# FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

A NAALAIYA THIRAN IBM PROJECT REPORT-2022
SUBMITTED BY

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**in**

**COMPUTER SCIENCE AND ENGINEERING**


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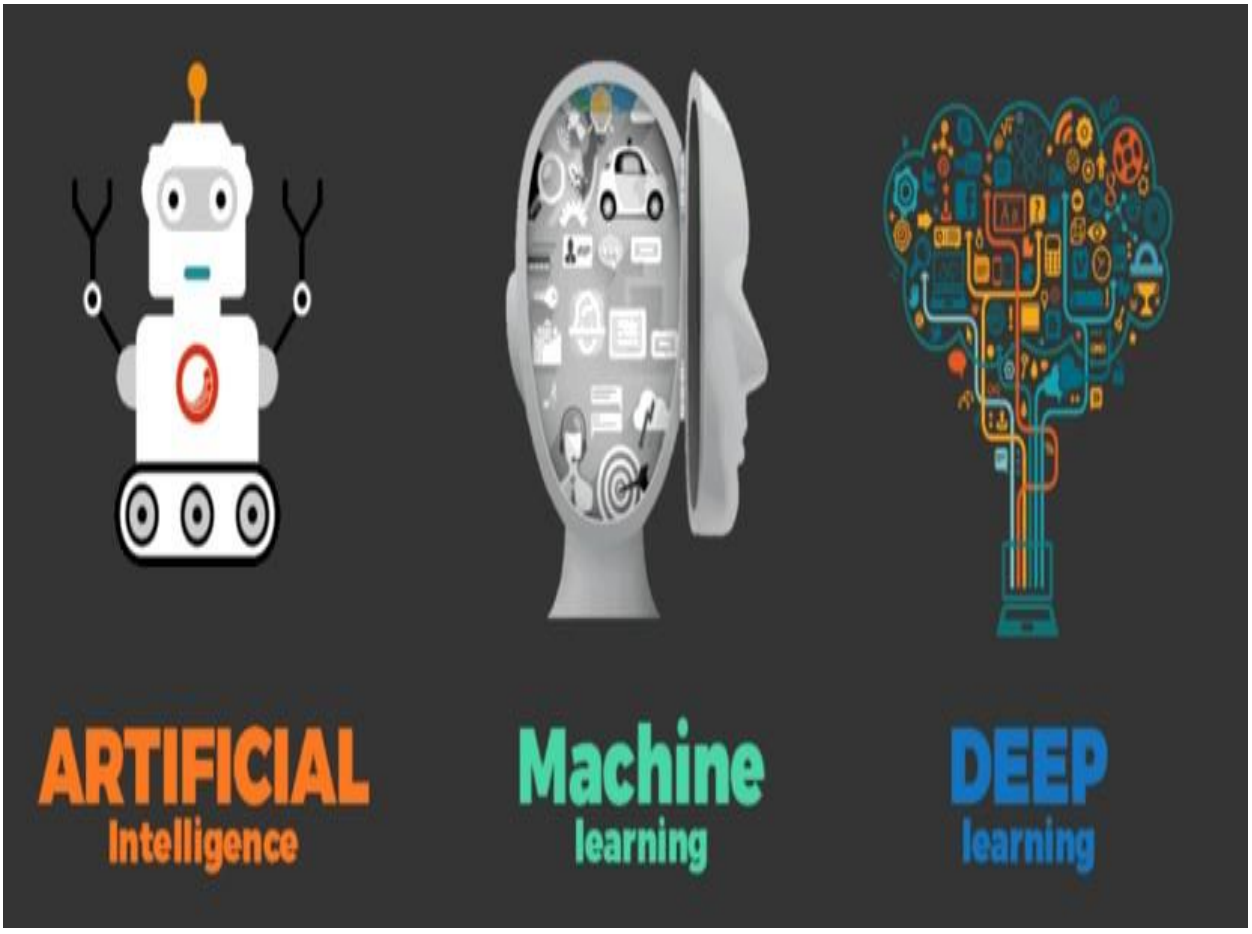
# INTRODUCTION

## Project Overview

Agriculture is the most important sector in today life.Most plants are affected by a wide variety of bacterial and fungal diseases.Diseases on plants placed a major constraint on the production and a major threat to foof security.Hence,early and accurate Identification of plant diseases is essential to ensure high quantity and best quality.In recent years,the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties.Automatic plant type identification process could offer a great help for application of pesticides ,fertilization and harvestingof different species On-time in order to improve the production processes of food and drug industries.In this paper,We,propose a Convolutional Neural Network(CNN) architecture to classifythe type of plants from the image

sequences collected from smart agro-station.Following the preprocessing step,Convolutional Neural Network architecture is employed to extract the features of images.



## PURPOSE

By making farming more connected and the intelligent, precision agriculture farming more connected helps reduce overall costs and improve the quality and quantity of products, the sustainability of agriculture and the experience for the consumer. Incerasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for the instance, helps eliminate the losing of losing yields. Additionally, automation boosts efficiency. With smart devices, multiple processes can be activated at the same time, and automated services enhance product quality and volume by better controlling production processes.

Smart farming system also enable careful management of the demand forecast and delivery of goods to market just in time to reduce waste. Precision agriculture is focused on managing the supply of land and based on its condition, consentrating on the right growing

parameters for example, moisture, fertilizer or material content to provide production for the right crop that is demand. The types of precision farming systems implemented depend on the use of software for the management of the business. Control systems manage sensor input, delivering remote information for supply and decision support, in addition to the automation of machines and equipment for responding to emerging issues and production support.

# 2.LITERATURE SURWAY

## DESCRIPTION:

Joaquin Gutierrez et al (2014).The paper aims at optimizing water use for agriculture crops.An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity.The system was powered by photovoltanic panel sand had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page.the issue is that the investment in electric power supply would be expensive

Shakthi priya N et al(2014), As mentioned it reviews the state of art wireless sensor technology agriculture.Based on the value of soil moisture sensor the water sprinkler works during the period of water scarcity. Once the field is sprinkled with adequate water,the water sprinkler is switched off. Hereby water can be conserved. Also, the value of soil pH sensor is send to the farmer via **SMS** using **GSM** modern. The issue is that it provides only precision values that is not accurate and is not cost efficient.

G.MeenaKumari et al(2014), The approach proposes technological development in wireless sensor networks made it possible to use in monitoring and control of greenhouse parameter in precision agriculture in the field bus concept, the data transfer is mainly controlled by hybrid syster(wired and wireless) to automate the system performance and throughput . ZigBee protocols based on IEEE 802.15.4 for wireless system are used. the atmospheric conditions are monitored and controlled online by using Ethernet IEEE802.3. partial root zone drying process is implemented to save water. Also, Controller Area Network(CAN) and hybrid network are used.It uses traditional

communication system is used.the future research can be focused on optical communication system with wavelength routing networks and can be also be implemented using advanced ARM controllers and core processors and also in energy saving data fusion and other directions.

BezaNegashGetu et al(2015). It investigate the design and simulation of an electronic system for automatic controlling of water pumps that are used for agricultural fields or plant watering based on the level of soil moisture sensing. The speed of the motor is varied according to the level of the soil moisture content; the motor is OFF during maximum wet and is running with HIGH speed during dry soil conditions respectively. The duration of water pumping is controlled by a timer circuit. The system is testing using NI MULTISM simulation software. DIAC and TRIAC techniques are used. The issue is that it does not support several water levels and uses old techniques.

## PROBLEM STATEMENT

In India, The Agriculture industry is extremely vital and crucial for economic and social development and jobs. In India, the agricultural sector provides a living for almost 48% of the population. As per the 2019-2020 economic survey, an Indian farmer's median wage in 16 states is Rupees 2500. Most of the Indian population depends on agriculture for their livelihood. Agriculture gives an opportunity of employment to the village people to develop a country like India on large scale and give a push in the economic sector. The majority of farmers face the problem of planting an inappropriate crop for their land based on a conventional or non-sciTentific approach.

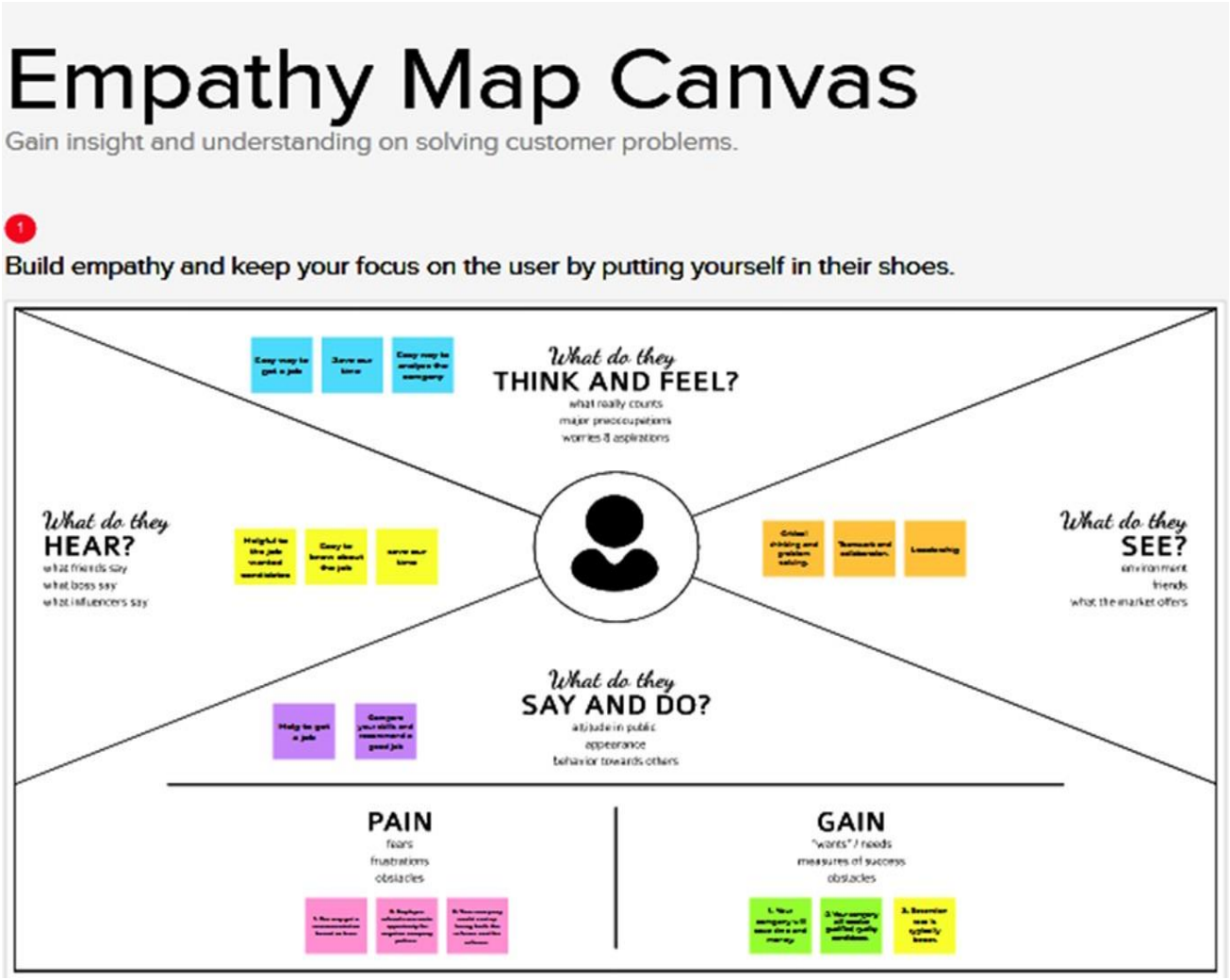
This is a challenging task for a country like India, where agriculture feeds approximately 42% of the population. And the outcomes for the farmer of choosing the wrong crop for land is moving towards metro city for livelihoods, suicide, quitting the agriculture and give land on lease to industrialist or use for the non-agriculture purpose. The outcome of wrong crop selection is less yield and less profit.

**Technical Stack:**

- PYTHON
- CNN
- IBM CLOUD
- IBM WATSON STUDIO
- IBM CLOUDANT DB
- DEEP LEARNING
- PYTHON FLASK

# 3.IDEATION & PROPOSED SOLUTION

## Empathy Map Canvas:



## problem Solution

The solution to the problem is Machine learning, which is one of the applications of Artificial Intelligence, is being used to implement the proposed system. Crop recommendation is going to recommend you the best crop you can grow in your land as per the soil nutrition value and along with as per the climate in that region. And recommending the best fertilizer for every particular crop is also a challenging task. And the other and most important issue is when a plant gets caught by heterogeneous diseases that effect on less amount of agriculture production and compromises with quality as well. To overcome all these issues this recommendation has been proposed . Nowadays a lot of research and work is being implemented in the smart and modern agriculture domain. Crop recommendation is characterized by a soil database comprised of Nitrogen, Phosphorus, potassium. The ensembles technique is used to build a recommendation model that combines the prediction of multiple machine learning. Models to recommend the right crop based on soil value and the best fertilizer to use.

## IDEATION

### Sensor Technology In Agriculture:

Vast variety of sensors are used in agricultural products such as soil moisture sensors, water-level sensors, equipment used to sample the state of the atmosphere at a given time meteorological sensor (monitors the current state of atmosphere), heavy metal detection sensors, brosensors (detection of an analyte), gas sensors (detect presence of gas).

### Intelligent Irrigation Technology:

Based on satellite positioning network and “shallow wells underground cables + field + automatic irrigation system pipe” technology,it can accumulate irrigation water,irrigation,electricity and time data to accomplish automation of farmland irrigation and through a complete.

## 4. REQUIREMENT ANALYSIS

### Functional Requirement:

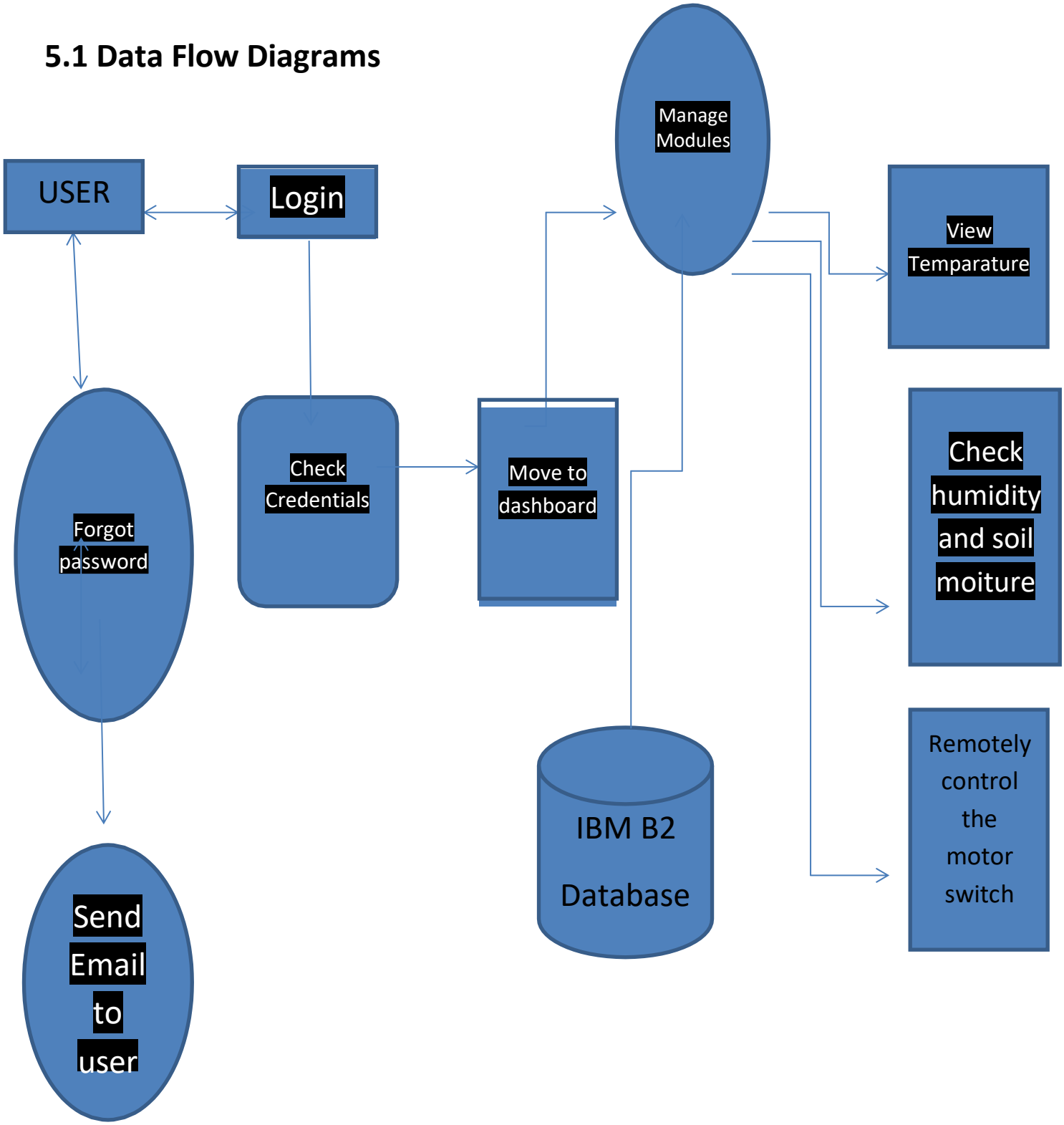
| FR NO. | Functional Requirement (Epic) | Sub Requirement(Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through form<br>Registration through Gmail |
| FE-2 | User Confirmation | Confirmation<br>Via Email<br>Confirmation<br>Via OTP |
| FE-3 | Sensor Function for framing system | Measure the Temperature and Humidity Measure the soil monitoring check the crop disease |
| FE-4 | Manage Modules | Manage Roles of<br>User Manage<br>User permission |
| FE-5 | Check whether details | Tempetature<br>Details<br>Humidity<br>details |

**Non-Functional Requirement:**

| FR-NO | NON-FUNCTIONAL REQUIREMENT | DESCRIPTION |
|---|---|---|
| NFR-1 | Usability | User friendly guidelines for users to avail the features.Most simplistic user interface for ease of use. |
| NFR-2 | Security | All the details about the user are producted from unauthorized access.Detection and identification Of any misfunctions of sensors. |
| NFR-3 | Reliability | Implementing mesh IoT Networks Building a multi-layered distance for IoT Networks. |
| NFR-4 | Performance | The use of modern technology solutions helps to achieve the maximum performances thus resulting in better quality and quantity yields. |
| NFR-5 | Availability | This app is available for all platforms. |

# 5. PROJECT DESIGN

## 5.1 Data Flow Diagrams



# Solution Architecture:

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

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

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

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

The solution to the problem is Machine learning, which is one of the applications of Artificial Intelligence, is being used to implement the proposed system. Crop recommendation is going to recommend you the best crop you can grow in your land as per the soil nutrition value and along with as per the climate in that region. And recommending the best fertilizer for every particular crop is also a challenging task. And the other and most important issue is when a plant gets caught by heterogeneous diseases that effect on less amount of agriculture production and compromises with quality as well. To overcome all these issues this recommendation has been proposed . Nowadays a lot of research and work is being implemented in the smart and modern

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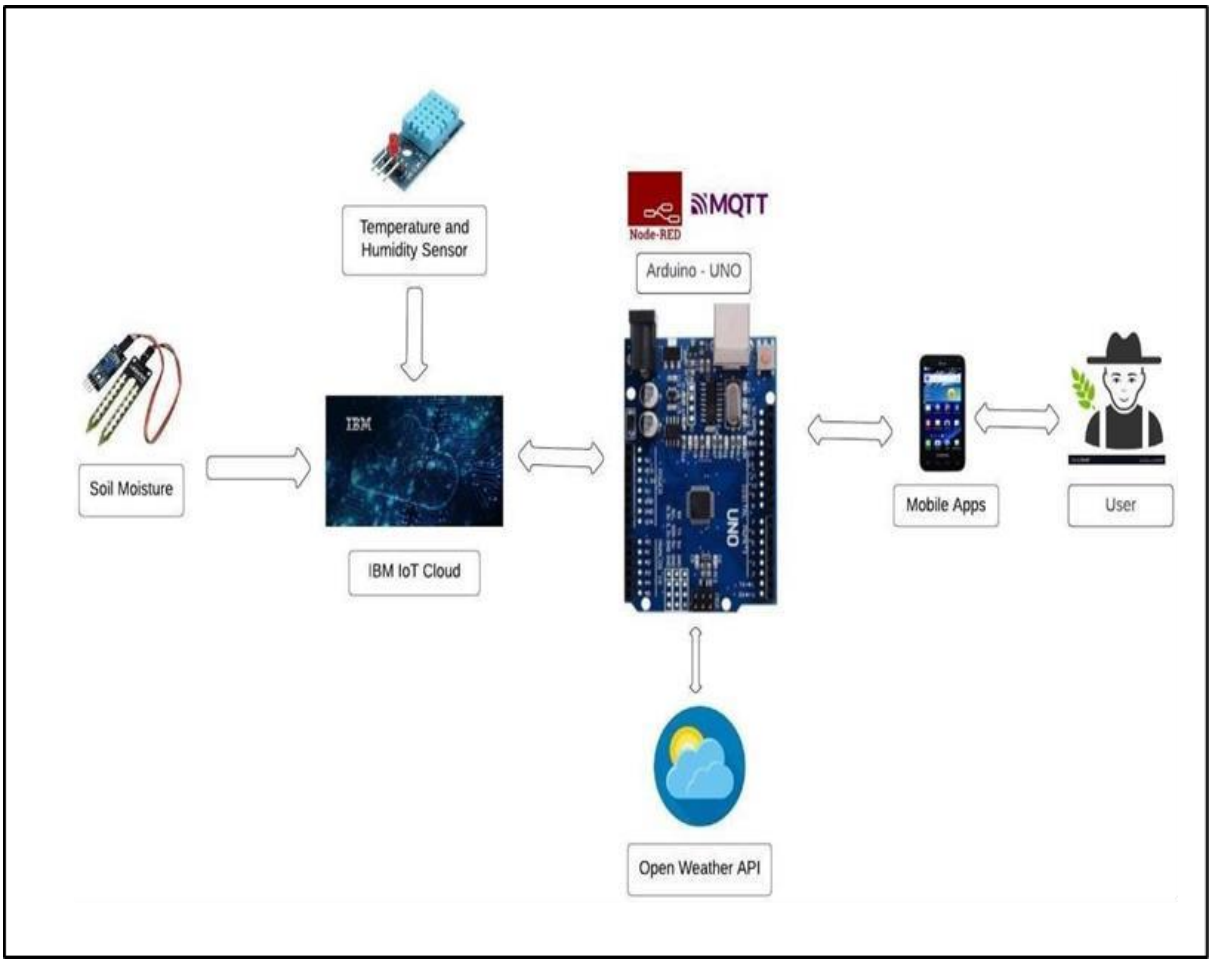


# Technology Architecture:

| Component | Description | Technology |
|---|---|---|
| 1. User Interface | How user interacts with application e.g.Web | MIT App Inventor |
| 2. Application Logic-1 | Logic for a process in the Application | Python |
| 3. Application Logic-2 | Logic for a process in the Application | IBM Watson IOT service |
| 4. Application Logic-3 | Logic for a process in the Application | IBM Watson Assistant |
| 5. Database | Data Type, Configurations etc. | MySQL, NoSQL, etc. |
| 6. Cloud Database | Database Service on Cloud | IBM Cloud |
| 7. File Storage | File storage requirements | IBM Block Storage or Other Storage |
| 8. External API-1 | Purpose of External API used in the application | Open Weather API |

# Application Characteristics:

| S. No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | Open-Source Frameworks | List the open-source frame works used | Technology of Opensource framework |
| 2. | Security Implementations | Sensitive and private datamust be protected from their production until the decision-making and storage stages. | Node-Red, Open weather App API, MIT App Inventor |
| 3. | Scalable Architecture | scalability is a major concern for IoT platforms.It has been shown that different architectural choices of IoT platformsaffect system scalability and that automatic real time decision-making is feasiblein an environmentcomposed of dozens of thousand. | Technology used |

# 6. PROJECT PLANNING & SCHEDULING

## Sprint Planning & Estimation:

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Simulation creation | USN-1 | Connect Sensors and Arduino withpython code | 2 | High | Tamilarasan S , Syedabuthahir M |
| Sprint-2 | Software | USN-2 | Creating device in the IBM WatsonIoT platform, workflow for IoT scenarios using Node-Red | 2 | High | Tamilarasan S , Syedabuthahir M |
| Sprint-3 | MIT App Inventor | USN-3 | Develop an application for the Smart farmer project using MIT App Inventor | 2 | High | Mohana Priyan M |
| Sprint-3 | Dashboard | USN-3 | Design the Modules and test the app | 2 | High | Tamil Selvan S |
| Sprint-4 | Web UI | USN-4 | To make the user to interact with software. | 2 | High | Tamilarasan S , Syedabuthahir M , Mohana Priyan M , Tamil Selvan S |

## Sprint Delivery Schedule:

| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Completed (as on Planned EndDate) | Sprint Release Date(Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 7 Days | 24 Oct 2022 | 01 Nov 2022 | 20 | 01 Nov 2022 |
| Sprint-2 | 20 | 5 Days | 02 Nov 2022 | 07 Nov 2022 | 20 | 07 Nov 2022 |
| Sprint-3 | 20 | 10 Days | 08 Nov 2022 | 18 Nov 2022 | 20 | 18 Nov 2022 |
| Sprint-4 | 20 | 9 Days | 19 Nov 2022 | 28 Nov 2022 | 20 | 28 Nov 2022 |

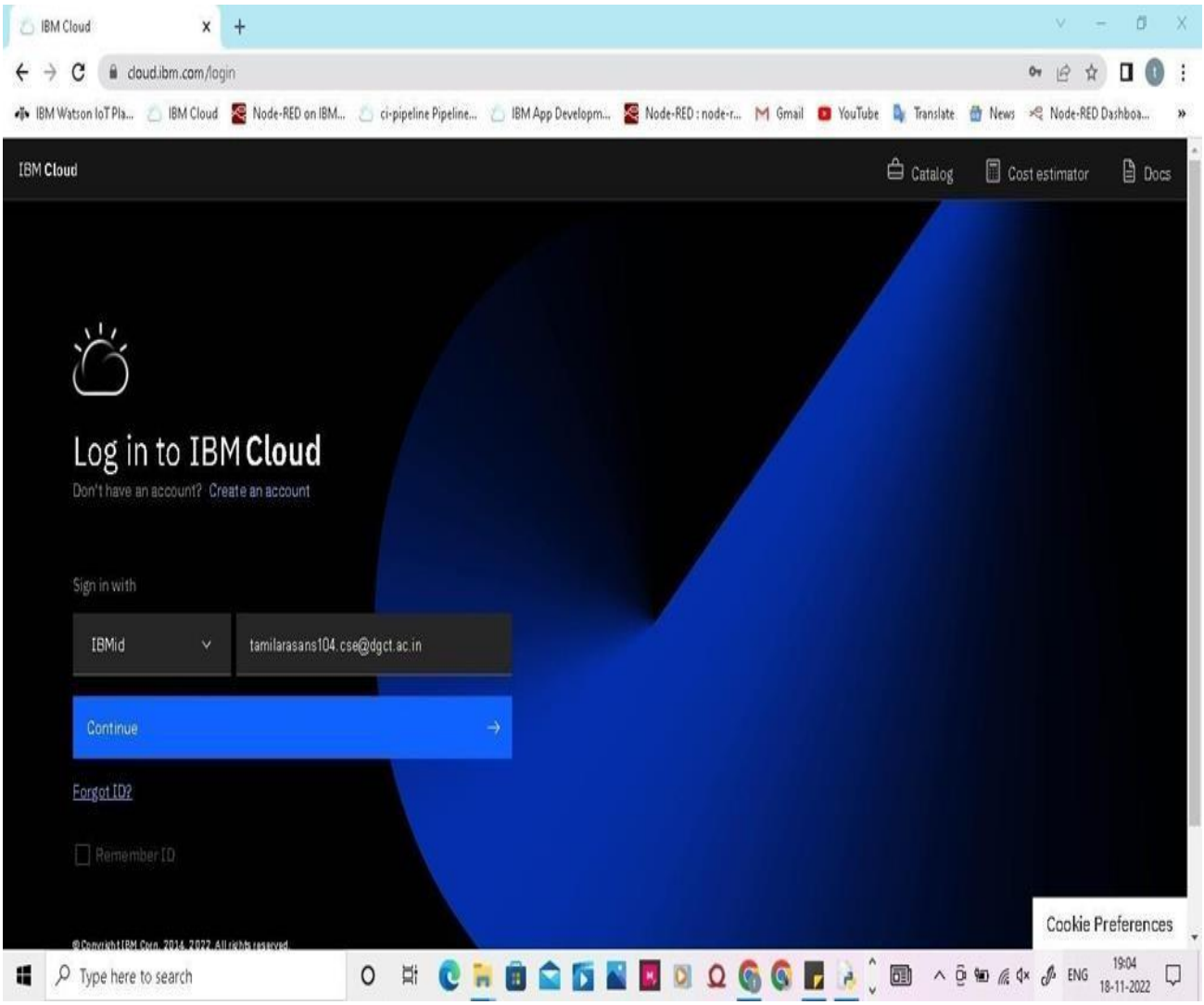
# 7. CODING

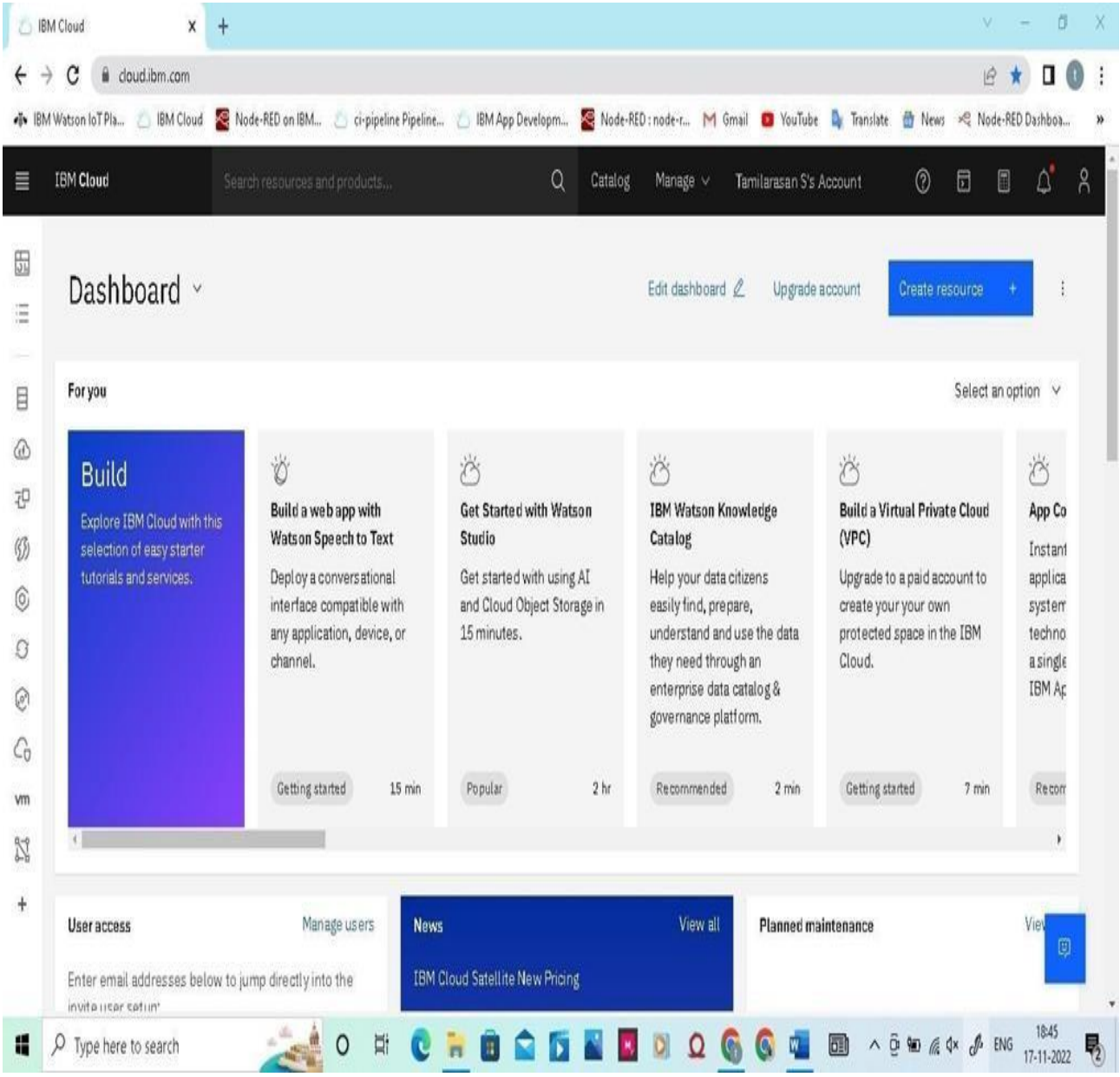
```
import
random
import sys
import time
import ibmiotf.application
import ibmiotf.device
#provide Your IBM Watson Device
Credentials organization = "9te1u1"
deviceType = "SFTTMS00"
deviceID = "SFTTMS11"
authMethod = "token"
authToken =
"PNTIBMSb18"
#Initialize GPIO
def myCommandCallback(cmd):
    print ("command received: %s"
    %cmd.data['command']) status=cmd.data['command']
    if status=="lighton":
        print  ("led is on")
    elif status ==
    "lightoff":
       print ("led is off")
    else:
      print ("please send proper command")
try:
      deviceOptions =
{'org':organization,'type':deviceType,'id':deviceID,'auth-
method':authMethod, 'auth-token': authToken}
      deviceCli = ibmiotf.device.Client(deviceOptions)
      #.....................................................
except Exception as e:
       print("caught exception connecting device:%s" %
       str(e)) sys.exit()
# connect and send a datapoint "hello"with value "world" info the cloud as
an event of type"greetings"10 times
```

```
deviceCli.connect()
while True:
        #Get sensor Data from DHT11
        temp=random.randint(0,100
        )
        Humid=random.randint(0,1
        00)
        soilmoisture=random.randi
        nt(0,100)
        data = { 'temp' : temp, 'Humid': Humid,
        'soilmoisture':soilmoisture} #print data
        def myOnPublishCallback():
            print ("published Temperature = %s C" % temp, "Humidity =
            is %s
%%" % Humid, "soilmoisture= is %s %%" % soilmoisture,"to IBM
Watson")
        success =
deviceCli.publishEvent("IOTSensor",
"json",data,qos=0,on_publish=myOnPublishC
allback)
        if not success:
            print("Not connected
        to IOTF") time.sleep(5)
```

# 8. RESULTS

## IBM CLOUD:




IBM Cloud
cloud.ibm.com
IBM Cloud
Search resources and products...
Catalog
Manage
Tamilarasan S's Account
Dashboard
Edit dashboard
Upgrade account
Create resource
For you
Select an option
Build
Explore IBM Cloud with this selection of easy starter tutorials and services.
Build a web app with Watson Speech to Text
Deploy a conversational interface compatible with any application, device, or channel.
Getting started
15 min
Get Started with Watson Studio
Get started with using AI and Cloud Object Storage in 15 minutes.
Popular
2 hr
IBM Watson Knowledge Catalog
Help your data citizens easily find, prepare, understand and use the data they need through an enterprise data catalog & governance platform.
Recommended
2 min
Build a Virtual Private Cloud (VPC)
Upgrade to a paid account to create your your own protected space in the IBM Cloud.
Getting started
7 min
User access
Manage users
Enter email addresses below to jump directly into the
News
View all
IBM Cloud Satellite New Pricing
Planned maintenance
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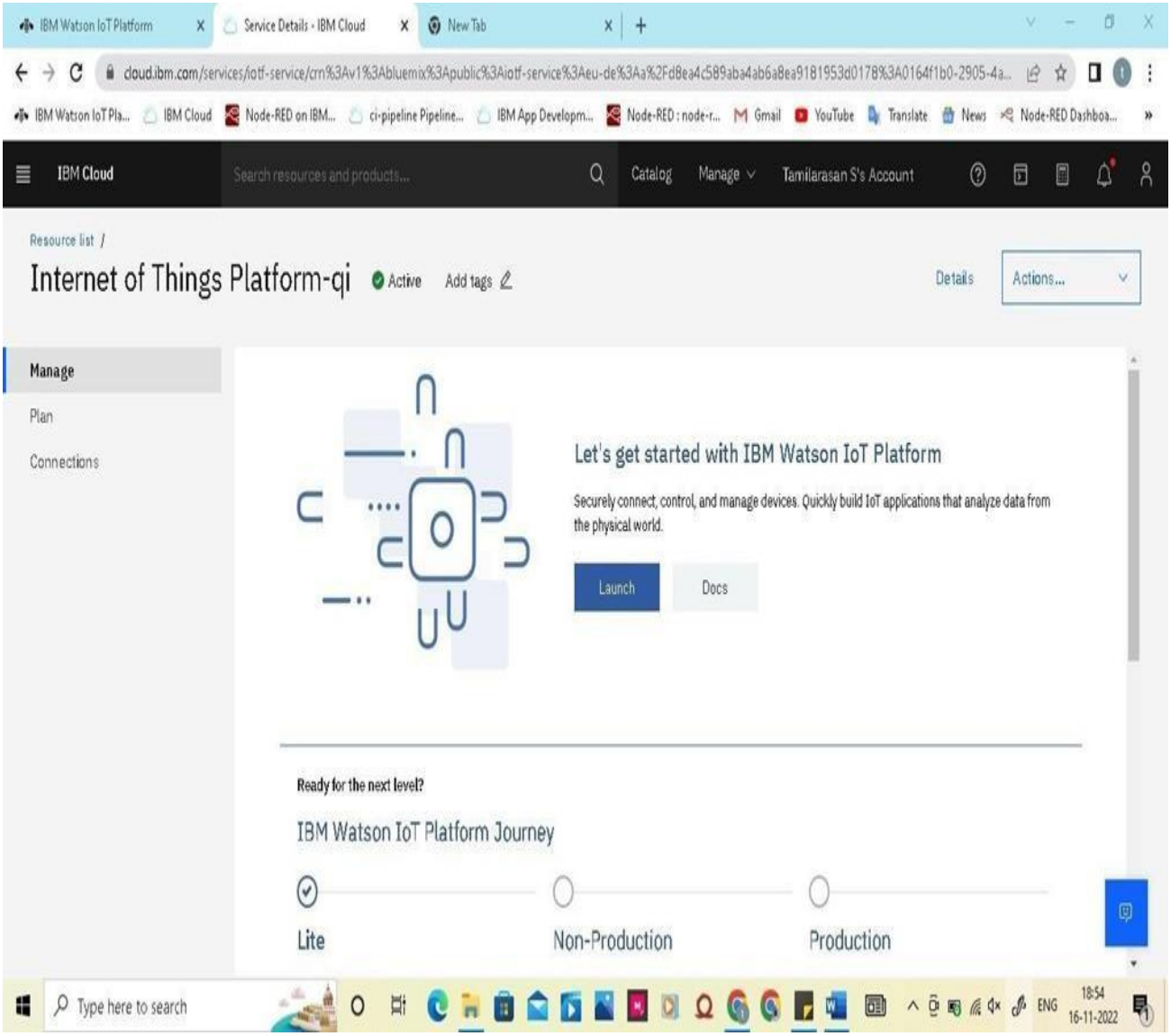
17-11-2022

# IBM WATSON:


IBM Watson IoT Platform
Service Details - IBM Cloud
New Tab
IBM Cloud
Search resources and products...
Catalog
Manage
Tamilarasan S's Account
Resource list /
Internet of Things Platform-qi
Active
Add tags
Details
Actions...
Manage
Plan
Connections
Let's get started with IBM Watson IoT Platform
Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.
Launch
Docs
Ready for the next level?
IBM Watson IoT Platform Journey
Lite
Non-Production
Production
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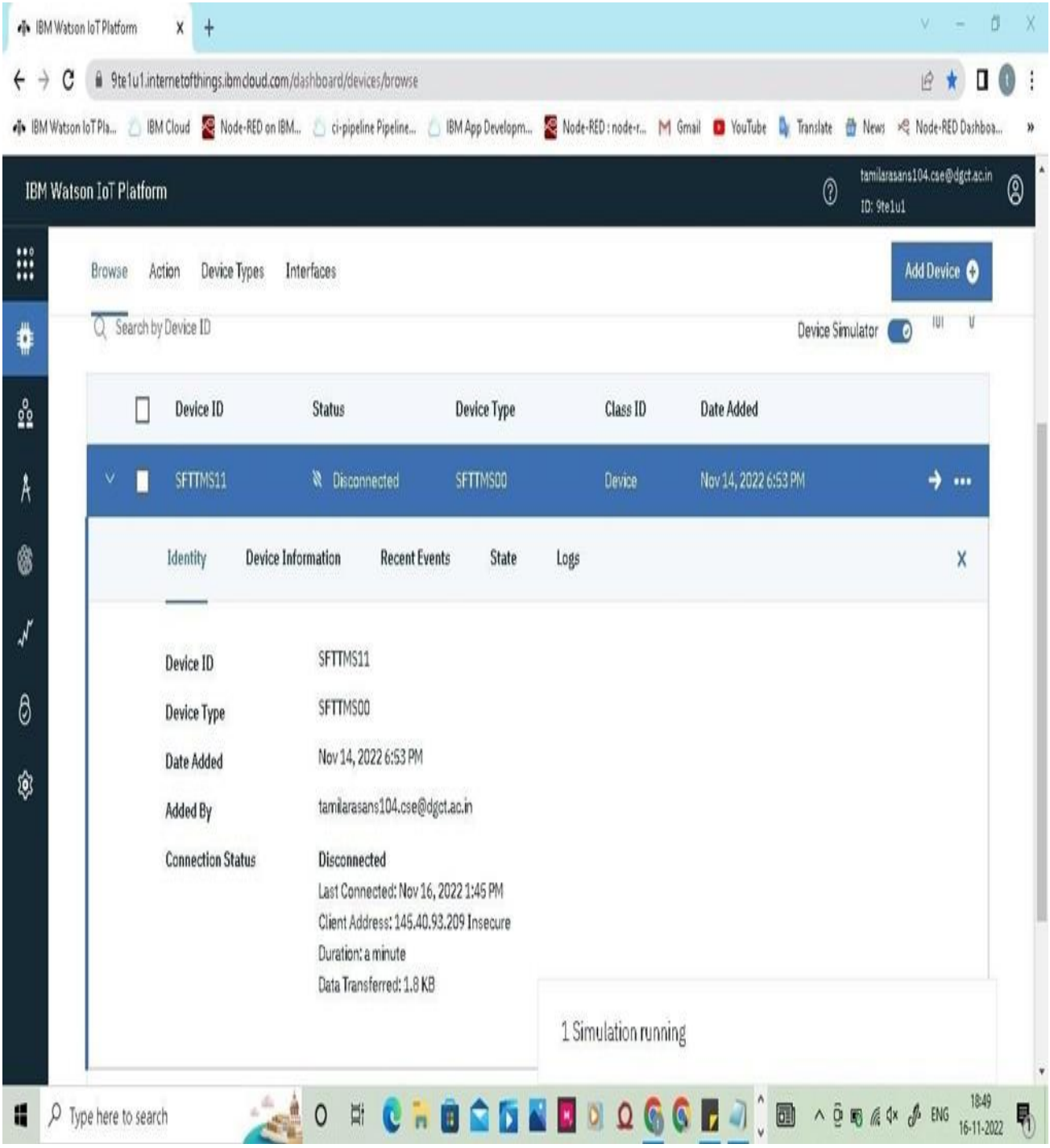
16-11-2022


IBM Watson IoT Platform
9te1u1.internetofthings.ibmcloud.com/dashboard/devices/browse
IBM Watson IoT Platform
tamilarasans104.cse@dgct.ac.in
ID: 9te1u1
Browse
Action
Device Types
Interfaces
Add Device
Search by Device ID
Device Simulator
Device ID
Status
Device Type
Class ID
Date Added
SFTTMS11
Disconnected
SFTTMS00
Device
Nov 14, 2022 6:53 PM
Identity
Device Information
Recent Events
State
Logs
Device ID
SFTTMS11
Device Type
SFTTMS00
Date Added
Nov 14, 2022 6:53 PM
Added By
tamilarasans104.cse@dgct.ac.in
Connection Status
Disconnected
Last Connected: Nov 16, 2022 1:45 PM
Client Address: 145.40.93.209 Insecure
Duration: a minute
Data Transferred: 1.8 KB
1 Simulation running
Type here to search
ENG
18:49
16-11-2022

## 13. ADVANTAGES & DISADVANTAGES

### 1. Advantages:

- A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labor-intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.

- For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

- Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

- Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

## 13.2 Disadvantages:

- The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. More over internet connection is slower.

- The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.

# CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of Farming irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be adjusted dependent on the local environmental variables. This technology also detects animal invasions, which are a major cause of crop loss. 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 Smart farming irrigation or not to do. Continuous internet connectivity is required for continuous monitoring of data from sensors. This also can be overcome by using GSM unit as an alternative of mobile app. By GSM, SMS can be sent to farmer's phone.

# FUTURE SCOPE

- In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places.

- In the current project we have implemented the project that can protect and maintain the crop. 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 an entire.

- We can update 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 an internet issues.

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

## GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-26656-1660207001