# UE17CS490B – Capstone Project Phase – 2

## SEMESTER - VIII

## END SEMESTER ASSESSMENT

Project Title : Smart Crop Monitoring and Plant Disease Detection
Project ID : PW21SUS02
Project Guide : Prof. Supreetha S
Project Team : Kamma SaiSahiti-PES1201700802
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# Abstract:

**PROBLEM STATEMENT**: To provide efficient decision support system using wireless sensor network which handle different activities of farm and gives useful information related to farm field to farmer and Plant Disease detection using machine learning for farm field activities.

**INTRODUCTION:**

Our Project goal is to provide Automation to daily Farm field activities such as controlling Temperature,Humidity,Soil Moisture Sensing etc..,

The above mentioned activities are done using Sensors which in turn are connected to Microcontroller through which data is collected and stored in firebase for furthure usage in future.

Leaf Disease detection is done through by capturing the pictures of the crop and by performing ML Algorithms such as Image Processing using MATLAB Technologies.

# SCOPE:

- Aim:

A. Provide Automation

B. Reduce Manual Work

C. Provide Better Yeild

- Benefits:The vital advantage of this cycle is that it permits the stakeholders to comprehend the present status of the undergoing Farm Field Activities.

- Usage: Farmers

# Team Roles and Responsibilities

| TEAM MEMBERS | ROLES AND RESPONSIBILITIES |
|---|---|
| KAMMA SAI SAHITI | Monitoring,Documentation,Research on Cloud Platforms and Algorithms and Technologies,GSM Module,Slides for Presentation,IEEE(Literature Survey, Final), Hardware Integration |
| PAMIDI SATYA PRANEETH | Monitoring,GSM Module,Research on Cloud Platforms and Algorithms and Technologies,Documentation,IEEE(Literature Survey), Hardware Integration |
| KEERTHANA O | Monitoring ,MATLAB,Documentation,Google Fire Base,Slides for Presentation,IEEE(Second Paper) |
| SUNITHA M | Monitoring,MIT App,Google Fire Base,Documentation,IEEE(Second Paper) |

# Summary of Requirements

| Hardware Requirements |
|---|
| ESP 32 |
| DHT11 Sensor |
| PIR Sensor |
| RainFall Detection Sensor |
| Soil Moisture sensor |
| Barometric sensor |
| LDR Sensor |
| IR Sensor |
| Smoke Sensor |
| Motor |
| GSM Module |

| Software Requirements |
|---|
| Google FireBase |
| MIT APP |
| MATLAB |

# Design Constraints

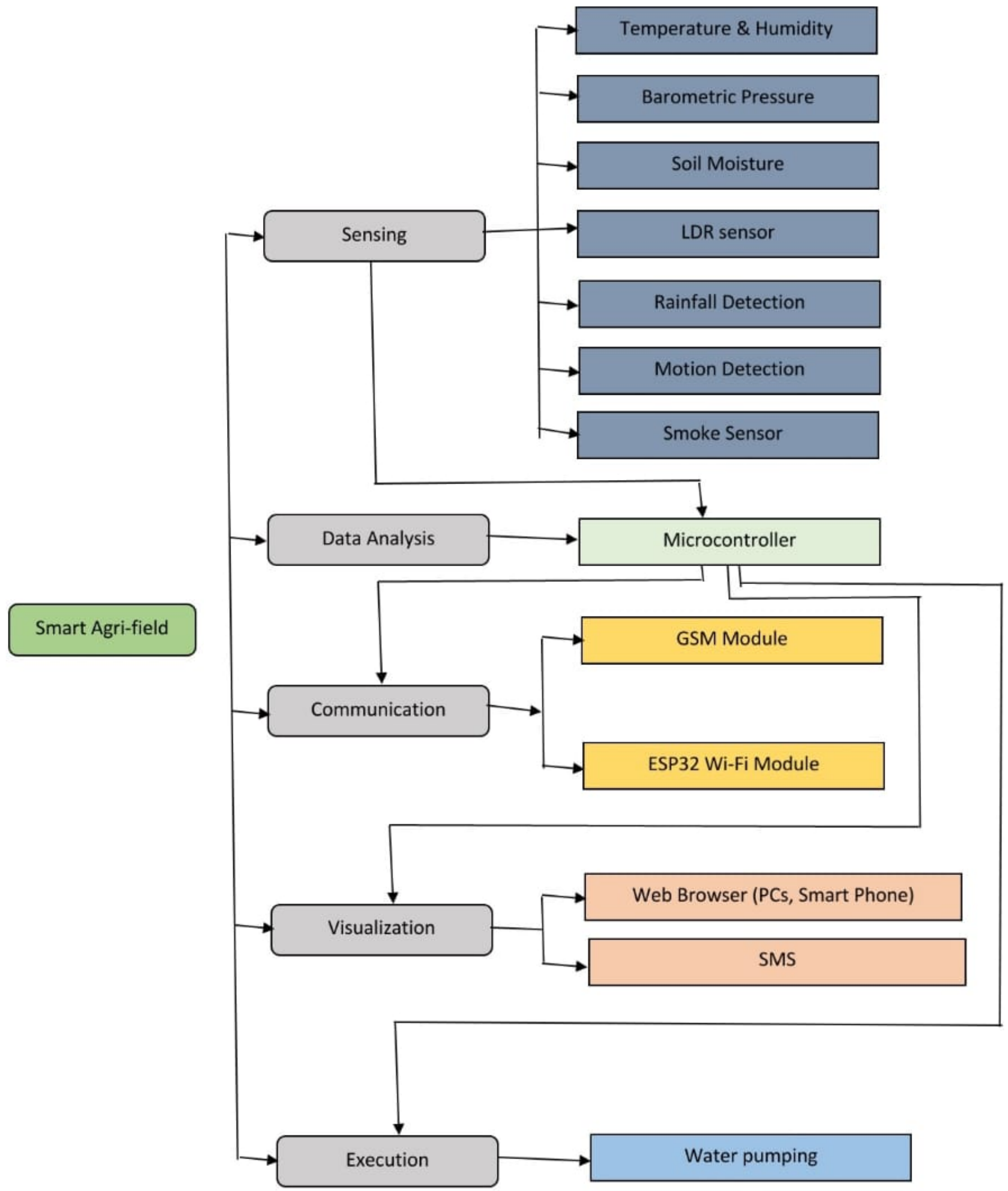
- Scalability and Flexibility
- Power Consumption
- Robustness and Fault Tolerance
- Harsh Device Environment

# Risks

- TECHNICAL FAILURE AND RESULTANT DAMAGE
- MOUNTING E-WASTE
- DATA SECURITY AND PRIVACY
- CONTEXT-AWARNESS (META DATA)

# Summary of Methodology

- Methodology tries to explore technological solutions to enhance agricultural productivity.
- Facilitate the growth of plant,Better Yeild.
- Improving the smart agri-system or farming system based on embedded electronics,IoT and wireless sensor networks.



# Design Approach

- **Design Goals**:
- **Physical Implementation :** a)Implementation of Sensors, Actuators and Micro Controllers
  b) Implementation of Network Equipment.
- **System Framework :**

  **Subsystems:**

  **a) Sensing**: Collection of Data (environment) through Sensors.
  **b) Data Communication**: I) Communication between the central and wireless sensor nodes.
  II) Sensor Data is collected into sheets, various Databases, Cloud Storage.
  **c) Visualisation** : visualisation, processing and manipulation of data.
  **d) Data Analysis**: Data is analysed using different algorithms.
- Through this the system is capable of decision making and execution based on manipulating sensor data.
- **Circuit Design**:
- **Wireless Sensor Nodes**: Monitoring and Recording the the physical conditions of the environment and organizing the collected data at a central location.
- **Central Node**: Consists of GSM Module, ESP32,wireless transceiver module and pumping system.

# Implementation Details

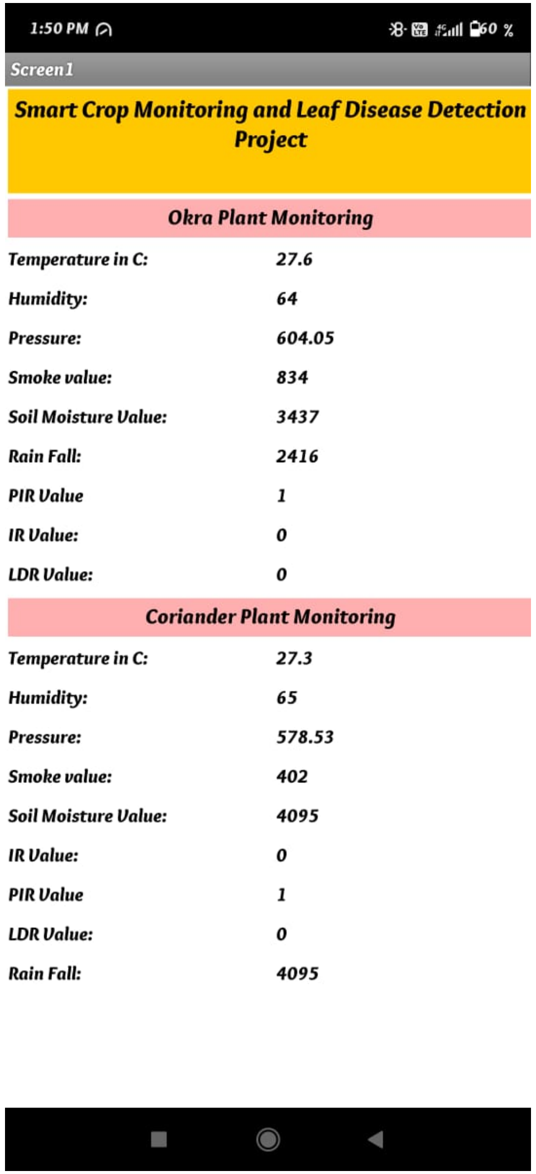
## Technologies Used:

IOT

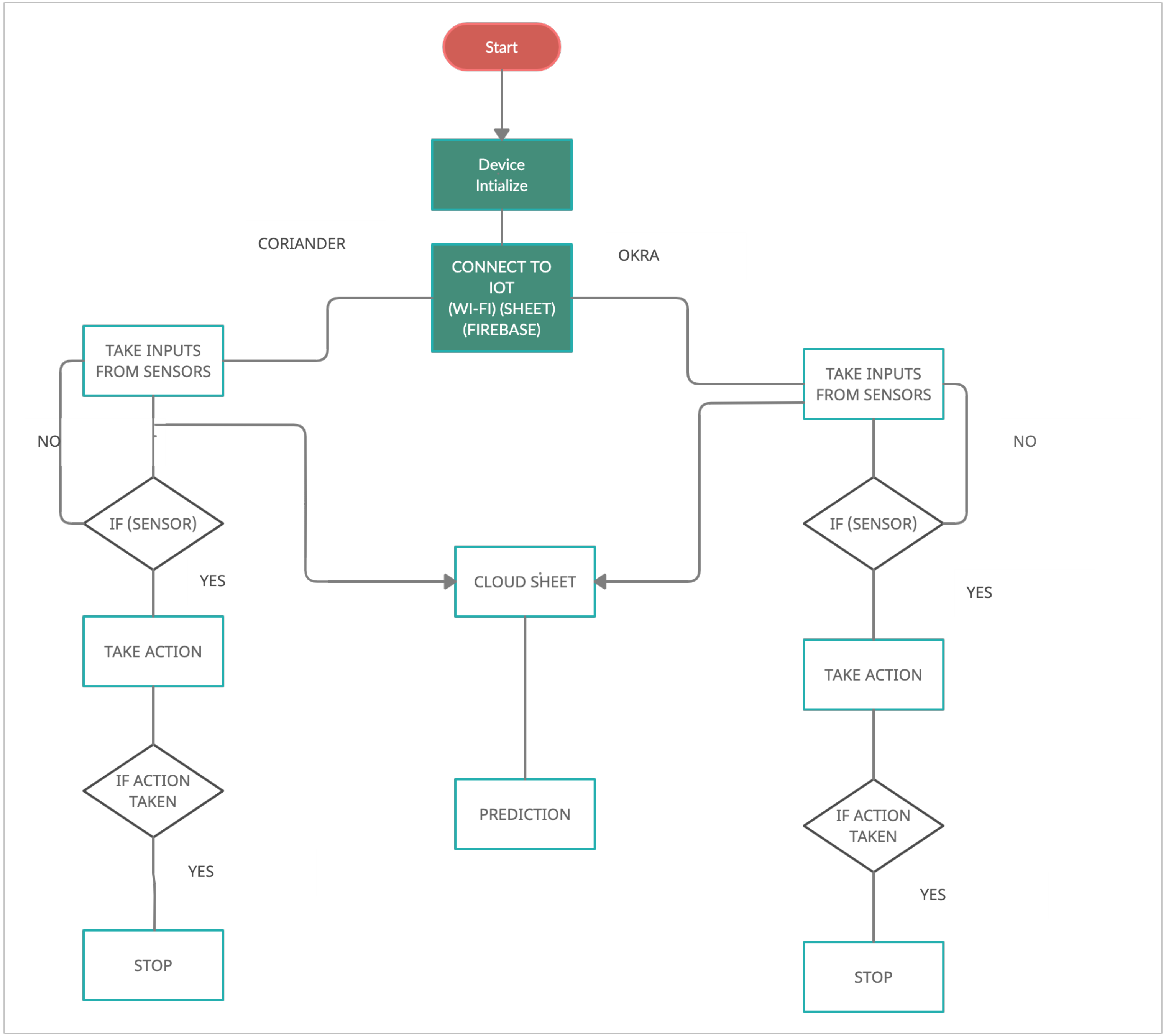
Cloud-FireBase

MIT APP

MATLAB

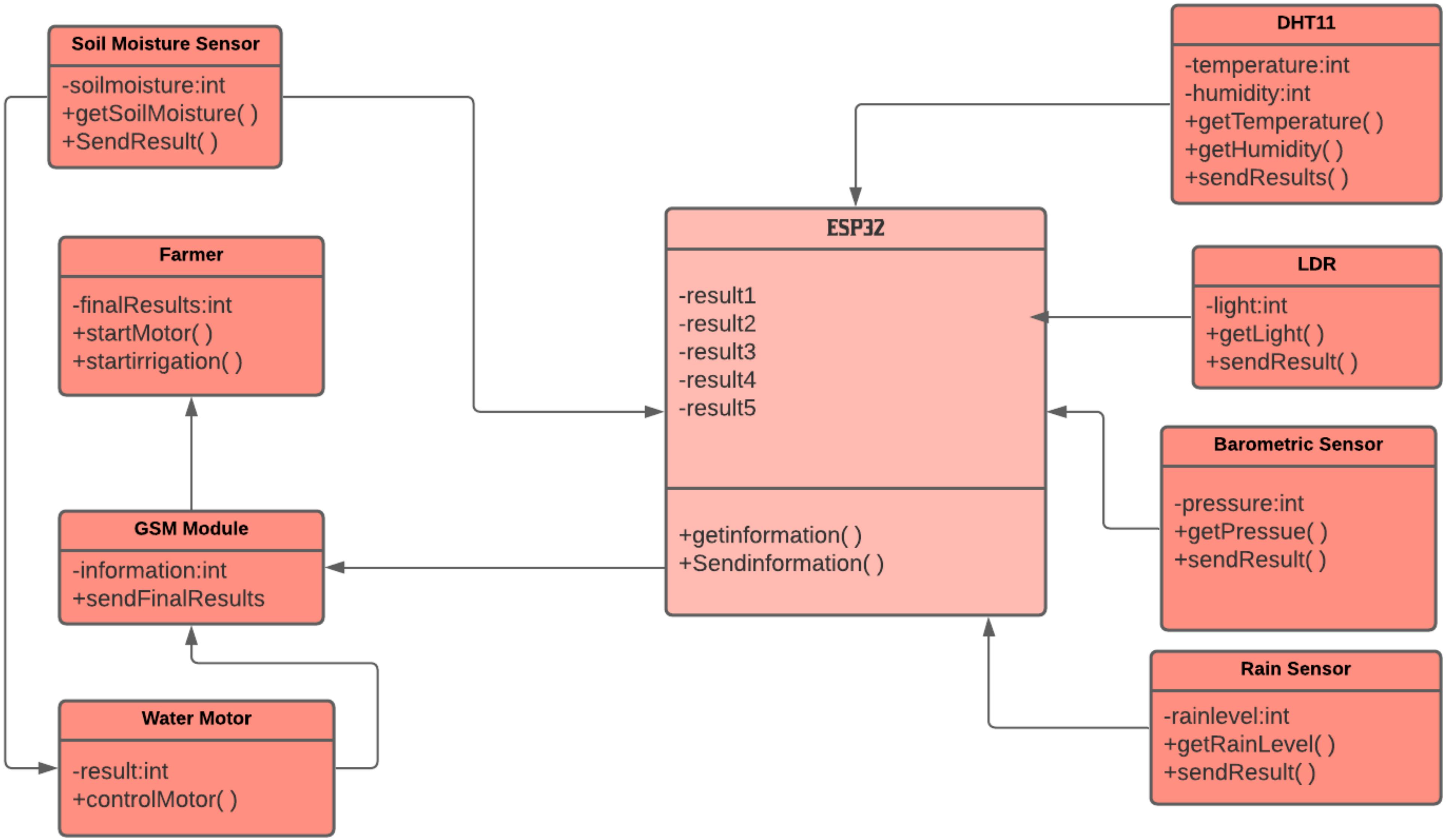


# FLOW CHART



Start
Device Intialize
CORIANDER
CONNECT TO IOT (WI-FI) (SHEET) (FIREBASE)
OKRA
TAKE INPUTS FROM SENSORS
TAKE INPUTS FROM SENSORS
NO
NO
IF (SENSOR)
IF (SENSOR)
YES
YES
CLOUD SHEET
TAKE ACTION
TAKE ACTION
IF ACTION TAKEN
IF ACTION TAKEN
PREDICTION
YES
YES
STOP
STOP

# Design Description:
# MASTER CLASS DIAGRAM



# Use Case Diagram

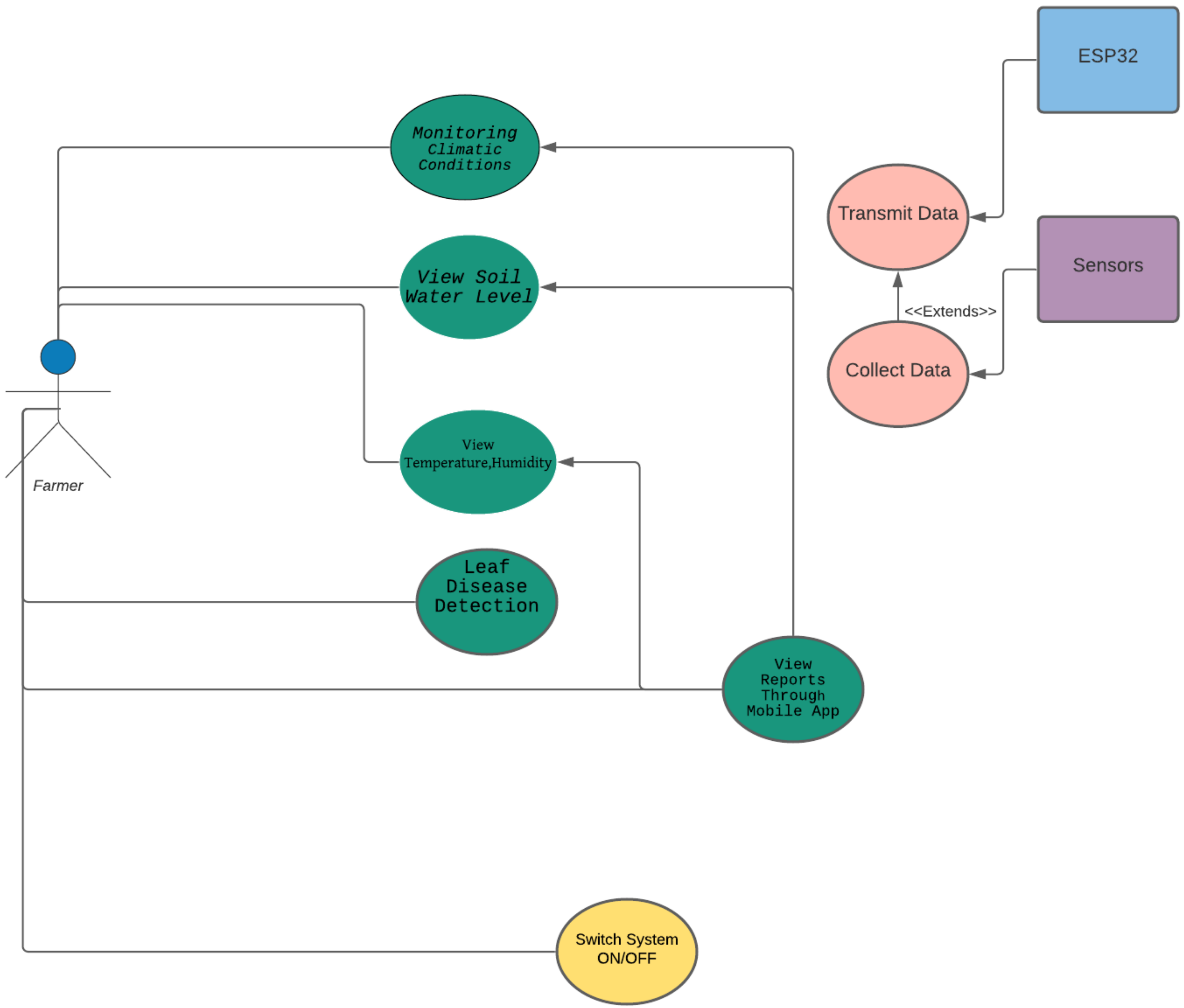
- To Model Fuctionalities of the System We Used Different:

  1)Roles-Farmer

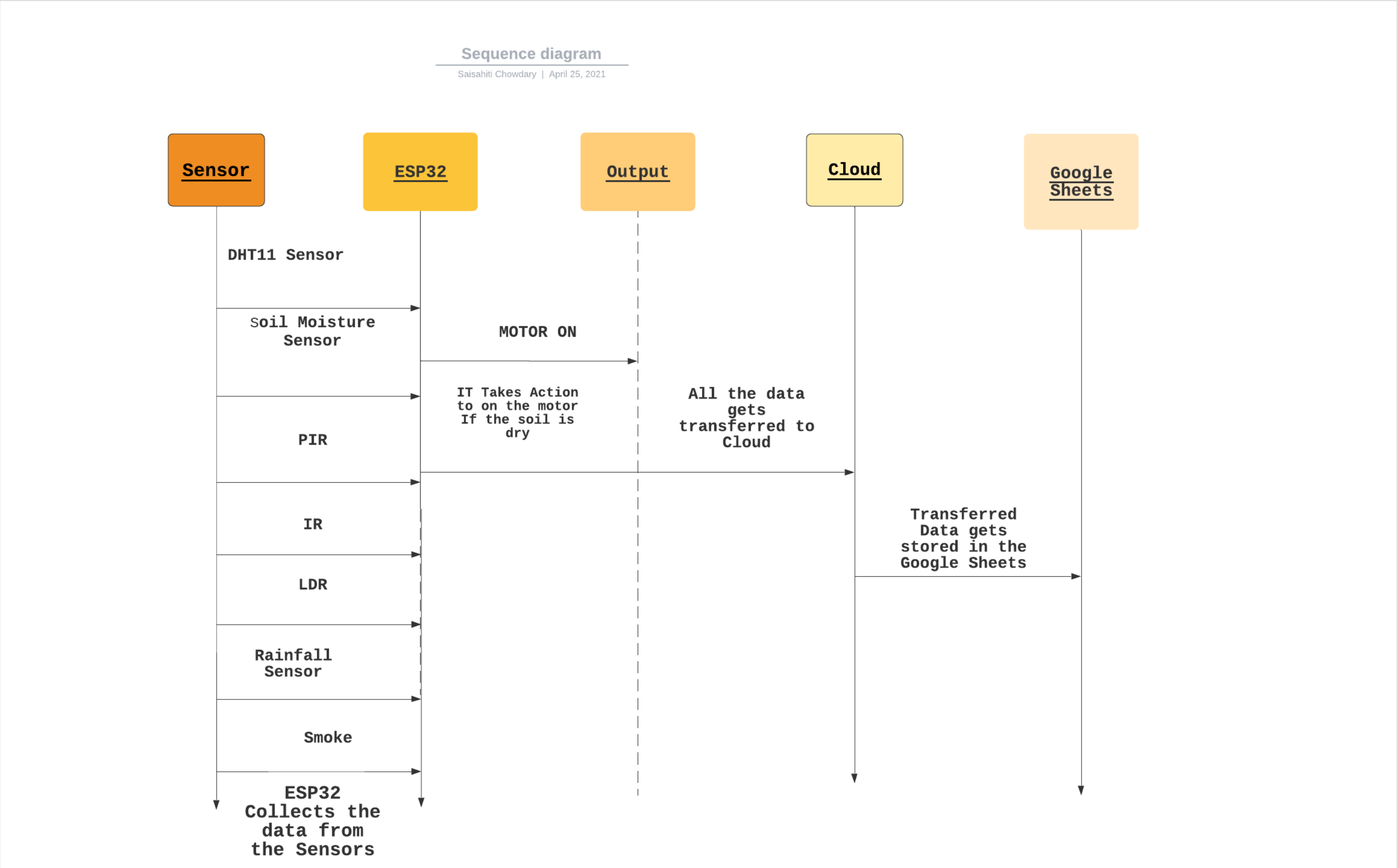
  2)Entitites-ESP32,Sensors

  3)Associated Use Cases

- The User Class Diagram here represents different functions, Services and actions performed in the system.



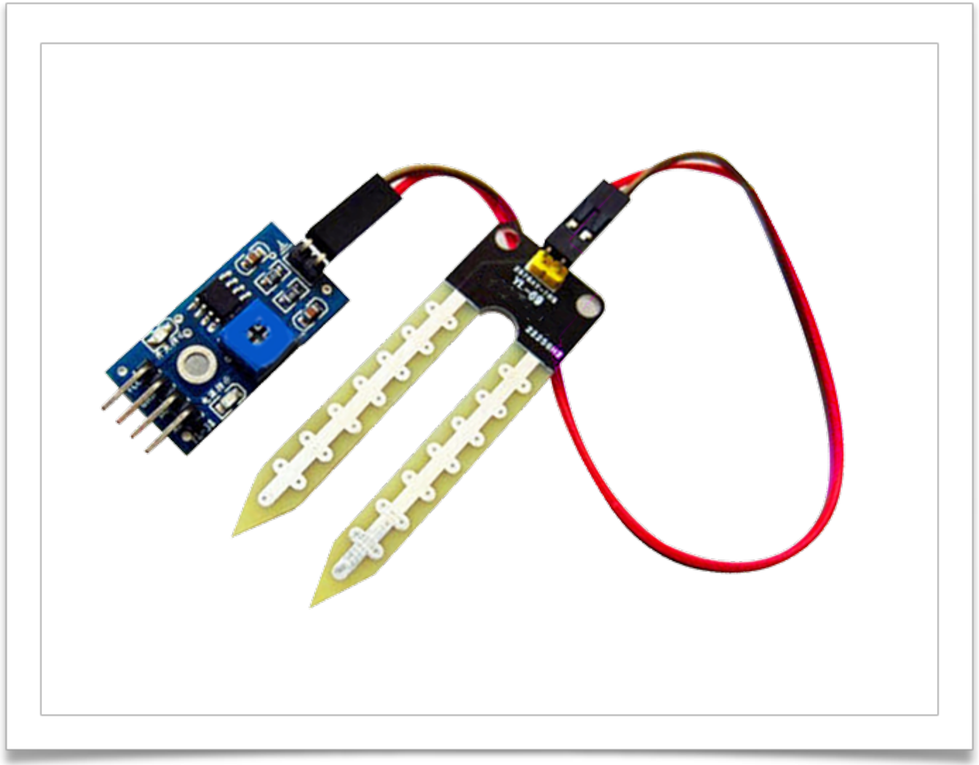
# Sequence Diagram



# Modules and Implementation Details

**Soil Moisture sensor**

```
void soilsensor()
{
  soilvalue=analogRead(35);
  if(soilvalue>3000)
  {
    Serial.print("Normal Detected");
  }
  else
  {
    Serial.print("High Water Detected");
      }
```



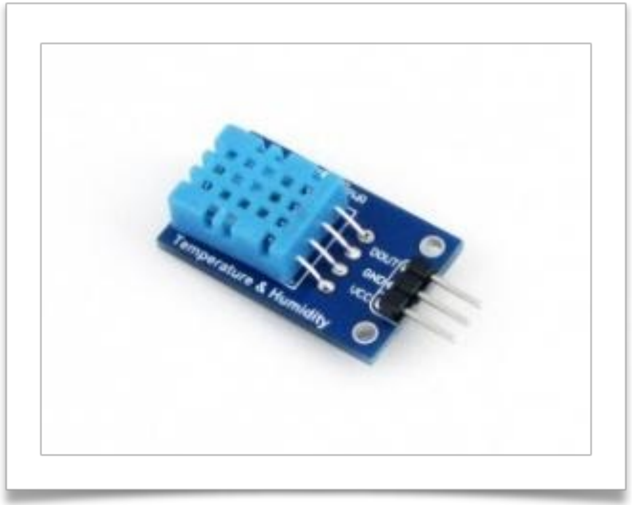
# Rainfall Detection sensor

```
void rainsensor()
{
  if(rainvalue<1700)
  {
    Serial.print("Rain Detected");
  }
  else
  {
    Serial.print("Rain Not Detected");
}
```

# Temperature and humidity

```
bool getTemperature() {

TempAndHumidity newValues = dht.getTempAndHumidity();
Serial.println(“Temperature:”+String(newValues.temperature)+”Humidity:"
String(newValues.humidity));
Serial.print(“Temperature:");
Serial.println(String(newValues.temperature));
Serial.print("Humidity:");
Serial.println(String(newValues.humidity));
Tempi=newValues.temperature;
Humii=newValues.humidity;
return true;
}
```

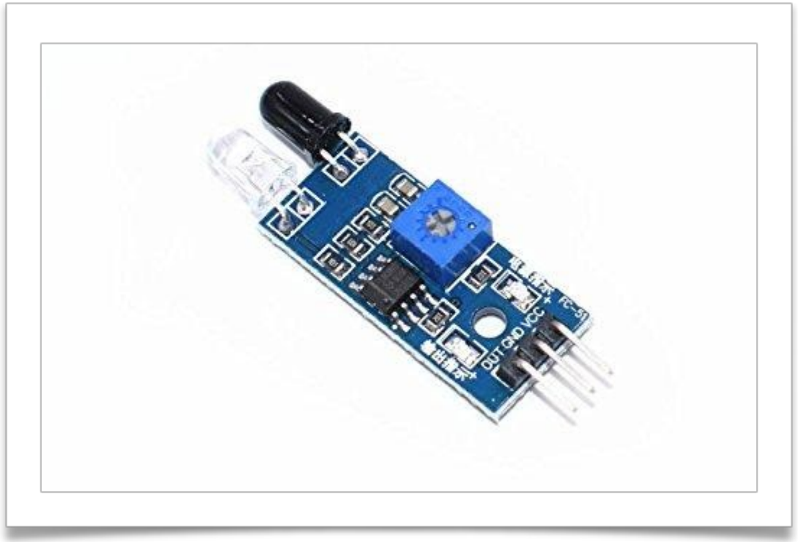


## PIR sensor

```
void pirsensor()
{
  pirvalue=digitalRead(pir);
  Serial.print("Pir value:");
  if(pirvalue==1)
  {
    Serial.print("Motion Detected");
  }
  else
  {
    Serial.print("Motion Not Detected");
  }
```

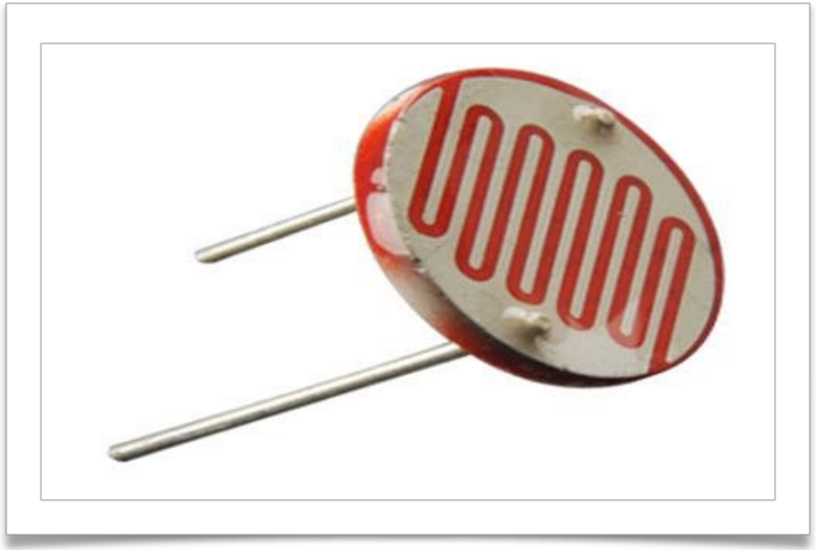
# IR sensor

```
void irsensor()
{
  irvalue=digitalRead(ir);
  if(irvalue==0)
  {
    Serial.print("Object Detected");
  }
  else
  {
    Serial.print("Object Not Detected");
}
```



## LDR sensor

```
void ldrsensor()
{
  ldrvalue=digitalRead(ldr);
  if(ldrvalue==1)
  {
    Serial.print("Dark Detected");
  }
  else
  {
    Serial.print("Light Detected");
}
```



# BAROMETRIC SENSOR

```
void pressure() {
  bool success = false;
  status = bmp180.startTemperature();
   if (status != 0) {
      status = bmp180.startPressure(3);
      if (status != 0) {
        delay(status);
        status = bmp180.getPressure(P, T);
      }
    }
}
```

# Smoke sensor

```
void smokesensor()
{
  gasvalue=analogRead(34);
  if(gasvalue>1200)
  {
    Serial.print("Smoke Detected");
  }
  else
  {
    Serial.print("Smoke Not Detected");
}
```

## WATER MOTOR

```
void soilsensor()
{
  soilvalue=analogRead(35);
  Serial.print("Soil value:");
    if(soilvalue>3000)
  {
    digitalWrite(relay, HIGH);
      delay(2000);
    digitalWrite(relay, LOW);
  }
  else
  {
    digitalWrite(relay, LOW);
  }
```

## **FIREBASE CONNECTION**

```
#include <WiFi.h>
#include <IOXhop_FirebaseESP32.h>
#define  FIREBASE_HOST "leaf-disease-f05af-default-rtdb.firebaseio.com"
#define  FIREBASE_AUTH "qIgP8rlWrp8dB0kzGRzzK1snS947qOH8gpIifjTl"
#define  WIFI_PASSWORD "qwertyuiop"
```

# MATLAB

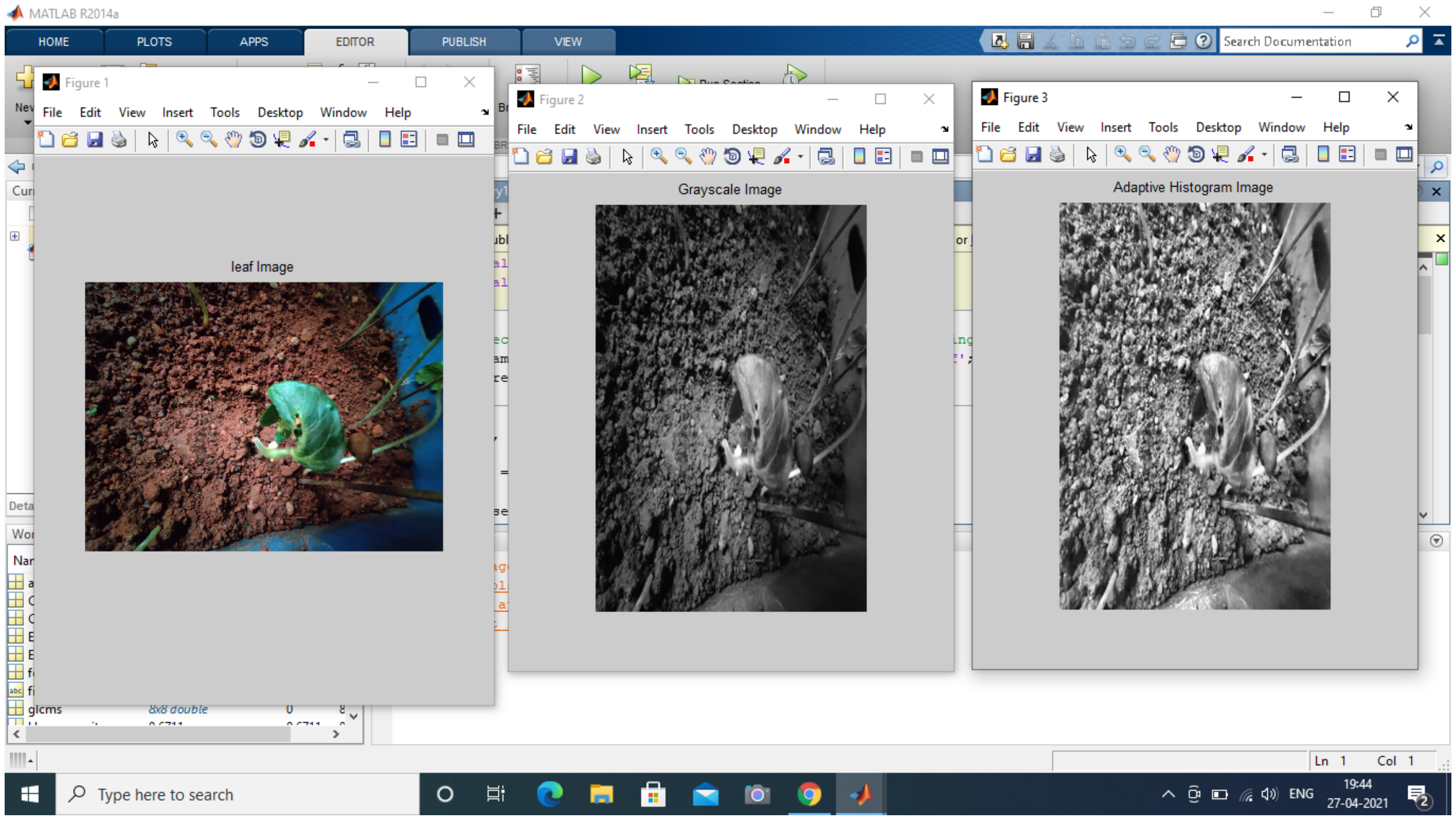

MATLAB R2014a
HOME
PLOTS
APPS
EDITOR
PUBLISH
VIEW
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Figure 1
leaf Image
Figure 2
Grayscale Image
Figure 3
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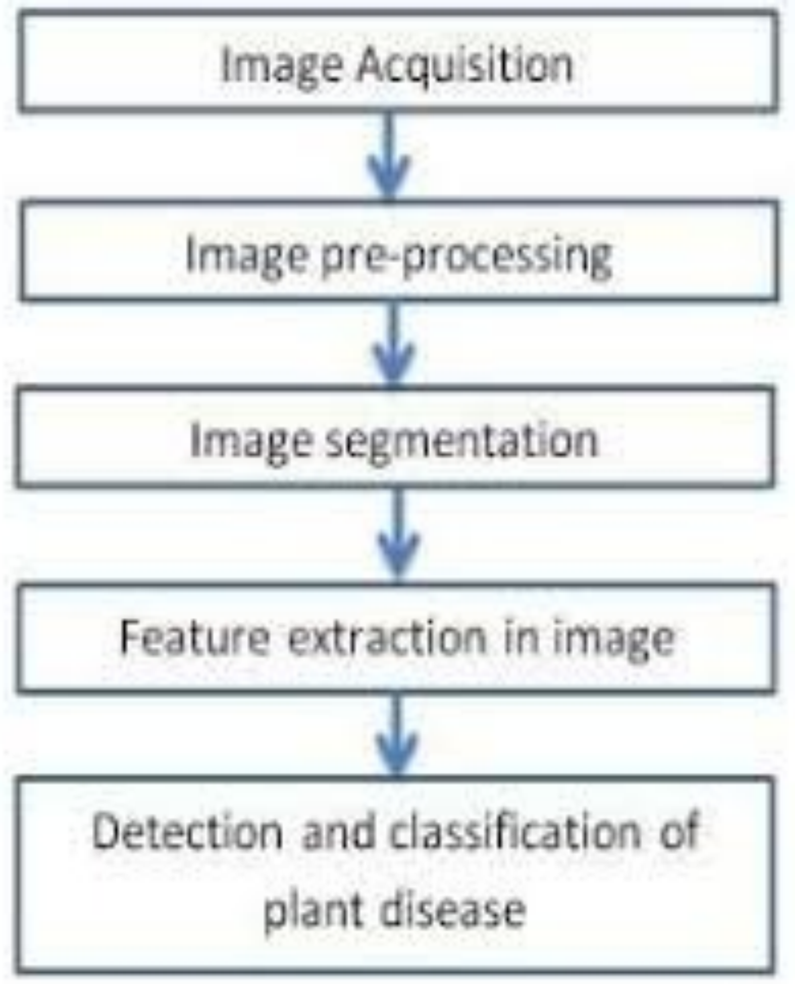
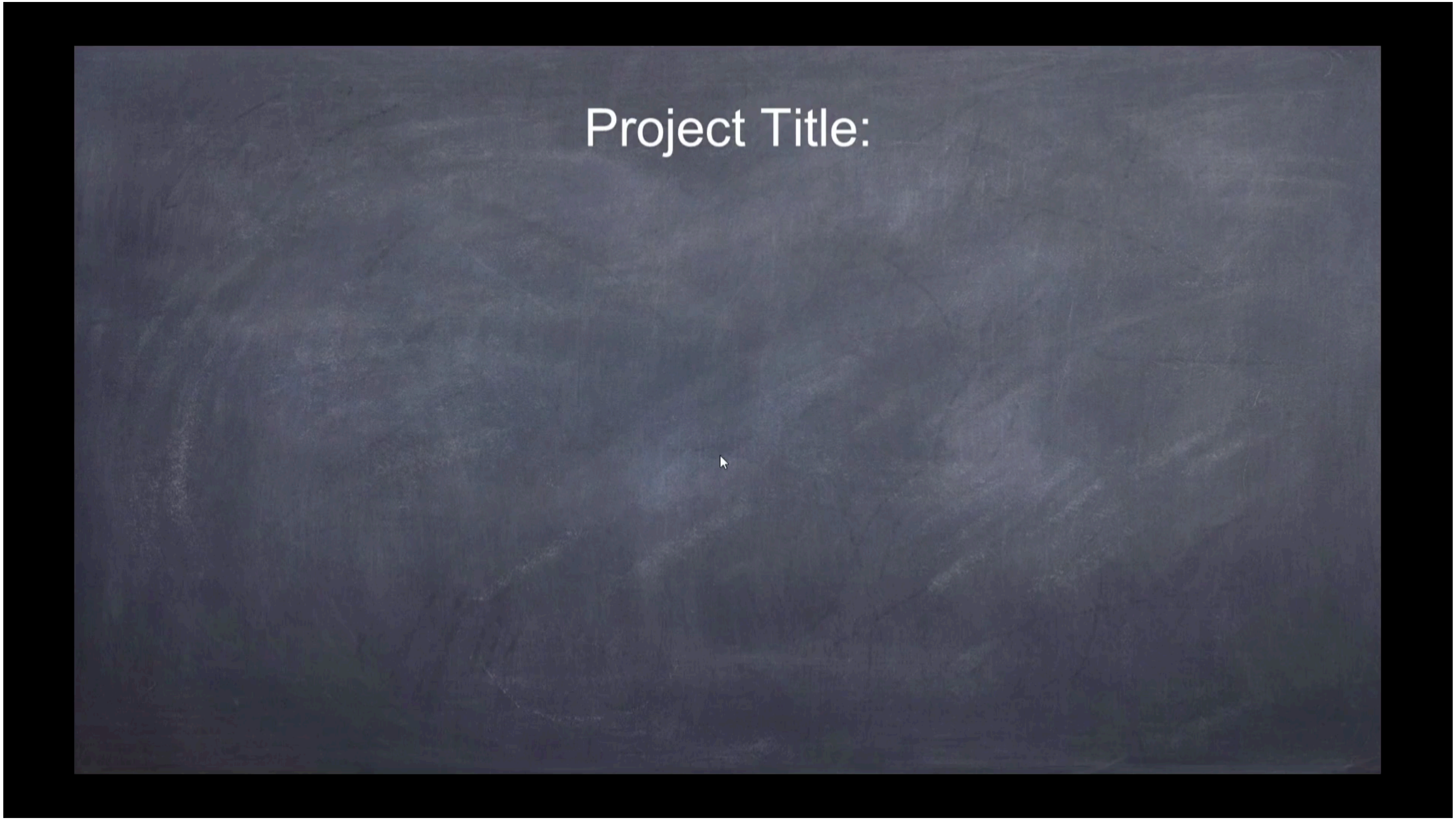


Image Acquisition
Image pre-processing
Image segmentation
Feature extraction in image
Detection and classification of plant disease

# Project Demonstration



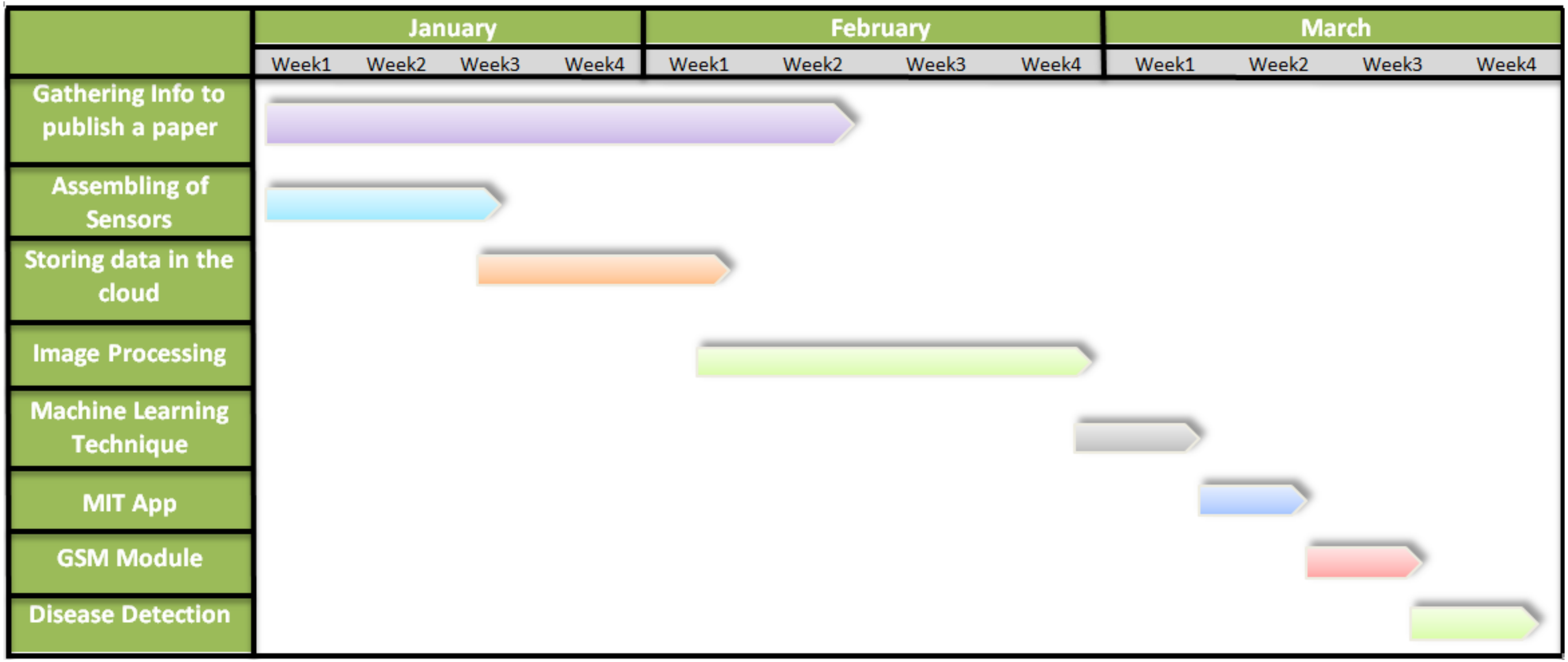
# Test Plan

| **FUNCTIONS TESTED** | **TEST RESULT** |
|---|---|
| Collect data | The sensors collected data and sent it to the ESP32 |
| Transmit data | Data collected was transmitted to the Fire Base |
| Retrieve data | After capturing data, we were able to view it on Google Sheets |
| Turn water pump on | Water pumped was activated |
| **Units Tested** | |
| Moisture sensor | Different moisture levels were tested out to determine their default/stable readings |
| Temperature & Humidity sensor | This is highly sensitive area; during testing it was discovered that it is hard to determine the actual temperature of a Crop. |
| Water pump | The water pumps were tested with and without a relay |
| MIT App | Tested the functionality and its connectivity to the Sheets and GSM module |
| Notification | Tested whether the farmer gets Alerts or not |
| Firebase Database | Data was able to be stored and retrieved as required |
| **Non - Functional Testing -Security:** | To provide safe login for the user.<br>Users can remotely monitor using MIT APP. |

# Results and Discussion

- Algorithms used are SVM and KNN.
- SVM accuracy - 96%
- KNN accuracy - 98%
- Grey scale image and Adaptive histogram image

# Schedule



January
February
March
Week1
Week2
Week3
Week4
Week1
Week2
Week3
Week4
Week1
Week2
Week3
Week4
Gathering Info to publish a paper
Assembling of Sensors
Storing data in the cloud
Image Processing
Machine Learning Technique
MIT App
GSM Module
Disease Detection

# Documentation

Github-https://github.com/sunitha1236401/capstone_PW21SUS02

# Lessons Learnt

- Current issues that farmers are facing in agriculture field
- How to implement new technologies to improve yeild
- Integration between hardware components and software
- Methods of detection to know about different plant dieseses
- Integration of different technologies(Cloud, MIT......)
- Executing a Project as a Team.

# Conclusion

- There are no limitations on how many connections and sensors can be set up in an IoT agricultural smart system.
- The discussed model and IoT system design explored in this project can be implemented in a small setting like a backyard garden, in-door garden and even on a large-scale farm.
- All the components and design can be scaled to meet the user's needs.
- However, it should be noted that the smart farming (as an application of IoT technology) has not been given much attention and sufficient research.
- This is basically happened because many of the farming operations usually occur in the remote areas.
- But given more attention especially from countries with much agriculture exports, the smart farming has the potential to revolutionize the way farms operate and hence to boost the food market around the world.

# Future Work

- Integrate an automatic mode for the system.
- USSD functionality to implement an offline action control mechanism for farm management.
- Implement On a Larger Area.

# References


[1]Yoganand S,Narasinga Perumal,Pratap Reddy P and Rahul S,"Prevention of crop disease in plants groundnut using IOT and machine learning models",2020

[2]Swagatam Bose Choudhary,Prachin Jain, Sujal kallamkuth,Saranya Ramanath,Prakriti V Bhatt,Sanat Sarangi and Srinivasu P,"Precision crop monitoring with affordable IOT: Experiences with Okra"2019 Global IOT summit (GIoTS)

[3]Lydia S Sabnath,Rakshitha H S,Pushpalatha N and Rajeshwari D,"Leaf Disease Detection and Monitoring system using IOT"2020

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[5]Apeksha Thorat,Sangeeta kumari and Nandakishor D. Valakunde,"An IOT based smart solution"2017 international conference on Big data,IOT and data science(BID)

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[7]Mobasshir Mahbub,"A Smart farming concept based on smart embedded electronics,internet of things and wireless sensor network"2020

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[10]Rajesh yakkundimath,Girish saunshi and Vishwanath kamatar,”Plant disease detection using IOT”International Journal of Engineering Science and Computing,September 2018.

# Thank You