PROJECT BASED EXPERIENTIAL LEARNING PROGRAM (NALAIYA THIRAN)

SMART FARMER – IOT ENABLED SMART FARMING APPLICATION

A PROJECT REPORT

Submitted by

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NOVEMBER 2022

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INTRODUCTION

PROJECT OVERVIEW

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, humidity using some sensors. Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for the farmers. They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself. Agriculture technologies have shown potential to improve agriculture management. This awareness has attracted researchers to develop technologies for farmers to ease their daily routine and also to reduce cost of labour and increase the yield production. Smartphone is one of the gadgets that can be useful in agriculture because of its useful functions, portability and affordable. It helps users to find locations, access information and capture images and sound. Smartphone functions can be combined to build versatile mobile agriculture applications. These helps to deliver information about crops and management needs.

PURPOSE

IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors. Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer isnot near his field. Watering the crop is one of the important tasks for the farmers. They can make the decision whether to water the crop or postpone it by monitoring the sensorparameters and controlling the motor pumps from the mobile application itself. The smart agriculture model main aim to avoid water wastage in the irrigation process. It islow cost and efficient system Is shown below. It includes Node MCU, Arduino Nano, sensors like soil moisture and Dht11, solenoid valves, relays. The main goal of farming apps is to optimize farming processes. Although most of the features are available on the computers & laptops and migrating them into mobile devices and that is next logical step which enables farmers to use technologies wherever they need to unlock.

LITERATURE SURVEY

EXISTING PROBLEM

Zuraida Muhammad, Muhammad Azri Asyraf Mohd Hafez, Nor Adni MatLeh, ZakiahMohd Yusoff, Shabinar Abd Hamid [1]
The term "Internet of Things" refers to the connection of objects, equipment, vehicles, and other electronic devices to a network for the purpose of data exchange (IoT). The Internet of Things (IoT) is increasingly being utilised to connect objects and collect data. As a result, the Internet of Things' use in agriculture is crucial. The idea behind the project is to create a smart agriculture system that is connected to the internet of things. The technology is combined with an irrigation system to deal with Malaysia's variable weather. This system's microcontroller is a Raspberry Pi 4 Model B. The temperature and humidity in the surrounding region, as well as the moisture level of the soil, are monitored using the DHT22 and soil moisture sensor. The data will be available on both a smartphone and a computer. As a result, Internet of Things (IoT) and Raspberry Pi-based Smart Agriculture Systems have a significant impact on how farmers work. It will have a good impact on agricultural productivity as well. In Malaysia, employing IoT-based irrigation systems saves roughly 24.44 percent per year when compared to traditional irrigation systems. This would save money on labour expenditures while also preventing water waste in daily needs.

Divya J., Divya M.,Janani V. [2] Agriculture is essential to India's economy and people'ssurvival. The purpose of this project is to create an embedded-based soil monitoring and irrigation system that will reduce manual field monitoring and provide information via a mobile app. The method is intended to help farmers increase their agricultural output. A pH sensor, a temperature sensor, and a humidity sensor are among the tools used to examine the soil. Based on the findings, farmers may plant the best crop for the land. Thesensor data is sent to the field manager through Wi-Fi, and the crop advice is created withthe help of the mobile app. When the soil temperature is high, an automatic watering system is used. The crop image is gathered and forwarded to the field manager for pesticide advice.

H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya [3] Development of an effective IoT-based smart irrigation system is also a crucial demand forfarmers in the field of agriculture. This research develops a low-cost, weather-based smartwatering system. To begin, an effective drip irrigation system must be devised that can automatically regulate water flow to plants based on soil moisture levels. Then, to make this water-saving irrigation system even more efficient, an IoT-based communication feature is added, allowing a remote user to monitor soil moisture conditions and manuallyadjust water flow. The system also includes temperature, humidity, and rain drop sensors, which have been updated to allow remote monitoring of these parameters through the internet.

Anushree Math, Layak Ali, Pruthviraj U[4] India is a country where agriculture plays a vital role. As a result, it's critical to water the plants wisely in order to maximise yield per unit space and so achieve good output. Irrigation is the process of providing a certain amount of water to plants at a specific time. The purpose of this project is to water the plants on the National Institute of Technology Karnataka campus with a smart drip irrigation system. To do this, the opensource platform is used as the system's fundamentalcontroller. Various sensors have been employed to supply the current parameters of components that impact plant healthiness on a continual basis. By controlling a solenoid valve, water is provided to the plants at regular intervals depending on the information acquired from the RTC module. The webpage may be used to monitor and manage the complete irrigation system. This website contains a function that allows you to manually or automatically control plant watering. The health of the plants is monitored using a Raspberry Pi camera that gives live streaming to the webpage. The controller receives water flow data from the water flow sensor through a wireless network. The controller analyses this data to see if there are any leaks in the pipe. Forecasting the weather is also done to restrict the quantity of water given, making it more predictable and efficient.

Dweepayan Mishra, Arzeena Khan, Rajeev Tiwari, Shuchi Upadhaye [5] Agriculture is a substantial source of revenue for Indians and has a huge impact on the Indian economy. Crop development is essential for enhanced yield and higher-quality delivery. As a result, crop beds with ideal conditions and appropriate moisture can have a big influence on output. Traditional irrigation systems, such as stream flows from one end to the other, are usually used. As a result of this delivery, the moisture levels in the fields canalter. A designed watering system can help to enhance the management of the water system. This research proposes a terrain-specific programmable water system that will save human work while simultaneously improving water efficiency and agricultural productivity. The setup is made up of an Arduino kit, a moisture sensor, and a Wi-Fi module. Data is acquired by connecting our experimental system to a cloud framework.After then, cloud services analyse the data and take the necessary actions.

R. Nageswara Rao, B.Sridhar [6] Agrarian countries like India rely heavily on agriculture for their development. Agriculture has always been a roadblock to the country's development. Smart agriculture, which comprises modernising present agricultural systems, is the only answer to this challenge. As a result, the suggested strategy attempts to use automation and Internet of Things technologies to make agriculture smarter. Crop growth monitoring and selection, irrigation decision assistance, and other uses are possible thanks to the Internet of Things (IoT). To modernise and boost crop yield, a Raspberry Pi-based autonomous irrigation IOT system has been proposed. This project's main purpose is to produce crops using the least amount of water possible. Most farmers waste a lot of time in the fields in order to focus on water available to plants at the appropriate time. Water management should be improved, and the system circuit's complexity should be minimised.

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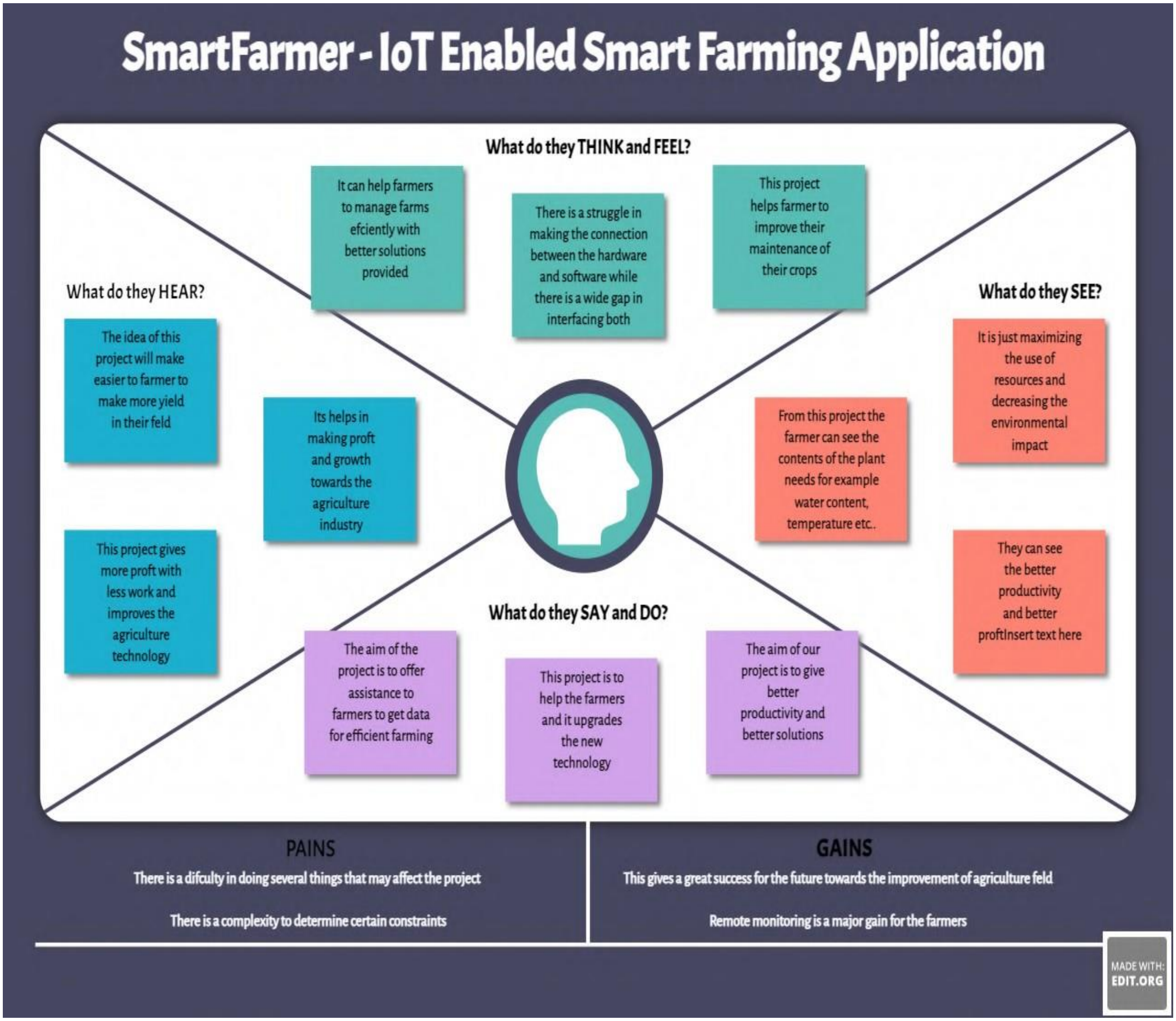
PROBLEM STATEMENT DEFINITION

Who does the problem affect?	**Persons who do Agriculture, Farmer**
What are the boundaries of the problem?	**Cope with climate change, soilerosion, biodiversity loss, invest in farming productivity, adapt and learn new technologies, stay resilient against global economic factors.**
What is the issue?	**Uncertainty in water supply, lack of remunerative problem, fragmentations of land holdings.**
When does the issue occur?	**farmers are under pressure to conserve water and use fewer agricultural inputs.**
Why is it important that we fix the problem?	**It is required for the growth of better-quality food products. It is important to maximize thecrop yield. It is important to maintain soil richness**
What solution to solve this issue?	**An application is introduced to know about various data about their land remotely, wherethey can schedule some events for a month or a day. It also provides suggestions to usersbased on the crop they planted.**
What methodology used to solve the issue?	**Some search results info from internet based oncrop planted. Arduino microcontroller to control the process and various sensors for data. An alert message using GSM. An app built using MIT App Inventor.**

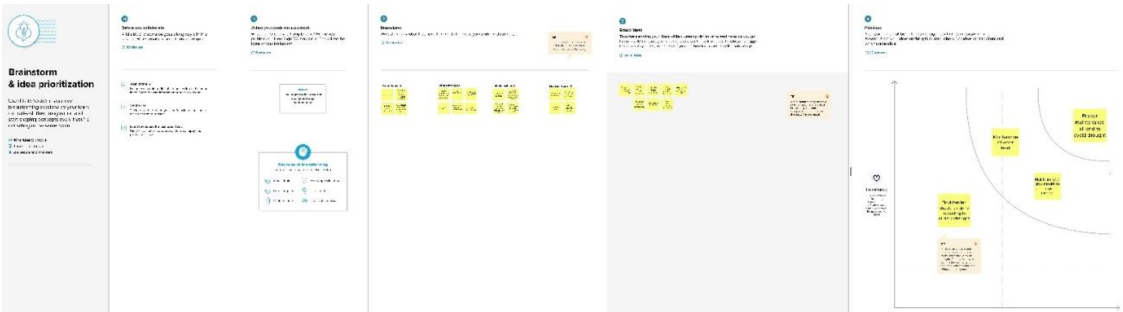
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
Watering the crop in agricultural filed using mobile application	**Farmer**	**Controlling the water pump and irrigation pipes**	**It takes too much time**	**Water is overflowing**	**Very tired and uncomfortable**

IDEATION AND PROPOSED SOLUTION

EMPATHY MAP



IDEATION AND BRAINSTORMING



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PROPOSED SOLUTION

S No	Parameter	Description
1.	Problem Statement (Problem to be solved)	**Ideally, each field should get just the right amount of water at just the right time. Under-watering causes crop stress and yield reduction. Overwatering can also cause yield reduction and consumes more water and fuel than necessary and leads to soil erosion and fertilizer, herbicide, and pesticide runoff.**
2.	Idea / Solution description	**It collects the data from different types of sensors and it sends the value to the main server. The Data collected by sensors, in terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitable crops.**
3.	Novelty / Uniqueness	**Collect the data about the different types of the soil and predict the yield about, in which soil the particular crop will be efficiently cultivated. It depends on IOT thus eliminating the need of physical work of farmers and thus increasing the productivity in every possible manner.**
4.	Social Impact / Customer Satisfaction	**Reduces the wages for labour who work in the agricultural field. It saves a lot of time. It makes a wealthy society.**
5.	Business Model (Revenue Model)	**For first one week we will give free access to this app then, after using this app they will come to know about the efficiency of this app. Then according to their convenience, they can make use of this application by using premium either a month or a year.**
6.	Scalability of the Solution	**Decrease farmer's burden. Easy to control and monitoring. Adopt and learn new technologies.**

PROBLEM SOLUTION FIT

Define CS, fit into

1. CUSTOMER SEGMENT(S) CS

The customer for this product is farmer who grow crops. Our aim is to assist, aid and help them to monitor the field parameters remotely and to keep track of the parameters. This product saves the agriculture from extinction

6. CUSTOMER CC

IOT based Smart farming helps farmers to better understand the important factors such as water, topography, vegetation, soil types. Network connectivity would be the main constraint as we use Wi-Fi which has major limitations like in coverage, scalability and power consumption.

5. AVAILABLE SOLUTIONS AS

Internet of Things (IoT) enables various applications of crop growth monitoring and selection, automatic irrigation decision support. The irrigation process is automated using IoT. weather data and field parameters were obtained and processed to automate the process of irrigation. The drawbacks are high cost of installation.

Explore AS,

Focus on J&P, tap into BE, understand

2. JOBS-TO-BE-DONE / PROBLEMS J&P

The objective of this product is to obtain the different field parameters using sensor and process it using a central processing system. Cloud is used to store and transmit the data by using IoT. Weather APIs are employed to assist the farmer in making decision. Our main job would be making the technologies feasible for the farmers by bridging the gap.

9. PROBLEM ROOT CAUSE RC

The frequent change or unpredictable weather and climate, made it difficult for the farmers to do agriculture. Lack of management commitment. Lack of or incorrect training and documentation. Increasing incomes. The monitoring of the field is hard when the farmer is out of station, thus leading to crop damage.

7. BEHAVIOUR BE

IoT applications help farmers to collect data regarding the location, well-being, and health of their crops. In addition use behaviour is influenced by behavioural intension. it was further found that technology readiness place a significant roll in the adaption of smart product. Using proper drain system to overcome the effects of excess water due to heavy rain. Using hybrid varieties of crop that are resistant to pests.

Focus on J&P, tap into BE, understand

Identify strong TR & EM

3. TRIGGERS TR

Customers get triggered mainly because to save their crops and to prevent them from the damage as they feel depressed when they face the losses and it indirectly affects their family too. This device is also a budget friendly device.

4. EMOTIONS: BEFORE / AFTER EM

Before: Lack of knowledge in weather forecasting →Random decisions →low yield.

After: Data from reliable source → correct decision →high yield

10. YOUR SOLUTION SL

Our product collects the data from different types of sensors and it sends the value to the main server. It also collects the weather data from the weather API. The ultimate decision, whether to water the crop or not is taken by the farmer using mobile application. Additional features like create an awareness about where to get agricultural loans, government agriculture schemes and get the feedback of every farmer on every month end and if it is related to government, then make it to reach the government.

8. CHANNELS of BEHAVIOUR CH

Offline:

Awareness camps to be organized to teach the importance and advantages of the automation and IoT in the development of agriculture.

Online:

The emerging out of convergences of IT and farming techniques. it enhances the agricultural value chain through the application of Internet and related technologies.

Extract online & offline CH of BE

REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT

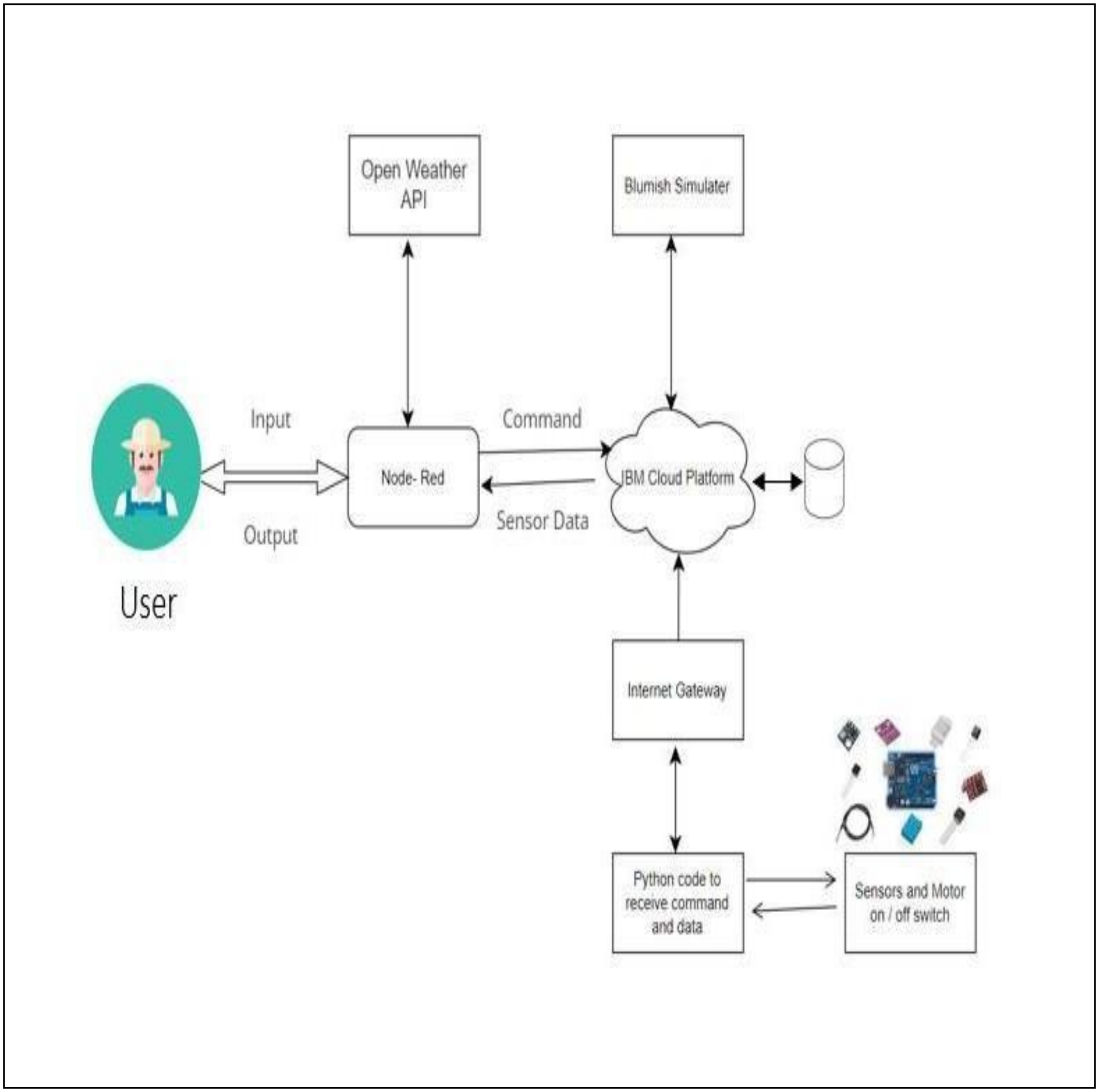
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the crop diseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature details Humidity details
FR-6	Data Management	Manage the data of weather conditions Manage the data ofcrop conditions Manage the data of livestock conditions

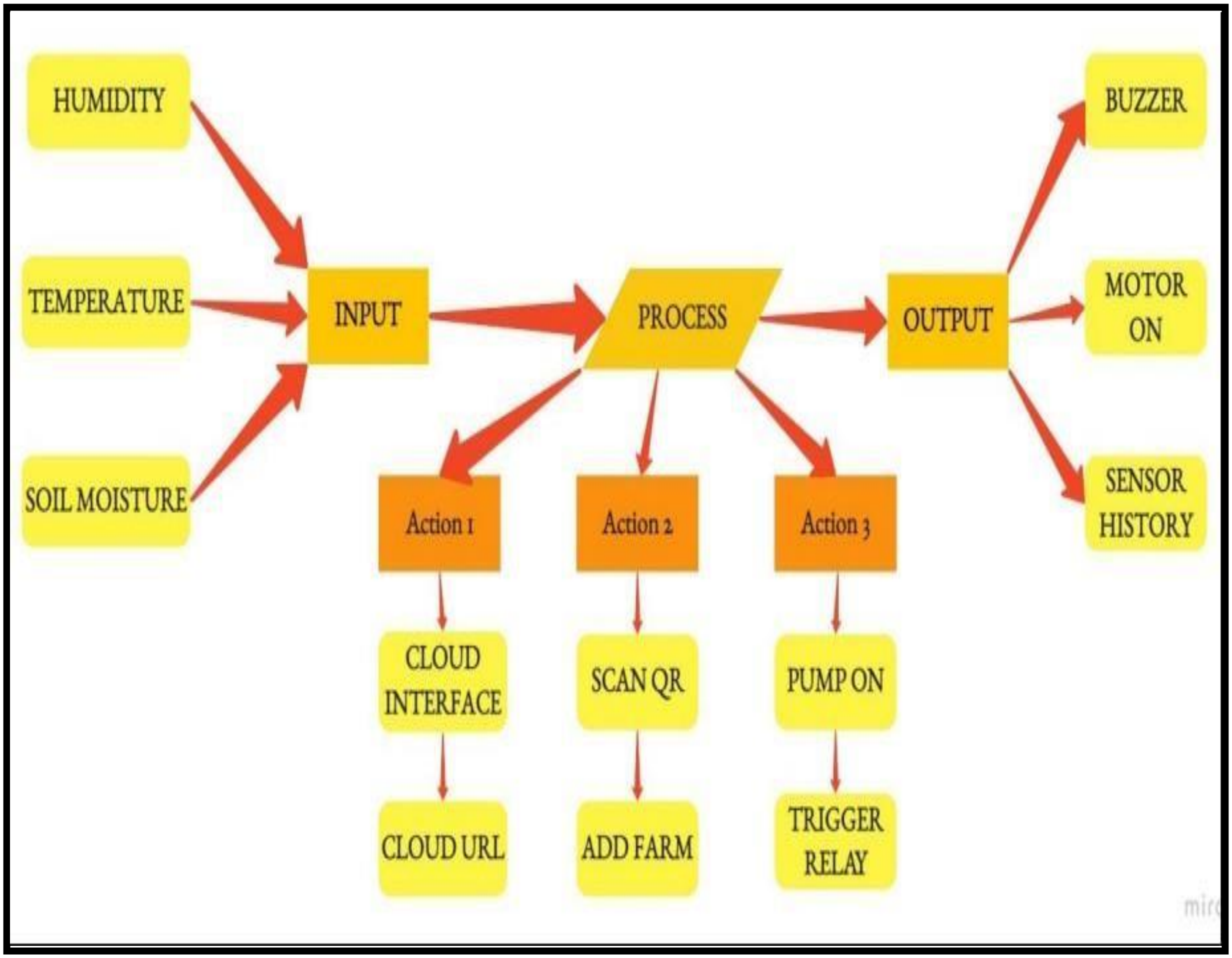
NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NF R-1	Usability	Usability includes easy understanding andlearn ability, efficiency in use, remember ability, lack of errors in operation and subjective pleasure.
NF R-2	Security	Sensitive and private data must be protected from their production until thedecision-making and storage stages.
NF R-3	Reliability	The shared protection achieves a bettertrade-off between costs and reliability. The model uses dedicated and shared Protection schemes to avoid farmservice outages.
NFR -4	Performance	The idea of implementing integrated sensors with sensing soil and environmental parameters in farming will be more efficient.
NFR -5	Availability	Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
NFR -6	Scalability	Scalability is a major concern for IoT platforms. It has shown that different architectural choices of IoT platforms affectsystem scalability, real time decision- making is feasible in an environment composed of dozens of thousand.

PROJECT DESIGN

DATA FLOW DIAGRAM



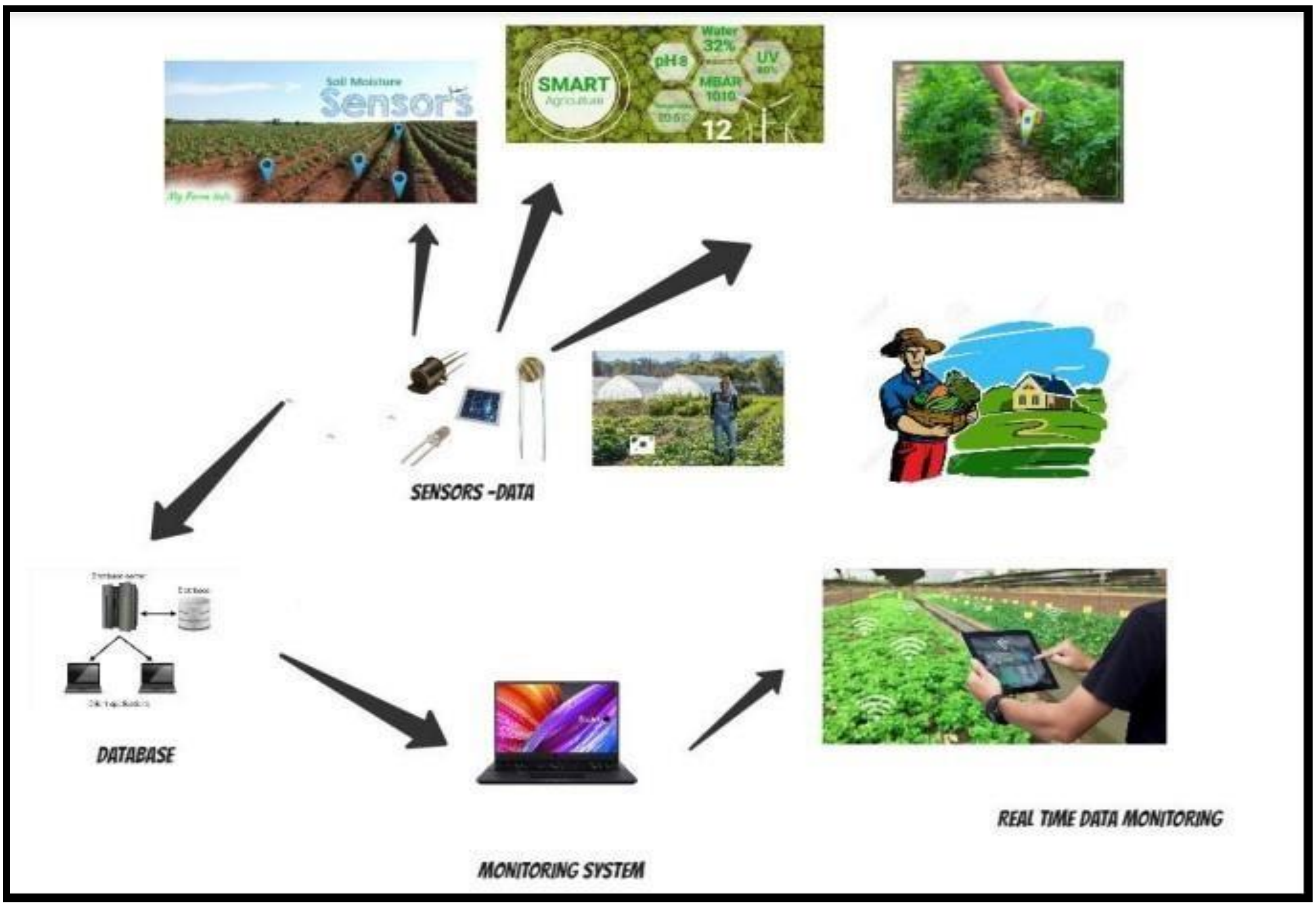


- **The parameters like temperature, humidity, and soil moisture are updated to the Watson IoT platform**
- **The device will subscribe to the commands from the mobile application and control the motors accordingly**
- **APIs are developed using Node-RED service for communicating with Mobile Application . A mobile application is developed using the MIT App inventor to monitor the sensor parameters and control the motors.**

SOLUTION AND TECHNICAL ARCHITECTURE

SOLUTION ARCHITECTURE

- IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture,temperature, and humidity using some sensors.
- Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for farmers.
- They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

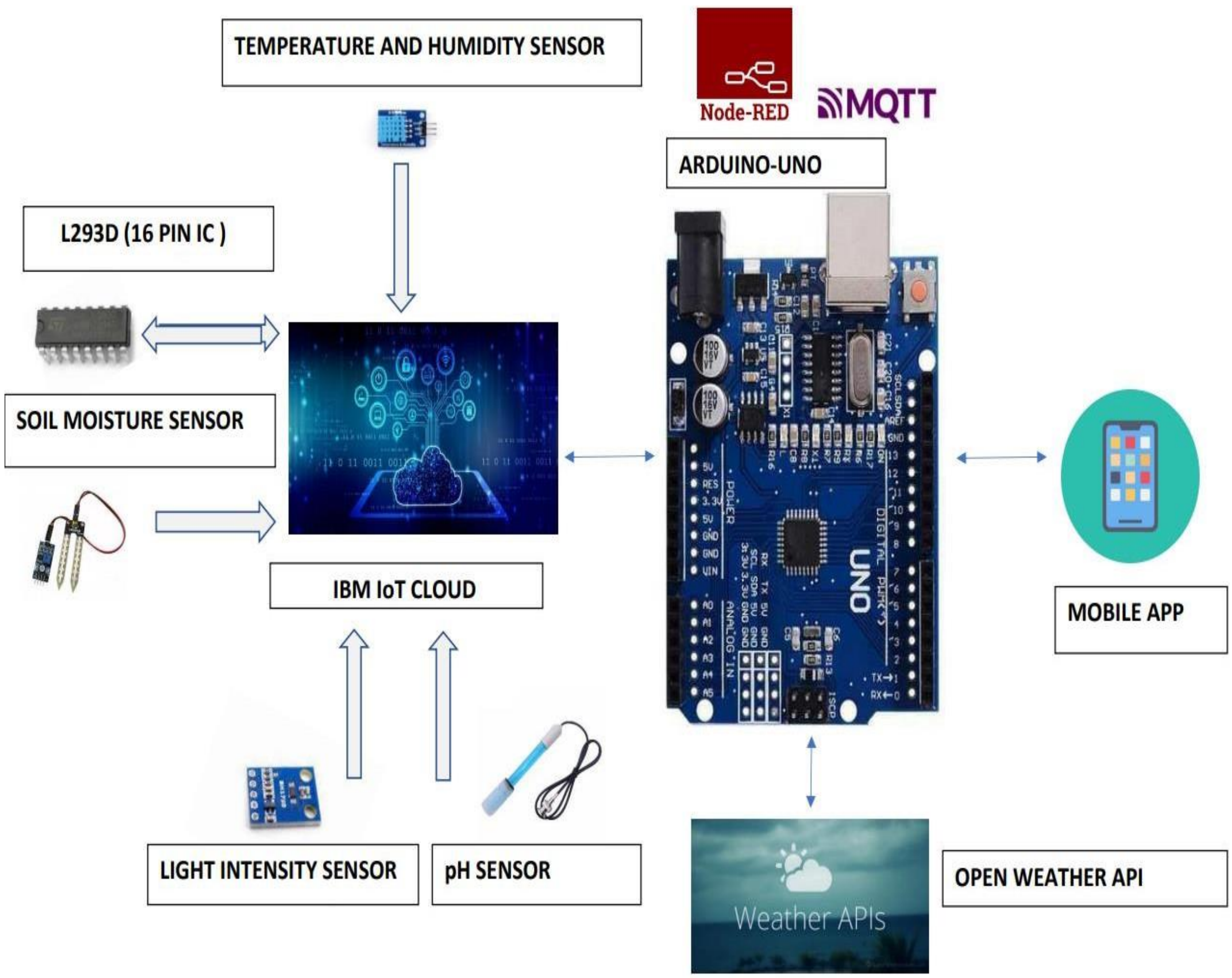


The different soil parameters (temperature, humidity, light intensity, pH level) are sensed using different sensors and the obtained value is stored inIBM cloud.

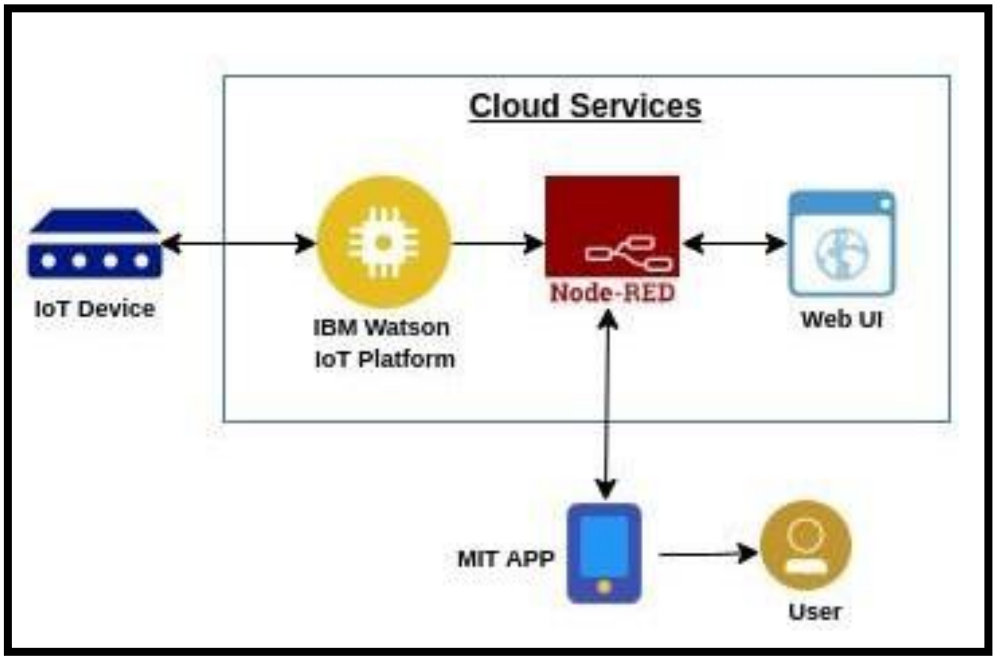
Arduino uno is used as a processing unit which processes the data obtainedfrom sensors and weather data from weather API.

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

All the collected data are provided to the user through a mobile application which was developed using MIT app inventor. The user could make decision through an app, whether to water the crop or not depending upon the sensorvalues.



TECHNICAL ARCHITECTURE



- **The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM B2 cloud.**
- **Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.**
- **NODE-RED is used as a programming tool to write the hardware, software and APIs. The MQTT protocol is followed for the communication.**
- **All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor**

Table - 1 : Components & Technologies:

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
9. Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration:	Local, Cloud Foundry.

Table 2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MQTT protocol	python
2.	Security Implementations	Sensitive and private data must be protected from their production until the decision-making and storage stages.	Node-Red, Open Weather AppAPI, MIT App Inventor
3.	Scalable Architecture	Scalability is a major concern for IoT platforms. It has been shown that different architectural choices of IoT platforms affect system scalability and that automatic real time decision-making is feasible in an environment composed of dozens of thousand.	Node-Red service
4.	Availability	Available feasible	Open weather App
5.	Performance	Design consideration for the performance of the application (numberof requests per sec, use of Cache, use of CDN’s) etc.	MIT app inventor

USER STORIES

User Type	Functional Requirement	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, password and confirmingmy password.	I can access myaccount/ dashboard	High	Sprint-1
	Permission	USN-2	As a user, I will receive confirmation email once I haveregistered for the application.	I can receive confirmati on email & click confirm.	High	Sprint-1
Customer (Web user)	Login	USN-3	As a user, I can log into the application by entering email &password.	I can register &access the dashboard with Login	High	Sprint-2
	Check credential s	USN-4	As a user, I can register for theapplication through mobile application	Temperatur eand Humidity details	Mediu m	Sprint-1
	Dashboard	USN-5	As a user can view the dashboard and this dashboardinclude the check roles of access and then move to the manage modules.	I can view the dashboard in thissmart farming application system.	Mediu m	Sprint-1
Customer care Executive	MIT app	USN-6	To make the user to interactwith the software.	Database to store in cloud services.	High	Sprint-1
Administrator	IOT devices	USN-7	As a user once view the managemodules this describes the manage system admins and Manage Roles of user and etc..,		Mediu m	Sprint-1
	Log out	USN-8	Exit	Sign out	High	Sprint-1

PROJECT PLANNING AND SCHEDULING

SPRINT PLANNING AND ESTIMATION

Product Backlog, Sprint Schedule and Estimation

Sprint - 1	**Hardware**	**USN-1**	**Sensors and Wi-Fi module with python code**	**2**	**High**	**Arun Kumar S**
Sprint - 2	**Software**	**USN-2**	**IBM Watson IOT Platform, Workflows forIOT scenarios**	**2**	**High**	**Bharadwajaa B**
Sprint - 3	**MIT App**	**USN-3**	**To develop amobile application using MIT.**	**2**	**High**	**Inbatamizhan A**
Sprint - 4	**Web UI**	**USN-4**	**To make the user interact with software.**	**2**	**High**	**Naveen Kumar M**

Project Tracker, Velocity & Burndown Chart

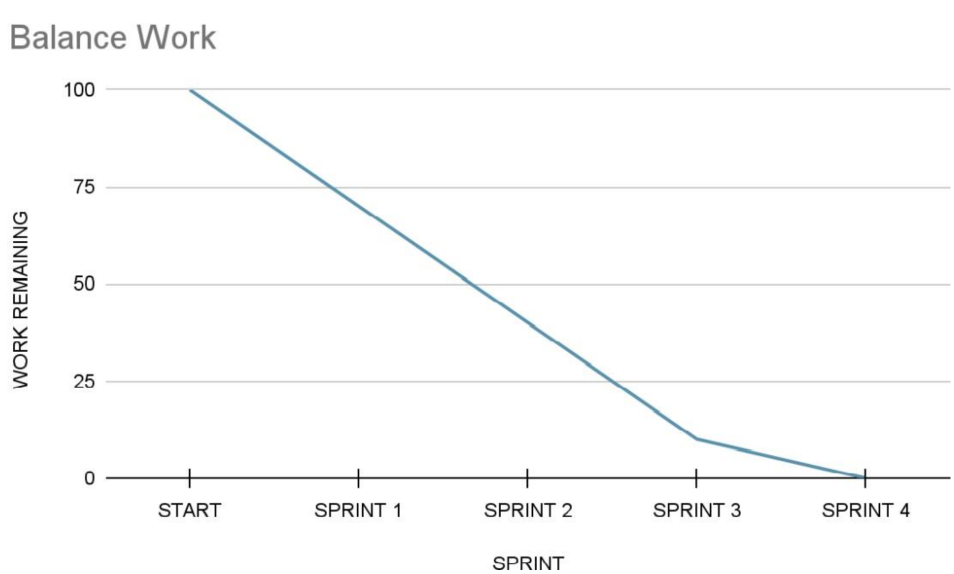
Sprint	Total Story Point	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Complete d(as on Planned EndDate)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of theteam is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

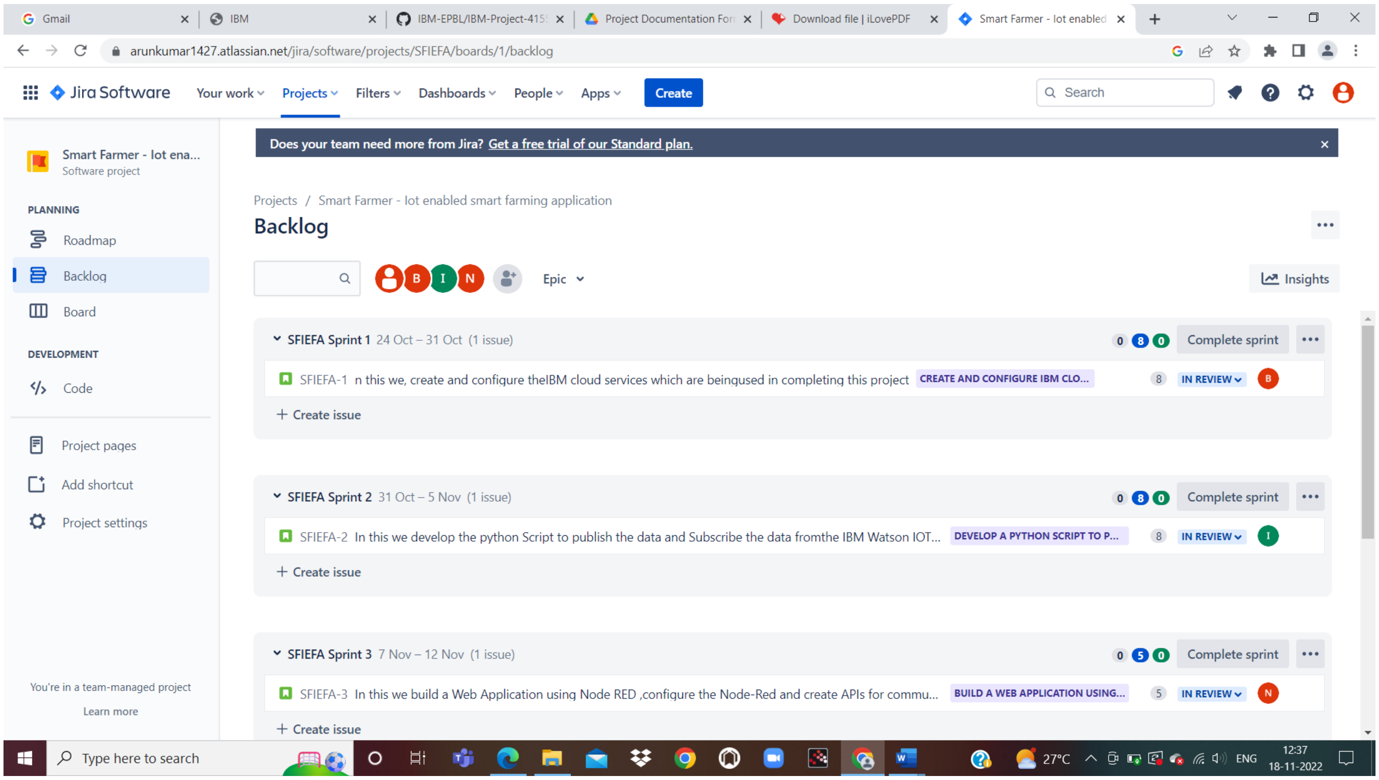
Burndown Chart:

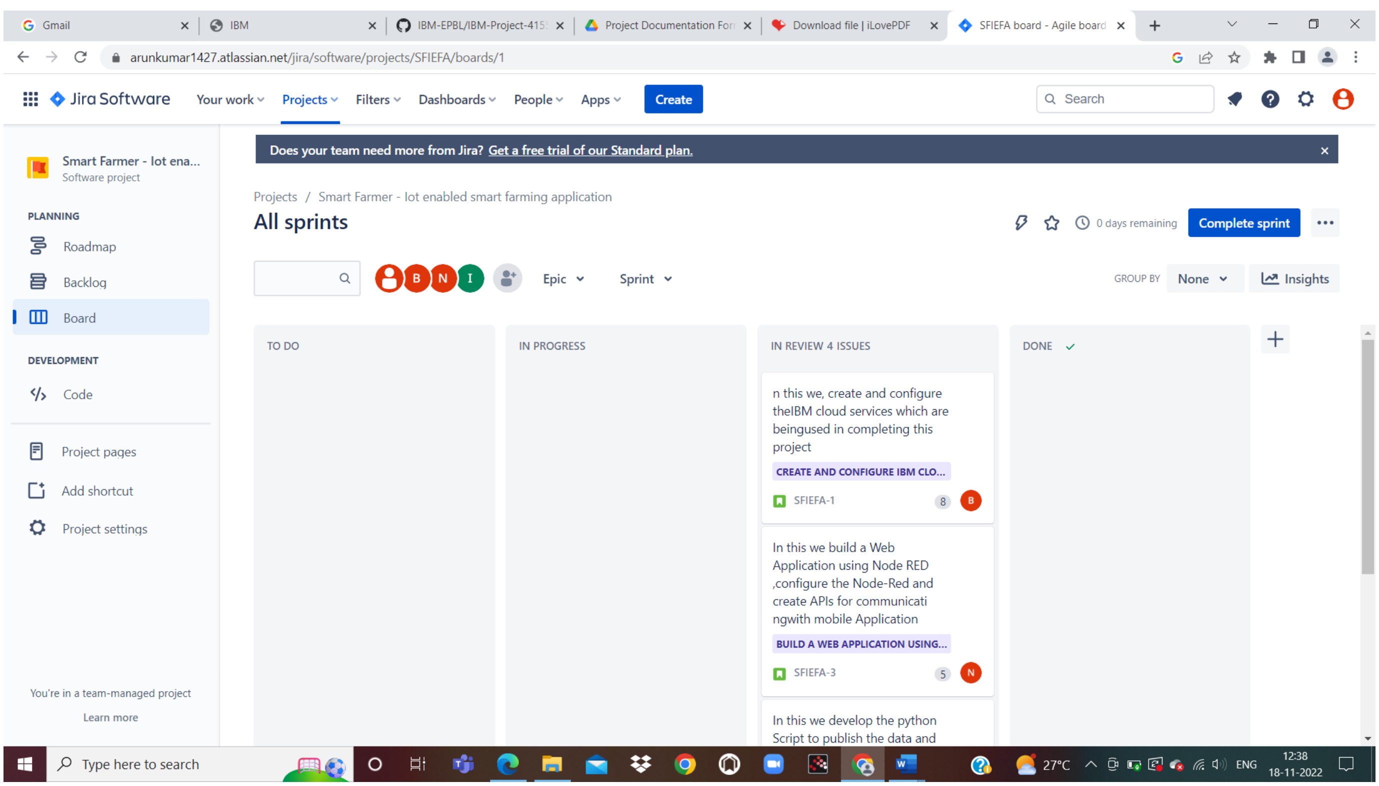


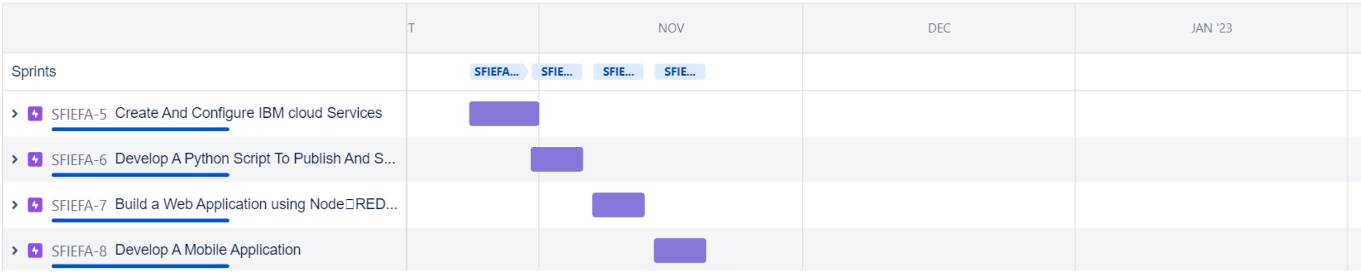
SPRINT DELIVERY SCHEDULE

1	Staring The Project	We the Team Members were Assigned all the TasksBased on Sprints and Workon It Accordingly	1 week
2	Completing Every Task	Team Leader should ensurethat whether every team member have completed the assigned task or not	1 week
3	Stand Up Meetings	Team Lead Must Have a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session	1 week
4	Deadline	Ensure that team membersare completing every task within the deadline	1 week
3	Budget and Scope of project	Analyze the overall budgetwhich must be 1 week within certain limit it should be favorable to every person	1 week

REPORTS FROM JIRA







CODING AND SOLUTIONS

Features

- Soil moisture and humidity detection
- Temperature detection
- Motor on and Motor off

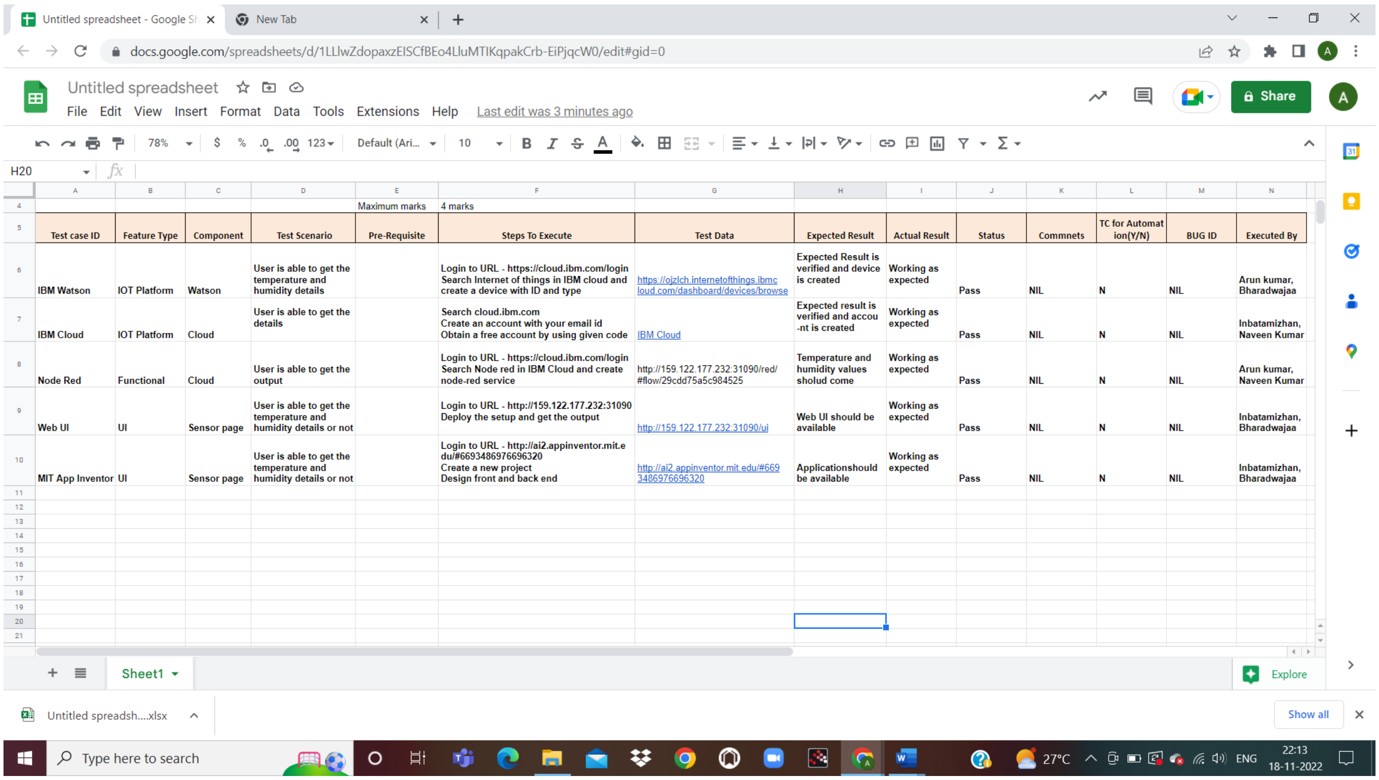
CODE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "ojzlch"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

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

try:
```

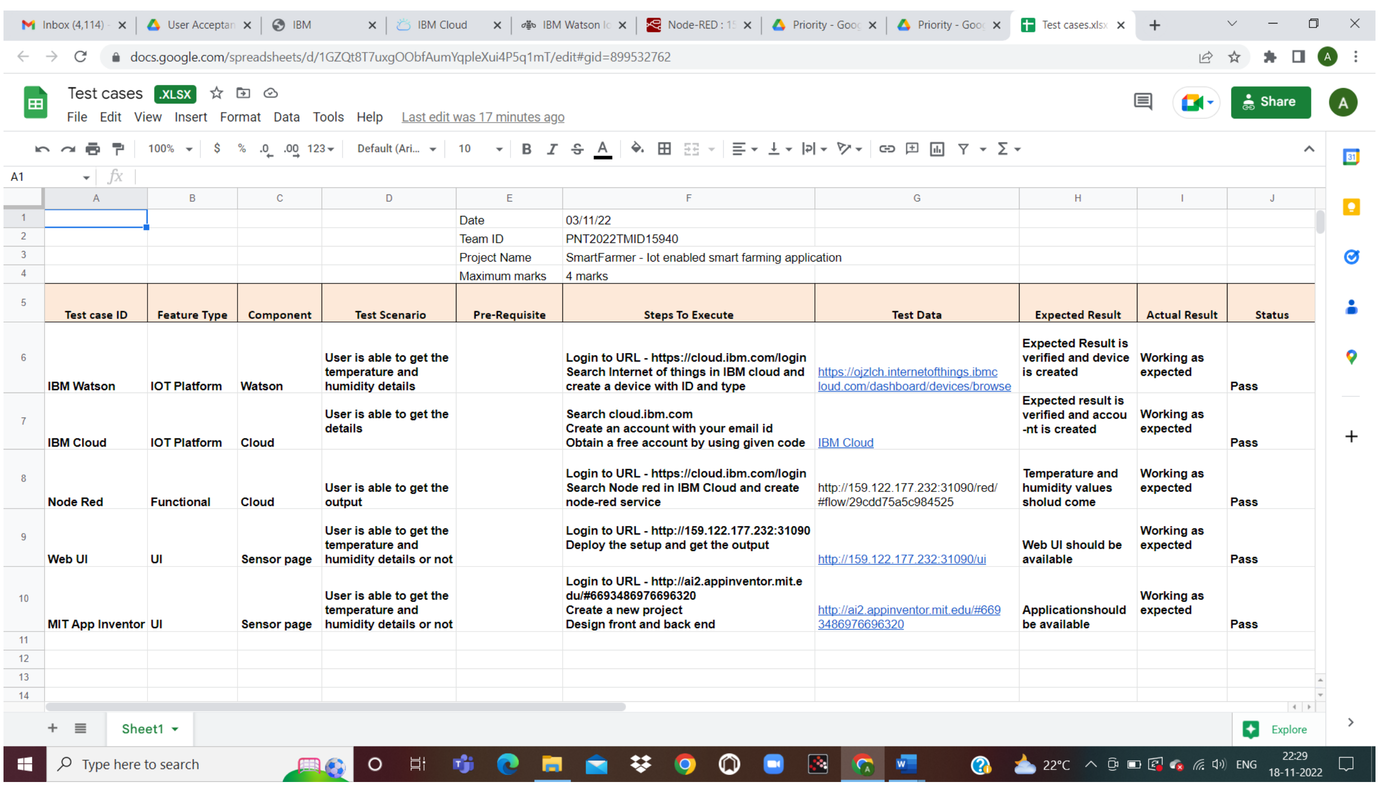
```
    deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-
    method": authMethod, "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
    #..............................................

except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an
    event of type "greeting" 10 times
deviceCli.connect()

while True:
      #Get Sensor Data from DHT11

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

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

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

      deviceCli.commandCallback = myCommandCallback

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

TESTING

TEST CASES



Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
IBM Watson	IOT Platform	Watson	User is able to get the temperature and humidity details		Login to URL - https://cloud.ibm.com/login Search Internet of things in IBM cloud and create a device with ID and type	https://ojzlch.internetofthings.ibmcloud.com/dashboard/devices/browse	Expected Result is verified and device is created	Working as expected	Pass	NIL	N	NIL	Arun kumar, Bharadwajaa
IBM Cloud	IOT Platform	Cloud	User is able to get the details		Search cloud.ibm.com Create an account with your email id Obtain a free account by using given code	IBM Cloud	Expected result is verified and accou-nt is created	Working as expected	Pass	NIL	N	NIL	Inbatamizhan, Naveen Kumar
Node Red	Functional	Cloud	User is able to get the output		Login to URL - https://cloud.ibm.com/login Search Node red in IBM Cloud and create node-red service	http://159.122.177.232:31090/red/#flow/29cdd75a5c984525	Temperature and humidity values sholud come	Working as expected	Pass	NIL	N	NIL	Arun kumar, Naveen Kumar
Web UI	UI	Sensor page	User is able to get the temperature and humidity details or not		Login to URL - http://159.122.177.232:31090 Deploy the setup and get the output	http://159.122.177.232:31090/ui	Web UI should be available	Working as expected	Pass	NIL	N	NIL	Inbatamizhan, Bharadwajaa
MIT App Inventor	UI	Sensor page	User is able to get the temperature and humidity details or not		Login to URL - http://ai2.appinventor.mit.edu/#6693486976696320 Create a new project Design front and back end	http://ai2.appinventor.mit.edu/#6693486976696320	Applicationshould be available	Working as expected	Pass	NIL	N	NIL	Inbatamizhan, Bharadwajaa



Date	03/11/22
Team ID	PNT2022TMID15940
Project Name	SmartFarmer - Iot enabled smart farming application
Maximum marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
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IBM Cloud	IOT Platform	Cloud	User is able to get the details		Search cloud.ibm.com Create an account with your email id Obtain a free account by using given code	IBM Cloud	Expected result is verified and accou-nt is created	Working as expected	Pass
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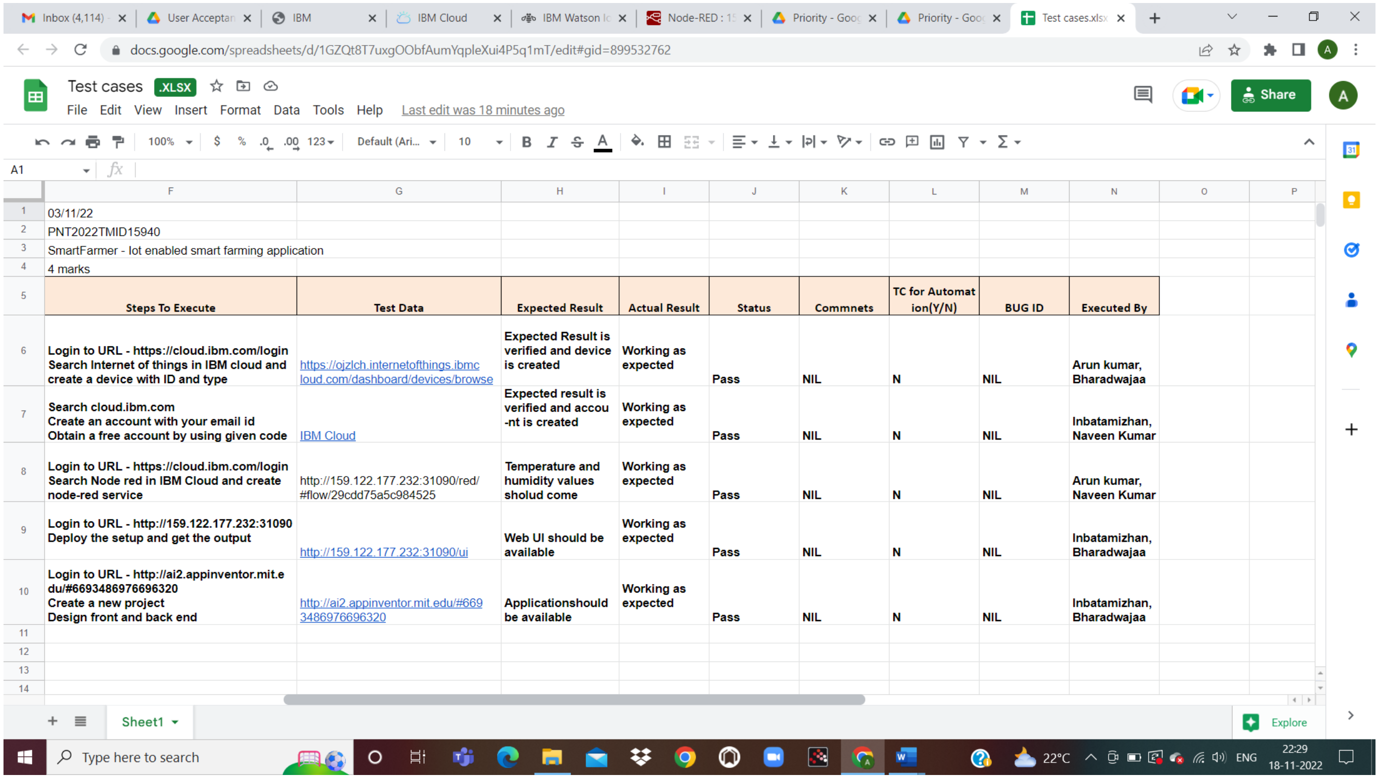

03/11/22
PNT2022TMID15940
SmartFarmer - Iot enabled smart farming application
4 marks

Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
Login to URL - https://cloud.ibm.com/login Search Internet of things in IBM cloud and create a device with ID and type	https://ojzlch.internetofthings.ibmcloud.com/dashboard/devices/browse	Expected Result is verified and device is created	Working as expected	Pass	NIL	N	NIL	Arun kumar, Bharadwajaa
Search cloud.ibm.com Create an account with your email id Obtain a free account by using given code	IBM Cloud	Expected result is verified and accou -nt is created	Working as expected	Pass	NIL	N	NIL	Inbatamizhan, Naveen Kumar
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TEST CASE EXCEL SHEET

https://docs.google.com/spreadsheets/d/1GZQt8T7uxgOObfAumYqpleXui4P5q1mT/edit?usp=share_link&ouid=113417365919541533386&rtpof=true&sd=true

TEST SCENARIOS

- To verify user is able to get details in Web UI
- To verify user is able to get details in MIT Inventor App

USER ACCEPTANCE TESTING

PURPOSE OF DOCUMENT

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Farmer – IOT enabled Smart Farming Application project at the time of the release to User Acceptance Testing (UAT).

DEFECT ANALYSIS

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By design	10	4	3	5	22
Web user interface	1	1	2	3	7
MIT Inventor Application	2	2	5	0	9
Fixed	10	0	0	0	10
Node red	5	0	0	1	6
IBM Watson IOT Platform	0	5	0	1	6
Won’t fix	0	0	1	2	3
Total	28	12	11	12	63

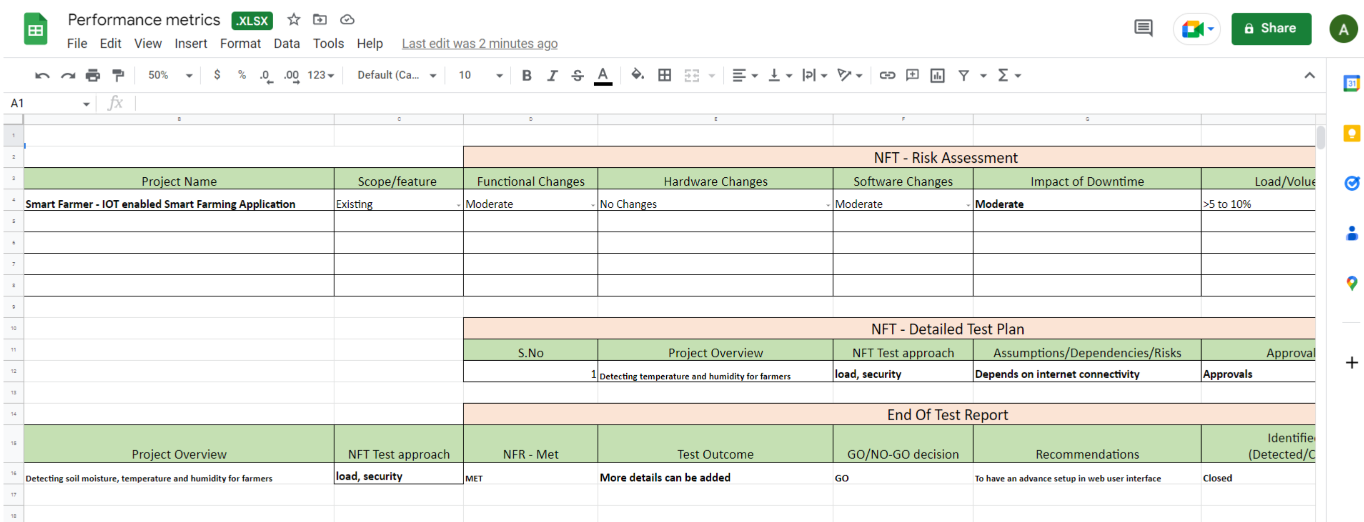
TEST CASE ANALYSIS

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Web User Interface	**7**	**0**	**0**	**7**
MIT Inventor App	**5**	**0**	**0**	**5**
Security	**8**	**0**	**0**	**8**
Node-RED	**6**	**0**	**0**	**6**
IBM Watson IOT Platform	**9**	**0**	**0**	**9**
Exception Reporting	**7**	**0**	**0**	**7**
Final Report Output	**5**	**0**	**0**	**5**

RESULTS

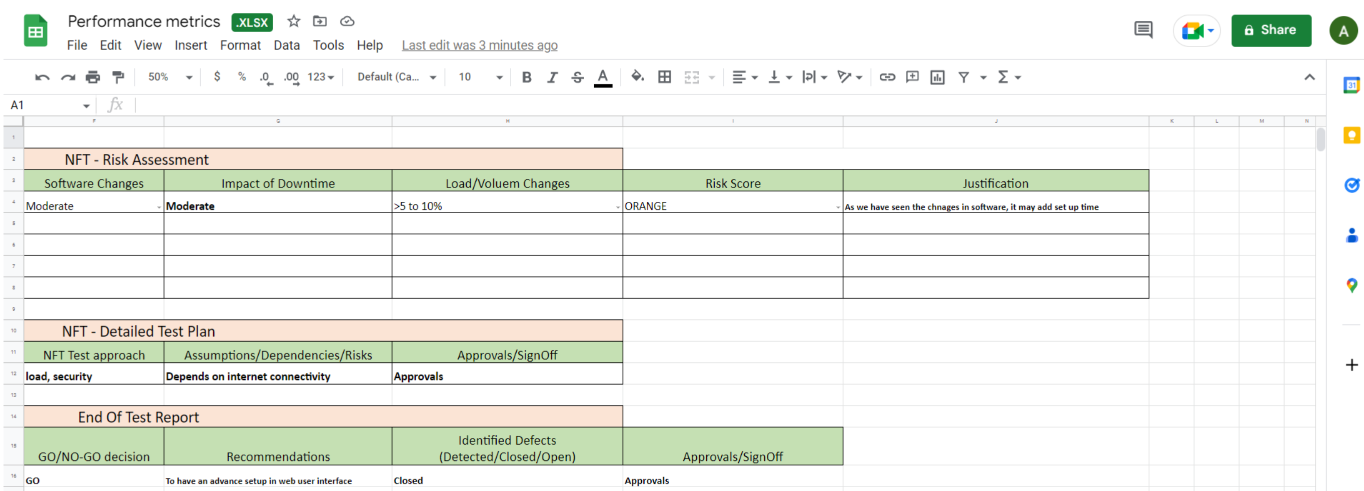
PERFORMANCE METRICS



NFT - Risk Assessment						
Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Volue
Smart Farmer - IOT enabled Smart Farming Application	Existing	Moderate	No Changes	Moderate	Moderate	>5 to 10%

NFT - Detailed Test Plan				
S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approval
1	Detecting temperature and humidity for farmers	load, security	Depends on internet connectivity	Approvals

End Of Test Report						
Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identifie (Detected/C
Detecting soil moisture, temperature and humidity for farmers	load, security	MET	More details can be added	GO	To have an advance setup in web user interface	Closed



NFT - Risk Assessment				
Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
Moderate	Moderate	>5 to 10%	ORANGE	As we have seen the chnages in software, it may add set up time

NFT - Detailed Test Plan		
NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff
load, security	Depends on internet connectivity	Approvals

End Of Test Report			
GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
GO	To have an advance setup in web user interface	Closed	Approvals

PERFORMANCE METRICS EXCEL SHEET

https://docs.google.com/spreadsheets/d/1LJ4raehmhkk4OC20D1iG6Qm7eGQaHiwa/edit?usp=share_link&ouid=113417365919541533386&rtpof=true&sd=true

ADVANTAGES & DISADVANTAGES

ADVANTAGES

Increased Production

- **Optimized crop treatment such as accurate planting, watering, pesticide application and harvesting directly affects production rates.**

Water Conservation

- **Weather predictions and soil moisture sensors allow for water use only when and where needed.**

Real-Time Data and Production Insight

- **Farmers can visualize production levels, soil moisture, sunlight intensity and more in real time and remotely to accelerate decision making process.**

Lowered Operation Costs

- **Automating processes in planting, treatment and harvesting can reduce resource consumption, human error and overall cost.**

Increased Quality of Production

- **Analyzing production quality and results in correlation to treatment can teach farmers to adjust processes to increase quality of the product.**

Accurate Farm and Field Evaluation

- **Accurately tracking production rates by field over time allows for detailed predicting of future crop yield and value of a farm.**

Improved Livestock Farming

- **Sensors and machines can be used to detect reproduction and health events earlier in animals. Geofencing location tracking can also improve livestock monitoring and management.**

Reduced Environmental Footprint

- **All conservation efforts such as water usage and increased production per land unit directly affect the environmental footprint positively.**

Remote Monitoring

- **Local and commercial farmers can monitor multiple fields in multiple locations around the globe from an internet connection. Decisions can be made in real-time and from anywhere.**

Equipment Monitoring

- **Farming equipment can be monitored and maintained according to production rates, labour effectiveness and failure prediction.**

- **The Internet of Things has truly enhanced many industries by providing data collection, real-time insight and process automation through low cost sensors and IoT platform implementation. As seen in the above benefits, the farming and agriculture industry overall can really benefit from implementation of such an IoT solution or platform. Not only is a smart agriculture solution the innovative farming method of today, it is the key solution to the growing concern of the global population's food consumption and environmental footprint.**

Real-time Analysis of Soil Demand

- **The Internet of Things provides precision technology for more sustainable and productive farming processes. Accurate soil data is one of the most valuable resources for farmers to grow quality crops. Also, IoT facilitates the farmers with advanced techniques on sowing the seeds along with informative insights on the weather forecast, required water content in the soil, appropriate temperature, and humidity. All this is performed in real-time and analyzed to ensure farm productivity. Such processes come under precision agriculture, enabling smart measures to improve farming efficiency in all aspects. The advancing technology provides a complete package to analyze the soil quality and suggest farming options to the farmers.**

DISADVANTAGES

Challenges in Using Smart Technologies in Farming

- **The use of technology in farming and agriculture making it smart agriculture, is of course, a good initiative and a much-needed one with the present increasing demand in the food supply.**
- **But there is the chance where smart farming will require certain skill sets in particular in order to understand and operate the equipment.**
- **In the case of equipment like robots and computer-based intelligence for running the devices, it is highly unlikely that a normal farmer will be able to possess this knowledge or even develop them.**
- **Farmers are not used to these high-end technologies. They do not understand computer language or the artificial intelligence.**
- **For the smart agriculture, Internet of Things is essential which will require artificial intelligence and computer-based intelligence. This cannot be balanced here.**
- **To overcome this challenge, the devices will have to be changed in a dramatic fashion so as to make it understandable for farmers.**
- **This also means that the devices should be somewhere in between where the technology experts and farmers can both communicate about it.**
- **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.**

Cost Involved in Smart Agriculture

- **While the use of smart technology in agriculture is impressive, it does incur a lot of costs.**
- **As said earlier, if the devices are to be altered according to the level of the farmers, it will involve a lot of money to transform these types of equipment.**
- **This, on the other hand, means that the process will cost huge money.**

- **Since the farming industry does not see higher profits, huge investments in this space are unlikely.**
- **Even after the altering of machines, there are chances where the farmers might tend to operate the machines wrongly causing it to damage or send it to repair.**
- **Since these pieces of equipment are already costly, repairing it or replacing it will again cost a lot of money.**
- **The cost of maintenance becomes high whether there is a repair or not.**

There could be wrong Analysis of Weather Conditions

- **In the case of agriculture, most of the process is dependent on weather conditions.**
- **It is a natural phenomenon which in spite of the updated technology can become unpredictable.**
- **There is no force which can change or control the weather conditions such as rain, sunlight, drought etc.**
- **Even when the smart systems are in place, the importance of natural occurrences cannot be changed.**
- **There is an issue where the machines used in smart agriculture can impact the environment in a negative manner.**
- **Since technology involves a lot of machines, there are chances where the data might get wrong at times.**
- **If there are faulty data processing equipment or sensors then it will lead to the situation where the wrong decisions are taken.**
- **This will lead to the overuse of resources like fertilizers or water.**
- **It might even lead to the over-application of fertilizers or pesticides on crops.**
- **This excessive use of chemicals might destroy the crop and reduce the richness of the land.**

CONCLUSION

Agriculture offers an opportunity to improve the lives of millions of food-insecure people and help countriesdevelop economies that create jobs and raise incomes. Smart farming stands as an opportunity to improve the livelihood of farmers and rural people. Farmers can benefit greatly from an IoT-based smart agriculture system. As a result ofthe lack of 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 irrigation or not to do.

FUTURE SCOPE

- **In the current project we have implemented the project that can protect and maintain 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 onetime 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 issue.**
- **We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts.**

APPENDIX

SOURCE CODE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "ojzlch"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

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

try:

     deviceOptions = {"org": organization, "type": deviceType, "id":
    deviceId, "auth-method": authMethod, "auth-token": authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)
    #..............................................
```

```
except Exception as e:
    print("Caught exception connecting device: %s" % str(e))
    sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud
    as an event of type "greeting" 10 times
deviceCli.connect()

while True:
      #Get Sensor Data from DHT11

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

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

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

      deviceCli.commandCallback = myCommandCallback

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

smart.py - C:\Users\Arun kumar\AppData\Local\Programs\Python\Python37\smart.py (3.7.0)

File Edit Format Run Options Window Help

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

#Provide your IBM Watson Device Credentials
organization = "ojzlch"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
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        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 even
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

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

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

Ln: 1 Col: 0

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

```
>>>
 RESTART: C:\Users\Arun kumar\AppData\Local\Programs\Python\Python37\smart.py
2022-11-19 01:08:18,425   ibmiotf.device.Client      INFO    Connected successfu
lly: d:ojzlch:abcd:12345
Published Temperature = 93 C Humidity = 82 % to IBM Watson
Published Temperature = 101 C Humidity = 68 % to IBM Watson
Published Temperature = 105 C Humidity = 72 % to IBM Watson
Published Temperature = 106 C Humidity = 98 % to IBM Watson
Published Temperature = 105 C Humidity = 61 % to IBM Watson
Published Temperature = 110 C Humidity = 79 % to IBM Watson
Published Temperature = 110 C Humidity = 87 % to IBM Watson
Published Temperature = 99 C Humidity = 78 % to IBM Watson
Published Temperature = 96 C Humidity = 77 % to IBM Watson
Published Temperature = 91 C Humidity = 94 % to IBM Watson
Published Temperature = 110 C Humidity = 95 % to IBM Watson
Published Temperature = 101 C Humidity = 61 % to IBM Watson
Published Temperature = 102 C Humidity = 94 % to IBM Watson
Published Temperature = 101 C Humidity = 93 % to IBM Watson
Published Temperature = 95 C Humidity = 61 % to IBM Watson
Published Temperature = 105 C Humidity = 62 % to IBM Watson
Published Temperature = 103 C Humidity = 77 % to IBM Watson
Published Temperature = 102 C Humidity = 94 % to IBM Watson
Published Temperature = 109 C Humidity = 91 % to IBM Watson
Published Temperature = 99 C Humidity = 76 % to IBM Watson
Published Temperature = 105 C Humidity = 86 % to IBM Watson
Published Temperature = 94 C Humidity = 68 % to IBM Watson
Published Temperature = 106 C Humidity = 98 % to IBM Watson
Published Temperature = 107 C Humidity = 65 % to IBM Watson
Published Temperature = 105 C Humidity = 76 % to IBM Watson
Published Temperature = 98 C Humidity = 100 % to IBM Watson
Published Temperature = 95 C Humidity = 67 % to IBM Watson
Published Temperature = 100 C Humidity = 61 % to IBM Watson
Published Temperature = 102 C Humidity = 81 % to IBM Watson
Published Temperature = 90 C Humidity = 62 % to IBM Watson
Published Temperature = 93 C Humidity = 74 % to IBM Watson
Published Temperature = 107 C Humidity = 63 % to IBM Watson
Published Temperature = 103 C Humidity = 79 % to IBM Watson
Published Temperature = 105 C Humidity = 93 % to IBM Watson
Published Temperature = 105 C Humidity = 67 % to IBM Watson
Published Temperature = 98 C Humidity = 62 % to IBM Watson
Published Temperature = 91 C Humidity = 76 % to IBM Watson
Published Temperature = 91 C Humidity = 75 % to IBM Watson
Published Temperature = 110 C Humidity = 98 % to IBM Watson
Published Temperature = 101 C Humidity = 79 % to IBM Watson
Published Temperature = 90 C Humidity = 86 % to IBM Watson
Published Temperature = 99 C Humidity = 64 % to IBM Watson
```

GITHUB LINK

IBM-Project-33440-1660221104

PROJECT DEMO LINK

https://drive.google.com/file/d/19tFSFnc6CXXZ4p6QGAunS1ZDs37O2w-3/view?usp=share_link