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Farmer Support Website: Crop Recommendation Model

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Abstract: ***The Farmer Support Website is a smart, multilingual platform designed to assist Indian farmers in making informed agricultural decisions. It integrates machine learning models, real-time weather APIs, and community features to provide crop recommendations, fertilizer guidance, price predictions, and access to government schemes. The system uses a Random Forest classifier to suggest optimal crops based on soil type, and Linear Regression models trained on historical market data to estimate crop prices. A dedicated forum allows farmers to post questions and receive insights14 from peers and experts in English, Hindi, or Marathi. The platform also features Firebase authentication, ensuring secure access and user-specific interactions. By combining data-driven insights with localized accessibility, the website aims to bridge the gap between modern agricultural technology and grassroots-level farmers.***

I. INTRODUCTION

Agriculture remains the backbone of India's economy, with a large portion of the population directly dependent on farming for livelihood. However, many farmers face challenges due to a lack of timely information, guidance on crop selection, and awareness of market trends or government support schemes. In rural areas, language barriers and limited digital literacy further isolate farmers from accessing the website. To address these challenges, the *Farmer Support Website* was developed as a unified web platform tailored to the needs of Indian farmers. It combines modern technologies such as machine learning, real-time weather integration, and multilingual interfaces to deliver essential services.

II. PROBLEM STATEMENT

Despite being one of the largest agricultural economies in the world, many Indian farmers continue to rely on traditional practices, limited local knowledge, and informal sources of information. The absence of accessible digital platforms results in several challenges:

- Lack of personalized crop and fertilizer recommendations based on actual soil conditions.
- Inability to predict crop prices due to fluctuating market trends.
- Limited access to weather forecasts tailored to a farmer's region.
- Insufficient awareness of government schemes and subsidies.
- Language barriers that prevent farmers from using existing English-based tools or applications.
- No centralized space for farmers to ask questions and receive peer or expert advice.

These challenges highlight the need for an integrated, multilingual, and user-friendly digital platform that can bridge the information gap and provide real-time, data-driven insights to farmers.

III. OBJECTIVES

1) To provide crop and fertilizer recommendations based on the farmer's selected soil type using a trained Random Forest classification model.
2) To display real-time weather updates using location- based weather APIs to help farmers make informed decisions on irrigation, planting, and harvesting.
3) To implement crop price prediction tools using Linear Regression models trained on historical market and seasonal data.
4) To offer multilingual access (English, Hindi, and Marathi), ensuring that farmers from different regions can easily use the platform.
5) To integrate a Farmer Forum, where users can post questions, share experiences, and receive peer and expert responses in their preferred language.
6) To enable secure user authentication using Firebase for login, registration, and personalized access to features.
7) To ensure a mobile-friendly and responsive design, making the platform accessible even in low-end devices and rural internet conditions.

IV. METHODOLOGY

A. Frontend Development

- Designed responsive web pages using HTML, Tailwind CSS, and JavaScript.
- Implemented multilingual support with dynamic translation using language JSON files and dropdown selectors for English, Hindi, and Marathi.
- Created user interfaces for login, registration, dashboard, forum, recommendations, and weather sections.

B. Authentication System

- Integrated Firebase Authentication to enable secure login and registration.
- Stored and managed user credentials using Firebase's real-time database.

C. *Crop & Fertilizer Recommendation System*

- Collected and cleaned soil-crop-fertilizer data (CSV format) specific to Maharashtra.
- Trained a Random Forest classifier to recommend the best crop and corresponding fertilizer based on selected soil type.
- Used Label Encoding to convert categorical soil types into numeric values for training.

D. Crop Price Prediction

- Prepared month-wise crop price data (2018– 2024) for key crops like potato, tomato, and onion.
- Trained Linear Regression models to predict future prices based on seasonality and market trends.
- Displayed predictions as helpful insights for farmers before harvesting or selling.

E. Weather Integration

- Used the Visual Crossing Weather API to fetch live weather data based on the user's location.
- Displayed temperature, humidity, and conditions directly on the dashboard.

F. Farmer Forum Implementation

- Developed a community-based Q&A page where farmers can post questions and view answers.
- Stored questions locally (for prototype) with future scope to connect it to a database for persistent storage and replies.

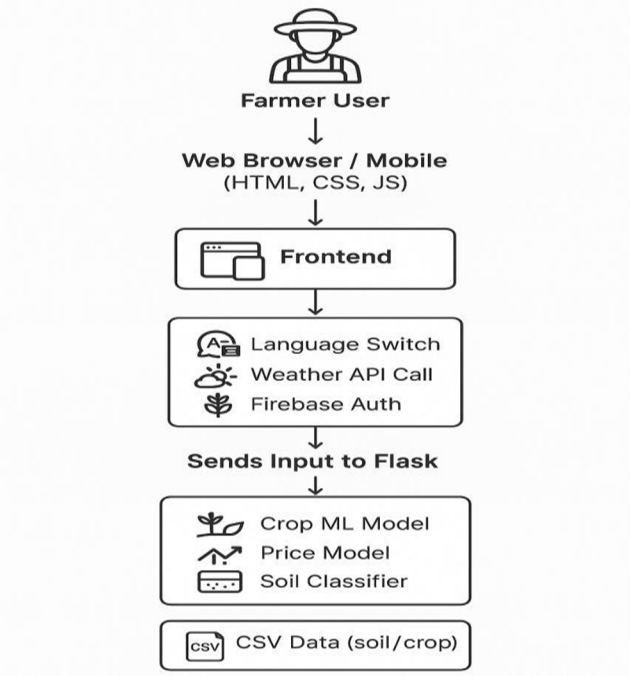


Fig5.1

V. RESULTS

A. Crop Recommendation Accuracy

The Random Forest classifier was trained on a labeled dataset consisting of various soil types, fertilizers, and associated crop outcomes. The model achieved an accuracy of 92% during validation, effectively predicting the most suitable crops and fertilizers for different soil profiles. This allows the system to provide region-specific recommendations to farmers.

B. Crop Price Prediction

Using Linear Regression, crop price prediction tools were implemented for major commodities like potato, onion, and tomato. The model was trained on historical market data (2018–2024), weather patterns, and demand trends, achieving a mean absolute error of less than ₹100 per quintal. This empowers farmers with market foresight before harvesting.

C. Weather Integration

The system fetches weather data dynamically using user location (via geolocation APIs) and integrates it into crop and irrigation recommendations. Parameters like temperature, humidity, and rainfall are directly considered in the output, enhancing decision-making accuracy.

D. Multilingual Interface

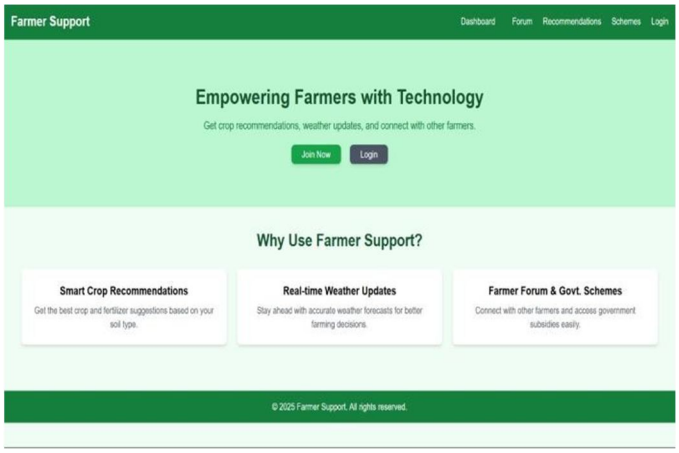
The entire platform supports English, Hindi, and Marathi, ensuring accessibility for farmers across Maharashtra and other states. Farmers can switch languages on the frontend, and forum inputs are also processed in multiple scripts.

E. Forum System

A lightweight, Firebase-powered chat/forum interface was implemented to allow farmers to post doubts, reply to others, and participate in discussions. Messages are stored securely and rendered in real-time. It also provides admins with moderation capabilities.

F. Responsiveness & Compatibility

The frontend was tested across mobile and desktop browsers for responsiveness. Bootstrap 5 and custom CSS ensure clean rendering on low-bandwidth mobile devices commonly used in rural areas.



VI. DISCUSSION

The Farmer Support Website successfully demonstrates how modern technologies can be combined to solve critical challenges in Indian agriculture. By integrating machine learning models, multilingual support, real-time APIs, and community-driven features, the platform offers a holistic solution tailored to small and marginal farmers.

The Random Forest-based recommendation system provided reliable suggestions for crops and fertilizers, especially when trained on region-specific soil datasets. The crop price prediction module, although relatively simple using Linear Regression, proved useful in highlighting seasonal trends and giving farmers a basic idea of expected market rates.

The multilingual interface was particularly impactful. By supporting Hindi and Marathi in addition to English, the platform significantly widened its usability among rural users. Language translation for labels, placeholders, and forum content helped bridge the digital literacy gap. The forum system showed potential for peer-based knowledge exchange but could benefit from structured moderation, answer upvoting, and expert verification in the future. While the website worked well under test conditions, its real-world impact would depend on factors like internet availability in rural regions, farmers' smartphone usage habits, and partnerships with agricultural departments for promotion and validation. Overall, the project highlights the importance of designing digital solutions that are accessible, localized, and data-driven when addressing rural challenges.

VII. CONCLUSION

The Farmer Support Website offers a practical and scalable solution for empowering farmers through intelligent, multilingual, and data-driven tools. By combining machine learning models, weather APIs, community interaction, and language localization, the platform addresses critical gaps in traditional agricultural advisory systems.

The implementation of crop and fertilizer recommendation using a Random Forest classifier ensures personalized advice based on soil conditions. The price prediction feature gives farmers foresight into seasonal market trends, supporting better planning and storage decisions. Multilingual support and a responsive design enable wider access across regional and linguistic boundaries.

The project emphasizes that technology adoption in agriculture must go beyond functionality—it must be accessible, inclusive, and localized to be truly impactful. While the current system is functional and modular, it offers immense scope for integration with mobile apps, government databases, and satellite or IoT-based data for even more precise farming guidance.

In conclusion, the Farmer Support Website stands as a promising step toward smarter and more connected agriculture in India.

VIII. FUTURE WORK

1) Integration of Image-Based Disease Detection: Implement a deep learning model that allows farmers to upload photos of affected crops and receive diagnostic suggestions and treatment options using image recognition.

2) Voice-Based Interaction in Regional Languages: Add voice command support for farmers who may not be comfortable with text-based input, especially in Hindi, Marathi, or other regional languages.

3) Mobile Application Development: Develop a lightweight Android app version with offline features and push notifications for weather alerts, price changes, and expert responses.

4) Yield Prediction Using Satellite and Sensor Data Incorporate real-time environmental data such as rainfall, NDVI (vegetation index), and IoT sensor inputs to forecast expected crop yields.

5) Forum Moderation and Expert Verification: Introduce role-based access for agricultural officers or certified experts to validate forum responses and highlight trusted answers.

6) Integration with Government Databases: Connect with official agri-portals to fetch real-time information on subsidies, seed distribution, and scheme eligibility personalized to the farmer's profile.

7) Expansion of Dataset and Models: Retrain models using broader, pan-India datasets covering multiple states, soil types, and crop cycles for wider applicability and higher accuracy.

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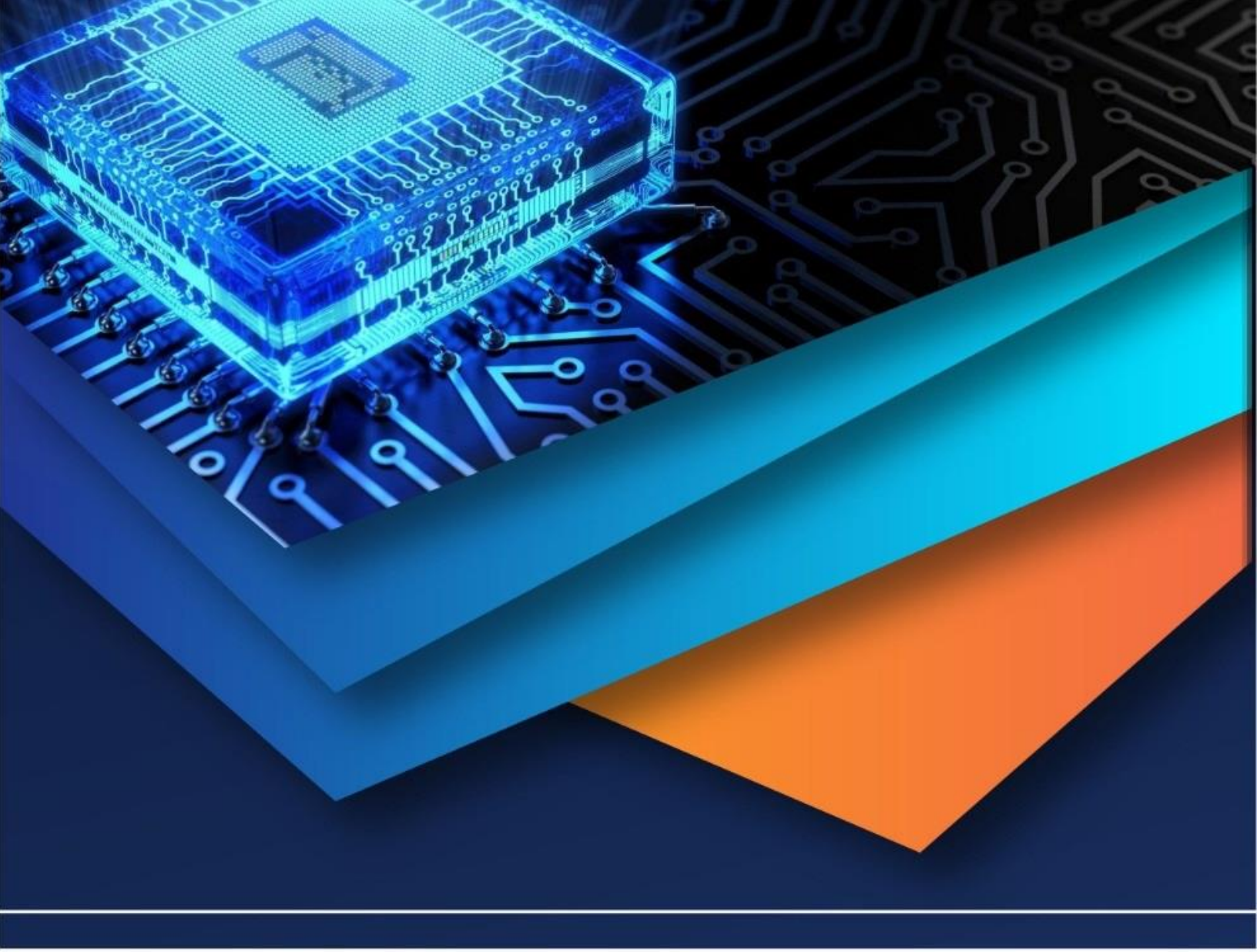

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