FarmWise: Your Smart Farming Companion

Sayali Shinde[1], Pradnya Koleshwar[2], Anuja Deore[3]*,

Shalini Dabhilkar[4], Dhanashri Dalvi[5].

[1,2,3,4,5]Department of Computer Science & Engineering (Data Science),
B.R.A.C.T's Vishwakarma Institute of Technology, Pune, MH, India

Corresponding Author: anuja.deore241@vit.edu

Abstract: Modern agriculture faces challenges ranging from unpredictable weather patterns and pest outbreaks to fluctuating market demands and the impacts of climate change. Farmers require reliable, accessible, and intelligent tools to make informed decisions quickly. This paper presents FarmWise — a prototype web platform designed as a smart farming companion. The platform integrates an AI chatbot, crop health scanner preview, weather updates, a trending agriculture news feed, and a farmer's market interface. Developed using HTML, CSS, and JavaScript, and powered by free APIs, FarmWise demonstrates how even foundational AI-enabled solutions can enhance decision-making, improve crop health monitoring, and connect farmers with essential market and weather data.

The system prioritizes usability and scalability, with features optimized for seamless interaction across various devices. Although currently operating with limited AI capabilities, the platform sets the stage for future integration of advanced analytics, including yield prediction, pest detection, and precision resource management. By bridging information gaps and delivering actionable insights, FarmWise contributes to the ongoing transformation toward data-driven, sustainable agriculture.

Keywords: Smart Farming; Artificial Intelligence (AI); Internet of Things (IoT); Chatbot Advisory Systems; Weather Forecasting; Federated Learning; Sustainable Agriculture; Digital Agriculture Platforms

1.Introduction

Modern agriculture faces challenges such as climate variability, pest and disease outbreaks, market fluctuations, and limited extension services, especially for smallholder farmers. Digital technologies like Artificial Intelligence (AI), Internet of Things (IoT), and web/mobile platforms have shown promise in bridging these gaps, but adoption is often constrained by cost, connectivity, and usability.

Recent studies highlight three key areas shaping smart farming. AI-based plant disease detection has achieved high accuracy in controlled settings, though performance in real-world conditions is limited by factors such as lighting and dataset bias. Conversational agents (chatbots) can scale agricultural advisory services and improve accessibility, particularly with regional language support, but require human oversight to ensure trust. IoT-enabled precision farming offers data-driven insights for irrigation and resource management, with edge computing and federated learning emerging to address concerns related to privacy and infrastructure.

Building on these advances, we present FarmWise, a lightweight, web-based prototype that integrates multiple services—chatbot, crop health scanner, weather forecasts, agricultural news, and a farmer market module—into a single accessible platform. Unlike infrastructure-heavy solutions, FarmWise emphasises simplicity, low cost, and usability. This paper outlines the system's design, evaluates its prototype performance, and discusses its role in enabling data-driven, sustainable farming.

2. Methodology

2.1 Objectives

Primary objectives of this study were:

i. Provide a single-entry, web-based interface combining advisory, disease screening (upload + preview), weather, news, and market information.
ii. Ensure cross-browser and mobile responsiveness.
iii. Design for low-cost deployment using free/open APIs and client-side logic.

2.2 Architecture

a. FarmWise follows a modular front-end heavy architecture:
b. Presentation layer: HTML, CSS, JavaScript (responsive layout, progressive enhancement).
c. API integrations: OpenWeather for localised forecasts, news APIs for curated agricultural updates, and placeholders for plant-disease detection and chatbot APIs (initially integrated with free conversational API endpoints or simple rule-based flows).
d. Data components: Minimal persistent storage for user preferences; heavy data (images) processed transiently or prepared for later ML integration. This design favours low latency and reduced server costs while enabling future back-end expansion (edge inference, federated learning).

2.3 Prototype Implementation Details

Chatbot: Rule-based + free conversational API for fallback; interface supports typed queries. Designed to accept future LLM/NLU integration and multilingual support.

Crop Health Scanner (preview): Client-side image upload workflow with UI for submitting photos; intentional decoupling from model inference to permit offline/secure inspection or future federated training.

Weather: OpenWeather API for geolocation-based current conditions and 3–7-day forecasts. PMC

Trending News: Aggregated via news APIs filtered by agricultural keywords.

Farmer Market Interface: Static catalogue for the prototype; intended to evolve to dynamic listings and price feeds.

2.4 Evaluation procedure

We have performed-

i. **Usability testing (n = 12):** Short tasks covering weather lookup, uploading a crop image, accessing policy news, and initiating a chatbot query. Participants included local agronomy students and extension workers to get both technical and agronomic perspectives.
ii. **Qualitative feedback:** Semi-structured interviews to capture usefulness, trust, and areas for improvement.
iii. **Functional checks:** API response times, mobile rendering on Chrome and Firefox, and image upload reliability.

3. Results and Discussions

The prototype of FarmWise was evaluated to assess its usability, functional effectiveness, and potential contribution toward smart farming practices. The evaluation combined system-level checks with user-based feedback to understand both technical performance and practical

relevance. Results are organized according to the major functional modules of the platform—chatbot, crop health scanner, weather services, news feed, and financial/market access. Each module's outcome is discussed in terms of observed strengths, limitations, and alignment with insights from recent literature. This approach ensures that findings are not only descriptive of the prototype's performance but also contextualized within broader trends in digital agriculture research.
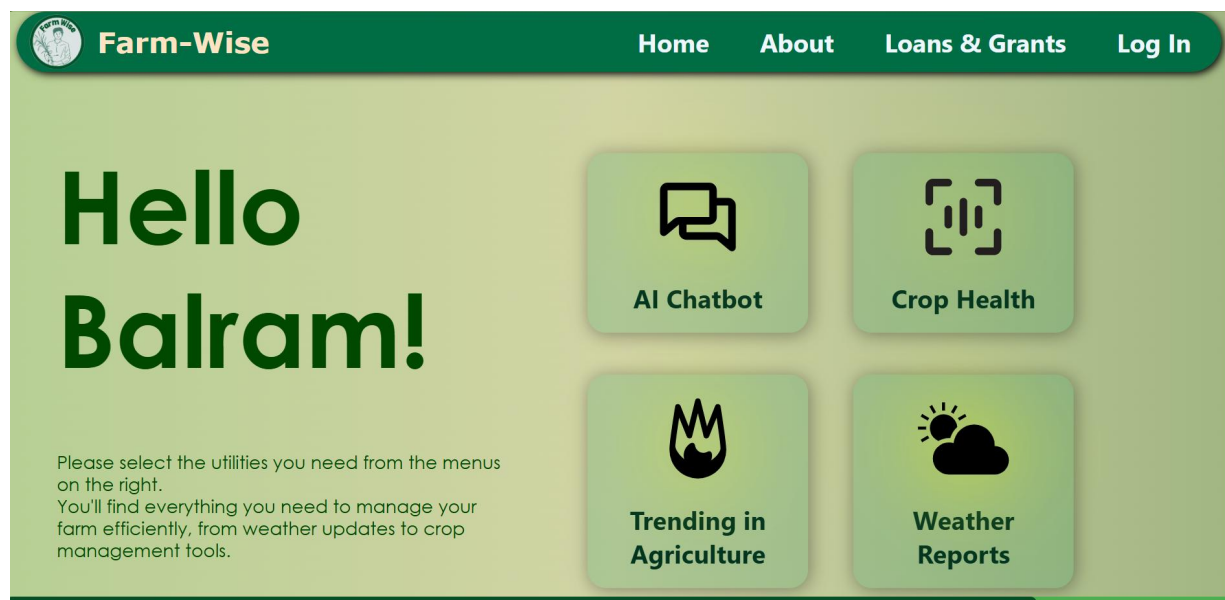

Fig. 1: Proposed digital framework of *Farm-Wise*, an AI-driven agricultural support platform.

3.1 Weather and News modules: immediate value

Participants repeatedly cited the weather module as the most frequently used feature during testing, with the news module serving as a secondary source of policy and market awareness. These modules require trustworthy, frequently refreshed data sources to remain useful—Open Weather provided reliable responses in our tests, but local microclimate modelling and agricultural-tailored alerts are future enhancements to increase relevance.

3.2 Chatbot: potential and constraints

The conversational assistant handled basic domain questions (sowing windows, fertiliser basics, weather checks). Users appreciated the "ask-anything" mental model, but expressed concerns regarding the depth and reliability of responses, especially for specific disease or pest management recommendations.
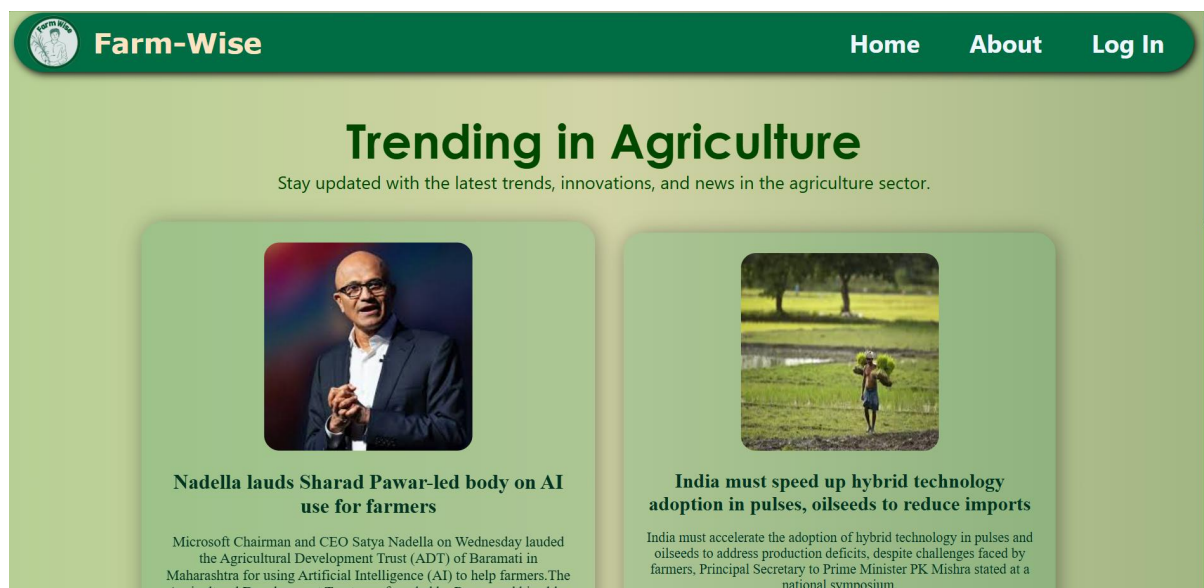
Fig. 2: *Trending in the Agriculture* module of the Farm-Wise platform.

Interpretation: Conversational AI can scale advisory reach, but it must be paired with disclaimers, human oversight, and local-language/audio support to build trust—observations echoed in recent field studies of agricultural chatbots.
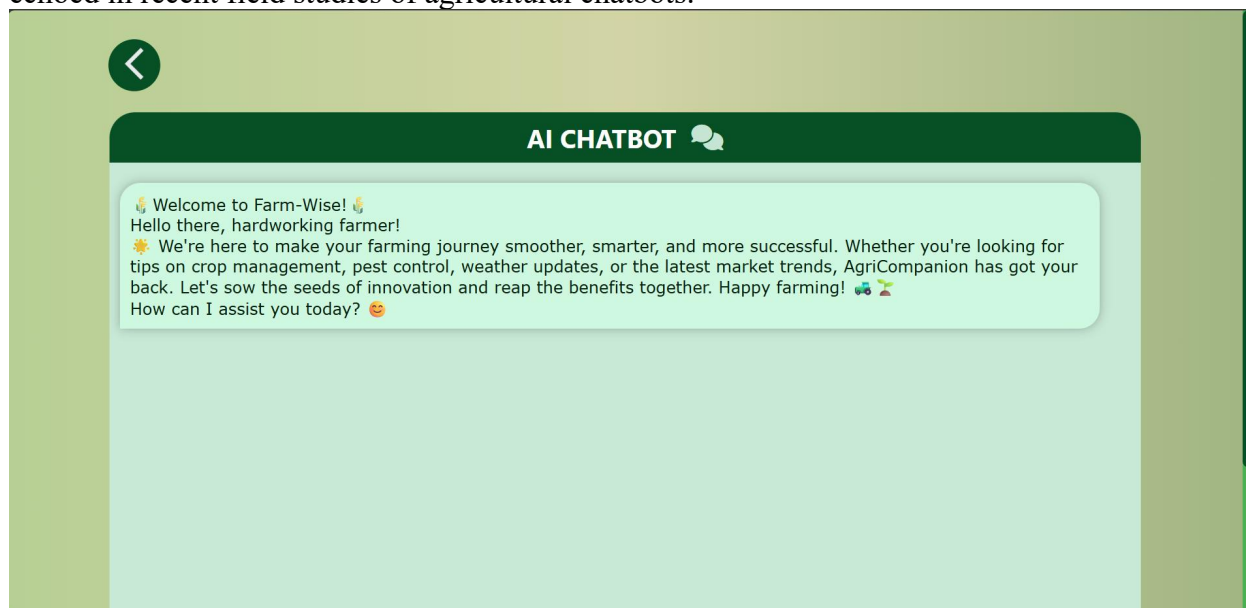

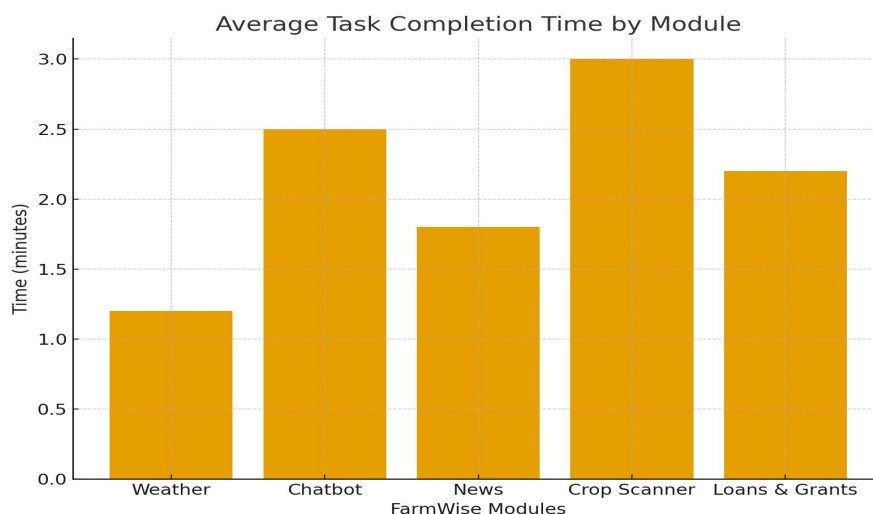**Fig. 3:** *AI Chatbot module of Farm-Wise.*

Fig. 4: *AI Chatbot module of Farm-Wise.*

Users rated Weather highest, followed by News and Chatbot, reflecting the value of timely information. Lower scores for Crop Scanner and Loans & Grants highlight the need to improve these prototype modules for better usability and trust.

3.3 Limitations and Risks

a. **Diagnostic accuracy:** Without integrated, field-validated ML models, automatic disease identification remains speculative. The literature warns about over-reliance on unvalidated ML outputs in high-stakes agricultural decisions.

b. **Connectivity and trust:** Web access and real-time updates assume intermittent connectivity; offline-first design and audio/local language support will be necessary for broad adoption. Chatbots should include confidence/provenance signals to avoid misguidance.

c. **Data privacy & governance:** If sensor data or images are collected, privacy-preserving training techniques (e.g., federated learning) and transparent consent flows are required to maintain farmer trust. Recent projects have demonstrated federated approaches to protect sensitive farm data while enabling model training.

4. Conclusion

FarmWise is a practical, low-cost prototype that integrates critical advisory services into a single web platform. Prototype evaluation suggests strong potential for improving farmers' access to actionable information, particularly weather and contextual advisory. However, to transition from prototype to production, FarmWise must (1) incorporate robust disease-detection models validated under field conditions, (2) offer offline and multilingual support, and (3) adopt privacy-preserving learning paradigms to maintain trust. The modular design facilitates these future steps and aligns with recent research advocating human-centred AI and federated approaches in agri-tech.

5. Future Scope

Farm Wise has the potential to expand far beyond its current prototype. Planned developments include advanced AI integration for precise crop disease detection and yield prediction, IoT

connectivity for real-time field monitoring, and multilingual interfaces to serve diverse farming communities. The farmer marketplace will be upgraded to provide live pricing, inventory updates, and secure transactions. A dedicated mobile application with offline functionality will enhance accessibility, while predictive analytics will enable farmers to anticipate weather impacts and optimise their resources. These enhancements will position Farm Wise as a comprehensive, intelligent platform for sustainable, technology-driven agriculture.

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