NALAIYA THIRAN - IBM PROJECT REPORT

(19EC406T - Professional Readiness for Innovation, Employability and Entrepreneurship)

ON

SMART FARMERS-IOT ENABLED SMART FARMING APPLICATION

Submitted by

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

VELAMMAL ENGINEERING COLLEGE, CHENNAI-66.

(An Autonomous Institution, Affiliated to Anna University, Chennai)

2022-2023

VELAMMAL ENGINEERING COLLEGE
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BONAFIDE CERTIFICATE

Certified that this NALAIYA THIRAN – IBM PROJECT REPORT **“SMART FARMERS-IOT ENABLED SMART FARMING APPLICATION”** is the Bonafide work of **“PARVEEN REHANA (113219041080), NANDHINI V (113219041072), SWETHA P (113219041122), THANYA V (113219041124)”** carried out in “PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP (NALAIYA THIRAN-IBM PROJECT)**”** during the Academic Year 2022-2023.

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College Name : Velammal Engineering College

Department : Electronics & Communication Engineering

Semester : VII Semester

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The report of the project work submitted by the above students in the partial fulfillment for the award of Bachelor of Engineering Degree in **ELECTRONICS AND COMMUNICATION ENGINEERING** of Anna University, Chennai was evaluated and confirmed to be the report of the work done by the above students and then evaluated.

Submitted for Internal Evaluation held on__/____/2022.

MENTOR **EVALUATOR**

ABSTRACT

Agriculture, a $2.4 trillion industry, is a foundation of economies worldwide. Factors such as climate change, population growth and food security concerns have propelled the industry into seeking more innovative approaches to protecting and improving crop yield. As a result, artificial intelligence is steadily emerging as part of the industry's technological evolution. This project is development of Iot enabled mobile application which monitor soil, field, climate, crop, irrigation and gives information to the farmers irrespective of the location of the farmers.

This project reduce the burden for the farmers and make farming as a easy task. 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.

CHAPTER 1

INTRODUCTION

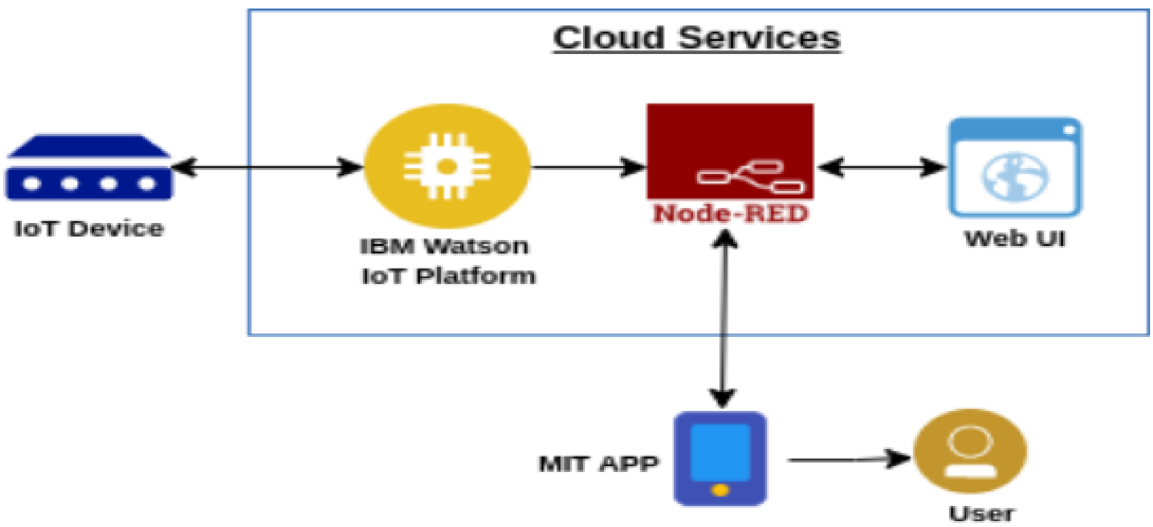
The impartial of this outline is to proposed IOT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done. After the examination showed that every crop field has different characteristics that can be measured separately in terms of both quality and quantity. Critical characteristics. like soil type. nutrient presence, flow of irrigation, pest resistance, etc., define its suitability and capability for a specific crop.Considering the standard farming procedures, farmers need to computing the agriculture plots frequently throughout the crop life to have a better idea about the crop conditions. For this, the need of smart agriculture arises, as 70% of farming time is spent monitoring and understanding the crop states. instead of doing actual field work.

Wireless sensors are facilitating the monitoring of crops constantly with higher accuracy and are able to, most importantly, detect early stages of unwanted state. This is the purpose of that why modern agriculture involves the usage of smart tools and kits, from sowing to crop harvesting and even during storage and transportation. Timely reporting using the value of sensors that makes the entire operation not only smart but also cost effective due to its precise monitoring capabilities. Different of autonomous tractors, harvesters, robotic weeders, drones, and satellites currently complement agriculture equipment. Sensors can be of the installed and start collecting data in a short time, which is then available for further analyses immediately.

1.1 PROJECT OVERVIEW

Agriculture has always been the backbone of any economic development. To promote further growth of agriculture, it must be integrated with modern practices and technologies. With the wide spread acceptance of technology, it can be used in farming to make farmers perform their activity with ease. Electronics and IoT has found its application in many of the personal assistant devices. This can be extended to many vital fields like agriculture where their assistants can help solve many issues faced. Electronics can help devices get physically connected with their operational environment and analyse and collect data. IoT can help analyse and transfer the data to the user. The combination of these gives rise to an all-in-one device capable of carrying out a task.

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.



1.2 PURPOSE

In recent times, the erratic weather and climatic changes have caused issues for farmers in predicting the perfect conditions to initiate farming. Though on a superficial scale it seems unpredictable, it can be determined with certain parameters with which crop planning can be done. Maintenance of farm fields during and after cultivation are also important. These can be performed by measuring soil moisture, humidity and temperature. Page 4 of 43 Measurement of these parameters are performed using physical sensors. This system is in turn connected to IoT system which can provide a easy to access interface for farmers to read, analyze and take action based on the presented condition. Taking it a step ahead, the system can also gain access to motors and other electrical equipment used in farming and automate their operation. This can help with unsupervised operation ensuring accuracy and lesser response time.

The smart agriculture model's main aim to avoid water wastage in the irrigation process. It is low cost and efficient system Is shown below. It includes Node MCU, Arduino Nano, sensors like soil moisture and Dht11, solenoid valves, relays.

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE SURVEY

1.IOT BASED SMART FARMING SYSTEM - YASIR FAHIM

Agriculture IOT system accurately monitors various parameters like warehouse temperature, shipping transportation management system and also integrates cloud-based recording systems. IoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps, cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the parties concerned. it needs to fetch more data with regard to pest control and also integrating GPS module in this system in enhancing the product.

2. SMART FARMING STICK DR.C.K. GOMATHY, MR.C. SAIGANESH, MR.B. SAIKIRAN

Smart Farming IoT Based Agriculture Stick for Live Monitoring of Temperature and Soil Moisture has been proposed using Node MCU Chip, Wifi Module and various other Hardware Devices. The stick has high efficiency and accuracy in fetching the live data of temperature, humidity and soil moisture. Smart farming based agriculture IoT stick is regarded as IoT gadget focusing on live monitoring of environmental data in terms of temperature, moisture and other types depending on sensors integrated with it**.** 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.

3.SMART AGRI FOOD PROJECT -ESTHER MIETZSCH, DANIEL MARTINI, WOLFGANG.

Identifying and developing smart agri-food-specific capabilities and conceptual prototypes, demonstrating critical technological solutions Development of a practical service pilot would be beneficial, management and maintenance are challenges .The smart farming based equipments require farmers to understand and learn the use of technology that is complex.

4. IOT-EQUIPPED AND AI-ENABLED NEXT GENERATION SMART AGRICULTURE-SAMEER QAZI

This enables efficient management of resources like minimizing water requirements for irrigation and minimizing the use of toxic pesticides. Adoption of IoT technologies for remote, unmanned monitoring of the agriculture fields Future crops will not be farmers choice rather dictated by data driven smart farming encounter cyber threats ,Hacking attack on smart machinery and cyber threats to agrobase.

2.2 EXISTING PROBLEMS

There has been several attempts and solution to help farmers adopt technological practices. Few solutions restricted their performance with just suggestions and alerts. While few employed IoT independent electronics. Few of the cases of previous attempts and researches are described below.

i. “IoT based smart sensors agriculture stick for live temperature and moisture monitoring using Arduino, cloud computing & solar technology”. This work was performed using Cloud computing platform (Things Speak) for data acquisition. The circuit was designed using Arduino and DHT 11 sensors.

ii. "Smart Farming using IoT, a solution for optimally monitoring farming conditions". This work used ESP-32 based IoT platform and Blynk mobile application.

iii. "Smart farming using IoT". The automation and interface part made use of water pump and HTTP protocol for parameters monitoring using website.

The above stated prior works lacked one or two features, which when included could have enhanced the performance. In the first work, including a Raspberry Pi based controller in place of Arduino can help reduce the design area while also providing microcontroller with additional UI and IoT interfaces. In the second stated work, going with MIT app inventor instead of Blynk application can improve the possibility of feature expansion. Farmers or developers won't need to go for a paid version of the app to include new features. In the third work, control of water pump can be enhanced with the use of servo-based water valves to direct and control the flow of water rather than using a bi-stated logic.

2.3 PROBLEM STATEMENT AND DEFINITION

NECCESSITY

- Farmers needs a way to get alert when animals enter into field so that the farmers get alert and protect crop from animals.
- Farmers need a way to know the soil erosion is reducing the amount of land available for agriculture, and declining biodiversity affects the pollination of crops so that farmers get alert and protect the land available for agriculture
- Farmers need a solution for pest control so that they can achieve greater efficiency in pest treatments.

- Farmers need a solution for proper livestock management system so that IoT agriculture sensors that can be attached to the animals on a farm to monitor their health and log performance. Livestock tracking and monitoring help collect data on stock health, well-being, and physical location.

The problem statement in a nutshell covers all the possible technical aspects that can be included by farmer to convert farming in to smart and efficient farming. IoT enabled smart farming, on a wider perspective, concentrates on connecting all the independently operating sub-systems in farming automation into a single entity. IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors.

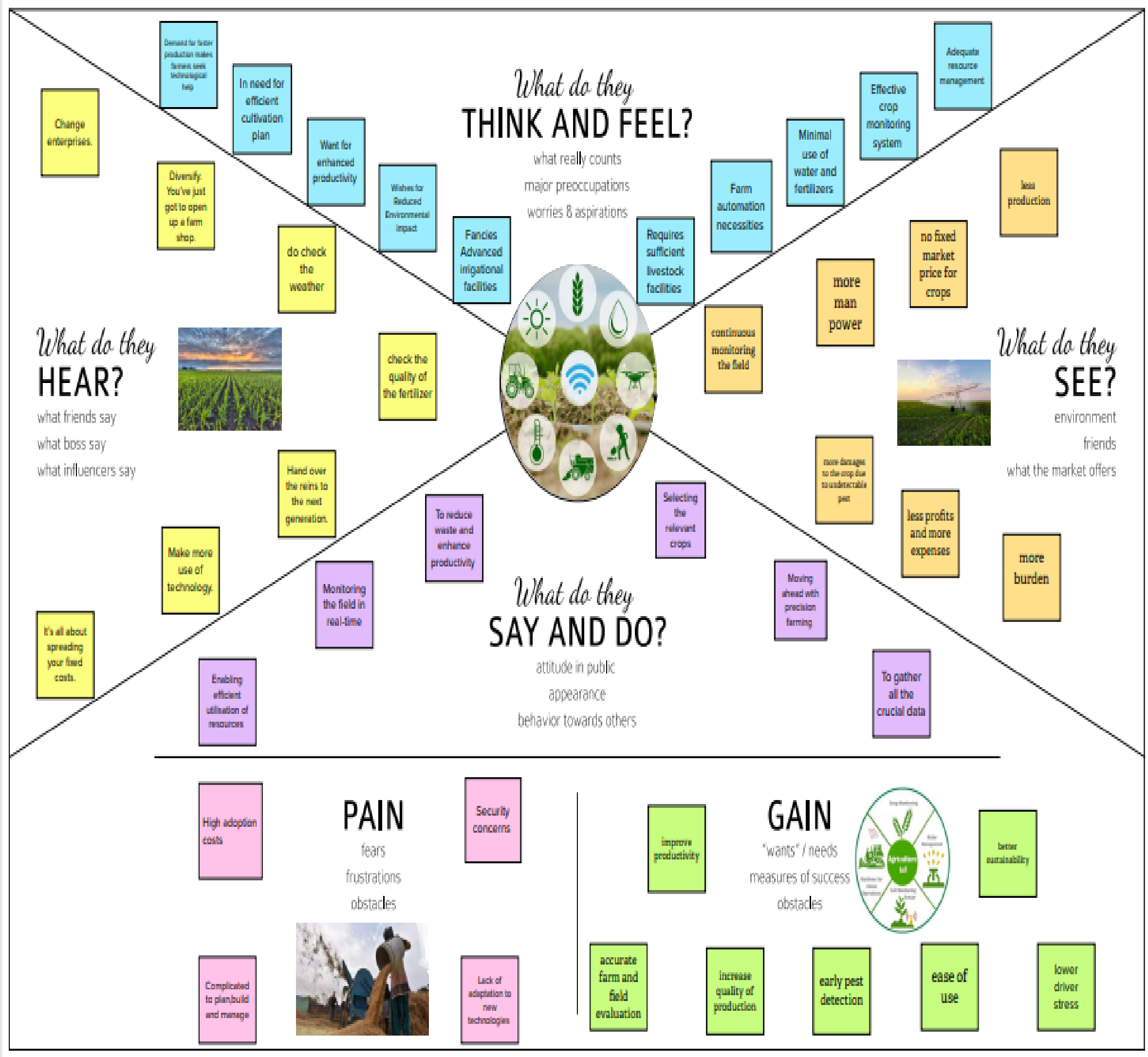
The soil moisture sensor measures wetness content in the soil. The Arduino UNO microcontroller used to receive input from a various sensor and it can be controlled automatically. When soil moisture sensor goes low the water pump will be on and it exceeds defined levels of the water motor will turn off automatically. We can constantly monitor the growth of a crop using ultrasonic sensor. PIR sensor detects the motion or unusual movement in the agricultural land. This device his very helpful to the former to monitor and control environmental parameters at their field. The farmers need not go to their field, they can remotely monitor and control using cloud.

The idea of IoT is further extended with the help of mobile and web application where farmers can monitor all the sensor parameters 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.

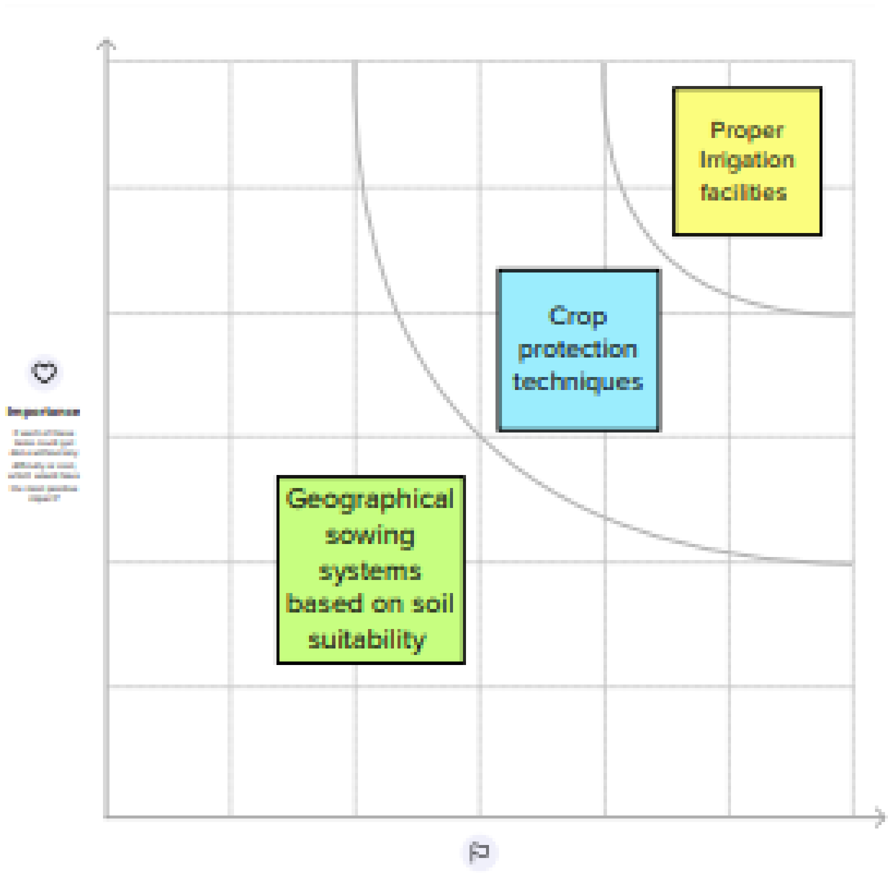
CHAPTER 3

IDEATION AN PROPOSED SYSTEM

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



IDEA 1: GEOGRAPHICAL SOWING SYSTEMS BASED ON SOIL SUITABILITY

DESCRIPTION:

A website that describes the features of the application, also provides important advices in farming regarding optimum conditions, crop health, use of resources etc. With this, along with farmers any hobbyist who is interested in farming can start cultivating in an efficient way with this guide.

IDEA 2: CROP PROTECTION TECHNIQUES

DESCRIPTION:

A complete application with sophisticated features to monitor all the field parameters and making it user friendly so that every farmer can benefit from that.

IDEA 3: PROPER IRRIGATION FACILITIES

DESCRIPTION:

Automating watering process to save water and for a continuous monitoring for crops in the field

3.3. PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1	Problem Statement (Problem to be solved)	Developing a smart application for farmers to make farming as automated and in smart way.
2	Idea / Solution description	(i)Internet of Things (IoT) implementation in this field has resulted in the term smart farming. (ii)IoT in smart farming is the future of precision farming and results in high quality produce and healthy cattle. (iii)With the use of many smart farming sensors, and wearables, one can get real-time update with a touch of the screen.
3	Novelty/ Uniqueness	The innovative approach has (i)climate based- crop risk management tools (ii)household bioeconomic models approaches (iii)whole farm dynamic models
4	Social Impact / Customer Satisfaction	i)With IoT, companies can enjoy benefits like better crop productivity and improved worker safety. (ii) They can use less fertilizer, water and pesticides. Because farmers can decrease the fertilizers and pesticides they use, there is less runoff into groundwater and rivers. This results in a lower impact on the ecosystem

5	Business Model (Revenue Model)	maintenance-as-a-service: Agriculture is a traditional sector and mature market with many established players in areas like equipment and machine manufacturing, seeds & chemicals, whole sellers, food processing industry and service provision. Therefore, it is very difficult and expenses for new players to enter the market, build up a brand recognition among farmers and establish a distribution network.Therefore,to win established corporate as distribution partners for startup companies and use the even the corporate customer relation infrastructure to serve startup clients
6	Scalability of the Solution	Since most smart farming data are small files that lead to many small files, Hadoop cannot be effective without a distributed system equipped with a high-performance computing system. To address this problem, the Hadoop Distributed File System (HDFS) has been designed to process large (and small size) datasets. Using cloud computing technology in a smart farming platform is another solution that can address scalability challenges related to capacity due to flexible and robust data collection, management, and processing capabilities

3.4 PROPOSED SOLUTION FIT

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

- The chief users and customers of our product are Farmers.
- We tend to provide an assistance for a remote monitoring of crop segments and field which helps in improving the crop cultivation techniques and make it easier

6. CUSTOMER CONSTRAINTS

- Customer can't rely upon a product that is complicated to use. Complex systems are prominently avoided by the farmers.
- A cost effective system is expected for continuous use of the proposed project.
- When there is no proper pest control and identification

5. AVAILABLE SOLUTIONS

The available solutions for the smart farming culture are

- Soil monitoring
- Automation in cultivation
- Temparature control

Explore AS, differentiate

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

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

- No proper irrigation
- Pest and animal invasion in fields
- Unpredicted weather and climate
- Lack of improper Monitoring of soil
- Usage of unnecessary fertilizer

9. PROBLEM ROOT CAUSE RC

- Lack of monitoring the fields
- No usage of modern technologies
- Lack of knowledge or awareness of technologies
- High cost of investment
- Need of internet facilities

7. BEHAVIOUR BE

- Aware about new technologies and implementing it for better progress
- Finding smarter ways to solve the problems
- Optimizing the usage of power and internet facilities

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

Identify strong TR & EM

3. TRIGGERS TR

The customer would be subsidizing his costs. He would be comparing his neighbour's electricity bills with his bill. the neighbour's bill may go down, but his bill will go up and so we would be prefer installing solar panel

4. EMOTIONS: BEFORE / AFTER EM

When faced with a crisis, they would feel weak and insecure. by analysing the problem properly and self-motivating the customer can gain confidence.

10. YOUR SOLUTION SL

- The advent of technology has helped multiple sectors in attaining profitability.
- One such sector is agriculture. Internet of Things (IoT) implementation in this field has resulted in the term smart farming.
- IoT in smart farming is the future of precision farming and results in high quality produce and healthy cattle.
- With the use of many smart farming sensors, and wearables, one can get real-time update with a touch of the screen

8. CHANNELS of BEHAVIOUR CH

1. ONLINE

Ubidots is an IoT platform that helps farmers to connect all their devices (weather station, irrigation system, soil moisture sensor, etc.) to the internet and manage them through a single dashboard. With the Ubidots IoT platform, farmers can: monitor in real-time the status of all their devices

2. OFFLINE

Agriculture is one of the major verticals to incorporate both ground-based and aerial drones for crop health assessment, irrigation, crop monitoring, crop spraying, planting, soil and field analysis, and other spheres. Since drones collect multispectral, thermal, and visual imagery while flying, the data they gather provide farmers with insights into a whole array of metrics: plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water pond mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat,

Identify strong TR & EM

CHAPTER 4

REQUIREMENT ANAYLSIS

4.1 FUNTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR.No.	FUNCTIONAL REQUIREMENT (EPIC)	SUB REQUIREMENT (STORY/SUB-TASK)
FR-1	User Registration	• Through Gmail
FR-2	User Confirmation	• Confirmation via Email • Confirmation via OTP
FR-3	Log into system	• Credentials Check • Roles of Access.
FR-4	Manage Modules	• Manage System Admins • Manage Roles of User Manage User permission Registration
FR-5	Check whether details	• Temperature details Humidity details
FR-6	Logout	Exit

4.2 NON- FUNCTIONAL REQUIREMENTS

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

NFR-1	**Usability**	Usability includes easy 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 or ambient parameters in farming will be more efficient for overall monitoring.
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 IoTplatforms affect system scalability and that automatic real time decision-making is feasible in an environment composed of dozens of thousand.

CHAPTER 5
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

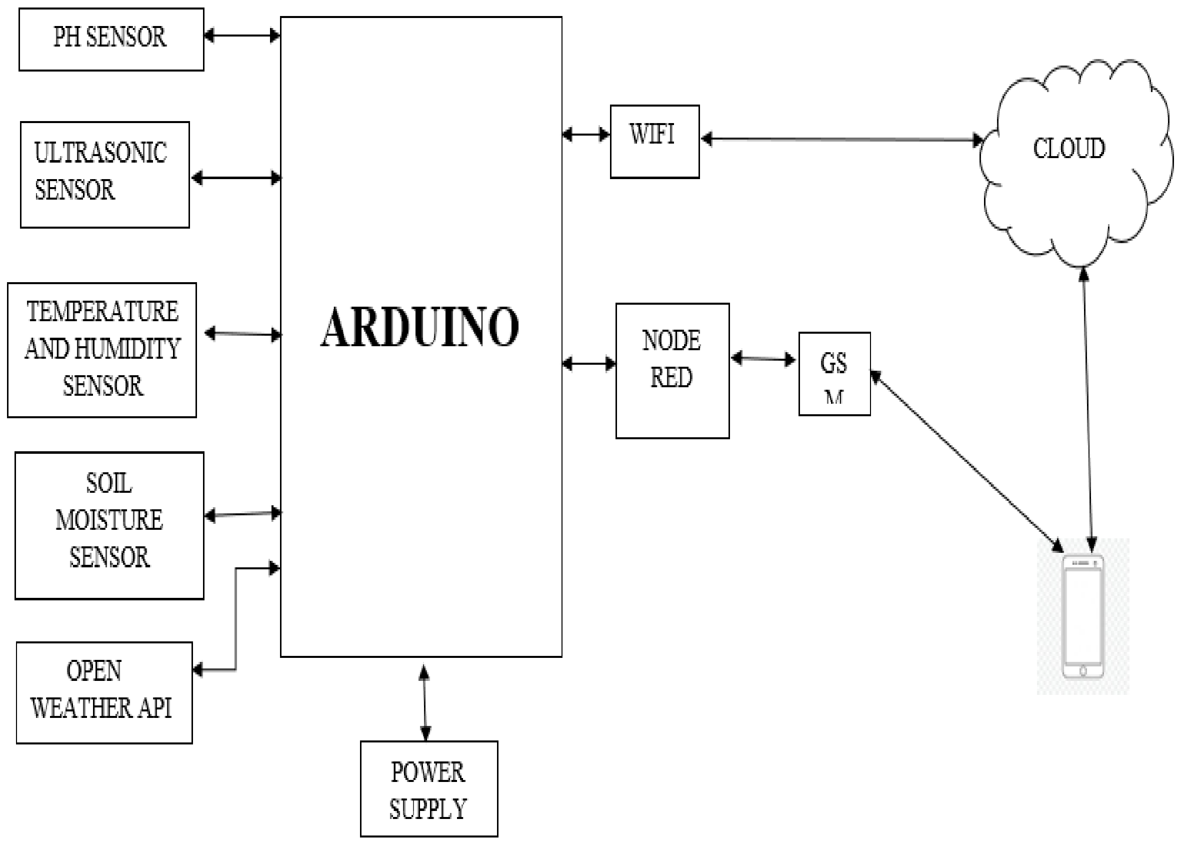
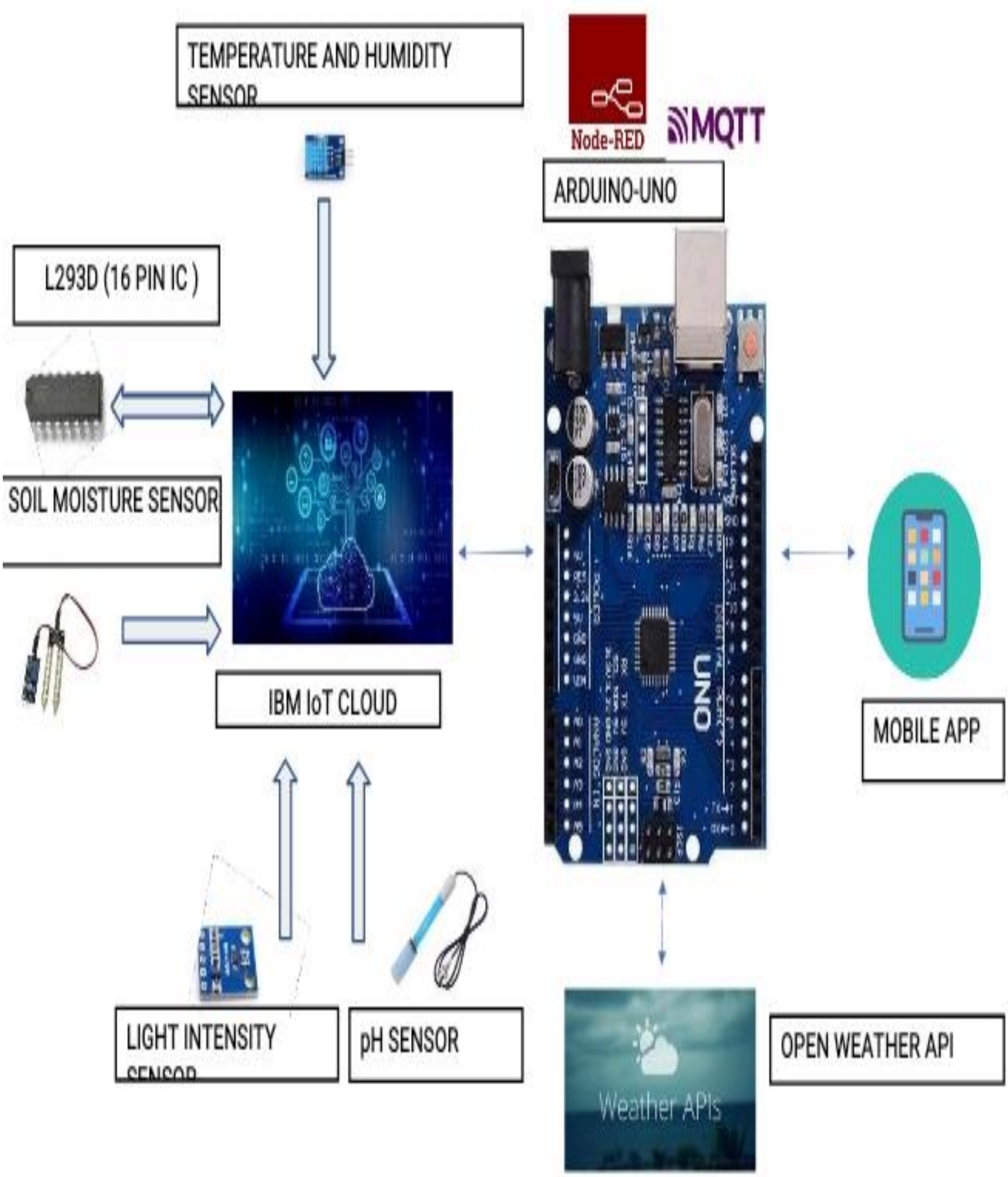


FIG 5.1 DATA FLOW DIAGRAM OF SMART FARMING- IOT ENABLED SMART FARMING APPLICATION

5.2 SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Farmers	Registration	US1	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
		US2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmati on email & click confirm	High	Sprint-1
		US3	As a user, I can register for the application through Gmail	I can access my account through email	Medium	Sprint-1
Farmers	Login	US4	As a user, I can log into the application by entering email & password		High	Sprint-1
Farmers	Model setup	US5	As a user, I can setup the model in the field with help of guide	I can setup the model through the guide assistance	High	Sprint-2
		US6	As a user, I setup the model through with help of instructions given in manual	I can setup the model with the help of instruction in manual	medium	Sprint-2
Farmers	Internet access	US7	As a user, I buy internet access from the provider	I buy internet access from the provider	High	Sprint-2
Farmers	Power supply	US8	As a user , I ensure the proper power supply for the setup	I ensure the sufficient power.	High	Sprint-2

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Farmers	Irrigation control monitoring	US9	As a user, I check the irrigation level through the smart farming application	I monitor the water level in the soil through the application	High	Sprint -2
Farmers	Weather control monitoring	US10	As a user, I check the weather condition through the application	I check the condition of the weather and take the prior actions	High	Sprint -2
Farmers	Animal invasion monitoring	US11	As a user, I get a alert system if the animals enter into the field	I get the alert sound if there is invasion of animals	High	Sprint -2
Farmers	Soil monitoring	US12	As a user, I get live details of the soil regarding the condition of the soil	I get live details of the soil regarding the condition of the soil from the application	High	Sprint -2
Application Administrator	Functioning of application	US13	As a user, I check the errors in application	I check whether the application does not make any problem	Medium	Sprint 1
Application Manager	Monitoring of Application	US14	As a user, I check well-functioning of the application	I check the proper functioning of application	High	Sprint -2

CHAPTER 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password.	2	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-1		USN-2	As a user, I will receive confirmation email once I registered for the application	1	High	Parveen Rehana Nandhini V Swetha P Thanya V

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email & password	1	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-1	Model setup	USN-5	As a user, I can setup the model in the field with help of guide	2	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-1		USN-6	As a user, I setup the model through with help of instructions given in manual	2	Low	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-2	Internet Access	USN-7	As a user, I buy internet access from the provider	1	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-2	Power supply	USN-8	As a user, I ensure the proper power supply for the setup	2	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-2	Functioning of application	USN-9	As a user, I check the errors in application	2	High	Parveen Rehana Nandhini V Swetha P Thanya V
Sprint-2	Monitoring of Application	USN-10	As a user, I check well-functioning of the application	2	High	Parveen Rehana Nandhini V Swetha P Thanya V

6.3 PROJECT TRACKER, VELOCITY & BURNDOWN CHART

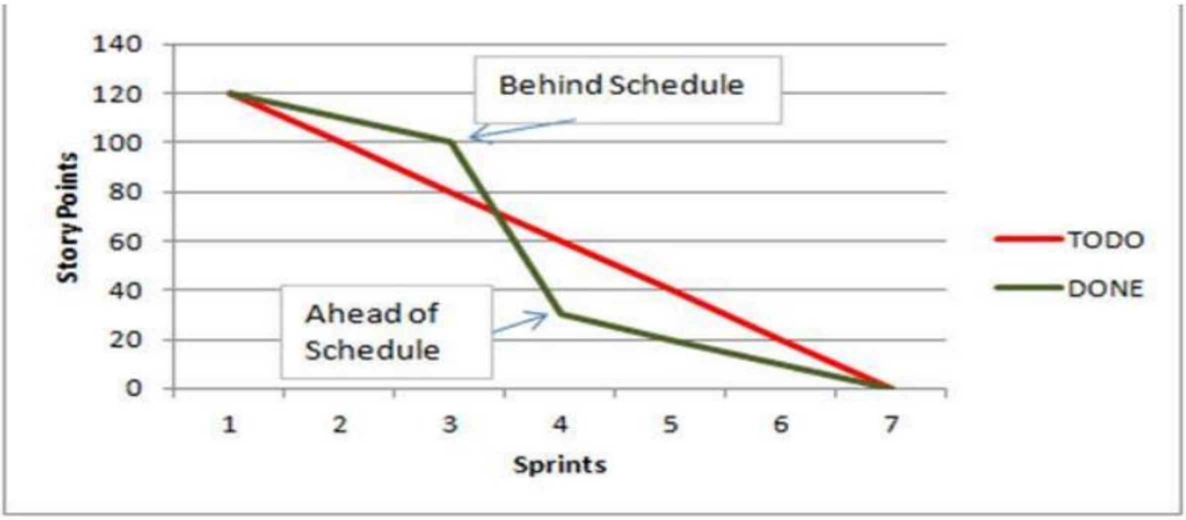
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	10	31Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	10	11Nov2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	10	18Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	10	30 Nov2022

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)

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

BURNDOWN CHART

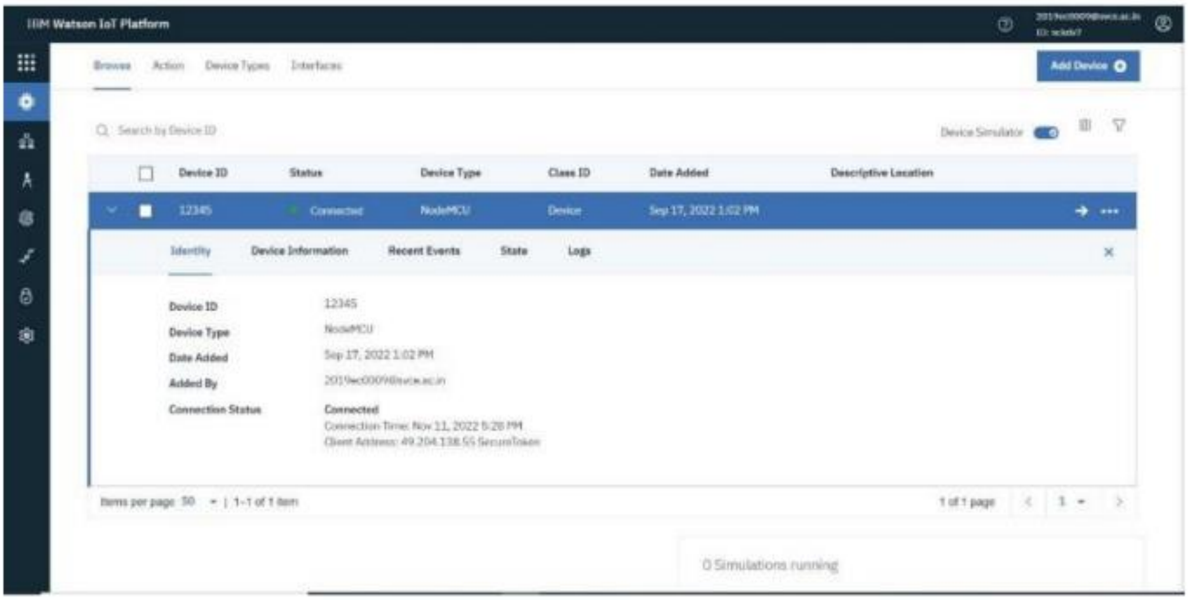


CHAPTER 7

CODING AND SOLUTIONS

7.1 CONFIGURATION OF THE IBM WATSON IOT PLATFORM AND A DEVICE

In the IBM Watson IOT Platform, under the catalog list, under the Internet of Things platform, a device has been created. From that the device credentials such as Device ID, Device Type, Organization ID, Authentication token were obtained.



DEVELOPMENT OF PYTHON SCRIPT

Development of Python Script to publish data to IBM Watson IOT platform:

CODE:

```
import time import sysimport ibmiotf.application import
ibmiotf.device import random
#Provide your IBM Watson Device Credentialsorganization =
"nckdv7" deviceType = "NodeMCU"
deviceId = "12345" authMethod = "token" authToken = "12345678" #
```

Initialize GPIO 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(0,100) pulse=random.randint(0,100)

moisture= random.randint(0,100)

humidity=random.randint(0,100); lat = 17 lon = 18 data = { 'temperature'

: temp, 'humidity' : humidity, 'Moisture' :moisture} #print

data

def myOnPublishCallback():

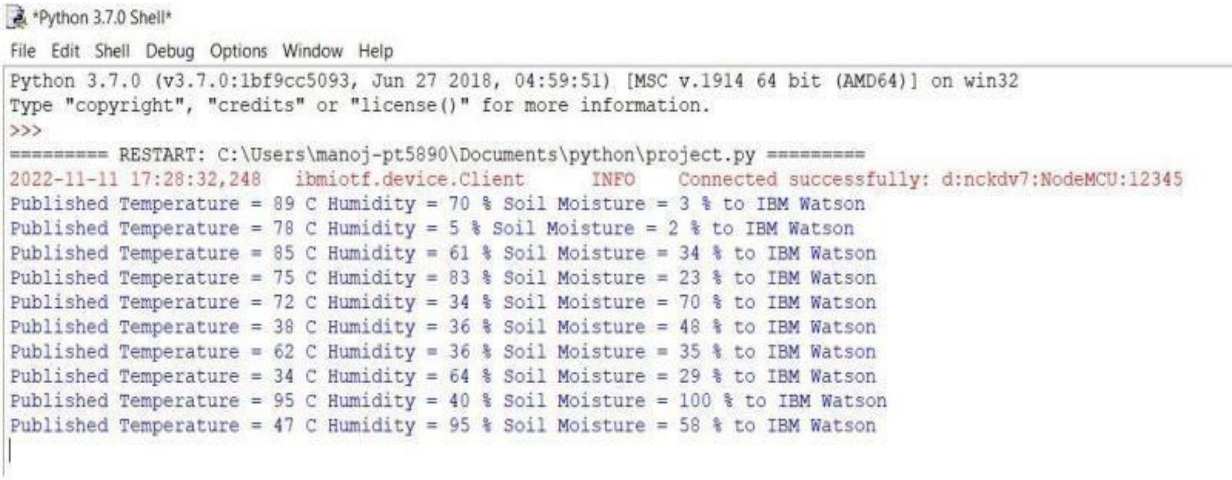
print ("Published Temperature = %s C" % temp, "Humidity = %s

%%" % humidity, "Soil Moisture = %s %%" % moisture,"to IBMWatson")

success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback) if not success: print("Not connectedto IoTF")

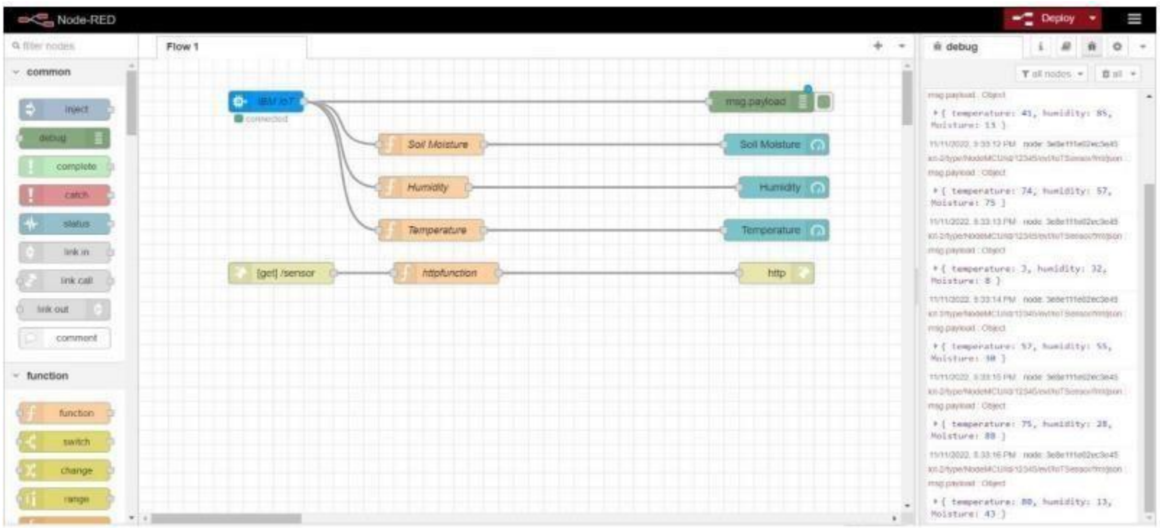
time.sleep(1) deviceCli.commandCallback = myCommandCallback # Disconnect the device and application from the cloud deviceCli.disconnect()

PYTHON CODE OUTPUT


```
*Python 3.7.0 Shell*
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========= RESTART: C:\Users\manoj-pt5890\Documents\python\project.py =========
2022-11-11 17:28:32,248   ibmiotf.device.Client     INFO    Connected successfully: d:nckdv7:NodeMCU:12345
Published Temperature = 89 C Humidity = 70 % Soil Moisture = 3 % to IBM Watson
Published Temperature = 78 C Humidity = 5 % Soil Moisture = 2 % to IBM Watson
Published Temperature = 85 C Humidity = 61 % Soil Moisture = 34 % to IBM Watson
Published Temperature = 75 C Humidity = 83 % Soil Moisture = 23 % to IBM Watson
Published Temperature = 72 C Humidity = 34 % Soil Moisture = 70 % to IBM Watson
Published Temperature = 38 C Humidity = 36 % Soil Moisture = 48 % to IBM Watson
Published Temperature = 62 C Humidity = 36 % Soil Moisture = 35 % to IBM Watson
Published Temperature = 34 C Humidity = 64 % Soil Moisture = 29 % to IBM Watson
Published Temperature = 95 C Humidity = 40 % Soil Moisture = 100 % to IBM Watson
Published Temperature = 47 C Humidity = 95 % Soil Moisture = 58 % to IBM Watson
```

7.2 CREATION OF NODE RED SERVICE

For device events monitoring creation of node red is essential, In the IBM Watson IOT platform, under the catalog, under the Node Red app service, an application is deployed using cloud foundry. In the cloud foundry, a group has been created and using the ci pipeline, the app URL is obtained. Using the URL, the Node red is launched. The IBM Watson IOTplatform is connected to Node red using the IBM IoT palette.



CODE BLOCK FOR THE FUNCTION PALETTE:

1. SOIL MOISTURE:

```
Soil=msg.payload.Moisture
msg.payload = "Soil Moisture :
" global.set('m',Soil) msg.payload = Math.round(Soil)
return msg;
```

2. HUMIDITY:

```
Humidity =msg.payload.humidity msg.payload =
"Humidity : " global.set('h',Humidity) msg.payload
= Math.round(Humidity) return msg;
```

3.TEMPERATURE:

```
Temperature = msg.payload.temperature msg.payload =
"Temperature : " global.set('t',Temperature) msg.payload
=Math.round(Temperature) return msg;
```

4.HTTP FUNCTION:

```
msg.payload = {"Temperature:":
global.get('t'),"Humidity:":global.get('h'),"Soil
Moisture:": global.get('m')} return msg;
```

7.3 CREATION OF WEBSITE DASHBOARD

A website dashboard has been created using the gauge palette. It can be accessed by adding “/ui” in the main URL of Node red. This dashboard displays the gauge representation of the data published in the IBM IOT platform.

PYTHON CODE USED:

```
import time import sysimport ibmiotf.application import
ibmiotf.device import random
#Provide your IBM Watson Device Credentials organization =
"nckdv7" deviceType = "NodeMCU" deviceId = "12345"
authMethod = "token"  authToken ="12345678" # Initialize
GPIO  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(0,100)

pulse=random.randint(0,100)moisture=

random.randint(0,100)

humidity=random.randint(0,100); lat = 17 lon = 18 data = {

'temperature' : temp, 'humidity' :

humidity, 'Moisture' : moisture}
#print data defmyOnPublishCallback():

print ("Published Temperature = %s C" % temp,
"Humidity =
%s %%" % humidity, "Soil Moisture = %s %%" %

moisture,"to IBM Watson")

success = deviceCli.publishEvent("IoTSensor", "json", data,

qos=0, on_publish=myOnPublishCallback) if not success:

print("Not connected to IoTF")

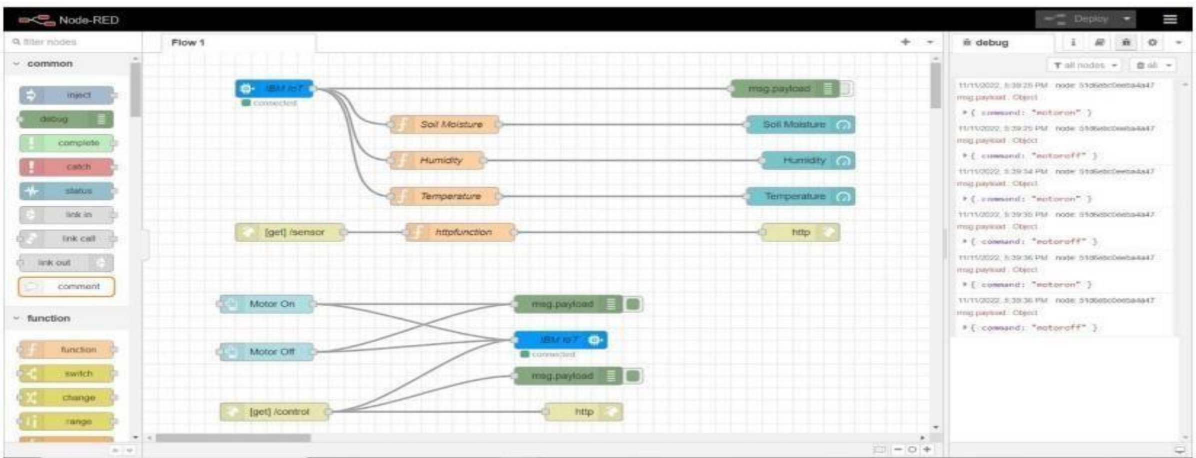
time.sleep(1) deviceCli.commandCallback

#Disconnect the device and application

from the cloud deviceCli.disconnect()

SERVICE FOR DEVICE COMMANDS:

In addition to the palettes used in the Sprint-2, additional palettes such as buttons have been included to control devices by giving commands and the output is printed in the debug whenever a specific command is given



DEVELOPMENT OF PYTHON SCRIPT TO SUBSCRIBE COMMAND FROM THE IBM IOTPLATFORM

Code:

```
import time import sysimport ibmiotf.application import
ibmiotf.device import random
#Provide your IBM Watson Device Credentials organization =
"nckdv7" deviceType = "NodeMCU" 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")
         else:
             print("Motor is OFF")

#print(cmd) try: deviceOptions = {"org": organization, "type":
deviceType, "id": deviceId, "authmethod": authMethod, "auth-token":
authToken} deviceCli = ibmiotf.device.Client(deviceOptions)
         #exceptException 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(0,100)
        pulse=random.randint(0,100) moisture= random.randint(0,100)
        humidity=random.randint(0,100); lat = 17 lon = 18 data = {
        'temperature' : temp, 'humidity' : humidity, 'Moisture”

        def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity =
```

%s

%%" % humidity, "Soil Moisture = %s %%" % moisture,"to

IBMWatson") success = deviceCli.publishEvent("IoTSensor",

"json", data, qos=0 on_publish=myOnPublishCallback) if not

success:

print("Not connected to IoTF")

time.sleep(1)deviceCli.commandCallback =

myCommandCallback

Disconnect the device and application from the cloud

deviceCli.disconnect()

OUTPUT

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

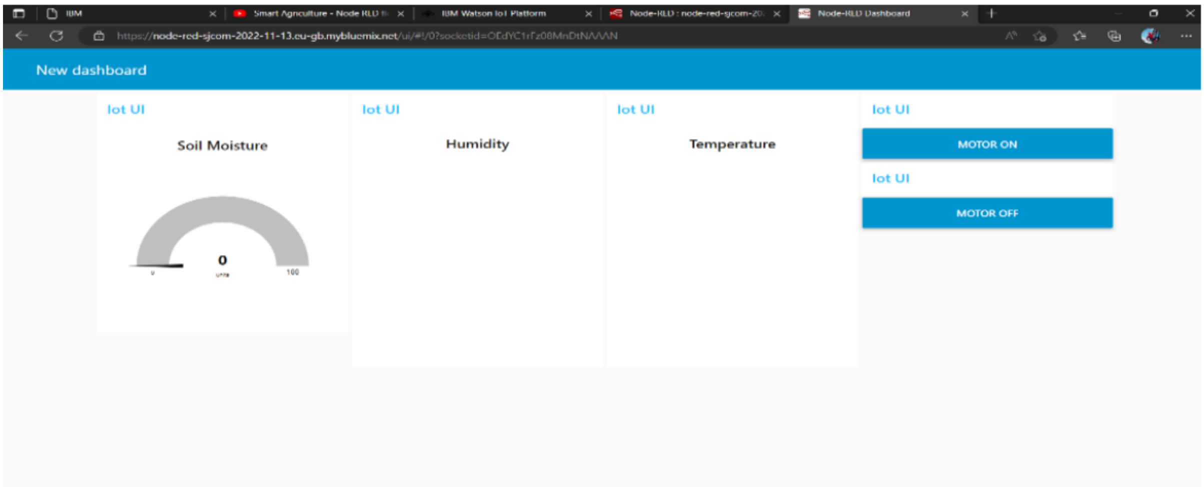
```
Published Temperature = 88 C Humidity = 66 % Soil Moisture = 3 % to IBM Watson
Published Temperature = 50 C Humidity = 97 % Soil Moisture = 63 % to IBM Watson
Published Temperature = 24 C Humidity = 33 % Soil Moisture = 50 % to IBM Watson
Published Temperature = 73 C Humidity = 29 % Soil Moisture = 56 % to IBM Watson
Published Temperature = 23 C Humidity = 1 % Soil Moisture = 90 % to IBM Watson
Published Temperature = 31 C Humidity = 12 % Soil Moisture = 38 % to IBM Watson
Published Temperature = 91 C Humidity = 62 % Soil Moisture = 58 % to IBM Watson
Published Temperature = 15 C Humidity = 49 % Soil Moisture = 70 % to IBM Watson
Published Temperature = 51 C Humidity = 81 % Soil Moisture = 84 % to IBM Watson
Published Temperature = 61 C Humidity = 17 % Soil Moisture = 37 % to IBM Watson
Published Temperature = 91 C Humidity = 87 % Soil Moisture = 70 % to IBM Watson
Published Temperature = 35 C Humidity = 6 % Soil Moisture = 95 % to IBM Watson
Published Temperature = 52 C Humidity = 41 % Soil Moisture = 63 % to IBM Watson
Published Temperature = 40 C Humidity = 51 % Soil Moisture = 86 % to IBM Watson
Published Temperature = 33 C Humidity = 21 % Soil Moisture = 38 % to IBM Watson
Published Temperature = 29 C Humidity = 48 % Soil Moisture = 22 % to IBM Watson
Published Temperature = 45 C Humidity = 32 % Soil Moisture = 23 % to IBM Watson
Published Temperature = 98 C Humidity = 38 % Soil Moisture = 8 % to IBM Watson
Published Temperature = 44 C Humidity = 71 % Soil Moisture = 16 % to IBM Watson
Command received: motoron
Motor is ON
Published Temperature = 62 C Humidity = 2 % Soil Moisture = 34 % to IBM Watson
Published Temperature = 21 C Humidity = 14 % Soil Moisture = 82 % to IBM Watson
Published Temperature = 35 C Humidity = 2 % Soil Moisture = 5 % to IBM Watson
Published Temperature = 34 C Humidity = 78 % Soil Moisture = 44 % to IBM Watson
Command received: motoroff
Motor is OFF
```

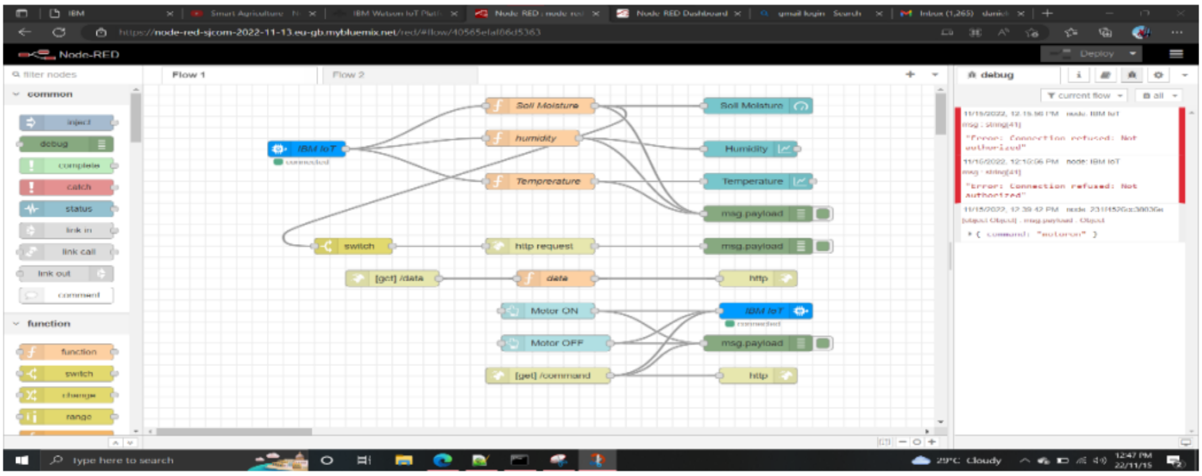
CHAPTER 8

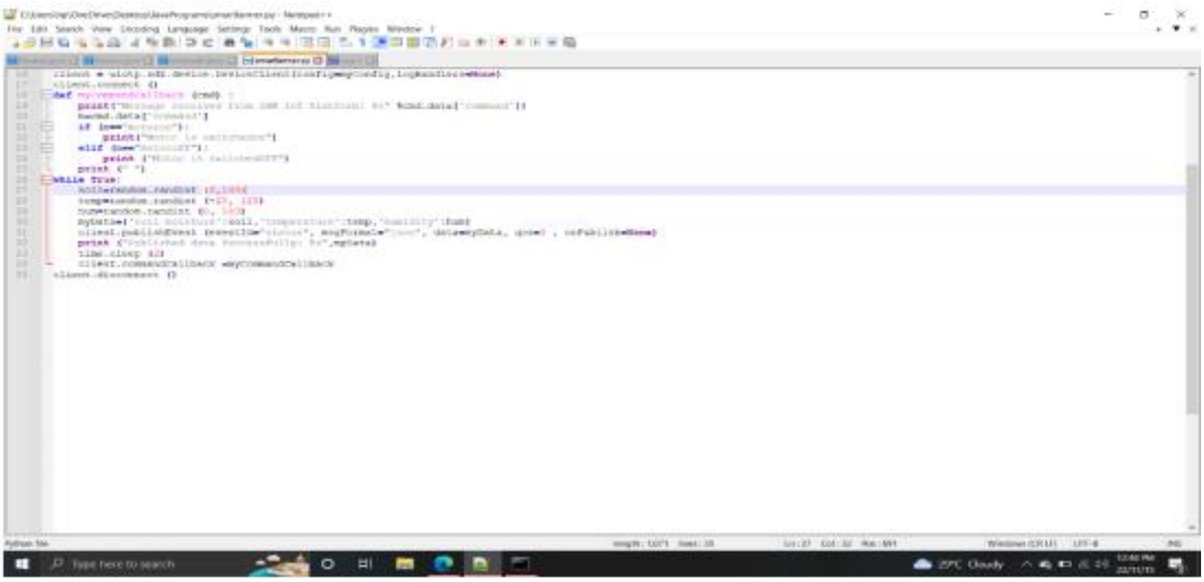
TESTING

8.1 TEST CASE

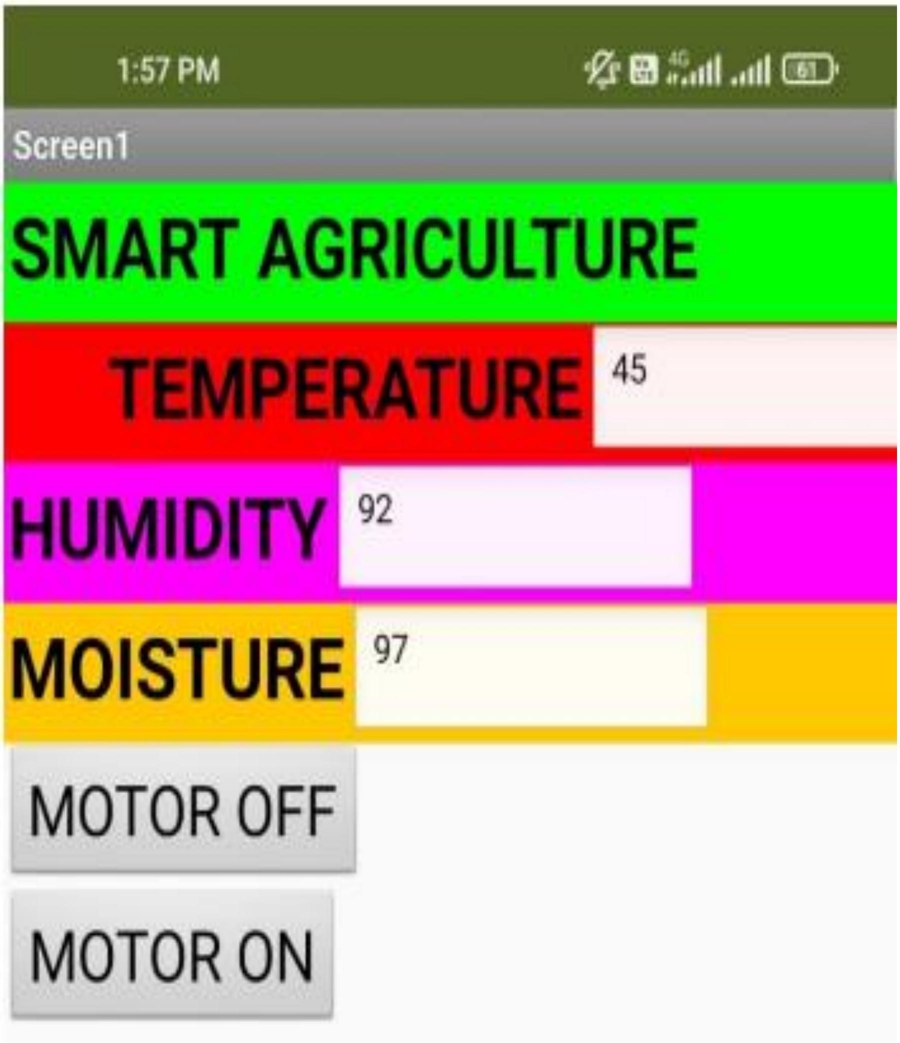
Web application using Node Red







8.2 USER ACCEPTANCE TESTING



CHAPTER 9

RESULTS

9.1 PERFOMANCE METRICS

S. No.	Name of the Phase	Tasks Performed	Performance Metrics
1.	Development of Problem Statement	The underlyingproblem analyzedand a rough idea of the solutionwas planned	The Problem statement was developed
2.	Ideation Phase	Extracting use and test cases	Empathy map, Ideation and Literature survey were formulated.
3.	Project Design Phase 1	Solution for theproblem is formulated and architecture is designed	Problem solution fit was designed and the Proposed solution is finalized with the help of Solution architecture.
4.	Project Design Phase 2	In depth analysisof the solution is performed including requirements, tech stack, etc.	Solution Requirements,Overall Technology stack, Data flow diagrams, User stories were formulated.
5.	Project Planning Phase	Various sprints were designed as individual progressive steps.	Project Milestone and Sprint Plans were developed.

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES:

- By monitoring the soil parameters of the farm, the user can have a complete analysis of the field, in terms of numbers.
- Using the website and the application, an interactive experience canbe achieved.
- As the data gets pushed to the cloud, one can access the data anywhere from this world. o Without human intervention, water pump can be controlled through the mobile application and it's flowcan be customized using servo motors.
- By using Raspberry Pi MCU, scalability can be increased due to itshigh processing power and enough availability of GPIO pins

10.2 DISADVANTAGES:

- Data transfer is through the internet. So data fetch and push might delay due to slow internet connection, depending on the location andother physical parameters.
- System can only monitor a certain area of the field. In order to senseand monitor an entire field, sensors should be placed in many places,which may increase the cost.
- Data accuracy may vary according to various physical parameters such as temperature, pressure, rain.
- Cost of the system is high due to usage of Raspberry Pi. o Rodent and insects may cause damage to the system.

CHAPTER 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 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.

The project thus monitors important parameters present in the field such as temperature, humidity, soil moisture etc., and controls important actuators such as motors etc. It is helpful for farmers to remotely monitor their fields even during adverse weather conditions and help them control farming equipment remotely using cloud.

CHAPTER 12

FUTURE SCOPE

In the current project we have implemented the project that can protect and maintain the the crop. In this project the farmer monitor and control the field remotely. In future we can add or update few more things to this project .

• We can create few more models of the same project ,so that the farmer can have information of 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 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 a internet issues.

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

REFERENCES

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- Vaishali. S, Suraj S, Vignesg.G, Divya.S and Udhayakumar.S, “Mobile integrated smart irrigation management and monitoring system using IoT”, IEEE International Conference on Communication and signal processing, pp. 2164- 2167, April 2019.

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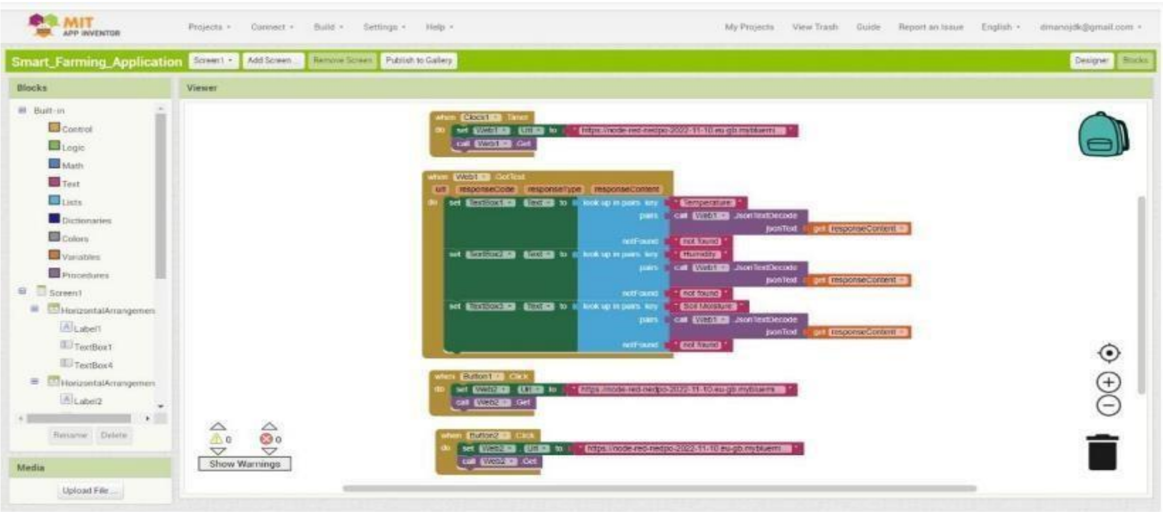
APPENDIX

MIT APP

BACKEND:



import time

import sys

import

ibmiotf.applic

ation import

ibmiotf.devic

e import

random

#Provide your IBM Watson Device Credentials

organization ="nckdv7" deviceType =

"NodeMCU" 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") else:
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"
as # an event of type "greeting" 10 times deviceCli.connect()
        while True: #Get        SensorData       from  DHT11
                temp=random.randint(0,100)
        pulse=random.randint(0,100)    moisture=
                random.randint(0,100)
        humidity=random.randint(0,100); lat = 17 lon = 18 data
        = {'temperature' : temp, 'humidity' : humidity,
        'Moisture' : moisture}

        #printdata              DefmyOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity =
        %s%%" % humidity, "Soil Moisture = %s %%" % moisture,"to
        IBMWatson")

         success = deviceCli.publishEvent("IoTSensor" "json", data,
        qos=0,  on_publish=myOnPublishCallback)

        if notsuccess:
        print("Not connected to IoTF")
         time.sleep(1)
        deviceCli.commandCallback = myCommandCallback
          # Disconnect the device anapplication from the cloud
        deviceCli.disconnect()
```

GITHUB AND PROJECT DEMO LINK:

1. GITHUB LINK:

   https://github.com/IBM-EPBL/IBM-Project-22400-1659851020

2. DEMOLINK:

   https://drive.google.com/file/d/1AU10oPx39pRdIko35ns41WrLnw5ojVbu/view?usp=drivesdk