Bharath Niketan Engineering College

[Aundipatti]

Computer science and engineering

IBM nalaiya thiran

Title. : **SMARTFARMER-IOT SMART FARMINGAPPLICATION**

Domain : *IOT*

Team ID : PNT2022TMID48419

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Team members : varatharajan.v

Chinnachamy.T

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Fuclty mentor name : yogadinesh

Smartfarmer

[IoT Enabled Smart Farming Application]

1. INTRODUCTION

In this project, we are going to build a Smart Farming System using IoT. The objective of this project is to offer assistance to farmers in getting Live Data (Temperature, Humidity, Soil Moisture, Soil Temperature) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. This smart agriculture using IoT system powered by NodeMCU consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip. When the IoT-based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, and soil temperature. It then sends this data to the IoT cloud for live monitoring. If the soil moisture goes below a certain level, it automatically starts the water pump. We previously build Automatic Plant Irrigation System which sends alerts on mobile but doesn't monitor other parameters. Apart from this, Rain alarm and soil moisture detector circuit can also be helpful in building Smart Agriculture Monitoring System.

1.1 Project Overview

Smart Farm is all about intelligent irrigation and smarter farming. We have developed a comprehensive state-of-the-art monitoring and control system that delivers the information farmers need on a daily and even hourly basis. Our patented wireless communications system integrates smart sensors and pump modules with RF wireless technology for remote field monitoring and well pump control.

The infographic below shows an overview of our terrestrial wireless network. Our system can function on a stand-alone basis and does not require 3rd-party cellular services providers to operate. The main headquarter base station communicates directly to local pumps or weather stations within range. This system can be expanded to hundreds of nodes spread over hundreds of square miles to outlying devices with appropriately spaced repeater towers. In this diagram each repeater tower connects to pumps within its range; each pump connects to its nearby moisture or water level monitoring station.

stat Our 900MHZ, 1W frequency hopping spread spectrum radio modules employ AES-128 encryption to insure long range and data security. These modules have a typical range of 4 to 7 miles, based on antenna height and terrain.

We offer secure mobile app connectivity allowing operators and farmhands to monitor and control the system on the go, as appropriate, based on three different levels of access rights. The mobile app and base station do require a cell or Internet connection to communicate together.

Some of our products are also ideal for Quarry sites. Select parts provide the ability to easily monitor and control water which increases safety, delivers reports on water removed from waterways for compliance and to provide real-time automation of water for time and money savings.

1.2 Purpose

<u>Benefits of IoT in Agriculture:</u>

We are increasingly reliant on technology in today's world for almost everything we do. And when it comes to farming, the reliance is only going to grow in the years ahead. Thanks to the Internet of Things (IoT), more and more farmers are using smart technology to increase productivity and efficiency.

Here are some of the benefits of IoT in agriculture projects:

Data: *One of the biggest benefits of IoT in agriculture is the ability to collect data. With sensors in place throughout the farm, farmers can track everything from soil moisture levels to crop health. This data can be used to make more informed decisions about irrigation, fertilization, and pesticides.*

Improved Quality: *With so much data at their fingertips, farmers can monitor their crops 24/7. This allows them to detect any problems early on and take corrective action before they become serious. As a result, crops are healthier and produce higher quality yields.*

Risk Reduction: *IoT also helps reduce risks for farmers. By tracking weather conditions, for example, farmers can make better decisions about when to plant and harvest their crops. This helps reduce the risk of losing a crop to bad weather.*

Business Automation: *With IoT, many agricultural tasks can be automated. This saves the farmer time and money. For example, automatic irrigation systems can adjust water flow rates based on soil moisture levels. This makes sure that crops get the right amount of water without over or under watering them.*

Remote Monitoring: *Farmers can now track the progress of their crops from a computer or even a mobile device. Smart farming systems can send alerts to farmers' phones if there is trouble with the soil, seeds, and other aspects of their crop.*

Improved ROI: *Automation has a direct impact on operational costs. IoT can also increase productivity making farms more efficient. With the help of sensors and data analytics, farmers can reduce water usage, energy consumption, and inputs like fertilizers.*

Drought Monitoring: *A big challenge for many farmers is dealing with drought conditions. IoT solutions can help farmers detect water shortages before they become a problem. Some systems can even provide information on when and where to irrigate in order to maximize crop watering.*

Harvesting Automation*:* *Robotics are increasingly being used in agricultural harvesting tasks. This saves labor costs and results in a more consistent product quality*.

2. LITERATURE SURVEY

2.1 Existing problem

Abstract

India is agriculture sector, on either side, is losing ground every day, affecting the

Ecosystem\’s output capacity. In order to restore vitality and put agriculture back on a

Path of higher growth, there is a growing need to resolve the issue. A large-scale

Agricultural system necessitates a great deal of upkeep, knowledge, and oversight.

The IoT is a network of interconnected devices that can transmit and receive data over The internet and carry out tasks without human involvement. Agriculture provides a

Wealth of data analysis parameters, resulting in increased crop yields. The use of IoT Devices in smart farming aids in the modernization of information and communication.

For better crop growth moisture, mineral, light and other factors can be assumed. This Research looks into a few of these characteristics for data analysis with the goal of

Assisting users in making better agricultural decisions using IoT. The technique isIntended to help farmers increase their agricultural output.

2.2 **References**

LITERATURE REVIEW

Yuridia Muhammad, Muhammad Azri Asyraf Mohd Hafez, Nor Adni MatLehZariah Mohd Yusoff , Shabinar Abd Hamid [1] The term "Internet of Things"refersTotheconnectionofobjects, equipment, vehicles, and other electronic devices to aNetwork for the purpose of data exchange (IoT). The Internet of Things (IoT) is Increasingly being utilised to connect objects and collect data. As a result, the Internet Of Things' use in agriculture is crucial. The idea behind the project is to create a smartAgriculture system that is connected to the internet of things. The technology is Combined with an irrigation system to deal with Malaysia's variable weather. ThisSystem's microcontroller is a Raspberry Pi 4 Model B. The temperature and humidity in The surrounding region, as well as the moisture level of the soil, are monitored using The DHT22 and soil moisture sensor. The data will be available on both a smartphone And a computer. As a result, Internet of Things (IoT) and Raspberry Pi-based Smart Agriculture Systems have a significant impact on how farmers work. It will have a good Impact on agricultural productivity as well. In Malaysia, employing IoT-based irrigation Systems saves roughly 24.44 percent per year when compared to traditional irrigation Systems. This would save money on labour expenditures while also preventing water Waste in daily needs.

Divya J., Divya M.,Janani V. [2] Agriculture is essential to India's economy and People's survival. The purpose of this project is to create an embedded-based soil Monitoring and irrigation system that will reduce manual field monitoring and provide Information via a mobile app. The method is intended to help farmers increase their Agricultural output. A pH sensor, a temperature sensor, and a humidity sensor are Among the tools used to examine the soil. Based on the findings, farmers may plant The best crop for the land. The sensor data is sent to the field manager through Wi-Fi, And the crop advice is created with the help of the mobile app. When the soil

Temperature is high, an automatic watering system is used. The crop image is Gathered and forwarded to the field manager for pesticide advice.H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya [3] Development of an effective loT-based smart irrigation system is also a cruciaDivya J., Divya M.,Janani V. [2] Agriculture is essential to India's economy and People's survival. The purpose of this project is to create an embedded-based soil Monitoring and irrigation system that will reduce manual field monitoring and provide Information via a mobile app. The method is intended to help farmers increase their Agricultural output. A pH sensor, a temperature sensor, and a humidity sensor are Among the tools used to examine the soil. Based on the findings, farmers may plant The best crop for the land. The sensor data is sent to the field manager through Wi-Fi, And the crop advice is created with the help of the mobile app. When the soil Temperature is high, an automatic watering system is used. The crop image is Gathered and forwarded to the field manager for pesticide advice.

H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya [3] Development of an effective loT-based smart irrigation system is also a crucialDemand for farmers in the field of agriculture. This research develops a low-cost, Weather-based smart watering system. To begin, an effective drip irrigation system Must be devised that can automatically regulate water flow to plants based on soil Moisture levels. Then, to make this water-saving irrigation system even more efficient, An IoT-based communication feature is added, allowing a remote user to monitor soil Moisture conditions and manually adjust water flow. The system also includes Temperature, humidity, and rain drop sensors, which have been updated to allowRemote monitoring of these parameters through the internet. In real time, these field Weather variables are stored in a remote database. Finally, based on the present Weather conditions, a weather prediction algorithm is employed to manage water Distribution. Farmers would be able to irrigate their crops more efficiently with the Proposed smart irrigation system.

Math, Layak Ali, Pruthviraj U[4] India is a country where agriculture plays A vital role. As a result, it's critical to water the plants wisely in order to maximise yield Per unit space and so achieve good output. Irrigation is the process of providing a Certain amount of water to plants at a specific time. The purpose of this project is to Water the plants on the National Institute of Technology Karnataka campus with a Smart drip irrigation system. To do this, the open source platform is used as the System's fundamental controller. Various sensors have been employed to supply the Current parameters of components that impact plant healthiness on a continual basis.

By controlling a solenoid valve, water is provided to the plants at regular intervals Depending on the information acquired from the RTC module. The webpage may be Used to monitor and manage the complete irrigation system. This website containsaFunction that allows you to manually automaticallycontroplanwateringThhealthOf the plants is monitored using a Raspberry Pi camera that gives livestreaming to the Webpage. The controller receives water flow data from the water flow sensor through a Wireless network. The controller analyses this data to see if there are any leaks in the Pipe. Forecasting the weather is also done to restrict the quantity of water given, Making it more predictable and efficient.

Dweepayan Mishra, Arzeena Khan, Rajeev Tiwari, Shuchi Upadhaye [5] Agriculture is a substantial source of revenue for Indians and has a huge impact On the Indian economy. Crop development is essential for enhanced yield and higher-Quality delivery. As a result, crop beds with ideal conditions and appropriate moisturCan have a big influence on output. Traditional irrigation systems, such as stream flows From one end to the other, are usually used. As a result of this delivery, the moisture Levels in the fields can alter. A designed watering system can help to enhance the Management of the water system. This research proposes a terrain-specific Programmable water system that will save human work while simultaneously improving Water efficiency and agricultural productivity. The setup is made up of an Arduino kit, a Moisture sensor, and a Wi-Fi module. Data is acquired by connecting our experimental System to a cloud framework. After then, cloud services analyse the data and take the Necessary actions.

R. Nageswara Rao, B.Sridhar [6] Agrarian countries like India rely heavily on Agriculture for their development. Agriculture has always been a roadblock to the Country's development. Smart agriculture, which comprises modernising present Agricultural systems, is the only answer to this challenge. As a result, the suggested Strategy attempts to use automation and Internet of Things technologies to make Agriculture smarter. Crop growth monitoring and selection, irrigation decision *assistance, and other uses are possible thanks to the Internet of Things (IoT). To Modernise and boost crop yield, a Raspberry Pi-based autonomous irrigation IOT System has been proposed. This project's main purpose is to produce crops using the Least amount of water possible. Most farmers waste a lot of time in the fields in order to Focus on water available to plants at the appropriate time. Water management should Be improved, and the system circuit's complexity should be minimised. Based on the Data collected from the sensors, the suggested system determines the amount of Water required. Two sensors detect the humidity and temperature of the soil, as well as The humidity, temperature, and length of sunshine each day, and send the data to the Base station. Based on these characteristics, the recommended systems must Calculate the irrigation water quantity. The key benefit of the system is the integrationOf Precision Agriculture (PA) and cloud computing, which will reduce water fertiliser Consumption while increasing crop yields and assisting in the evaluation of field Weather conditions.*

B. Saraf, Dhanashri H. Gawali [7] The Internet of Things (IoT) is the Internet-based connectivity of a huge number of devices (IoT). A unique identity links Each item, allowing data to be sent without human involvement It makes it possible to Develop strategies for improved natural resource management. Smart gadgets withObservation of soil conditions. Proposed system also set with an algorithm such that on Soil moisture pattern data it can predict decision on irrigation of crops. System also Warns farmer about empty water source if it occurs . benefits of using this system also Includes weather prediction through website. The device has the potential to be Beneficial in water-scarce, geographically isolated places due to its energy Independence and low cost. The fact that the technology is simple to use for farmers Adds to its utility. It also saves water by preventing waste.

BnShiny Rajendrakumar, Prof. V K Parvati, Prof. Rajashekarappa [12] Agricultural Irrigation is very important for the production of crops. Many methods have developed To save water in different ways. In traditional irrigation systems we require an operator Or farmer to put water on crops but he does not come to know which crop require how Much amount of water to get proper amount of yields. Irrigation means planting the Crops by water. There are so many traditional irrigation methods, but all these methods Consume large amount of water. Automated irrigation is the method which saves the Water from up to 97% as compared to traditional methods. By using these modern Methods like ICT productivity can be improved without unnecessary wastage of water.

Here we are concentrating on IoT ie.

Iot Things Of technique in irrigation for the purpose to save water. In this paper Author states that Soil constitution is related with the availability of elements of Nourishment plant requires as well as the presence in soil of elements and chemical Composition that exist at different proportion that are best nourishment to plants and Soil organisms and appropriate water to plant is most essential for all of the other Nourishment to work at best. The Arduino will on the buzzer to give an alert to the Farmer. So Serial monitor of Arduino HE gives a message as “motion detected” when The buzzer is on and as “motion ended” when the buzzer is off. This innovation is Prescribed for efficient automated agricultural watering system frameworks and it might Give a profitable apparatus for preserving water arranging and watering system Booking which is extendable other comparable horticultural harvests. The drawback of This proposed system is the whole system works on electricity, if in the case ofElectricity problem the farmer cannot on the motor to irrigate his land. The solution is to Have generator, if there is no electricity so that generator gets on to run this framework

2.3 **Problem Statement DDefinition**

INTRODUCTION

The India is an agricultural country. Nowadays, at regular intervals the lands are

Manually irrigated by the farmers. There is a chance that the water consumption will be

Higher or that the time it takes for the water to reach the destination will be longer,

Resulting in crop dryness. Real-time temperature and humidity monitoring is crucial in

Many agricultural disciplines. However, the old method of wired detection control is

Inflexible, resulting in several application limitations. This project achieves irrigation

Automation as a crucial answer to this problem. This is accomplished with the aid of a

Raspberry Pi, which controls the moisture and temperature sensors based on the input Provided. Moisture sensors are used in the construction of an automated plant

Watering system for this purpose. The main aim of our project is to reduce the Complexity of supervision and to avoid the continuous monitoring. We can accomplish

Smart agriculture using our system. This system includes IoT-based agricultural

Monitoring. The Internet of Things (IOT) is transforming the agriculture business and

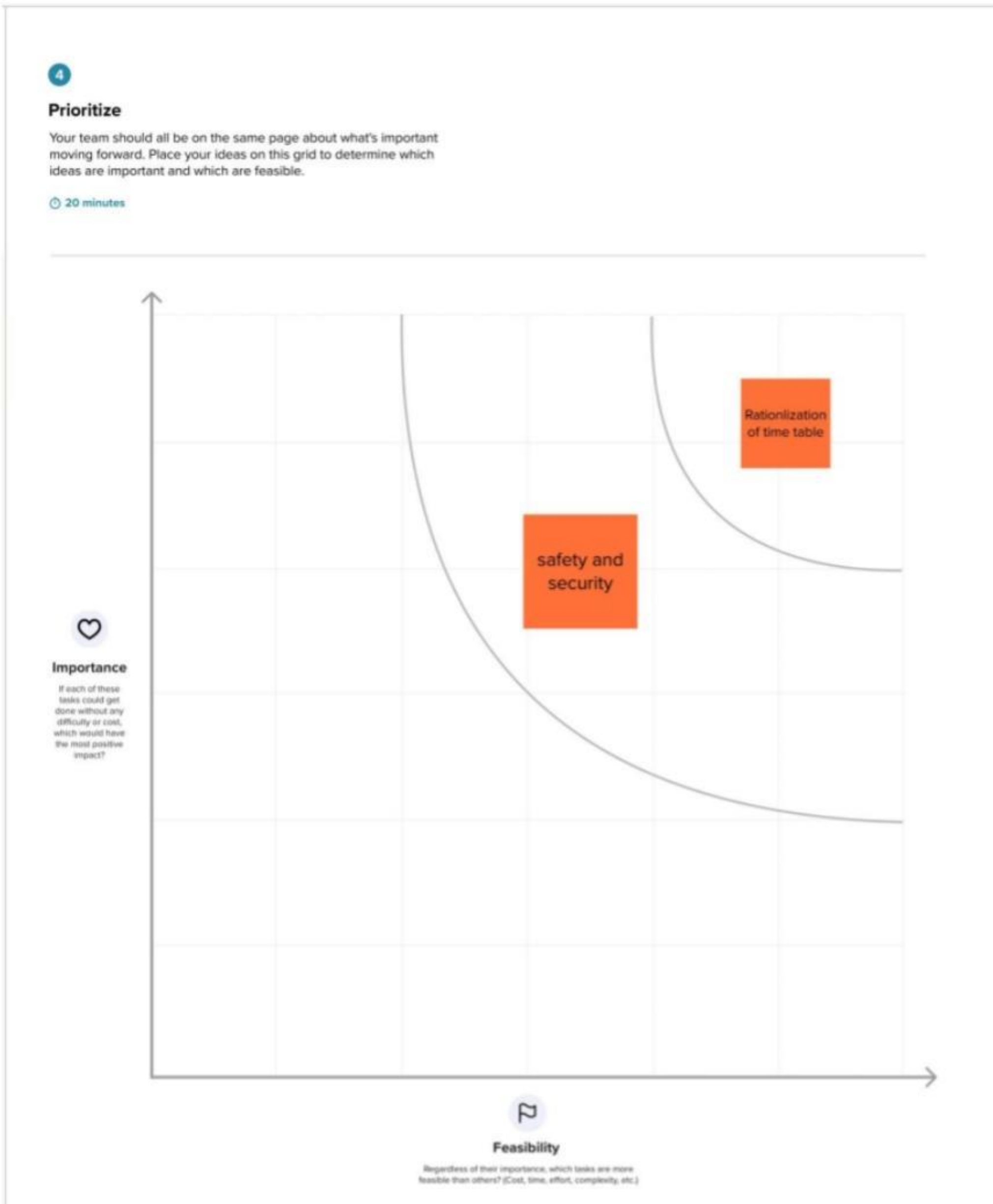
Addressing the enormous difficulties and huge obstacles that farmers confront today in The field. The soil moisture sensor is put into the soil to determine whether the soil is

Wet or dry, and If the moisture level in the soil is low, the relay unit attached to thMotor switch must be monitored on a regular basis. When the soil is dry, it will turn on

The motor, and when the soil is moist, it will turn off the engin

3.**IDEATION & PROPOSED SOLUTION** 3.1 Empathy Map Canvas

3.2 Ideation & Brainstormins



3.3. Problem Statement (Problem to beSolved)

FARMER-IOT ENABLED SMART FARMING

2.Idea / Solution description

Hazardous Area Monitoring for Industrial PlantPowered by IoT is a project report that focusesOn the necessity of the monitoring of hazardousAreas in industrial plants. Industrial plants areThe ones that contain both hazardous and non-Hazardous areas. The monitoring of theHazardous areas in industrial plants isImportant from time to time. If the damageThatoccurs in hazardous areas can result in theLoss of property or lives. So monitoring of suchAreas can help in easy monitoring of theHazardous areas. There can be smart devicesIntegrated at the hazardous areas that can helpIn detecting any fishy things that can occur inwhichthis equipment exists. For example, equipment used in subsea applicationsor on offshore operations cannot be monitored as frequently or easily.

3.**Social Impact/ Customer Satisfaction**

1-time plant monitoring
3) Reduced risks of disasters
4) Automated detection
5) Excellent customer experience

4..**4dea / Solution description**

Hazardous Area Monitoring for Industrial PlantPowered by IoT is a project report that focusesOn the necessity of the monitoring of hazardousAreas in industrial plants. Industrial plants areThe ones that contain both hazardous and non-Hazardous areas. The monitoring of theHazardous areas in industrial plants isImportant from time to time. If the damageThat occurs in hazardous areas can result in theLoss of property or lives. So monitoring of suchAreas can help in easy monitoring of theHazardous areas. There can be smartdevicesIntegratedahazardous areas that can helpIn detecting any fishy things thatcan occur inThe particular area.

5..Novelty / Uniqueness

* A hazardous area is any area with anAtmosphere containing, or potentiallyContaining, gases, vapor or dust which areFlammable or explosive. These areas areRigorously analyzed with condition monitoringWhen installing equipment to minimize the riskTo individuals and assets. It is crucial thatEquipment operating in these conditions areEffectively monitored to pre-empt any issuesBefore they occur. Unlike most industries, thesIssues not only result in downtime, but presenA significantsafety riskCondition monitoring is integral in industrialOperations to avoid downtime, to implementMaintenance and to reduce the risk of failure.Remote condition monitoring has previouslyBeen limited in hazardous areas due to the lackOf cost-effective and easy to install solutions –And the often-challenging environments in

3.4 Problem Solution fit

Project Design Phase-I - Solution Fit Template **Team ID** PNT2022TMID48419

SmartFarmer - IoT Enabled Smart Farming Application

Define CS, fit into CC

Explore AS, different

1. CUSTOMER SEGMENT(S) Who is your customer? • Highway division	**6. CUSTOMER** What constraints prevent your customers from taking action or limit their choices of solutions? The impact of the network on the tests was a significant and unexpected element. Given the quantity of sensors, this IoT-based system was successful in simulating a large-scale smart sign board.	**5. AVAILABLE SOLUTIONS** Which solutions are available to the customers when they face the problem Along roadways, static signs with clear
2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? Among its many duties, the Smartboard Connectivity is in charge of keeping correct temperature sensor readings and informing the board of the speed of the customer's vehicle.	**9. PROBLEM ROOT CAUSE** What is the real reason that this problem exists? What is the back story behind the need to do this job? No Sensor readings from the weather would alter the speed restriction if there was no internet Unnecessary pressing of the accident indicator button by some people could lead to problems.	**7. BEHAVIOUR** What does your customer do to address the problem and get the job done? As a teacher, the IOT cloud updates the smartboard on the condition of the roads on a regular basis.
3. TRIGGERS TR What triggers customers to act? . Poor weather conditions prevail. The vehicle should be moving at threshold speed. The sensor value should be shown on the smart board to alert the customer.	**10. YOUR SOLUTION** SL **We employ smart linked sign boards as an alternative to static signboards. With the help of a web app and weather API, these intelligent connected sign boards automatically**	**8. CHANNELS of BEHAVIOUR** CH 8.1 ONLINE What kind of actions do customers take online? **The departments can receive direct emails or messages from customers. (Officers on nearby patrol).** 8.2 OFFLINE

4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? Clients will feel better after selecting an operation mode with the use of smartboard connectivity, and they will then follow the instructions on the smartboard.	**update with the current speed limits. The speed may rise or fall in response to variations in the weather. The display of diversion signs are determined by traffic and potentially fatal situations. As appropriate, there are also signs that read "Guide (Schools), Warning, and Service" (Hospitals, Restaurants). Using buttons, it is possible to choose from a variety of operating modes.**	What kind of actions do customers take offline? Following directions is one of the main tasks for the traveler, but they can utilize the smartboard signs to check the state of the road from wherever they are.

4.REQUIREMENT ANALYSIS

4.1 functional requirement

Requirements analysis is very critical process that enables the success of a system or software project to be assessed. Requirements are generally split into two types: Functional and Non-functional requirements.

Functional Requirements: These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed and the output expected. They are basically the requirements stated by theuser which one can see directly in the final product,

4.2 non Functional requirement

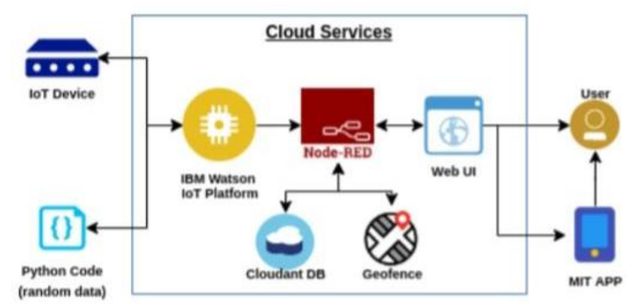
____These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are also called non-behavioral requirements.

They basically deal with issues like:

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

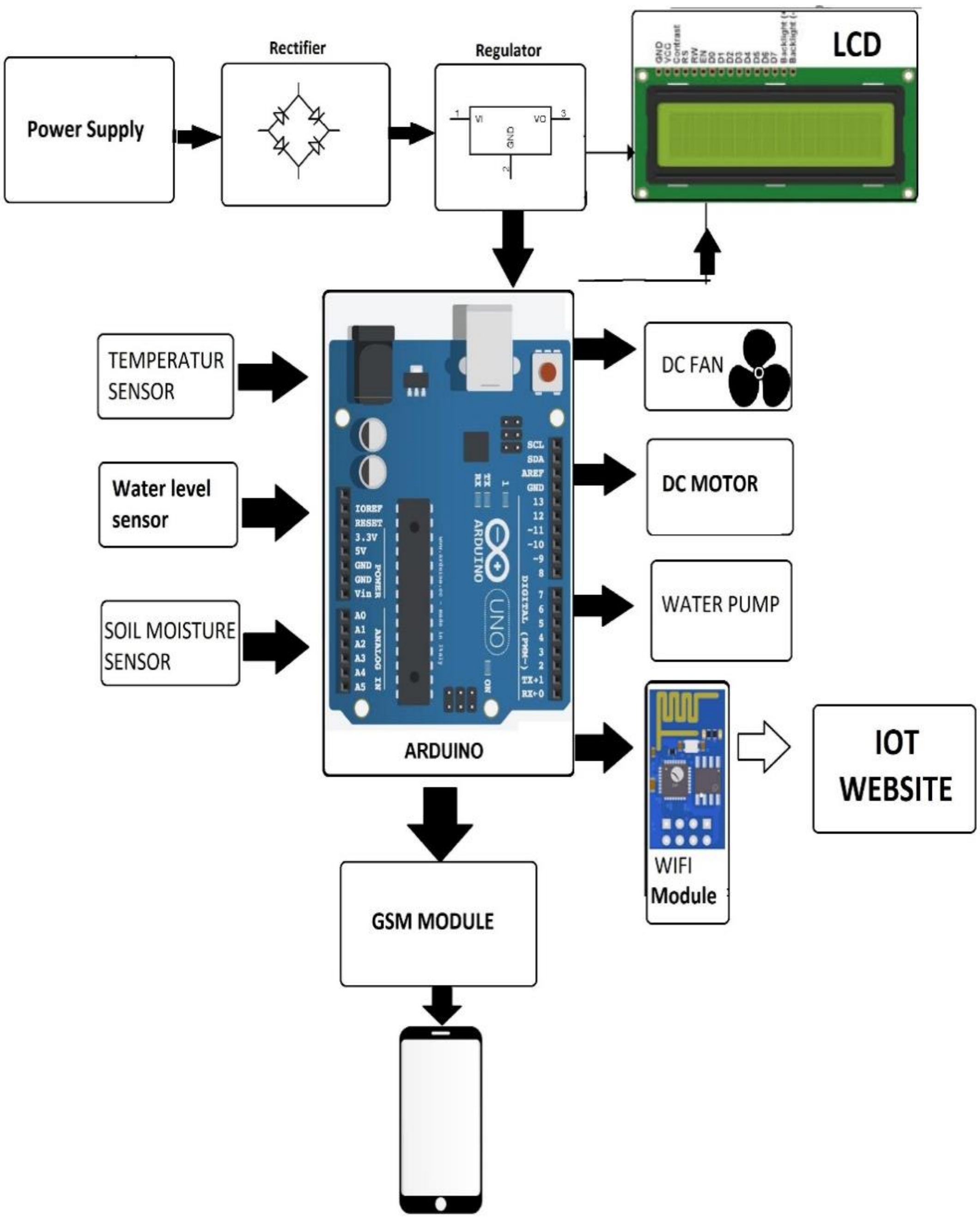
Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	SMART FARMER-IOT ENABLED SMART FARMING
2.	Idea / Solution description	Hazardous Area Monitoring for Industrial Plant powered by IoT is a project report that focuses on the necessity of the monitoring of hazardous areas in industrial plants. Industrial plants are the ones that contain both hazardous and non-hazardous areas. The monitoring of the hazardous areas in industrial plants is important from time to time. If the damage that occurs in hazardous areas can result in the loss of property or lives. So monitoring of such areas can help in easy monitoring of the hazardous areas. There can be smart devices integrated at the hazardous areas that can help in detecting any fishy things that can occur in the particular area.
3.	Novelty / Uniqueness	* A hazardous area is any area with an atmosphere containing, or potentially containing, gases, vapor or dust which are flammable or explosive. These areas are rigorously analyzed with condition monitoring when installing equipment to minimize the risk to individuals and assets. It is crucial that equipment operating in these conditions are effectively monitored to pre-empt any issues before they occur. Unlike most industries, these issues not only result in downtime, but present a significant safety risk. * Condition monitoring is integral in industrial operations to avoid downtime, to implement maintenance and to reduce the risk of failure. Remote condition monitoring has previously been limited in hazardous areas due to the lack of cost-effective and easy to install solutions – and the often-challenging environments in

		which this equipment exists. For example, equipment used in subsea applications or on offshore operations cannot be monitored as frequently or easily.
4.	Social Impact / Customer Satisfaction	1) To prevent pollution 2) Real-time plant monitoring 3) Reduced risks of disasters 4) Automated detection 5) Excellent customer experience
5.	Business Model (Revenue Model)	Raspberry -Pi 3 Temperature Sensor - DS18B20 Gas Sensor - MQ 5/9 Breadboard Raspbian OS (Running on Rpi-3) Simple push API Thing speak Cloud Platform
6.	Scalability of the Solution	This system can be deployed in many industrial areas like mining, underground factories, metal refineries, automatic welding factories and even heavy parts production lines. It will help to provide a safe and efficient working environment in wich aroos, while also opening new paths to improve the safety parameters of these places

ARCHITECTURE



5.3 **User Stories**

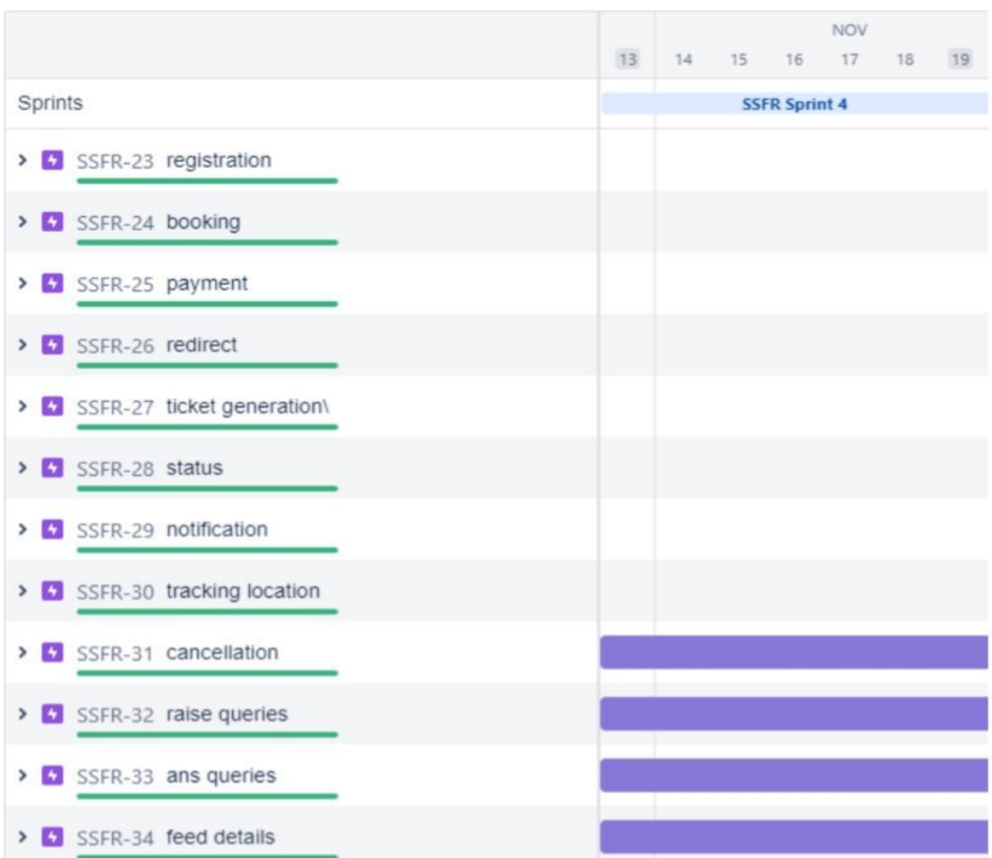
Our system will store an entire growing season's worth of field-monitored, event-triggered, maintenance event and fault data locally on the base station. Reports can easily be generated and printed based on this database, including reports that provide the information a farmer needs to submit to government monitoring agencies.

Our customers own their data — and we will not disclose it to any outside entity without written permission. We will keep a copy of all data from our customers' systems for backup in case it is needed. We will compile data from multiple locations to be used in our regional data analytics package. No farmer-specific information will be disclosed in that software package.

6. **PROJECT PLANNING & SCHEDULING**

6.1 Reports from JIRA


NOV
31 1 2 3 4 5
Sprints
SSFR Sprint 2
SSFR-23 registration
SSFR-24 booking
SSFR-25 payment
SSFR-26 redirect


NOV
13 14 15 16 17 18 19
Sprints
SSFR Sprint 4
SSFR-23 registration
SSFR-24 booking
SSFR-25 payment
SSFR-26 redirect
SSFR-27 ticket generation\
SSFR-28 status
SSFR-29 notification
SSFR-30 tracking location
SSFR-31 cancellation
SSFR-32 raise queries
SSFR-33 ans queries
SSFR-34 feed details

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

```
#include <ESP8266WiFi.h>

#include <DallasTemperature.h>

#include <OneWire.h>

#include “DHT.h”

#include “Adafruit_MQTT.h”

#include “Adafruit_MQTT_Client.h”

#include <ArduinoJson.h>

Const char *ssid =  “Galaxy-M20”;     // Enter your WiFi Name

Const char *pass =  “ac312124”; // Enter your WiFi Password

WiFiClient client;

#define MQTT_SERV “io.adafruit.com”

#define MQTT_PORT 1883

#define MQTT_NAME “aschoudhary” // Your Adafruit IO Username

#define MQTT_PASS “1ac95cb8580b4271bbb6d9f75d0668f1” // Adafruit IO AIO key

Const char server[] = “api.openweathermap.org”;

String nameOfCity = “Jaipur,IN”;

String apiKey = “e8b22b36da932dce8f31ec9be9cb68a3”;

String text;

Const char* icon=””;

Int jsonend = 0;

Boolean startJson = false;

Int status = WL_IDLE_STATUS;

#define JSON_BUFF_DIMENSION 2500
```

Unsigned long lastConnectionTime = 10 * 60 * 1000;   // last time you connected to the server, in milliseconds

Const unsigned long postInterval = 10 * 60 * 1000; // posting interval of 10 minutes (10L * 1000L; 10 seconds delay for testing)

Const int ldrPin = D1;

Const int ledPin = D0;

Const int moisturePin = A0; // moisteure sensor pin

Const int motorPin = D8;

Float moisturePercentage;   //moisture reading

Int temperature, humidity, soiltemp;

#define ONE_WIRE_BUS 4   //D2 pin of nodemcu

#define DHTTYPE DHT11   // DHT 11

#define dht_dpin D4

DHT dht(dht_dpin, DHTTYPE);

OneWire oneWire(ONE_WIRE_BUS);

DallasTemperature sensors(&oneWire);

Const unsigned long Interval = 50000;

Unsigned long previousTime = 0;

//Set up the feed you're publishing to

Adafruit_MQTT_Client mqtt(&client, MQTT_SERV, MQTT_PORT, MQTT_NAME, MQTT_PASS);

Adafruit_MQTT_Publish Moisture = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Moisture"); // Moisture is the feed name where you will publish your data

Adafruit_MQTT_Publish Temperature = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Temperature");

Adafruit_MQTT_Publish Humidity = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Humidity");

Adafruit_MQTT_Publish SoilTemp = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/SoilTemp");

```
Adafruit_MQTT_Publish WeatherData = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME
"/f/WeatherData");

//Set up the feed you're subscribing to

 Adafruit_MQTT_Subscribe LED = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME
"/f/LED");


 Adafruit_MQTT_Subscribe Pump = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME
"/f/Pump");


Void setup()

{

  Serial.begin(9600);

  Delay(10);

  Dht.begin();

  Sensors.begin();

  Mqtt.subscribe(&LED);

  Mqtt.subscribe(&Pump);

  pinMode(motorPin, OUTPUT);

  pinMode(ledPin, OUTPUT);

  pinMode(ldrPin, INPUT);

  digitalWrite(motorPin, LOW); // keep motor off initally

  digitalWrite(ledPin, HIGH);

  text.reserve(JSON_BUFF_DIMENSION);

  Serial.println("Connecting to ");

  Serial.println(ssid);

  WiFi.begin(ssid, pass);

  While (WiFi.status() != WL_CONNECTED)

  {

    Delay(500);

    Serial.print(".");            // print … till not connected
```

```
  }
  Serial.println(“”);
  Serial.println(“WiFi connected”);
}
Void loop()

{
 Unsigned long currentTime = millis();
 MQTT_connect();



 If (millis() – lastConnectionTime > postInterval) {
   // note the time that the connection was made:
   lastConnectionTime = millis();
   makehttpRequest();
  }
//}
 Int ldrStatus = analogRead(ldrPin);
   If (ldrStatus <= 200) {
      digitalWrite(ledPin, HIGH);
      Serial.print(“Its DARK, Turn on the LED : “);
      Serial.println(ldrStatus);
   }
   Else {
     digitalWrite(ledPin, LOW);
     Serial.print(“Its BRIGHT, Turn off the LED : “);
     Serial.println(ldrStatus);
    }
  moisturePercentage = ( 100.00 – ( (analogRead(moisturePin) / 1023.00) * 100.00 ) );
```

```
 Serial.print("Soil Moisture is  = ");
 Serial.print(moisturePercentage);
 Serial.println("%");
If (moisturePercentage < 35) {
 digitalWrite(motorPin, HIGH);        // tun on motor
}

If (moisturePercentage > 38) {
 digitalWrite(motorPin, LOW);         // turn off mottor
}
 Temperature = dht.readTemperature();

 Humidity = dht.readHumidity();

 //Serial.print("Temperature: ");
 //Serial.print(temperature);
 //Serial.println();
 //Serial.print("Humidity: ");
 //Serial.print(humidity);
 //Serial.println();
 Sensors.requestTemperatures();
 Soiltemp = sensors.getTempCByIndex(0);
// Serial.println("Soil Temperature: ");
// Serial.println(soiltemp);
If (currentTime – previousTime >= Interval) {
   If (! Moisture.publish(moisturePercentage)) //This condition is used to publish the
Variable (moisturePercentage) on adafruit IO. Change thevariable according to yours.
       {
         }
```

```
If (! Temperature.publish(temperature))
    {
     }
If (! Humidity.publish(humidity))
    {
    //delay(30000);
     }

If (! SoilTemp.publish(soiltemp))
  {
     }
If (! WeatherData.publish(icon))
  {
    }
     previousTime = currentTime;

}
```

Adafruit_MQTT_Subscribe * subscription;

While ((subscription = mqtt.readSubscription(5000))) //Don’t use this one until you are conrolling something or getting data from Adafruit IO.

```
  {
If (subscription == &LED)
  {
   //Print the new value to the serial monitor
   Serial.println((char*) LED.lastread);
     If (!strcmp((char*) LED.lastread, “OFF”))
    {
      digitalWrite(ledPin, LOW);
     }
```

```
      If (!strcmp((char*) LED.lastread, "ON"))
        {
       digitalWrite(ledPin, HIGH);
       }
    }
   If (subscription == &Pump)
    {
    //Print the new value to the serial monitor


    Serial.println((char*) Pump.lastread);
    If (!strcmp((char*) Pump.lastread, "OFF"))
     {
      digitalWrite(motorPin, HIGH);
     }
    If (!strcmp((char*) Pump.lastread, "ON"))
     {
      digitalWrite(motorPin, LOW);


    }
   }
  }
 Delay(9000);
// client.publish(WeatherData, icon)
}
Void MQTT_connect()
{
 Int8_t ret;
 // Stop if already connected.
 If (mqtt.connected())
```

```
 {
   Return;
 }
 Uint8_t retries = 3;
 While ((ret = mqtt.connect()) != 0) // connect will return 0 for connected
 {
      Mqtt.disconnect();
      Delay(5000);  // wait 5 seconds
      Retries--;

     If (retries == 0)
      {
        // basically die and wait for WDT to reset me
        While (1);
      }
 }
}
Void makehttpRequest() {



 // close any connection before send a new request to allow client make connection to
server
 Client.stop();
 // if there's a successful connection:
 If (client.connect(server, 80)) {
   Client.println("GET /data/2.5/forecast?q=" + nameOfCity + "&APPID=" + apiKey +
"&mode=json&units=metric&cnt=2 HTTP/1.1");
   Client.println("Host: api.openweathermap.org");
   Client.println("User-Agent: ArduinoWiFi/1.1");
```

```
  Client.println("Connection: close");

  Client.println();

  Unsigned long timeout = millis();

  While (client.available() == 0) {

    If (millis() – timeout > 5000) {

      Serial.println(">>> Client Timeout !");

      Client.stop();

      Return;

    }

  }


  Char c = 0;

  While (client.available()) {

    C = client.read();

    // since json contains equal number of open and close curly brackets, this means we
can determine when a json is completely received  by counting

    // the open and close occurences,

    //Serial.print©;

    If (c == '{') {

      startJson = true;        // set startJson true to indicate json message has started

      jsonend++;

    }


    If (c == '}') {

      Jsonend--;

    }

    If (startJson == true) {

      Text += c;

    }
```

```
    // if jsonend = 0 then we have have received equal number of curly braces
    If (jsonend == 0 && startJson == true) {
     parseJson(text.c_str());  // parse c string text in parseJson function
     text = “”;              // clear text string for the next time
     startJson = false;       // set startJson to false to indicate that a new message has not
yet started
    }
  }
 }
 Else {
  // if no connction was made:

  Serial.println(“connection failed”);
  Return;
 }
}
//to parse json data received from OWM
Void parseJson(const char * jsonString) {
 //StaticJsonBuffer<4000> jsonBuffer;
 Const size_t bufferSize = 2*JSON_ARRAY_SIZE(1) + JSON_ARRAY_SIZE(2) +
4*JSON_OBJECT_SIZE(1) + 3*JSON_OBJECT_SIZE(2) + 3*JSON_OBJECT_SIZE(4) +
JSON_OBJECT_SIZE(5) + 2*JSON_OBJECT_SIZE(7) + 2*JSON_OBJECT_SIZE(8) + 720;
 DynamicJsonBuffer jsonBuffer(bufferSize);
//  DynamicJsonDocument(bufferSize);
 // FIND FIELDS IN JSON TREE
 JsonObject& root = jsonBuffer.parseObject(jsonString);
 If (!root.success()) {
  Serial.println(“parseObject() failed”);
  Return;
 }
```

```
  JsonArray& list = root["list"];
  JsonObject& nowT = list[0];
  JsonObject& later = list[1];
  JsonObject& tommorow = list[2];
//  String conditions = list.weather.main;
  // including temperature and humidity for those who may wish to hack it in
  String city = root["city"]["name"];
  String weatherNow = nowT["weather"][0]["description"];
  String weatherLater = later["weather"][0]["description"];
  String list12 = later["weather"][0]["list"];
  Serial.println(list12);
  Serial.println(weatherLater);
  If(weatherLater == "few clouds"){
    Icon = "Few Clouds";
    Serial.print(icon);
  }
  Else if(weatherLater == "rain"){
    Icon = "Rain";
    Serial.print(icon);
  }
  Else if(weatherLater == "broken clouds"){
    Icon = "Broken Clouds";
    Serial.print(icon);
  }
  Else {
    Icon = "Sunny";
    }
}
```

7.1 Feature 1

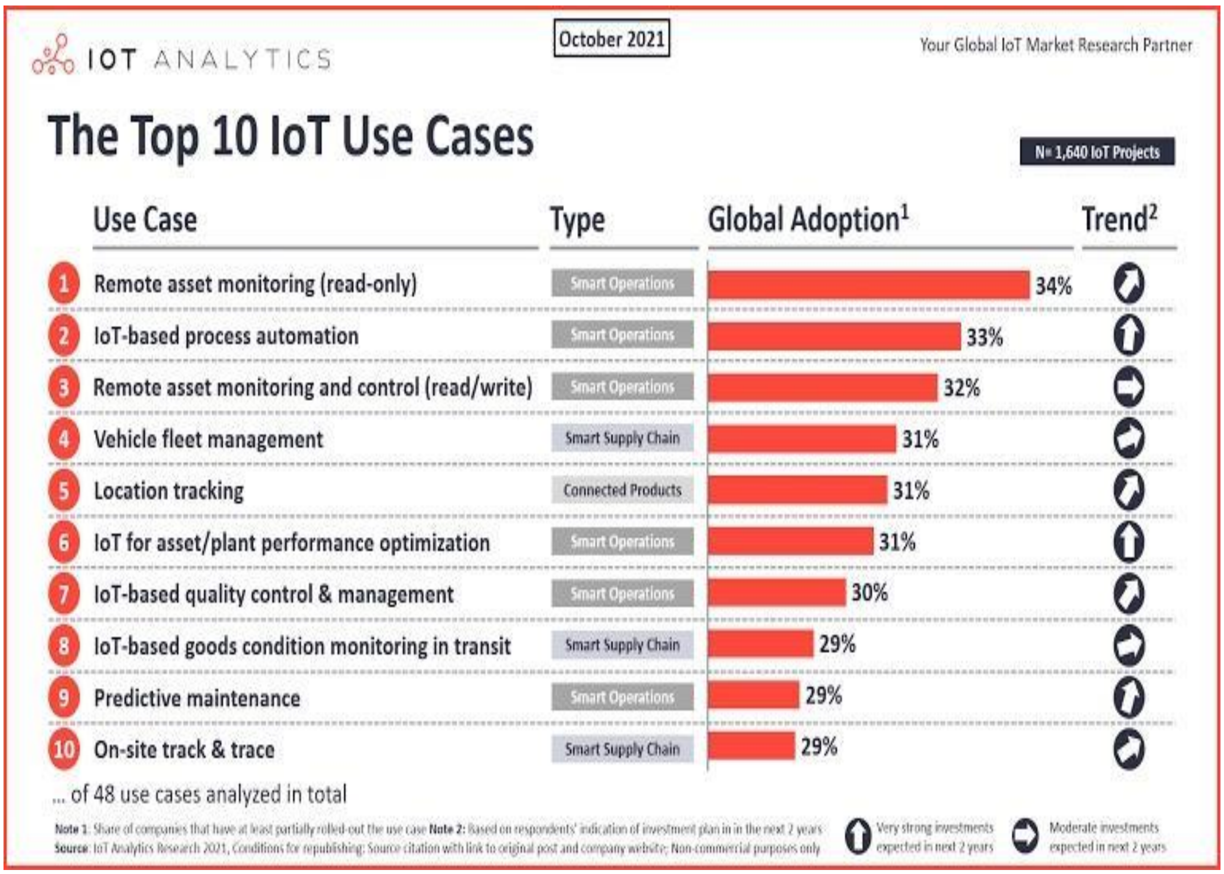
- IOT device
- IBM Watson platform
- Node red
- Cloudant DB
- Web UI
- Geofence
- MIT App
- Python code

7.2 Feature 2

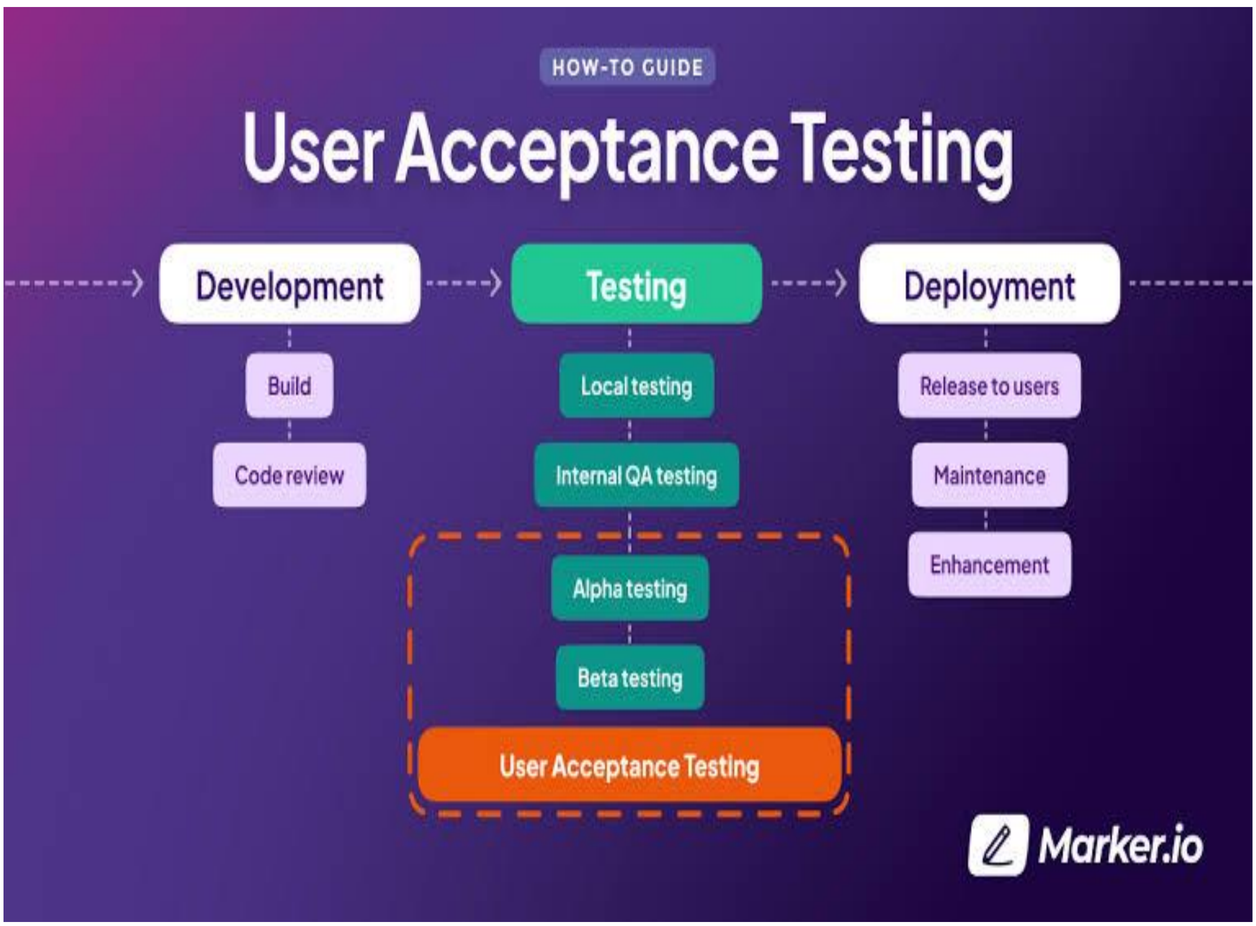
- Registration
- Login
- Verification
- Ticket Booking
- Payment
- Ticket Cancellation
- Adding Queries

8. **TESTING**

8.1 Test Cases



8.2 **User Acceptance Testing**



9. **RESULTS**


30%
60%
10:2
Seat Availability % During Peak Times
Seat Availability %
Customer Injury Rate per Million Passenger Trips
Today's Trains
Current Trains Route
Train 1
Route 1
Train 2
Route 2
Train 3
Route 3
Train 4
Route 4
Train 5
Route 5
Train 6
Route 6
Train 7
Route 7
Revenue
Total Trains
Employees
Number of Passenger kilometres

10. **ADVANTAGES & DISADVANTAGES**

10.1 Benefits or advantages of Smart Agriculture;

➡*It allows farmers to maximize yields using minimum resources such as water, fertilizers, seeds etc.*

➡*Solar powered and mobile operated pumps save cost of electricity.*

➡*Smart agriculture use drones and robots which helps in many ways. These improves data collection process and helps in wireless monitoring and control.*

➡*It is cost effective method.*

➡*It delivers high quality crop production*

10.2 Drawbacks or disadvantages of Smart Agriculture

➡*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 challenge in adopting smart agriculture farming at large scale across the countries.*

11. **CONCLUSION**

1. *This 7^{th} edition of the IoT week has consolidated our event as the global conference that attracted experts in IoT technology not only from Europenbut also from all over the world. With around 200 sessions and activities, the event gathered over 800 experts from 49 countries who are active in the Internet of Things realm.*

2. *One of the main outcomes of this year has been the adoption of the international declaration on the internet of things for sustainable development which has been supported by the ITU together the IoT community and the United Nations System.*

3. *In addition to the strong involvement and participation of international organizations and the European Commission, the IoT Week 2017 was also able to attract more researchers and academia experts through the organization of the first IEEE endorsed Global IoT Summit (GIoTS). This summer underscored over 80 Scientific Articles and Publication of the most recent IoT innovations.*

4. *The facilities of the Geneva International Congress Centre (CICG) also allowed us to promote international dialogue and cooperation for the Internet of Things, organizing an Exhibition Area, the Hackathon, numerous private meetings and workshops in parallel, site visits and other social events to foster synergies among its participants.*

5. *A clear example of this spirit was the Welcome Reception with the participation of Houlin Zhao, ITU Secretary-General and Nicolas Walder, Mayor of the City of Carouge.*

6. *On this occasion, the IoT Forum announced officially the launch of a new Master of Advanced Studies on Internet of Things in collaboration with the University of Geneva and Mandat International.*

7. *This intensive programme has been implemented through the full collaboration of the Host Committee composed of the IoT Forum, the International Telecommunication Union (ITU), the University of Applied Science Western Switzerland (HESSO) and Mandat International.*

8. *The IoT Week is a nomadic yearly conference and following the previous editions hosted in Barcelona, Berlin, Venice, Bald, Helsinki, London, Lisbon, Belgrade and Geneva, we were pleased to announce at the Closing Plenary Session that the next IoT Week Conference will take place next year for the first time in Bilbao (Spain) from 4th to 7th June 2018*.

12. **FUTURE SCOPE**

Pump Control – *remote and automated turn-off control of most electric and diesel irrigation well pumps used on farms today.*

Pump Monitoring – *the essential information a farmer needs to know about the operation condition of his well pumps.*

- Water flow rate, flow start and stop times/flow rate variance alert
- Seasonal total volume of ground water extraction
- Diesel pump monitoring parameters:
- Fuel tank level/fuel consumption/fuel tamper alert
- Engine tachometer/speed variance alert
- Battery voltage/low voltage alert
- Murphy panel system faults

Pump Automation Features – *easy-to-use, easy-to-understand automation features that have a tremendous positive impact on field operations. Examples include:*

- Scheduled automatic off times – diesel and electric pumps
- Rain gauge triggered automatic shutdowns
- Soil moisture level threshold automatic shutdowns
- “All Off” pump command feature
- Water level triggered automatic shutdowns for rice fields based on standing water levels
- Field operator specific automation scheduling access rights

Pump Preventative Maintenance Reminders – *will maximize the operation life and efficiency of in-field equipment.*

- Filter and fluids scheduler based on run-time tracking
- Organizer for equipment maintenance items by engine type and filter part numbers
- Field operator specific accountability

In-Field Sensor Monitoring – *the critical information you need to know about field and environmental conditions – so that you can make the best possible decisions about your irrigation schedules.*

- Map view of operational status of entire farm
- Soil moisture levels
- Rice field water levels
- Trend line graphing all sensors, all stations
- Our optional weather stations can be installed at any pump or monitoring locations and provide: Rain gauge accumulations, Anemometer (wind speed and direction), Instantaneous and total accumulated solar radiation, Ambient temperature We also provide critical crop and field information based on crop type and weather station readings: Growth degree days, Evapotranspiration rate, Heat index and Dew point

13. **APPENDIX**

Appendices

Iotanalytics

https://iot-analytics.com/top-10-iot-project-application-areas-q3-2016/

https://iot-analytics.com/10-internet-of-things-applications/

techbang

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http://trendwatching.com/trends/10-asian-trends-for-2015/

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https://hbr.org/2014/12/who-provides-tech-support-for-the-internet-of-things

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