IoT Based Smart Crop Protection System for Agriculture

PROJECT REPORT

TEAM ID – PNT2022TMID26521

Submitted by

NITHYASREE P (211719106055)

NITIN J (211719106056)

POLAKI SANDEEP KUMAR (211719106057)

SHYLENDRAN R (211719106077)

in partial fulfillment for the award of the degree of,

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RAJALAKSHMI INSTITUTE OF TECHNOLOGY

ANNA UNIVERSITY: CHENNAI 600 025

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BONAFIDE CERTIFICATE

Certified that this project report **"IoT Based Smart Crop Protection System for Agriculture"** is the bonafide work of **"NITHYASREE P (211719106055), NITIN J (211719106056), POLAKI SANDEEP KUMAR (211719106057), SHYLENDRAN R (211719106077)",** who carried out the project work under my supervision.

SIGNATURE:	**SIGNATURE:**
Dr. S. MANJULA,	**Mr. L Franklin Telfer,**
M.E., Ph.D,	**M.E , Assistant Professor**
HEAD OF THE DEPARTMENT,	**MENTOR,**
Dept. of Electronics and	Dept. of Electronics and
Communication Engg.,	Communication Engg.,
Rajalakshmi Institute of	Rajalakshmi Institute of
Technology,	Technology,
Kuthambakkam Post,	Kuthambakkam Post,
Chennai - 600 124	Chennai - 600 124

The viva-voce is held on ____________________

INTERNAL EXAMINER **EXTERNAL EXAMINER**

CONTENTS

1. INTRODUCTION

1.1 PROJECT OVERVIEW

This is a Smart Agriculture System project based on Internet Of Things (IoT), that can measure soil moisture and temperature conditions for agriculture using Watson IoT services. IoT is network that connects physical objects or things embedded with electronics, software and sensors through network connectivity that collects and transfers data using cloud for communication. Data is transferred through internet without human to human or human to computer interaction. An intelligent crop protection system helps the farmers in protecting the crop from the animals and birds which destroy the crop. This system also helps farmers to monitor the soil moisture levels in the field and also the temperature and humidity values near the field. The motors and sprinklers in the field can be controlled using the mobile application.

1.2 PURPOSE

IoT based farming improves the entire agriculture system by monitoring the field in real-time. With the help of IoT in agriculture not only saves the time but also reduces the extravagant use of resources such as water and electricity. Sometimes due to over or less supply of water in the agricultural field crops may not grow proper. Using IoT supply of water and growth of plants can be satisfied to a greater extent. The flow of water can be controlled from the application.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

In agriculture water is needed for the crops for their growth. If the Soil gets dry it is necessary to supply water. But sometime if the farmer doesn't visit the field, it is not possible to know the condition of soil. Sometimes over supply of water or less supply of water affects the growth of crops. Sometimes if the weather/temperature changes suddenly it is necessary to take certain actions. Specific crops grow better in specific conditions, they may get damaged due to bad weather.

2.2 REFERENCES

1. TOPIC: Smart Crop protection system from living objects and fire using Arduino.

   AUTHOR: Dr. M. Chandra, Mohan Reddy, KeerthiRaju, KamakshiKodi.
   DESCRIPTION: This is an Arduino Uno primarily based device the use of microcontroller. This technique makes use of a motion sensor to discover wild animals drawing near the sphere and smoke sensor to discover the hearth. In such a case the sensor alerts the microcontroller to require action. The microcontroller now sounds an alarm to woo the animals away from the sector further as sends SMS to the farmer and makes call, in order that farmer may fathom the difficulty and come to the spot just in case the animals don’t recede by the alarm. If there's a smoke, it immediately turns ON the motor. This provides us entire safety of plants from animals and from fireplace for this reason protecting the farmer’s loss.

   PUBLISHED ON: Sept 2020.

2. TOPIC: Review on IoT in Agricultural Crop Protection and Power Generation.

   AUTHOR: Anjana, Sowmya, Charen Kumar, Monisha, Sahana.

   DESCRIPTION: Agriculture is that the science and artwork of cultivating plants. Agriculture performs most important position inside the economic development of our us of a and this can be the first occupation from a few years. so as to extend the productivity of the crops and to attenuate the expenses of agricultural practices we adopt smart agriculture techniques using IOT. The sensors are placed at different locations within the farm, by which the parameters is controlled using remote or through internet services and by interfacing the sensors operations are performed with microcontrollers. India is that the second most populated country. Power generation and supply is typically an unlimited problem.

   PUBLISHED ON: Nov 2019.

3. TOPIC: IOT based smart crop monitoring in farm land.

   AUTHOR: G. Naveen Balaji, V. Nandhini, S. Mithra, N. Priya, R. Naveena.

   DESCRIPTION: As new technologies has been introduced and utilized in modern world, there is a need to bring advancement in the sector of agriculture also. Various Researches have been undergone to enhance crop cultivation and are widely used. So as to enhance the crop productivity efficiently, it is necessary to monitor the environmental conditions in and around the field. The parameters that has to be exact monitored to enhance the yield are soil characteristics, weather conditions, moisture, temperature, etc., Internet of Things (IOT) is being utilized in a number of real time applications. The introduction of Internet of thing (IOT) along with the sensor network in framrefurbishes the traditional way of farming. Online crop monitoring the use of IOT helps the farmers to stay related to his subject from somewhere and anytime.

PUBLISHED ON: Nov 2018.

4. TOPIC: SMART CROP PROTECTION SYSTEM AGAINST WILD ANIMALS USING IOT

   AUTHOR: S. Sivagamasundari, S. Janani.

   DESCRIPTION: Crops are vulnerable to wild animals. Therefore, it is very important to monitor the nearby presence of animals. Then the actuation of various devices should follow to repel the hazardous animals. Traditional methods have been widely applied depending on the kinds of produce and imperiling animals. In this paper, we propose a method to protect farms from wild animals via ubiquitous wired network devices, which is applied to farm along with traditional methods to improve the protection performance. Operational amplifier circuits are utilized mainly for the detection of animal intrusion from the outside of farms. The proposed monitoring scheme is to provide an early warning about possible intrusion and damage by wild animals.

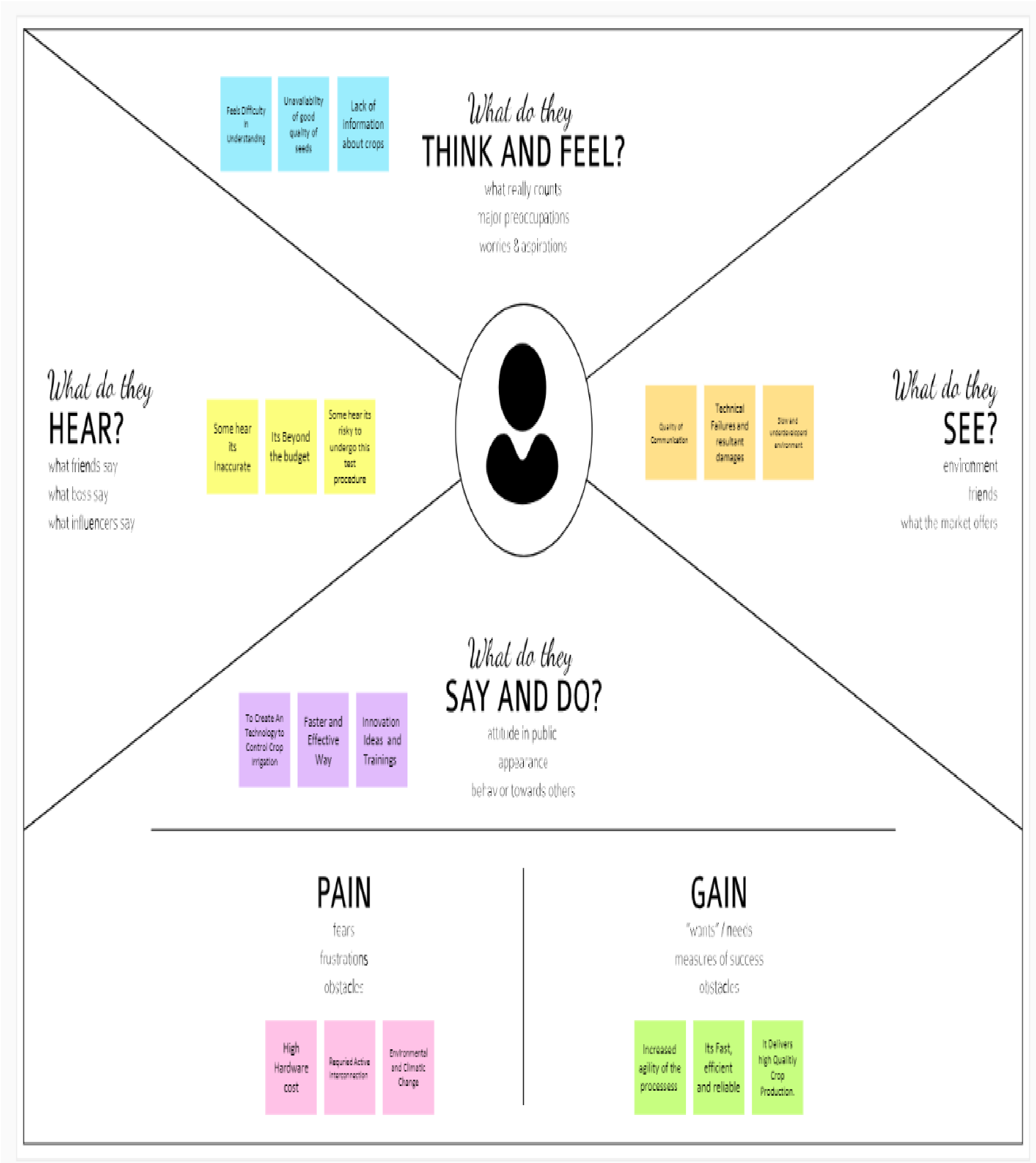
   PUBLISHED ON: March 2014.

2.3 PROBLEM STATEMENT DEFINITION

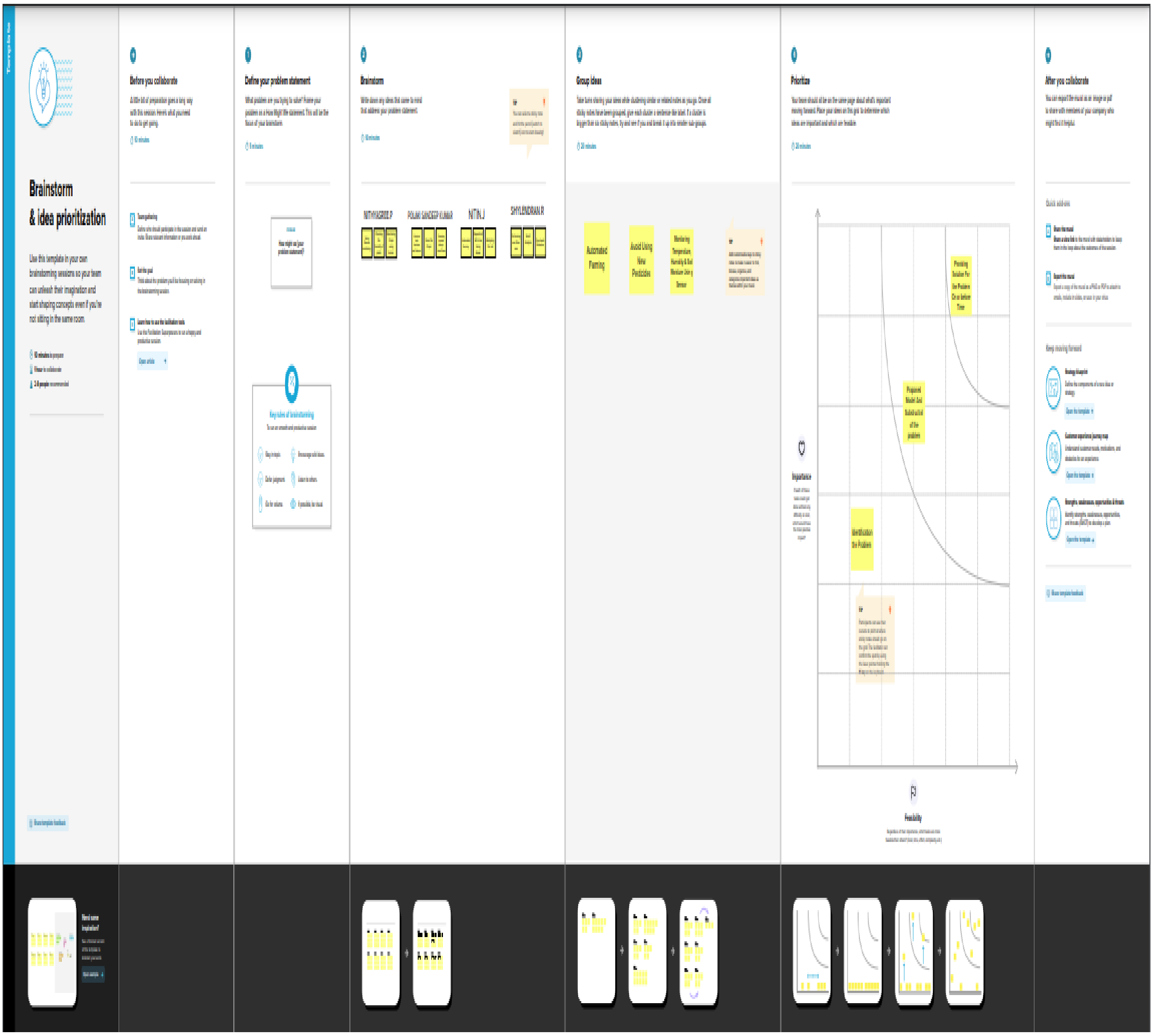
The Smart protection system defines that this project help to farmer for the protection of a farm. We have designed this project for the only secure from animals but we this project have the provision to secure from the human begins also. This can achieve by the help of IOT device that we are discuss in this paper. The SCPS work on the battery so that this project can be easily portable and also we are add solar panels and converter modules this can help the battery to charge from solar energy. The IOT device is used to indicate the farmer by a message while someone enter into the farm and we are used SD card module that helps to store a specified sound to fear the animals. Overuse of pesticides and fertilizer in agricultural fields leads to destruction of the crop as well as reduces the efficiency of the field increasing the soil vulnerability toward pest. IoT applications may be used to update the farmer/user about type & quantity of pesticide required by the crop and also protecting crops from wild animals attacks birds and pests.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

Overuse of pesticides and fertilizer in agricultural fields leads to destruction of the crop as well as reduces the efficiency of the field increasing the soil vulnerability toward pest. IoT applications may be used to update the farmer/user about type & quantity of pesticide required by the crop and also protecting crops from wild animal's attacks birds and pests. Moisture sensor is interfaced with Arduino Microcontroller to measure the moisture level in soil and relay is used to turn ON & OFF the motor pump for managing the excess water level. It will be updated to authorities through IOT. There are temperature sensors connected to microcontroller which is used to monitor the temperature in the field. Image processing techniques with IOT is followed for crop protection against animal attack.

3.4 PROBLEM SOLUTION FIT

The issue of the labor scarcity is addressed, and the cost budget is reduced. The device continuously and automatically checks the humidity level in plants and waters them even when there are no physical and personal present. A soil moisture sensor measures the current soil moisture, produces better crops. Pesticides often known as chemical crop protection agents, aid in the control of insects, illnesses, fungi and other unwanted pests. One of the main hazards to diminishing crop yield is crop damage brought on by animal and bird attack. It continuously monitors the animal's entry. Tensiometers gauze soil moisture tension in an indirect manner. Electrical fences are designed to shock animals that come into touch, keeping them to attempting to cross the fence. Results from soil moisture sensors are immediately available. Increasing crop yield while reducing the fertilizer expenditures. Crop Security using IOT platform from attacks by birds and other animals. IOT based crop protection system against birds and wild animal's attacks. From online farmers will be receiving data from data analytics frequently. Using IOT, Data storage is also secure. The suggested system has several sensors that can measure and ensure crop quality based on elements like temperature, soil moisture and humidity. This project helps farmers in reducing time spent and raising profitability.

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

- User Visibility

  Sense animals nearing the crop field & sounds alarm to woo them away as well as sends SMS to farmer using cloud service.

- User Reception

The Data like values of Temperature, Humidity, Soil moisture Sensors are received via SMS.

- User Understanding

  Based on the sensor data value to get the information about the present of farming land.

- User Action

  The User needs take action like destruction of crop residues, deep plowing, crop rotation, fertilizers, strip cropping, scheduled planting operations.

4.2 NON-FUNCTIONAL REQUIREMENTS

- Usability

  Mobile Support Users must be able to interact in the same roles & tasks on computers & mobile devices where practical, given mobile capabilities.

- Security

  Data requires secure access to must register and communicate securely on devices and authorized users of the system who exchange information must be able to do.

- Reliability

  It has a capacity to recognize the disturbance near the field and doesn’t give a false caution signal.

- Performance

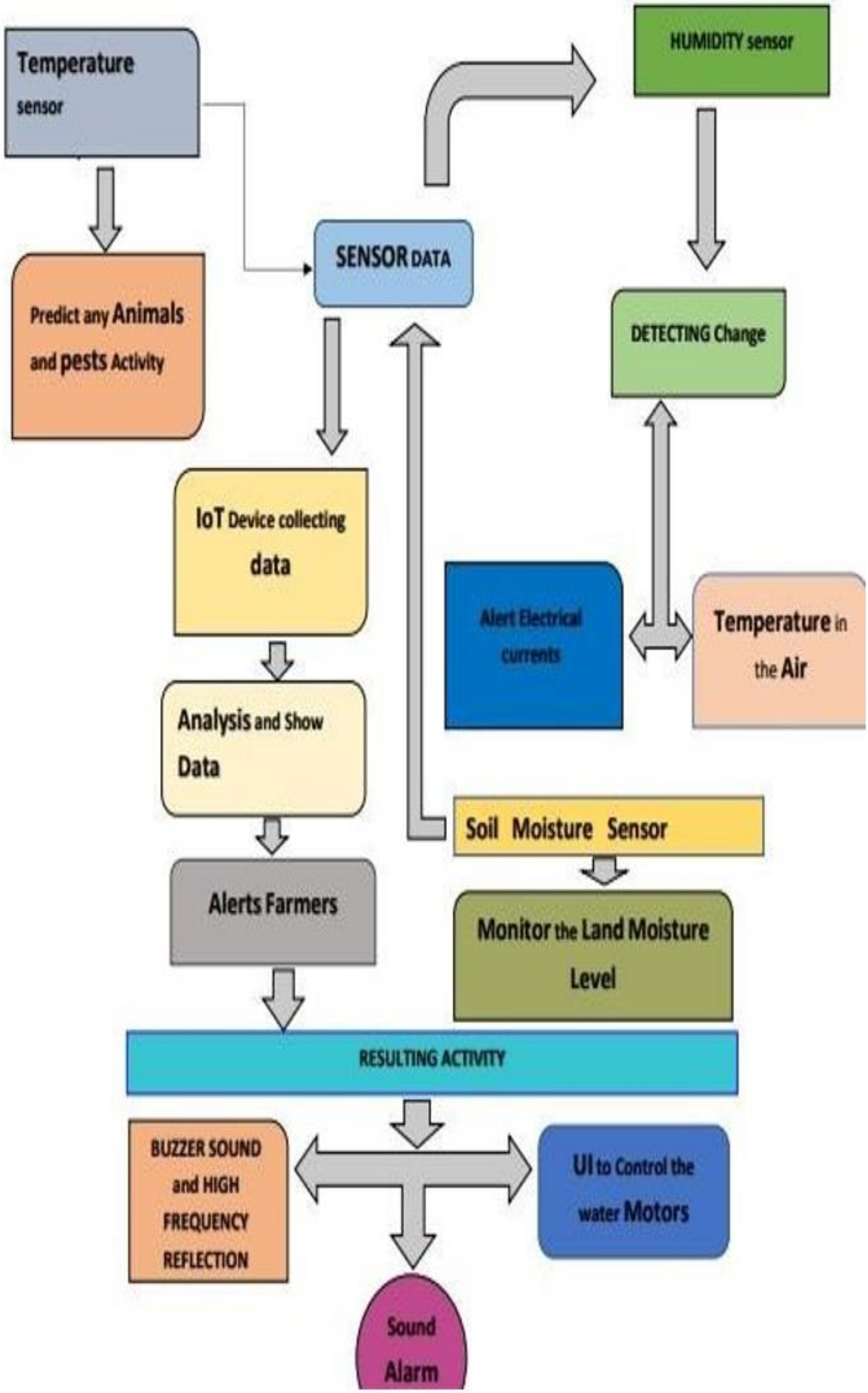
Must provide acceptable response times to users regardless of the volume of data that is stored and the analytics that occurs in background. Bidirectional, near real-time communications must be supported. This requirement is related to the requirement to support industrial and device protocols at the edge.

- Availability
  IOT Solutions and domains demand highly available systems for 24 x 7 operations. Isn’t a critical production application, which means that operations or production don’t go down if the IOT solution is down.
- Scalability
  System must handle expanding load & data retention needs that are based on the upscaling of the solution scope, such as extra manufacturing facilities and extra buildings.

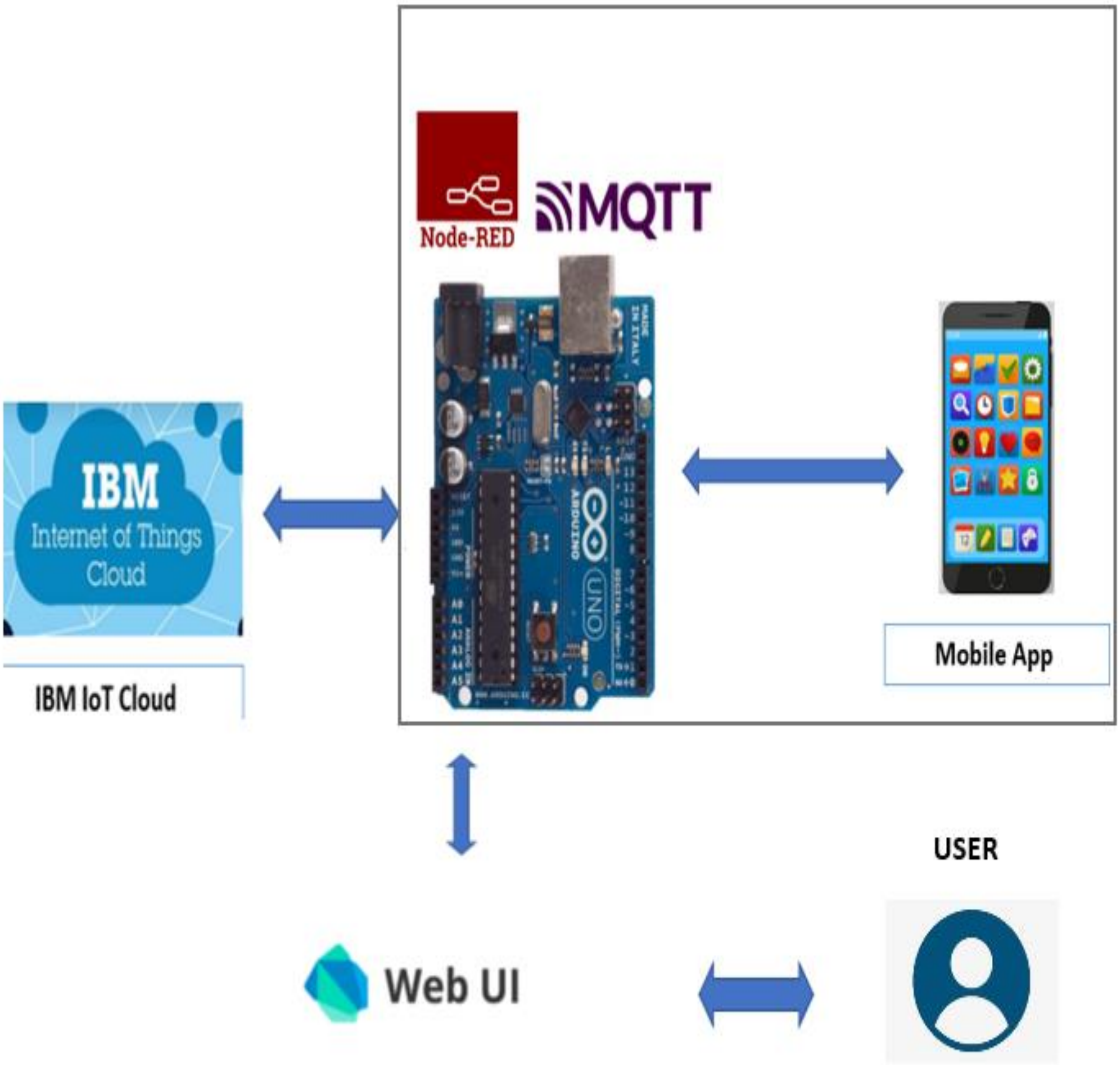
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

I.


Temperature sensor
HUMIDITY sensor
Predict any Animals and pests Activity
SENSOR DATA
DETECTING Change
IoT Device collecting data
Alert Electrical currents
Temperature in the Air
Analysis and Show Data
Soil Moisture Sensor
Alerts Farmers
Monitor the Land Moisture Level
RESULTING ACTIVITY
BUZZER SOUND and HIGH FREQUENCY REFLECTION
UI to Control the water Motors
Sound Alarm

5.2 SOLUTION & TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional requirement (Epic)	User Story number	User Story/Task	Acceptance criteria	Priority	Release
Mobile users	Registration	USN-1	User can enter into the web application	I can access my account dashboard	High	Sprint 1
		USN-2	User can register their credentials like email id and password	I can receive confirmation email & click Confirm	High	Sprint 1
	Login	USN-3	User can log into the application by entering email & password	I can login to my account	High	Sprint 1
	Dashboard	USN-4	User can view the temperature	I can view the data given by the device	High	Sprint 2
		USN-5	User can view the level of sensor monitoring value	I can view the data given by the device	High	Sprint 2
Web users	Usage	USN-1	User can view the web page and get the information	I can view the data given by the device	High	Sprint 3

Customer	Working	USN-1	User act according to the alert given by the device.	I can get the data work according to it	High	Sprint 3
		USN-2	User turns ON the water motors/Buzzer/Sound Alarm when occur the disturbance on field.	I can get the data work according to it	High	Sprint 4 Sprint 3
Customer care Executive	Action	USN-1	User solve the problem when some faces any usage issues.	I can solve the issues when someone fails to understanding the procedure	High	Sprint 4
Administration	Administration	USN-1	User store every information.	I can store the gained information	High	Sprint 4

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Sprint	**User Story Number**	**User Story / Task**	**Priority**
Sprint-1	US-1	Create the IBM Cloud services which are being used in this project.	High
Sprint-1	US-2	Configure the IBM Cloud services which are being used in completing this project	Medium
Sprint-2	US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	Medium
Sprint-2	US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	High

Sprint-3	US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	High
Sprint-3	US-2	Create a Node-RED service	High
Sprint-3	US-1	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform	High
Sprint-3	US-2	After developing python code, commands are received just print the statements which represent the control of the devices.	Medium
Sprint-4	US-3	Publish Data to The IBM Cloud.	High
Sprint-4	US-1	Create Web UI in Node- Red.	High
Sprint-4	US-2	Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant.	High

7. CODING

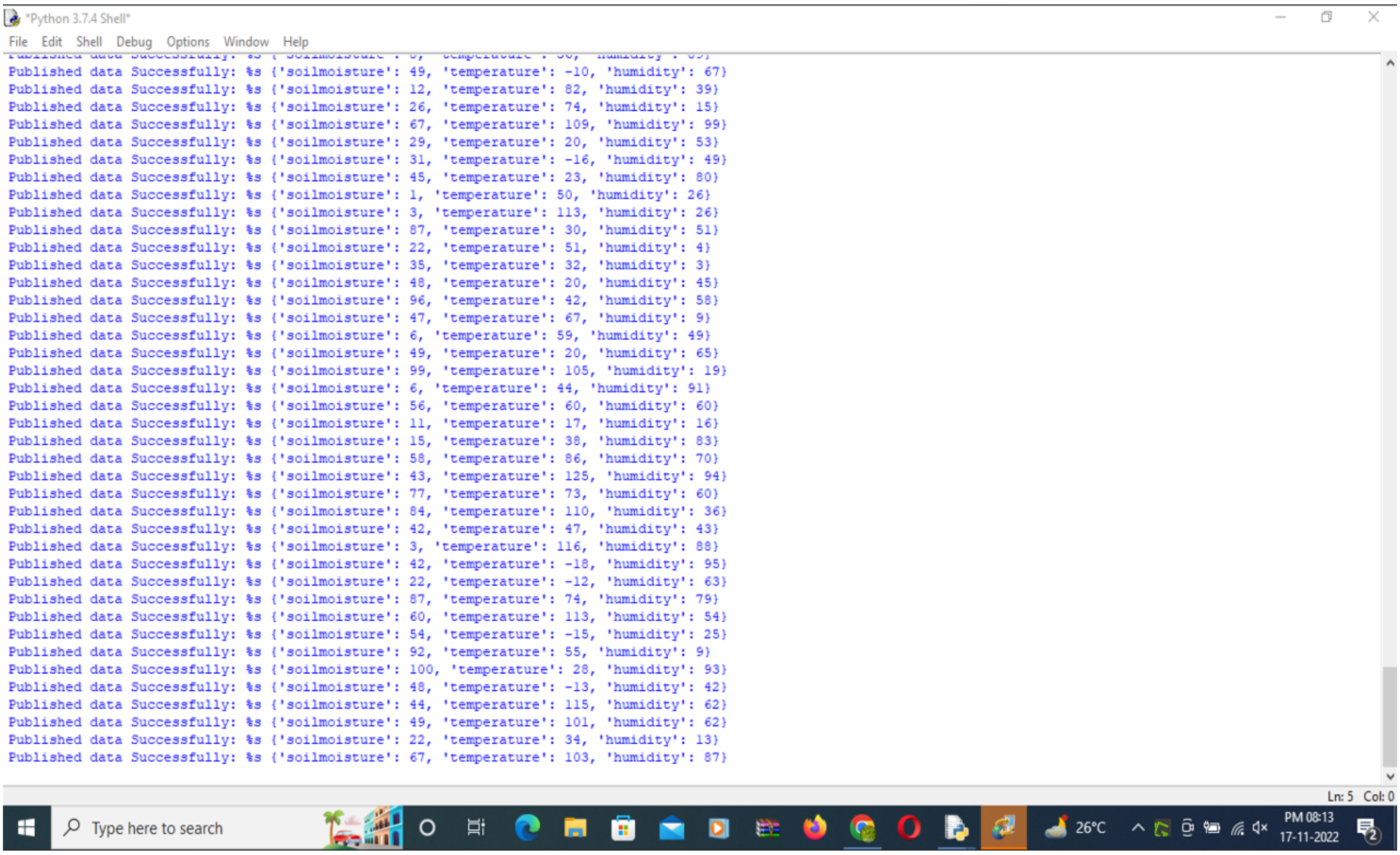
7.1 PYTHON SCRIPT

```
import  wiotp.sdk.device
import time
import  os
import  datetime
import  random
myconfig = {
    "identity": {
        "orgId": "eop5qk",
        "typeId": "NodeMCU",
        "deviceId": "12345"
    },
    "auth": {
        "token": "ei0i7Fp@6V!LE5PWdN"
        }
}
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 & sprinkler is switched on")
    elif(m=="motoroff"):
        print("motor & sprinkler is switched OFF")
```

```
    print("  ")
while True:
    soil=random.randint(0,100)
    temp=random.randint(-20,125)
    hum=random.randint(0,100)
    myData={'soilmoisture':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.myCommandCallback = myCommandCallback
client.disconnect ()
```

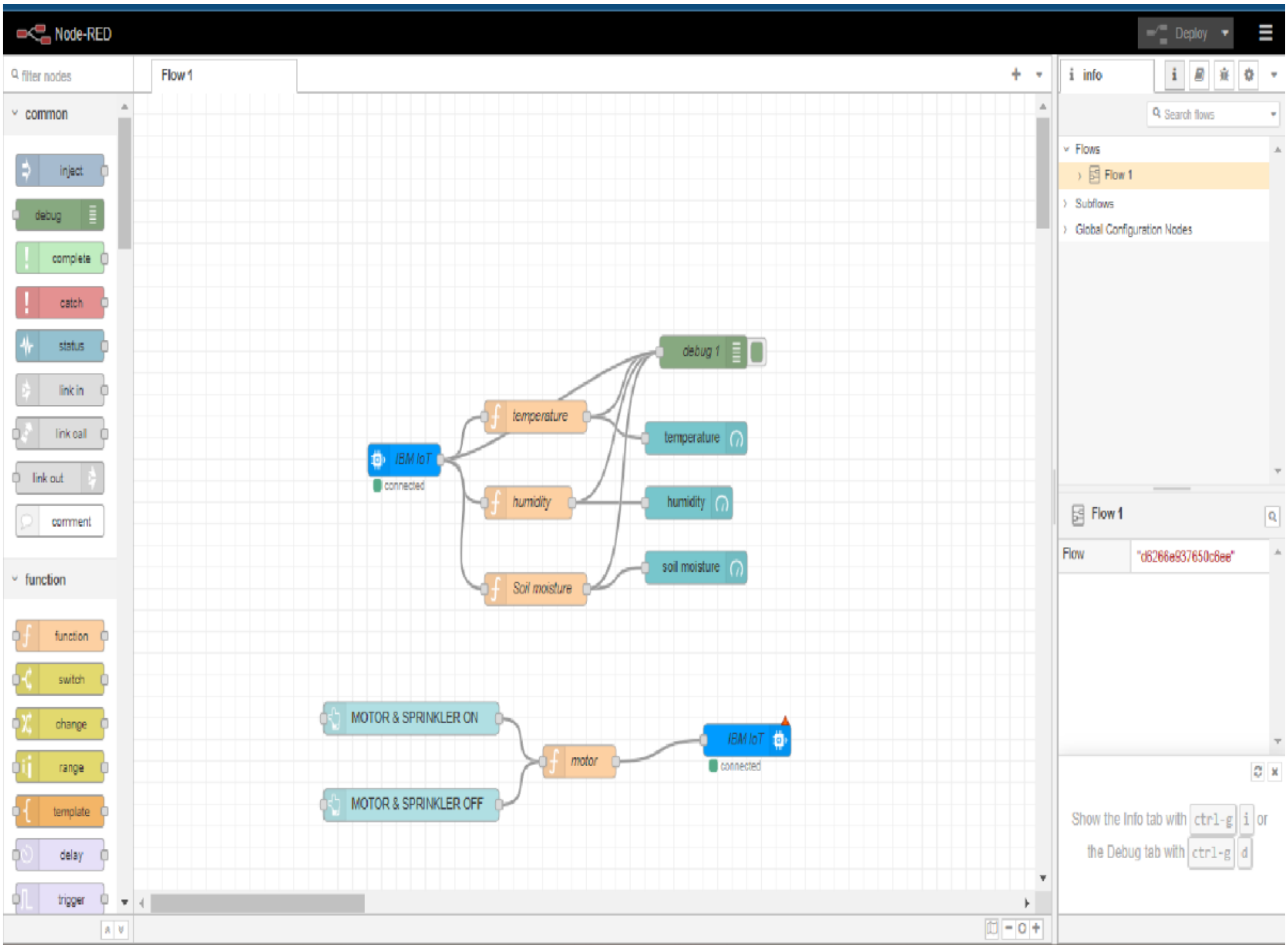
```
Python_Script.py - C:\Users\NITIN\Desktop\Python_Script.py (3.11.0)
File  Edit  Format  Run  Options  Window  Help
Python 3.11.0 (main, Oct 24 2022, 18:26:48) [MSC v.1933 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> import  wiotp.sdk.device
... import  time
... import  os
... import  datetime
... import  random
... myconfig = {
...     "identity": {
...         "orgId": "eop5qk",
...         "typeId": "NodeMCU",
...         "deviceId": "12345"
...     },
...     "auth": {
...         "token": "ei0i7Fp@6V!LE5PWdN"
...         }
... }
... 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 & sprinkler is switched on")
...     elif(m=="motoroff"):
...         print("motor & sprinkler is switched OFF")
...     print("  ")
... while True:
...     soil=random.randint(0,100)
...     temp=random.randint(-20,125)
...     hum=random.randint(0,100)
...     myData={'soilmoisture':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.myCommandCallback = myCommandCallback
Ln: 1  Col: 0
```

7.2 Output

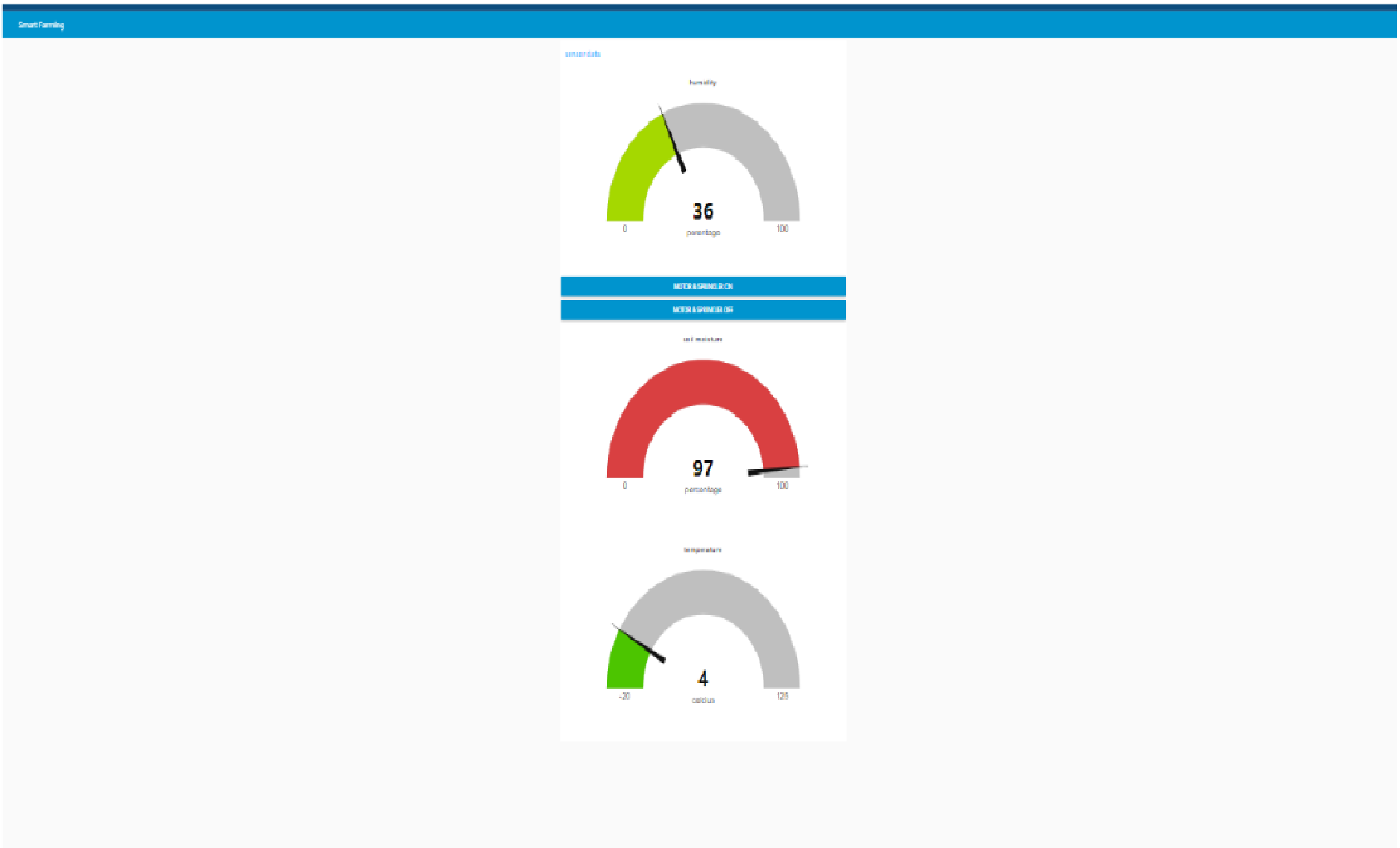


8. TESTING

NODE RED Flow Connections,



WEB UI OUTPUT



9. ADVANTAGES & DISADVANTAGES

9.1 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.

9.2 DISADVANTAGES

- Smart Agriculture requires internet connectivity continuously, but rural parts cannot fulfill this requirement.
- Any faults in the sensors can cause great loss in the agriculture, due to wrong records and the actions of automated processes.
- IoT devices need much money to implement.

10. APPLICATIONS

- Precision Farming that is farming processes can be made more controlled and accurate.
- Live monitoring can be done of all the processes and the conditions on the agricultural field.
- All the controls can be made just on the click.
- Quality can be maintained.

11. CONCLUSION

A IoT Web Application is built for smart agricultural system using Watson IoT platform, Watson simulator, IBM cloud and Node-RED.

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.

13. APPENDIX

https://careereducation.smartinternz.com/Student/profile

https://cloud.ibm.com/

https://github.com/IBM-EPBL/IBM-Project-22688-1659856364

https://drive.google.com/file/d/1mVQLhuhAqm-eXAmZMur3ytSJIhKLZVGa/view?usp=drivesdk