Smart Farmer - IoT Enabled Smart Farming Application

Team ID PNT2022TMID54368

INTRODUCTION

OVERVIEW:

The farmer may monitor several field characteristics, such as soil moisture, temperature,and humidity, using an IoT-based agriculture system.Even when the farmer is far from his field, he or she can use a web or mobile application to monitor all the sensor parameters. One of the crucial tasks for farmers is to water the crops.By keeping an eye on the sensor parameters and managing the motor pumps from the mobile application itself, they may decide whether to water the crop or delay it.

PURPOSE:

With smart sensors that monitor every aspect of everyday work automatically, IoT technology for agriculture allows farmers to automate real-time data collection to increase

production volumes, reduce costs an
manage expenses and improve overall efficiency in many different aspects of agriculture.

- ## LITERATURE SURVEY

EXISTING PROBLEM

Cope with climate change, soil erosion and biodiversity loss
Invest in farm productivity
Adopt and learn new technologies

REFERENCES

[1] Prathibha S., Hongal A., and Jyothi M. (2017). IOT Based Monitoring System in Smart Agriculture. 2017 International Conference on Recent Advances in Electronics And Communication Technology (ICRAECT). doi: 10.1109/icraect.2017.52.

[2] Lahande P., and Mathpathi D. (2018). IOT Based Smart Irrigation System. International Journal of Trend in Scientific Research and Development Volume-2(Issue-5), pp. 359-362. doi: 10.31142/ijtsrd15827.

[3] Alipio M., Dela Cruz A., Doria J., and Fruto R. (2019). On the design of Nutrient Film Technique hydroponics farm for smart agriculture. Engineering in Agriculture, Environment and Food, 12(3), pp.315- 324. doi: 10.1016/j.eaef.2019.02.008.

[4] Benyezza H., Bouhedda M., Djellout K., and Saidi A. (2018). Smart Irrigation System Based Thingspeak and Arduino. International Conference on Applied Smart Systems (ICASS). doi: 10.1109/icass.2018.8651993.

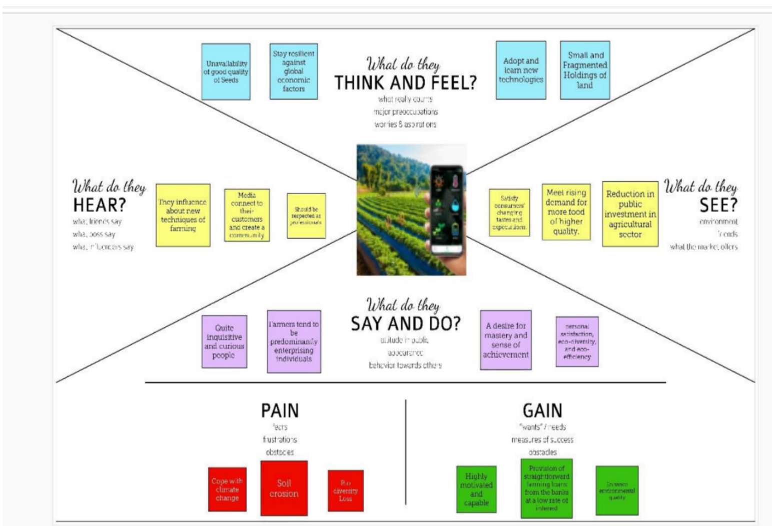
[5] Kiani F., and Seyyedabbasi A. (2018). Wireless Sensor Network and Internet of Things in Precision Agriculture. International Journal of Advanced Computer Science and Applications, 9(6). doi: 10.14569/ijacsa.2018.090614.

PROBLEM STATEMENT

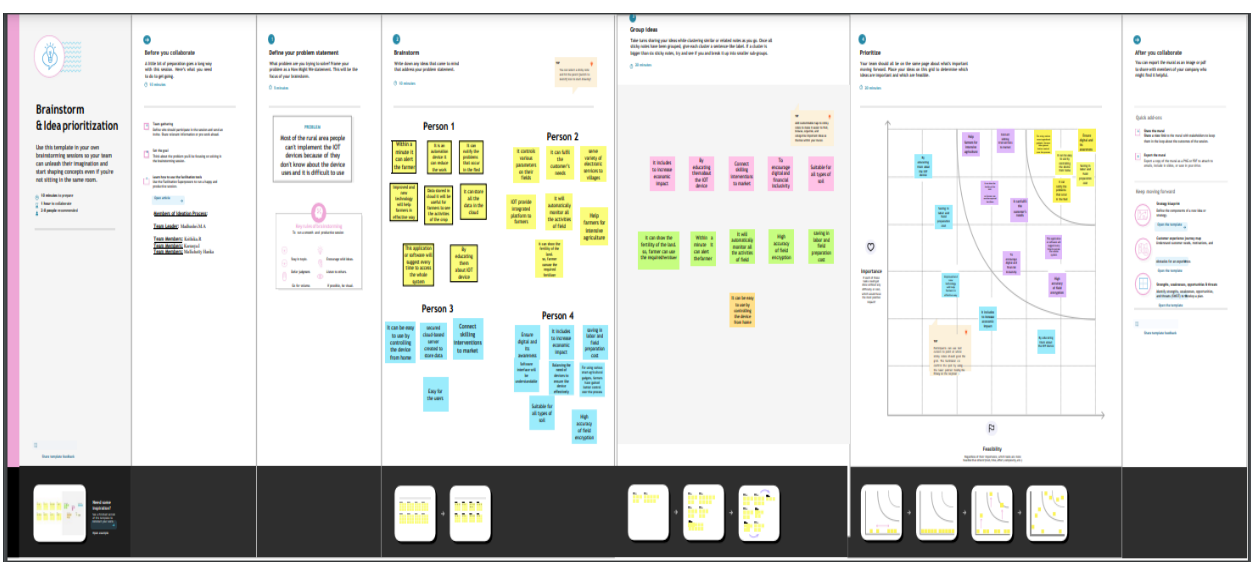
To create an effective decision-making web using a wireless sensor network that can manage various agricultural activities and deliver relevant farm-related information information pertaining to temperature, humidity, and soil moisture.The weather is to blame for the rising water level. There are many distractions for farmers, which is bad for agriculture.Farmers use that smartphone application to regulate water levels in both Automatic and Manual modes. It will make farming easier.Agriculture takes a huge amount of time to complete.

- ## IDEATION & PROPOSED SOLUTION

EMAPTHY MAP



IDEATION AND BRAINSTORMING



PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	● Watering the field is a difficult process, Farmers haveto wait in the field until the water covers the whole farm field. ● Power Supply is also one of the problems. In Village Side, the power supply may vary. ● The Biggest Challenges Faced by IoT in the Agricultural Sectorare Lack of Information, High Adoption, Cost and Security Concerns, etc
2.	Idea / Solution description	● As is the case of precision Agriculture Smart Farming Technique Enables Farmers betterto monitor the fields and maintain the humidity level accordingly. ● The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitablecrops.
3.	Novelty / Uniqueness	**ALERT MESSAGE** – IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT backhaul devices. **REMOTE ACCESS –** It helps the farmer to operate the motor from anywhere.

4.	Scalability of the Solution	Scalability in smart farming refers to the adaptability of a system to increase the capacity, for example, the number of technology devices such as sensors and actuators, while enabling timely analysis.

PROBLEM SOLUTION FIT


Define CS, fit into CC

1. Customer Segment(S) CS

Who is your customer?
i.e. working parents of 0-5 y.o. kids

The customer for this product is a farmer who grows crops. Our goal is to help them, monitor field parameters remotely. This product saves agriculture from extinction.

6. Customer CC

What constraints prevent your customers from taking action or limit their choices of solutions?
i.e. spending power, budget, no cash, network connection,

Using many sensors is difficult. An unlimited or continuous internet connection is required for success.

5. AVAILABLE SOLUTIONS A

Which solutions are available to the customers when they face the problem. or need to get the job done? What have they tried in the past? What pros & cons

The irrigation process is automated using IoT. Meteorological data and field parameters were collected and processed to automate the irrigation process. Disadvantages are efficiency only over short distances, and difficult data storage.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

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

customers? There could be more than one; explore

The purpose of this product is to use sensors to acquire various field parameters and process them using a central processing system. The cloud is used to store and transmit data using IoT. The Weather API is used to help farmers make decisions. Farmers can make decisions through mobile applications.

9.PROBLEM ROOT CAUSE

What is the real reason that this problem exists?
What is the back story behind the need to do

Frequent changes and unpredictableweather and climate made it difficult for farmers to engage in agriculture. These factors play an important role in deciding whether to water your plants. Fields are difficult to monitor when the farmer is not at the field, leading to crop damage.

7. BEHAVIOUR

What does your customer do to address the problem and get the job done?
i.e. Directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated:

Use a proper drainage system to overcome the effects of excess water from heavy rain. Use of hybrid plants that are resistant to pests.

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- **REQUIREMENT ANALYSIS:**

FUNCTIONAL REQUIREMENT

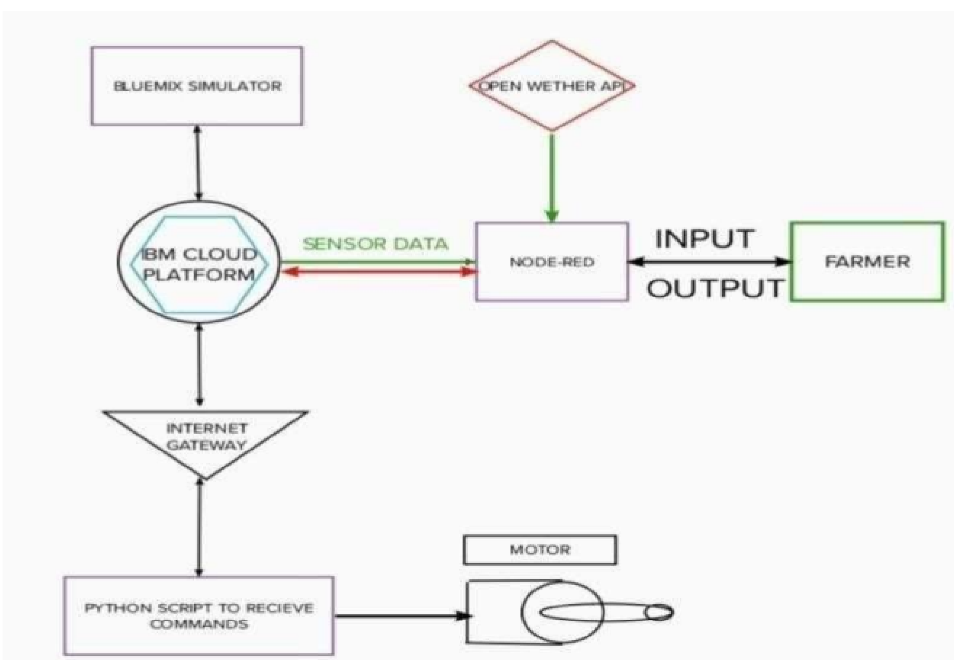
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	EMAIL: Enter email address PASSWORD: Enter password
FR-2	User Confirmation	Confirmation via Email. Thanks for your email.
FR-3	Log in to system	Serve authenticated content
FR-4	Manage Modules	Manage System Admins Manage Roles of User Manage User permission
FR-5	Check whether condition	Temperature monitoring status Humidity monitoring Status
FR-6	Log out	Exit

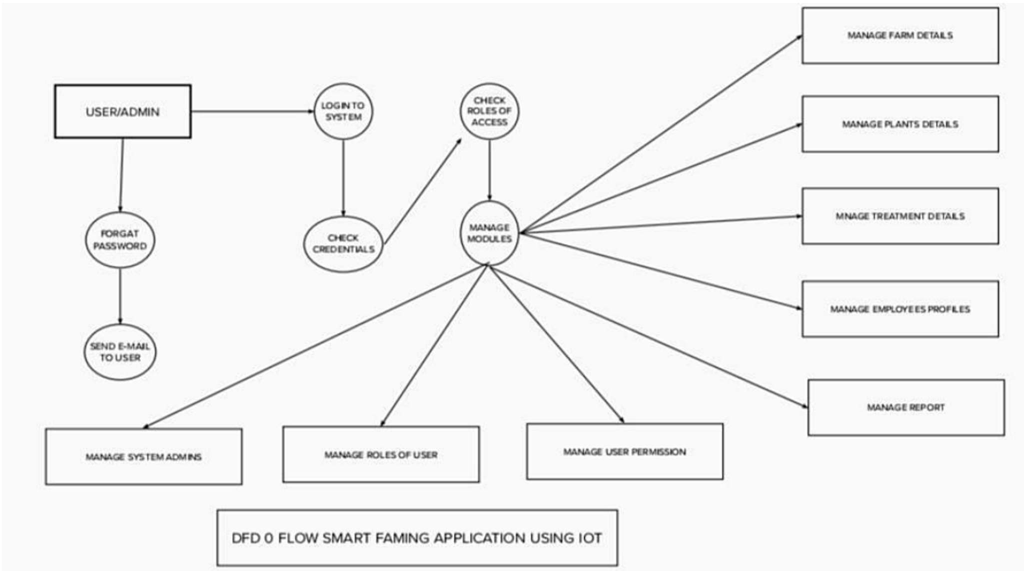
NON-FUNCTIONAL REQUIREMENT

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usability includes easy understanding and learn ability, efficiency in use,remember ability, lack of errors in operation and subjective pleasure.
NFR-2	**Security**	Sensitive and private data must be protected from their production until the decision-making and storage stages.
NFR-3	**Reliability**	The shared protection achieves a better trade-off between costs and reliability. The model uses dedicated and shared protection schemes to avoid farm service outages.

NFR-4	**Performance**	The idea of implementing integrated sensors with sensing soil and environmental parametersin 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 affect system scalability,real time decision-making is feasible in an environment composed of dozens of thousand.

- **PROJECT DESIGN**





- The various soil parameters, including temperature, moisture content, and humidity, are measured using various sensors, and the results are saved in the IBM cloud.
- Arduino UNO is utilized as a processing unit to process the data gathered from the sensors and weather API data.
- The hardware, software, and APIs are written using NODE-RED as a programming language. For communication, the MQTT protocol is used.
- A mobile application created with MIT App Inventor makes all the collected data available to the user. Depending on the sensor results, a user could choose whether or not to water a crop using an app. They can control the motor switch from a distance using the app.

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 confirming my password.	I can access my account/ dashboard	High	Sprint-1
	Permission	USN-2	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-1

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 credentials	USN-4	As a user, I can register for the application through mobile application	Temperature and Humidity details	Medium	Sprint-1
	Dashboard	USN-5	As a user can view the dashboard and this dashboard include the check roles of access and then move to the manage modules.	I can view the dashboard in this smart farming application system.	Medium	Sprint-1
Customer care Executive	MIT app	USN-6	To make the user to interact with the software.	Database to store in cloud services.	High	Sprint-1
Administrator	IOT devices	USN-7	As a user once view the manage modules this describes the manage system admins and Manage Roles of user and etc..,		Medium	Sprint-1
	Log out	USN-8	Exit	Sign out	High	Sprint-1

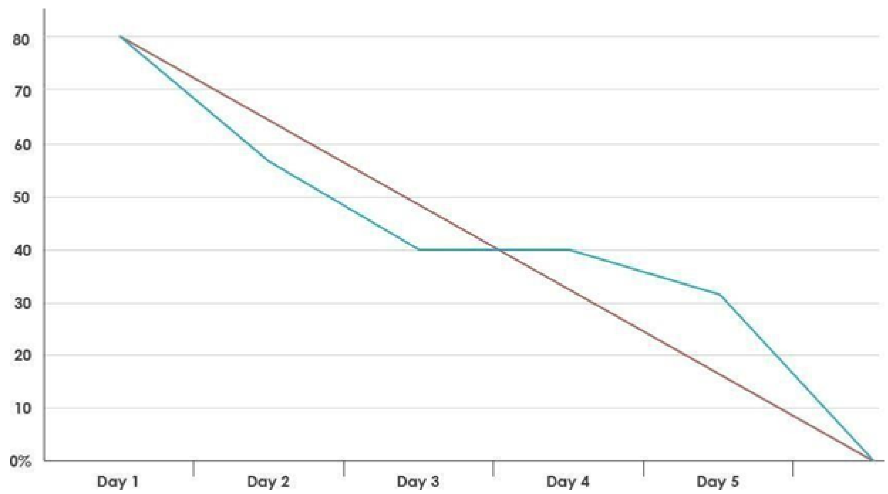
- **PROJECT PLANNING & SCHEDULING**

Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Story Points	Priority	Team Member
Sprint-1	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Manjari M(Leader)
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Mahalaxmi G(Member2)

Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	Nithiyashree S(Member 3)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	Pratheeksha G (Member 4)
Sprint-3	Registration (Farmer -Web User)	USN - 1	As a user, I can log into the application by entering email and password	3	High	Ponlatha M(Member 5)
Sprint - 2	Login	USN - 2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	High	Manjari M(Leader)
Sprint - 4	Web UI	USN - 3	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	Mahalaxmi G (Member2)
Sprint - 1	Registration (Chemical Manufacturer - Web user)	USN - 1	As a new user, I want to first register using my organization email and create a password for the account.	2	High	Nithiyashree S(Member 3)

Sprint - 4	Login	USN - 2	As a registered user, I need to easily log in using the registered account via the web page.	3	High	Pratheeksha N (Member 4)
Sprint - 3	Web UI	USN - 3	As a user, I need to have a userfriendly interface to easily view and access the resources.	3	Medium	Ponlatha M(Member 5)
Sprint - 1	Registration (Chemical Manufacturer - Mobile User)	USN - 1	As a user, I want to first register using my email and create a password for the account.	1	High	Manjari M(Leader)
Sprint - 1	Login	USN - 2	As a registered user, I need to easily log in to the application.	2	Low	Mahalaxmi G(Member2)

BURNDOWN CHART



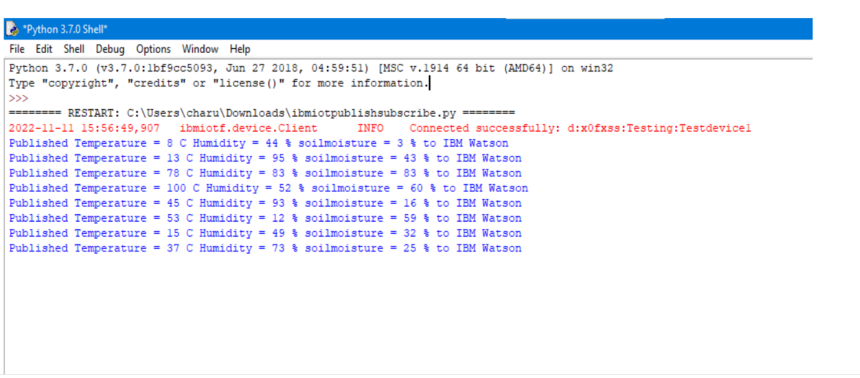
- ## CODING & SOLUTIONING:

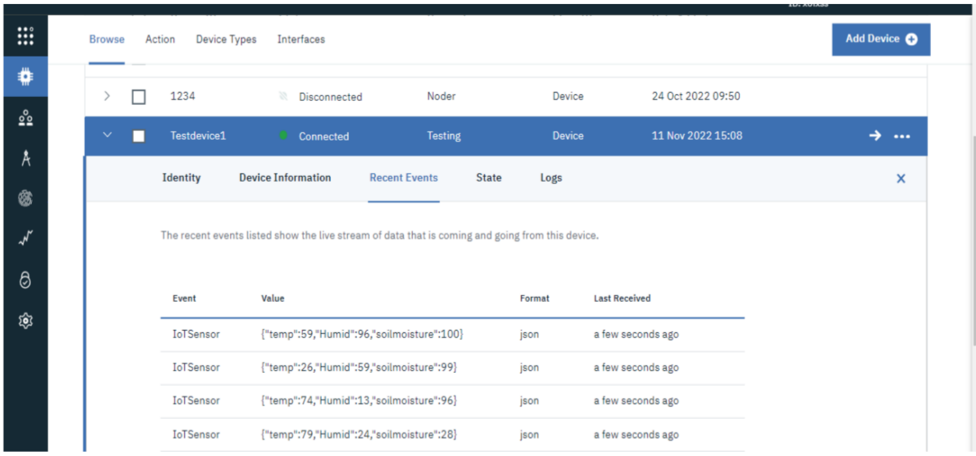
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
organization = "x0fxss"
deviceType = "Testing" deviceId = "Testdevice1"
authMethod = "token"
authToken = "123456789"
def myCommandCallback(cmd):
print ("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
 if status=="motoron":
   print ("motor is on")
elif status == "motoroff" :
   print ("motor is off")
elif status == "motor30" :
```

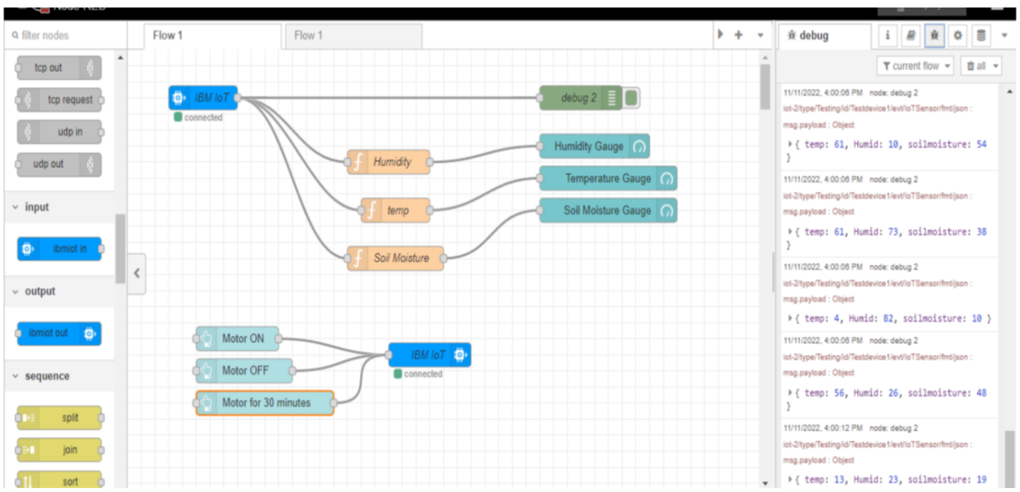
```
  print ("motor is on for 30 minutes")
try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method":
authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
except Exception as e:
 print("Caught exception connecting device: %s" % str(e))
sys.exit()
deviceCli.connect()
while True:
temp=random.randint(0,100)
Humid=random.randint(0,100)
soilmoisture=random.randint(0,100)
data = { 'temp' : temp, 'Humid': Humid, 'soilmoisture': soilmoisture }

def myOnPublishCallback():
  print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid,
"soilmoisture = %s %%" %soilmoisture, "to IBM Watson")
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
 if not success:
  print("Not connected to IoTF")
 time.sleep(5)
deviceCli.commandCallback = myCommandCallback
deviceCli.disconnect()
```

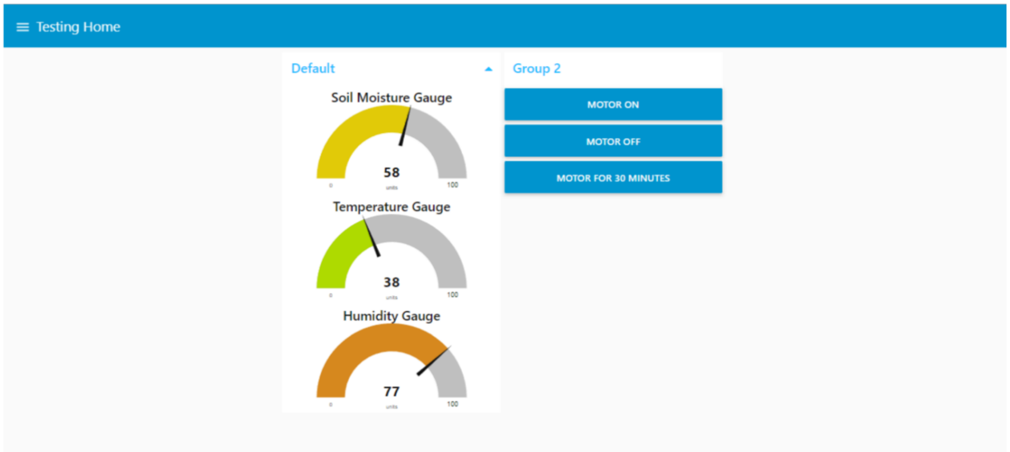
OUTPUT & SOLUTIONING:








```
Published Temperature = 25 C Humidity = 32 % soilmoisture = 86 % to IBM Watson
Published Temperature = 27 C Humidity = 16 % soilmoisture = 26 % to IBM Watson
Command received: motoron
motor is on
Command received: motoron
motor is on
Published Temperature = 10 C Humidity = 69 % soilmoisture = 82 % to IBM Watson
Published Temperature = 75 C Humidity = 37 % soilmoisture = 2 % to IBM Watson
Published Temperature = 63 C Humidity = 59 % soilmoisture = 11 % to IBM Watson
Published Temperature = 31 C Humidity = 20 % soilmoisture = 43 % to IBM Watson
Published Temperature = 47 C Humidity = 38 % soilmoisture = 95 % to IBM Watson
Published Temperature = 62 C Humidity = 5 % soilmoisture = 93 % to IBM Watson
Command received: motoroff
motor is off
Command received: motor30
motor is on for 30 minutes
Published Temperature = 19 C Humidity = 99 % soilmoisture = 96 % to IBM Watson
Published Temperature = 6 C Humidity = 56 % soilmoisture = 85 % to IBM Watson
```



- **TESTING**

SECTION	**TOTAL CASES**	**NOT TESTED**	**FAIL**	**PASS**
Overallprocess	4	0	0	4
client side	30	0	0	30
Security and user information protection	3	0	0	3
outsoarce shipping	3	0	0	3
exception reporting	3	0	0	3
report output	5	0	0	5
version control and updation	2	0	0	2
Adaptation	2	0	0	2

USER ACCEPTANCE TESTING

SECTION	SATISFIED	DISSATISFIED	NO COMMENTS	SCORE
user easiness	7	1	2	10
reliability	8	1	1	10
security	8	2	0	10

availability	3	2	5	10
performance	9	0	1	10
scalability	5	2	3	10
adaption	4	2	4	10

- **RESULTS**

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

It is a high-tech system to grow crop cleanly and sustainably for the masses. It is the application of modern Information and Communication Technologies in agriculture.Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automation of irrigation systems. Further with the help of these sensors, farmers can monitor the field conditions from anywhere. Internet of Things based Advanced Farming is highly efficient when compared with the conventional approach. The applications of intelligent Agriculture solutions not only targets conventional, large farming. With operations, but could also be new levers to uplift other growing or common trends in agricultural like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of specific or high-quality varieties, etc.), and enhance highly transparent Farming.

- **ADAVANTAGES**

They help in intelligent data collection.Farmers can visualize production levels, soil moisture, sunlight intensity and more in real time and remotely to accelerate decision making process.They help in reducing the waste.Weather predictions and soil moisture sensors allow for water use only when and where needed.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.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.

- **DISADVANTAGES**

The biggest challenges faced by IoT in the agricultural sector are lack of information, high adoption costs, and security concerns. Most of the farmers are not aware of the implementation of IoT in agriculture. Major problem is that some of them are opposed to new ideas and they do not want to adopt even if it provides numerous benefits. Farms are located in remote areas and are far from access to the internet. A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.Automated machinery cost more than manually operated machinery as they include cost for farm management software and cloud access to record data.

- **CONCLUSION**

Smart farming reduces the ecological footprint of farming. Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases.Thus, the IoT agricultural applications are making it possible for ranchers and farmers to collect meaningful data. Large landowners and small farmers must understand the potential of IoT market for agriculture by installing smart technologies to increase and sustainability in their productions. With the population growing rapidly, the demand can be successfully met if the ranchers, as well as small farmers, implement agricultural IoT solutions in a prosperous manner.

- **FUTURE SCOPE**

Data analytics can be used to analyze climate, animal, and crop conditions. As a result, data analytics allows for better decision-making through technological advances. Through collecting data from sensors using IoT devices, we will learn about the real-time state of your crops.The future of IoT in agriculture allows predictive analytics to help you make better harvesting decisions. Pattern forecasting can be used by farmers to predict weather patterns and crop harvesting. IoT has helped farmers maintain the quality of their crop production and soil fertility. This has increased product quality and volume.

- **APPENDIX**

demo videolink:https://drive.google.com/file/d/1-Li5hDTwtgf7VDu3Le0iuaAqhVG-8yGb/view?usp=share_link