

PROJECT REPORT

Project Name: SMARTFARMER- IOT ENABLED SMART FARMING
APPLICATION

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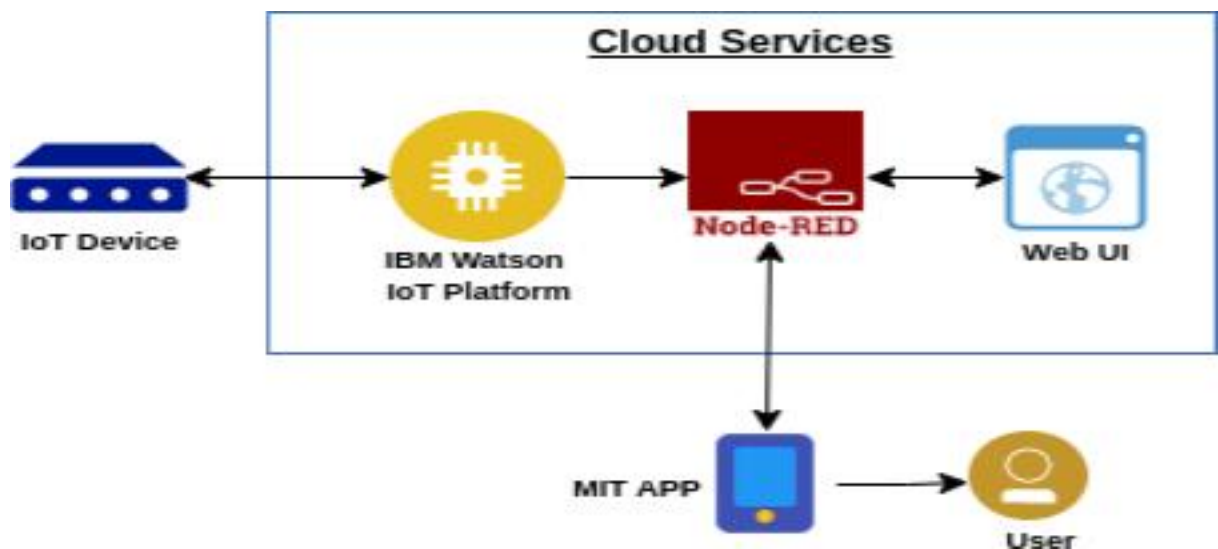
GitHub & Project Demo Link

SMART FARMING

1.INTRODUCTION:

1.1 PROJECT OVERVIEW:

- IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, Temperature, humidity using some sensors.
- This is system that enables framers to monitor and control their forms with a web-based application build with Node-RED.
- It uses the IBM IOT Watson cloud platform as its Backend.



1.2 PURPOSE:

Smart Farming reduce the ecological foot print of farming. Minimized or Site Specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases.

2. LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

The biggest challenges faced by IoT in the agricultural sector are lack of information, high adoption costs, and security concers etc. Most of the farmers are not aware of the implementation of IoT in agriculture.

To successfully deploy a smart agriculture system, consider setting up a communications network that can integrate a limited number of sensors across a large area of farmland. This will require third-party network provisioning or setting up a private network consisting of access points and uplinks to a private backhaul network, which channels all the data traffic to centralized monitoring software or an analytics head-end system

- It is not a secure system.
- There is no motion detection for protection of agriculture field.
- Automation is not available.

2.2 REFERENCES:

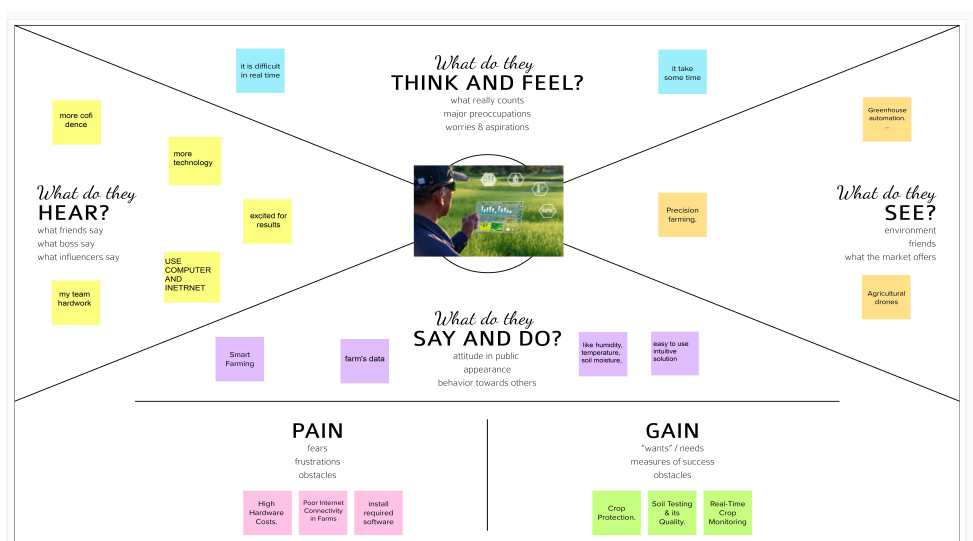
It is the application of modern ICT (Information and Communication Technologies) into agriculture. In IOT- based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.). The farmers can monitor the field conditions from anywhere.

2.3 PROBLEM STATEMENT DEFINITION:

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.

3. IDEATION & PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:



3.2 IDEATION AND BRAINSTORMING:

Introduction on Internet of Things (IoT), application of IoT in agricultural field to improve the yield and quality by reducing the cost is provided. The sensors which are used in the architecture are discussed briefly and the process of transmission of data from the agriculture field to the central system is explained. The proposed system advantages are included. In addition, open research issues, challenges, and future of IoT in agricultural field are highlighted. The concept is basically developed on an idea, where there are numerous things or objects - such as Arduino, sensors, GSM models, LCD display, etc., that are connected with the Internet. Each of the objects has a different address and is able to interact with other items. The things or objects co-operate with each other to reach a common goal.

We are going to construct a smart agricultural monitoring system which can collect crucial agricultural data and send it to an IoT platform called Thing speak in real time where the data can be logged and analyzed. The logged data on Thing speak is in graphical format, a botanist or a reasonably knowledgeable farmer can analyze the data (from anywhere in the world) to make sensible changes in the supplied resources (to crops) to obtain high quality yield.

Smart agriculture monitoring system or simply smart farming is an emerging technology concept where data from several agricultural fields ranging from small to large scale and its surrounding are collected using smart electronic sensors. The collected data are analyzed by experts and local farmers to draw short term and long-term conclusion on weather pattern, soil fertility, current quality of crops, amount of water that will be required for next week to a month etc.

We can take smart farming a step further by automating several parts of farming, for example smart irrigation and water management. We can apply predictive algorithms on microcontrollers or SoC to calculate the amount of water that will be required today for a particular agriculture field. Say, if there was rain yesterday and the quantity of water required today is going to be less. Similarly, if humidity was high the evaporation of water at upper ground level is going to be less, so water required will be less than normal, thus reducing water usage.

3.3 PRPOSED SOLUTION:

- To develop a Smart Agricultural System based on IOT which can give real time data and can help farmers in a very efficient manner.
- Soil Moisture can be checked by using the sensors that can sense the soil condition and send the data (moisture content in the soil) over the cloud services to the web application.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	our project give the problem statement in helping the farmers for analyzing pH,tempreature,turbidityand moister content
2.	Idea / Solution description	the sensors used in our device helps to analyze the moister,tempreature,ph of the soil and inform the farmers through SMS
3.	Novelty / Uniqueness	smart farming it involves the use of sensors which can help the farmers monitor their farmland's condition from anywhere
4.	Social Impact / Customer Satisfaction	this will help the farmers in different ways for analyzing their lands condition without the help of others and in less time
5.	Business Model (Revenue Model)	soil smart agriculture is a development in farming process it will help in improving the analyzing of soil easily
6.	Scalability of the Solution	smart farming systems uses modern technology to identify the contents of soil in a small period of time and with less work

3.4 PROBLEM SOLUTION FIT:

- With the help of the IoT devices, you can know the real-time status of the crops by capturing the data from sensors.
- Using predictive analytics, you can get an insight to make better decisions related to harvesting.

Project Title:

Project Design Phase-I - Solution Fit Template

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids <div>Farmers are our customers.</div>	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. <div>The availability of device, and budget are several constraints, Knowledge about the application.</div>	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking <div>Most commonly used irrigation type is raspberry PI the most common disadvantage is when it using means it have budget issue its cost is too high. In smart farming we can use Arduino empowered smart irrigation system also the irrigation system is connected with network to overcome this.</div>	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. <div> To make farming easier more quantitatively. 1. Monitoring the Ph value and temperature 2. Monitoring turbidity . 3. Monitoring moisture </div>	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. <div>When there is no knowledge about the soil problem arises on what to be sowed. Ph, temperature conditions also play a major role. Knowledge on how to water the plants</div>	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) <div>The customers will reach us when they don't have idea on how to analyse the soil and to improve the current irrigation system</div>	
Identify strong TR & EM	3. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels; reading about a more efficient solution in the news. <div>To get correct accuracy on what to be done on the farm and to produce more crops and livestock quantitatively. To get correct accuracy on the values of Ph, Temperature and turbidity and moisture</div>	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. <div>There will be less weed growth, Maximum use of water efficiently, Control of soil Ph value and temperature and turbidity and maximum crop yield.</div>	8. CHANNELS OF BEHAVIOUR CH 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. <div>we will reach the customer directly ask about their problems and provide effective solutions if their problems match our application and provide them knowledge about our application to make their farming even more easier.</div>	Identify strong TR & EM
	4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. <div> As when the productivity increases farmers will be satisfied. They will not worry about the loss or soil condition . Irrigation will be more efficient than before. </div>			

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	IoT devices	Sensors and Wifi module.
FR-2	Software	Web UI, Node-red, IBM Watson, MIT app

4.2 NON -FUNCTIONAL REQUIREMENTS:

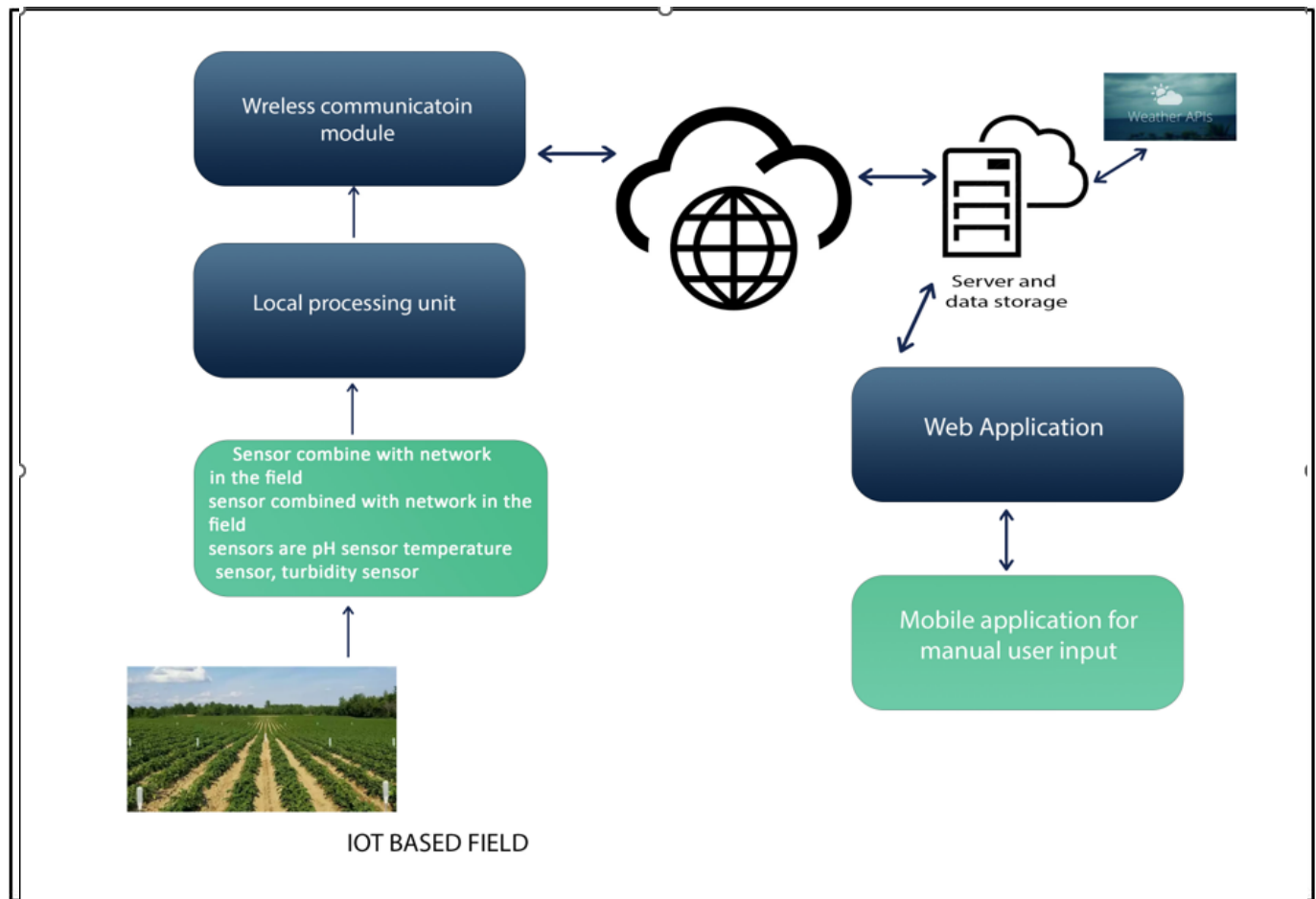
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Time consumability is less, Productivity is high.
NFR-2	Security	It has low level of security features due to integration of sensor data.
NFR-3	Reliability	Accuracy of data and hence it is Reliable.
NFR-4	Performance	Performance is high and highly productive.
NFR-5	Availability	With permitted network connectivity the application is accessible
NFR-6	Scalability	It is perfectly scalable many new constraints can be added

5 PROJECT DESIGN:

5.1 DATA FLOW DIAGRAM:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	IoT devices	USN-1	Sensors and wi-fi module		High	Sprint-1
Customer	Software	USN-2	IBM Watson IoT platform, Workflows for IoT scenarios using Node-red		High	Sprint-2
Customer	MIT app	USN-3	To develop an application using MIT		High	Sprint-3
Customer	Web UI	USN-4	To make the user to interact with the software.	User can access the app for the services.	High	Sprint-4

5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

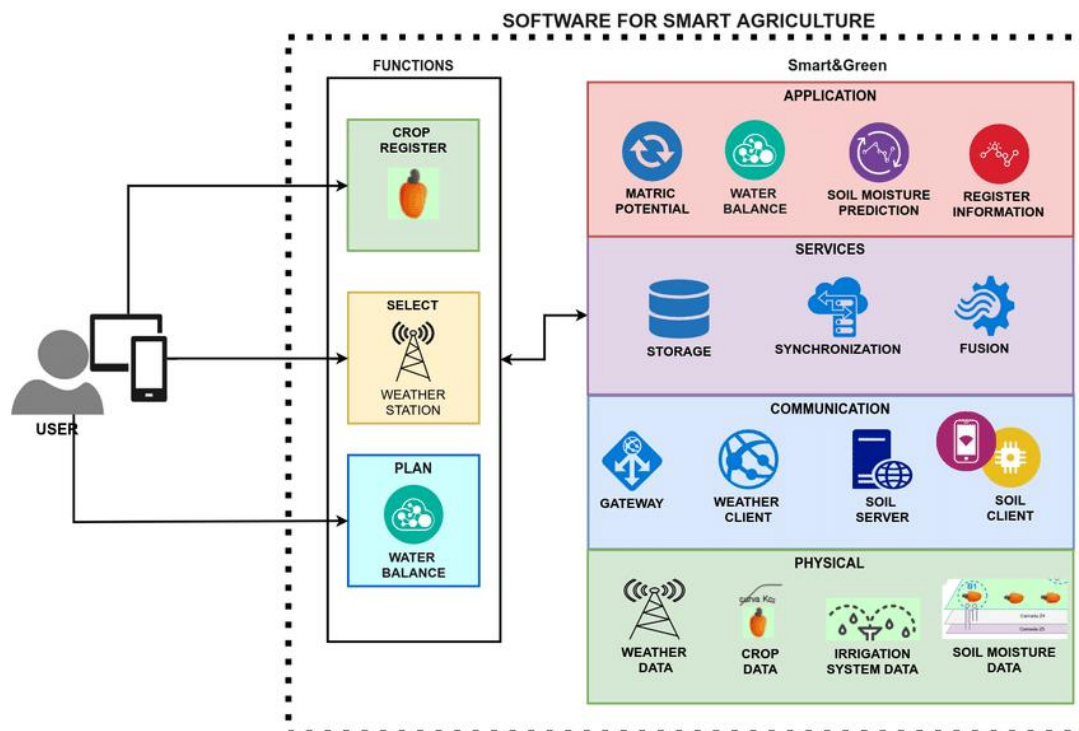


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	MIT app
2.	Application Logic-1	Logic for a process in the application	Node red/IBM Watson/MIT app
3.	Application Logic-2	Logic for a process in the application	Node red/IBM Watson/MIT app
4.	Application Logic-3	Logic for a process in the application	Node red/IBM Watson/MIT app
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM cloud.

7.	Temperature sensor	Monitors the temperature of the crop	
8.	Humidity sensor	Monitors the humidity	
9.	Soil moisture sensor (Tensiometers)	Monitors the soil temperature	
10.	Weather sensor	Monitors the weather	
11.	Solar panel		
12.	RTC module	Date and time configuration	
13.	Relay	To get the soil moisture data	

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	MIT app, Node-Red	Software
2.	Scalable Architecture	Drone technology, pesticide monitoring, Mineral identification in soil	Hardware

6.PROJECT PLANNING AND SCHEDULING :

6.1 SPRINT PLANNING AND ESTIMATION:

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1	Understanding the project	Assign the team members after that create repository in the GitHub and then assign task to each member and guide them how to access the GitHub while submitting the assignments	1 week
2	Staring The Project	Team Members to Assign All the Tasks Based on Sprints and Work on It Accordingly.	1 week
3	Completing Every Task	Team Leader should ensure that whether every team member have completed the assigned task or not	1 week
4	Stand Up Meetings	Team Lead Must Have a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session	1 week
5	Deadline	Ensure that team members are completing every task within the deadline	1 week
6	Budget and Scope of project	Analyze the overall budget which must be within certain limit it should be favorable to every person	1 week

6.2 SPRINT DELIVERY SCHEDULE:

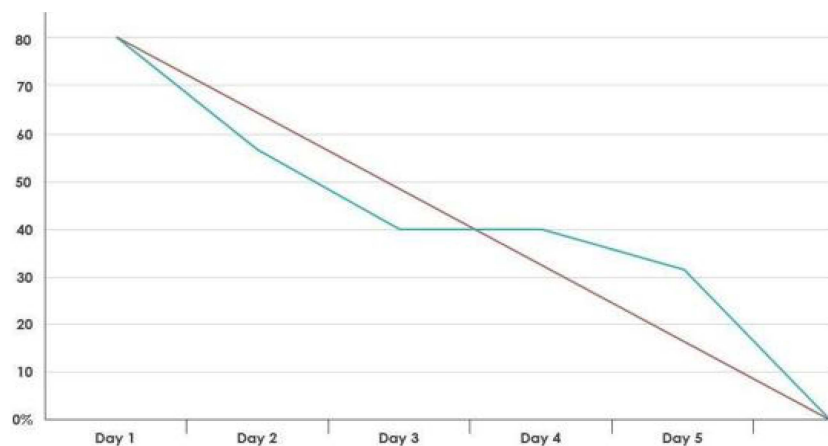
Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Story Points	Priority	Team Member
Sprint-1	Stimulation Creation	USN-1	Connect Sensors and Arduino with python code	2	High	Alan sam
Sprint-1	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Kalesh M
Sprint-1	Registration (Farmer Mobile User)	UNS-3	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Muhamed Sonu A V

Sprint-1	Login	UNS-3	As a user, I will receive confirmation email once I have registered for the application	1	High	Muhammed sonu A V
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Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	Muhammed sonu A V
Sprint-3	Registration (Farmer -Web User)	USN - 4	As a user, I can log into the application by entering email and password	3	High	Pranav Prakash Kumar
Sprint - 2	Login	USN - 4	As a registered user. I need to easily login log into my registered account via the web page in minimum time	3	High	Pranav Prakash Kumar
Sprint - 4	Web UI	USN -	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	Pranav Prakash Kumar

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	1 Nov 2022	7 Nov 2022	20	8 Nov2022
Sprint-2	6	6 Days	8 Nov 2022	14 Nov 2022	20	15 Nov2022
Sprint-3	6	6 Days	8 Nov 2022	14 Nov 2022	20	15 NOV 2022
Sprint-4	6	6 Days	14 Nov 2022	19 Nov 2022	20	19 NOV 2022



7. CODING AND SOLUTIONING:

7.1 CODING:

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random


#Provide your IBM Watson Device

organization = "r8cpvf"

deviceType = "farming"

deviceId = "12345"

authMethod = "token"

authToken ="87654321"

# Initialize GPIO

def myCommandCallback(cmd):

    print("Commandreceived: %s" % cmd.data['command'])

    status=cmd.data['command']

    if status=="motoron":

        print ("motor is on")

    elif status == "motoroff":

        print("motor is off")

    else :

        print ("please send proper command")


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
aneventof type "greeting" 10 times

deviceCli.connect()

while True:

#Get Sensor Data fromDHT11

    temp=random.randint(90,110)

    Humid=random.randint(60,100)

    Mois=random. randint(20,120)

    data = { 'temp' : temp, 'Humid': Humid , 'Mois': Mois}

#print data

def myOnPublishCallback():

    print ("Published Temperature = %s C" % temp, "Humidity
= %s %%" %Humid, "Moisture =%s deg c" % Mois, "to IBM Watson")

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

if not success:

    print("Not connected to IoTf")

time.sleep(10)

deviceCli.commandCallback = myCommandCallback

#Disconnect the device and application from the cloud

deviceCli.disconnect()

```

7.2 SOLUTION:

```
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\HP\Downloads\ibmiot.py =====
Published data Successfully: %s2022-11-10 10:26:00.029 %iotp.sdk.device.client.DeviceClient INFO Connected successfully: d:r8cpvf:farming:12345
{'temperature': 60, 'humidity': 51, 'moisture': 16}
Published data Successfully: %s {'temperature': 36, 'humidity': 74, 'moisture': 6}
Published data Successfully: %s {'temperature': 29, 'humidity': 14, 'moisture': 13}
Published data Successfully: %s {'temperature': 15, 'humidity': 65, 'moisture': 76}
```

8. TESTING:

IBM Watson IoT Platform

Browse Action Device Types Interfaces

Add Device

Browse Devices

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

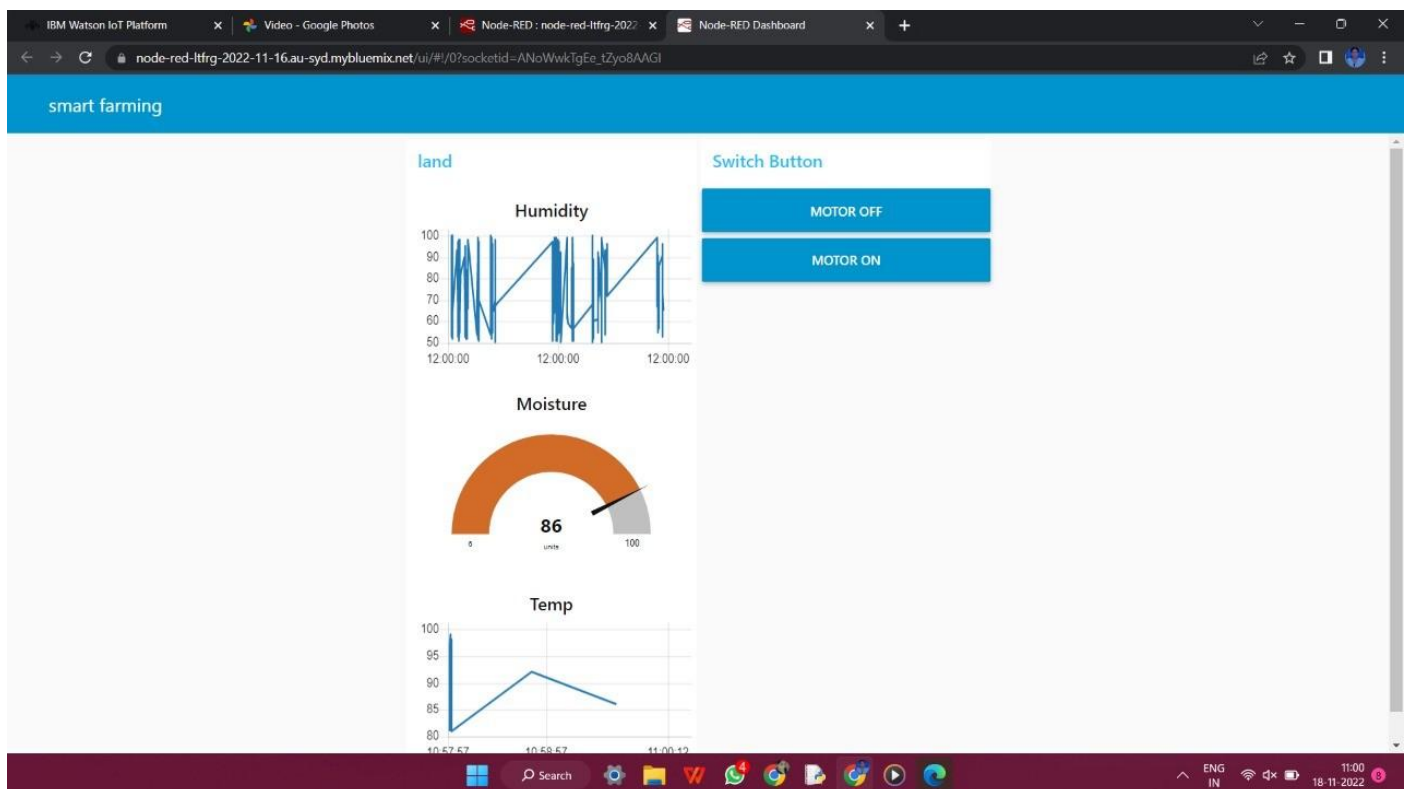
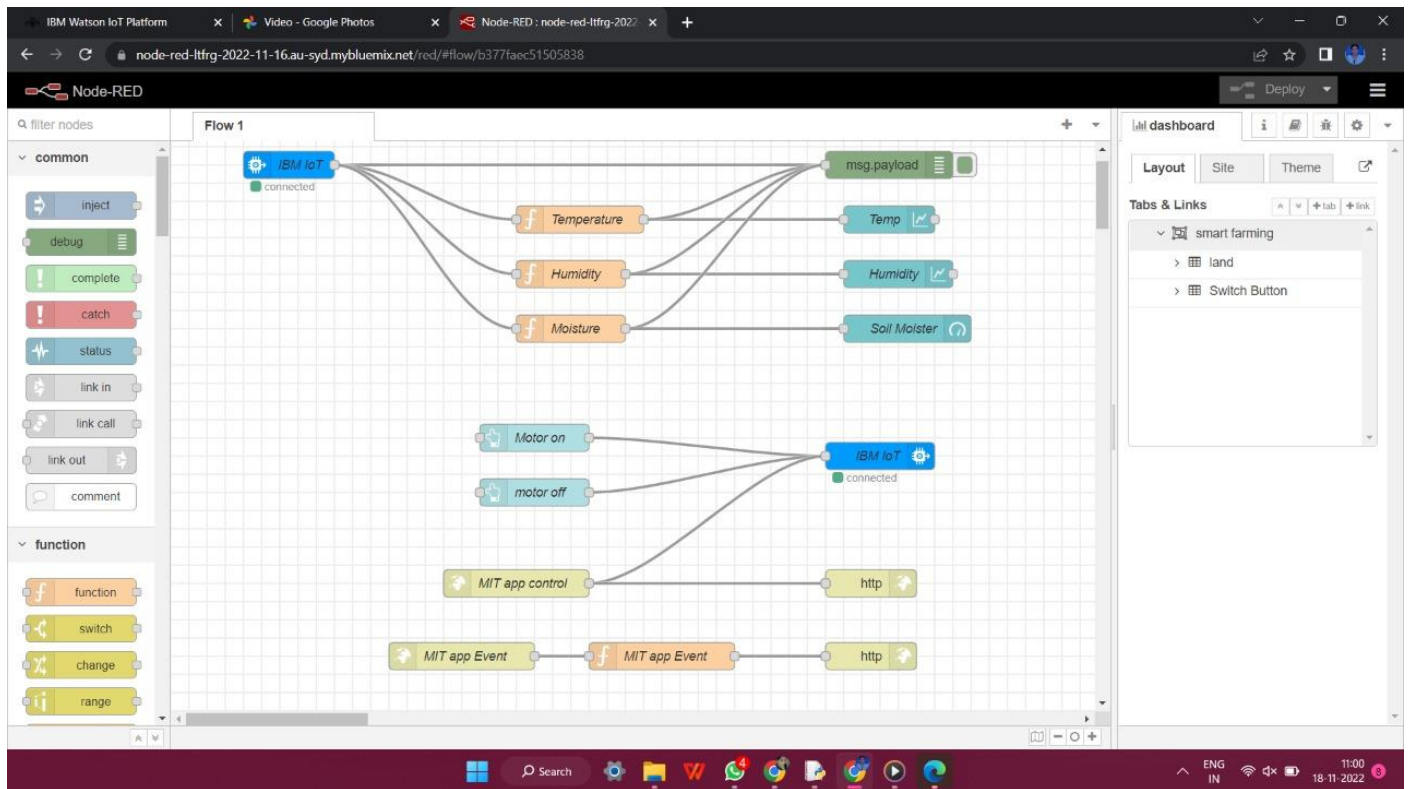
Search by Device ID

Device Simulator

Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
12345	Connected	farming	Device	Nov 17, 2022 11:38 AM	

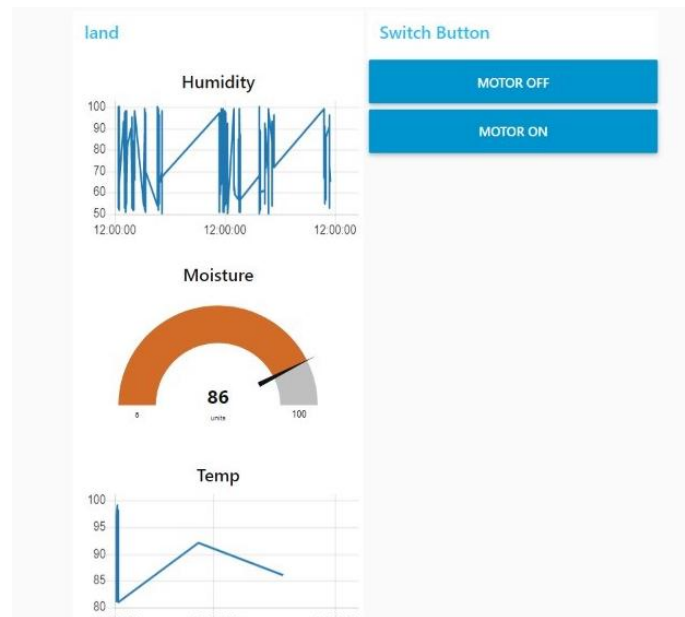
Identity	Device Information	Recent Events	State	Logs
Device ID	12345			
Device Type	farming			
Date Added	Nov 17, 2022 11:38 AM			
Added By	510419104025@smartinternz.com			
Connection Status	Connected			

1 Simulation running



9. RESULTS:

We have successfully built a web based UI and integrated all the services using Node-RED.



10. ADVANTAGES AND DISADVANTAGES:

10.1 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.

10.2 DISADVANTAGES:

- Smart Agriculture requires internet connectivity continuously, but rural parts can not fulfill this requirement.
- IoT devices need much money to implement.

11. CONCLUSION:

An IOT based smart agriculture 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 :

13.1 SOURCE CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device
organization = "r8cpvf"
deviceType = "farming"
deviceId = "12345"
authMethod = "token"
authToken = "87654321"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Commandreceived: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="motoron":
        print ("motor is on")
    elif status == "motoroff":
        print("motor is off")
    else :
        print ("please send proper command")
```

```

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
aneventof type "greeting" 10 times

deviceCli.connect()

while True:
#Get Sensor Data fromDHT11
    temp=random.randint(90,110)
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    Mois=random. randint(20,120)
    data = { 'temp' : temp, 'Humid': Humid , 'Mois': Mois}
#print data
def myOnPublishCallback():
    print ("Published Temperature = %s C" % temp, "Humidity
= %s %%" %Humid, "Moisture =%s deg c" % Mois, "to IBM Watson")
    success = deviceCli.publishEvent("IoTSensor", "json",
data,qos=0,on_publish=myOnPublishCallback)
if not success:
    print("Not connected to IoTf")
time.sleep(10)
deviceCli.commandCallback = myCommandCallback
#Disconnect the device and application from the cloud deviceCli.disconnect()

```

13.2. GITHUB AND PROJECT DEMO LINK:

PROJECT DEMO LINK:

<https://photos.app.goo.gl/xGerTKsL2v5gjrSw5>

GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-51314-1660978052>