 **DHANALAKSHMI SRINIVASAN COLLEGE OF**

**ENGINERING AND TECHNOLOGY**

**PROJECT REPORT**

**Project Name**: SMARTFARMER- IOT ENABLED SMART FARMING APPLICATION

**Team ID:** PNT2022TMID26870

# Team:-

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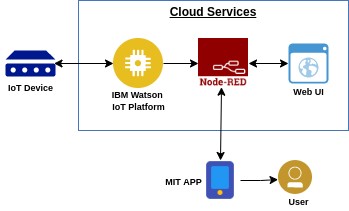
Code

GitHub & Project Demo Link

## **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. 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

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

**2.LITERATURE SURVEY**

2.2 References

**Exis ng problem :**

In India there are many cases of crop failures and most of the cases have the same reason behind it and that is lack of water which causes the irriga on system inadequate for the crop filed. There are some other reason as well like regional floods, quality of the seed is poor and out of all the main cocern is inefficient farming prac ces which leads to crop failures.We can overcome this by providing proper technology to the farmers and for the farming ac vity, which in turn increases the yield which further increases the income of the farmer and also this plays an important role in country's GDP level growth (GDP: Gross Domes c Product).And the challenge now is to develop a cheap, but accurate system that will provide the farmer with the adequate amount of informa on related to the moisture of the soil, the temperature, humidity and all required elements which play an important role in the vegeta on yield.

**Keywords:** GDP (Gross Domes c Product), IoT (Internet of Things), AI(Ar ficial

Intelligence), ML(Machine Learning), [allMETEO,](https://www.allmeteo.com/) [Smart Elements,](https://smartelements.io/) and [Pycno,](https://www.pycno.co/)

[Farmapp](https://farmappweb.com/) and [Growlink](http://growlink.com/), SCR by Allflex and [Cowlar,](https://cowlar.com/) Arable, DroneSeed, Sensefly.

**Things to consider before developing your smart farming solu on**

**(Challenges):**

# 1.The hardware

To build an IoT solu on for agriculture, you need to choose the sensors for your device. Your choice will depend on the types of informa on you want to collect and the purpose of your solu on in general.That is based on the informa on required for the Smar arming.Importantly, the quality of your sensors is crucial to the success of your product: it will depend on the accuracy of the collected data and its reliability.

# 2. The brain

Data analy cs should be at the core of every smart agriculture solu on. The collected data itself will be of li le help if you cannot make use of it.Thus, you need to have powerful data analy cs capabili es and apply predic ve algorithms and machine learning in order to obtain ac onable insights based on the collected data.

# 3. The maintenance

Maintenance of your hardware is a challenge that is of primary importance for IoT products in agriculture, as the sensors are typically used in the field and can be easily damaged.

Thus, you need to make sure your hardware is durable and easy to maintain as well it should be user-friendly . Otherwise you will need to replace/repair your sensors more o en than you would like. It will become me consuming.

# 4. The mobility

Smart farming applica ons should be tailored for use in the field. A business owner or farm manager should be able to access the informa on on site or remotely via a smartphone or desktop computer.Plus, each connected device should be autonomous and have enough wireless range to communicate with the other devices and send data to the central server.

## **5. The infrastructure**

To ensure that your smart farming applica on performs well (and to make sure it can handle the data load), you need a solid internal infrastructure.

Furthermore, your internal systems have to be secured and should be well fenced with firewall. Failing to properly secure your system only increases the likeliness of someone breaking into it, stealing your data or even taking control of your system.

# 6. Connectivity

The need to transmit data between many agricultural facili es s ll poses a challenge for the adop on of smart farming. Needless to say, the connec on between these facili es should be reliable enough to withstand bad weather condi ons and to ensure non-disrup ve opera ons. Today, IoT devices s ll use varying connec on protocols, although the efforts to develop unified standards in this area are currently underway. The advent of 5G and technologies like spacebased Internet will, hopefully, help find a solu on to this problem.

# 7. Data collection frequency

Because of the high variety of data types in the agricultural industry, ensuring the op mal data collec on frequency can be problema c. The data from field-based, aerial and environmental sensors, apps, machinery, and equipment, as well as processed analy cal data, can be a subject of restric on and regula ons. Today, the safe and mely delivery, and sharing of this data is one of the current smart farming challenges.

# 8. Data security in the agriculture industry

Precision agriculture and IoT technology imply working with large sets of data, which increases the number of poten al security loopholes that perpetrators can use for data the and hacking a acks. Unfortunately, data security in agriculture is s ll, to a large extent, an unfamiliar concept. Many farms, for example, use drones that transmit data to farm machinery. This machinery connects to the Internet but has li le to zero security protec on, such as user passwords or remote access authen ca ons. Some of the basic IoT security recommenda ons include monitoring data traffic, using encryp on methods to protect sensi ve data, leveraging AI-based security tools to detect traces of suspicious ac vity in real- me, and storing data in the blockchain to ensure its integrity. To fully benefit from IoT, farmers will have to get familiar with the data security concept, set up internal security policies, and adhere to them.

**IoT use cases in agriculture(with examples):**

# 1.Climatic conditions should be monitored

The most popular smart agriculture gadgets are weather sta ons, combining various smart farming sensors. Located across the field, they collect various data from the environment and send it to the cloud. The provided measurements can be used to map the climate condi ons, choose the appropriate crops, and take the required measures to improve their capacity (i.e.

precision farming).

Some examples of such agriculture IoT devices are [allMETEO](https://www.allmeteo.com/), [Smart Elements,](https://smartelements.io/) and [Pycno.](https://www.pycno.co/)

# 2.Greenhouse automation

Typically, farmers use manual interven on to control the greenhouse environment. The use of IoT sensors enables them to get accurate real- me informa on on greenhouse condi ons such as ligh ng, temperature, soil condi on, and humidity. In addi on to sourcing environmental data, weather sta ons can automa cally adjust the condi ons to match the given parameters.

Specifically, greenhouse automa on systems use a similar principle.

For instance, [Farmapp](https://farmappweb.com/) and [Growlink](http://growlink.com/) are also IoT agriculture products offering such capabili es among others.

[GreenIQ](https://easternpeak.com/works/iot/) is also an interes ng product that uses smart agriculture sensors. It is a smart sprinklers controller that allows you to manage your irriga on and ligh ng systems remotely.

# 3.Cattle management and monitoring

Just like crop monitoring, there are IoT agriculture sensors that can be a ached 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 loca on.

For example, such sensors can iden fy sick animals so that farmers can separate them from the herd and avoid contamina on. Using drones for real- me ca le tracking also helps farmers reduce staffing expenses. This works similarly to [IoT](https://easternpeak.com/blog/how-to-develop-an-internet-of-things-application-for-pet-care-a-go-to-market-guide/) [devices for petcare.](https://easternpeak.com/blog/how-to-develop-an-internet-of-things-application-for-pet-care-a-go-to-market-guide/)

For example, [SCR by Allflex](http://www.scrdairy.com/) and [Cowlar](https://cowlar.com/) use smart agriculture sensors (collar tags) to deliver temperature, health, ac vity, and nutri on insights on each individual cow as well as collec ve informa on about the herd.

# 4.Crop management

One more type of IoT product in agriculture and another element of precision farming are crop management devices. Just like weather sta ons, they should be placed in the field to collect data specific to crop farming; from temperature and precipita on to leaf water poten al and overall crop health.

Thus, you can monitor your crop growth and any anomalies to effec vely prevent any diseases or infesta ons that can harm your yield.

[Arable a](https://arable.com/)nd [Semios](http://semios.com/) can serve as good representa ons of how this use case can be applied in real life.

# 5.Agricultrual drones

Perhaps one of the most promising agritech advancements is the use of agricultural drones in smart farming. Also known as UAVs (unmanned aerial vehicles), drones are be er equipped than airplanes and satellites to collect agricultural data. Apart from surveillance capabili es, drones can also perform a vast number of tasks that previously required human labor: plan ng crops,

figh ng pests and infec ons, agriculture spraying, crop monitoring, etc.

[DroneSeed,](https://www.droneseed.com/) for example, builds drones for plan ng trees in deforested areas. The use of such drones is 6 mes more effec ve than human labor. A [Sense Fly](https://www.sensefly.com/) agriculture drone eBee SQ uses mul spectral image analyses to es mate the health of crops and comes at an affordable price.

# 6.Smart farming using Analytical prediction

Precision agriculture and predic ve data analy cs go hand in hand. While IoT and smart sensor technology are a goldmine for highly relevant real- me data, the use of data analy cs helps farmers make sense of it and come up with important predic ons: crop harves ng me, the risks of diseases and infesta ons, yield volume, etc. Data analy cs tools help make farming, which is inherently highly dependent on weather condi ons, more manageable, and predictable.

For example, the [Crop Performance p](https://crop-performance.com/)la orm helps farmers access the volume and quality of yields in advance, as well as their vulnerability to unfavorable weather condi ons, such as floods and drought. It also enables farmers to op mize the supply of water and nutrients for each crop and even select yield traits to improve quality.

**Proposed Solu on:**

Every aspect of the tradional farming method can be changed from roots by adop ng the latest technologies of IoT in agriculture pracces. Integra ng of sensors and the IoT in smart agriculture can raise agriculture to levels which were previously un-imaginable.

Every land cannot support the growth of every crop so by simultaneously measuring soil parameters like the nutrient presence, flow of irriga on, soil type, temperature of the milieu, etc.We can create a report, based on that report a farmer may crop seeds which are suitable to that land.And also aerial vehicles can be arranged to monitor the crops without the use of a man. Temperature and humidity sensors would be buried under the soil and the device reports it to the farmer through phone applica on on live basis. A dashboard kind of UI can be displayed to the user/farmer through the web app or a applica on specially designed using MIT App Inventor. The IoT device is also integrated with the weather forecast services so that user, farmer in our case always updated with the weather in that loca on.

And now the farmer should be a experienced person so as to use the data's collected and plant crops accordingly. And also we can use AI (Ar ficial Intelligence) to suggest the farmer with the crops which can be sown. Flow of water can also be controlled using the data acquired from the IoT sensor (Soil moisture sensor). Switching the motor can be done with the help of relay and also in case of many valves we can have an array of relays. And this can be done from any place as the applica on is available online and can be connected through the internet. And also ML (Machine Learning) can be used and implemented to smoothen the process of farming for the farmer.

**Conclusion:**

By using this system farmers can effec vely produce more yield and can save water from wastage. With help of weather forecast service farmer can water their land as per weather. Farmer can also turn ON/OFF motor whenever required based on the water content in soil.

**Reference:**

**Youtube:** [h](https://www.youtube.com/embed/Rr3KZ5QU3Xs) [ps://www.youtube.com/embed/Rr3KZ5QU3Xs](https://www.youtube.com/embed/Rr3KZ5QU3Xs) [h](https://www.youtube.com/embed/pOLAIVUs9S8) [ps://www.youtube.com/embed/pOLAIVUs9S8](https://www.youtube.com/embed/pOLAIVUs9S8)  [h](https://www.youtube.com/embed/0z9Fnc4IkFo) [ps://www.youtube.com/embed/0z9Fnc4IkFo](https://www.youtube.com/embed/0z9Fnc4IkFo)

**Internet:**

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**How to write a Literature Survey :**  [h](https://www.scribbr.com/dissertation/literature-review/) [ps://www.scribbr.com/disserta on/literaturereview/](https://www.scribbr.com/dissertation/literature-review/)

**IEEE Papers:**

IOT Based Smart Farming

Publisher: IEEE

[C. Mageshkumar;](https://ieeexplore.ieee.org/author/37088451137) [K.R. Sugunamuki](https://ieeexplore.ieee.org/author/37086548581)

Smart Farming: The IoT based Future Agriculture

Publisher: IEEE

[Vijaya Saraswathi R;](https://ieeexplore.ieee.org/author/37089313617) [Sridharani J](https://ieeexplore.ieee.org/author/37089312751); [Saranya Chowdary P;](https://ieeexplore.ieee.org/author/37089310447) [Nikhil K;](https://ieeexplore.ieee.org/author/37089310994)[Sri Harshitha M;](https://ieeexplore.ieee.org/author/37089312551) [Mahanth](https://ieeexplore.ieee.org/author/37089310643)

[Sai K](https://ieeexplore.ieee.org/author/37089310643)

IOT Based Smart Agriculture System

Publisher: IEEE [G. Sushanth;](https://ieeexplore.ieee.org/author/37086508579)

[S.Sujatha](https://ieeexplore.ieee.org/author/37085634178)

**Example:**

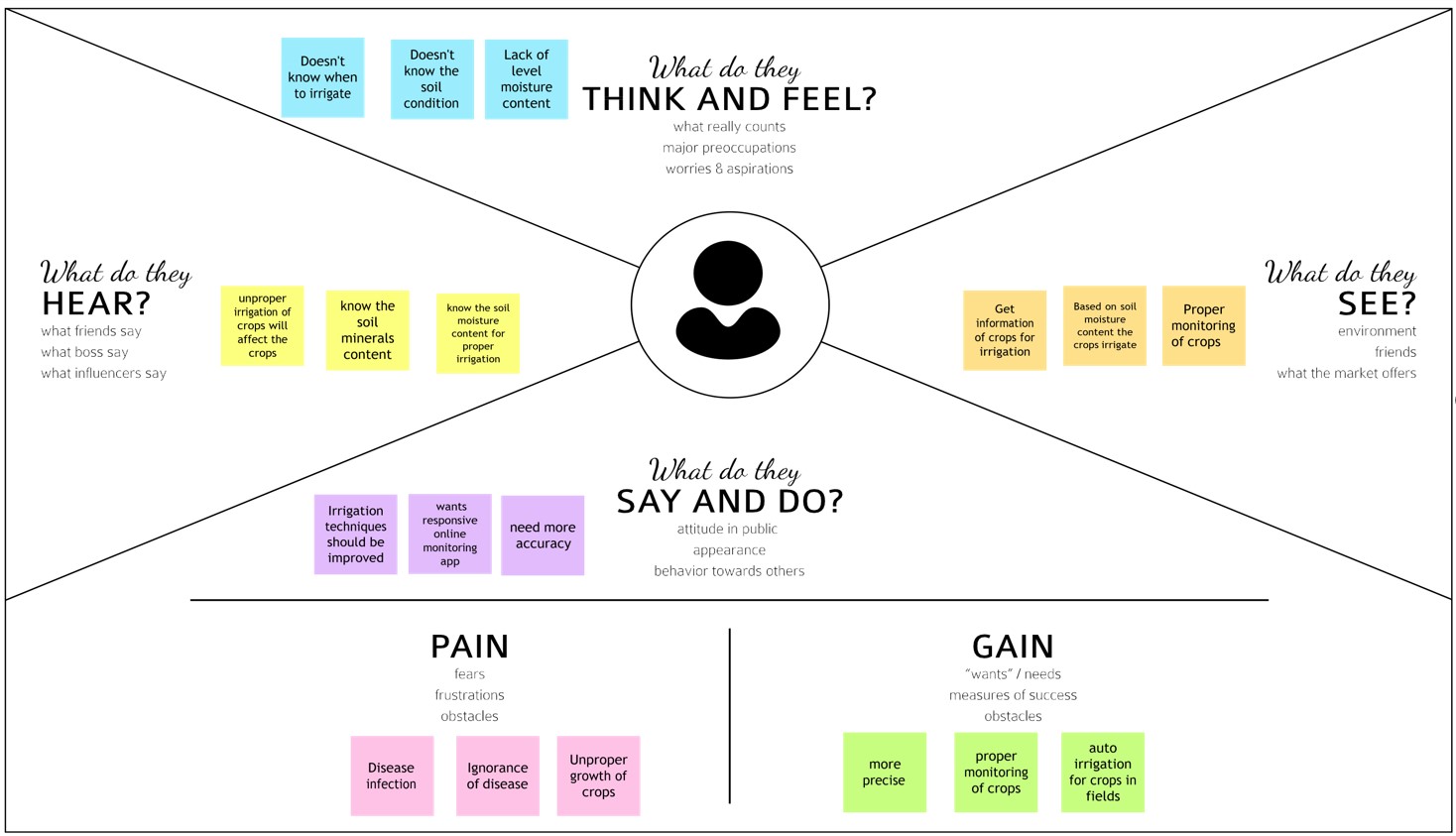


**3. IDEATION & PROPOSED SOLUTION**

3.1 Empathy Map Canvas

## 3.2 Ideation and Brainstorming

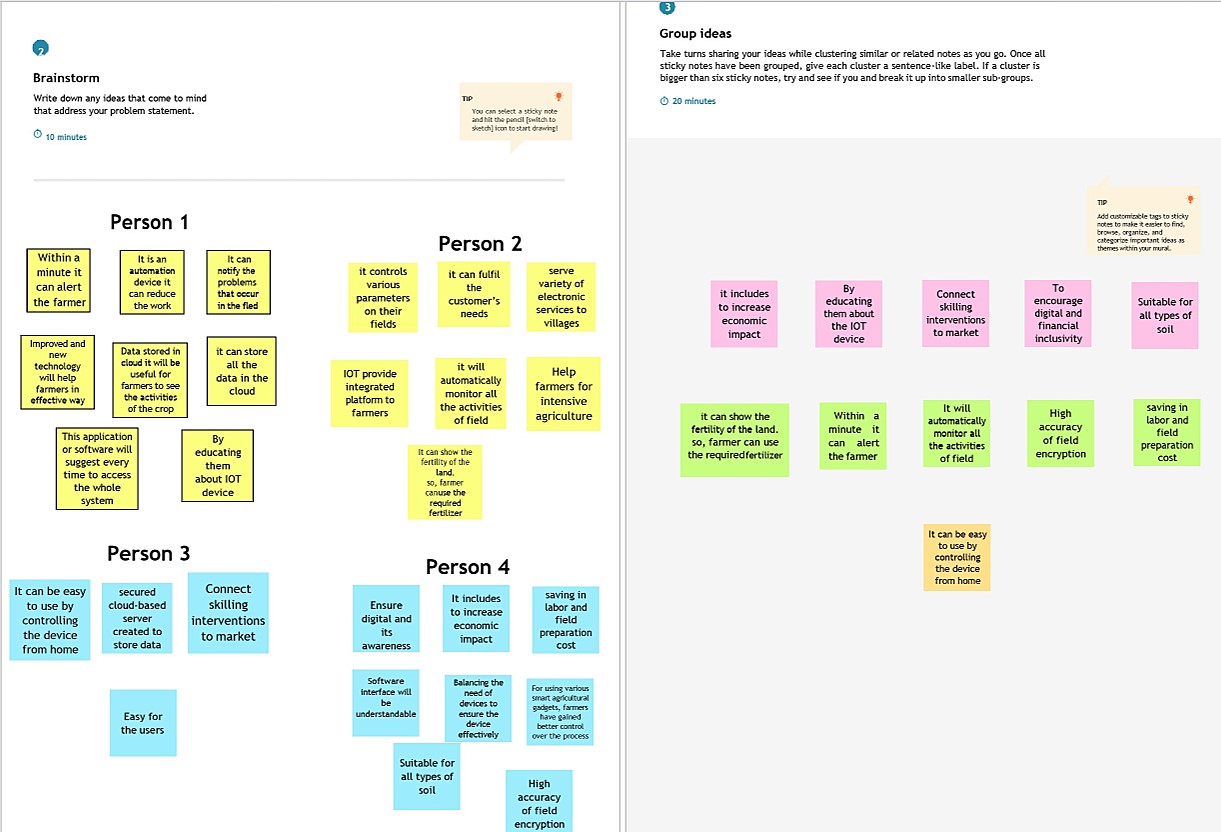
### Step-1: Team Gathering, Collabora on and Select the Problem Statement



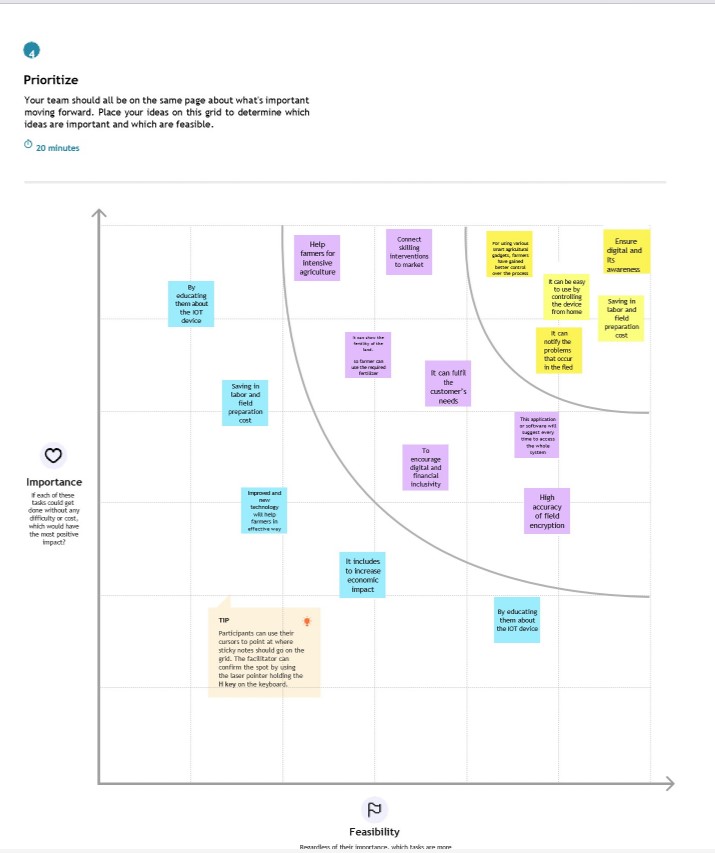
**Problem Statement Definition**



**Step-2: Brainstorm, Idea Listing and Grouping**



**Step-3: Idea Prioritization**



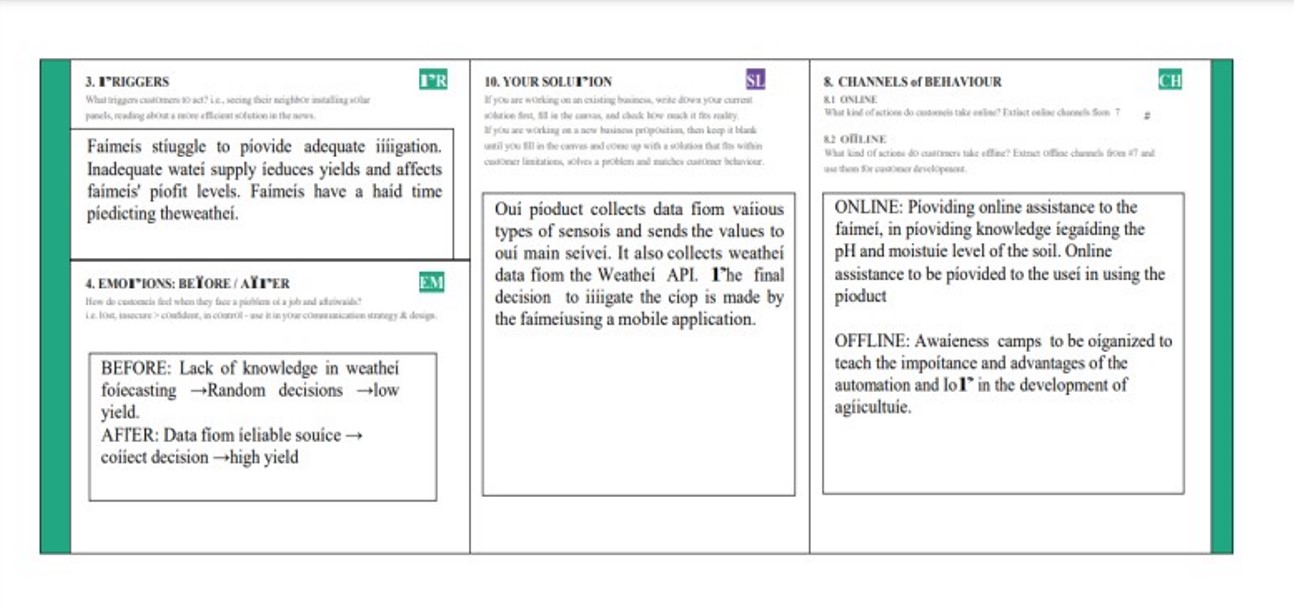
3.3 **Proposed Solution**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
| 1. | Problem Statement (Problem to be solved) | 1. Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. 2. Power Supply is also one of the problems. In Village Side, the power supply may vary. 3. The Biggest Challenges Faced by IoT in the Agricultural   Sector are  Lack of Information, High  Adoption, Cost and Security  Concerns, etc |
| 2. | Idea / Solution description | 1. As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. 2. The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in determining the weather pattern in Farms. So cultivation is done for suitable crops. |
| 3. | Novelty / Uniqueness | **ALERT MESSAGE** – IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | backhaul devices.  **REMOTE ACCESS –** It helps the farmer to operate the motor from anywhere. | | | | | | | | |
| 4. | Social Impact / Customer  Satisfaction | 1. Reduces the wages for labors who work in the agricultural field. 2. It saves a lot of time. 3. IoT can help improve customer relationships by enhancing the customer's overall experience. 4. Easily identify maintenance needs, build better products, send personalized communications, and more. 5. IoT can also help e-commerce businesses thrive and increase sales. 6. It make a wealthy society | | | | | | | | |
| 5. | Business Model (Revenue  Model) | Revenue (No. of Users vs Months) | | | | | | | | |
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| 800  700  600  500  400 300 200  100 0 | | | | |
|  |  | | 0 1 2 3 4  5 | | | | | | |  |
| User              Months | | | | | | |
| 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 timely analysis. | | | | | | | |

**3.4 Problem solution fit**





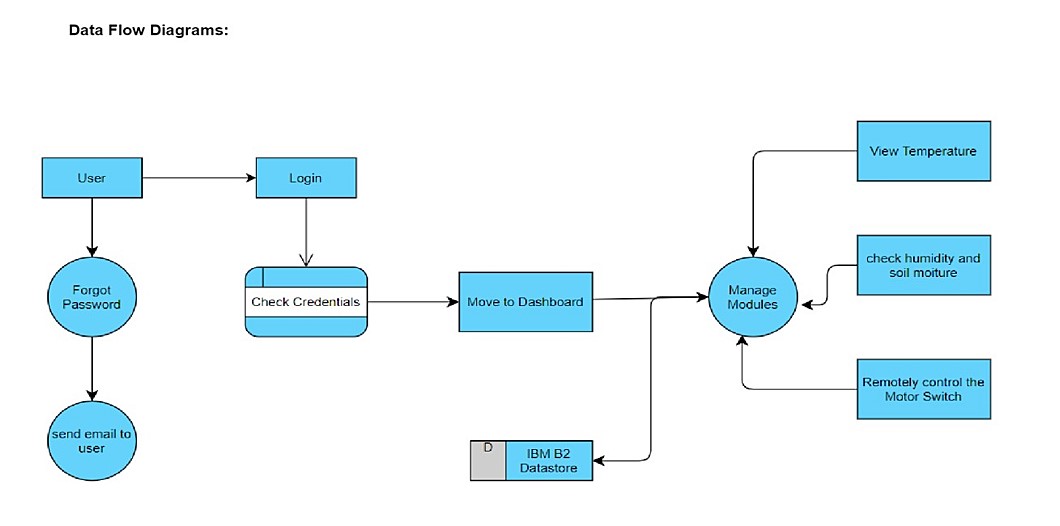
1. **Requirement Analysis**

4.1 Functional Requirement following are the functional requirements of the proposed soluation.

|  |  |  |
| --- | --- | --- |
| **FR NO.** | **Functional Requirements (Epic)** | **Sub Requirements (story/sub-task)** |
| FR-1 | use Registration | Registration gmail |
| FR-2 | use confirmation | Confirmation via Email confirmation via otp |
| FR-3 | log into system | check credentails check Roles of access |
| FR-4 | manage module | Manage system admins manage roles of user manage user permission |
| FR-5 | check wheather details | Temperature details Humidity details |
| FR-6 | log out | Exit |

1. **PROJECT DESIGN**

## 5.1 Data flow diagrams



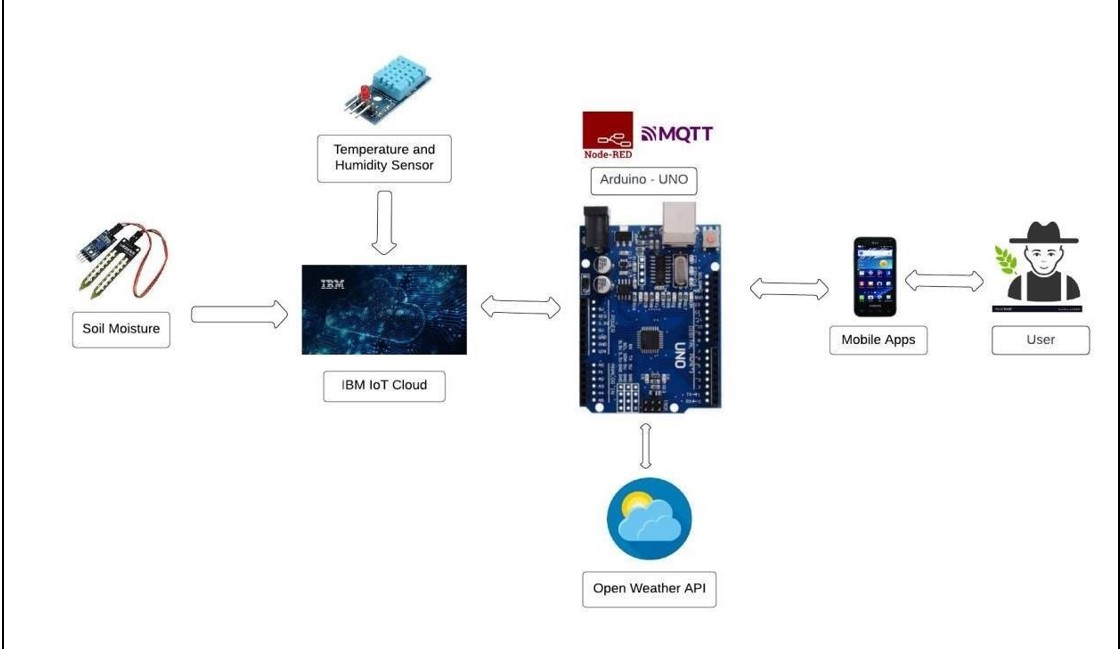
**5.2 Solution and Technical Architecture**

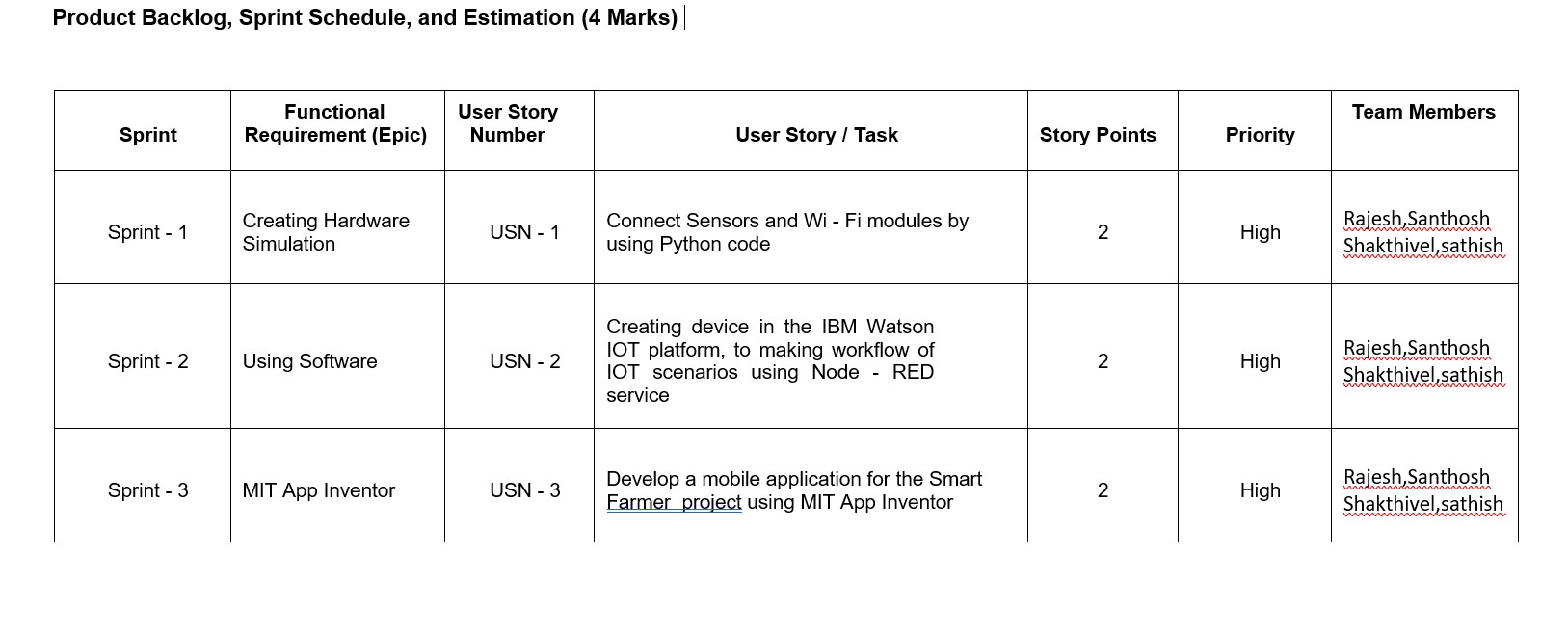
1. The different soil parameters (temperature, humidity, Soil Moisture) are sensed using different sensors, and the obtained value is stored in the IBM cloud.
2. Arduino UNO is used as a processing unit that processes the data obtained from sensors and weather data from weather API.
3. Node-red is used as a programming tool to wire the hardware, software, and APIs. The

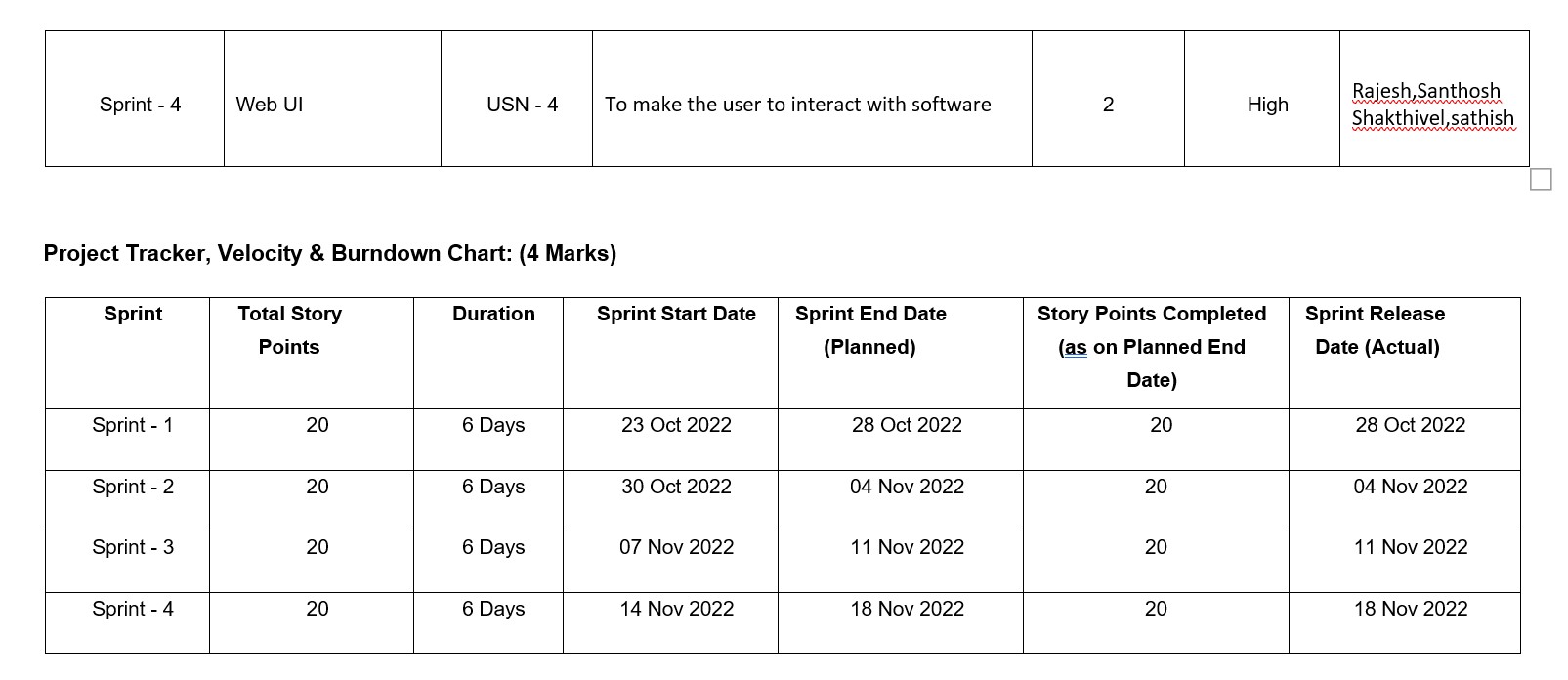
MQTT protocol is followed for communication.

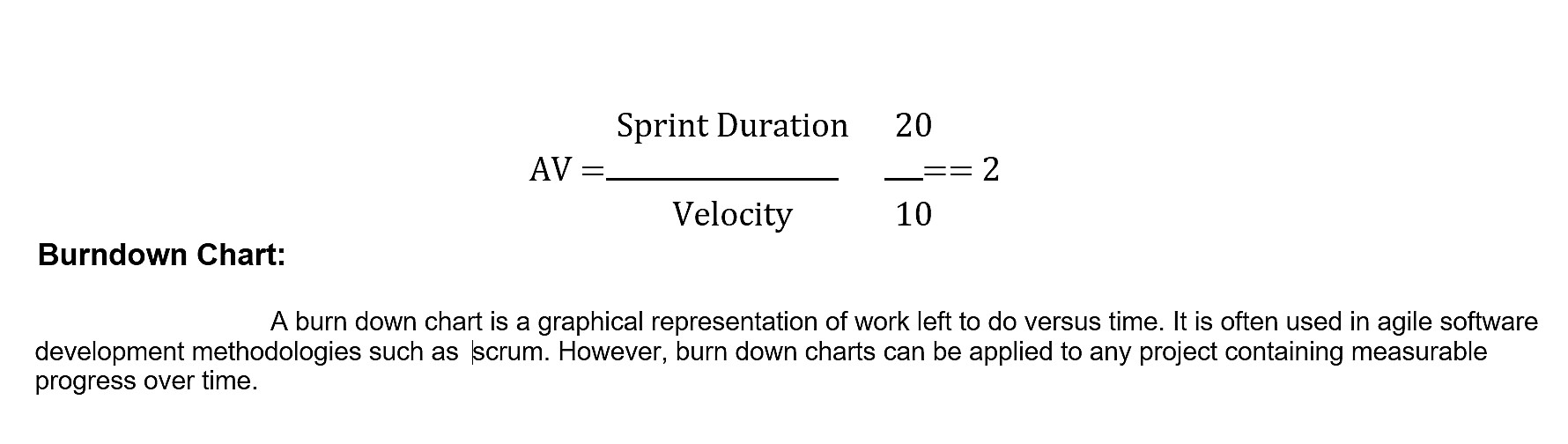
1. All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor. The user could make a decision through an app, whether to water the crop or not depending upon the sensor values. By using the app they can remotely operate the motor switch.

**6.PROJECT PLANNING AND SCHEDULING**









**10**

**Burndown Chart:**

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

[**https://www.visual-paradigm.com/scrum/scrumburndown-chart/**](https://www.visual-paradigm.com/scrum/scrum-burndown-chart/) [**https://www.atlassian.com/agile/tutorials/burndowncharts**](https://www.atlassian.com/agile/tutorials/burndown-charts)

**Reference:**

[**https://www.atlassian.com/agile/project-management**](https://www.atlassian.com/agile/project-management)

[**https://www.atlassian.com/agile/tutorials/how-to-doscrum-with-jira-software**](https://www.atlassian.com/agile/tutorials/how-to-do-scrum-with-jira-software) [**https://www.atlassian.com/agile/tutorials/epics**](https://www.atlassian.com/agile/tutorials/epics) [**https://www.atlassian.com/agile/tutorials/sprints**](https://www.atlassian.com/agile/tutorials/sprints) [**https://www.atlassian.com/agile/projectmanagement/estimation**](https://www.atlassian.com/agile/project-management/estimation) [**https://www.atlassian.com/agile/tutorials/burndo wn-charts**](https://www.atlassian.com/agile/tutorials/burndown-charts)

**7.CODING AND SOLUTIONING**

**7.1 Feature**

**PROGRAM :**

import me import sys import ibmio .applica on import ibmio .device

import random

#Provide your IBM Watson Device Creden als organiza on = "ypafe4" deviceType = "NodeMCU" deviceId = "12345678" authMethod = "token" authToken = "7COKiYfQcW-Czyz3FA"

# Ini alize GPIO

def myCommandCallback(cmd):

print("Command received: %s" % cmd.data['command']) status=cmd.data['command']

if status=="lighton": print ("led is on") else :

print ("led is off")

#print(cmd)

try:

deviceOp ons = {"org": organiza on, "type": deviceType, "id": deviceId, "authmethod": authMethod, "auth-token": authToken}

deviceCli = ibmio .device.Client(deviceOp ons)

#..............................................

except Excep on as e:

print("Caught excep on connec ng device: %s" % str(e)) sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type

"gree ng" 10 mes

deviceCli.connect()

while True:

#Get Sensor Data from DHT11

temp=random.randint(0,100) Humid=random.randint(0,100)

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

#print data

def myOnPublishCallback(): print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "to IBM Watson")

success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on\_publish=myOnPublishCallback)

if not success:

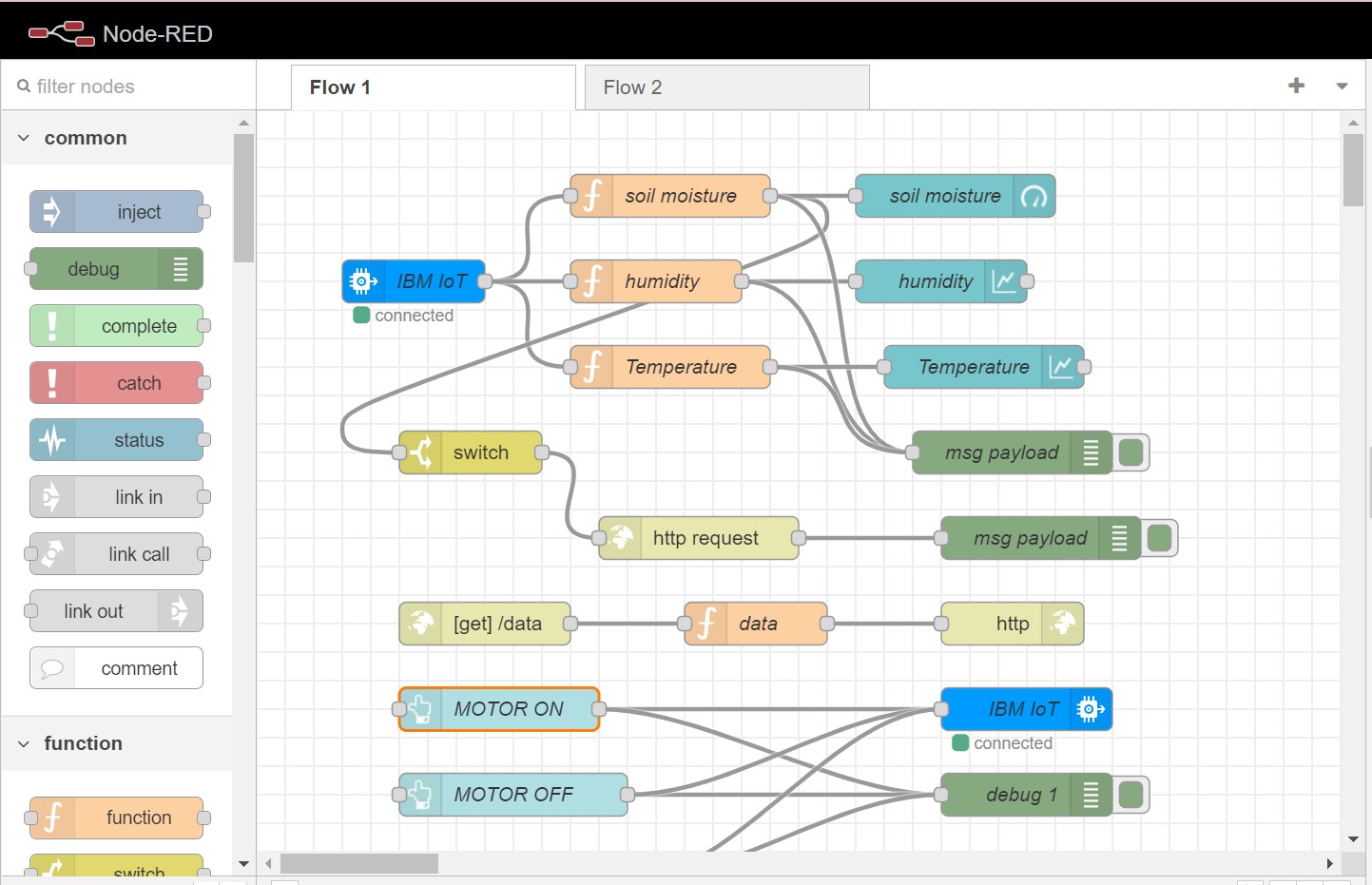
print("Not connected to IoTF") me.sleep(1)

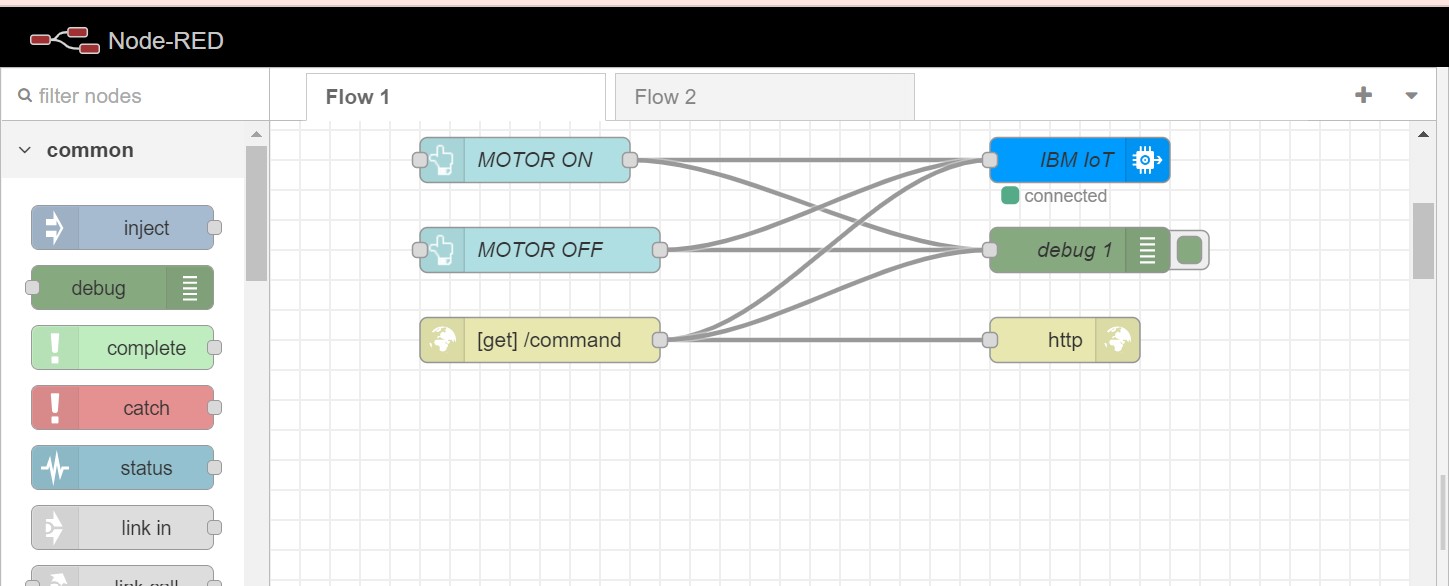
deviceCli.commandCallback = myCommandCallback

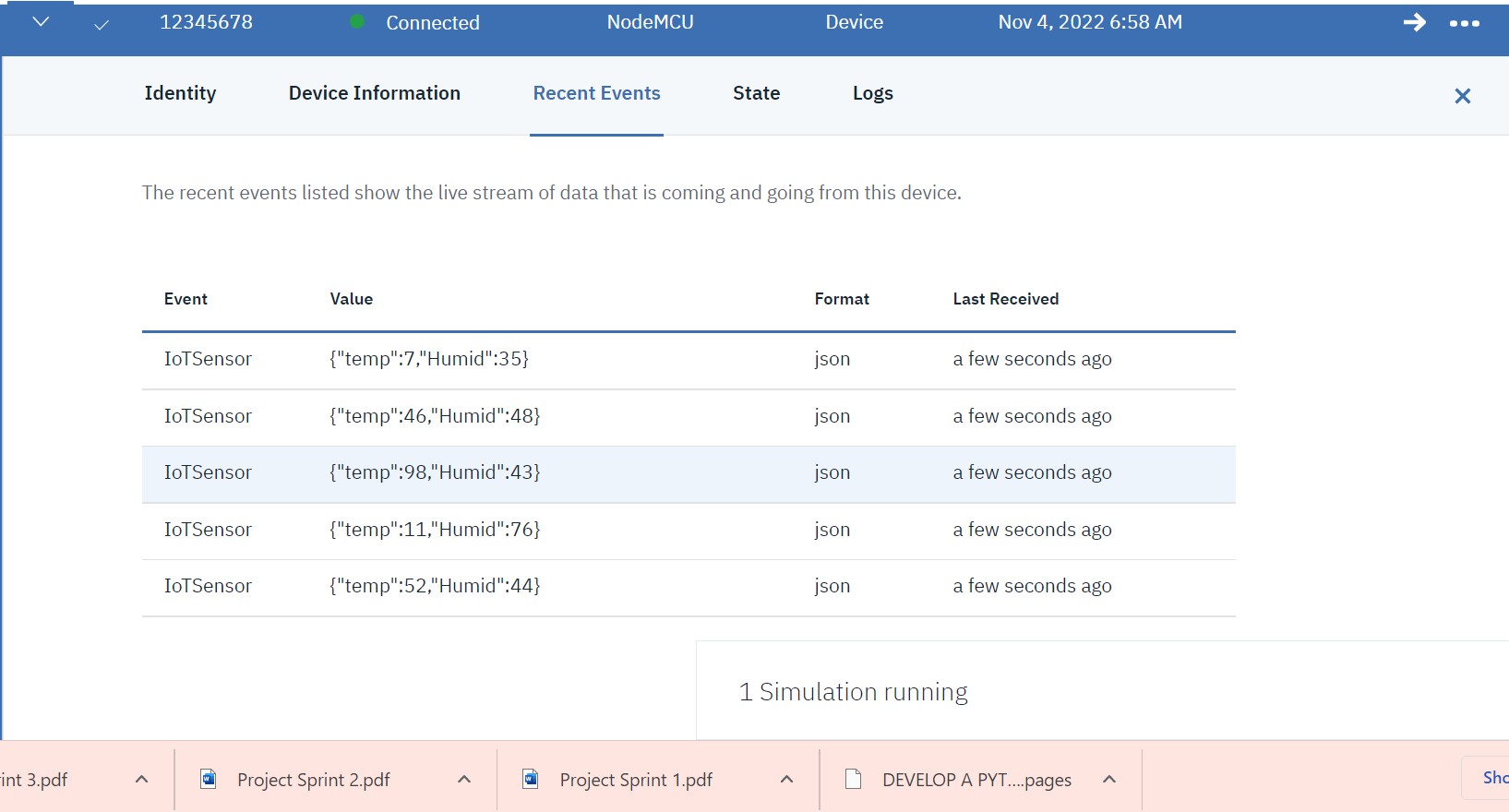
# Disconnect the device and applica on from the cloud deviceCli.disconnect()

### 8.TESTING

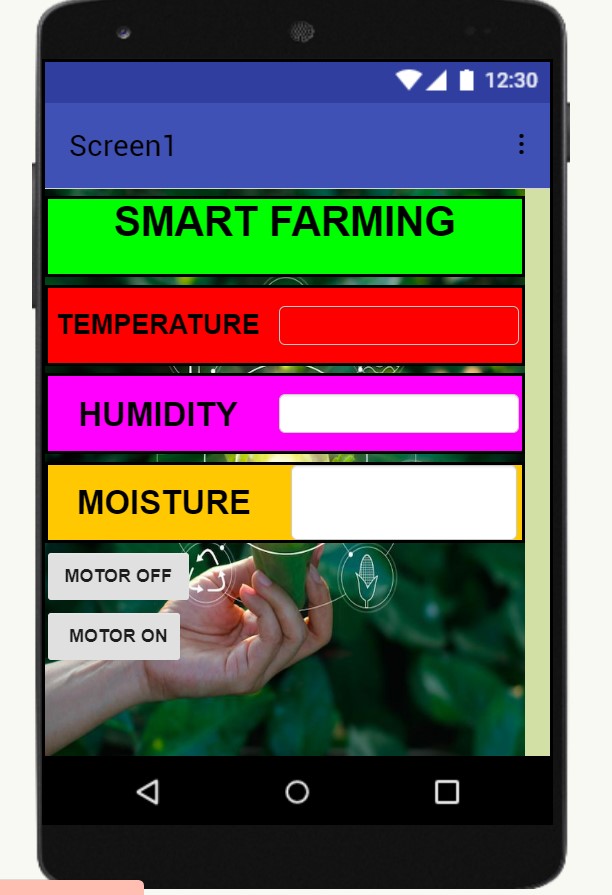
**8.1 Test case**



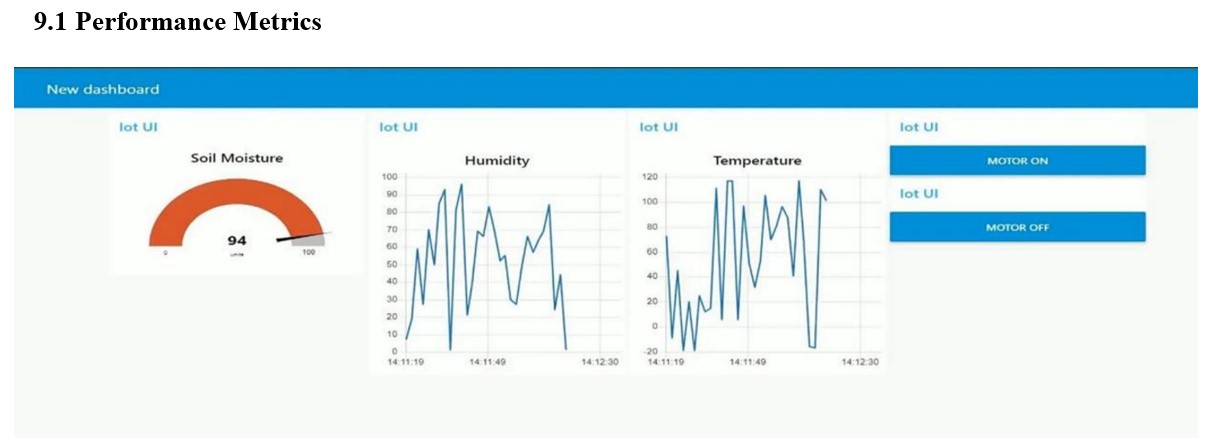




**8.2 User Acceptance Testing**



## **9.RESULTS**



**10.Advantages and disadvantages**

**Advantages:**

1. A remote control system can help in working irrigation system valves 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.
2. For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.
3. 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.
4. Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and different kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

**Disadvantages:**

1. 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.
2. 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.

### 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.

### 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.

1. 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.
2. 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.
3. 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 time** **import sys** **import ibmiotf.application** **import ibmiotf.device**

**import random**

**#Provide your IBM Watson Device Credentials** **organization = "ypafe4"** **deviceType = "NodeMCU"**

**deviceId = "12345678"** **authMethod = "token"** **authToken = "7COKiYfQcW-Czyz3FA"**

**# Initialize GPIO**

**def myCommandCallback(cmd):**  **print("Command received: %s" % cmd.data['command'])**  **status=cmd.data['command']**

**if status=="lighton":**

**print ("led is on")**

**else :**

**print ("led is off")**

**#print(cmd)**

**try:**

**deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "authmethod": 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)**

**Humid=random.randint(0,100)**

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

**#print data**

**def myOnPublishCallback():**

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

**myCommandCallback**

**# Disconnect the device and application from the cloud**

**deviceCli.disconnect()**

**Github link:** <https://github.com/IBM-EPBL/IBM-Project-15788-1659604658>

**Project Demo link:**  <https://vimeo.com/772819903>