**Smart Farmer - IOT Enabled Smart Farming Application**



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**INTRODUCTION**

Project Overview

**Abstract**

Internet of Things (IoT) play crucial role in smart agriculture. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. The paper aims making use of evolving technology i. e. IoT and smart agriculture using automation. Monitoring environmental factors is the major factor to improve the yield of the efficient crops. The feature of this paper includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip. Camera is interfaced with CC3200 to capture images and send that pictures through MMS to farmers mobile using Wi-Fi. Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like GPS based remote controlled monitoring, moisture & temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities. It makes use of wireless sensor networks for nothing the soil properties, and environmental factors continuously.

Purpose

* Smart farming helps farmers to better understand the important factors such as water, topography, aspect, vegetation and soil types.
* This allows farmers to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically sustainable manner.
* By making farming more connected and intelligent, precision agriculture helps reduce overall costs and improve the quality and quantity of products, the sustainability of agriculture and the experience for the consumer.
* Increasing control over production leads to better cost management and waste reduction.
* Agriculture provides most of the world's food and fabrics. Cotton, wool, and leather are all agricultural products. Agriculture also provides wood for construction and paper products. These products, as well as the agricultural methods used, may vary from one part of the world to another
* India is an agricultural-based nation because in our country around 70% of the population depends on the agriculture sector for their livelihood and farming is their main proof.

**LITERATURE SURVEY**

**Existing Problem**

**1.Small and fragmented land-holdings:**  
The seemingly abundance of net sown area of 141.2 million hectares and total cropped area of 189.7 million hectares (1999-2000) pales into insignificance when we see that it is divided into economically unviable small and scattered holdings.  
The average size of holdings was 2.28 hectares in 1970-71 which was reduced to 1.82 hectares in 1980-81 and 1.50 hectares in 1995-96. The size of the holdings will further decrease with the infinite Sub-division of the land holdings.  
  
**2. [Seeds](https://www.bighaat.com/collections/seeds" \o "Quality Agriculture Seeds):**  
Seed is a critical and basic input for attaining higher crop yields and sustained growth in agricultural production. Distribution of assured quality seed is as critical as the production of such seeds. Unfortunately, good quality seeds are out of reach of the majority of farmers, especially small and marginal farmers mainly because of exorbitant prices of better seeds.  
  
**3. [Manures, Fertilizers and Biocides](https://www.bighaat.com/collections/plant-nutrition" \o "Plant Nutrition):**  
Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. The average yields of almost all the crops are among t e lowest in the world. This is a serious problem which can be solved by using more manures and fertilizers.  
  
**4. Irrigation:**  
Although India is the second largest irrigated country of the world after China, only one-third of the cropped area is under irrigation. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic India cannot achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation.  
  
**5. Lack of mechanisation:**  
In spite of the large scale mechanisation of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and [implements](https://www.bighaat.com/collections/agri-implements" \o "Agriculture Implements) like wooden plough, sickle, etc.  
  
**6. Soil erosion:**  
Large tracts of fertile land suffer from soil erosion by wind and water. This area must be properly treated and restored to its original fertility.  
  
**7. Agricultural Marketing:**  
Agricultural marketing still continues to be in a bad shape in rural India. In the absence of sound marketing facilities, the farmers have to depend upon local traders and middlemen for the disposal of their farm produce which is sold at throw-away price.

Reference

* JoaquínGutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara, :Automated Irrigation System Using a Wireless Sensor Network and GPRS Module:,IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, 0018-9456,2013
* Dr. V .Vidya Devi,G. Meena Kumari, :Real- Time Automation and Monitoring System for Modernized Agriculture: ,International Journal of Review and Research in Applied Sciences and Engineering,Vol3 No.1. PP 7-12, 2013.
* Aqueel-ur-Rehman, Abu Zafar Abbasi, Noman Islam, Zubair Ahmed Shaikh, :A review of wireless sensor and networks applications in agriculture:, Computer Standards & Interfaces 36(2014) 263-270.
* R.Gaikwad. Internet of Things(iot): Revolution of internet for smart environment: Oracle,.

2.3 Problem Statement Definition

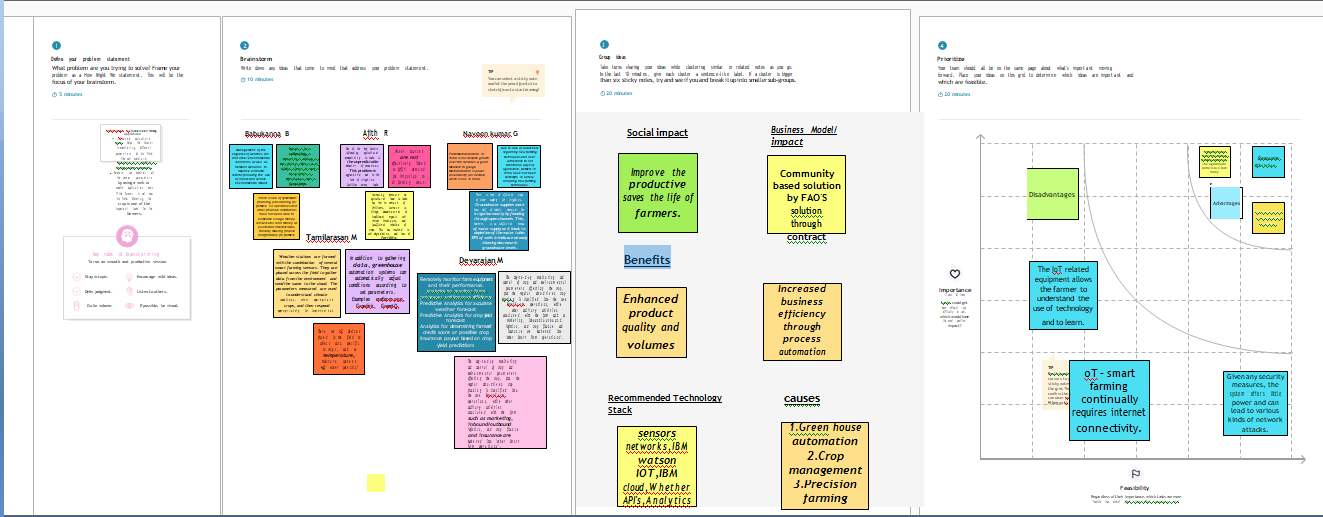
* + An average framer cannot maintain the field in distance.
  + It requires low data.
  + It controls transferable.
  + Make the receivers gain information easily. Consequent connection.
  + Proper information provided by the application.
  + Best solutions for tolerance met.
  + Monitor different parameters.
  + Better decision for whether change.

3. **IDEATION & PROPOSED SOLUTION**

3.1 Empathy Map Canvas



* 1. Ideation & Brainstorming



3.3 Proposed Solution

**Proposed Solution Template**

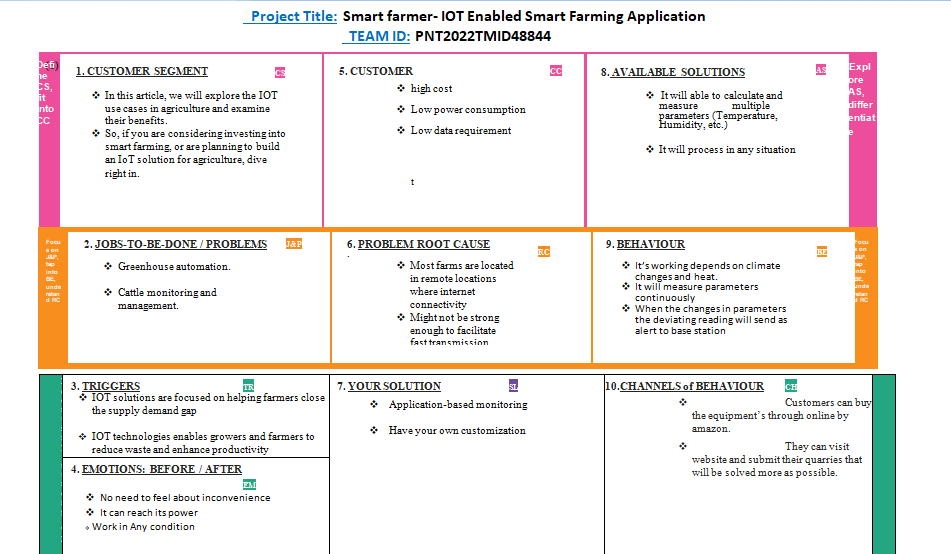
|  |  |
| --- | --- |
| Date | 01 October2022 |
| Team ID | PNT2022TMID48844 |
| Project Name | Project – Smart Farmer –IOT Enabled Smart Farming Application |
| Maximum Marks | 2 Marks |

**Proposed Solution Template:**

Project team shall fill the following information in proposed solution template.

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
|  | Problem Statement (Problem to be solved) | To provide efficient decision support system using wireless sensor network which handle different activities of farm and gives useful information related to farm. Information related to soil moisture, temperature and humidity content |
|  | Idea / Solution description | Smart agricultural system solution provide an integrated IOT platform in agriculture that allows farmers to leverage sensors, smart gateways and monitoring systems to collect information. |
|  | Novelty / Uniqueness | Various eminent researchers have been making efforts for smart farming by using IOT concepts in agriculture. But a bouquet of unfolded challenges is still in a queue for their effective solution. |
|  | Social Impact / Customer Satisfaction | Reduces the wages for labours who work in the agricultural field. It saves a lot of time. |
|  | Business Model (Revenue Model) | A monthly subscription is charged to farmers for prediction and suggesting the irrigation timing based on sensors parameters like temperature, humidity ,soil, moisture. |

* 1. Problem Solution fit



4. **REQUIREMENT ANALYSIS**

4.1 Functional requirement

|  |  |
| --- | --- |
| Date | 27 October 2022 |
| Team ID | PNT2022TMID48844 |
| Project Name | Smart Farmer – IOT Enabled Smart Farming Application |
| Maximum Marks | 4 Marks |

## Functional Requirements:

Following are the functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | User Registration | Registration through Form Registration through email  Registration through LinkedIn |
| FR-2 | User Confirmation | Confirmation via Email Confirmation via OTP |
| FR-3 | Sensor Function farming system | Measure the Temperature and Humidity Measure the soil Monitoring  Check the soil levels |
| FR-4 | Manage Modules | Manage Roles of User Manage Sensors |
| FR-5 | Check Weather details | Temperature details humidity details |
| FR-6 | Data Management | Manage the data of weather conditions Manage the data of crop conditions  Manage the levels of water level conditions |

4.2 Non-Functional requirements

**Non-functional Requirements:**

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

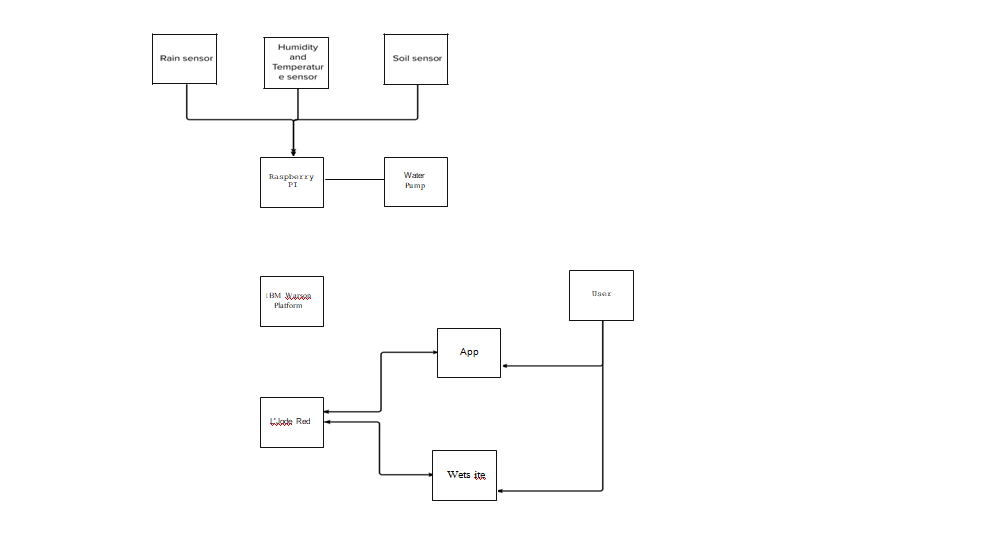
|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | User-friendly instructions are provided for users to use the functionalities.  Users may utilize it easily and efficiently with a simple user interface. |
| NFR-2 | **Security** | All of the user's information is encrypted and hidden from unauthorized users.  Only by providing the user details, it is possible to manipulate sensors. |

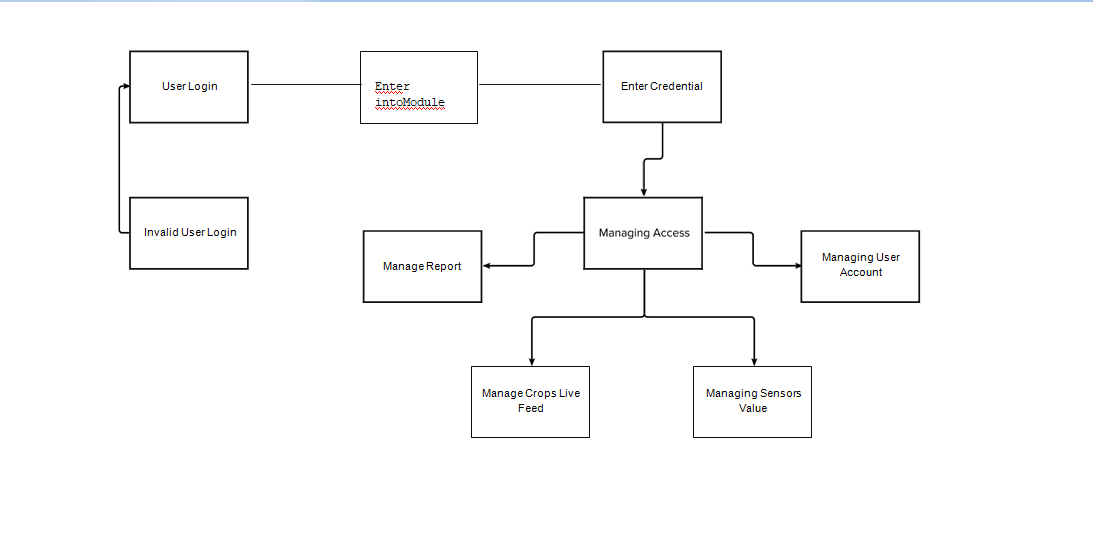
|  |  |  |
| --- | --- | --- |
| NFR-3 | **Reliability** | Since the values of the result will be accurate, this application is trustable and consistent. |

|  |  |  |
| --- | --- | --- |
| NFR-4 | **Performance** | Utilizing contemporary technology solutions helps to maximize performance, producing greater quality and quantity yields. The usage of sensors also aids in understanding the water requirements and other  necessities for a higher yield. |
| NFR-5 | **Availability** | The application is available in the website and mobile app. |
| NFR-6 | **Scalability** | It refers to the ability to expand resource availability and system capabilities without having to undergo a  significant system redesign or implementation. |

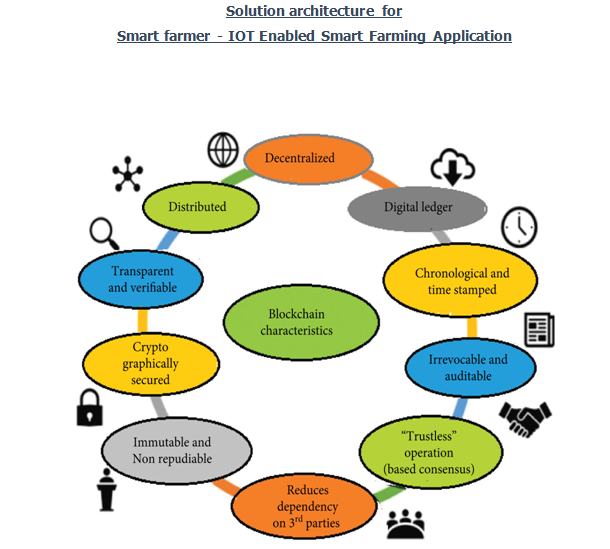
**5. PROJECT DESIGN**

* 1. Data Flow Diagrams

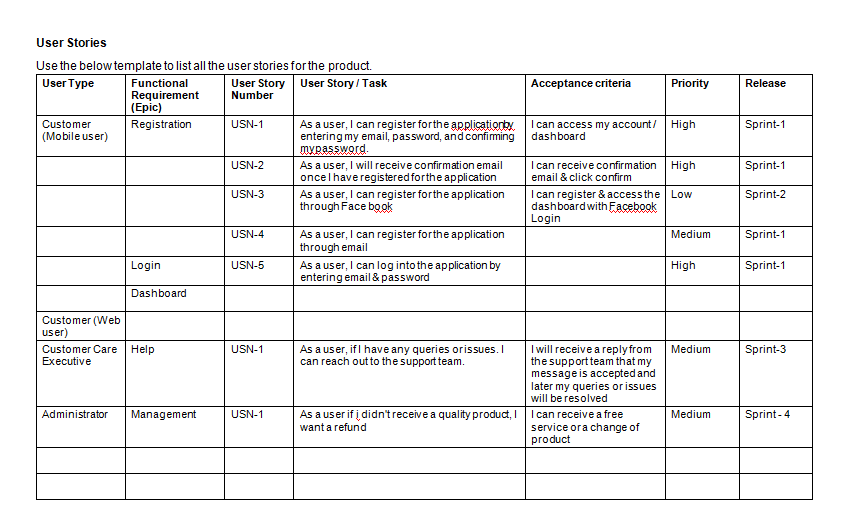




5.2.Solution & Technical Architecture



5.3.User Stories



**6.PROJECT PLANNING & SCHEDULING**

6.1.Sprint Planning & Estimation

**1.Introduction:**

The main aim of this project is to help farmers automate their farms

by providing them with a Web App through which they can monitor

the parameters of the field like Temperature, soil moisture, humidity

etc and control the equipment like water motor and other devices

remotely via the internet without their actual presence in the field.

**2. Problem Statement:**

Farmers need to deal with many problems like coping with climate

Change, soil erosion and Biodiversityloss. Farmers are to be present at farm for its maintenance irrespective of the weather

conditions. They have to ensure that the crops are well watered

and the farm status is monitored by them physically. Farmers have

to stay most of the time in field in order to get a good yield. In

difficult times like in the presence of pandemic also they have to

work hard in their fields risking their lives to provide food for the

country.

**3. Proposed Solution:**

To provide an efficient decision support system using wireless

sensor networks which handle different activities of the farm and

give useful information related to soil moisture, Temperature and

Humidity content. Due to the weather condition, water level

increases, Farmers get a lot of distractions which is not good for

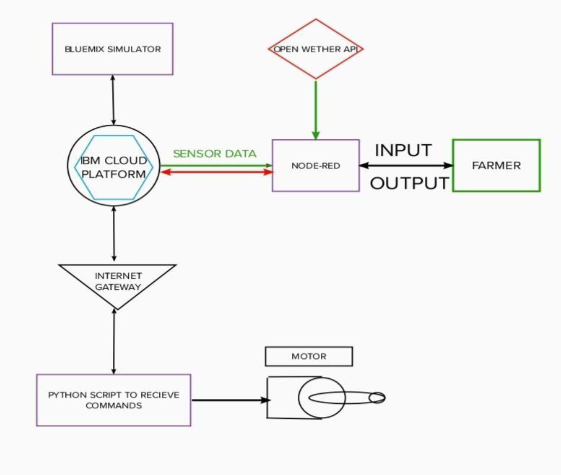
Agriculture.

**4. Theoretical Analysis:**

**4.1 Block Diagram:**

In order to implement the solution , the following approach as

shown in the block diagram,is used



**4.2 Required Software Installation:**

**4.2.A Node-Red:**

Node-RED is a flow-based development tool for visual

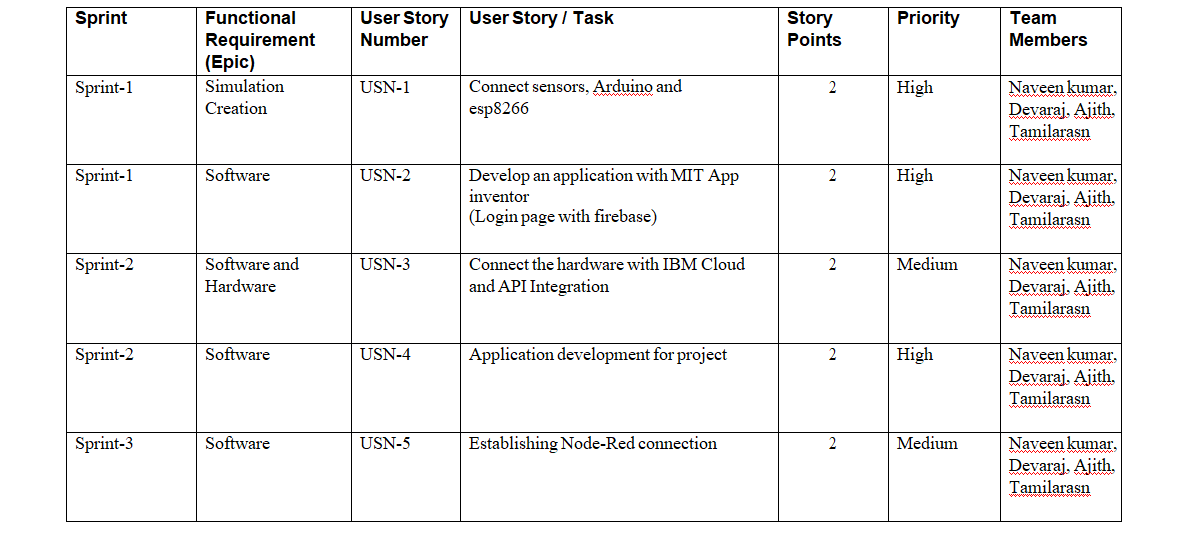
programming developed originally by IBM for wiring together

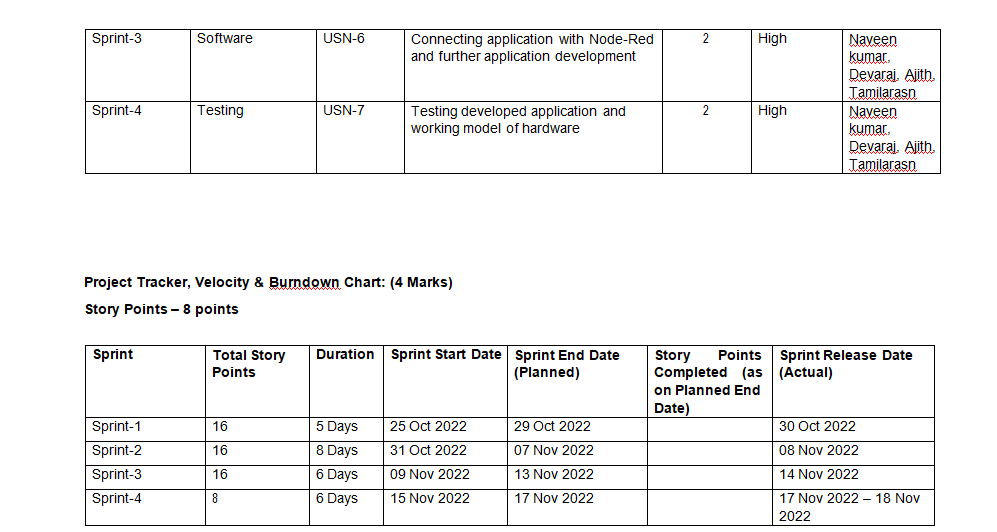
hardware devices,APIs and online services as part of the Internet

of Things.Node-RED provides a web browser-based flow editor,

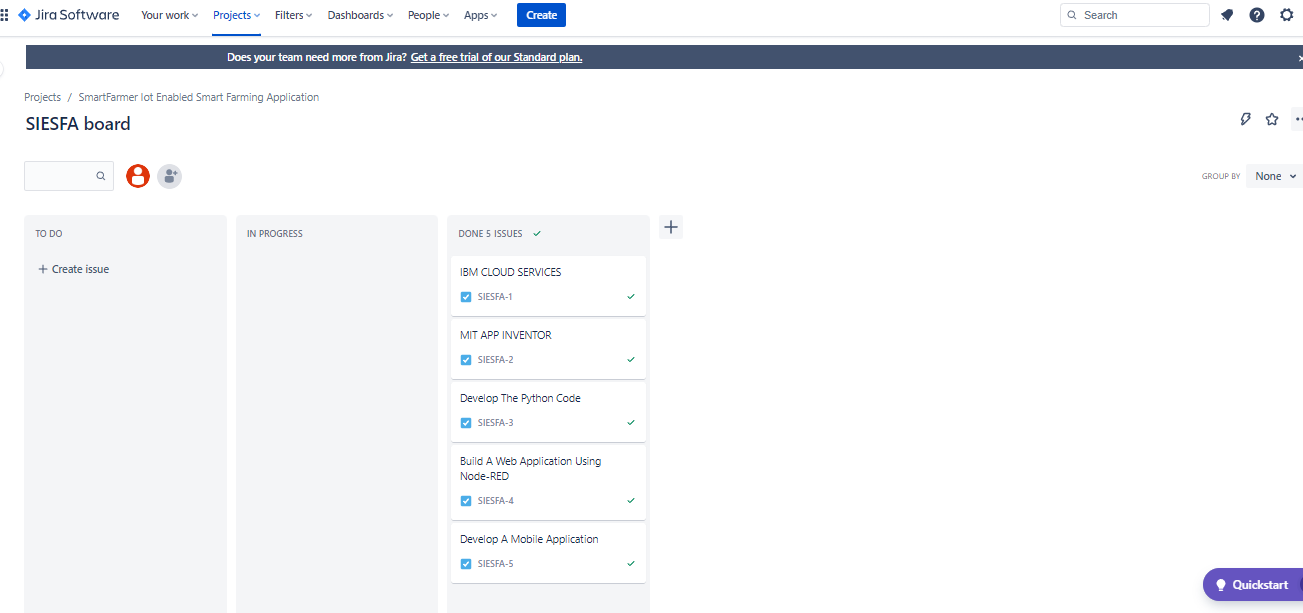
which can be used to create JavaScript functions

**6.2.Sprint Delivery Schedule**





6.3.Reports from JIRA



**7.CODING & SOLUTIONING (Explain the features added in the project along with code)**

7.1.Feature 1

import time  
import sys  
import ibmiotf.application  
import ibmiotf.device  
import random  
  
  
#Provide your IBM Watson Device Credentials  
organization = "iu047g"  
deviceType = "W"  
deviceId = "W\_1"  
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, "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)  
        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()

7.2.Feature 2

* [Sensors](https://www.techtarget.com/whatis/definition/sensor) for soil scanning and water, light, humidity and temperature management.
* [Telecommunications](https://www.techtarget.com/searchnetworking/definition/telecommunications-telecom) technologies such as advanced networking and [GPS](https://www.techtarget.com/searchmobilecomputing/definition/Global-Positioning-System).
* Hardware and software for specialized applications and for enabling IoT-based solutions, robotics and automation.
* [Data analytics](https://www.techtarget.com/searchdatamanagement/definition/data-analytics) tools for decision making and prediction. Data collection is a significant part of smart farming as the quantity of data available from crop yields, soil-mapping, climate change, fertilizer applications, weather data, machinery and animal health continues to escalate.
* [Satellites](https://www.techtarget.com/searchmobilecomputing/definition/satellite) and drones for gathering data around the clock for an entire field. This information is forwarded to IT systems for tracking and analysis to give an “eye in the field” or “eye in the barn” that makes remote monitoring possible.

The combination of these technologies facilitates machine-to-machine ([M2M](https://internetofthingsagenda.techtarget.com/definition/machine-to-machine-M2M)) derived data. This data feeds into a decision support system so that farmers can see what is happening at a more granular level than in the past. For example, by precisely measuring variations within a field and adapting the strategy accordingly, farmers can greatly increase the effectiveness of pesticides and fertilizers and use them more judiciously. Similarly, smart farming techniques, help farmers better monitor the needs of individual animals and adjust their nutrition to prevent disease and enhance herd health.

**8. TESTING**

* 1. Test Cases

1.Monitoring of climate conditions:

Probably the most popular smart agriculture gadgets are weather stations, 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 conditions, choose the appropriate crops, and take the required measures to improve their capacity (i.e. precision farming).

2.Crop management

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

### 3. Cattle monitoring and management

Just like crop monitoring, there are 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.

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

**4.End-to-end farm management systems:**

A more complex approach to IoT products in agriculture can be represented by the so-called farm productivity management systems. They usually include a number of agriculture IoT devices and sensors, installed on the premises as well as a powerful dashboard with analytical capabilities and in-built accounting/reporting features.

This offers remote farm monitoring capabilities and allows you to streamline most of the business operations. Similar solutions are represented by FarmLogs and Cropio.

In addition to the listed IoT agriculture use cases, some prominent opportunities include vehicle tracking (or even automation), storage management, logistics, etc.

* 1. User Acceptance Testing

In the agri-food sector, external environment (e.g. market and weather fluctuation) is more variable and unpredictable than in any other sector; and therefore the need to reduce uncertainties in e.g. food quality and safety is more urgent (Verdouw, Sundmaeker, Tekinerdogan, Conzon, & Montanaro, 2019).

IoT applications in agri-food allow monitoring, controlling, planning and optimization of processes in a virtual way in addition to relying on only physical observations. Agri-food supply chain partners can use IoT to build self-adaptive systems in which smart objects operate, decide and learn autonomously (Verdouw et al., 2019).

The agri-food sector is expected to benefit from IoT in dealing with major sustainability challenges, such as food waste, variable harvest, unpredictable supply, food safety, and agri-food sustainability.

Additionally, IoT solutions improve safety systems and support making informed decision, e.g. by providing warning systems in case of incidents, allowing re-considering decisions in case of unexpected change in external environments.

However, the IoT technologies have not yet achieved wide uptake and acceptance as one would expect. To achieve wider uptake and acceptance, technologies need to be properly embedded in the food chain and integrated with the business models of the chain actors.

Many factors explain the slow uptake, such as lack of certain technical and technological quality, infrastructure, compatibility and interoperability standards, concern about safety, high costs and uncertainty about benefits and usability (Saenz, Elkmann, Gibaru, & Neto, 2018).

Uptake and acceptance of technology can increase when the technology is better matched with user needs and user expectations, and capacities are better matched with what the technology offers (Broadbent, Stafford, & MacDonald, 2009).

The WP4 user acceptance team has initiated the user acceptance testing tools to support the 33 use

cases engaged in the IoF2020 project. The objective is to understand the end users, consider their

concerns, needs, values, receive feedback from them, integrate end user feedback in the tech

development, and by doing so, improve the offered IoT services along the years. Though the Technology

Readiness Level (TRL) may be different per use case, an overview of current end user acceptance can

be provided. As part of the WP4 task “T4.3 - Product Support”, the objective for the User Acceptance

Testing (UAT) team is to support use cases in building successful, well-accepted solutions and to

promote them to gather feedback from end-users in all stages of product development, including the

very early stages.

**9. RESULTS**

9.1 Performance Metrics

Thus, the smart farming will revolutionize the world of farming and it will increase the productivity as well as improve the quality and can save lives of farmer.

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer’s side. With the recent advancement of technology, it has become necessary to increase the annual crop production output of our country India, an entirely Agrocentric economy.

The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops in one of the main aims of incorporating such technologyinto the agricultural domain of the country.

To save farmer’s effort, water and time has been the most important consideration. Hence, a smart farming IoT based agriculture stick for live monitoring of temperature, humidity, soil moisture, pH, sun shine, smoke detection, wind speed and rainfall conditions has been proposed using NodeMCU and Cloud computing.

The stick has high efficiency and accuracy in fetching these live data. The agriculture stick being proposed in this project will assist farmers in increasing the agriculture yield and take efficient care of food production as the stick will always provide helping hand to farmers for getting accurate live feed of environmental results.

This will also enable farmers to use IoT technology and they will be able to implement other smart farming techniques in their land to increase yield

**10. ADVANTAGES & DISADVANTAGES**

10.1.ADVANTAGES

* Intelligent data collection. Sensors installed on IoT devices are able to collect a large volume of

useful information for farmers.

* Waste reduction.
* Process automation.
* Animal monitoring.
* Competitive advantage.

10.2.DISADVANTAGES

* The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement.
* Moreover internet connection is slower.
* The smart farming based equipments require farmers to understand and learn the use of technology.
* This is major challange in adopting smart agriculture farming at large scale across the countries.

**11. CONCLUSION**

* Thus the smart agriculture using IoT will

revolutionized the world of farming and it will increase the

productivity as well as improve the quality and can save

lives of farmer.

* There is an urgent need for a system that

makes the agricultural process easier and burden free from

the farmer’s side.

* With the recent advancement of

technology it has become necessary to increase the annual

crop production output of our country India, an entirely

agro centric economy.

* The ability to conserve the natural

resources as well as giving a splendid boost to the

production of the crops is one of the main aims of

incorporating such technology into the agricultural domain of the country. To save farmer’s

effort, water and time has been the most important consideration.

**12. FUTURE SCOPE**

* **UN Food and Agriculture Organization**
* As a result of the declining agricultural workforce, adoption of internet connectivity solutions in farming practices has been triggered, to reduce the need for manual labor**.**
* IoT solutions are focused on helping farmers close the supply demand gap.
* **the global smart agriculture market size is expected to triple by 2025.**
* **IoT technologies enables growers and farmers to reduce waste and enhance productivity .**
* The farmers can monitor the field conditions from anywhere.
* Data collected by smart agriculture sensors.
* Agricultural Drones.
* Farmers have started to realize that the IoT is a driving force for increasing agricultural production in a cost-effective way.

**Project Demo Link:**

[https://drive.google.com/file/d/1p2jnGhh9eCG-snhmWLcx8mM2d7hOFFax/view?usp=drivesdk](https://drive.google.com/file/d/1p2jnGhh9eCG-snhmWLcx8mM2d7hOFFax/view?usp=drivesdk" \t "https://mail.google.com/mail/u/0/?tab=rm&ogbl" \l "inbox/_blank)