FarmOS: A Smart Web Based Solution for End-to-End Farm Management

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***Abstract*—Agriculture requires efficient planning and resource management to improve productivity and reduce operational challenges. This paper presents a farm management system designed to organize agricultural data and support informed decision-making. The system enables structured monitoring of farm activities, resource usage, and basic analytical insights through a user-friendly interface. By digitizing farm operations, the proposed solution reduces manual effort and improves accessibility to agricultural information, making it suitable for small and medium-scale farming environments.**

***Index Terms*—Farm management system, smart agriculture, agricultural data analysis, decision support system**

I. INTRODUCTION

Agriculture plays a crucial role in economic development and food security, especially in developing countries like India. Despite its importance, many farmers still rely on manual record keeping and traditional decision-making practices, which can lead to inefficiencies in resource utilization and farm planning.

Recent advancements in digital technologies have enabled the development of farm management systems that assist farmers in monitoring agricultural activities. Such systems help in organizing farm related information, improving accessibility to data, and supporting better planning. However, many existing solutions are either complex or require advanced infrastructure, limiting their adoption among small scale farmers.

The objective of this work is to develop a simple and effective farm management system that supports agricultural data monitoring and basic analysis. The proposed system focuses on usability, structured data storage, and decision support, enabling farmers to manage farm operations more efficiently.

II. RELATED WORK

Various digital solutions have been proposed to support agricultural management and decision-making. Existing systems focus on areas such as crop monitoring, price forecasting, irrigation control, and yield analysis. Some approaches utilize machine learning techniques for prediction, while others rely on rule-based systems for farm planning.

Although these systems provide valuable insights, many of them require continuous data collection, advanced hard ware, or complex interfaces. In contrast, the proposed farm management system emphasizes simplicity and accessibility by focusing on structured data management and essential analytical features suitable for practical agricultural use.

III. SYSTEM FEATURES

FarmOS is a web-based farm management system designed to digitize and streamline agricultural operations through modular, real-time, and role-based functionalities. The key features of the system are summarized below.

A. Role-Based User Management

The system supports multiple user roles including Admin, Manager, Worker, and Viewer. Each role is assigned predefined permissions to ensure secure and organized access. Administrators are responsible for onboarding users, assigning roles, and controlling platform access.

B. Inventory and Asset Management

FarmOS enables efficient tracking of farm assets

such as tools, machinery, seeds, and fertilizers. The system maintains records of quantity, unit, usage date, and asset status, with updates reflected in real time across dashboards and inventory records.

Fig. 1 shows the inventory adjustment functionality of the system.

C. Planting and Activity Logging

Users can log planting activities by specifying crop type, planting date, and associated farm location. Historical planting records are preserved to support planning and future analysis, and are integrated with calendar and dashboard modules.

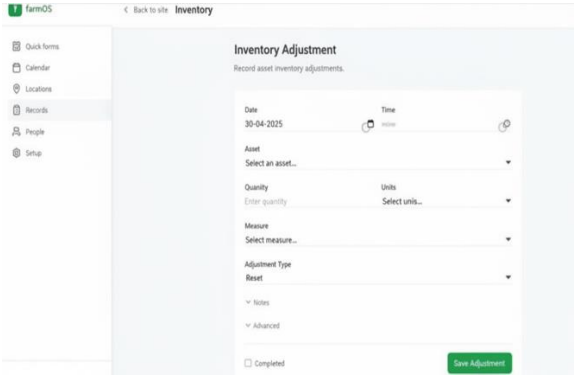

Fig. 1. Inventory Adjustment and Asset Management Interface

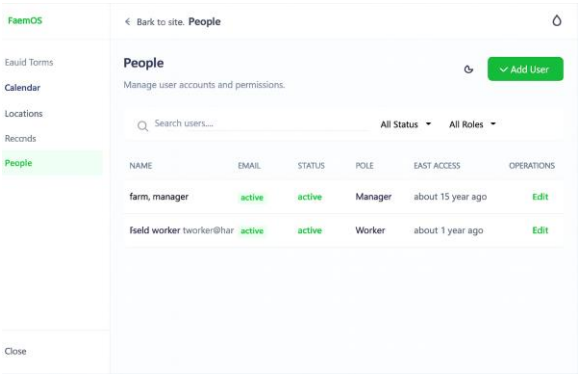

Fig. 2. Role-Based User Management Interface in FarmOS

Fig. 2 demonstrates the role-based user management mod- ule.

D. Calendar-Based Task Scheduling

Date based activities are automatically converted into calendar events, providing a visual representation of farm operations. The calendar supports monthly navigation and assists users in planning and monitoring scheduled tasks.

E. Task Monitoring and Status Tracking

The system categorizes tasks as upcoming or late based on due dates. This feature helps managers prioritize activities, reduce missed deadlines, and improve accountability and operational efficiency.

F. Real Time Dashboard Analytics

FarmOS provides a real time dashboard displaying key metrics such as inventory usage, task status, and planting trends using charts and graphs. These visual insights support quick and informed decision-making.

G. Location Mapping and Farm Plot Management

The system incorporates an interactive map interface that allows users to mark farm locations and manage plot bound arise. Location data is linked with planting and activity records to enhance spatial tracking of farm operations.

H. Modular and Scalable Design

FarmOS is built using a modular architecture that allows each component to function independently while remaining interconnected. This design supports scalability and enables future integration with technologies such as IoT devices, AI based analytics, and weather APIs.

IV. SYSTEM ARCHITECTURE

The FarmOS platform follows a modular, three-tier architecture consisting of a frontend layer, backend layer, and data management layer. This architecture is designed to ensure scalability, maintainability, and secure handling of farm-related data while supporting real-time updates and role-based access.

A. Frontend

The frontend of FarmOS is developed using HTML, CSS, and JavaScript and provides role-based interfaces for different users such as Admin, Manager, Worker, and Viewer. Each role is granted access to specific functionalities based on predefined permissions.

The user interface enables interaction with core system modules including inventory management, planting logs, task scheduling, dashboard analytics, and location mapping. Visual elements such as charts, tables, and calendars are used to present farm data in an intuitive manner. The responsive de- sign ensures accessibility across multiple devices, making the

system usable for individuals with varying levels of technical expertise.

B. Backend

The backend is implemented using a server-side framework and is responsible for handling application logic, user authentication, and data processing. It manages secure communication between the frontend and the database, ensuring consistency and integrity of farm records.

The backend processes user requests related to asset tracking, activity logging, task updates, and location management. It also enforces role-based access control and maintains system logs for monitoring and administrative oversight. RESTful APIs are used to support efficient data exchange and future system integrations.

C. Data Management Layer

The data management layer handles the storage and retrieval of farm related information such as user records, inventory details, planting history, task schedules, and location data. All data is stored in a structured format to support efficient querying and real time updates across system modules.

This layer ensures data traceability by maintaining times tamps for critical operations and supports synchronization with dashboards and analytical views. The design allows for future extensions such as integration with external services or advanced analytical tools.

D. System Workflow

The system workflow begins with user interaction through the frontend interface, where inputs such as planting records, inventory updates, or task schedules are submitted. These inputs are validated and processed by the backend before being stored in the data management layer.

Updated information is immediately reflected in dashboards, calendars, and visual analytics modules. Administrators and managers can monitor system activity and operational status through dedicated views, ensuring effective coordination and maintenance of farm operations.

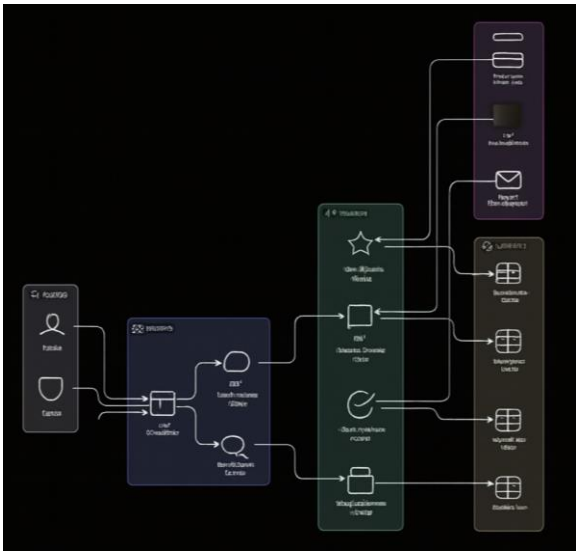

Fig. 3. System Architecture of the Proposed FarmOS Platform

Fig. 3 illustrates the modular architecture of the FarmOS system.

V. RESULTS AND DISCUSSION

The implementation of the FarmOS platform demonstrates effective consolidation of core farm management operations into a unified digital system. The integration of inventory management, planting records, task scheduling, location mapping, and role-based access control resulted in improved operational visibility and reduced reliance on manual record keeping. Real time synchronization across system modules ensured consistent and up-to-date data availability, minimizing delays and entry errors.

The system interface was evaluated through role-based usage scenarios involving administrators, managers, and workers. The results indicate that users were able to efficiently log activities, monitor task status, and track inventory with minimal training. The dashboard analytics and calendar-based scheduling enhanced planning capabilities by providing clear visual insights into farm operations.

A. Practical Implications

The FarmOS system supports digital adoption in agriculture by enabling structured task management, real-time resource tracking, and location-aware farm planning. These capabilities help reduce operational inefficiencies and improve decision making related to planting schedules, asset utilization, and workforce coordination. The role-based access model improved

accountability while facilitating collaboration among different stakeholders.

The web-based and modular architecture allows the platform to be deployed across farms of varying scales without requiring specialized infrastructure. This flexibility makes FarmOS suitable for diverse agricultural environments, including regions with limited technical resources.

B. Deployment and Future Enhancements

The results indicate that cloud-based deployment can enhance scalability, data availability, and system reliability. However, connectivity limitations in rural areas highlight the need for future support of offline data entry with delayed synchronization. Additional enhancements such as integration with IoT sensors, weather forecasting services, and advanced analytical tools can further improve system intelligence.

Fig. 4. Dashboard Visualization of Farm Operations and Task Distribution

Overall, the results confirm that FarmOS provides a practical and scalable solution for digitizing farm operations while supporting future technological extensions.

VI. CONCLUSION

The FarmOS platform provides an effective solution for modern farm management by digitizing and centralizing key agricultural operations into a unified system. By integrating inventory management, planting activity logging, task scheduling, location mapping, and role-based access control, the system improves operational efficiency, data consistency, and decision-making capabilities. The real-time synchronization of farm data reduces manual errors and enhances visibility across all operational levels.

The evaluation of the system demonstrates its usability for both technical and non-technical users, making it suitable for

practical deployment across farms of varying scales. The modular and scalable architecture ensures flexibility and supports future system expansion. Overall, FarmOS serves as a reliable digital platform that simplifies agricultural management while promoting structured and data driven farming practices.

Future enhancements may include integration with IoT based sensors for automated data collection, weather forecasting services for improved planning, offline data entry with delayed synchronization, and mobile application support for increased accessibility. These extensions can further transform FarmOS into a comprehensive smart agriculture platform that supports sustainable and efficient farming.

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