PROJECT REPORT

ProjectName: SMART FARMER-IOT ENABLED SMART FARMING APPLICATION.

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Team:

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ProjectReportFormat

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SMARTFARMING

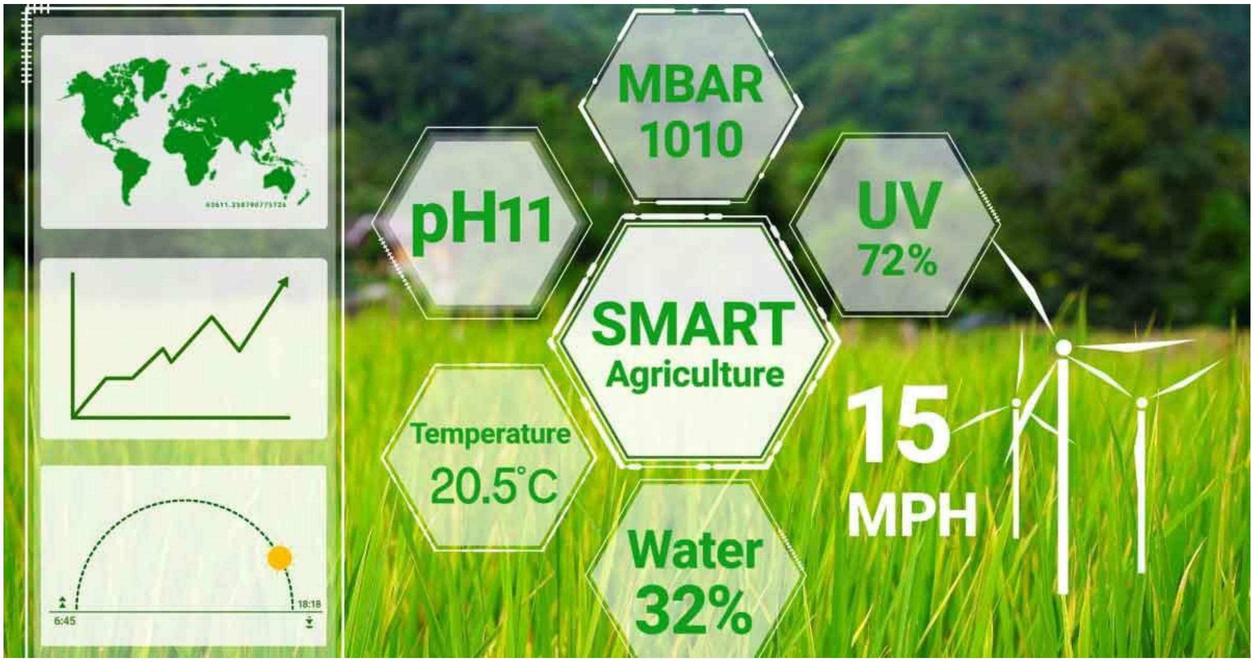
1.INTRODUCTION:

PROJECTOVERVIEW:

This is system that enables framers to monitor and their forms with a web-basedapplicationbuildwithNode-RED.Theabilitytotraceanomaliesincrop growth or livestock health, for instance, helps eliminate the risk of losing yields.

PURPOSE:

SmartFarmingreducetheecologicalfoodprintoffarming.Minimizedorsite-specific application of inputs, such as fertilizers and pesticides, in precision agriculturesystemswillmitigateleachingproblemsaswellastheemissionof greenhouse gases.



2.LITERATUREREVIEW

2.1 EXISTINGPROBLEM:

S.NO	PROJECT TITLE	YEAR OF PUBLISHING	PROPOSED WORK	COMPONENT USED	TECHNOLOGY
1	Smart Farming: IoT Based Smart Sensors Agriculture Stick for Live Temperature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology	2021	Novel Smart IoT based Agriculture Stick assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to do smart farming and increase their overall yield and quality of products.	Soil moisture sensor, Temperature sensor, solar plate , battery	Arduino mega Nodemcu
2	Smart Agriculture Using Iot	2020	Development of a system which can monitor temperature, level of water, moisture and even the movement if any happens in the field which may destroy the crops in agricultural field through sensors using Arduino UNO board	Soil Moisture Sensor, Water level Sensor , Buzzer	Arduino Uno
3	Smart Farming using IoT, a solution for optimally monitoring farming conditions	2019	The product will assist farmers by getting live data (Temperature, humidity, soil moisture, UV index, IR) from the farmland to take necessary steps to enable them to do smart farming by also increasing their crop yields and saving resources (water, fertilizers).	DHT11 Temperature Humidity Sensor , Soil Moisture Sensor ,SI1145 Digital UV Index IR Visible Light Sensor	ESP32
4	Smart Farming Using Iot	2020	The proposed system can forecast weather data, switching ON the pump motor and switch ON the bulb for artificial light due to less light intensity, for farms acknowledging the dampness of soil of moisture levels. The IR sensor detects the pest and humans by their temperature; the sensors are interfaced to process module Arduino-UNO. The Smart agriculture system can be operated from anywhere with the help of networking technology.	Soil moisture sensor, IR sensor	Arduino UNO

2.2REFERENCES:

1)ShradhaVerma,AnshulBhatia,AnuradhaChugandAmitPrakashSingh,“Recent Advancements in Multimedia Big Data Computing for IoT Applications in Precision Agriculture: Opportunities”, Multimedia Big Data Computing for IoT Applications:Concepts,ParadigmsandSolutions,Volume163,SpringerNature Singapore Pte Ltd. 2020

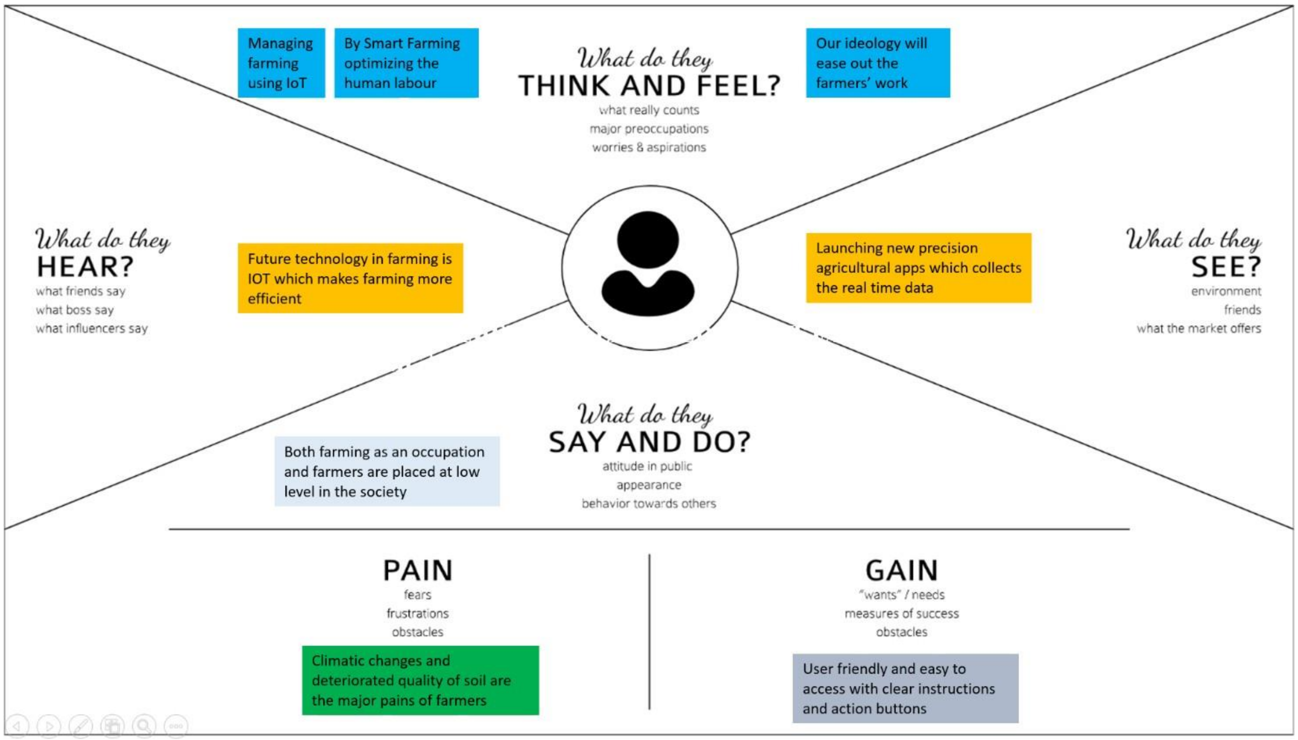
2)Cloud and IoT based smart architecture for desalination water treatment: Mohammed Alshehri, Ph.D., Akashdeep Bhardwaj, Manoj Kumar, Ph.D., Shailendra Mishra,Jaya dev Gyani https://doi.org/10.1016/j.envres.2021.110812/ Â© 2021 Elsevier Inc. All rights reserved.

2.3 PROBLEMSTATEMENTDEFINITION:

Todetectthemoisturelevelsinthesoilandautomaticallygiveappropriate water supply to the fields without the intervention of the farmer

3. IDEATION&PROPOSEDSOLUTION:

3.1EMPATHYMAPCANVAS



3.2IDEATION&BRAINSTORMING:

Our objective is to design a IoT Enabled Smart Farming Application which generates messages on different platforms to notify farmers. Our product will assist farmers by obtaining the Realtime data from the farmland to take necessary steps during unfavorable conditions. Ourproposed product uses NodeMCU,DHT11TemperatureandHumiditySensor,SoilMoistureSensor, Relay Coil, AC Motor Pump, Buzzer. Farmers can monitor all the sensor parametersbyusingaweb/mobileapplication/dashboardevenifthefarmer 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 control the motor pumps from the mobile application itself.

GROUPIDEAS:

- TemperatureandHumiditysensortodetectthetemperatureandhumidityof the soil
- Moisturesensortodetectmoisturecontentofsoil
- Triggerthemotortopumpwaterifthresholdofmoisturesensorislow, through the website
- Usingabuzzertogiveanalarmingsoundtoindicatedanger
- Connecting NodeMCU and IBM Watson cloud to reflectreal time valuesin dashboard that is the cloud
- SendSMSduringemergency

PRIORITIES:

- Interfacingallthesensorswiththemicrocontroller
- Controllingthewaterpump
- Produceanalarmingsoundduringemergency

3.3PROPOSED SOLUTION

Theprojectpresentstheuseofsoilmoisturesensorswhichhelpstoeaseout the difficulty to monitor and keep record about the changes in soil moisture. UsingtheNodeMcuwithamoisturesensor,temperatureandhumiditysensor, soil condition is measured and analyzed. The sensors provide information relatedtothemoisturestatusofthesoil.TheNodeMcuwillcollectandprocess the data received from the Sensors and send it to the IBM Cloud platform. When a threshold moisture level of the soil is reached, the water will supply accordingly.This isessentialbecause water mustbe provided to the plantat a particular time for a good yield. This project is highly useful for farmers, Nursery professionals by eradicating traditional or manual methods of irrigation systems

3.4PROBLEMSOLUTIONFIT:

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Approximately 60% of the Indian population works in the agriculture industry. A major population among these are small-scale farmers who are majorly affected by improper watering of crops leading to losses.Our system addresses this problem of the farmers making them our potential customers.

6. CUSTOMER CONSTRAINTS CC

Crop yields will fall dramatically owing to excessive watering that affects the farmers' income. They find it difficult to adopt and learn new technologies. More commonly pressures on financial resources for some farmers slow the adoption of some technologies.

5. AVAILABLE SOLUTIONS AS

The existing method uses these sensors that trigger the motor pump to turn on automaticaly and it will continue to sprinkle the water until the moisture goes upto 55% after that the pump will be turned off. The sensor data will be sent to cloud so that it can be monitored from anywhere .

Explore AS, differentiate

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

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

1. Economical Insecurity
2. Climatic changes and deteriorated quality of soil.

9. PROBLEM ROOT CAUSE RC

Climatic factors

1. Drought
2. Flooding
3. Poor rainfall
4. Too much rain
5. High temperature

7. BEHAVIOUR BE

1. Remove debris and sediments.
2. Repair eroded soil.
3. Crop management practices like tillage, fertility recommendations, cover crop termination, inoculation, seeding practices, and weed control

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

Identify strong TR & EM

3. TRIGGERS TR

Studies show that up to 50% of water usage for landscape irrigation can be saved with cloud-based Smart Irrigation systems. This will help the farmers to save water resources dramatically and have a better control over it.

4. EMOTIONS: BEFORE / AFTER EM

Both farming as an occupation and farmers are placed at a low level

10. YOUR SOLUTION SL

Our product will assist farmers by obtaining real-time data from the farmland to take necessary steps during unfavorable conditions. Our proposed product uses NodeMCU, DHT11 Temperature and Humidity Sensor, Soil Moisture Sensor, Relay Coil, AC Motor Pump, and Buzzer. Farmers can monitor all the sensor parameters by using a web / mobile application/dashboard even if the farmer is not near his field. 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.

8. CHANNELS of BEHAVIOUR CH

The customer can buy our end product in offline stores such as Hardware and the Electronics Stores and also in several online shopping platforms.

Identify strong TR & EM

4. REQUIREMENTANALYSIS

4.1 FUNCTIONALREQUIREMENTS

FRNo.	Functional Requirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserRegistration	Registration through Form Registration through Gmail RegistrationthroughLinkedIn
FR-2	UserConfirmation	Confirmationvia Email Confirmationvia OTP
FR-3	UserLogin	Creating Username Creating Password Accessingthewebsite
FR-4	AICompanion	LoginbyscanningQR CodeLoginbyentering the code
FR-5	ResetPassword	Changing the password when the user forgottheoldpasswordReceivingalinkto aconfirmedmailaddressorphonenumber Entering new password

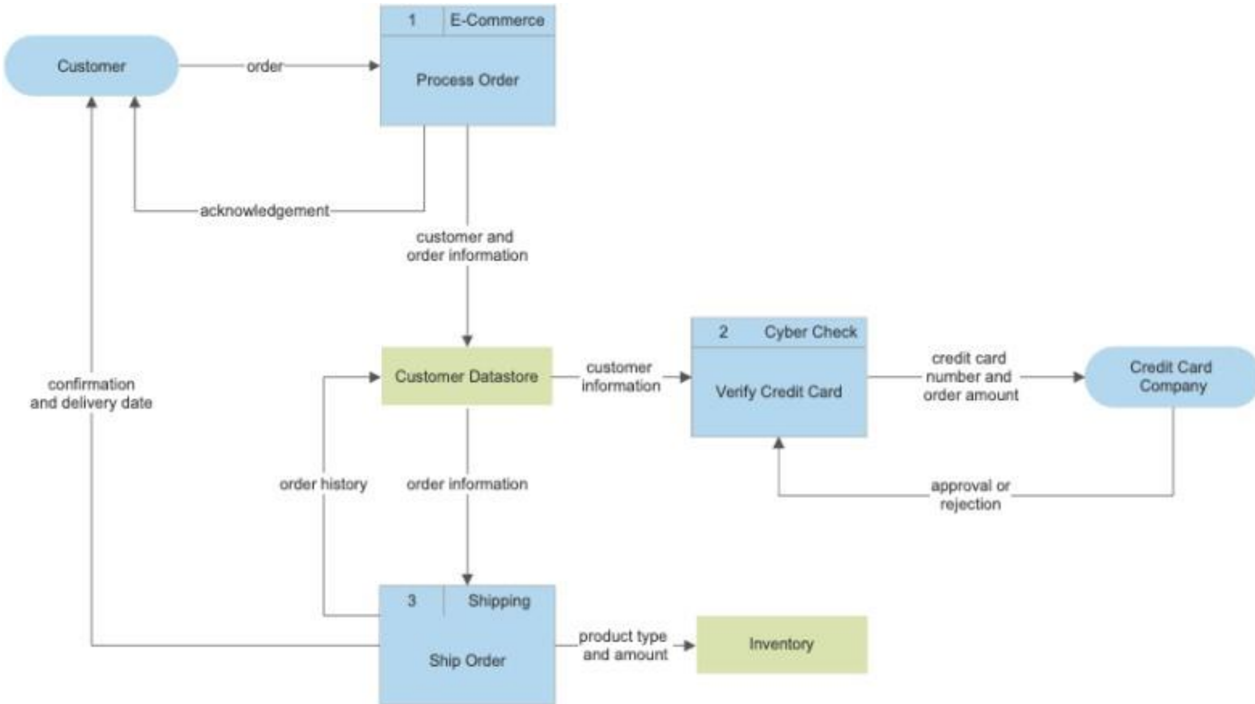
4.2 NON-FUNCTIONALREQUIREMENS

FR NO	NONFUNCTIONAL REQUIREMENTS	DESCRIPTION
NFR-1	Usability	Around 54.6% of the population in Indiadoesfarmingandoutofwhichthe majority are smallscale farmers this systemwill majorlypreventtheirlosses and be helpful to them and since the system and its operation and design is very simple the farmer can use the product with ease.
NFR-2	Security	Eachuserhasuniquecredentials assignedtothemhencethedata

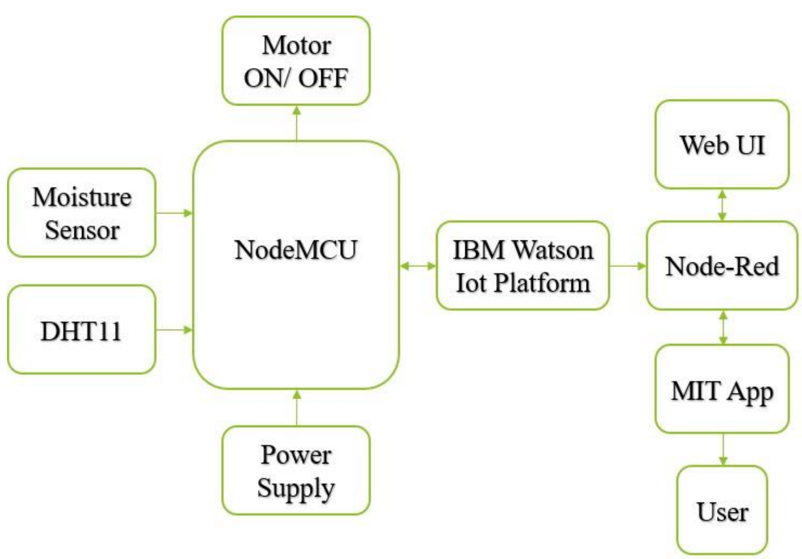
		associatedwiththefarmerandhisfield cannot be accessed by anyone else.
NFR-3	Reliability	Thesensorsandmicrocontrollersused as a part of the system are highly reliable,andaccurateandhaveagood life which makes the overall system reliable and long-lasting.
NFR-4	Performance	Apart from the system ’s basic functionality , the farmer can also control the pump so that during situations such as rain , the pumps do not supply surplus water which would lead to waterlogging and this leads to theefficientperformanceofthesystem at all climatic conditions.
NFR-5	Availability	The product can be sold to agriculture -based companies that are pioneers in agricultural-basedproducts.Thesystem can be sold directly to consumers as a stand -alone product.
NFR-6	Scalability	The sensors, microcontrollers , and variousothercomponentsusedasapart of this system are cost - effectivehence this product is scalable.

5. PROJECTDESIGN

5.1 DATAFLOWDAIGRAM



5.2 SOLUTION&TECHNICALARCHITECTURE



S.No	Component	Description	Technology
1.	UserInterface	WebUI,MobileApp	HTML,CSS, JavaScript/ AngularJs/ ReactJs
2.	ApplicationLogic-1	Thepythoncoderetrievesthemoisturevaluesfromthe soil and depending on the values fed in the code the farms are watered accordingly.	Python
3.	ApplicationLogic-2	IBMWatsonactsasawebdashboardwhichreflectsthe values retrieved from the system and also acts as an interface from where the values can be sent to various otherplatforms.	IBM Watson
4.	ApplicationLogic-3	Node-Red is a platform that retrieves values from IBM Watsonandcanbeusedtovisualizethedataintheform of a web dashboard and it can also send the retrieved datatovariousotherplatformssuchasMITAppInventor and can also interact with the system directly.	Node-Red
5.	CloudDatabase	DatabaseServiceonCloud	IBMWatson Cloud
6.	Infrastructure(Server /Cloud)	Application Deployment on Cloud Cloud ServerConfiguration:IBMWatson,Wokwi	Cloud Foundry
7.	NodeMCU	Microcontrollerboardwhichprovidesthefacilityof internet connectivity	
8.	DHT11	Tomonitorthetemperatureandhumidityofcrop	
9.	Soilmoisturesensor	Tomonitorthetemperatureofsoil	
10.	Electricmotorpump	Toprovidetherequiredwatersupplytothecrop	
11.	Buzzer	Togiveanalarmingsoundoncethevaluesreachabove threshold	

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Usercancreatetheircloudfoundrybyusinglogin credentials of Gmail.	IBMWatson,Node-red, MIT app
2.	Security Implementations	Eachuserhasuniquecredentialsassignedtothem hencethedataassociatedwiththefarmerandhis field cannot be accessed by anyone else.	Encryptions
3.	Scalable Architecture	The sensors, microcontrollers, and various other componentsusedasapartofthissystemarecost-effective hence this product is scalable.	ESP-32
4.	Availability	DistributedServers	ClientServer System

6. PROJECTPLANNING&SCHEDULING

6.1 SPRINTPLANNINGANDESTIMATION

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1	**Understanding the project**	Assigntheteammembersafterthatcreaterepository in the GitHub and then assign task to each member and guide them how to access the GitHub while submitting the assignments	1 week
2	**StaringThe Project**	TeamMemberstoAssignAlltheTasks Based on Sprints and Work on It Accordingly.	1week
3	**Completing EveryTask**	TeamLeadershouldensurethatwhethereveryteam member have completed the assigned task or not	1week
4	**StandUp Meetings**	TeamLeadMustHaveaStand-UpMeetingwithThe Team and Work on The Updates and Requirement Session	1week
5	**Deadline**	Ensurethatteammembersarecompletingeverytask within the deadline	1week
6	**Budgetand Scope of project**	Analyse the overall budget which must be within certainlimititshouldbefavourabletoeveryperson	1week

6.2 SPRINTDELIVERYSCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	UserStory/Task	Story Points	Priority	Team members
Sprint-1	Configuration	USN-1	Creating account in – IBM Cloud,IBMWatson,Node-Red, MIT App Inventor	4	High	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S

Sprint-1	Simulation	USN-2	Connecting the circuit consistingofNodeMCU and the sensors and simulating it in Wokwi.	3	High	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S
Sprint-2	Connect Wokwi and IBM Watson.	USN-3	Connectionisestablished between IBM WatsonandWokwithrough the Mqttprotocol.	5	Mediu m	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S
Sprint-2	Sending data from Wokwi toIBMWatson	USN-4	Sensorvaluesaresentto IBMWatson	4	High	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S
Sprint-3	Sendingdata from IBM Watson to Node-Red	USN-6	PublishdatafromIBM Watson to Node-Red	3	High	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S
Sprint-4	Sendingdata from Node-Redto MIT App Inventor	USN-7	Theusercanmonitorthe field conditions.	3	High	Mahalakshmi. M.M, Radha.G, Rithikaa.K, Pavithra.S

Sprint	**TotalStory Points**	**Duration**	**SprintStart Date**	**Sprint EndDate (Planned)**	**Story Points Completed(as on PlannedEnd Date)**	**Sprint ReleaseDate (Actual)**
Sprint-1	7	6 Days	24Oct2022	29 Oct 2022	7	30Oct2022
Sprint-2	8	6 Days	31Oct2022	05 Nov 2022	8	08 Nov 2022
Sprint-3	2	6 Days	07 Nov 2022	12 Nov 2022		14 Nov 2022
Sprint-4	3	6 Days	14 Nov 2022	19 Nov 2022		18-19Nov 2022

Velocity:

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

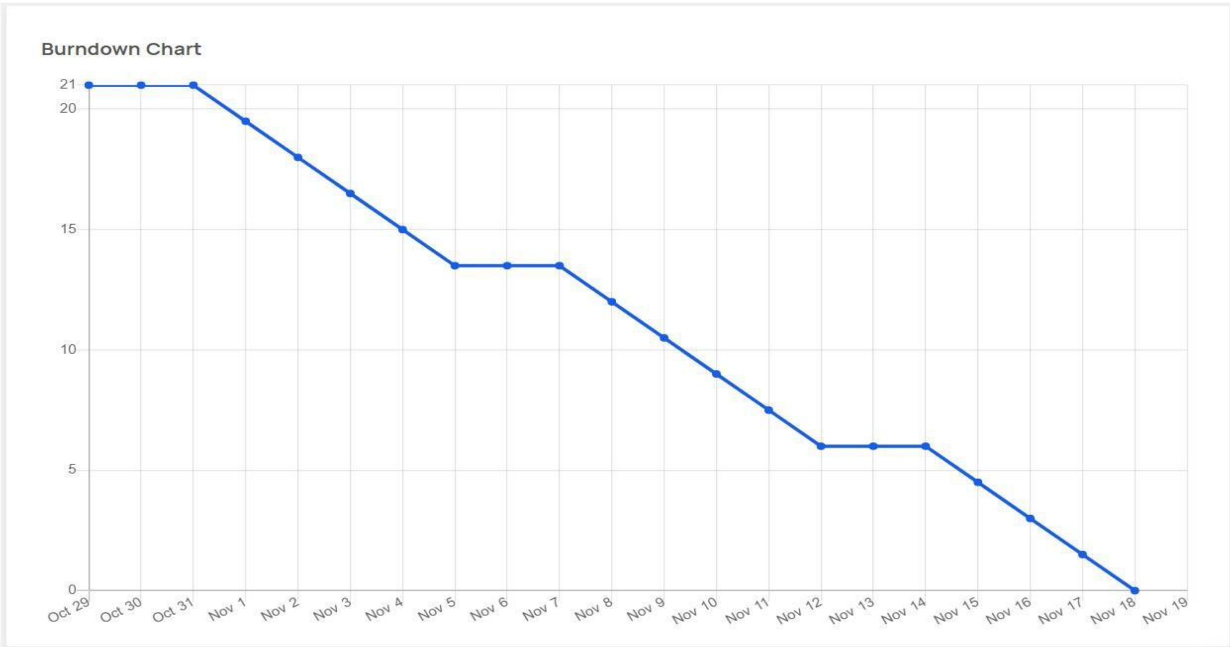
TotalSprintPoints=21

Total Sprint = 7

AverageVelocity=21/7=3

Burndownchart

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum.However, burn down charts can be applied to any project containing measurable progress over time.



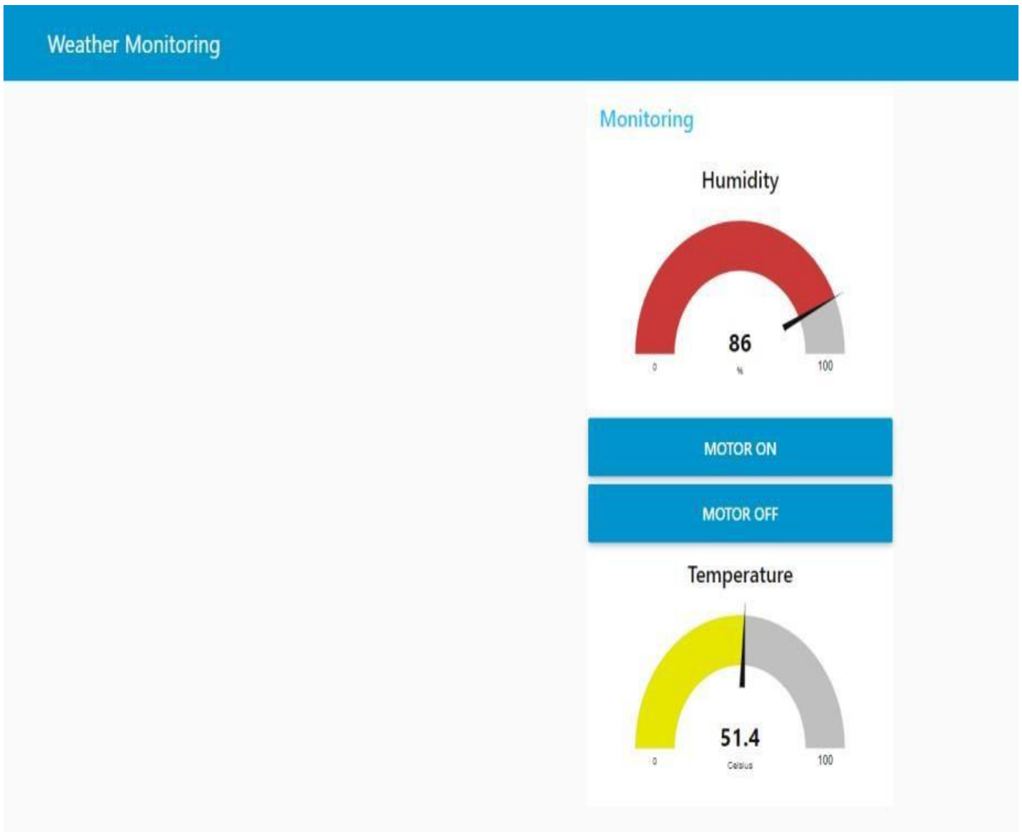
7. CODINGANDSOLUTION

7.1 FEATURE

```
importtime
import sys
importibmiotf.application
import ibmiotf.device
import random

#ProvideyourIBMWatsonDeviceCredentials organization
= "93oivx"
deviceType="NodeMCU"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"




#InitializeGPIO
defmyCommandCallback(cmd):
    print("Commandreceived:%s"%cmd.data['command']) print(cmd)
try:
 deviceOptions={"org":organization,"type":deviceType,"id":deviceId,"auth-method": authMethod,
"auth-token": authToken}
 deviceCli=ibmiotf.device.Client(deviceOptions)
 #.............................................

exceptExceptionase:
 print("Caughtexceptionconnectingdevice:%s"%str(e))
 sys.exit()
#Connectandsendadatapoint"hello"withvalue"world"intothecloudasaneventof type
"greeting" 10 times

deviceCli.connect()
while True:
        #GetSensorDatafromDHT11 temp=51.4
        humidity=86
        data={'temp':temp,'humidity':humidity}

        #printdata
        defmyOnPublishCallback():
            print("PublishedTemperature=%sC"%temp,"Humidity=%s%%"% humidity, "to
IBM Watson")
```

```
        success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,
on_publish=myOnPublishCallback)
        ifnotsuccess:
            print("NotconnectedtoIoTF")
        time.sleep(1)

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

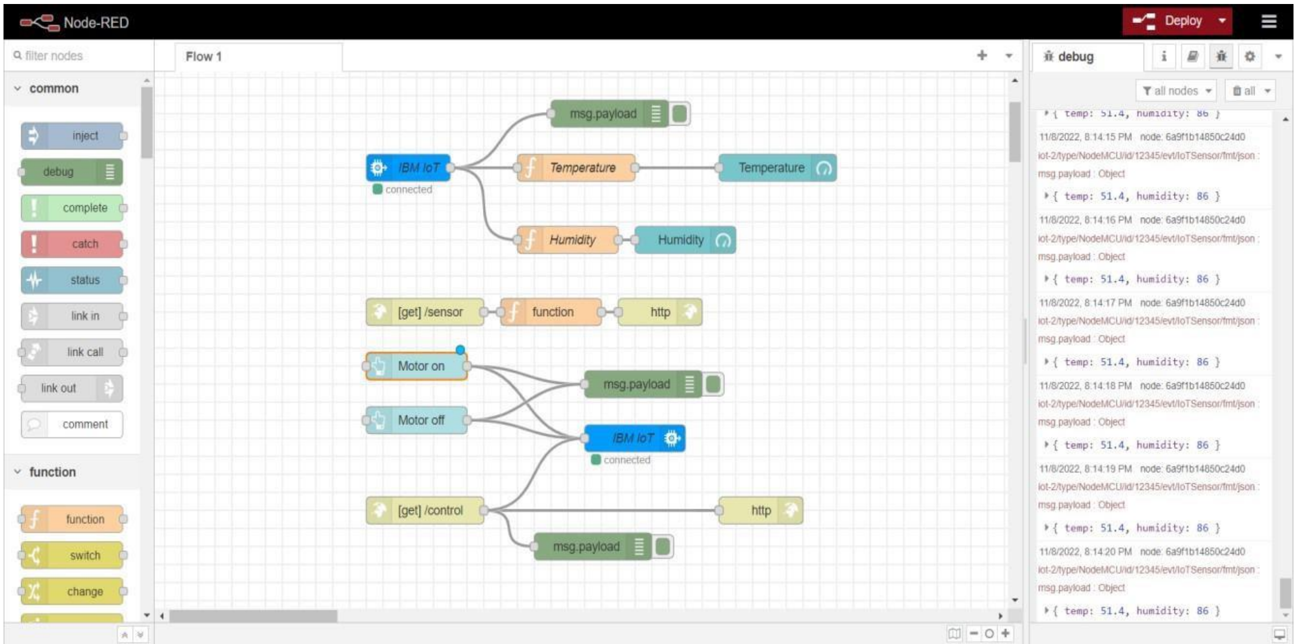
7.2 SOLUTION

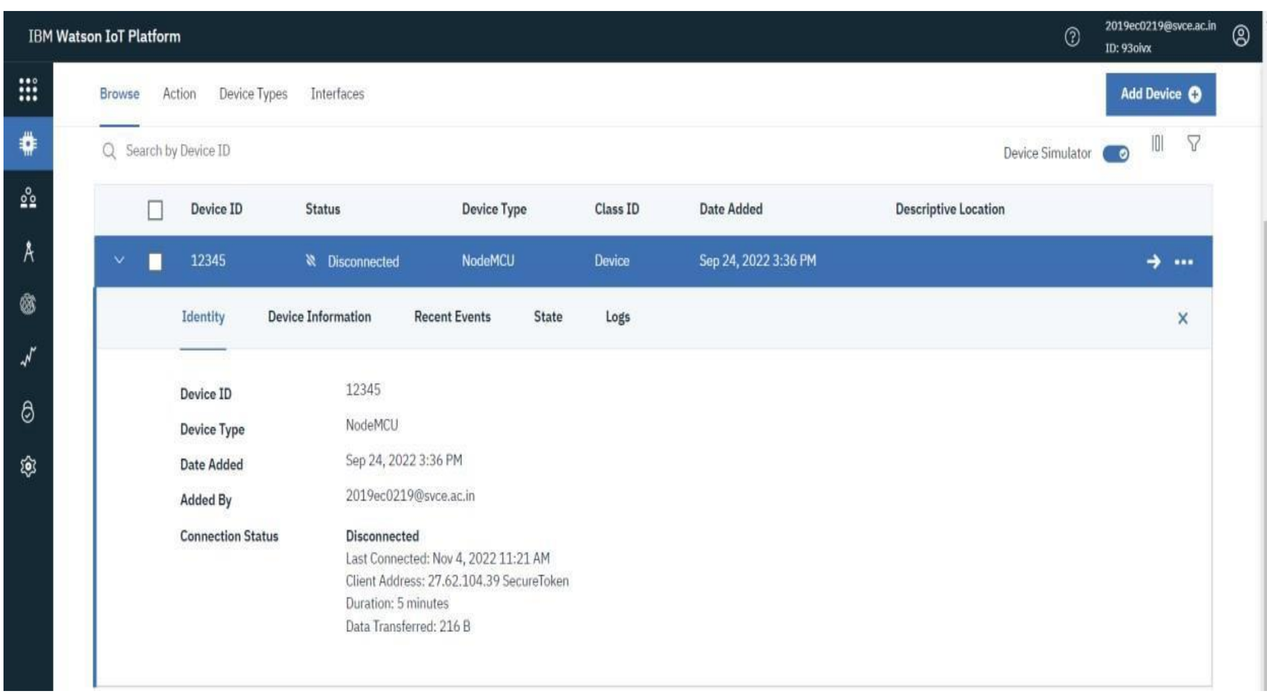


8. TESTING

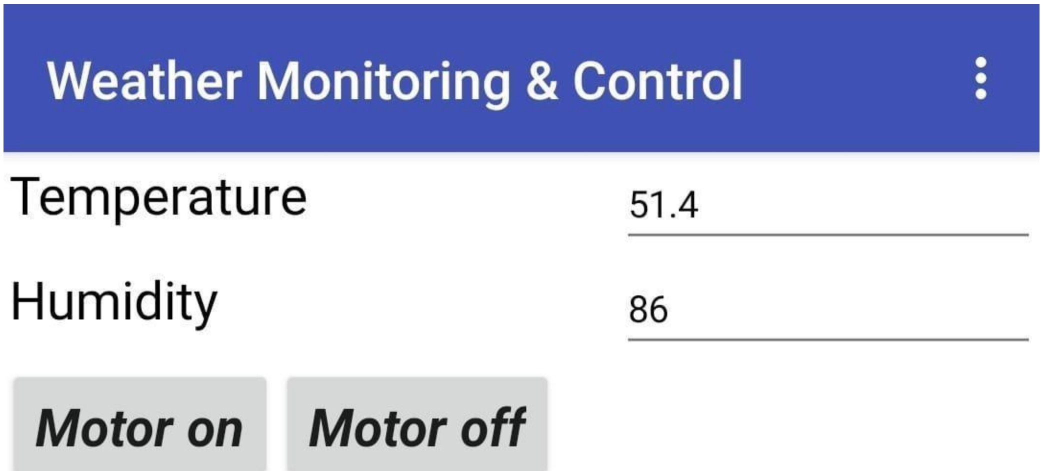
8.1 TESTCASE

WEBAPPLICATIONUSINGNODE-RED:

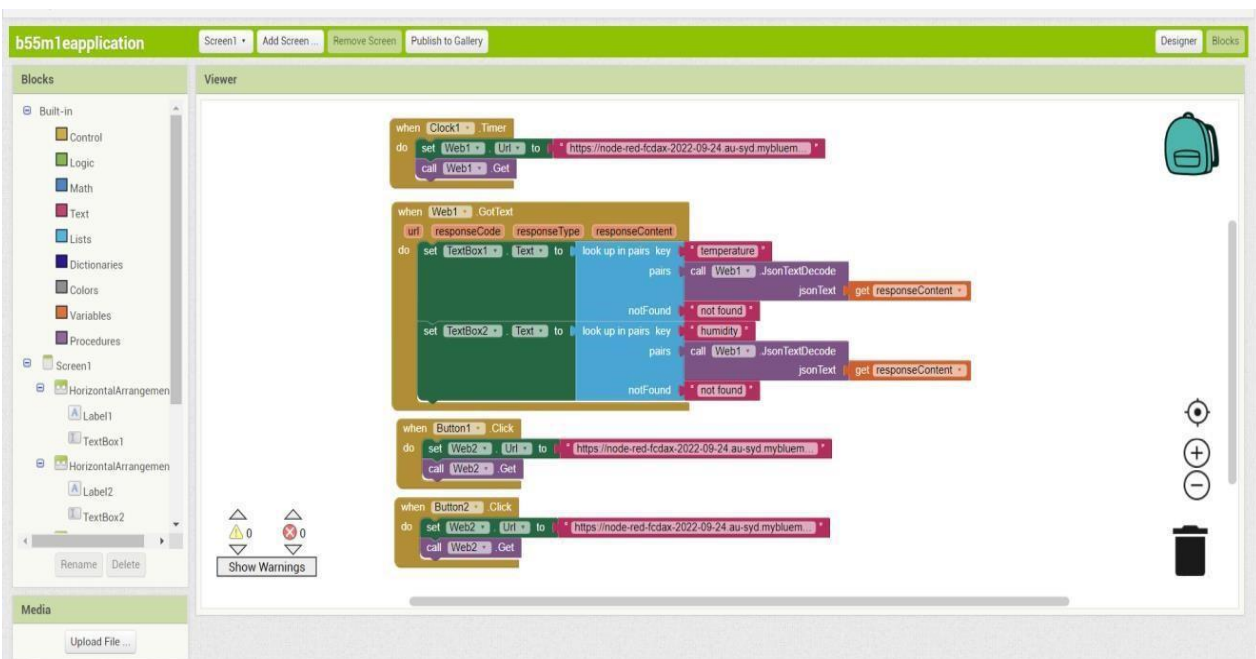




8.2 USERACCEPTANCETESTING

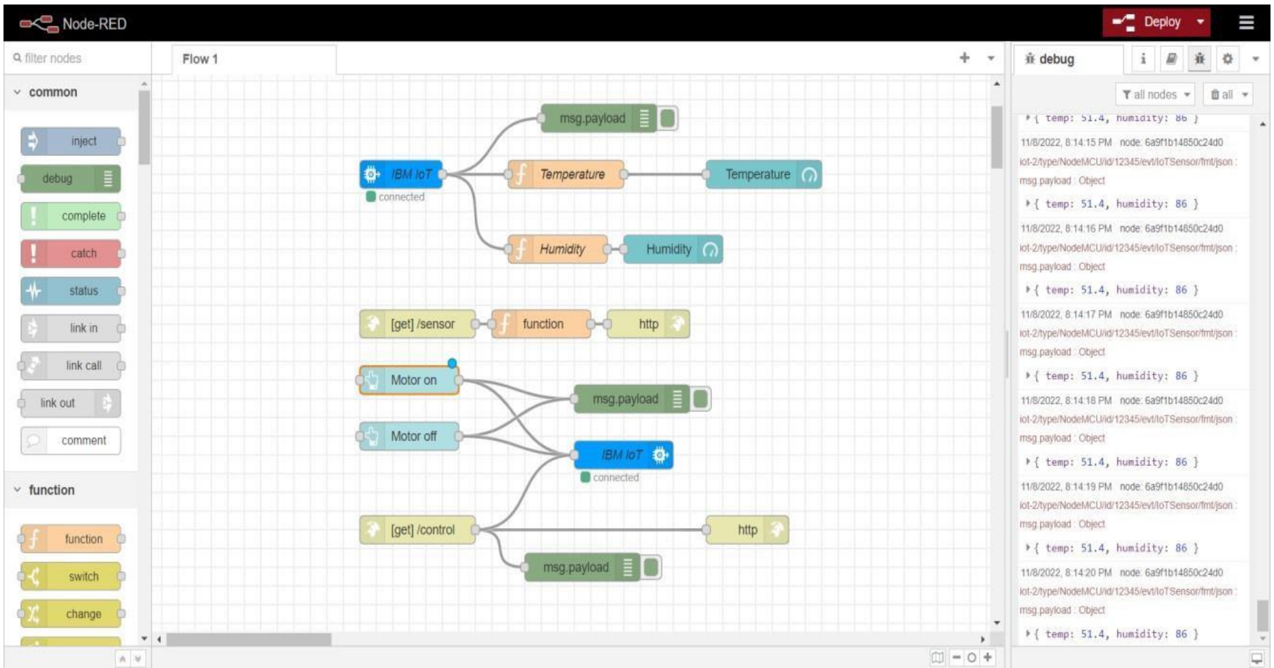


MITAPPINVERTER



9. RESULT

9.1 PERFORMANCEMETRICS



10. ADVANTAGESANDDSIADVANATGES

ADVANTAGES:

- Allthedatalikeclimaticconditionsandchangesinthem,soilorcrop conditions everything can be easily monitored.
- Riskofcropdamagecanbeloweredtoagreaterextent.
- Manydifficultchallengescanbeavoidedmakingtheprocessautomated and the quality of crops can be maintained.
- Theprocessincludedinfarmingcanbecontrolledusingtheweb applications from anywhere, anytime.

DISADVANTAGE:

- Anyfaultsinthesensorscancausegreatlossintheagriculture,dueto wrong records and the actions of automated processes.
- IOTdevicesneedmuchmoneytoimplement.

11. CONCLUSION

AnIOTbasedsmartagriculturesystemusingWatsonIOTplatform, Watson simulator, IBM cloud and Node-RED.

12. FUTURESCOPE

Infutureduetomoredemandofgoodandmorefarminginless time, for betterment of the crops and reducing the usage of extravagant resourceslikeelectricityandwaterIOTcan beimplementedinmostofthe places.

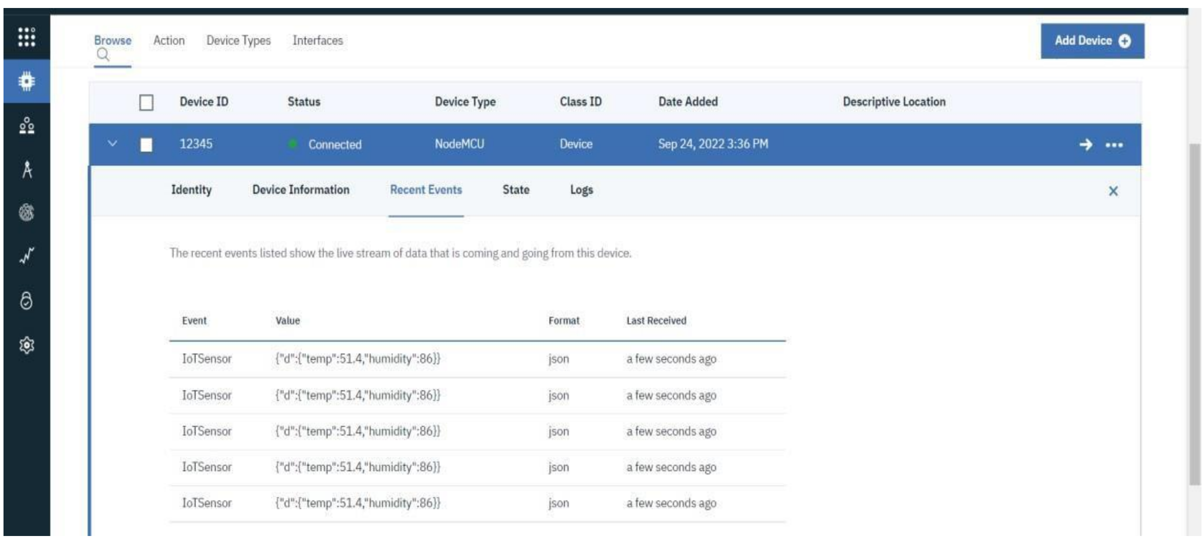
13. APPENDIXS

OURCECODE:

```
importtime
import sys
importibmiotf.application
import ibmiotf.device
import random

#ProvideyourIBMWatsonDeviceCredentials organization
= "93oivx"
deviceType="NodeMCU"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

#InitializeGPIO
defmyCommandCallback(cmd):
    print("Commandreceived:%s"%cmd.data['command']) print(cmd)
try:
 deviceOptions={"org":organization,"type":deviceType,"id":deviceId,"auth-method": authMethod,
"auth-token": authToken}
 deviceCli=ibmiotf.device.Client(deviceOptions)
 #..............................................

exceptExceptionase:
 print("Caughtexceptionconnectingdevice:%s"%str(e))
 sys.exit()
#Connectandsendadatapoint"hello"withvalue"world"intothecloudasaneventof type
"greeting" 10 times
```

```
deviceCli.connect()
while True:
        #GetSensorDatafromDHT11 temp=51.4
        humidity=86
        data={'temp':temp,'humidity':humidity}

        #printdata
        defmyOnPublishCallback():
            print("PublishedTemperature=%sC"%temp,"Humidity=%s%%"% humidity, "to
IBM Watson")
        success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,
on_publish=myOnPublishCallback)
        ifnotsuccess:
            print("NotconnectedtoIoTF")
        time.sleep(1)

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

OUTPUT:



GITHUB:

https://github.com/IBM-EPBL/IBM-Project-11016-1659253493

PROJECT DEMO LINK:

click here for the demo video