PROJECT REPORT

Team ID	PNT2022TMID48661
Project Name	Smart Farmer – IOT Enabled Smart Farming Application
Domain	Internet of Things
College name	NPR COLLEGE OF ENGINEERING AND TECHNOLOGY

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➢ INTRODUCTION

- **Project Overview**

  Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like moisture & temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities. It makes use of wireless sensor networks for noting the soil properties and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any internet services and the operations are performed by interfacing sensors, Wi-Fi, camera with microcontroller. This concept is created as a product and given to the farmer's welfare.

- **Purpose**

  Most projects signify the use of wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc.. Hence automation must be implemented in agriculture to overcome these problems

  i) To avoid 24/7 hours monitoring.
  ii) It will provide the field conditions regularly and farmers will not be in need to check the conditions by going directlly to the field.
  iii) It can also stop the water wastage whenever there is excess water the system will indicate them.
  iv) It also can reduce the stress of the farmers due to loss that occurs from crop damage

➢ LITERATURE SURVEY

- **Existing problem**

  The main issue which slows the ability of farmers to profit from latest technologies is connectivity. BTRC has stated that although there are more than ninety millions of Internet users, we do not have exact reports of the usage of Internet of smart phones by farmers for the purpose of agriculture. These technologies are used by vast agriculture companies and are not widely famous with rural farmers. The second and subsequent major challenge is awareness. An American research report states that amidst 1600 farmers, only 68% are familiar with IoT. These technologies will be more challenging in small land

holdings and crop diversity compared to large farms. However, manufacturing and maintenance expense of these technologies will also be high. In agronomical farms, the software and hardware expense in soaring due to exposure to the unsympathetic atmosphere such as cold, heat, water, storm, wind, sand and physical dents. The main issue which slows the ability of farmers to profit from latest technologies is connectivity. BTRC has stated that although there are more than ninety millions of Internet users, we do not have exact reports of the usage of Internet of smart phones by farmers for the purpose of agriculture. These technologies are used by vast agriculture companies and are not widely famous with rural farmers. The second and subsequent major challenge is awareness. An American research report states that amidst 1600 farmers, only 68% are familiar with IoT. These technologies will be more challenging in small land holdings and crop diversity compared to large farms. However, manufacturing and maintenance expense of these technologies will also be high.. The next issue is IT security. Devices should be secured against theft and wrong exploit as the prospect of farming predictions is possible, product pricing and expenses could also be manipulated and they should be monitored. The final challenge is trained human resources.

- In agriculture water is needed for the crops for their growth. If the Soil gets dry it is necessary to supply water. But sometime if the farmer doesn't visit the field it is not possible to know the condition of soil.
- Sometimes over supply of water or less supply of water affects the growth of crops.
- Sometimes if the weather/temperature changes suddenly it is necessary to take certain actions.
- Specific crops grow better in specific conditions, they may get damaged due to bad climate

- **References**

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8) Jhonattan M, Pedro P and Arturo M 2019 Sensing, smart and sustainable technologies for Agri-Food 4.0 Computers in Industry 108 21-36

9) Wolfert S, Ge L, Verdouw C and Bogaardt M-J 2017 Big Data in Smart Farming - A Review Agricultural Systems 153 69-80

10) Wolfert S, Ge L, Verdouw C and Bogaardt M-J 2017 Big Data in Smart Farming - A Review Agricultural Systems 153 69-80

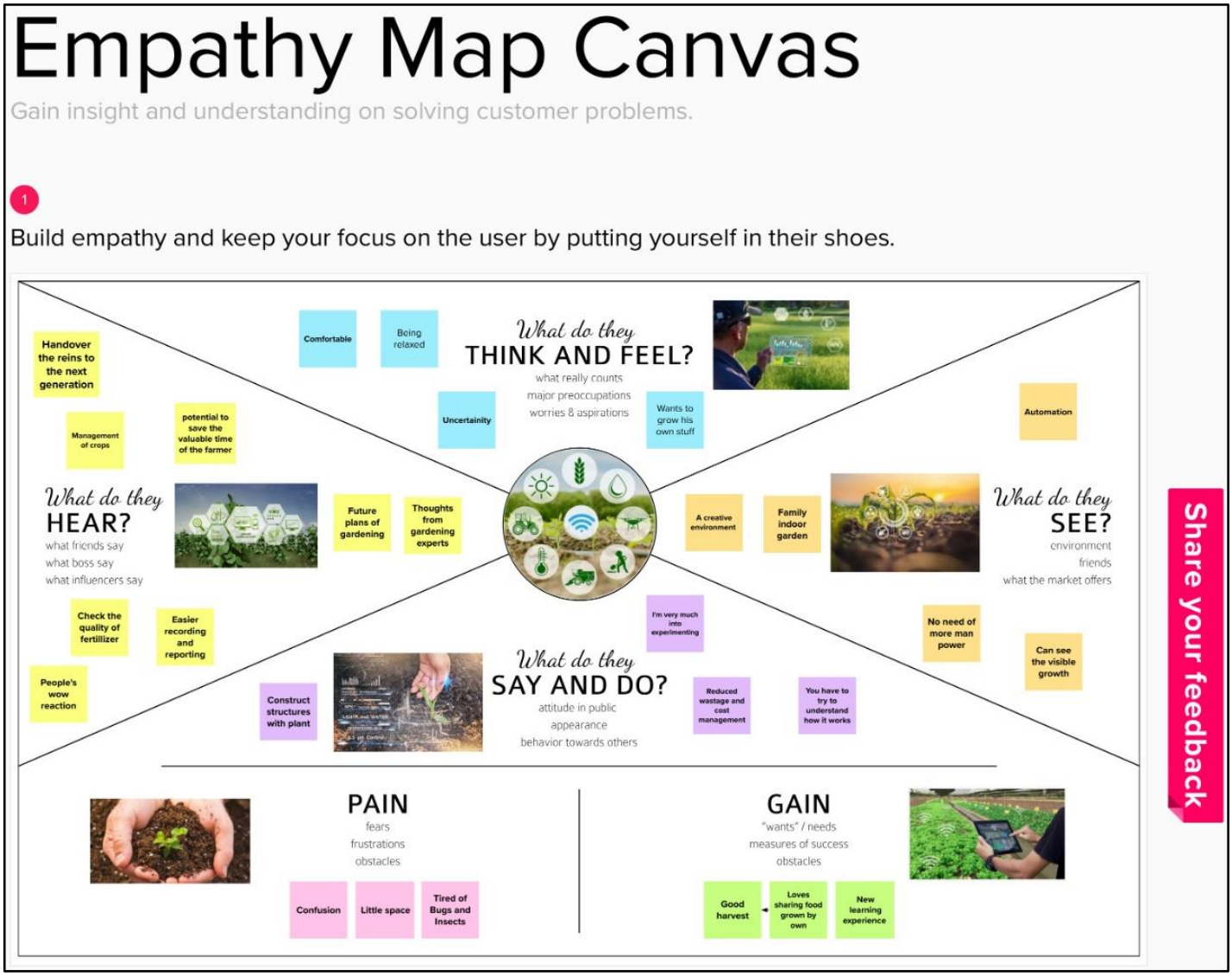
- **Problem Statement Definition**

  The traditional agriculture and allied sector cannot meet the requirements of modern agriculture which requires high-yield, high quality and efficient output. Thus, it is very important to turn towards modernization of existing methods and using the information technology and data over a certain period to predict the best possible productivity and crop suitable on the very particular land. The adoptions of access to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning) are few key technologies characterizing the precision agriculture trend. Precision agriculture is one of the most famous applications of IoT in the agricultural sector and numerous organizations are leveraging this technique around the world. Some products and services in use are VRI optimization, soil moisture probes, virtual optimizer PRO, and so on. VRI (Variable Rate Irrigation) optimization maximizes profitability on irrigated crop fields with topography or soil variability, improve yields, and increases water use efficiency. IoT has been making deep inroads into sectors such as manufacturing, health-care and automotive. When it comes to food production, transport and storage, it offers a breadth of options that can improve India's per capita food availability. Sensors that offer information on soil nutrient status, pest infestation, moisture conditions etc. which can be used to improve crop yields over time. Some of the sample problem statements related to Agriculture & allied sectors where IoT application will be beneficial are given below.

  "Farmers needs a way to get altered when there is a change in the environmental conditions on their field. So, we are designing a device which indicates the farmer about the humidity level, temperature changes and the proper irrigation based upon the condition. People can operate in both a) Manual b) Automatic. So, when needed we can change the water level. All the updates will be given to the farmer through message and mail. So, they can stay updated by this device we can save the time and relieve the stress of the farmer"

➢ IDEATION & PROPOSED SOLUTION

- **Empathy Map Canvas**



- **Ideation & Brainstorming**

✓ **Problem statement including use of ICT :** Develop affordable app-based solution for Soil health monitoring and suggest which crop to be sown based on it.

Expected Output: Create app-based solution to detect soil parameters like moisture content, temperature, relative humidity, nutrient, Ph, CEC, NPK and provide crop suggestions to be produced based on soil parameters & environment values.

Bonus Objective: Provide remedies & alerts on soil deficiencies like Watering for low Moisture level, Fertilizers for Nutrient deficiencies etc.

How Does it help : Currently farmers follow Traditional Crop yielding pattern and irrespective of soil condition, farmers take routine crops. Farmers irrespective of whether soil nutrient requirement uses blanket fertilizers for crop. Because of these issues, losses in crop yielding and soil health gets affected.

- ✓ **Problem statement including use of ICT:** Develop app-based solution for Cotton Crop health monitoring and suggest remedial actions.

  Output : With the help of sensors/ imaginary input create cotton crop health monitoring application which will provide various parameters related to cotton crop like moisture level, nutrient level, pest infection level, maturity/harvesting time etc. and create alert for remedial action.

  Bonus Objective: To identify type & level of pest infection and pesticide to be used

  How Does it help : Cotton is one of the largest cash crops grown in Vidarbha region. Most of the farmers in Vidarbha region follow traditional agriculture practice and because of which losses are seen in cotton yield.

- ✓ **Problem statement including use of ICT :** To create affordable IoT based smart hydroponic vertical farming system

  Output : With the help of IoT sensor create affordable hydroponic system for growing spinach, fenugreek, coriander, lettuce plant which will utilize maximum available natural light exposure in Vidarbha region and develop mobile app for monitoring & controlling of various environmental factors like temperature, relative humidity, CO2 concertation, light intensity and quality parameters of solution like pH, total dissolved solid (TDS) etc. Standardize the nutrient uptake of each high value vegetable.

  How Does it help: In Vidarbha region problems related to traditional agriculture includes water issue, less land holding capacity, Climate issue, Traditional crops mainly based on rainfed agriculture, labor issues etc. because of which many times farmers get small income compared to total cost for farming. With the help of Hydroponic based Vertical farming (VF), famers can earn money with 80-90% less water, in very small space, can grow 100% Organic Food, less & controlled nutrient supply, may opt indoor farming, VF is climate independent, can grow Veggies & Medicinal crop having high market values, High Yielding in small time, All year-round yielding.

- ✓ **Problem statement including use of ICT :**Develop smart & affordable solution to protect crops from wild animals

  Output : With the help of remote sensing technologies develop crop protection solution from wild animal attacks. Provide alerts on any crop damage in case animals destroy crops.

  How Does it help : In Vidarbha region, Main Cash Crops such as Pigeon Pea, Green Gram, Black Gram, Jowar, Cotton, Soybean etc. present and are badly affected by wild animals like Deer, Rohi (Neel Gai), wild Pigs, Peacock etc. In few districts in Vidarbha

crop loss is more than 35%. Main Wild animals attacking crops in region are Akola, Buldhana Washim etc.

- ✓ **Problem statement including use of ICT :**Develop system for predicting potential pest, disease, insect attacks (before at least 15-day & more) on Cotton crop and yield prediction of cotton.

  Output : To develop app-based forecasting system which provide prediction of possible pest/disease/insect attack on Cotton crop &Predict the cotton crop yield production for Vidarbha region farmers based on the farm historical data, local terrain, weather scenario, various sensor inputs rather than generic guidance. The prediction expected to be at farm level so that individual farmer may take immediate action.

  How Does it help : Farmers can take immediate actions resulting better crop produces and farmers have better income. High Yield and prescriptive guidance.

- Proposed Solution

1.	Problem Statement (Problem to be solved)	This is the project from the motivation of the farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of their land. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required. Moreover, for the power indication they are glowing a single bulb between any one of phase and neutral, meanwhile when there is any phase deduction occurs in other phases, the farmer cannot know their supply is low. If they Switch ON any of the motor, there will be the sudden defuse in motor circuit. They may have to travel so far for SWITCHING ON/OFF the motor. They may be suffering from hot Sun, rain and night time too. After reaching their farm, they found that there is no power, so they quietly disappointed to it!! Is there any solution for it??? Let's check our solution.
2.	Idea / Solution description	This project presents proposed model for Smart Agriculture to develop real time monitoring system for soil properties like Temperature, Humidity and moisture, crop yield identification

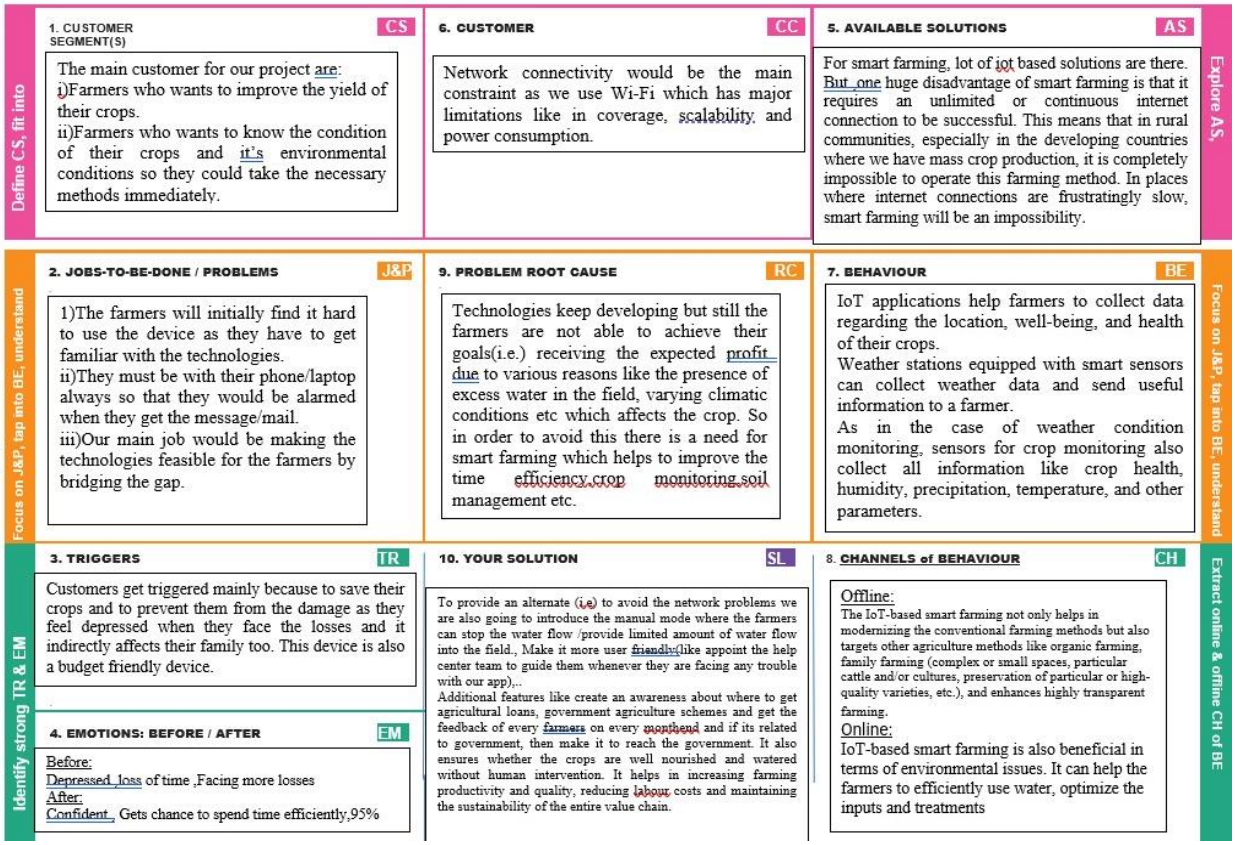
		using SMS based Alerts. It will also be possible to control various operations of the field remotely from anywhere, anytime by mobile as well as web application. The IOT based agricultural monitoring system has been used to maximize the yield of crop by monitoring the environmental parameters and thus providing the required information to farmer remotely. This system can be implemented in any type of agricultural field with varying soils. The use of IOT over the other technology one aides for deploying it in any type of environment for monitoring, making it flexible and robust. The proposed system is developed for the goodwill of farmers. The system greatly reduces the human interaction, labour cost and wastage of water. Threshold values for climatic conditions like humidity, temperature, moisture can be fixed based on the environmental conditions of that particular region.This system generates irrigation schedule based on the sensed real time data from field and data from the weather repository. Using the water level sensor the water level in the tank can be calculated and based on the data from humidity and moisture sensor the land can be irrigated automatically and can detect the overflow in the water tank. Thus, smart irrigation system helps to improve the crop yield and thereby meet the demand. This project remotely measure and monitor water moisture levels in the soil to ensure that crops are getting optimal water resources and automatically trigger sprinkler systems to address low moisture levels in the soil to prevent crop damage or loss. This idea will improve the crop yield and manage them.
3.	Novelty / Uniqueness	Water being a precious resource must be utilized efficiently. Agriculture is one of those areas which consumes lot of water. Irrigation to the farm is a time consuming process and must be done on timely basis. As aimed, through this work an auto irrigation system measuring the moisture content, and the water level. Later harvesting the excess water from the cultivation field and recycled back to the tank.
4.	Social Impact / Customer Satisfaction	Third Green Revolution Smart farming and IoT-driven agriculture are paving the way for what can be called a Third

		Green Revolution.Following the plant breeding and genetics revolutions, 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, through, 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
5.	Business Model (Revenue Model)	Sensors,control systems, robots, autonomous vehicles ,motion detectors, button cameras, and wearable devices are all important components in this approach to farm management. This information can be used to track the overall state of the company, as well as employee performance and equipment efficiency. The ability to predict production output provides for improved product distribution planning. I)**Agriculture Drones** are being utilised in agriculture to improve a variety of agricultural processes, including crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis. II) **Greenhouses with Intelligence** – A smart greenhouse built with IoT monitors and manages the climate intelligently, removing the need for manual intervention. III)**Smart farming with predictive analytics**, Crop prediction is important because it aids the farmer in making future decisions about crop production, storage, marketing tactics, and risk management. IV)**Artificial networks** are used to predict crop output rates using data received from farm sensors. V)**A snowballing world population** means the agricultural industry will need to produce approximately 70 percent more food in 2050 than it did in 2006, according to the UN Food and

		VI)**Agriculture Organization**. - To maximize crop yields and use of resources, farmers are utilizing smart agriculture technology to track progress, predict outcomes and drive decision-making. VII)**Precision agriculture(Precision farming):** Weather forecasting accuracy and other dynamic data inputs can affects crop productivity to a great extent. The higher the level of accuracy, the lower the chances of crops being damaged; thus, more accurate weather forecasts can lead to higher profitability and productivity levels
6.	Scalability of the Solution	Scalability is another requirement that should be considered in a smart farming platform. Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation. We can increase the capacity for data processing by increasing the cloud resources in the second layer and computation resources in the third layer. The challenges related to scalability in smart farming fall into two categories: i)Capacity ii)Performance Scaling capacity refers to the ability to add new nodes or resources to the system. Scaling performance is the ability to improve performance or to keep the performance identical while expanding capacity. The fundamental bottleneck that may affect system performance may be caused by different deployment configurations of various components. Other challenges of scalability are identity management and access control, security, privacy , governance, and fault tolerance . Since farming data generation is rapidly increasing every day, such data are too large to be stored on a single node. A fundamental solution to address this need is distributing data collection mechanisms across multiple nodes. For instance, Zhou et al employed Hadoop to process and store 1.44 million data records for daily temperature monitoring. Since most smart farming data are small files that lead to many small files, Hadoop cannot be effective without a distributed system equipped with a high-performance computing system. To address this problem, the Hadoop Distributed File System (HDFS) has been designed to process large (and small size) datasets. Using cloud computing technology in a smart farming platform is another solution that can address scalability challenges

		related to capacity due to flexible and robust data collection, management, and processing capabilities [83]. Cloud computing provides a high level of flexibility by providing remote services for monitoring and managing farm data. Moreover, these services can provide on-demand storage and computation resources with no need for on-farm hardware installation. The data stored in the cloud systems are usually distributed in the data storage platforms supported by backup mechanisms. The data-driven services are finally offered by web services accessible through diverse tools, including laptops, tablets, and smartphones in the last stage of smart farming tasks. Smart Farm Net is an example of a scalable platform that utilizes cloud computing technology to provide a scalable solution for smart farming.

- Problem Solution fit



➢ REQUIREMENT ANALYSIS

- **Functional requirement**

FR No.	**Functional Requirement**	**Functional Requirement**
FR-1	User Registration	Registration through form Registration through gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	System Login	Check username and password Check multifactor enrollment Check accessthrough a different device Check wrong credentials
FR-4	Data Management	Manage the data of weather conditions Manage the data of crop conditions Manage the data of livestock conditions
FR-5	Manage Modules	Manages system admin Manage Roles of access
FR-6	Logout	exit

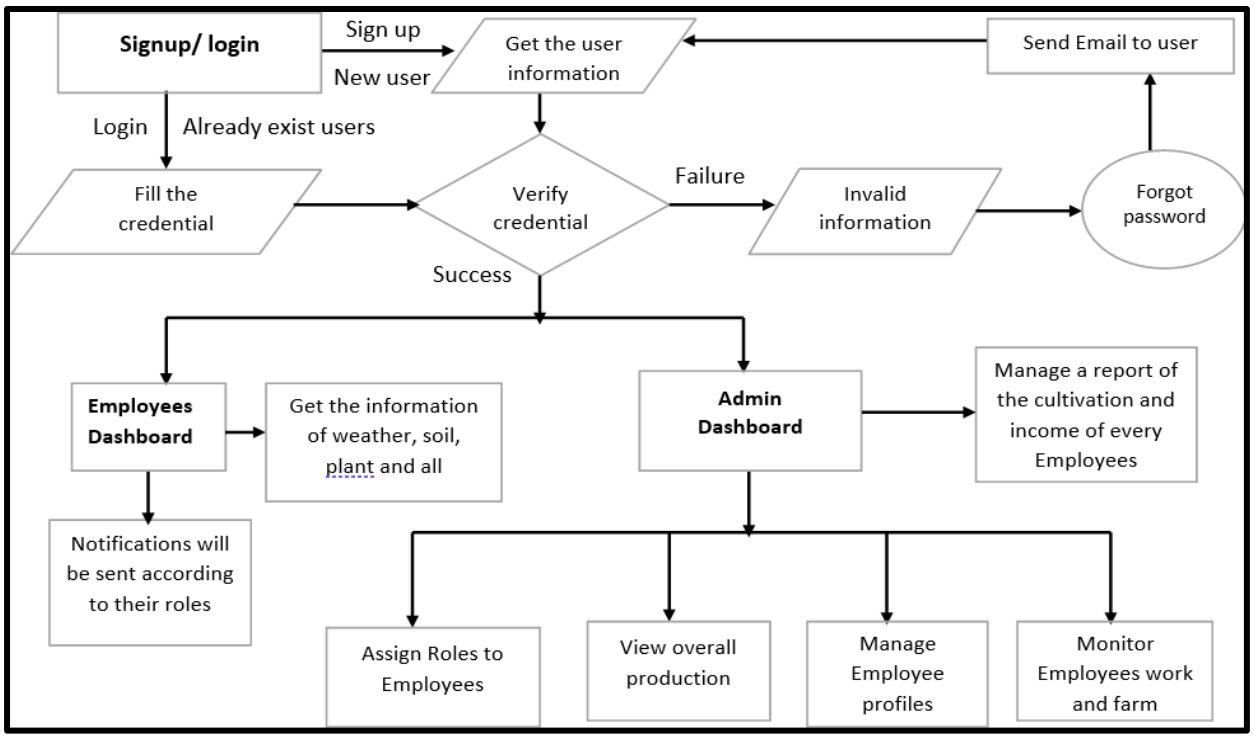
- **Non-Functional requirements**

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	The proposed system usesrobots, drones, remote sensors, analytical tools, and the whole system is monitored and managed through an app on a smartphone. This makes the system user friendly and the usage of this product doesn't require any prior learning
NFR-2	**SECURITY**	The proposed system includes Data anonymization which is a process in which any information that can enable personal identification, including name, address, geographic identifiers, are removed from data and Access control which helps in privacy-preserving and security.
NFR-3	**RELIEABILITY**	The use of sensors, specialized software IOT platform and enhanced uninterrupted internet connectivity withstand severe weather events and open space conditions. The system provides an accurate measurement of data, and it can have a longer lifespan.
NFR-4	**PERFORMANCE**	The use of modern technological solutions helps to bridge the gap between production and quality and quantity yield. Data Ingested by obtaining and importing

		information from the multiple sensors for real time use or storage in a database ensuresswift action and less damage to the crops increasing the overall performance of the system.
NFR-5	**AVAILABILITY**	The present system can be improved easily by integrating new components with enhanced features. Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto adjust temperature and humidity
NFR-6	**SCALABILITY**	The proposed system uses Cloud database deployment which can be visualized as the intermediate medium between hardware system and user's mobile application. With increased production, lowered operation costs and with accurate farm and field evaluation, proposed system is scalable.

➢ PROJECT DESIGN

- Data Flow Diagrams



- **Solution & Technical Architecture**

SENSORS

The soil moisture sensor senses the moisture level in the soil. The humidity and temperature sensor gives the humidity and temperature values of the atmosphere which determine whether the crop is suitable for growth. The soil moisture sensor, humidity and temperature sensor continuously monitors the soil and environmental conditions, sends the live data to mobile.

ARDUINO UNO

Arduino Uno is the heart of the system. The facts gathered with the aid of the sensors is sent to the Arduino UNO.The gathered information may be displayed in a Arduino IDE.

SOIL MOISTURE SENSOR

A soil moisture sensor empowers agriculturalists to estimate the water levels without the need to be physically present in the field

TEMPERATURE SENSOR

The temperature sensor senses the surrounding temperature of the farm in different farm conditions

HUMIDITY SENSOR

Humidity sensors are electronic devices that measure and report the moisture and air temperature of the surrounding environment

AC MOTOR PUMP

This pump will pump water from well and water is sent to the farmland.

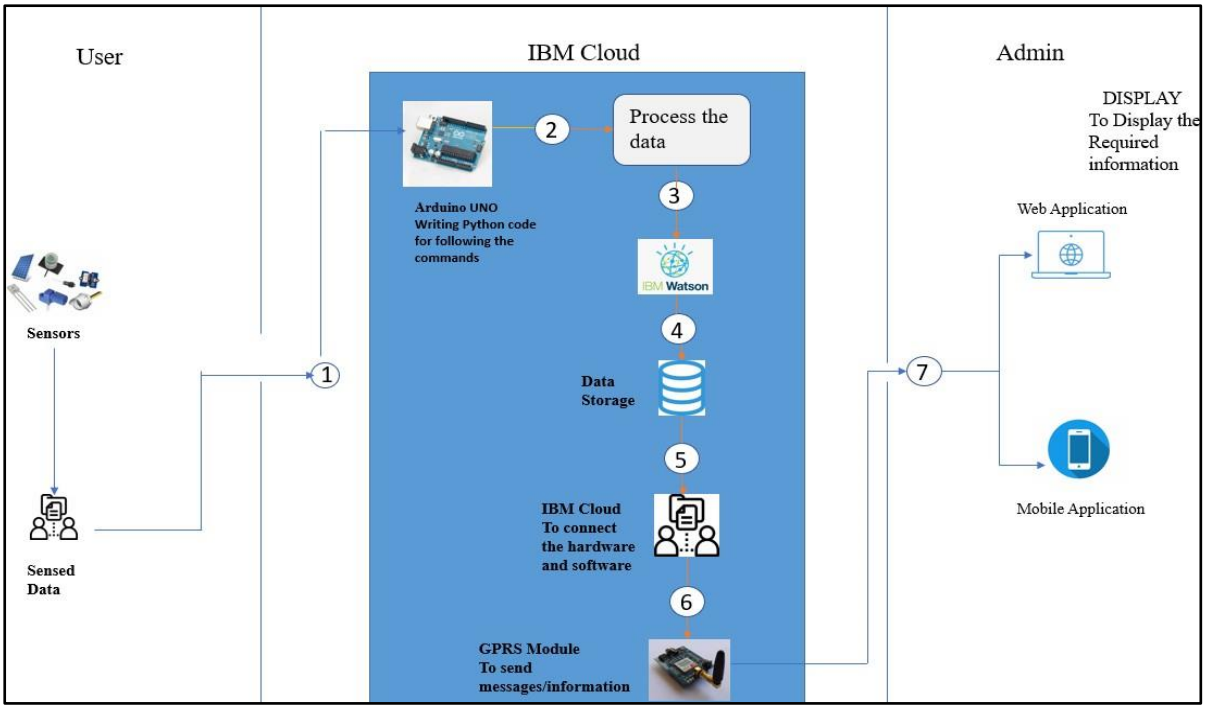


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Through Mobile app or Web Application the information processed will be sent to the user through message or mail.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2 .	Application Logic-1	The code will include certain conditions like based on the humidity condition the water flow will be controlled, based on the moisture content the water flow will be controlled and if the temperature exceeds certain level it will also be intimated through message and mail.	Java / Python
3	Application Logic-2	Here we can develop the software process like creating a device and then adding Node RED to form as an interface.	IBM Watson STT service
4	Application Logic-3	Here the sensed data and the conditions can be checked and the final result can be obtained.	IBM Watson Assistant
5	Database	We can save all the data in SQL or any other database so that the user can retrieve data whenever required.	MySQL, NoSQL, etc.
6	Cloud Database	The database we created and the predefined data's like weather from external API can be combined here and can be stored safely with security for future purpose.	IBM DB2, IBM Cloudant etc.
7	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8	External API-1	With the help of external API only we can know the weather condition and compare with our sensed inputs.	IBM Weather API, etc.
9	External API-2	Purpose of External API used in the application	Aadhar API, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MIT App Inventor, Python, Weather App API.	Technology of Opensource framework
2.	Security Implementations	Here we are using IBM Cloud and it is the very secured place where we can store the data and retrieve the information whenever needed.	IBM Cloud, MIT App Invertor , IBM Watson Assistant
3,	Scalable Architecture	Cloud-based IoT is becoming an increasingly popular and desirable solution. This work presents a specially designed architecture based on IBM Cloud services for monitoring livestock using Internet of things (IoT) equipment and a wide range of cloud native services. Used services in IBM a stress test to prove the ability of the developed architecture for data processing was completed	IBM Cloud
4.	Availability	Many important features are available in this application instead of wasting time by staying in the farm and monitoring the conditions we have the moisture, humidity and temperature which will denote the corresponding quantities and we have both automatic and manual mode so once the certain conditions are met pump will be on/off and messages will be sent when needed so the farmer just have to check	Sensor Networks , IBM Watson IoT , IBM Cloud, Weather API'S , Analytics

References:

- https://developer.ibm.com/patterns/online-order-processing-system-during-pandemic/
- https://aws.amazon.com/architecture
- https://medium.com/the-internal-startup/how-to-draw-useful-technical-architecture-diagrams- 2d20c9fda90d

- **User Stories**

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Employee dashboard	Registration	USN-1	As an employee, I can register for the application	I can access my account/ dashboard	High	Sprint-1

			by entering my email, password, and confirming my password			
	Login	USN-2	As an employee, I can log into the application by entering correct email and password	I can access my account/ dashboard	High	Sprint-1
	Dashboard	USN-3	As an employee According to my role, I will get notification about my task	I get the information about whatI have to doin monsoons	High	Sprint-1
	Forgot Password	USN-4	As an employee, I can resetmy password by this option incase I forgot myold password	I get access to my account again	Medium	Medium
	Know more	USN-5	As an employee, I will be guided by expertise through online session once in a week about how to take care of the plant and all	Know something more	Low	Sprint-3
	Help me	USN-6	As an employee, I can post my problems and will get Solution from expertise	I can ask my query and all	High	Sprint-1
	Feedback	USN-7	As a user , if I face any problem while using the app or want to give some suggestion about the app. That I can do by posting	I can tell my problems	Medium	Sprint-2

			my issuesin feedback			
Admin dashboard	Login	USN-1	As an admin, I can login to the application by	I can access my account/dashboard	High	Sprint-1
	Dashboard	USN-2	As an admin, I can see the per formance of the employees	I get the information employees work	High	Sprint-1
	Forgot Password	USN-3	As an admin, I can reset my password by this option incase I forgot myold password	I get accessto my account again	Medium	Sprint-2
	Role Assignment	USN-4	As an admin, I can assignroles to employees	I can assign roles to employees	High	Sprint-1
	Production view	USN-5	As an admin, I can view the overall production of everymonth	I get the information of cultivation	High	Sprint-1
	Note Book	USN-6	As an admin, I can make a note of expenditure of my farm and all	I can use note book also	Low	Sprint-3

➢ PROJECT PLANNING & SCHEDULING

- **Sprint Planning & Estimation**

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Hardware	USN-1	Sensors and wi-fi module with python code	2	High	Balaji M Harishwar S Kishorekrishnaa J Krithick N

Sprint-2	Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios usingNode-red	2	High	Balaji M Harishwar S Kishorekrishnaa J Krithick N
Sprint-3	MIT app	USN-3	To develop an mobile application using MIT	2	High	Balaji M Harishwar S Kishorekrishnaa J Krithick N
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Balaji M Harishwar S Kishorekrishnaa J Krithick N

- **SPRINT DELIVERY SCHEDULE:**

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022		29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

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

- **Feature 1**

Python Code

```
import wiotp.sdk.device

import time

import os
```

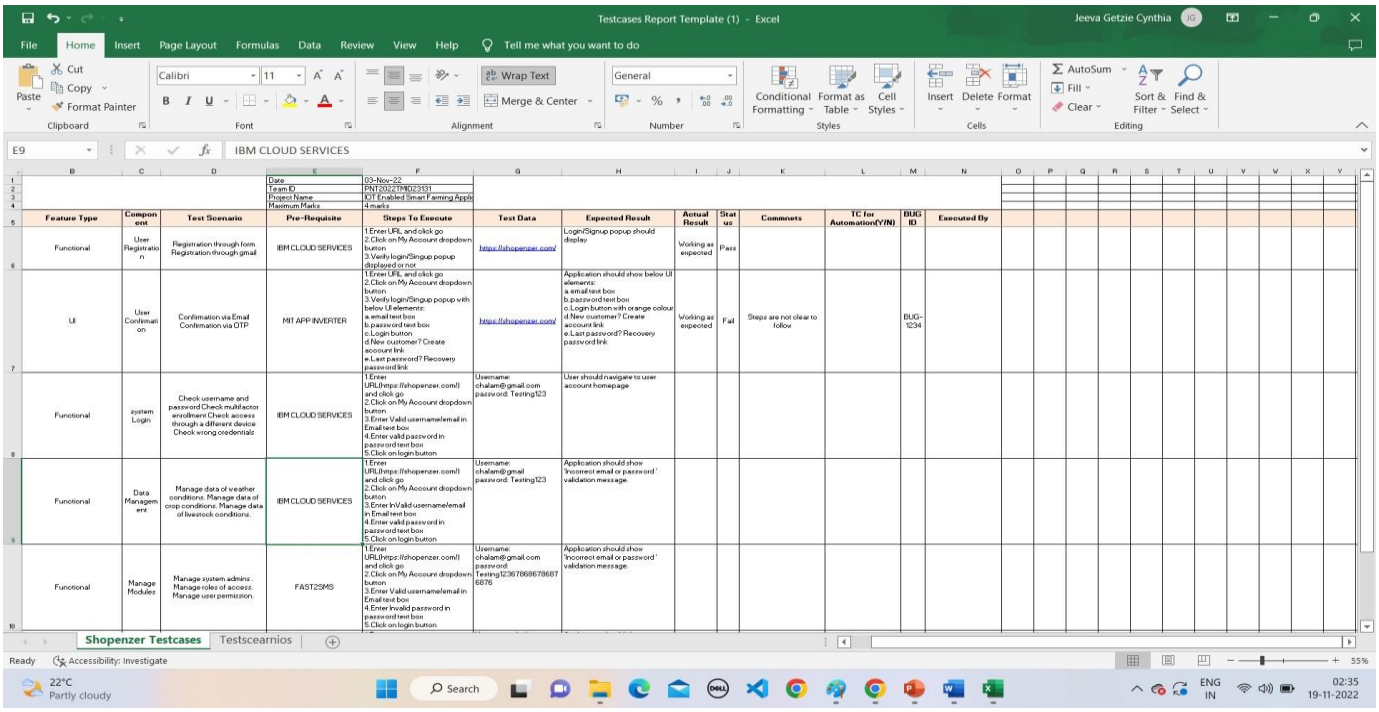
```
import datrtime
import random
myConfig = {
   "identity": {
      "orgId": "vut8fi",
      "typeId": "NodeMCU",
      "deviceId":"12345"
   },
   "auth": {
      "token": "12345678"
   }
}
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

def myCommandCallback(cmd):
   print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
   m=cmd.data['command']
   if(m=="motorON"):
    print("Motor is switched OFF")
   print("")

while True:
   temp=random.randint(-20,125)
   soil=random.randint(0,100)
   hum=random.randint(0,100)
   myData={'temperature':temp, 'soil_moisture':soil, 'humidity':hum}
   client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
   print("Published data Successfully: %s", myData)
   client.commandCallback = myCommandCallback
```

```
time.sleep(2)
client.commandcallback=mycommandcallback
client.disconnect()
```

FEATURE 2: MOBILE APP

Now with the help of MIT App Inventor and the datas from NODE - RED Device we have created the mobile app using which the Farmer can know the same field conditions (Humidity, Moisture and Temperature) and also the MOTOR ON and MOTOR OFF Buttons. It is more feasible than web application as the values will be directly displayed instead of charts

TEST CASES



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).

Acceptance Testing (UAT) Weather plays a very significant role when it comes to the Agriculture sector. In agriculture, there is almost everything dependable upon the climate condition. In smart Farming, temperature humidity, and soil moisture can be monitored through various sensors. These are again used by the reactive system to trigger alerts or

automate the process such as water and air control. Farmers usually use a sampling method to calculate soil fertility, moisture content. Fortunately, 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. Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be adjusted dependent on the local environmental variables. This technology aids in the scheduling of irrigation based on present data from the field and records from a climate source. It helps in deciding the farmer to whether to do irrigation or not to do. Continuous internet connectivity is required for continuous monitoring of data from sensors.

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	8	3	2	3	16
Duplicate	1	0	2	0	3
External	2	3	0	1	6
Fixed	10	2	3	18	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2

TEST CASE ANALYSIS

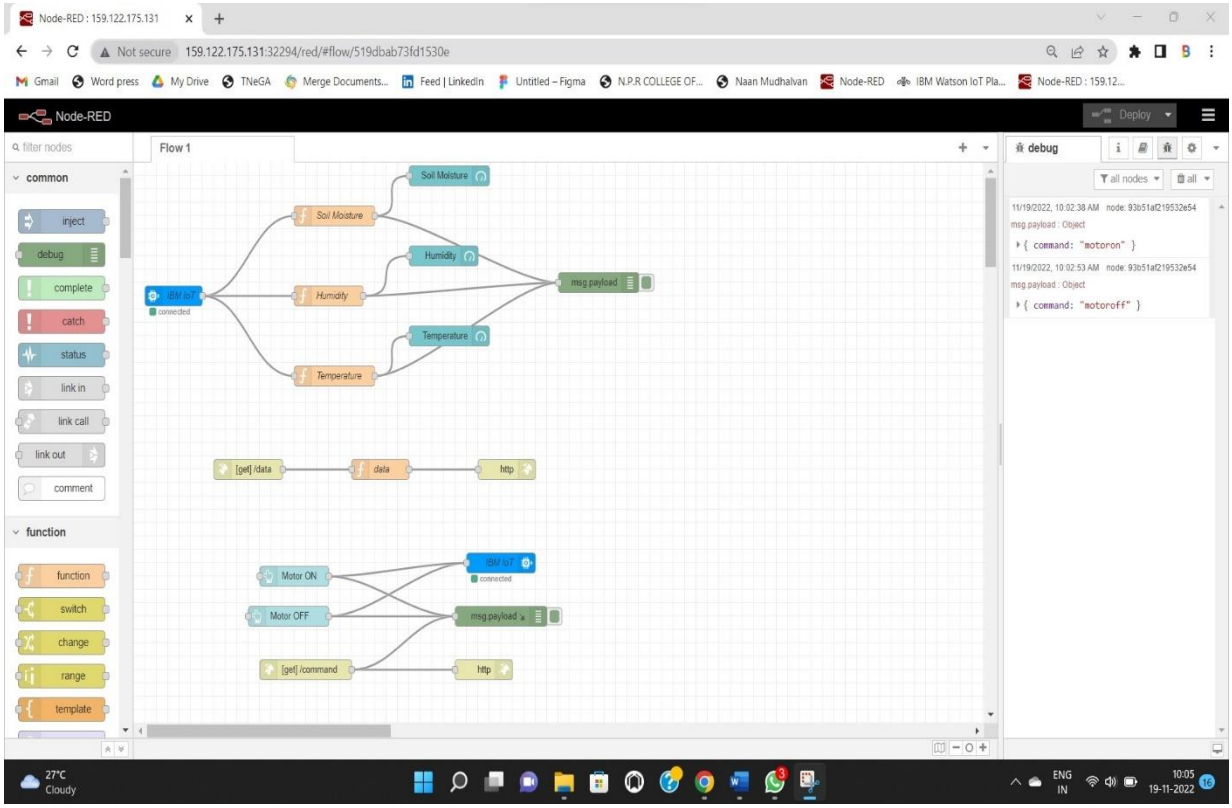
Test Case Analysis This report shows the number of test cases that have passed, failed, and untested

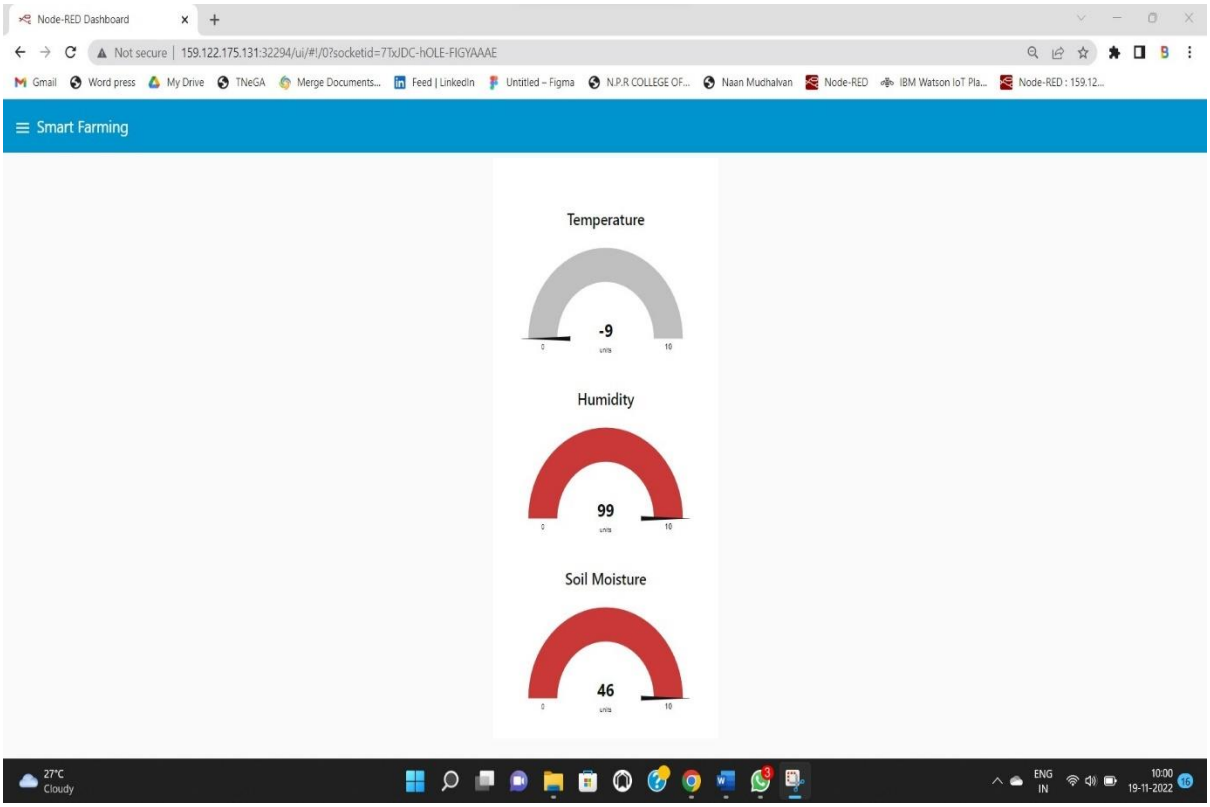
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	45	0	0	45
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

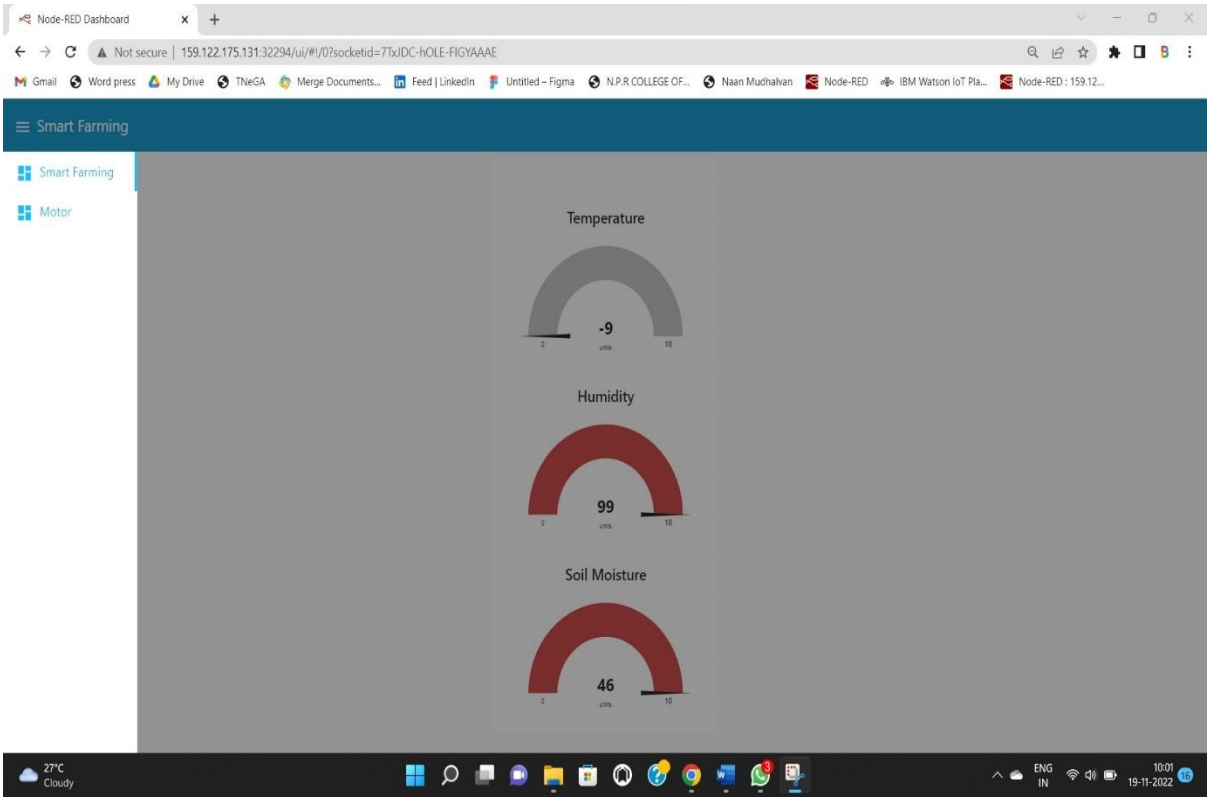
➢ RESULTS

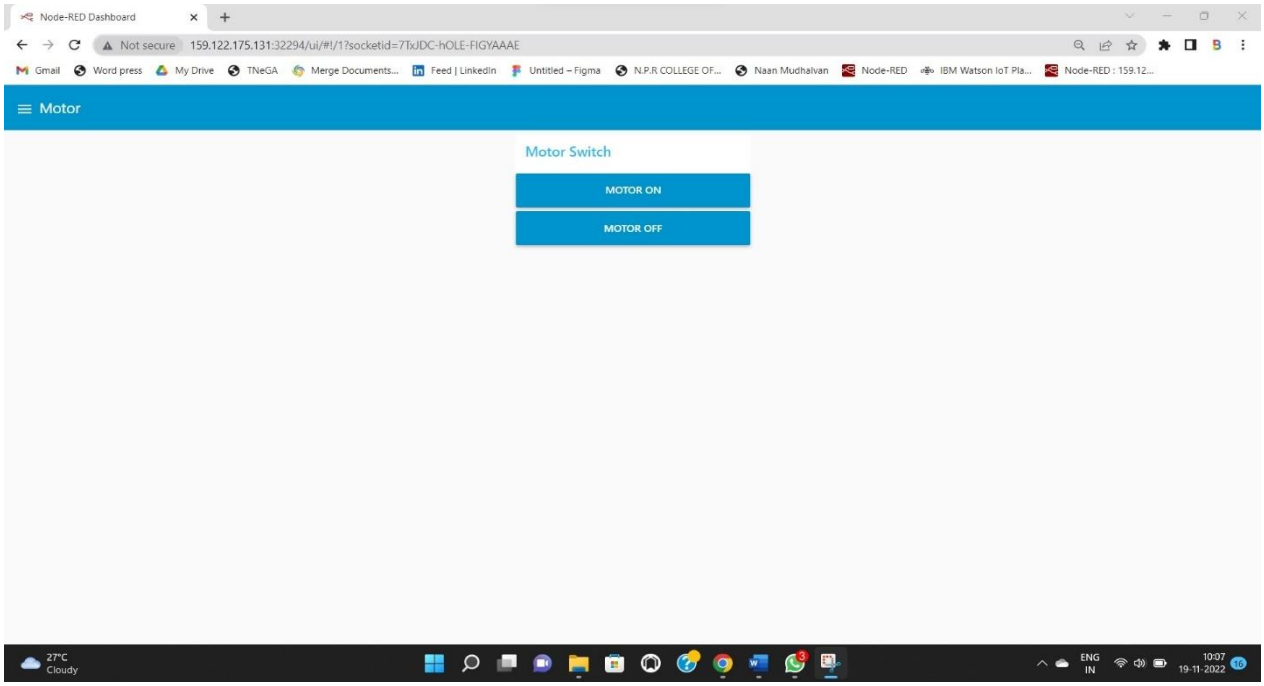
- Performance Metrics

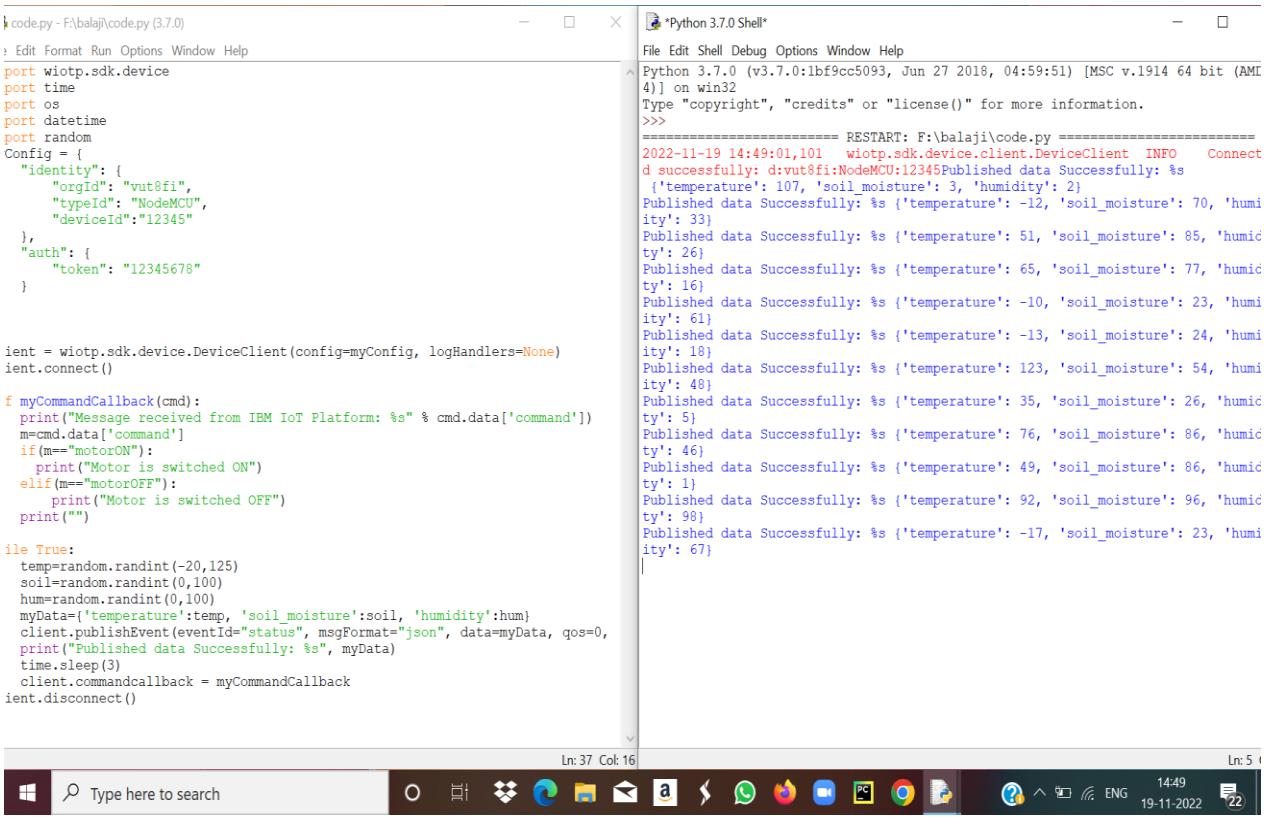
Web Application

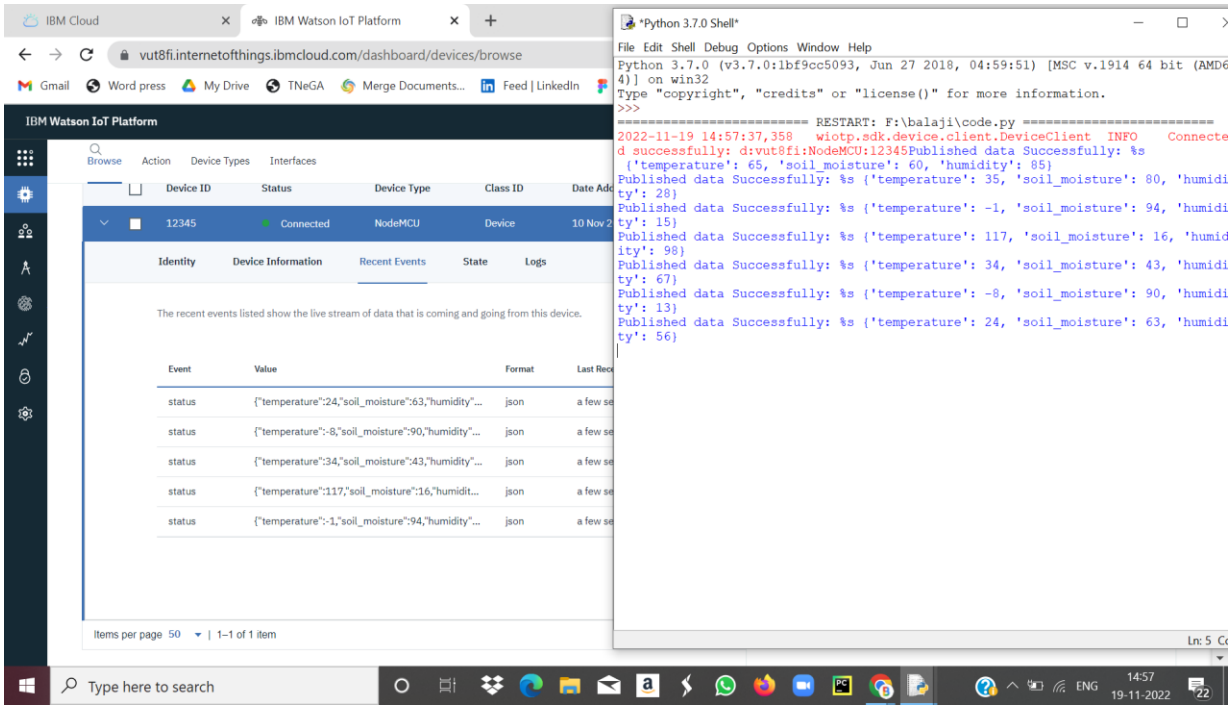


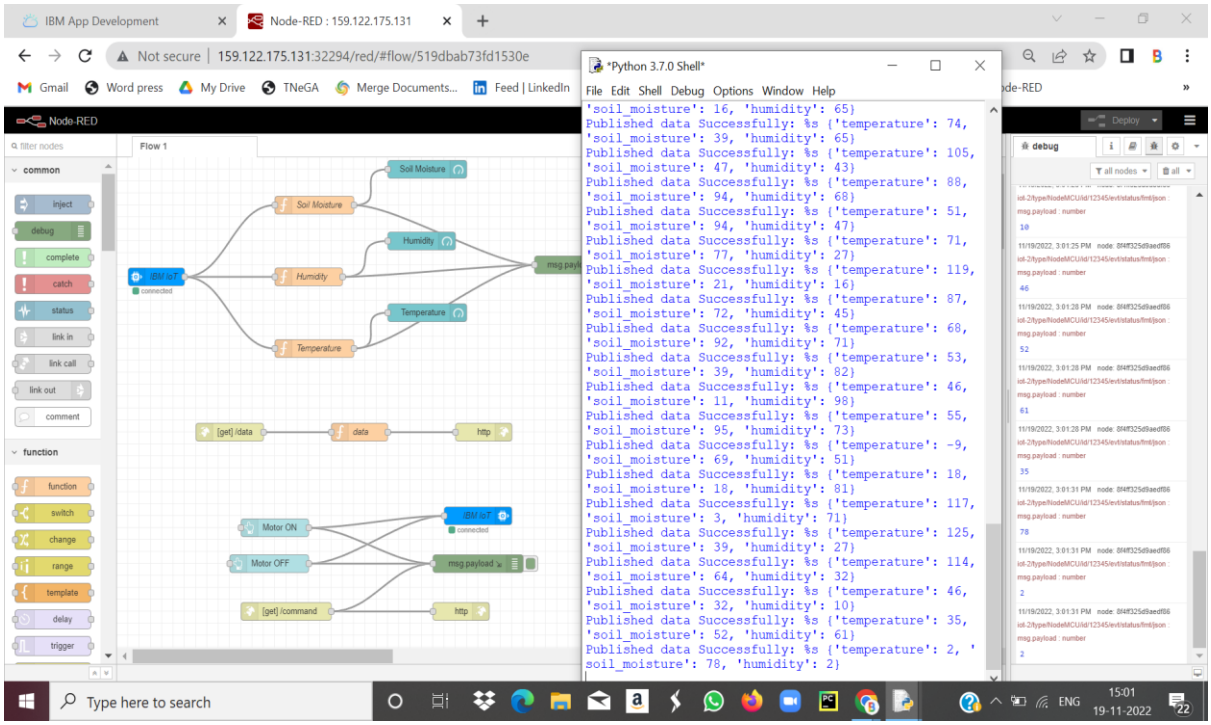

Node-RED Dashboard
Not secure | 159.122.175.131:32294/ui/#!/0?socketid=7TxJDC-hOLE-FIGYAAAE
Gmail
Word press
My Drive
TNeGA
Merge Documents...
Feed | LinkedIn
Untitled – Figma
N.P.R COLLEGE OF...
Naan Mudhalvan
Node-RED
IBM Watson IoT Pla...
Node-RED : 159.12...
Smart Farming
Temperature
-9
Humidity
99
Soil Moisture
46
27°C
Cloudy
ENG
IN
10:00
19-11-2022

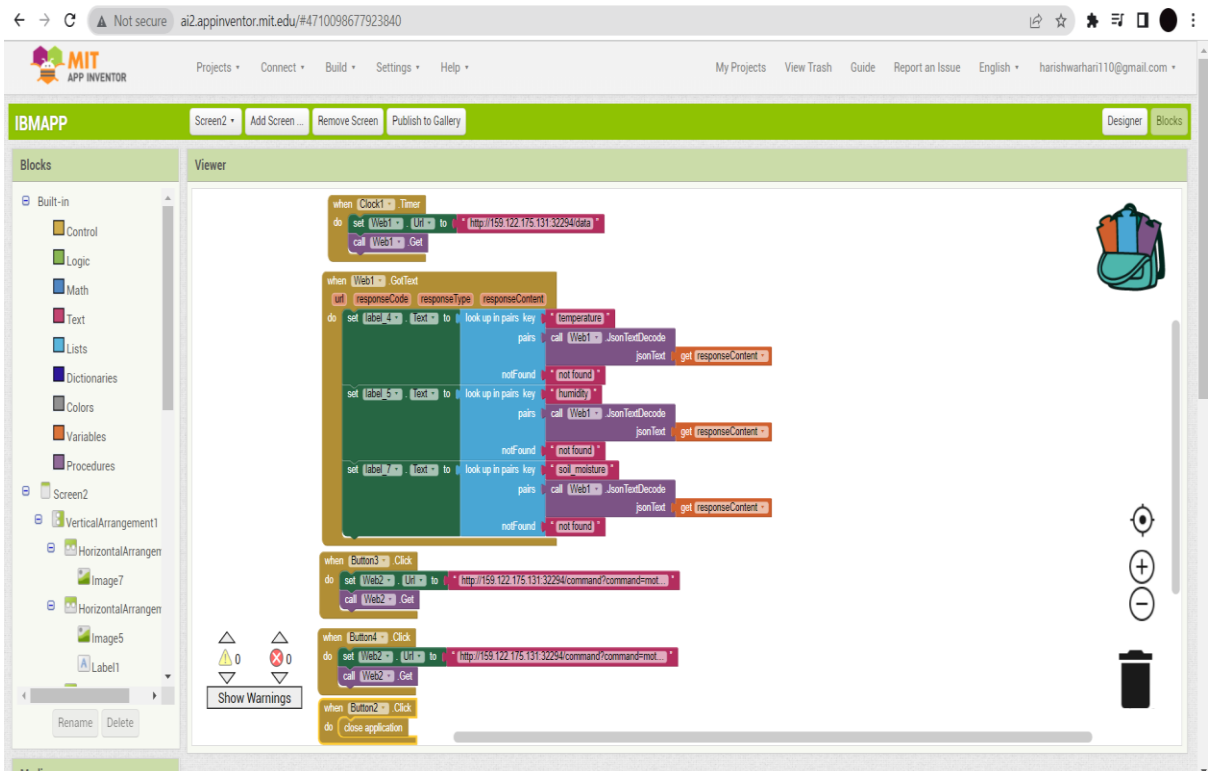

Node-RED Dashboard
Not secure | 159.122.175.131:32294/ui/#!/0?socketid=7TxJDC-hOLE-FIGYAAAE
Gmail
Word press
My Drive
TNeGA
Merge Documents...
Feed | LinkedIn
Untitled – Figma
N.P.R COLLEGE OF...
Naan Mudhalvan
Node-RED
IBM Watson IoT Pla...
Node-RED : 159.12...
Smart Farming
Smart Farming
Motor
Temperature
-9
Humidity
99
Soil Moisture
46
27°C
Cloudy
ENG
IN
10:01
19-11-2022

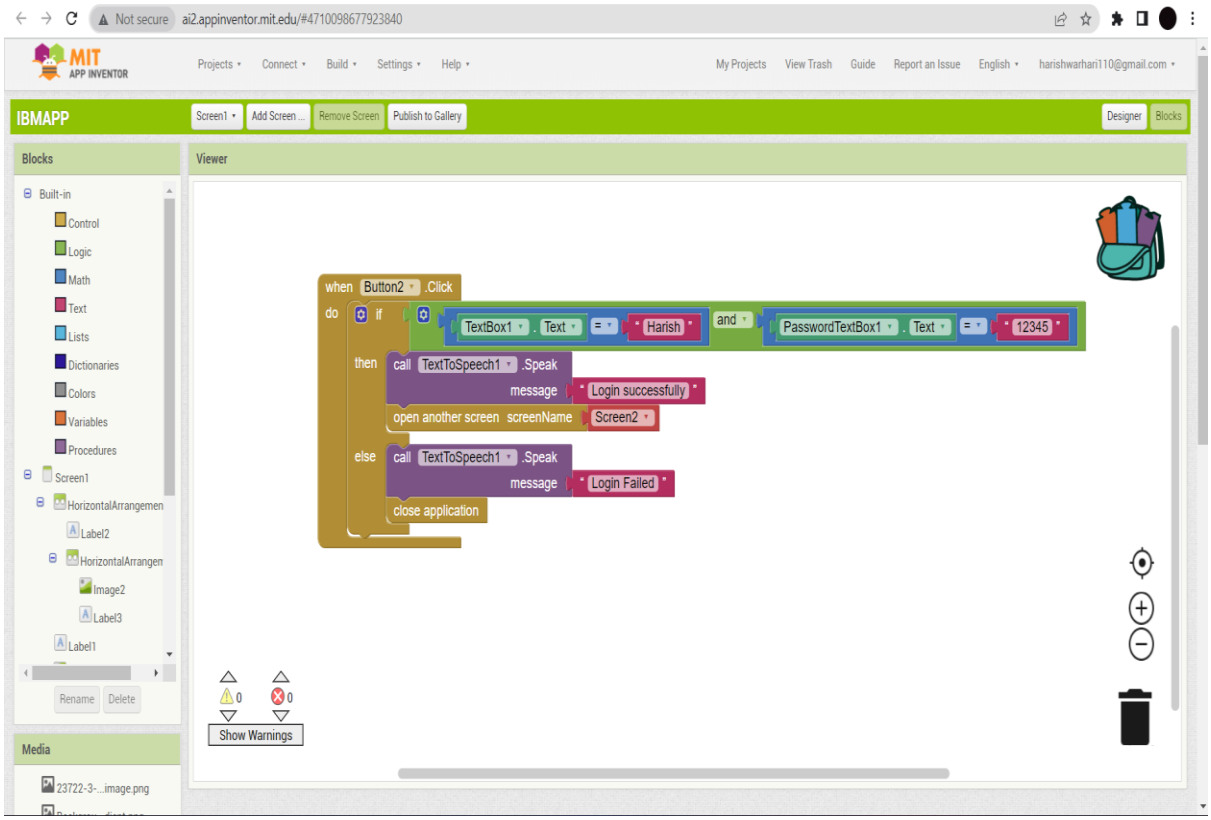

Node-RED Dashboard
Not secure
159.122.175.131:32294/ui/#!/1?socketid=7TxJDC-hOLE-FIGYAAAE
Motor
Motor Switch
MOTOR ON
MOTOR OFF

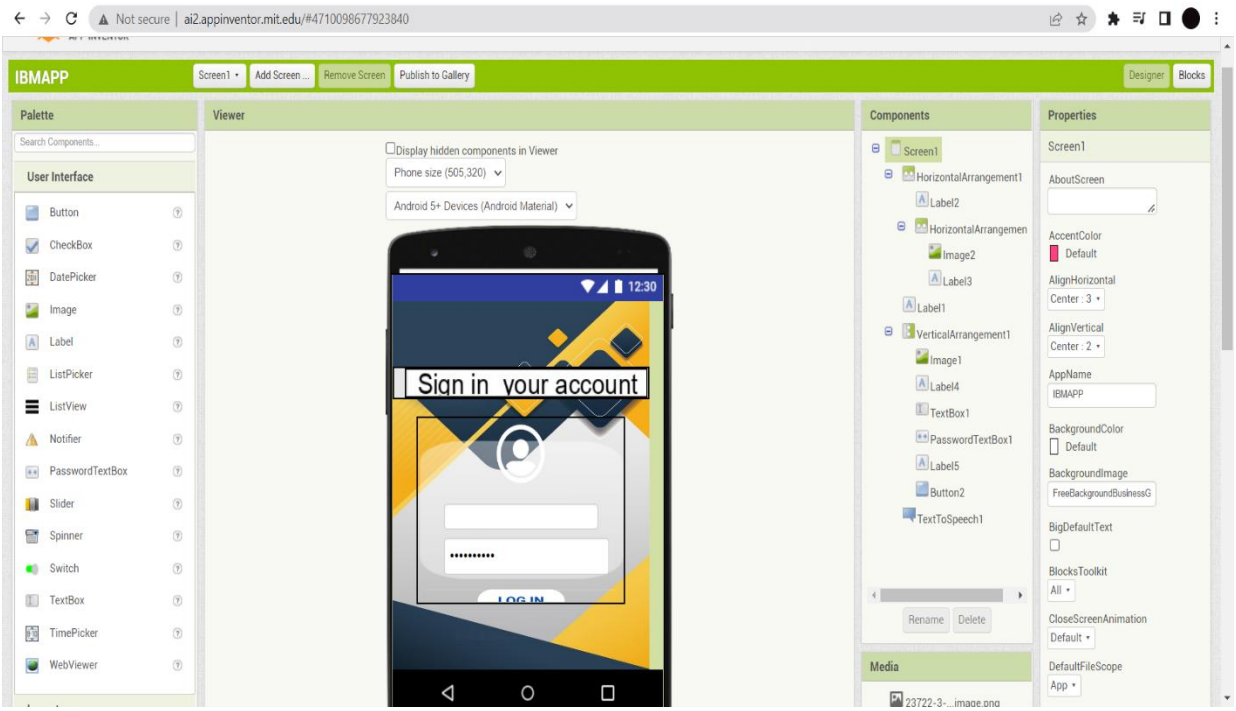

code.py - F:\balaji\code.py (3.7.0)
Edit Format Run Options Window Help
port wiotp.sdk.device
port time
port os
port datetime
port random
Config = {
"identity": {
"orgId": "vut8fi",
"typeId": "NodeMCU",
"deviceId":"12345"
},
"auth": {
"token": "12345678"
}
ient = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
ient.connect()
f myCommandCallback(cmd):
print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
m=cmd.data['command']
if(m=="motorON"):
print("Motor is switched ON")
elif(m=="motorOFF"):
print("Motor is switched OFF")
print("")
ile True:
temp=random.randint(-20,125)
soil=random.randint(0,100)
hum=random.randint(0,100)
myData={'temperature':temp, 'soil_moisture':soil, 'humidity':hum}
client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
print("Published data Successfully: %s", myData)
time.sleep(3)
client.commandcallback = myCommandCallback
ient.disconnect()
Ln: 37 Col: 16
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD
4)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: F:\balaji\code.py ==========
2022-11-19 14:49:01,101 wiotp.sdk.device.client.DeviceClient INFO Connect
d successfully: d:vut8fi:NodeMCU:12345Published data Successfully: %s
{'temperature': 107, 'soil_moisture': 3, 'humidity': 2}
Published data Successfully: %s {'temperature': -12, 'soil_moisture': 70, 'humi
ity': 33}
Published data Successfully: %s {'temperature': 51, 'soil_moisture': 85, 'humid
ty': 26}
Published data Successfully: %s {'temperature': 65, 'soil_moisture': 77, 'humid
ty': 16}
Published data Successfully: %s {'temperature': -10, 'soil_moisture': 23, 'humi
ity': 61}
Published data Successfully: %s {'temperature': -13, 'soil_moisture': 24, 'humi
ity': 18}
Published data Successfully: %s {'temperature': 123, 'soil_moisture': 54, 'humi
ity': 48}
Published data Successfully: %s {'temperature': 35, 'soil_moisture': 26, 'humid
ty': 5}
Published data Successfully: %s {'temperature': 76, 'soil_moisture': 86, 'humid
ty': 46}
Published data Successfully: %s {'temperature': 49, 'soil_moisture': 86, 'humid
ty': 1}
Published data Successfully: %s {'temperature': 92, 'soil_moisture': 96, 'humid
ty': 98}
Published data Successfully: %s {'temperature': -17, 'soil_moisture': 23, 'humi
ity': 67}
Ln: 5
Type here to search
ENG
14:49
19-11-2022

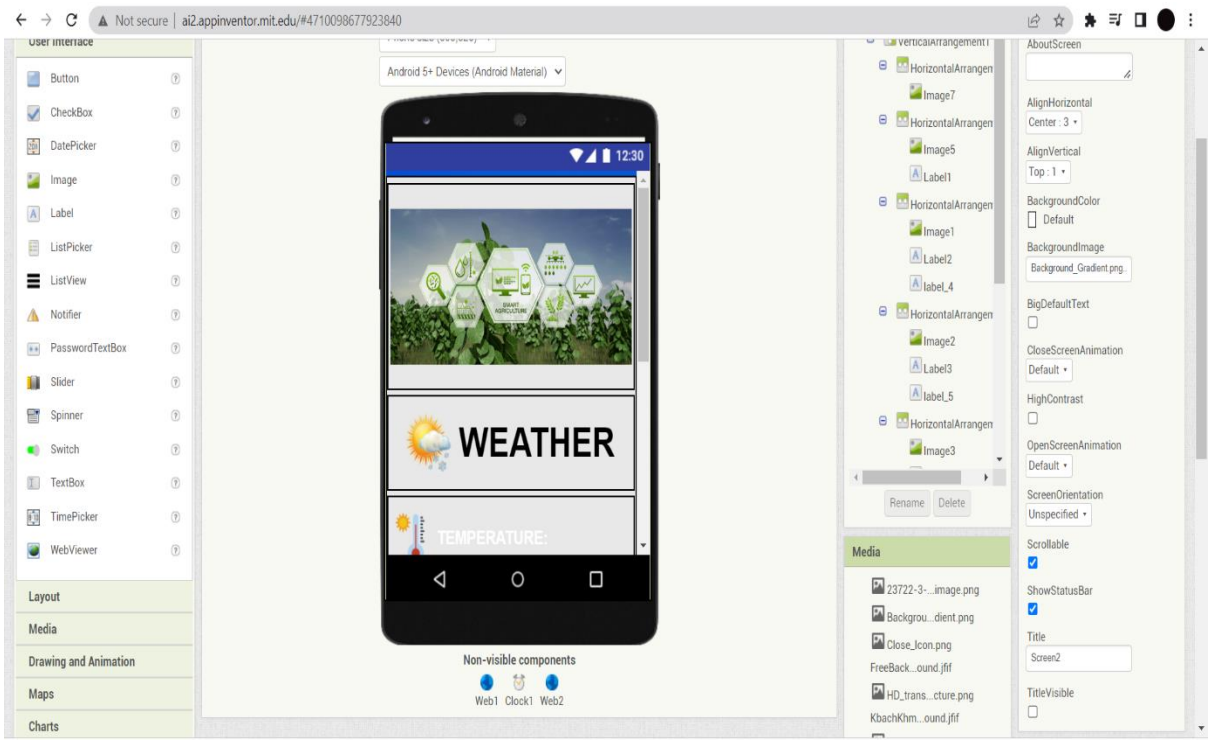

IBM Cloud
IBM Watson IoT Platform
vut8fi.internetofthings.ibmcloud.com/dashboard/devices/browse
Gmail
Word press
My Drive
TNeGA
Merge Documents...
Feed | LinkedIn
IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Device ID
Status
Device Type
Class ID
12345
Connected
NodeMCU
Device
Identity
Device Information
Recent Events
State
Logs
The recent events listed show the live stream of data that is coming and going from this device.
Event
Value
Format
status
{"temperature":24,"soil_moisture":63,"humidity"...
json
status
{"temperature":-8,"soil_moisture":90,"humidity"...
json
status
{"temperature":34,"soil_moisture":43,"humidity"...
json
status
{"temperature":117,"soil_moisture":16,"humidit...
json
status
{"temperature":-1,"soil_moisture":94,"humidity"...
json
Items per page 50
1–1 of 1 item
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: F:\balaji\code.py ==========
2022-11-19 14:57:37,358 wiotp.sdk.device.client.DeviceClient INFO Connected successfully: d:vut8fi:NodeMCU:12345Published data Successfully: %s {'temperature': 65, 'soil_moisture': 60, 'humidity': 85}
Published data Successfully: %s {'temperature': 35, 'soil_moisture': 80, 'humidity': 28}
Published data Successfully: %s {'temperature': -1, 'soil_moisture': 94, 'humidity': 15}
Published data Successfully: %s {'temperature': 117, 'soil_moisture': 16, 'humidity': 98}
Published data Successfully: %s {'temperature': 34, 'soil_moisture': 43, 'humidity': 67}
Published data Successfully: %s {'temperature': -8, 'soil_moisture': 90, 'humidity': 13}
Published data Successfully: %s {'temperature': 24, 'soil_moisture': 63, 'humidity': 56}
Ln: 5
Type here to search
ENG
14:57
19-11-2022

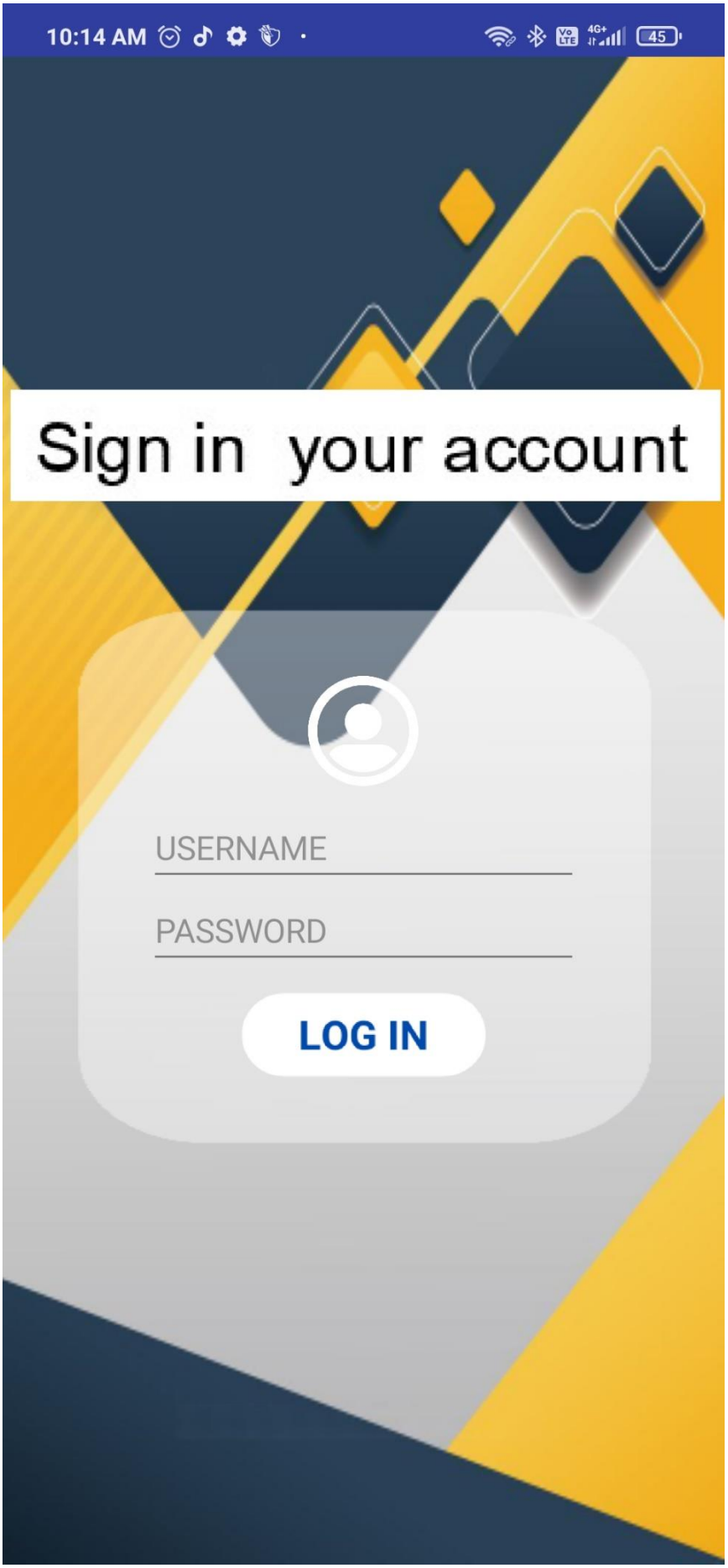

IBM App Development
Node-RED : 159.122.175.131
Not secure | 159.122.175.131:32294/red/#flow/519dbab73fd1530e
Gmail
Word press
My Drive
TNeGA
Merge Documents...
Feed | LinkedIn
Node-RED
Flow 1
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
range
template
delay
trigger
Soil Moisture
Humidity
Temperature
IBM IoT
connected
[get] /data
data
http
Motor ON
Motor OFF
[get] /command
msg.payload
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
'soil_moisture': 16, 'humidity': 65}
Published data Successfully: %s {'temperature': 74, 'soil_moisture': 39, 'humidity': 65}
Published data Successfully: %s {'temperature': 105, 'soil_moisture': 47, 'humidity': 43}
Published data Successfully: %s {'temperature': 88, 'soil_moisture': 94, 'humidity': 68}
Published data Successfully: %s {'temperature': 51, 'soil_moisture': 94, 'humidity': 47}
Published data Successfully: %s {'temperature': 71, 'soil_moisture': 77, 'humidity': 27}
Published data Successfully: %s {'temperature': 119, 'soil_moisture': 21, 'humidity': 16}
Published data Successfully: %s {'temperature': 87, 'soil_moisture': 72, 'humidity': 45}
Published data Successfully: %s {'temperature': 68, 'soil_moisture': 92, 'humidity': 71}
Published data Successfully: %s {'temperature': 53, 'soil_moisture': 39, 'humidity': 82}
Published data Successfully: %s {'temperature': 46, 'soil_moisture': 11, 'humidity': 98}
Published data Successfully: %s {'temperature': 55, 'soil_moisture': 95, 'humidity': 73}
Published data Successfully: %s {'temperature': -9, 'soil_moisture': 69, 'humidity': 51}
Published data Successfully: %s {'temperature': 18, 'soil_moisture': 18, 'humidity': 81}
Published data Successfully: %s {'temperature': 117, 'soil_moisture': 3, 'humidity': 71}
Published data Successfully: %s {'temperature': 125, 'soil_moisture': 39, 'humidity': 27}
Published data Successfully: %s {'temperature': 114, 'soil_moisture': 64, 'humidity': 32}
Published data Successfully: %s {'temperature': 46, 'soil_moisture': 32, 'humidity': 10}
Published data Successfully: %s {'temperature': 35, 'soil_moisture': 52, 'humidity': 61}
Published data Successfully: %s {'temperature': 2, 'soil_moisture': 78, 'humidity': 2}
debug
Deploy
Type here to search
ENG
15:01
19-11-2022

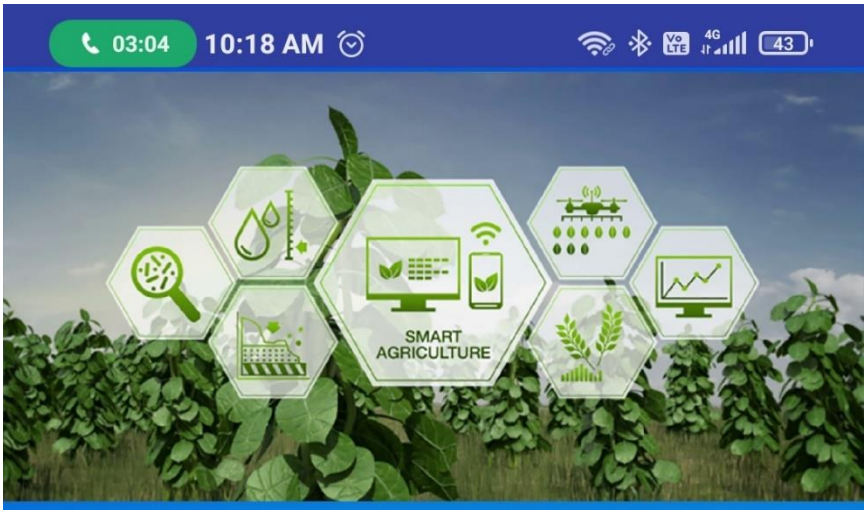

Not secure
ai2.appinventor.mit.edu/#4710098677923840
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
harishwarhari110@gmail.com
IBMAPP
Screen2
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen2
VerticalArrangement1
HorizontalArrangen
Image7
HorizontalArrangen
Image5
Label1
Rename
Delete
when Clock1 .Timer
do set Web1 . Url to http://159.122.175.131:32294/data
call Web1 .Get
when Web1 .GotText
url responseCode responseType responseContent
do set label_4 . Text to look up in pairs key temperature
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound not found
set label_5 . Text to look up in pairs key humidity
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound not found
set label_7 . Text to look up in pairs key soil_moisture
pairs call Web1 .JsonTextDecode
jsonText get responseContent
notFound not found
when Button3 .Click
do set Web2 . Url to http://159.122.175.131:32294/command?command=mot...
call Web2 .Get
when Button4 .Click
do set Web2 . Url to http://159.122.175.131:32294/command?command=mot...
call Web2 .Get
when Button2 .Click
do close application
0
0
Show Warnings


Not secure
ai2.appinventor.mit.edu/#4710098677923840
MIT APP INVENTOR
Projects
Connect
Build
Settings
Help
My Projects
View Trash
Guide
Report an Issue
English
harishwarhari110@gmail.com
IBMAPP
Screen1
Add Screen ...
Remove Screen
Publish to Gallery
Designer
Blocks
Viewer
Built-in
Control
Logic
Math
Text
Lists
Dictionaries
Colors
Variables
Procedures
Screen1
HorizontalArrangemen
Label2
HorizontalArrangen
Image2
Label3
Label1
Rename
Delete
Media
23722-3-...image.png
when Button2 .Click
do if TextBox1 . Text = Harish and PasswordTextBox1 . Text = 12345
then call TextToSpeech1 .Speak
message Login successfully
open another screen screenName Screen2
else call TextToSpeech1 .Speak
message Login Failed
close application
0
0
Show Warnings


Not secure | ai2.appinventor.mit.edu/#4710098677923840
IBMAPP
Screen1
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
Viewer
Display hidden components in Viewer
Phone size (505,320)
Android 5+ Devices (Android Material)
12:30
Sign in your account
LOG IN
Components
Screen1
HorizontalArrangement1
Label2
HorizontalArrangemen
Image2
Label3
Label1
VerticalArrangement1
Image1
Label4
TextBox1
PasswordTextBox1
Label5
Button2
TextToSpeech1
Rename
Delete
Media
23722-3-...image.png
Properties
Screen1
AboutScreen
AccentColor
Default
AlignHorizontal
Center : 3
AlignVertical
Center : 2
AppName
IBMAPP
BackgroundColor
Default
BackgroundImage
FreeBackgroundBusinessG
BigDefaultText
BlocksToolkit
All
CloseScreenAnimation
Default
DefaultFileScope
App


Not secure | ai2.appinventor.mit.edu/#4710098677923840
User Interface
Button
CheckBox
DatePicker
Image
Label
ListPicker
ListView
Notifier
PasswordTextBox
Slider
Spinner
Switch
TextBox
TimePicker
WebViewer
Layout
Media
Drawing and Animation
Maps
Charts
Android 5+ Devices (Android Material)
12:30
WEATHER
TEMPERATURE:
Non-visible components
Web1
Clock1
Web2
HorizontalArrangen
Image7
Image5
Label1
Image1
Label2
label_4
Image2
Label3
label_5
Image3
Rename
Delete
Media
23722-3-...image.png
Backgrou...dient.png
Close_Icon.png
FreeBack...ound.jfif
HD_trans...cture.png
KbachKhm...ound.jfif
AboutScreen
AlignHorizontal
Center : 3
AlignVertical
Top : 1
BackgroundColor
Default
BackgroundImage
Background_Gradient.png
BigDefaultText
CloseScreenAnimation
Default
HighContrast
OpenScreenAnimation
Default
ScreenOrientation
Unspecified
Scrollable
ShowStatusBar
Title
Screen2
TitleVisible


10:14 AM
Sign in your account
USERNAME
PASSWORD
LOG IN



WEATHER

TEMPERATURE: -9

HUMIDITY: 99

SOIL MOISTURE: 46

MOTOR ON

MOTOR OFF

EXIT

- ADVANTAGES

●One of the really good things about this branch of farming is that it allows for Soil Sensing. This aspect of smart farming gives room for you as a farmer to test your soil for information and also measure it for a wide range of important and nutritious constituents necessary in securing the good health of your farm produce.

●Soil sensing is also employe to appropriately control the application of real-time variable rate equipment. This allows you to understand the scale of your grounds, making you also, in this process, device effective ways of conserving necessary farming resources like water, fertilizer and so on. So, with this, you only have to apply fertilizers and pesticides where you need to apply them so as not to negatively affect your plants. You also get to conserve seeds, fertilizer, water, etc., and still even maximize yields at the end of the day.

●You also get to get important information about the amount of air and the levels of air, sound, humidity, and temperature of your environment.

●Smart farming is a wonderful option if you want to save the cost of electricity. It allows for the use of solar- powered tools like pumps that save your expenditure. It is cost-effective as it somewhat reduces the spending usually generated by farmers in maintaining their capital-intensive techs.

●Smart agriculture makes use of AI to improve the process of wireless monitoring, regulation and data collection. With these inputs on your farm, all thanks to smart farming, you can be sure of high-quality crop production and delivery.

- **DISADVANTAGES**

●One huge disadvantage of smart farming is that it requires an unlimited or continuous internet connection to be successful. This means that in rural communities, especially in the developing countries where we have mass crop production, it is completely impossible to operate this farming method. In places where internet connections are frustratingly slow, smart farming will be an impossibility.

●As pointed out earlier, smart farming makes use of high techs that require technical skill and precision to make it a success. It requires an understanding of robotics and ICT. However, many farmers do not have these skills. Even finding someone with this technical ability is difficult or even expensive to come by, at most. And, this can be a discouraging factor hindering a lot of promising farmers from adopting it.

➢ CONCLUSION:

A system to monitor temperature, humidity, moisture levels in the soil was designed and the project provides an opportunity to study the existing systems, along with their features and drawbacks. Agriculture is one of the most water- consuming activities. The proposed system can be used to switch the motor (on/off) depending on the favorable condition of plants i.e. sensor values, thereby automating the process of irrigation, which is one of the most time efficient activities in farming, which helps to prevent over-irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through an Android App. Though this project can be concluded that there can be considerable development in farming with the use of IOT and automation

➢ FUTURE SCOPE

In this project the farmer monitor and control the field remotely. In future we can add or update few more things to this project:

- We can create few more models of the same project,so that the farmer can have information of a entire.

- We can update the this project by using solar power mechanism. So that the power supply from electric poles can be replaced with solar panels. It reduces the power line cost. It will be a one time investment. We can add solar fencing technology to this project.

- We can use GSM technology to this project so that the farmers can get the information directly to his home through SMS. This helps the farmer to get information if there is a internet issues.

- We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.

➢ APPENDIX:

NODE-RED Flow: http://159.122.175.131:32294/red/#flow/519dbab73fd1530e

PYTHON CODE: https://github.com/IBM-EPBL/IBM-Project-39117-1660396177/blob/main/Develop%20a%20Python%20Script%20to%20Publish%20and%20Subscribe%20to%20IBM%20IOT%20Platform/Develop%20a%20Python%20Script%20to%20Publish%20and%20Subscribe%20to%20IBM%20IOT%20Platform.pdf

GITHUB LINK : https://github.com/IBM-EPBL/IBM-Project-39117-1660396177

PROJECT DEMO LINK: https://github.com/IBM-EPBL/IBM-Project-39117-1660396177/blob/main/Final%20Deliverence/km_20221119_720p_30f_20221119_203628.mp4