



KISAN AI – FARMER ASSISTANT

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Abstract: This paper presents KisanAI, an integrated AI-powered assistant platform designed to mitigate the challenges of fragmented digital agricultural services in India. Developed using a high-performance stack of Next.js, React, and TypeScript, the platform unifies critical services into a single accessible interface. A central contribution of this work is the enhancement of digital inclusion through Hindi voice-based Q&A support tailored for rural dialects. The system employs Python-based AI/ML microservices to provide real-time crop health diagnostics via image analysis, enabling early detection of pests and diseases. Beyond advisory tools, the application integrates real-time weather forecasting, localized market price updates, and a streamlined digital application process for the Kisan Credit Card (KCC) loan program. By consolidating AI-driven diagnostics with financial and market intelligence, KisanAI optimizes farmer decision-making and supports sustainable agricultural development.

Index Terms - Digital Agriculture, KisanAI, Natural Language Processing, Crop Disease Detection, Machine Learning, Kisan Credit Card (KCC), Rural Digital Inclusion, Next.js.

I. INTRODUCTION

The agricultural sector in India is currently hindered by a fragmented digital landscape where essential information—such as real-time weather, localized market prices, and crop diagnostics—is scattered across multiple, non-integrated platforms. This lack of a unified system, combined with language barriers, leads to suboptimal decision-making and underutilized resources in rural communities. The KisanAI project addresses these inefficiencies by providing an AI-powered assistant tailored to the diverse needs of Indian farmers. By leveraging a modern tech stack including Next.js and Python-based AI microservices, the platform simplifies access to critical resources through a single, intuitive interface.

The manual handling of agricultural data often results in technological barriers for small-scale farmers. There is a significant need for an integrated advisory system that combines real-time data with actionable insights. KisanAI bridges this gap by offering Hindi voice support and integrating financial services, such as the Kisan Credit Card (KCC) loan application, directly into the agricultural advisory workflow.

II. LITERATURE REVIEW

The contemporary digital agriculture landscape is characterized by a fragmented ecosystem where platforms often provide isolated functionalities rather than integrated solutions. Previous research by the AIKosh Team introduced AI-powered voice assistants focusing on government schemes and weather data in Hindi, yet these systems remain standalone tools with limited diagnostic capabilities [1]. Similarly, the "Kisan Sathi" platform explored multilingual NLP interfaces for smart agriculture, but it failed to incorporate features for financial service integration or digital loan processing [2].

Significant progress has been made in crop monitoring through IoT and Machine Learning integrations, with some studies achieving over 95% accuracy in disease detection [3, 5]. However, these models often function as standalone applications without real-time market synchronization or weather-specific advisories. Furthermore, while the Reserve Bank Innovation Hub has pioneered the end-to-end digitalization of Kisan Credit Card (KCC) lending to reduce turnaround times, their solution lacks the agricultural advisory support necessary for holistic farm management [4]. By consolidating AI-driven diagnostics, market intelligence, and streamlined KCC application support into a single interface, KisanAI addresses the research gap left by these disparate systems.

III. PROPOSED METHODOLOGY

The development of KisanAI follows a service-oriented architectural approach to ensure modularity and real-time performance across diverse agricultural services. This section outlines the technical framework and the structural design of the platform.

A. Technical Requirements and Stack

The platform is built on a modern, high-performance web stack to ensure responsiveness and scalability. The frontend utilizes Next.js 15 and React 18 paired with TypeScript to provide a robust, type-safe user experience. For styling, Tailwind CSS is employed to maintain a utility-first, responsive design compatible with both mobile and desktop devices.

The backend infrastructure is powered by **Node.js** (Express.js), which manages business logic, user authentication, and data flow orchestration. Data persistence is handled by **MongoDB**, chosen for its flexibility in managing diverse datasets such as user profiles and government scheme logs. Core AI capabilities, including image-based crop analysis and Hindi Natural Language Processing (NLP), are deployed as independent **Python-based microservices** to handle computationally intensive tasks efficiently.

B. System Architecture

The architecture of KisanAI is designed to handle multi-modal inputs, specifically voice queries and image uploads, through a distributed system.

1. **User Interface Layer:** Farmers interact via mobile or web browsers, providing voice input for Q&A or images for health diagnostics.
2. **Service Layer:** The frontend captures these inputs and routes them to the appropriate AI/ML microservices or the Backend API.
3. **Integration Layer:** The system interfaces with external APIs to fetch localized weather forecasts and real-time market price updates.
4. **Financial & Scheme Layer:** A dedicated module manages the digital Kisan Credit Card (KCC) application workflow, coordinating document uploads and eligibility checks with the database.

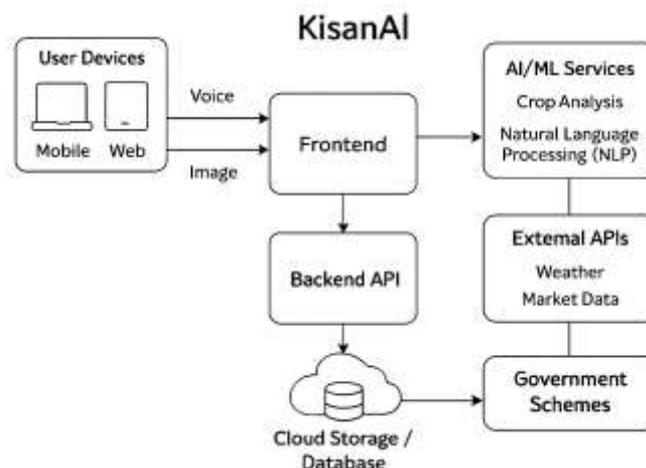


Fig. 1. System Architecture of KisanAI

C. Data Flow Analysis

The operational flow of the KisanAI system is mapped through multi-level Data Flow Diagrams to illustrate how farmer requests are processed. At the fundamental level, the system acts as a central hub receiving voice queries, crop images, and loan application details from the user.

The internal logic is divided into specialized processes:

1. Query Processing: Voice inputs are transformed into data requests and matched against a dedicated Farming Knowledge Base to return localized advice.
2. Diagnostic Flow: Crop images are routed to the analysis module, which generates a health report that is simultaneously returned to the farmer and saved for future reference.
3. Financial Workflow: The KCC application module handles a complex sequence including form capture, document verification, and submission to the banking system, with real-time status tracking for the user.
4. External Integration: Continuous data streams from weather and market APIs are processed to provide real-time alerts and price updates.

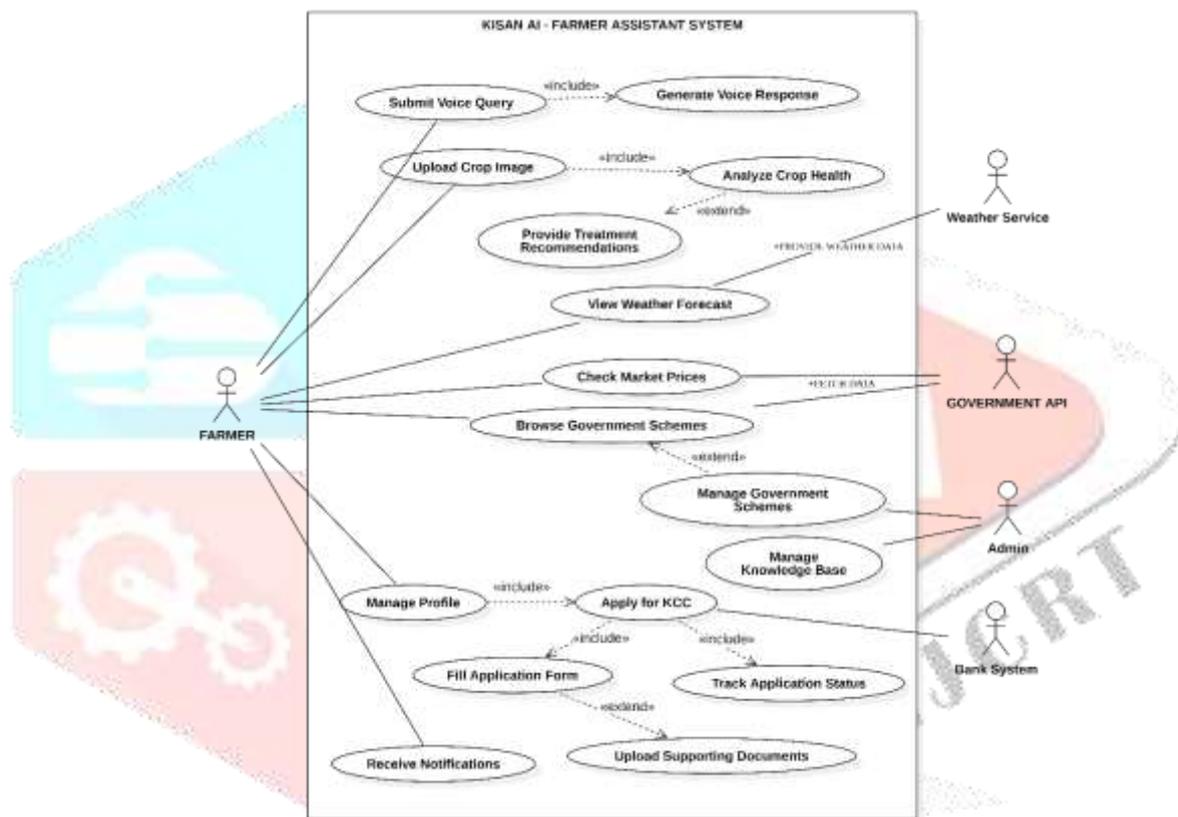


Fig. 2. Use Case Diagram



Fig. 4. Multilingual Interface



Fig. 5. AI Voice Assistant



Fig. 6. Market Analysis



Fig. 7. Government Schemes Section

V. CONCLUSION

The KisanAI system successfully demonstrates the potential of integrating AI-driven diagnostics with real-time agricultural data to empower the Indian farming community. By consolidating fragmented services—including Hindi voice-assisted Q&A, image-based crop analysis, and market intelligence—into a single, high-performance web platform, the project effectively reduces the technological barriers often faced by rural users. The implementation of a modular, service-oriented architecture ensures that the platform is not only scalable but also resilient enough to handle diverse data streams from external APIs and AI microservices. Ultimately, this work provides a strong foundation for a unified digital ecosystem that enhances decision-making and fosters sustainable agricultural development across India.

VI. FUTURE SCOPE

While the current version of KisanAI addresses critical information gaps, several avenues exist for further enhancement:

1. **Multilingual Expansion:** Future iterations aim to extend Natural Language Processing (NLP) capabilities to include a wider array of regional Indian dialects for broader accessibility.
2. **IoT and Real-Time Monitoring:** Integrating soil sensors and IoT-enabled devices could provide farmers with hyper-localized data on soil health and irrigation needs.
3. **Blockchain Integration:** Implementing blockchain technology could secure agricultural supply chains, ensuring transparent crop-to-market tracking and fair digital payments.
4. **Predictive Analytics:** Future modules could leverage advanced AI to forecast market demand trends, potential pest outbreaks, and expected crop yields.
5. **Offline Functionality:** To support users in low-connectivity rural areas, the platform could be optimized with offline caching and SMS-based integration.

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