM MODULE)	GSM MODULE TECHNOLOGY
5.	PERFORMANCE	Design consideration for the performance of the application (number of requests per sec, use of Technology used Cache, use of CDN's) etc.	

CUSTOMER JOURNEY

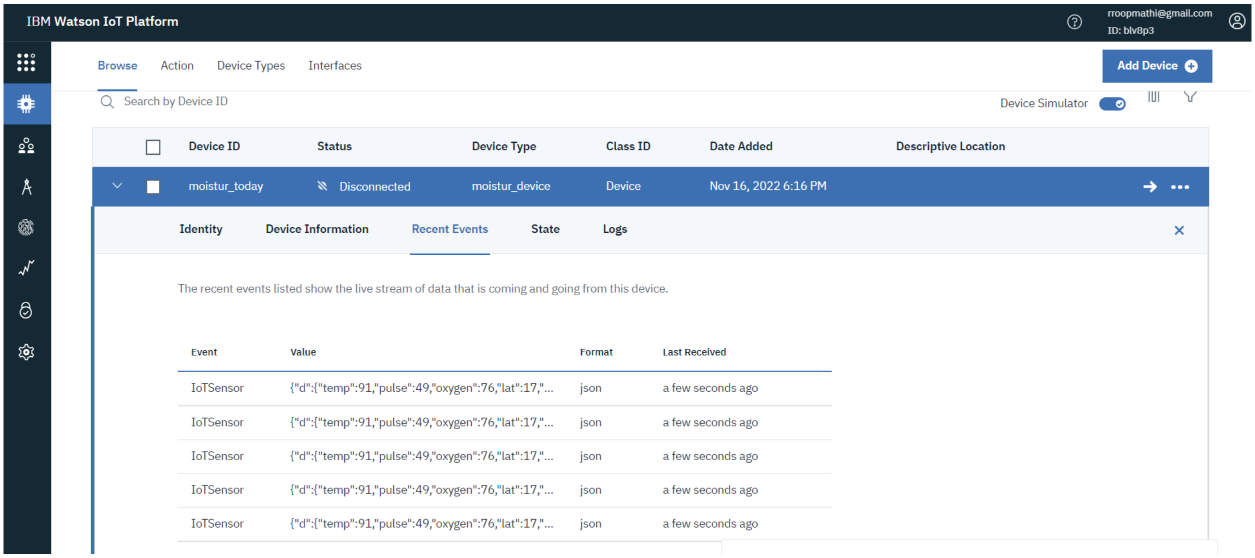
Farmers today endure burdens of water shortage/floods, land unavailability, unstable costs as they tirelessly work to feed the planet. With such extreme conditions, deteriorating soil value, drylands, and falling ecosystems, food production becomes complex and expensive for the poor farmers with no proper farming and agricultural education.Internet of Things in agriculture is now helping many farmers close this ever-growing demand-supply gap. How? Smart IoT farming ensures high yields, increases in profit, and protects the environment. Using IoT-based smart agriculture monitoring systems, farmers achieve optimum resource application and high quality and quantity of crop yield, thus decreasing operational costs while still making a profit. This is precision agriculture.



CODING AND SOLUTIONING

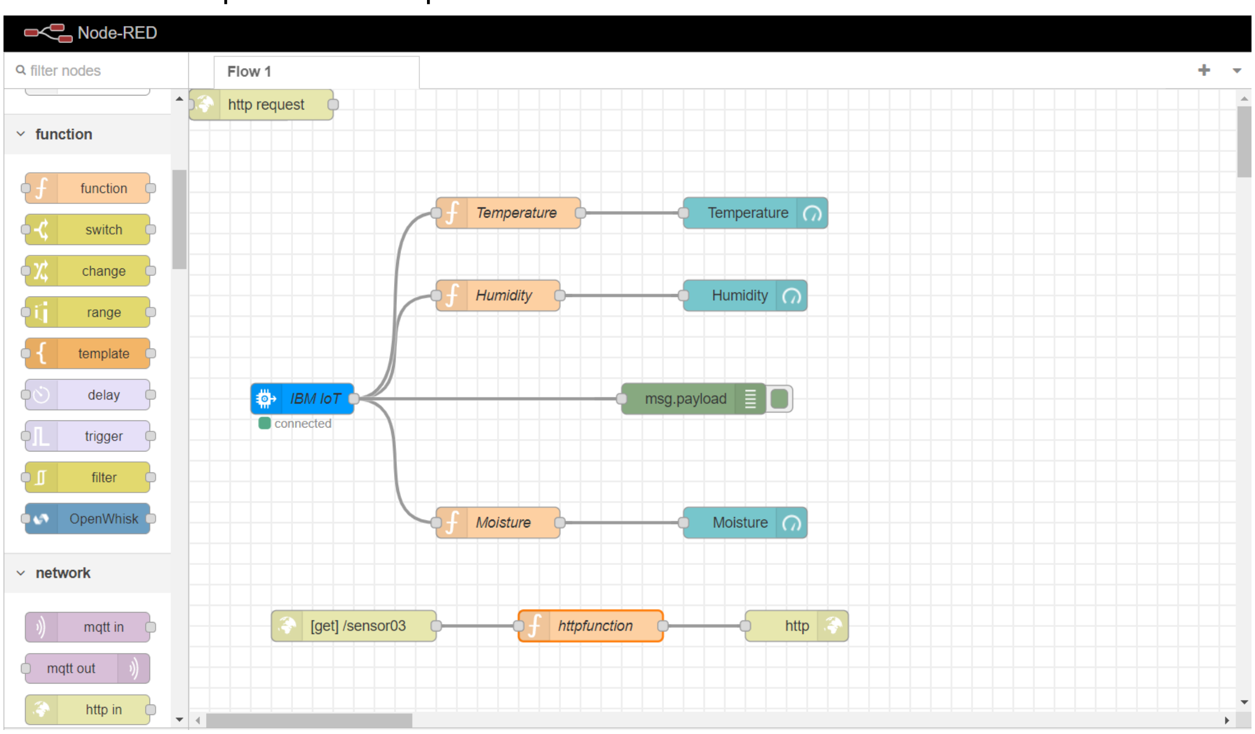
Watson IoT Platform

Two devices have been created in Watson IoT Platform. One for sending command to the User and another to receive the data from an IoT simulator (Temperature, humidity & soil moisture) and Open Weather API (recent weather information of the farm). Device is connected to the IoT Simulator to get the simulator data.



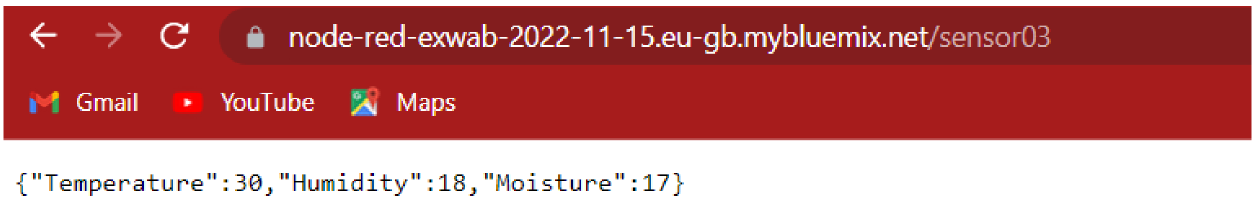
Node Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. Device is connected to Node red is installed on the PC and required nodes is installed in the node red to configure the device to display the received data from simulator and open weather apilication to user interface dashboard.



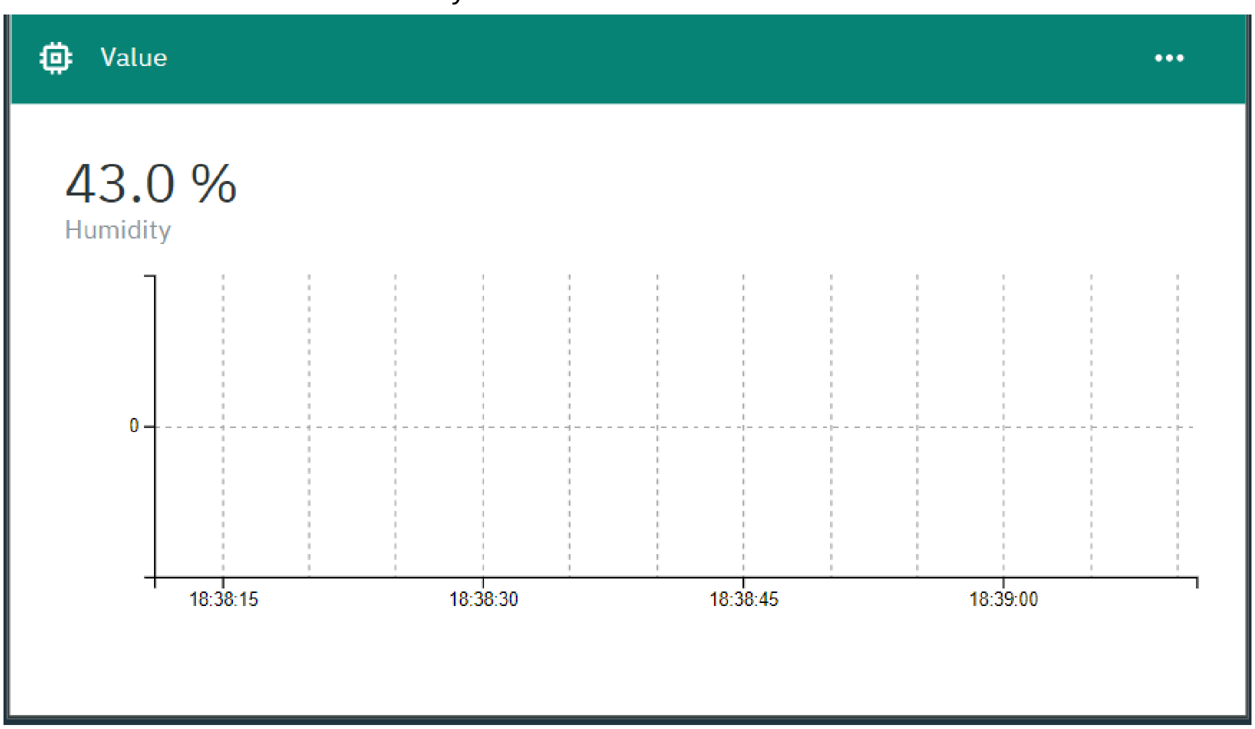
Web App

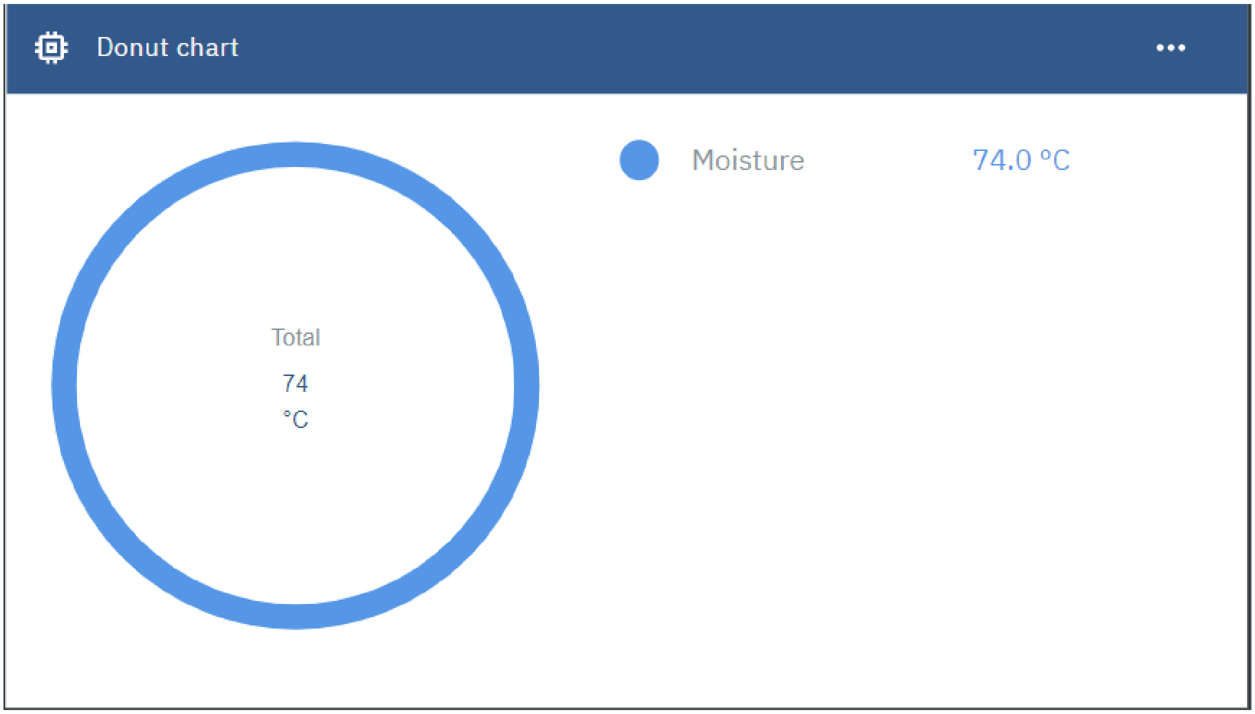
A web application is created which displays the temperature, humidity, and soil moisture data of past one hour that is received by the device from the IoT simulator. It also displays live weather parameters of the farm using open weather api. There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely. A python code is written to track down the commands (like turning motor and light ON/OFF) that are being sent by the user through web application.

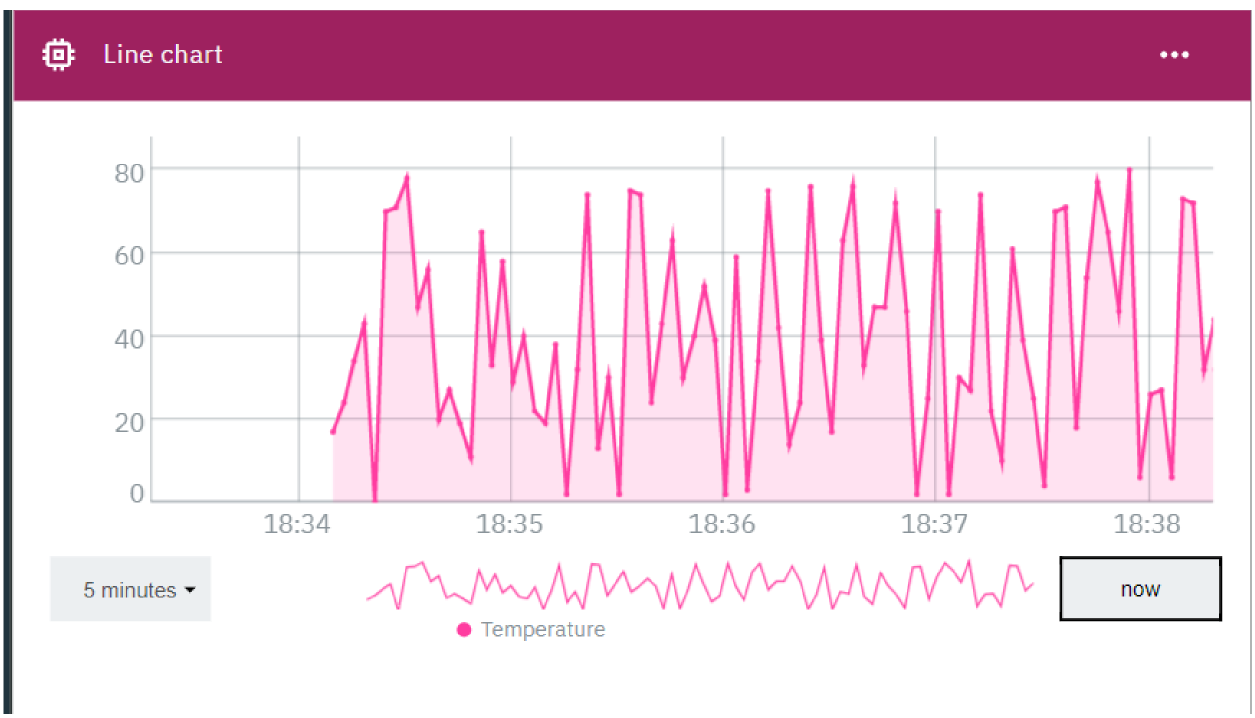


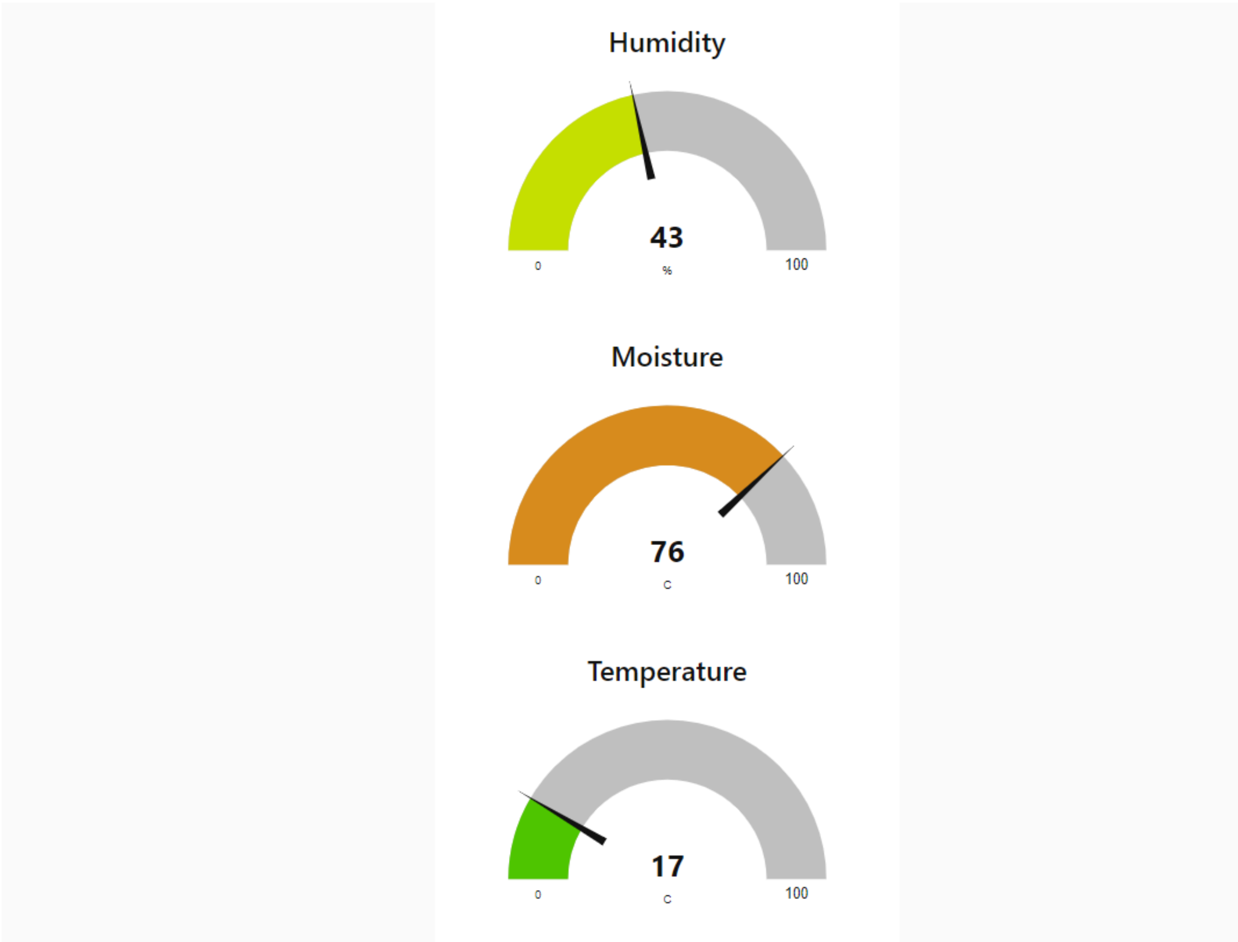
RESULT

The yield appeared beneath signifies the temperature, soil moisture and humidity data received from the IoT simulator sensor and open weather api. The web app displays all these data of past one hour. There are set of buttons on the web application that can be used to control themotor and light on the farm to turn them ON/OFF remotely.




Donut chart
Moisture
74.0 °C
Total
74
°C


Line chart
80
60
40
20
0
18:34
18:35
18:36
18:37
18:38
5 minutes
Temperature
now



TESTING

PERFORMANCE TESTING

S. no	Monitoring App	OUTPUT	TIME IN SEC	COMMENTS
1	Temperature Humidity Moisture	START "Welcome To Smart Farming"	5 sec	>>Click the Monitoring App >>Cick The Start Button >>You will see a pop up like "Welcome To Smart Farming
2	Temperature Humidity	Published Temperature = 67 C Published Humidity = 46 %	2 sec	>>Compute radii range depending

	Moisture	Published Moisture = 87 C		upon the Minimum radius and Maximum radius >>Monitoring Temperature >> Monitoring Humidity >>Monitoring Moisture
3	Temperature Humidity Moisture	Published Temperature = 20 C Published Humidity = 26 % Published Moisture = 83 C	2 sec	>>Compute radii range depending upon the Minimum radius and Maximum radius >>Monitoring Temperature >> Monitoring Humidity >>Monitoring Moisture
4	Temperature Humidity Moisture	Published Temperature = 43 C Published Humidity = 37 % Published Moisture = 60 C	2 sec	>>Compute radii range depending upon the Minimum radius and Maximum radius >>Monitoring Temperature >> Monitoring Humidity >>Monitoring Moisture
5	Temperature Humidity Moisture	Published Temperature = 16 C Published Humidity = 36 % Published Moisture = 97 C	2 sec	>>Compute radii range depending upon the Minimum radius and Maximum radius

				>>Monitoring Temperature >> Monitoring Humidity >>Monitoring Moisture
6	Temperature Humidity Moisture	Published Temperature = 16 C Published Humidity = 36 % Published Moisture = 97 C	2 sec	>>Compute radii range dependig upon theMinimum radius and Maximum radius >>Monitoring Temperature >> Monitoring Humidity >>Monitoring Moisture

ADVANTAGES AND DISADVANTAGES

The following are the benefits of adopting new technology - Internet of Things in Agriculture:

1. Climate Condition IoT solution enables us to know the real-time weather conditions. Sensors are placed inside and outside of the agriculture fields. They collect data from the environment which is used to choose the right crops which can grow and sustain in the particular climatic conditions.
2. Precision Farming The goal of precision farming is to analyze the data, generated via sensors, to react accordingly. Precision Farming helps farmers to generate data with the help of sensors and analyze that information to take intelligent and quick decisions. With the help of Precision farming, you can analyze soil conditions and other related parameters to increase the operational efficiency.
3. Smart Greenhouse To make our greenhouses smart, IoT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions. Adoption of IoT in Greenhouses has eliminated the human intervention, thus making entire process costeffective and increasing accuracy at the same time.

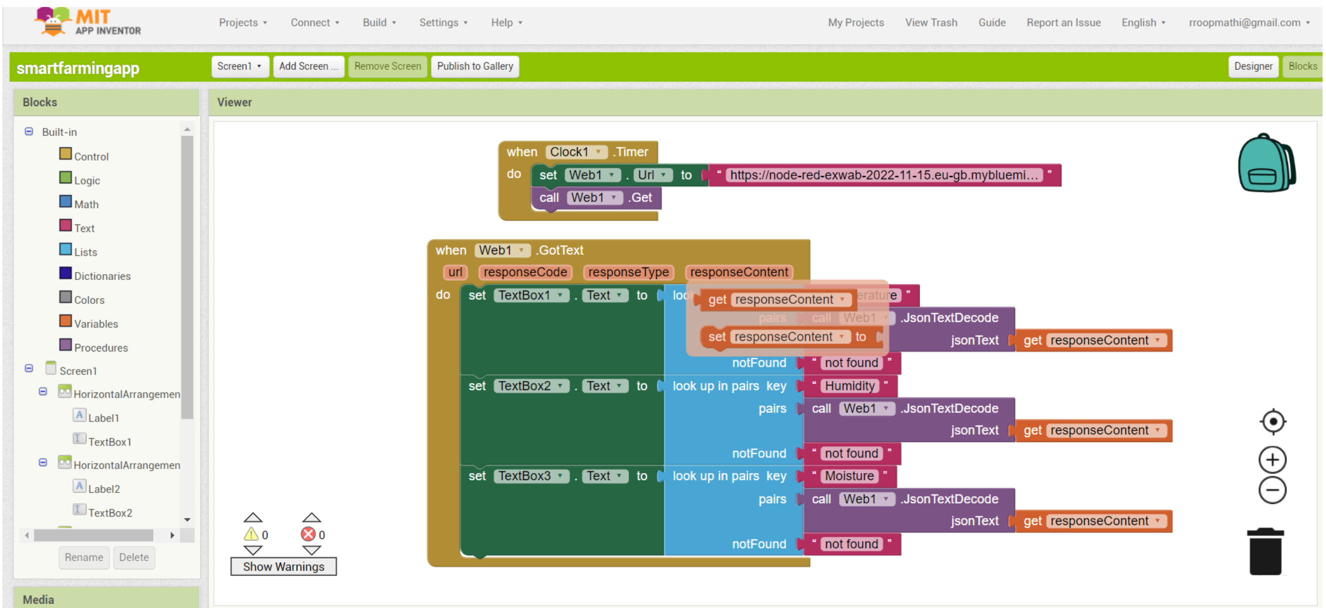
4. Data Analytics Cloud based data storage and an end-to-end IoT Platform plays an important role in the smart agriculture system. These systems are estimated to play an important role such that better activities can be performed. In the IoT world, sensors are the primary source of collecting data on a large scale. The data is analyzed and transformed to meaningful information using analytics tools. The data analytics helps in the analysis of weather conditions, livestock conditions, and crop conditions.

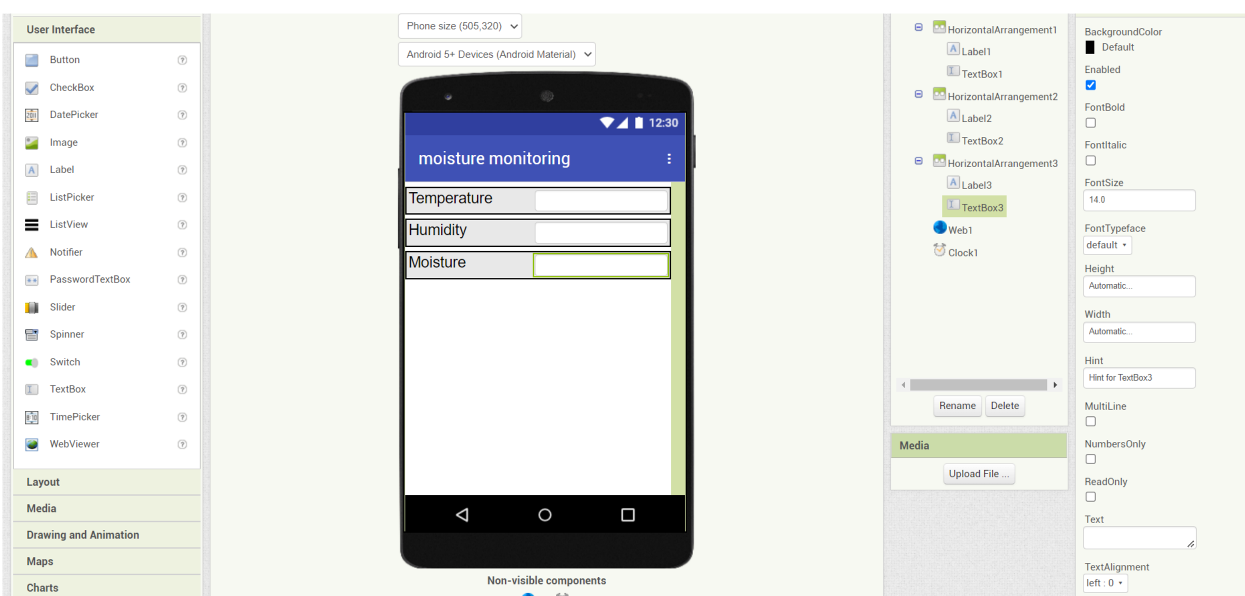
APPLICATION

By implementing the latest sensing and IoT technologies in agriculture practices, every aspect of traditional farming methods can be fundamentally changed. Currently, seamless integration of wireless sensors and the IoT in smart agriculture can raise agriculture to levels which were previously unimaginable. By following the practices of smart agriculture, IoT can help to improve the solutions of many traditional farming issues, like drought response, yield optimization, land suitability, irrigation, and pest control. Figure 9 lists a hierarchy of major applications, services and wireless sensors being used for smart agriculture applications.

RESULT

The yield appeared beneath signifies the temperature, soil moisture and humidity data received from the IoT simulator sensor and open weather api. The web app displays all these data of past one hour. There are set of buttons on the web application that can be used to control the motor and light on the farm to turn them ON/OFF remotely.






11:34
moisture monitoring
Temperature
35
Humidity
23
Moisture
17

CONCLUSION

Node Red and IBM Cloud Platform have been suggested for an Internet of Things (IoT) based Smart Agriculture System for Live Monitoring of Temperature and Soil Moisture as well as Remote Control of Motor and Light. The system is highly accurate and efficient at retrieving real-time data on soil moisture and temperature. The proposed IoT-based smart farming system will help farmers increase agricultural yield and effectively manage food production because it will always lend a helping hand to them in order to obtain accurate live feeds of environmental temperature and soil moisture with results that are more than 99% accurate.Therefore, the project puts forth the idea of integrating the most recent innovation into the agricultural field to transform the traditional water system techniques to modern strategies, thereby making simple profitable and temperate trimming.

The use of Arduino and cloud computing has been proposed for an Internet of Things-based smart farming system for real-time temperature and soil moisture monitoring. The system is highly accurate and efficient at retrieving real-time data on soil moisture and temperature. The IoT-based smart farming system that is suggested in this report will help farmers increase agricultural yield and effectively manage food production because it will constantly lend a hand to them in order to get accurate live feeds of environmental temperature and soil moisture with results that are more than 99% accurate.

FUTURE SCOPE

Future development will concentrate further on expanding the system's sensors to collect more data, particularly in relation to pest control, and incorporating a GPS module to further develop this agriculture IoT technology into a fully functional, agriculture precision-ready device.

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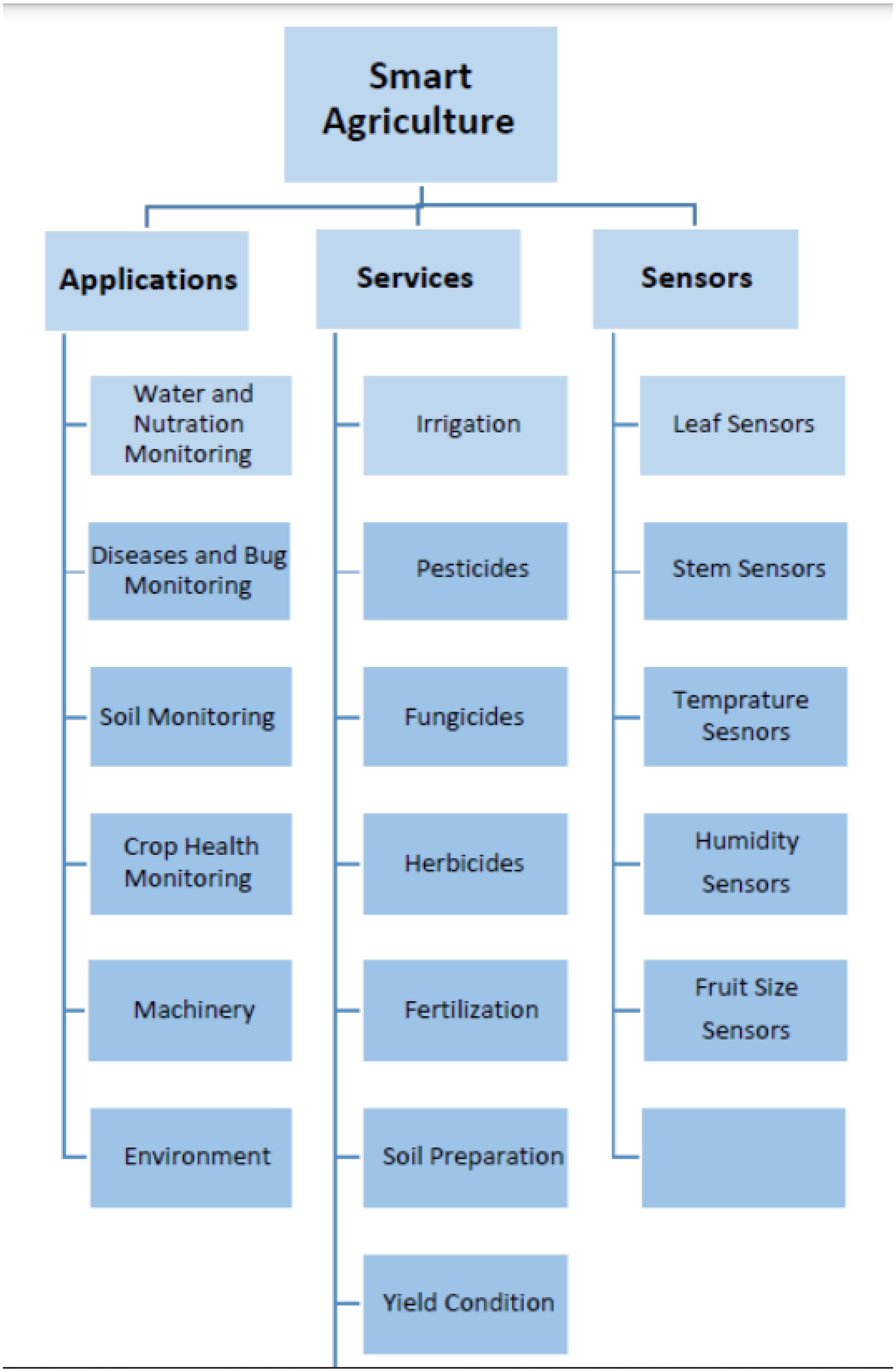
Smart Agriculture
Applications
Services
Sensors
Water and Nutration Monitoring
Diseases and Bug Monitoring
Soil Monitoring
Crop Health Monitoring
Machinery
Environment
Irrigation
Pesticides
Fungicides
Herbicides
Fertilization
Soil Preparation
Yield Condition
Leaf Sensors
Stem Sensors
Temprature Sesnors
Humidity Sensors
Fruit Size Sensors

APPENDIX
Source Code

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


#Provide your IBM Watson Device Credentials
organization = "blv8p3"
deviceType = "moistur_device"
deviceId = "moistur_today"
authMethod = "token"
authToken = "-b07a8H3qi2acCBZjP"

# Initialize GPIO

temp=random.randint(0,100)
pulse=random.randint(0,100)
oxygen= random.randint(0,100)
lat =  17
lon = 18


def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    print(cmd)



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

        data = {"d":{ 'temp' : temp, 'pulse': pulse ,'oxygen': oxygen,"lat":lat,"lon":lon}}
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % pulse,
"Moisture = %s C" % oxygen,  "to IBM Watson")

        success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(1)

        deviceCli.commandCallback = myCommandCallback

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

GitHub link

https://github.com/IBM-EPBL/IBM-Project-1939-1658420948

Project Demo Link

https://drive.google.com/drive/folders/1qXL1zx0pEAwBmuxFtWRZU9ZKuArxLYeY?usp=share_link