PROJECT REPORT

Smart Farmer-IOT Enabled Smart Farming Application

Submitted by

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 PROJECT OVERVIEW
1.2 PURPOSE

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM
` 2.2 REFERENCES
2.3 PROBLEM STATEMENT DEFINITION

3. IDEATION

3.1 EMPATHY MAP CANVAS
3.2 IDEATION & BRAINSTORMING
3.3 PROPOSED SOLUTION
3.4 PROBLEM SOLUTION FIT

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS
4.2 NON-FUNCTIONAL REQUIREMENTS

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM
5.2 SOLUTION & TECHNICAL ARCHITECTURE
5.3 USER STORIES

6. PROJECT PLANNING AND SCHEDULING

6 PROJECT PLANNING AND SCHEDULING
6.1 SPRINT PLANNING AND ESTIMATION
6.2 SPRINT DELIVERY SCHEDULE

7. CODING AND SOLUTIONING

8. TESTING

8.1 TEST CASES
8.2 USER ACCEPTANCE TESTING
8.2.1 DEFECT ANALYSIS
8.2.2 TEST CASE ANALYSIS

9. RESULTS

9.1 PERFORMANCE METRICS

10. ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES
10.2 DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

APPENDIX

SOURCE CODE

GITHUB

PROJECT DEMO

1. INTRODUCTION

1.1 PROJECT OVERVIEW:

Smart farming is certainly a leading enabler in producing more food with less for an increasing world population. Smart farming enables increased yield through more efficient use of natural resources and inputs, and improved land and environmental management. While this is crucial to sustainably feeding the world's growing population, there are other benefits that smart farming provides farmers and communities all around the world.

Conventional supply chains have been characterized by a power imbalance with farmers often having less power because they've had less information about how their product performs relative to customer requirements. Smart farming provides a vital link between all players in the supply chain by enabling the efficient and equitable flow of information and in doing so, facilitating better decision making. This has the potential to rebalance power and redistribute profits more equitably throughout the supply chain

1.2 PURPOSE:

Smart farming helps farmers to better understand the important factors such as water, topography, aspect, vegetation and soil types. This allows farmers to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically sustainable manner.

One of the goals of smart farming is to make better use of the land and improve yields as a first step in solving world hunger.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Agriculture is one of the most important aspects in India. Irrigation accounts for 55-70% of water usage in India. Water usage for irrigation is nearly 60%. Most of this water used is wasted. We can use soil moisture sensor as a solution for wastage of water. This is done by IOT devices. The IOT networks reduce human labor requirements on the farm. IOT uses wireless sensor networks for gathering information to monitor and control the activities. For monitoring the farm remotely, the end devices are equipped with soil moisture sensor, temperature sensor, etc. There is no means for farmers to have complete control over their farms and monitor the activity on the farm remotely. Here we try to provide a system that is cost effective and provides the functionalities that is required by the Indian farmers.

2.2 REFERENCES:

[1] Joaquín Gutiérrez, Juan Francisco Villa-Medina, Aracely López-Guzmán, and Miguel Ángel Porta Gándara, “Smartphone Irrigation Sensor”, Proceedings of IEEE Sensors Journal Sensors 2015, P.3-4

[2] F. Viani, M. Bertolli, M. Salucci, “Low-Cost Wireless Monitoring and Decision Support for Water Saving in Agricultu
re’, Proceedings of IEEE Sensors Journal, Vol 0, 2017, P.69.

[3] Jan Bauer and Nils Aschenbruck,” Design and Implementation of an Agricultural Monitoring System for Smart Farming”, Proceedings of IEEE IOT Vertical and Tropical Submit on Agriculture, 2018, P.978-982.

[4] Soumil Heble, Ajay Kumar, K.V.V. Durga Prasad, Soumya Samirana, P. Rajalakshmi, U. B. Desai” A Low Power IOT Network for Smart Agriculture”, Proceedings of Data Science Based Farming Support System for Sustainable Crop Production Under Climatic Changes, 2016, P.609-613.

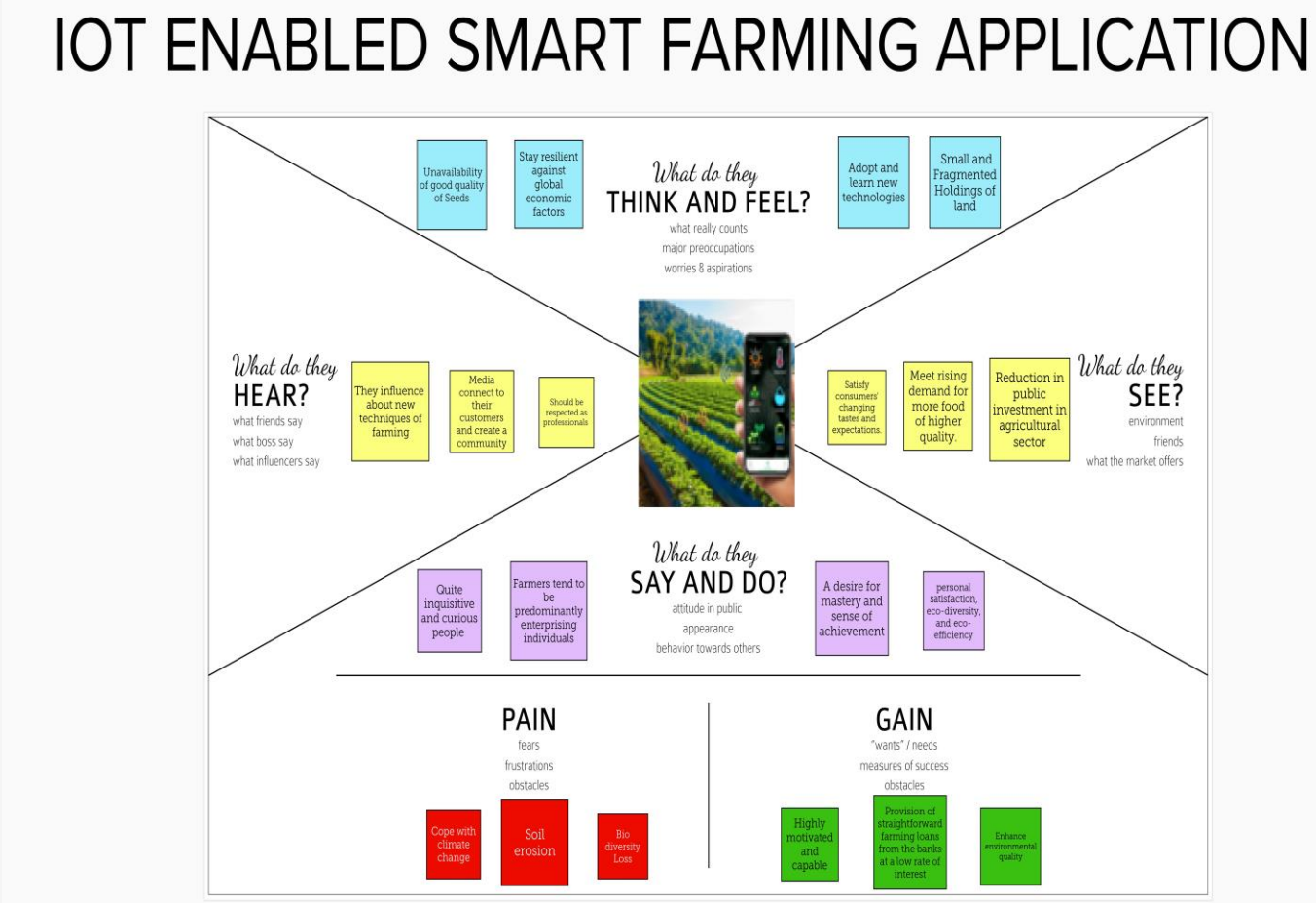
An overview of the Smart Farmer - IOT Enabled Smart Farming Application is presented and an extensive survey on smart solution for crop growth using IOT is provided.

2.3 PROBLEM STATEMENT DEFINITION:

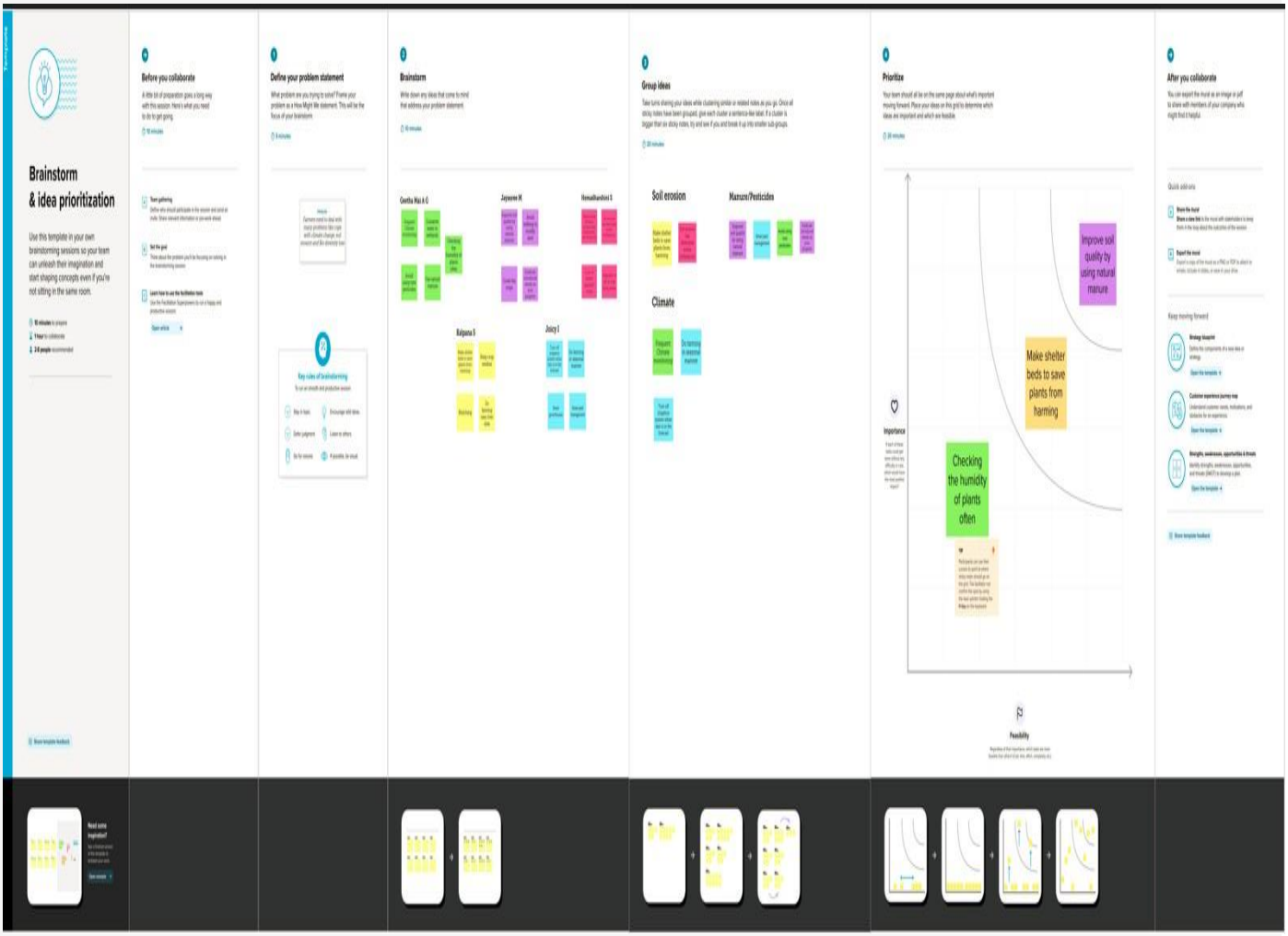
Farmers need to deal with many problems like coping with climate change, soil erosion and Biodiversity loss. To provide efficient decision support system using wireless sensors network which handle different activities of farm and gives useful information related to soil moisture, Temperature and Humidity content. Due to the weather condition, water level increasing Farmers get lot of distractions which is not good for agriculture.

3. IDEATION

3.1 EMPATHY MAP CANVAS:



3.2 IDEATION AND BRAINSTORMING:

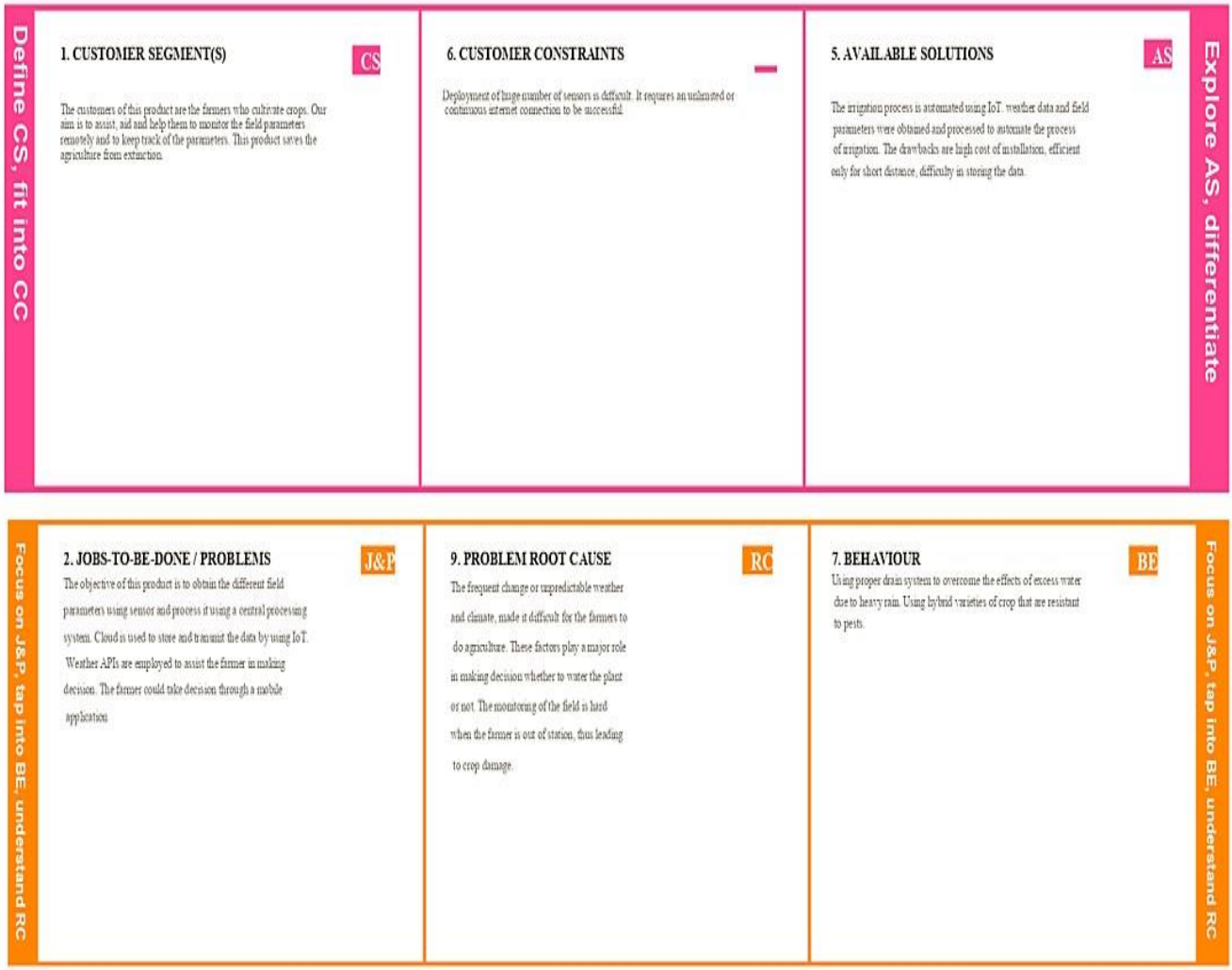


3.3 PROPOSED SOLUTION:

S. No.	Parameters	Description
1.	Problem Statement (Problem to be solved)	To provide efficient decision support system using wireless sensors network which handle different activities of farm and gives useful information related to soil moisture, Temparature and Humidity content.Due to the weather condition,water level increasing Farmers get lot of distractions which is not good for Agriculture.
2.	Idea / Solution description	It is a network of different devices which make a self-configuring network. The new developments of Smart Farming with use of IoT, by day turning the face of conventional agriculture methods by not only making it optimal but also making it cost efficient for farmers and reducing crop wastage.
3.	Novelty / Uniqueness	IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity.
4.	Social Impact / Customer Satisfaction	Smart farming, the dependency on manual labor has reduced significantly. The processes like pest control, fertilizing, and irrigation are increasingly becoming automated, and farmers can control them remotely. The use of smart IoT sensors can maintain these processes, increasing crop production.
5.	Business Model (Revenue Model)	It is trying to execute this technique as we need to introduce an arduino gadget which was modified with an Arduino that takes received signals from sensors. Easy operatability and maintenance. Required low time for maintain. Cost is reasonable.
6.	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 time analysis.

3.4 PROBLEM SOLUTION FIT:

Project Title: Smartfarmer - IoT Enabled Smart Farming Application | Project Design Phase-I Solution Fit | Team ID: PNT2022TMID33194



4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

-Following are the functional requirements of the proposed solution

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

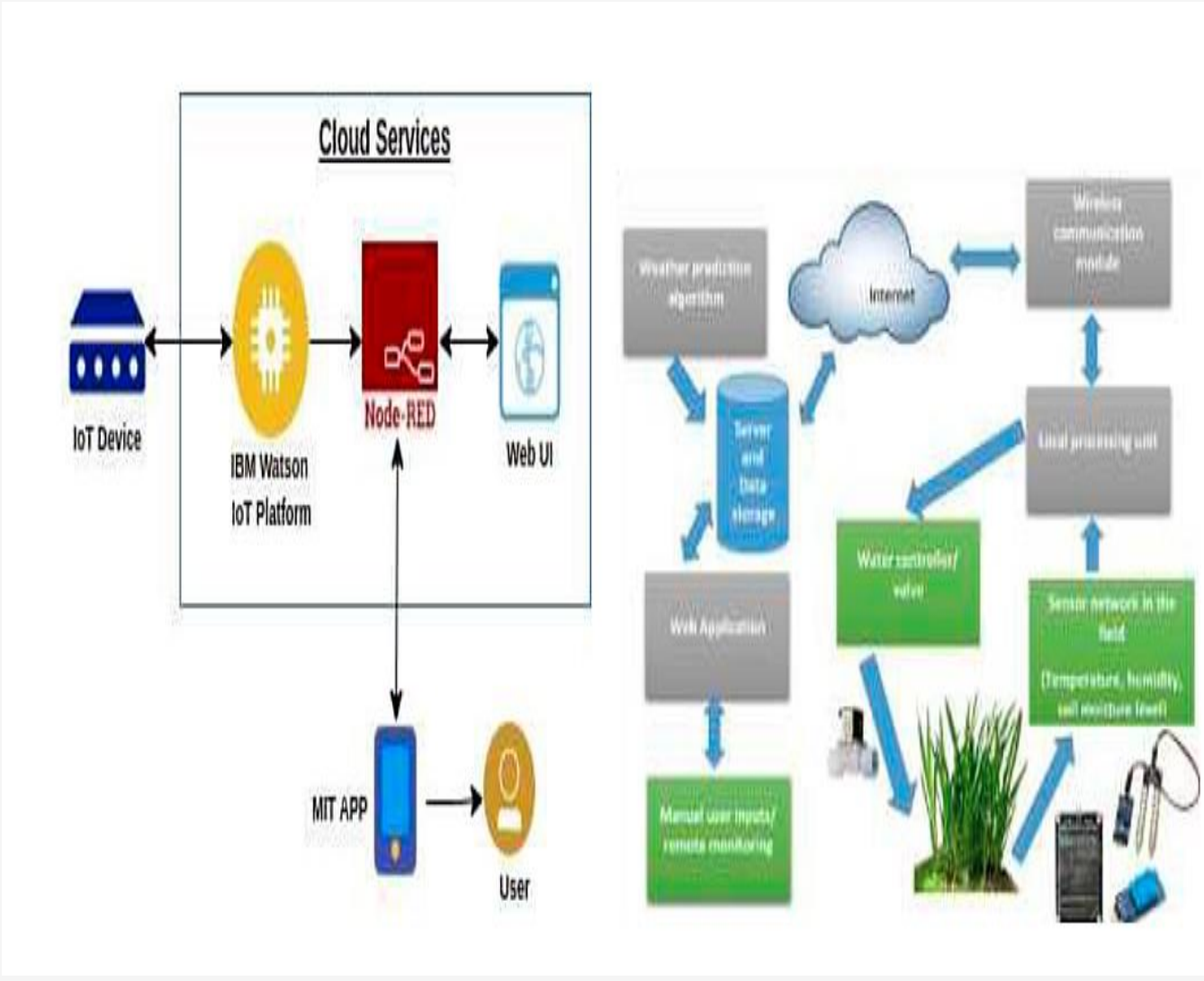
4.2 NON- FUNCTIONAL REQUIREMENTS:

-Following are the non-functional requirements of the proposed solution.

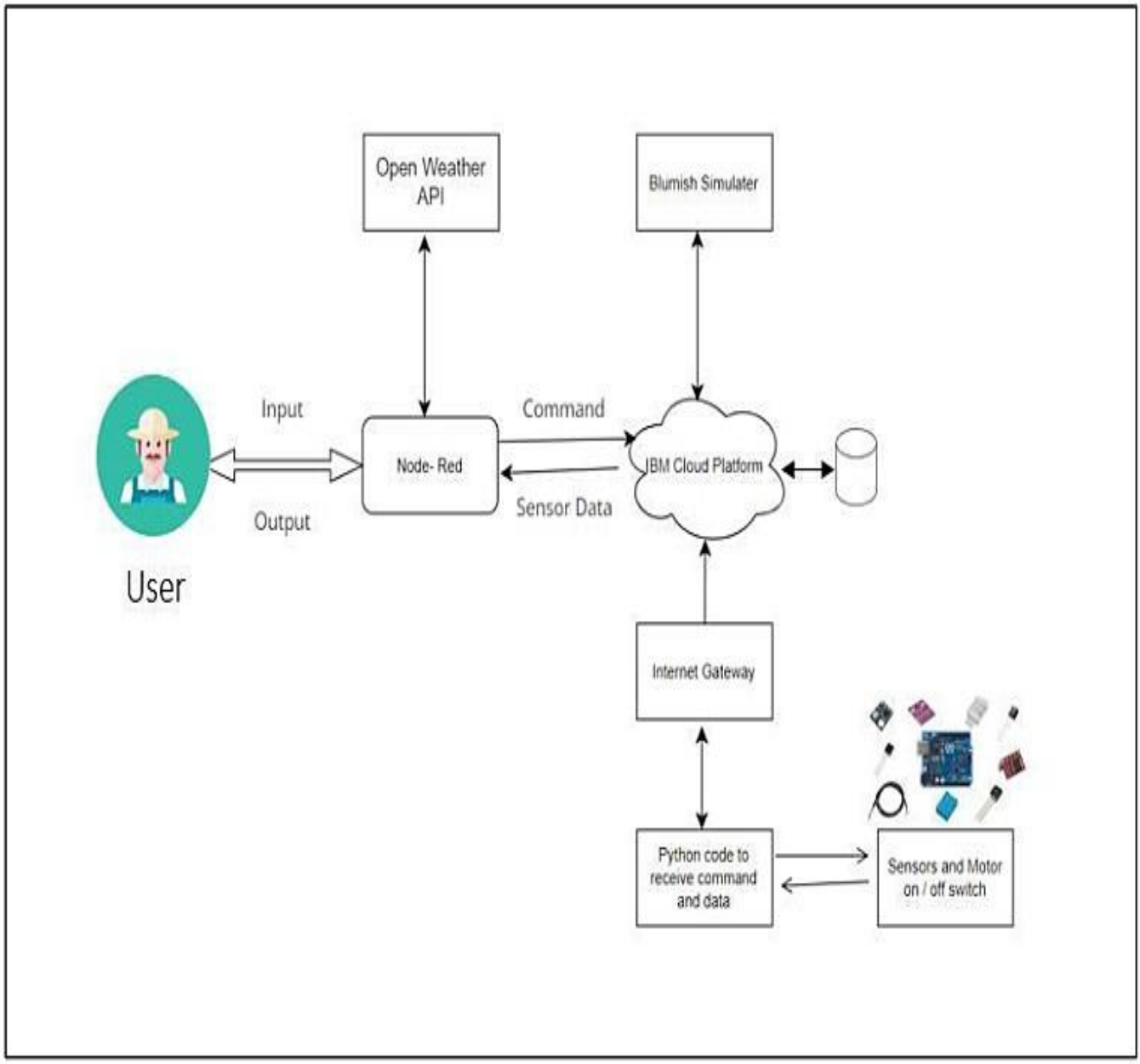
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Usability includes easy understanding and learn ability, efficiency in use, remember ability, lack of errors in operation and subjective pleasure.
NFR-2	Security	Sensitive and private data must be protected from their production until the 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 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 affect system scalability,real time decision-making is feasible in an environment composed of dozens of thousands.

5. PROJECT DESIGN

Data Flow Diagram



5.2 SOLUTION AND TECHNICAL ARCHITECTURE



5.3 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

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

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	A.G.Geethamai (Leader)
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	M.Jayasree (Member 1)
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	S.Hemadharshini (Member 2)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	I.Joicy (Member 3)
Sprint-3	Registration (Farmer -Web User)	USN - 1	As a user, I can log into the application by entering email and password	3	High	S.Kalpana (Member 4)
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	A.G.Geetamai (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	M.Jayasree (Member 1)
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	S.Hemadharshini (Member 2)

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	I.Joicy (Member 3)
Sprint - 3	Web UI	USN - 3	As a user, I need to have a user friendly interface to easily view and access the resources.	3	Medium	S.Kalpana (Member 4)
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	A.G.Geethamai (Leader)
Sprint - 1	Login	USN - 2	As a registered user, I need to easily log in to the application.	2	Low	M.Jayasree (Member 1)

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	12	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	6	6 Days	31 Oct 2022	05 Nov 2022	20	30 OCT 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	20	6 NOV 2022
Sprint-4	6	6 Days	14 Nov 2022	19 Nov 2022	20	7 NOV 2022

7. CODING AND SOLUTIONING

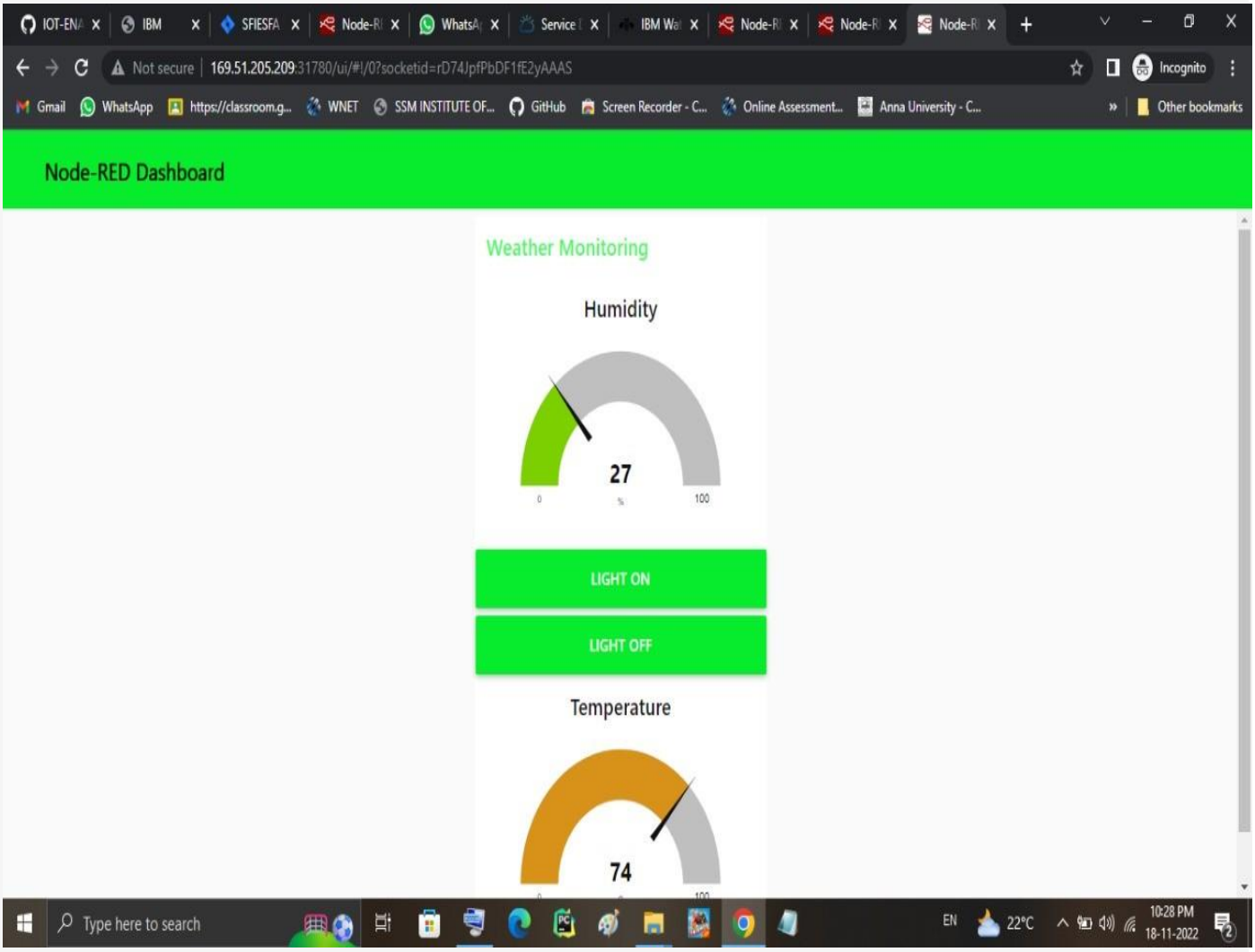
```
import wiotp.sdk.device
import time
import os
import datetime
import random
myConfig = {
"identity": {
"orgId": "u9qhfi",
"typeId": "Devicetype1",
"deviceId": "DeviceID1"
},
"auth": {
"token": ")hSb7_ZD+evl2fRhXi"
} }
client=wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=
None)
client.connect ()
def myCommandCallback (cmd) :
```

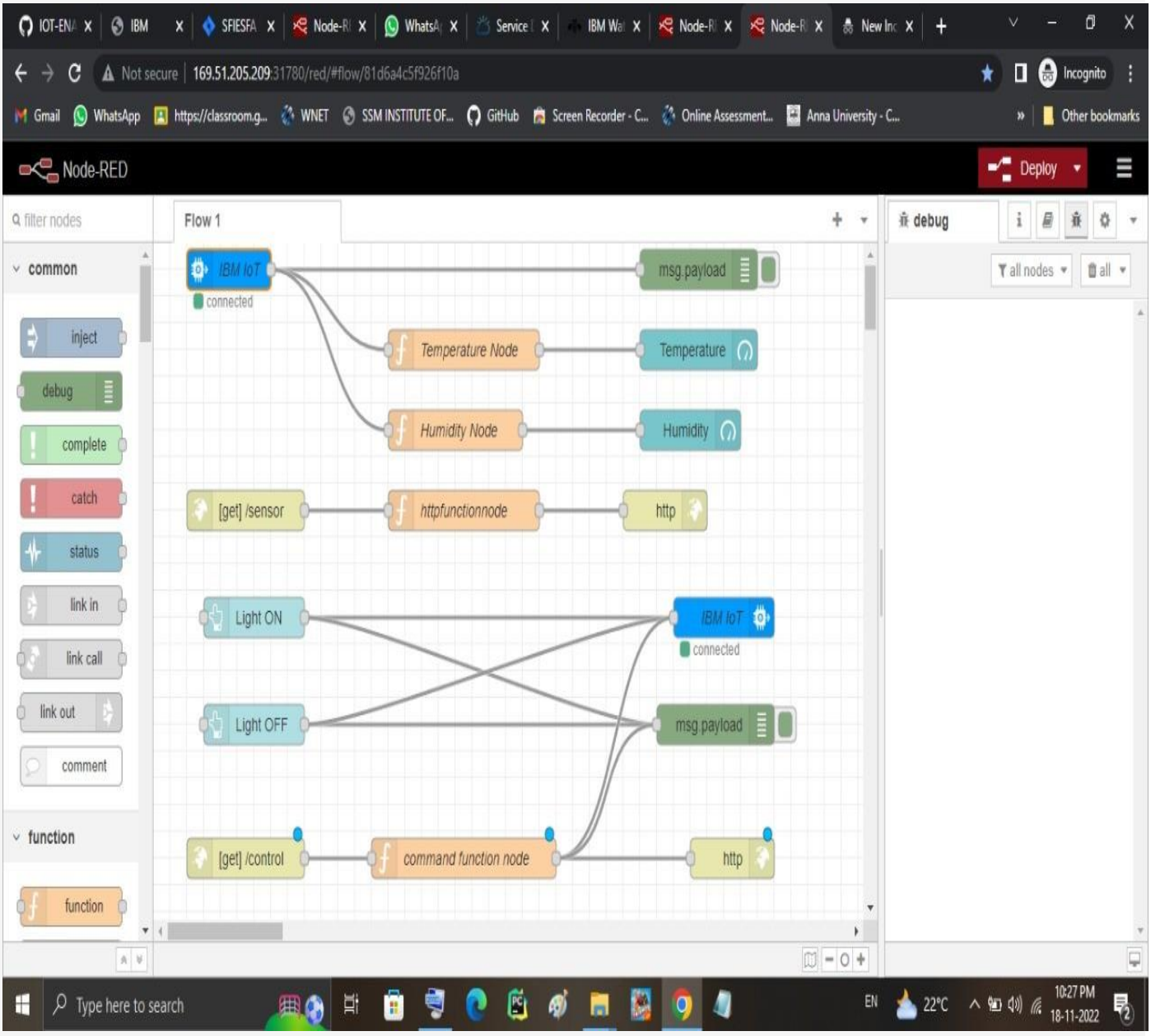
```
    print ("Message received from IBM IoT Platform:
    %s"%   cmd.data['command'])
          m=cmd.data['command']
          if (m=="motoron"):
              print ("Motor is switched on")
              elif (m=="motoroff"):
                  print ("Motor is switched OFF")
              print (" ")
while True:
       soil=random.randint (0,100)
       temp=random.randint (-20, 125)
       hum=random.randint (0, 100)
       myData={'soil moisture': soil, 'temperature':temp, 'humidity':hum}
            client.publishEvent (eventId="status",msgFormat=
            "json",  data=myData, qos=0 ,onPublish=None)
            print ("Published data Successfully: %s", myData)
            time.sleep (2)
client.commandCallback = myCommandCallback
client.disconnect ()
```

8.TESTING

8.1 TEST CASES

Test case ID	Feature Type	Component	Component	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_001	Functional	Registration Page	As a new user, I want to first register using my email and create a password for the account	wifi connection, Laptop/Mobile	1.Enter URL and click go 2.Register using registration form.	https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Appli	Login/Signup popup should display	Working as expected	Pass	Steps are all clear to follow	yes	Nil	Hemadharshini S
Loginpage_TC_002	Functional	Registration Page	for the application by entering my email, password, and confirming my	wifi connection, Laptop/Mobile	1.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go. 2.Click on SmartFarmer.apk		Application should show below UI elements: a. Username text box b. Password text box c. Login button with green color	Working as expected	Pass	Steps are all clear to follow	yes	Nil	Jayasree M
LoginPage_TC_003	UI	Gmail	As a user, I will receive confirmation email once I have registered for the application	wifi connection, Laptop/Mobile	.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go 2.Click on SmartFarmer.apk		Application should show below UI elements: a. Username text box b. Password text box c. Login button with green color	Working as expected	pass	Steps are all clear to follow	yes	Nil	Kalpana S
LoginPage_TC_004	UI	Home page	As a user, I can register for the application through Facebook	wifi connection, Laptop/Mobile	.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go 2.Click on SmartFarmer.apk	Username: geethamai575@gmail.com password: 1234	User should navigate to user account Login page	Working as expected	pass	Steps are all clear to follow	yes	Nil	Geetha Mai A G
LoginPage_TC_005	Functional	Login page	As a user, I can register for the application through GMAIL	wifi connection, Laptop/Mobile	.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go 2.Click on SmartFarmer.apk	Username: selvanhema67@gmail.com password: 1316	Application should show 'Incorrect email or password ' validation message	Working as expected	pass	Steps are all clear to follow	yes	Nil	Hemadharshini S
LoginPage_TC_006	Functional	Login page	As a user, I can log into the application by entering email and password	wifi connection, Laptop/Mobile	.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go 2.Click on SmartFarmer.apk	Username: jsree6578@gmail.com password: 2419	Application should show 'Incorrect email or password ' validation message if credentials given wrong	Working as expected	pass	Steps are all clear to follow	yes	Nil	Jayasree M
LoginPage_TC_007	Functional	Login page	As a registered user, I need to easily login log into my registered account via the web page in minimum time	wifi connection, Laptop/Mobile	.Enter URL(https://github.com/IBM-EPBL/IOT-ENABLED-SMART-FARMING-APPLICATION-/tree/main/5.%20Develop%20A%20Mobile%20Application) and click go 2.Click on SmartFarmer.apk	Username: jcicy02@gmail.com password: 1116	Application should show 'Incorrect email or password ' validation message if credentials given wrong	Working as expected	pass	Steps are all clear to follow	yes	Nil	Jacy I


Not secure 169.51.205.209:31780/ui/#!/0?socketid=rD74JpfPbDF1fE2yAAAS
Incognito
Gmail
WhatsApp
https://classroom.g...
WNET
SSM INSTITUTE OF...
GitHub
Screen Recorder - C...
Online Assessment...
Anna University - C...
Other bookmarks
Node-RED Dashboard
Weather Monitoring
Humidity
27
0
%
100
LIGHT ON
LIGHT OFF
Temperature
74
Type here to search
EN
22°C
10:28 PM
18-11-2022


Not secure 169.51.205.209:31780/red/#flow/81d6a4c5f926f10a
Node-RED
Deploy
filter nodes
Flow 1
debug
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
IBM IoT
connected
msg.payload
Temperature Node
Temperature
Humidity Node
Humidity
[get] /sensor
httpfunctionnode
http
Light ON
Light OFF
IBM IoT
connected
msg.payload
[get] /control
command function node
http
all nodes
all
Type here to search
22°C
10:27 PM
18-11-2022

8.2 USER ACCEPTANCE TESTING

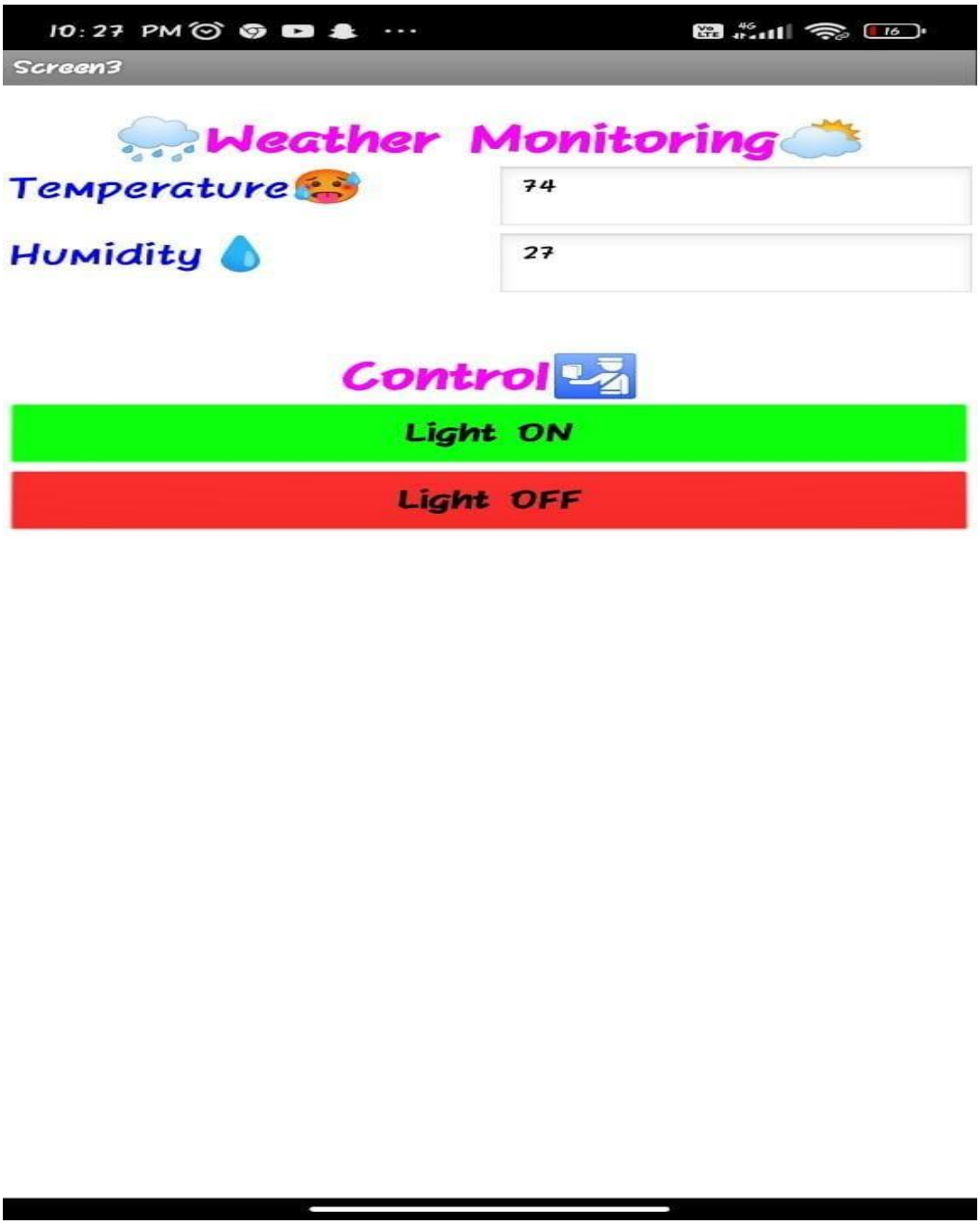
8.2.1 DEFECT ANALYSIS

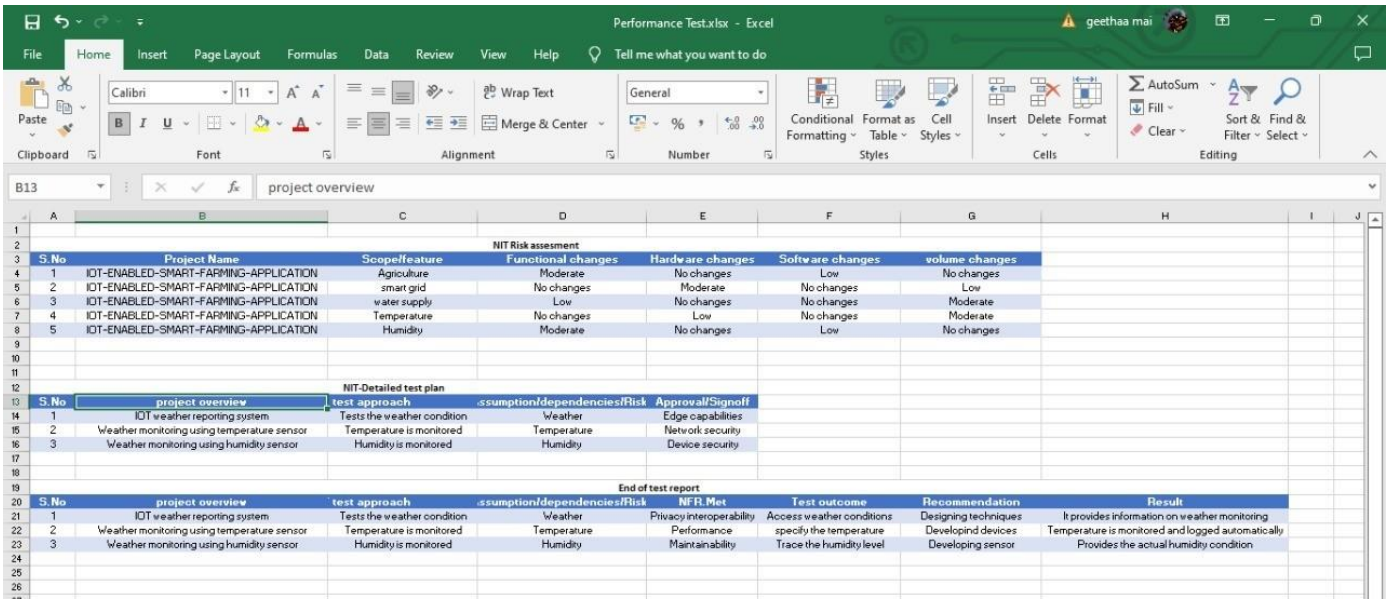
This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	1	0	0	2
Duplicate	0	0	0	0	0
External	1	1	0	0	2
Fixed	1	1	1	0	3
Not Reproduced	0	0	0	0	0
Skipped	0	1	0	0	1
Won't Fix	0	0	0	0	0
Totals	3	4	1	0	8

8.2.2 TEST CASE ANALYSIS

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	0	0	0	0
Client Application	5	0	0	5
Security	1	0	0	1
Outsource Shipping	3	0	0	3
Exception Reporting	5	0	0	0
Final Report Output	4	0	0	4
Version Control	2	0	0	2


10:27 PM
Screen3
Weather Monitoring
Temperature
74
Humidity
27
Control
Light ON
Light OFF



Performance Test.xlsx - Excel

B13: project overview

NIT Risk assesment

S.No	Project Name	Scope/feature	Functional changes	Hardware changes	Software changes	volume changes
1	IOT-ENABLED-SMART-FARMING-APPLICATION	Agriculture	Moderate	No changes	Low	No changes
2	IOT-ENABLED-SMART-FARMING-APPLICATION	smart grid	No changes	Moderate	No changes	Low
3	IOT-ENABLED-SMART-FARMING-APPLICATION	water supply	Low	No changes	No changes	Moderate
4	IOT-ENABLED-SMART-FARMING-APPLICATION	Temperature	No changes	Low	No changes	Moderate
5	IOT-ENABLED-SMART-FARMING-APPLICATION	Humidity	Moderate	No changes	Low	No changes

NIT-Detailed test plan

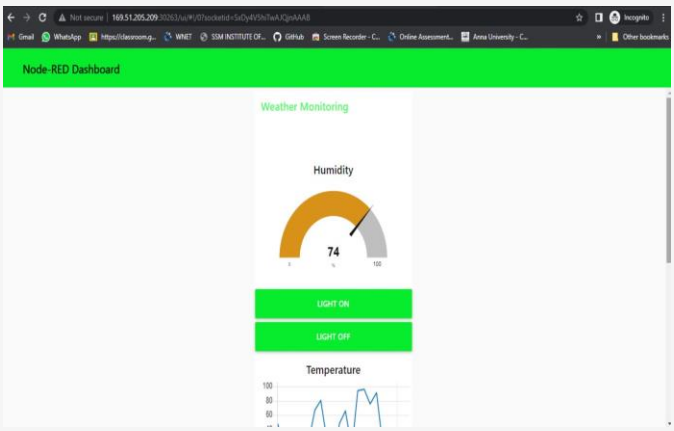
S.No	project overview	test approach	ssumption/dependencies/Risk	Approval/Signoff
1	IOT weather reporting system	Tests the weather condition	Weather	Edge capabilities
2	Weather monitoring using temperature sensor	Temperature is monitored	Temperature	Network security
3	Weather monitoring using humidity sensor	Humidity is monitored	Humidity	Device security

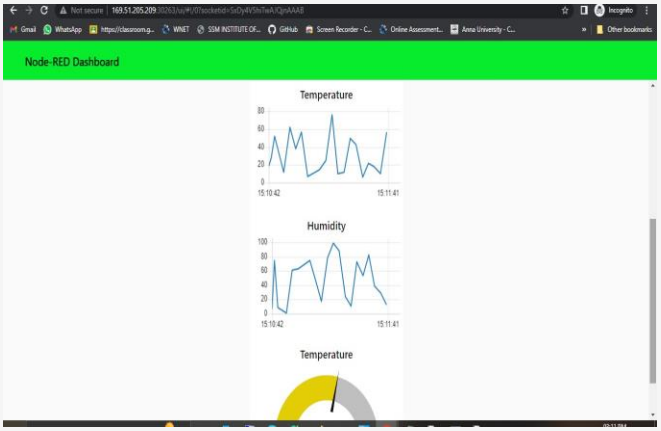
End of test report

S.No	project overview	test approach	ssumption/dependencies/Risk	NFR Met	Test outcome	Recommendation	Result
1	IOT weather reporting system	Tests the weather condition	Weather	Privacy interoperability	Access weather conditions	Designing techniques	It provides information on weather monitoring
2	Weather monitoring using temperature sensor	Temperature is monitored	Temperature	Performance	specify the temperature	Developind devices	Temperature is monitored and logged automatically
3	Weather monitoring using humidity sensor	Humidity is monitored	Humidity	Maintainability	Trace the humidity level	Developing sensor	Provides the actual humidity condition

9.RESULTS

9.1 PERFORMANCE METRICS





10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- ⭐All the data like climatic conditions and changes in them, soil or crop conditions everything can be easily monitored.
- ⭐Risk of crop damage can be lowered to a greater extent.
- ⭐Many difficult challenges can be avoided making the process automated and the quality of crops can be maintained.
- ⭐The process included in farming can be controlled using the web applications from anywhere, anytime.
- ⭐A remote control system can help in working irrigation systemvalves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and laborintensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.
- ⭐Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the program transmits a sign to the unit within seconds by means of a mobile phone system.

DISADVANTAGES:

- The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
- The smart farming based equipment require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.
- IOT devices need much money to implement.
- Any faults in the sensors can cause great loss in the agriculture,due to wrong records and the actions of automated processes.

11. CONCLUSION

Farmers can benefit greatly from an IoT-based smart agriculture system. As a result of the lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature, and moisture can be adjusted dependent on the local environmental variables. This technology 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. Continuous internet connectivity is required for continuous monitoring of data from sensors. This also can be overcome by using GSM unit as an alternative of mobile app. By GSM, SMS can be sent to farmers phone.An IOT based smart agriculture system using Watson IOT platform, Watson simulator, IBM cloud and Node-RED are also provided.

12. FUTURE SCOPE

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places.We can create few more models of the same project ,so that the farmer can have information of a entire.We can update the this project by using solar power mechanism. So that the power supply from electric poles can be replaced with solar panels. It reduces the power line cost. It will be a one time investment. We can add solar fencing technology to this project.We can add camera feature so that the farmer can monitor his field in real time. This helps in avoiding thefts

13. Appendix

Source code

```
import wiotp.sdk.device
import time
import os
import datetime
import random
myConfig = {
"identity": {
"orgId": "u9qhfi",
"typeId": "Devicetype1",
"deviceId": "DeviceID1"
},
"auth": {
"token": ")hSb7_ZD+evl2fRhXi"
} }
client=wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=
None)
client.connect ()
def myCommandCallback (cmd) :
```

```
    print ("Message received from IBM IoT Platform:
    %s"%  cmd.data['command'])
        m=cmd.data['command']
        if (m=="motoron"):
            print ("Motor is switched on")
            elif (m=="motoroff"):
               print ("Motor is switched OFF")
            print (" ")
while True:
        soil=random.randint (0,100)
        temp=random.randint (-20, 125)
        hum=random.randint (0, 100)
        myData={'soil moisture': soil, 'temperature':temp, 'humidity':hum}
            client.publishEvent (eventId="status",msgFormat=
            "json",  data=myData, qos=0 ,onPublish=None)
            print ("Published data Successfully: %s", myData)
            time.sleep (2)
client.commandCallback = myCommandCallback
client.disconnect ()
```

GITHUB LINK : https://github.com/IBM-EPBL/IBM-Project-6653-1658834200

PROJECT DEMO LINK:
https://drive.google.com/file/d/1BcADMJkqmjIaxqGbh8qO