# ABSTRACT

This project presents an AI-powered precision farming solution aimed at reducing the overuse of fertilizers and pesticides. It integrates **Soil Health Card data**, **weather forecasts**, and **Leaf Color Chart (LCC)** analysis to offer intelligent, location-specific recommendations to farmers.

By leveraging machine learning algorithms, the system analyzes real-time data to provide crop-specific insights. This helps optimize input usage, enhance crop productivity, and promote eco-friendly agricultural practices, leading to healthier soil and lower farming costs.

Designed as a mobile-friendly application, the solution empowers farmers with data-driven

decisions right at their fingertips. It contributes to sustainable agriculture by combining

technology with traditional farming wisdom.

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# Module 1. User Authentication and Registration

The **User Authentication and Registration module** is the entry point for users to access the AgroAssist system. It allows new users—primarily farmers—to register by providing essential details such as **username, password, email, farmer ID**, and **location**. Upon successful registration, the user's information is stored securely in the database.

Existing users can **log in** using their credentials. The login process verifies the username and password by comparing the hashed password stored in the database. If authenticated successfully, the user is granted access to the dashboard, where personalized agricultural recommendations are available.

The system implements security features such as **password hashing** and **session management** to protect user data. In case of invalid login attempts, an appropriate error message is displayed. The module is designed to be **user-friendly**, secure, and accessible on various devices.

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# Module 2. Dashboard

**User Dashboard Access**  
Once the farmer logs in using their secure credentials, they are directed to a personalized dashboard, enabling seamless access to intelligent agricultural tools and services.

**Soil & Climate-Based Recommendations**

The system utilizes real-time input from the user about their **soil parameters**, **location**, and **weather data**. This data is fed into a machine learning model that suggests the most suitable **crop recommendations**, ensuring maximum yield and resource efficiency.

**AI-Powered Pest & Disease Prediction**

By uploading images of affected crops or leaves, users activate the **plant disease detection system**, which leverages trained image recognition models to diagnose diseases and suggest remedies instantly.

**Smart Notifications & Alerts**

The system periodically notifies the user about **climate updates**, **irrigation alerts**, and **fertilizer tips** through SMS or dashboard alerts, improving decision-making and reducing losses due to unforeseen events.

**Profile Customization & History**  
Users can track their **previous crop suggestions**, **uploaded images**, and **diagnosis history** from the profile section, enabling informed agricultural planning over multiple seasons.

**Data Security & Logout**  
Upon finishing tasks, users can securely **log out** from the dashboard, and all personal data is stored with high-level encryption, ensuring **user privacy and data integrity**.

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# Module 3. Crop Recommendation System Interaction

**User Input Options**

Users can initiate crop analysis in two ways—either by manually entering soil parameters like Nitrogen (N), Phosphorus (P), Potassium (K), pH, temperature, humidity, and rainfall; or by entering their **location**, which auto-fetches soil and weather data using integrated datasets.

**Soil & Weather Data Analysis**

Once the input is submitted, the system processes the provided values through a trained machine learning model. This model predicts the most suitable crops for the given soil and climate conditions, aiming to **maximize yield** and **minimize input waste**.

**AI-Powered-Recommendation-Report**  
The output is displayed in the form of a detailed report. It includes the analyzed values of soil and weather parameters, alongside the **AI-generated crop recommendations**. Each recommendation is backed by agro-scientific logic and current data trends.

**Report Accessibility and Storage**

The generated report can be **viewed, downloaded**, and stored for future reference. All user-specific reports are accessible through the "Reports" section, where previous submissions and recommendations are organized chronologically.

**Fallback and Validation**

If the location-based data fetch fails or is incomplete, the system gracefully falls back to manual input. Input fields include validation rules to ensure accurate data entry, helping maintain recommendation reliability.

**User Experience Focus**

Designed with simplicity in mind, this module offers a clean and interactive UI, enabling both tech-savvy and rural users to understand and use the system effectively for real-time decision-making on crop planning.

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# Module 4. ****Leaf Analysis & Fertilizer**** Recommendation

**Input Options**

Users can either upload a leaf image or manually describe symptoms (like yellowing, spots, curling, etc.). The system uses AI to process images or rules-based logic for symptom input.

**AI-Powered Diagnosis**

The system analyzes the input to detect **diseases, nutrient deficiencies, or pest attacks**. A detailed report is generated with the diagnosis, confidence level, treatment suggestions, and preventive tips.

**Report Access & User Experience**Users can **view, download, and store reports** in the dashboard. The interface is simple and intuitive, making it easy for both rural and tech-savvy users to assess plant health effectively.

# Module 5. Weather Forecast & Advisory System

**Real-Time Weather Detection**

The system automatically detects the user's location or allows manual selection, fetching real-time weather conditions including temperature, humidity, wind speed, and precipitation from reliable APIs for accurate farm planning.

**7-Day Forecast with Visual Insights**

It presents a dynamic 3 to 7-day forecast using graphical charts and forecast cards, helping farmers anticipate temperature and rainfall trends. These visuals enable proactive decisions such as irrigation planning or pest control scheduling.

**Smart Advisory & Alerts**The system gives farming tips and weather alerts based on forecasts. Users can also download personalized reports and set custom notifications for extreme conditions.

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# Module 6. Final Report

**Comprehensive Farm Report Overview**

This module provides users with a detailed **final report** summarizing their soil analysis, weather conditions, and AI-generated crop recommendations. Each report is uniquely identified and timestamped, helping users track their farming decisions over time.

**Interactive Insights & Recommendations**

The report displays analyzed data such as **nitrogen, phosphorus, potassium levels, pH, temperature, rainfall**, and **humidity**. It highlights the **recommended crop** best suited for the given conditions, along with expected yield potential and a summary of benefits.

**Download, Manage & Monitor**Users can **download, view, or delete** any report directly from the dashboard. The layout is clean and accessible, allowing for easy review and long-term monitoring of farm inputs.

# PSEUDOCODE FOR MODULES

# 1.Login authentication

16. 6. Card Management

1. START
2. DISPLAY Login/Register Page
3. IF user clicks "Register" THEN
4. PROMPT user to enter:
   1. Username
   2. Password
   3. Email
   4. Farmer ID
   5. Location
5. HASH the entered password
6. CONNECT to database
7. CHECK IF username or email already exists
   1. IF exists THEN
      1. DISPLAY "Username or email already exists" error
   2. ELSE
      1. INSERT user details into users table
      2. DISPLAY "Registration successful"
   3. END IF
8. CLOSE database connection
9. END IF
10. IF user clicks "Login" THEN
11. PROMPT user to enter:
    1. Username
    2. Password
12. CONNECT to database
13. FETCH user record using entered username
14. IF user exists AND password matches hashed password THEN
    1. START user session
    2. STORE user ID and username in session
    3. REDIRECT to dashboard
15. ELSE
    1. DISPLAY "Invalid username or password"
16. END IF
17. CLOSE database connection
18. END IF
19. IF user clicks "Logout" THEN
20. CLEAR session data
21. REDIRECT to login page
22. DISPLAY "Logged out successfully"
23. END IF
24. ENDELSE IF choice == 7 THEN
25. Logout and terminate session
26. Display "Thank you for using ATM!"
27. END IF
28. ELSE
29. Display "Invalid PIN, please try again"
30. END IF
31. END

**2. Dashboard**

1. START
2. IF user is authenticated THEN
3. REDIRECT to Dashboard Page
4. DISPLAY welcome message with user’s name
5. SHOW dashboard options:
   * Crop Recommendation
   * Leaf Analysis
   * Weather Info
   * Final Report
6. IF user selects "Crop Recommendation" THEN
7. PROMPT user to enter:
   * Soil parameters (N, P, K, pH, temperature, humidity, rainfall)
   * OR
   * Location (PIN or City)
8. IF soil parameters entered THEN
   * FEED input into ML crop recommendation model
9. ELSE
   * FETCH soil/weather data using location
   * FEED fetched data into ML model
10. END IF
11. DISPLAY recommended crop
12. END IF
13. IF user selects "Leaf Analysis" THEN
14. PROMPT user to upload leaf image
15. PROCESS image using trained CNN model
16. ANALYZE image for:
    * Color patterns
    * Disease symptoms
17. RETURN diagnosis and recommended treatment
18. END IF
19. IF user selects "Weather Info" THEN
20. FETCH real-time weather based on user location
21. DISPLAY weather forecast and advisory
22. END IF
23. IF user selects "Final Report" THEN
24. RETRIEVE all previous analyses linked to user
25. DISPLAY in report format with option to download
26. END IF
27. ELSE
28. REDIRECT to Login Page
29. END IF
30. END

**3. Crop Recommendation System Interaction**

1. START
2. DISPLAY options:
3. Enter Soil Parameters Manually
4. Use Location to Auto-Fetch Data
5. IF user selects manual input THEN
6. PROMPT user to enter:
   1. Nitrogen (N)
   2. Phosphorus (P)
   3. Potassium (K)
   4. pH
   5. Temperature
   6. Humidity
   7. Rainfall
7. ELSE IF user selects location-based input THEN
8. PROMPT user to enter location (PIN/City)
9. FETCH soil and weather data using API
10. IF data fetch fails THEN
11. DISPLAY fallback to manual input
12. END IF
13. END IF
14. VALIDATE input values
15. IF valid THEN
16. FEED data into crop recommendation ML model
17. RECEIVE predicted crop(s)
18. DISPLAY recommendation report with:
    1. Input summary
    2. Recommended crop
    3. Suitability reasons
    4. Expected yield info
19. STORE report in user's dashboard
20. ALLOW user to view/download report
21. ELSE
22. DISPLAY "Invalid input" message
23. END IF
24. END

**4. leaf analysis & fertilizer recommentations**

1. START

2. IF user is authenticated THEN

3. REDIRECT to Dashboard Page

4. DISPLAY welcome message with user’s name

5. SHOW dashboard options:

- Crop Recommendation

- Leaf Analysis

- Weather Info

- Final Report

6. IF user selects "Leaf Analysis" THEN

7. PROMPT user to upload leaf image

8. IF image uploaded THEN

9. PROCESS image using trained CNN model

10. ANALYZE image for:

- Color patterns

- Disease symptoms (yellowing, spots, etc.)

11. IF disease detected THEN

12. RETURN diagnosis (e.g., "Fungal Infection")

13. PROVIDE recommended treatment (e.g., "Apply fungicide X")

14. PROVIDE preventive tips (e.g., "Avoid over-watering")

15. ELSE

16. RETURN "No disease detected"

17. END IF

18. ELSE IF user chooses to describe symptoms THEN

19. PROMPT user to enter symptoms (e.g., yellowing, spots, curling)

20. ANALYZE symptoms using predefined rule-based logic

21. IF symptom matches a known disease THEN

22. RETURN diagnosis based on symptoms (e.g., "Pest Attack")

23. PROVIDE recommended treatment (e.g., "Use pesticide Y")

24. PROVIDE preventive tips (e.g., "Regularly check for pests")

25. ELSE

26. RETURN "Symptoms not recognized, please consult expert"

27. END IF

28. END IF

29. DISPLAY diagnosis, treatment suggestions, and preventive tips

30. STORE analysis result in user's dashboard

31. END IF

32. ELSE

33. REDIRECT to Login Page

34. END IF

35. END

## 5. Weather Forecast & Advisory System

1. START

2. IF user is authenticated THEN

3. REDIRECT to Dashboard Page

4. DISPLAY welcome message with user’s name

5. SHOW dashboard options:

- Crop Recommendation

- Leaf Analysis

- Weather Info

- Final Report

6. IF user selects "Weather Info" THEN

7. PROMPT user to allow location access OR manually enter location

8. IF location access granted OR location entered THEN

9. FETCH real-time weather data using weather API

10. DISPLAY current weather:

- Temperature

- Humidity

- Wind Speed

- Precipitation

11. FETCH 7-day weather forecast using API

12. DISPLAY forecast using:

- Visual charts (temperature/rainfall trends)

- Forecast cards (daily breakdown)

13. ANALYZE forecast data for critical patterns

14. IF extreme weather predicted THEN

15. GENERATE weather alert (e.g., "Heavy Rainfall Expected")

16. NOTIFY user with smart alert

17. END IF

18. PROVIDE farming advisory tips based on forecast:

- Irrigation schedule

- Pest/Disease control suggestions

19. ALLOW user to:

- Download personalized weather report

- Set custom weather alerts/notifications

20. ELSE

21. DISPLAY error: "Location not available"

22. END IF

23. END IF

24. ELSE

25. REDIRECT to Login Page

26. END IF

27. END

**6. Final Report**

1. START

2. IF user is authenticated THEN

3. REDIRECT to Dashboard Page

4. DISPLAY welcome message with user’s name

5. SHOW dashboard options:

- Crop Recommendation

- Leaf Analysis

- Weather Info

- Final Report

6. IF user selects "Final Report" THEN

7. RETRIEVE all stored reports linked to the user

8. FOR each report DO

9. DISPLAY:

- Timestamp and unique report ID

- Soil data: N, P, K, pH

- Weather data: Temperature, Rainfall, Humidity

- Recommended crop

- Expected yield and benefits

10. ENABLE interaction options:

- View full report

- Download report (PDF/CSV)

- Delete report from dashboard

11. END FOR

12. PROVIDE summary insights:

- Total reports generated

- Crop frequency suggestions

- Farming trend insights

13. END IF

14. ELSE

15. REDIRECT to Login Page

16. END IF

17. END