PROJECT REPORT

ON

AGRO-Z-MINE

JC Bose University of Science and Technology,YMCA

In the partial fulfillment of the Requirement for the award of the degree of

BACHELOR OF TECHNOLOGY (B.Tech)

IN

COMPUTER SCIENCE ENGINEERING

Batch:2022-2025

ARAVALI COLLEGE OF ENGINEERING & MANAGEMENT

creating achievers

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ARAVALI COLLEGE OF ENGINEERING AND MANAGEMENT

FARIDABAD-121002

DECLARATION

We declare that the project work entitled “AGRO-Z-MINE” submitted to JC Bose University of science and technology, NIT Faridabad, Haryana (India). It is an original work that is done by us. Under the guidance of our respected teacher Ms. Rashika and Ms. Neha in the Department of computer science engineering. I have followed the guidelines provided by the Institute preparing the report and I have also confirmed that I am not using any copyrighted content in the project.

This Project work is submitted to the partial fulfillment of the requirements for the award of the degree of Bachelors of Technology in Computer Science and Engineering.

ACKNOWLEDGEMENT

We feel humble pleasure to express my sincere thanks and sense of gratitude to all those people who played a valuable role for the successful completion of this project by their invaluable suggestions and advice. We are very grateful to **Ms. Sakshi Kumar, Head of the Department, (Computer Science and Engineering)**, whose motivation and constant encouragement has led me to pursue a project in the field of IOT based project. We are very thankful to my guide **(project Coordinator)**, and also thankful to the institute for providing this opportunity and constant encouragement given by them during the course. We are grateful to the teachers for their valuable guidance and suggestions during my project work. From the bottom of my heart We express very thanks to my internal guide and all other professors, who are always giving motivation & suggestions to me and also giving help for the completion of my project. and without their guidance completion of the project is not possible.

ABSTRACT

The aim of this project is to make a platform where users and farmers can use multiple features easily on a single platform. This project presents an intelligent system that predicts soil moisture based on the information collected from the sensors deployed at the field and the weather forecast information available on the Internet. The field data has been collected through a self designed sensor node. The server-side software has been developed with node side connectivity along with information visualization and decision support features. The purpose behind this platform with the soil monitoring device is to make all the things easier and availability of multiple features on a single platform that can be very useful for the peoples who wants to do farming at beginning level. AGRO-Z-MINE is a platform that integrates soil monitoring, crop charting process about that specific crop that a person wants to grow, market price prediction, and crop yield prediction based on image analysis is a comprehensive and innovative approach to precision agriculture.

CONTENTS

INTRODUCTION OF AGRO-Z-MINE

AGRO-Z-MINE is a device that we can termed as soil monitoring system and a platform that presents an intelligent system that predicts soil moisture based on the information collected from the sensors deployed at the field and the weather forecast information available on the Internet. The field data has been collected through a self designed sensor node.

And AGRO-Z-MINE is also a platform that integrates soil monitoring, crop charting process about that specific crop that a person wants to grow, market price prediction, and crop yield prediction based on image analysis is a comprehensive and innovative approach to precision agriculture.

The Soil Monitoring System is an innovative approach to precision agriculture. By integrating soil monitoring this system empowers farmers with data-driven insights. Precision agriculture aims to optimize crop production by leveraging technology and data analytics. The Soil Monitoring System combines real-time sensor data, machine learning models, and direct farmer-buyer connections. It addresses critical aspects of modern farming, enhancing productivity and sustainability.

1.1 DESCRIPTION ABOUT THE PROJECT

➢ Soil Monitoring:

- The system incorporates IoT sensors such as nitrogen (N), phosphorus (P), and potassium (K) sensors, pH sensors, and soil moisture sensors. These sensors detect soil quality in real time.
- By analyzing soil properties like NPK levels, pH, and moisture, the system provides insights into soil health and nutrient balance Crop.

➢ Charting Process:

- The platform assists farmers in crop selection and planning. It charts the growth stages, optimal planting times, and crop-specific requirements.
- By considering factors like climate, soil quality, and historical data, it helps farmers make informed decisions**.**

➢ Market Price Prediction:

- The system leverages machine learning models to predict market prices for specific crops.
- By analyzing historical price trends, demand-supply dynamics, and other relevant data, it provides price forecasts**.**

➢ Crop Yield Prediction:

- Real-time data from IoT sensors and image analysis contribute to accurate crop yield predictions.
- Machine learning algorithms, such as k-nearest neighbors (KNN) and extreme gradient boosting (XGBoost), process this data.

➢ Direct Farmer–Buyer Connection:

- The system offers a marketplace portal where farmers can showcase their crops.
- Buyers can directly connect with farmers, streamlining the supply chain.

1.2 METHODOLOGY USED IN PROJECT

AGRO-Z-MINE is a multifaceted system that plays a pivotal role in precision agriculture. Let's delve into its components and methodologies:

- **Soil Monitoring System:**

AGRO-Z-MINE incorporates a soil monitoring system, which acts as a crucial foundation. This system collects real-time data from field-deployed sensors. These sensors are strategically placed in the soil to measure parameters such as soil moisture, temperature, and nutrient levels.

The self-designed sensor node facilitates data collection, allowing farmers to gain insights into soil conditions. By monitoring these factors, AGRO-Z-MINE empowers farmers to make informed decisions about irrigation, fertilization, and crop management.

- **Crop Charting and Specific Crop Insights:**

AGRO-Z-MINE goes beyond soil monitoring. It provides a crop charting process tailored to specific crops. Farmers can access detailed information about the growth stages, optimal planting times, and nutrient requirements for their chosen crops.

For instance, if a farmer intends to grow wheat, AGRO-Z-MINE offers customized guidance on when to sow seeds, how to manage pests, and the ideal harvesting window.

- **Market Price Prediction:**

The platform also integrates market price prediction. By analyzing historical data, market trends, and external factors, AGRO-Z-MINE forecasts crop prices. This information assists farmers in making decisions related to selling their produce.

Imagine a tomato farmer receiving real-time price predictions—this enables them to choose the best time to sell their tomatoes for maximum profit.

- **Crop Yield Prediction through Image Analysis**:

AGRO-Z-MINE leverages image analysis to predict crop yields. By analyzing images of crops (such as aerial photographs or drone imagery), the system estimates the potential yield.

For example, if a farmer captures images of their cornfield, AGRO-Z-MINE processes these images to estimate the expected corn yield per acre.

1.3TOOLS AND TECHNOLOGY USED

➢ **Soil Moisture and Humidity Sensor:** Soil moisture sensor measure the water content in soil. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. The module uses LM393 comparator to compare the soil moisture level with the preset threshold. When the soil moisture deficit module outputs a high level, and vice versa.
A humidity sensor (also known as a **hygrometer**) is an electronic device that measures and monitors the moisture and air temperature in the atmosphere. It detects humidity in its surroundings and converts the data into electrical signals.

➢ **PH sensor:** A sensor that is used to detect the hydrogen ions concentration within a solution and changes it into an equivalent usable o/p signal is known as pH sensor. This sensor includes a signal transmission part and chemical part. This sensor is used to measure alkalinity & acidity within water. This sensor's standard measurement range is 0 to 14 that is represented in digital. The substance pH value 7 indicates neutrality.

➢ **Water level sensor:** Water level sensors play a crucial role in precision agriculture by **monitoring soil moisture levels**. This information helps farmers optimize irrigation, ensuring efficient water usage and healthier crops. Additionally, water level sensors are used in monitoring the water levels in reservoirs, ensuring proper supply for irrigation needs.

➢ **Arduino UNO:** The Arduino Uno is a microcontroller board based on the Atmel's ATmega328.It has 14 digital input/output pins (of which 6 can be used as PWM outputs) and 6 analog inputs. The Arduino Uno can be powered via USB connection or with an external power supply. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable (not included). Arduino IDE supports Windows, Mac OS X or Linux.

1.4 HARDWARE SPECIFICATION

- **Arduino or ESP32 Board:**
  These microcontrollers serve as the brain of the system.
  They handle sensor data, communication, and data processing.
  Common choices include Arduino UNO and ESP32.

- **Soil Sensors:**
  Soil Moisture and humidity Sensor
  Soil PH levels.
  Water level sensor to prevent overwatering.

- **ESP32 WiFi Module:**
  Acts as the gateway to connect to the internet.
  Uploads data to cloud platforms or local servers.

1.5 SOFTWARE SPECIFICATIONS

Arduino IDE:

Arduino designs, manufactures, and supports electronic devices and software, allowing people around the world to easily access advanced technologies that interact with the physical world. Our products are straightforward, simple, and powerful, ready to satisfy users' needs from students to makers and all the way to professional developers. The development environment where you write, compile, and upload code to the Arduino.

Flutter Flow:

Flutter Flow is a **low-code builder for developing native mobile applications**. It is a browser-based drag-and-drop interface that allows you to build fully functional apps with Firebase integration, API support, animations, and more. You can use dozens of page templates and components, accept payments with Braintree, Stripe or RevenueCat, send push notifications to users, use AI to write custom functions, and more. Flutter Flow allows you to build your app 10x faster than traditional development.

2. LITERATURE REVIEW

A literature review on soil monitoring systems would typically cover various aspects such as the importance of soil monitoring, existing methods and technologies, recent advancements, challenges, and potential future directions. Here's a structured outline for your literature review:

1. Introduction

- Briefly introduce the importance of soil monitoring for agriculture, environmental management, and sustainability.
- Highlight the significance of real-time and continuous monitoring in modern soil management practices.
- Provide an overview of the objectives and scope of the literature review.

2. Importance of Soil Monitoring

- Discuss the role of soil in agriculture productivity, ecosystem health, and carbon sequestration.
- Highlight the impact of soil degradation, erosion, and pollution on global food security and environmental sustainability.
- Emphasize the need for accurate and timely soil data to support informed decision-making in agriculture, land use planning, and environmental protection.

3. Traditional Soil Monitoring Methods

- Review conventional methods of soil analysis, including laboratory-based techniques such as soil sampling and chemical analysis.
- Discuss the limitations of traditional methods, including time-consuming processes, high cost, and limited spatial and temporal resolution.
- Highlight the importance of complementary data sources such as remote sensing and geospatial technologies.

4. Emerging Technologies for Soil Monitoring

- Survey recent advancements in soil sensing technologies, including in-situ sensors, wireless sensor networks, and Internet of Things (IoT) devices.
- Discuss the principles of operation, advantages, and limitations of different sensor types, such as electromagnetic induction, capacitance, and optical sensors.
- Provide examples of commercial soil monitoring systems and research prototypes, highlighting their applications in precision agriculture, environmental monitoring, and soil research.

5. Data Analysis and Interpretation

- Review methods for processing and analyzing soil sensor data, including statistical techniques, machine learning algorithms, and geospatial analysis.
- Discuss approaches for integrating soil sensor data with other environmental datasets, such as climate data, satellite imagery, and land use maps.
- Highlight the importance of data visualization and decision support tools for communicating soil information to stakeholders.

6. Challenges and Limitations

- Identify key challenges and limitations associated with soil monitoring systems, including sensor accuracy, data interoperability, and scalability.
- Discuss factors influencing the adoption and implementation of soil monitoring technologies, such as cost, technical expertise, and regulatory barriers.
- Highlight areas for future research and development to address current limitations and improve the effectiveness of soil monitoring systems.

7. Conclusion

- Summarize the key findings of the literature review, emphasizing the importance of soil monitoring for sustainable land management.
- Discuss the potential benefits of advanced soil monitoring technologies for agriculture, environmental protection, and climate change mitigation.
- Provide recommendations for future research directions and practical applications of soil monitoring systems.

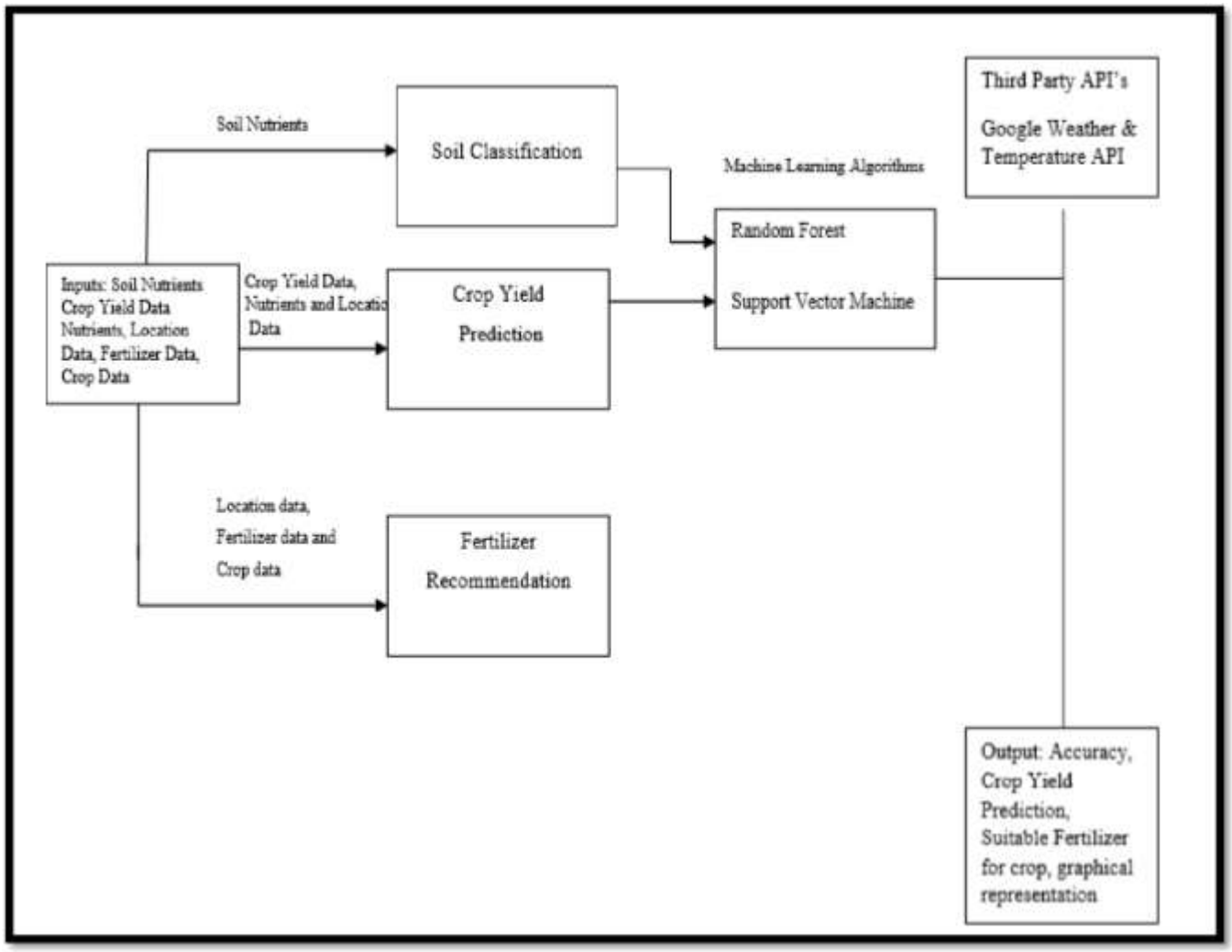
8. References

- Compile a list of cited references, including journal articles, conference papers, books, and online resources related to soil monitoring and related topics.

By following this outline, you can systematically review existing literature on soil monitoring systems, identify gaps in knowledge, and contribute to the advancement of this important field.

SYSTEM ANALYSIS AND DESIGN

3.1DATA FLOW DIAGRAM



3.2TESTING PROCESS

What is Testing?

A process of executing a program with the explicit intention of finding errors, that is making the program fail. Testing is the process of detecting errors. Testing performs a very critical - role for quality assurance and for ensuring the reliability of software. The results of testing are used later on during maintenance also.

Psychology of Testing:

The aim of testing is often to demonstrate that a program works by showing that it has no errors. The basic purpose of the testing phase is to detect the errors that may be present in the program. Hence one should not start testing it with the intent of showing that a program works but the intent should be to show that a program does not work. Testing is the process of executing a program with the intent of finding errors. Testing Objectives: The main objective of testing is to uncover a host of errors, systematically and with minimum effort and time. Stating formally, we can say,

- Testing is a process of executing a program with the intent of finding an error.
- A successful test is one that uncovers an as yet discovered error..
- A good test case is one that has a high probability of finding error, if it exists.
- The tests are inadequate to detect reliable standards.

Testing is a crucial step in ensuring the accuracy and reliability of a soil monitoring system. Let's explore the testing process:

- **Sensor Calibration and Verification:**

Calibrate soil sensors (e.g., moisture, temperature, NPK sensors) before deployment.

Verify that sensors provide accurate readings under controlled conditions.

Adjust sensor parameters if needed.

- **Field Testing:**

Install sensors in the actual soil environment.

Monitor soil conditions over an extended period.

Validate sensor data against ground truth measurements (e.g., manual soil sampling).

- **Functional Testing:**

Ensure sensors transmit data correctly to the central point (gateway or cloud).

Verify data integrity during transmission.

Confirm that all sensors are operational.

- **Data Validation and Quality Control:**

Check for outliers or anomalies in sensor data.

Implement data validation rules (e.g., range checks, consistency checks).

- **Choosing Sampling Locations:**

Select representative areas within the farm that accurately reflect overall soil conditions.

Use tools like soil probes, hand trowels, or soil augers to collect samples from different locations.

- **Collection of Soil Samples:**

Once sampling locations are determined, collect soil samples.

These samples are then sent to soil testing laboratories for analysis.

- **Interpreting Test Results:**

Based on the lab results, farmers can make informed decisions:

Adjust fertilization practices.

Optimize irrigation strategies.

Prevent nutrient runoff that harms water ecosystems.

Choose suitable soil amendments and crop varieties.

- **Baseline and Tracking:**

Regular soil testing establishes a baseline for comparison.

Farmers can track changes over time and adapt management practices accordingly.

WORKING OF AGRO-Z-MINE

4.1 CODE

The program for the working of product Agro-z-mine:

```
// Define the pin connected to the soil moisture sensor
const int soilMoisturePin = A0;
const int waterLevelSensorPin = A1; // Analog pin A1

// Define the threshold value for considering water present
const int waterThreshold = 500;

void setup() {
  // Initialize serial communication
  Serial.begin(9600);
}

void loop() {
  // Read the soil moisture value
  int soilMoistureValue = analogRead(soilMoisturePin);

  // Convert the analog value to voltage (0-5V)
  float voltage = soilMoistureValue * (5.0 / 1023.0);
  int moisturePercentage = map(soilMoistureValue, 0, 1023, 0, 100);
int Temp=0;
 for (int i = 0; i < 5; i++) {
  float Temperature = random(20, 30);
  Temp=Temp+Temperature;

  }


  // Convert voltage to percentage (assuming the sensor outputs 0V when dry and 5V when wet)
  // You may need to adjust these values based on your sensor's specifications

  int NEWMOISTURE=0;
 for (int i = 0; i < 5; i++) {
   int moisturePercentage = map(soilMoistureValue, 0, 1023, 0, 100);
    NEWMOISTURE= moisturePercentage+NEWMOISTURE;
  }
  int NEWHUMIDITY=0;
 for (int i = 0; i < 5; i++) {
  int humidityPercentage = map(soilMoistureValue, 0, 1023, 100, 0);
    NEWHUMIDITY= humidityPercentage + NEWHUMIDITY;
  }
```

```
  NEWHUMIDITY=(NEWHUMIDITY/5);
  NEWMOISTURE=(NEWMOISTURE/5);
  // Print the humidity percentage
  Serial.print("Soil Humidity: ");


  Serial.print(NEWHUMIDITY);
  Serial.println("%");
   Temp=(Temp/5);
  // Print random temperature value
  Serial.print("Temperature: ");
  Serial.print(Temp);
  Serial.println("°C");


    Serial.print("Soil Moisture: ");
    Serial.print(moisturePercentage);
  Serial.println("%");
  int sensorValue = analogRead(waterLevelSensorPin);

  // Print the sensor value to the serial monitor
  Serial.print("Sensor Value: ");
  Serial.println(sensorValue);

  // Check if the water level is above the threshold
  if (sensorValue >= waterThreshold) {
    Serial.println("Water Detected!"); // Water is present
  } else {
    Serial.println("No Water Detected"); // No water is present
  }

  // Delay before taking the next reading
  delay(4000); // Adjust as needed
}
```

The Back-end code:

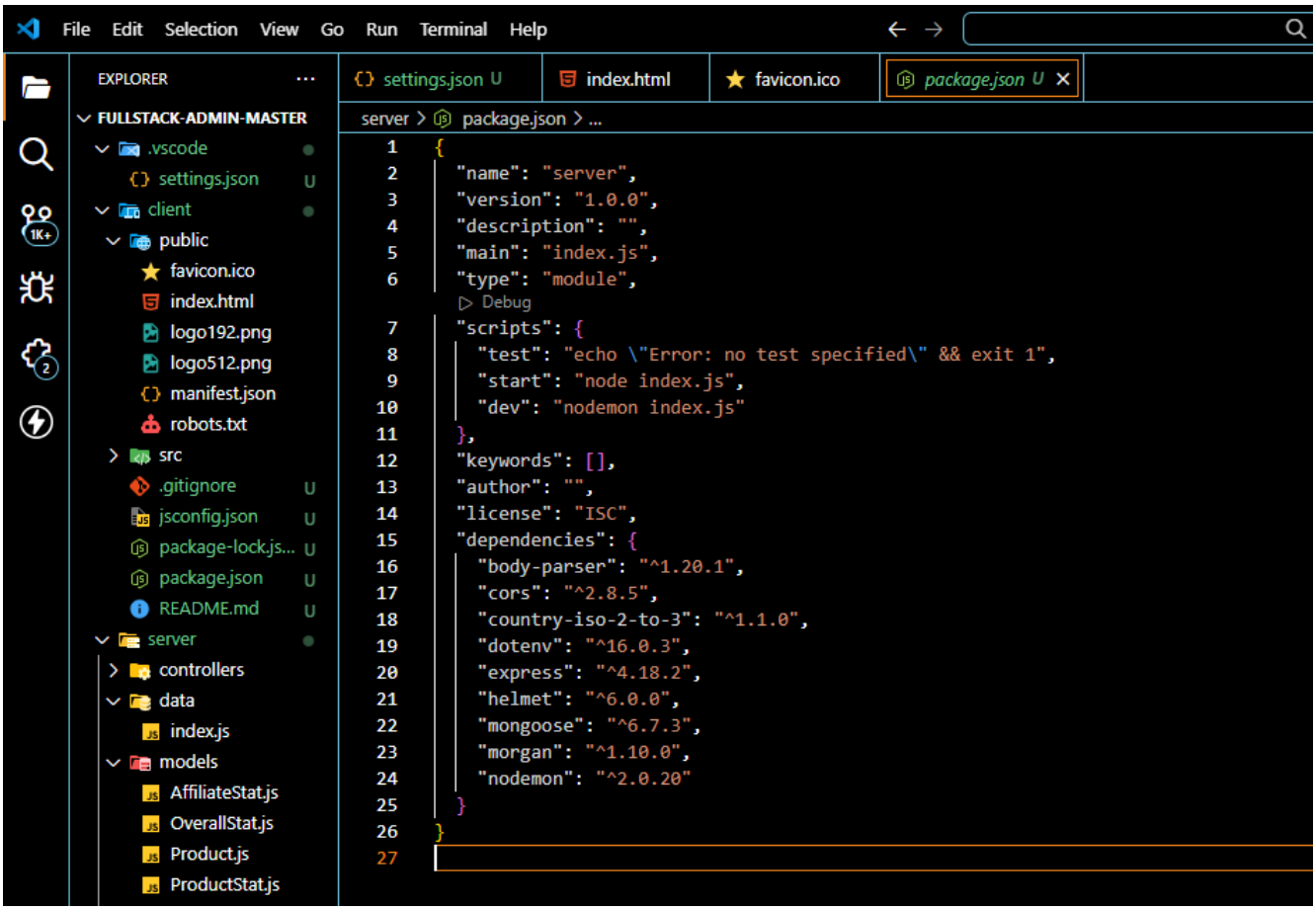
count	2416.000000	2416.000000	2416.000000	2416.000000	2416.000000	2.416000e+03
mean	186.271147	189.578224	182.916639	186.403651	186.403651	5.572722e+06
std	118.740163	120.892329	116.857591	119.136020	119.136020	4.987809e+06
min	16.139999	16.629999	14.980000	15.800000	15.800000	1.185000e+05
25%	34.342498	34.897501	33.587501	34.400002	34.400002	1.899275e+06
50%	213.035004	216.745002	208.870002	212.960007	212.960007	4.578400e+06
75%	266.450012	270.927513	262.102501	266.774994	266.774994	7.361150e+06
max	673.690002	786.140015	673.520020	780.000000	780.000000	4.706500e+07

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2416 entries, 0 to 2415
Data columns (total 7 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   Date       2416 non-null   object 
 1   Open       2416 non-null   float64
 2   High       2416 non-null   float64
 3   Low        2416 non-null   float64
 4   Close      2416 non-null   float64
 5   Adj Close  2416 non-null   float64
 6   Volume     2416 non-null   int64  
dtypes: float64(5), int64(1), object(1)
memory usage: 132.3+ KB
```

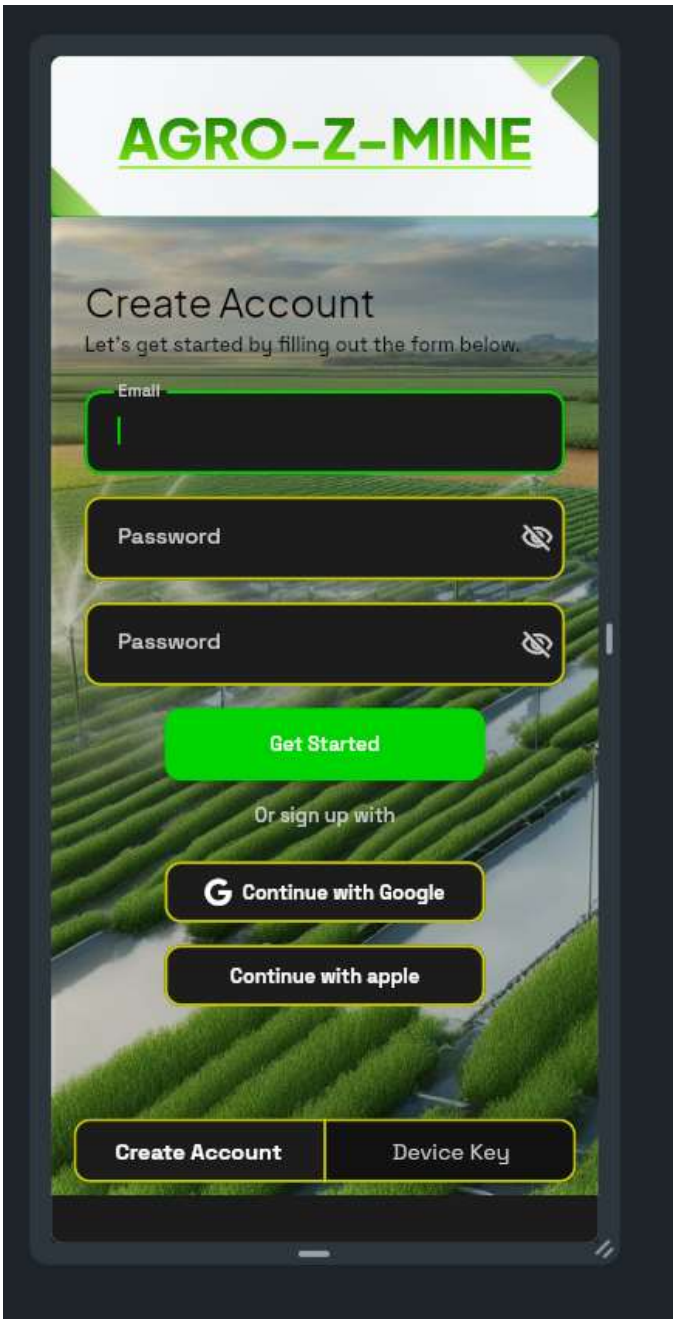
```
EXPLORATORY DATA ANALAYSIS (EDA)
```

```
plt.figure(figsize=(15,5))
plt.plot(df['Close'])
plt.title('Tesla Close price.', fontsize=15)
plt.ylabel('Price in dollars.')
plt.show()
```

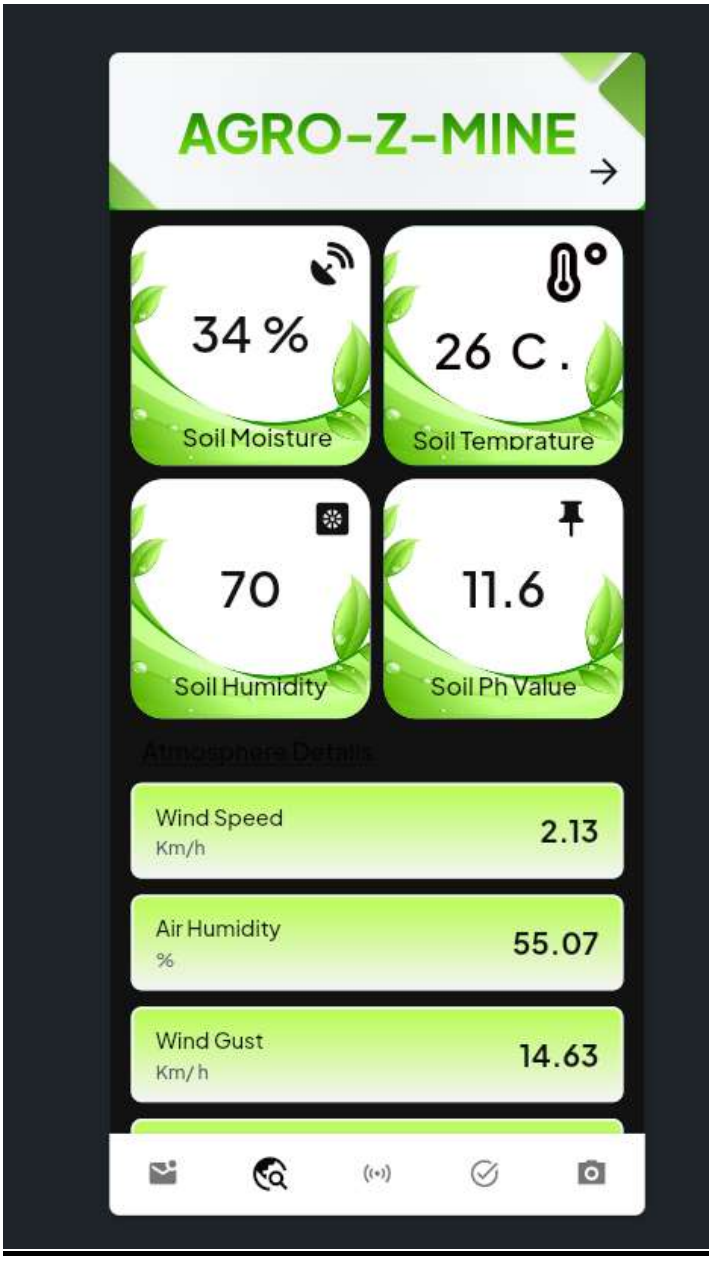

File Edit Selection View Go Run Terminal Help
EXPLORER
FULLSTACK-ADMIN-MASTER
.vscode
settings.json
client
public
favicon.ico
index.html
logo192.png
logo512.png
manifest.json
robots.txt
src
.gitignore
jsconfig.json
package-lock.js...
package.json
README.md
server
controllers
data
index.js
models
AffiliateStat.js
OverallStat.js
Product.js
ProductStat.js
settings.json U
index.html
favicon.ico
package.json U
server > package.json > ...
{
"name": "server",
"version": "1.0.0",
"description": "",
"main": "index.js",
"type": "module",
Debug
"scripts": {
"test": "echo \"Error: no test specified\" && exit 1",
"start": "node index.js",
"dev": "nodemon index.js"
},
"keywords": [],
"author": "",
"license": "ISC",
"dependencies": {
"body-parser": "^1.20.1",
"cors": "^2.8.5",
"country-iso-2-to-3": "^1.1.0",
"dotenv": "^16.0.3",
"express": "^4.18.2",
"helmet": "^6.0.0",
"mongoose": "^6.7.3",
"morgan": "^1.10.0",
"nodemon": "^2.0.20"
}
}

4.2 USER-INTERFACE FOR OUR PLATFORM AGRO-Z-MINE

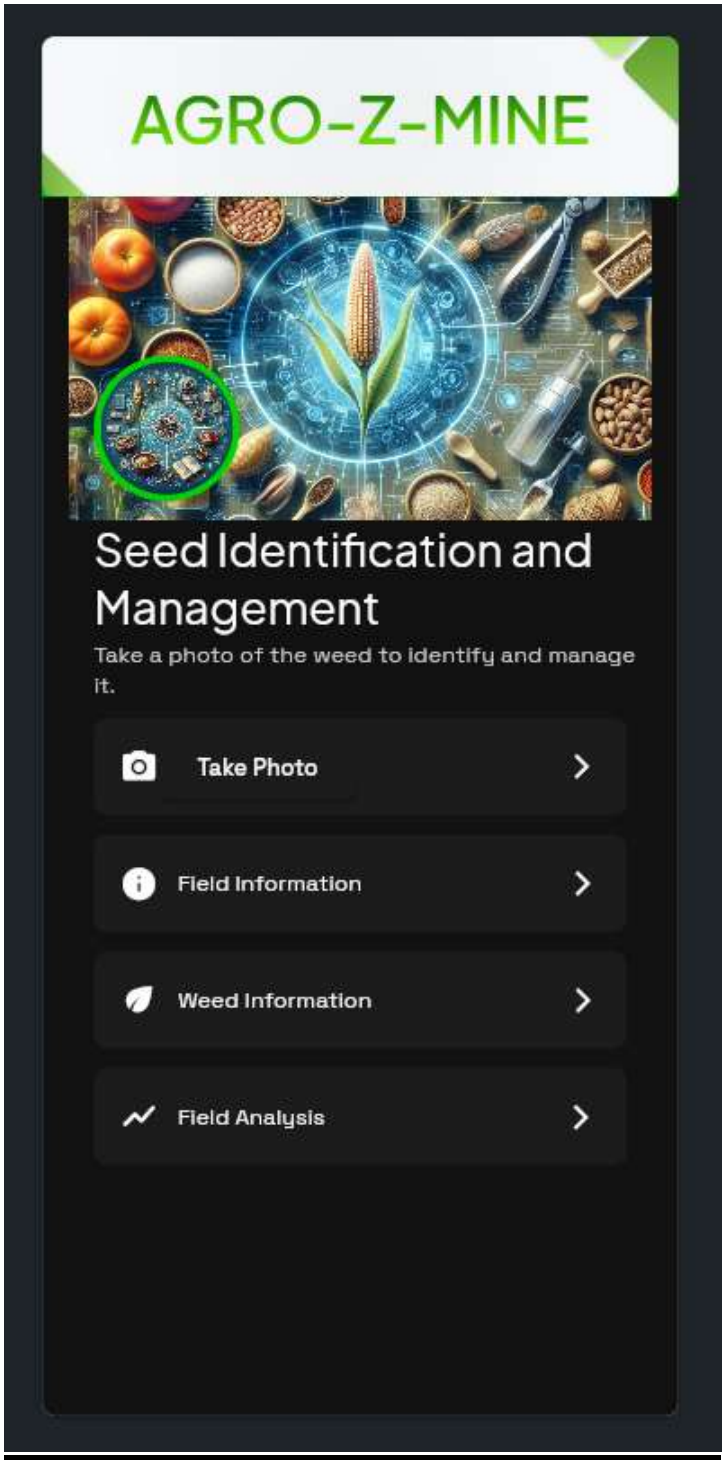
Firstly you have to Logged In with device key to get the sensed parameters of soil:



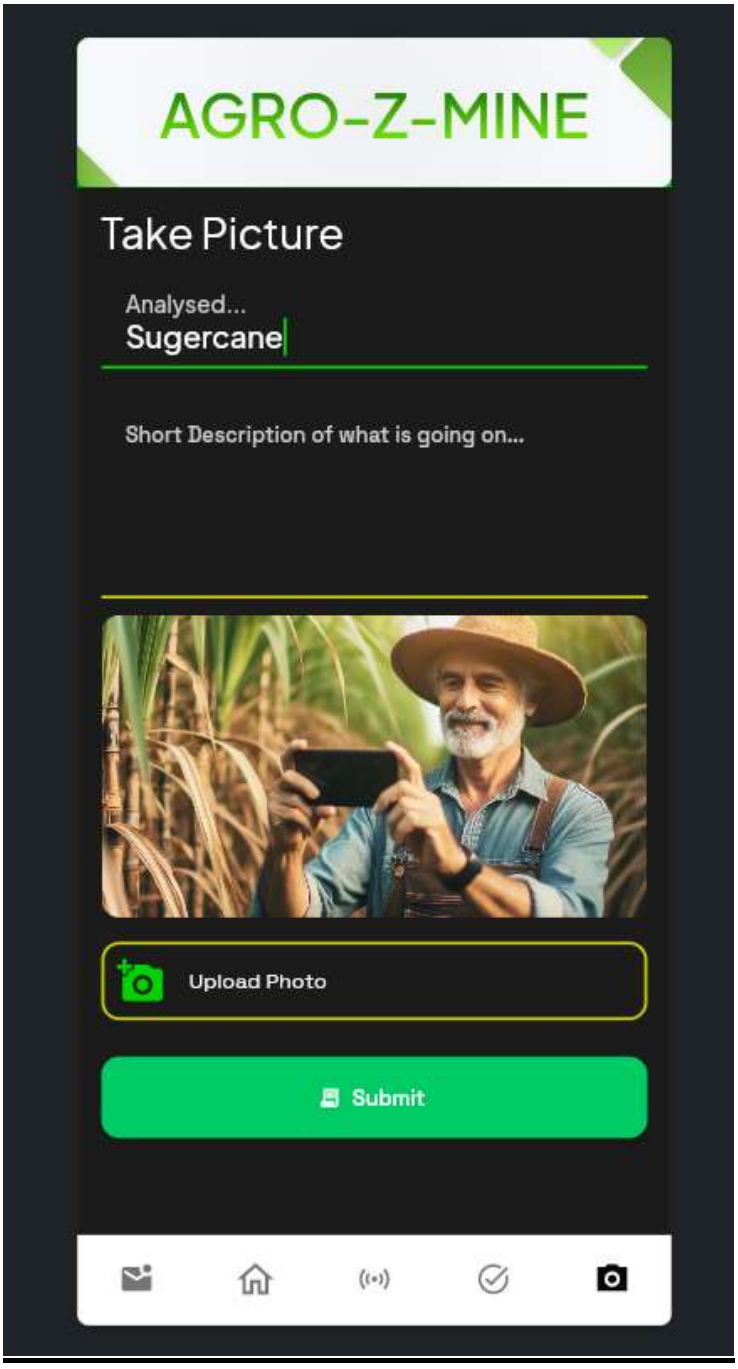
Then you can know your soil requirements like soil moisture, soil humidity, soil temprsture, soil ph value that is sensed by using the product Agro-z-mine



Then you can take a picture and know the fields soil requirements like soil moisture, soil humidity, soil temperature, soil ph value that is sensed by using the product Agro-z-mine and you have more options like Field information, weed information, fields analysis.

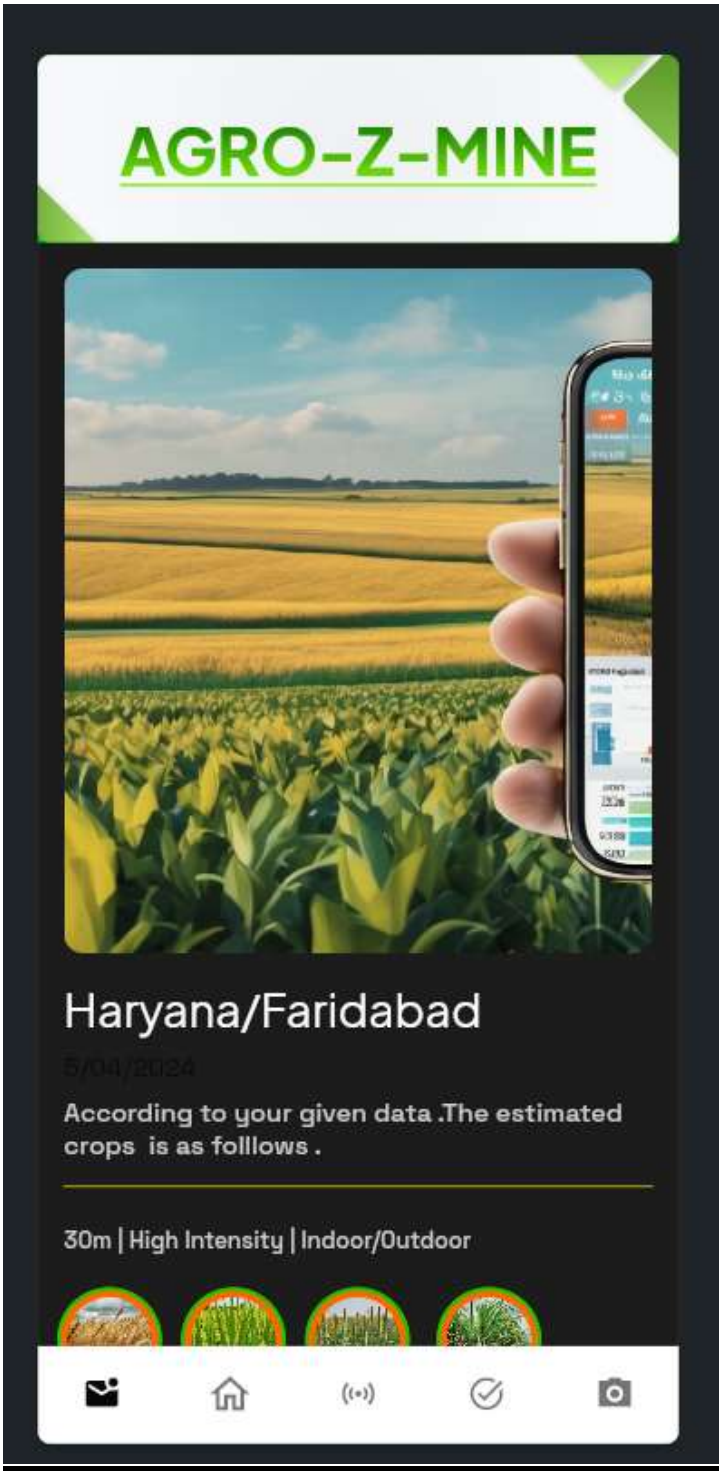


Information of that particular field and crop:

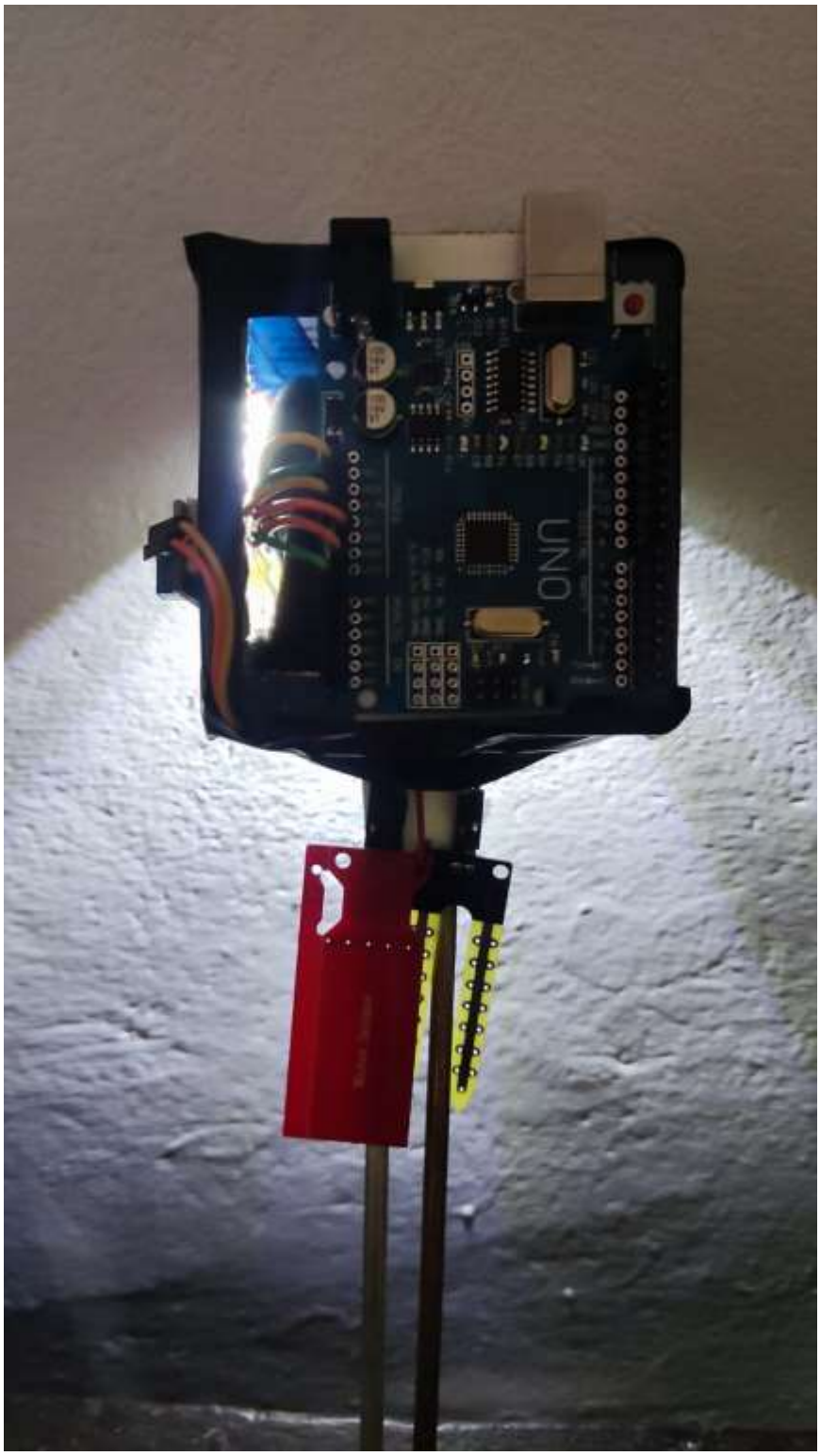



SUGARCANE
User Name
All
Pending
In Progress
Completed
Task Name
Assigned To
Status
Need Water
In Progress
Fertilizers
Completed
Need Pesticides
Pending
Need Heat
In Progress
Vegetable Planatation
Pending

Market price prediction by taking the picture of the field it uses the phone’s goole location:



And the device Agro-z-mine looks like:



OBJECTIVES AND SCOPE

5.1 OBJECTIVES OF THE STUDY

The objectives of the project are:-

- With the development of information technology in our society one can expect that computer systems to a larger extent will be embedded into our environment. Crop growth and production are basic information of national social and economic.

- Crop growth and production are related to the people's livelihood. The information is significance for making national and regional socioeconomic development planning, making plans of agriculture imports and exports to ensure national food security, guiding and regulating planting structure adjustment and improving the management level of the relevant enterprises and farmers.

- The timely and accurate regional agricultural condition monitoring is the basis of macro-control of the national agriculture. Use of remote sensing can realize the intelligent control of agricultural production, improve the monitoring accuracy and reliability, refinement, rich monitoring content, and expand the scope of monitoring.

- At the same time the results via the internet timely to support agriculture production decision.

5.2 FUTURE REFERENCES

- The machine learning requires a mass data so our recorded metero-logical data helps a lot in improving the performance. The region or area wise prediction can be done for giving more accurate farming suggestions of which crop can be grown by analyzing the data based on the soil and weather conditions.
- This paper can further be industrialized with camera feeds for checking the discoloration of leaves or plants and accordingly send the results to control the disease from anywhere.
- The field area can be protected from the trespassers by the deployment of AI and surveillance.
- By training machine learning models on a dataset of diseased and healthy plant images, AGRO-Z-MINE can predict diseases early. Farmers receive alerts and can take preventive measures promptly.
- Enhance irrigation efficiency by integrating soil moisture data with irrigation systems. AGRO-Z-MINE can trigger irrigation based on actual soil needs rather than fixed schedules.

6. PROBLEM STATEMENT

The problem statement of the project indicates that:

- Based on the above context, there is a need for a classification of data, which take care of all the different aspects in analyzing the frequently occurring Data.
- The proposed system devices a simple system, using which Farmer can get real time data on his website, so that he can take preventive and productive measures to increase the yield soil.

- The proposed system combines data classification, real-time data delivery, and analytics to empower farmers. By leveraging technology, farmers can enhance productivity, prevent yield loss, and make data-driven decisions for sustainable agriculture.

7. CONCLUSION

- The use of sensor Network and Cloud services in agricultural field provides high potential benefits which are economically worth in the field of agriculture.

- In this project we have proposed the IoT-based agricultural monitoring system which has built on the long-standing desire of farmers to ensure their land remains productive into the future. It also addresses the community's expectations and concerns for safe food and for environmental protection.

- An agricultural production system for the agricultural production using IoT technology and implemented it as GUI visualization software was designed. The IoT based agricultural production system through correlation analysis between the crop statistical information and agricultural environment information has enhanced the capacity of farmers, researchers, and government official to examine current conditions and predict future harvest.

8. REFERENCES

- www.google.com
- www.youtube.com
- www.stackoverflow.com
- www.w3schools.com