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KrishiMitra: A Smart Agriculture Advisory System

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A B S T R A C T

Agriculture plays an important role in India, while farmers may face difficulties in accessing timely and understandable information about crop selection, weather conditions, soil, crop diseases, market information and government support programmes. This paper presents KrishiMitra, a web-based smart agriculture advisory system that brings several farming-support services together in a single platform. The system includes farmer login and profile management, an AI-powered farming assistant, crop recommendation, weather information, soil analysis, image-based assistance for possible crop diseases and pests, market and mandi information, government-scheme information, multilingual support and location-based advisory. The frontend is developed using React.js and Vite, while the backend uses Node.js, TypeScript and Express.js. Google Gemini API is integrated for AI-assisted responses, and Firebase Firestore is used for database operations. The platform aims to make agricultural information easier to access through a unified interface. The reliability of recommendations depends on the quality of user inputs, connected data sources and validation of generated responses.

Keywords: Smart agriculture; agricultural advisory system; crop recommendation; weather information; soil analysis; Gemini API; Firebase Firestore; multilingual platform.

1. Introduction

Agriculture supports livelihoods and food production, and farmers make decisions throughout the crop cycle. These decisions include selecting crops, preparing soil, managing irrigation, identifying crop-health problems and deciding when and where to sell produce. Such decisions require relevant information about weather, soil, crop health, market conditions and available government support. When this information is spread across different services, it can be difficult for farmers to locate and understand it.\n\nKrishiMitra is designed as an integrated web-based advisory platform that brings multiple farming-support features together. It provides a common interface for accessing an AI-powered farming assistant, crop recommendation, weather information, soil analysis, image-based crop disease and pest assistance, market information and government schemes. The platform also includes multilingual support, farmer profiles and location-based advisory.

2. Problem Statement

Farmers may need to consult multiple sources to obtain information about crop selection, weather, soil, crop diseases, market prices and government schemes. Accessing and understanding information from separate platforms can be time-consuming, particularly when users need information in a preferred language or relevant to their location. An integrated system is therefore useful for organising these services in one place while making the source and limitations of information clear.

3. Objectives

The main objectives of KrishiMitra are to develop a user-friendly agricultural advisory platform; provide AI-assisted answers to farming-related questions; support crop recommendation and soil-related guidance; display weather information; assist with preliminary crop disease and pest image analysis; make market and government-scheme information easier to access; support multiple languages and location-based advisory; and provide farmer login and profile management.

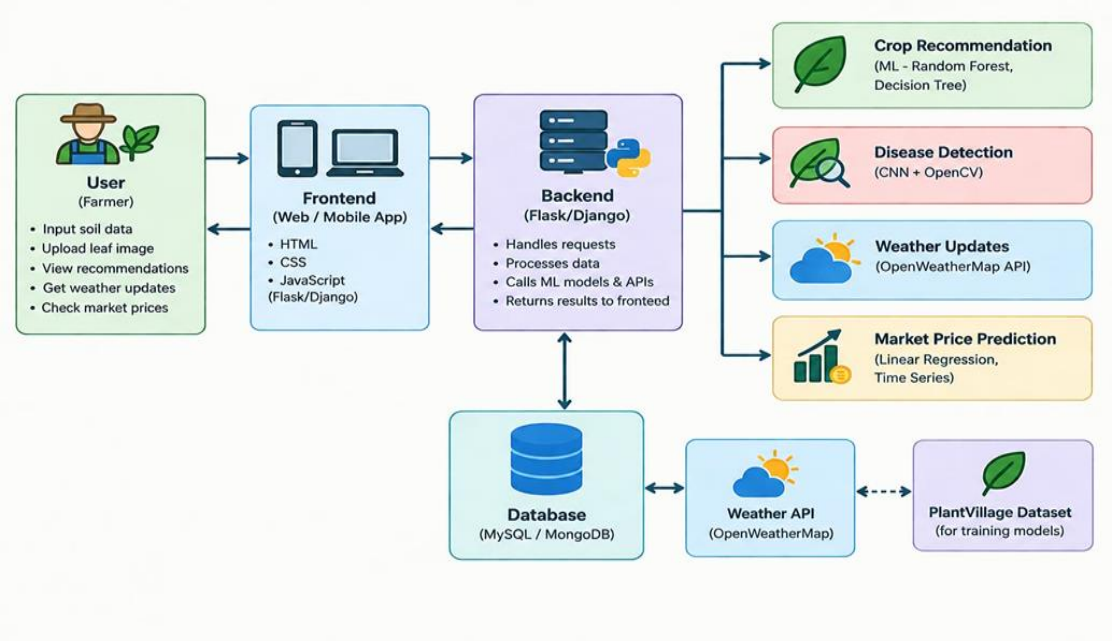
4. Proposed System

KrishiMitra provides a farmer dashboard through which users can access the available agricultural modules. The frontend is developed using React.js and Vite. Server-side operations and requests are handled by backend services developed using Node.js, TypeScript and Express.js. Google Gemini API

is integrated for AI-assisted interaction, and Firebase Firestore is used for database operations. The application returns processed information to the user through the relevant dashboard or module.

5. System Architecture

The system follows a frontend-backend architecture. The frontend accepts user inputs and displays results. The backend handles application requests, server-side processing and communication with integrated services. The AI integration supports responses to farming-related queries, while Firebase Firestore stores and retrieves application data. The general workflow is: user login; selection of a dashboard module; submission of the required input; backend processing and service integration; retrieval or generation of a response; and display of the result to the user.



6. Technologies Used

React.js and Vite are used for frontend development. Node.js, TypeScript and Express.js are used for backend development and request handling. Google Gemini API provides AI-assisted responses. Firebase Firestore is used for database storage and retrieval.

7. System Modules

7.1 Farmer Login and Profile Management

This module provides the farmer access flow and profile area for maintaining user-related information used by the application.

7.2 AI Farming Assistant

This module allows users to ask agriculture-related questions and receive AI-assisted responses through the integrated Google Gemini API. Generated advice should be checked against reliable agricultural guidance when necessary.

7.3 Crop Recommendation and Weather Information

The crop recommendation module presents crop suggestions based on the inputs and recommendation logic supported by the application. The weather module provides weather-related information intended to help farmers consider local conditions while planning farming activities. The accuracy and freshness of displayed information depend on the connected data sources.

Sl. No	Module / Feature	Description
1	Crop Recommendation	Suggests suitable crops based on the inputs provided by farmers and the application's recommendation logic.
2	Weather Information	Displays weather-related information to help farmers understand local weather conditions.

Sl. No	Module / Feature	Description
3	Location-Based Weather	Provides weather information according to the selected or available location.
4	Farming Planning Support	Helps farmers consider crop suggestions and weather conditions while planning agricultural activities.

7.4 Soil Analysis and Image-Based Crop Health Assistance

The soil analysis module provides soil-related information and guidance based on available inputs or data. The image assistance module accepts crop images for AI-assisted analysis of possible disease or pest symptoms. These results are preliminary guidance and should not be treated as certified laboratory results or a definitive diagnosis.

7.5 Market Information and Government Schemes

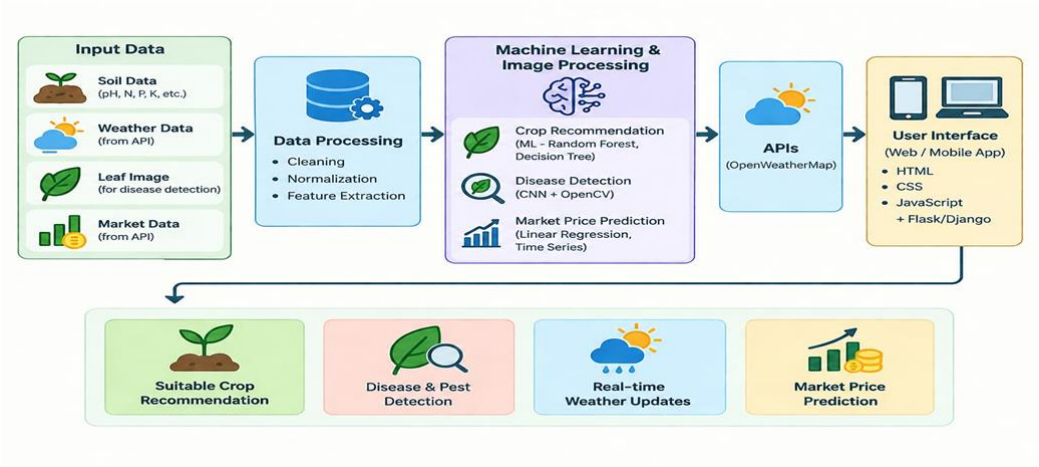
The market module presents available market and mandi-related information. Prices and market details should be displayed with their source and update date/time. The government schemes module organises information about agriculture-related programmes and directs users to official sources for current eligibility and application details.

7.6 Multilingual and Location-Based Advisory

Multilingual support helps users access the application in supported languages. Location-based advisory uses the location information available to the application to make displayed agricultural information more relevant to the user's area. Translation quality and location accuracy depend on the services and data configured in the application.

8. Methodology

A farmer signs in and selects a required service from the dashboard. The user enters the necessary information, such as a question, crop details, soil inputs, location or image. The frontend sends the request to the backend, where server-side processing is performed. When AI assistance is required, the backend communicates with the Gemini API. Application information is stored or retrieved through Firebase Firestore as needed. The processed response is then displayed to the user.



9. Results and Discussion

KrishiMitra brings the listed agricultural support modules together in a common web-based interface. Its architecture combines the frontend, backend, AI integration and database components. The platform is intended to reduce the need to navigate between separate interfaces for different farming-related information. Actual performance and usefulness must be demonstrated through testing of the working application.\n\n[Before submission, add actual test cases and results for login, crop recommendation, weather information, soil analysis, image assistance, market information, scheme information, language selection, location handling and database operations. Add genuine screenshots if permitted. Do not insert invented accuracy percentages, response times or user counts.]

10. Limitations

AI-generated responses may be incomplete or incorrect and should be verified when necessary. Weather, market and scheme information depend on the availability and update frequency of connected sources. Image-based assistance may be affected by image quality and similarity between symptoms. Soil guidance depends on the accuracy of available data. Translation quality may vary between supported languages.

11. Conclusion

This paper presents KrishiMitra, a smart agriculture advisory system that combines multiple farmer-support services in one web-based platform. The system includes farmer login and profile management, an AI-powered farming assistant, crop recommendation, weather information, soil analysis, image-based disease and pest assistance, market and mandi information, government-scheme information, multilingual support and location-based advisory. React.js and Vite are used for the frontend, Node.js, TypeScript and Express.js for backend services, Google Gemini API for AI-assisted interaction and Firebase Firestore for database operations. The system aims to improve access to agricultural information. Its reliability depends on verified data sources, appropriate testing and clear communication of AI limitations.

12. Future Enhancements

Future work may include integrating additional verified agricultural and government data sources, improving regional-language terminology and voice interaction, conducting field testing with farmers and agricultural experts, evaluating image-based disease assistance using labelled datasets, and improving monitoring of API availability, security, response time and data consistency.

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