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AGRIHUB - A Digital Agriculture Platform

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Abstract: *This project, titled "AgriHub – A Digital Agriculture Platform," involves the design and development of a centralized, web-based system to provide farmers with real-time agricultural data and smart farming solutions. The system uses multiple integrated modules—including crop cultivation details, live market prices, government schemes, and direct expert advice—to deliver comprehensive support efficiently. The working principle is based on a role-based modular architecture built using modern web technologies like Spring Boot, Thymeleaf, and MySQL, which seamlessly connects farmers, buyers, and agricultural experts through a unified digital interface.*
The main objective of this project is to develop an accessible, cost-effective, and easy-to-use digital information hub suitable for small to medium-scale farmers and rural agricultural communities. The AgriHub platform reduces dependency on traditional manual information gathering and middlemen, improves data-driven decision-making, and ensures timely access to professional guidance compared to conventional offline methods. System design and research confirm that the platform performs reliably as an information exchange, demonstrating the practical application of Information and Communication Technology (ICT) in modernizing agriculture and promoting sustainable farming operations.

Keywords: Digital Agriculture, Smart Farming, Information and Communication Technology (ICT), E-Agriculture

I. INTRODUCTION

AGRIHUB – A Digital Agriculture Platform is a web-based system developed to support farmers by providing essential agricultural information in a single digital platform. The main goal of the system is to bridge the gap between farmers, agricultural experts, government services, and market information through modern technology.

Agriculture plays a crucial role in the Indian economy, but many farmers still depend on traditional methods to obtain information about crops, fertilizers, market prices, and government schemes. These traditional approaches often involve visiting government offices, relying on middlemen, or depending on word-of-mouth information, which can be time-consuming and sometimes inaccurate. As a result, farmers may not receive timely updates that affect their productivity and income.

To solve these challenges, AGRIHUB provides a centralized digital platform where farmers can easily access important agricultural resources. The platform includes features such as crop information, fertilizer recommendations, government scheme updates, weather forecasts, and expert advice. By bringing these services together in one system, AGRIHUB helps farmers make informed decisions about cultivation, fertilizer usage, and selling their crops.

The system is developed using modern web technologies such as HTML, CSS, JavaScript for the frontend and Spring Boot with MySQL for the backend, ensuring a secure, scalable, and user friendly platform. With multilingual support and a simple interface, AGRIHUB is designed to be easily accessible even for farmers with limited technical knowledge.

In the era of digital transformation, AGRIHUB demonstrates how technology can modernize agriculture by improving access to information, increasing transparency, and supporting sustainable farming practices. The platform aims to empower farmers with knowledge and digital tools, ultimately improving productivity, profitability, and rural development.

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AGRIHUB also supports awareness and knowledge sharing among farmers and experts. It encourages the adoption of modern farming techniques and promotes transparency in agricultural markets. With the help of this platform, farmers can stay informed about new agricultural policies, subsidies, and technological advancements.

In the future, AGRIHUB can be enhanced by integrating advanced technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and real-time market price APIs. These improvements can help farmers receive predictive crop recommendations, smart irrigation suggestions, and accurate weather forecasting. Such developments will further strengthen the role of digital technology in building a smarter, sustainable, and digitally empowered agricultural ecosystem.

II. LITERATURE SURVEY

Agriculture is one of the most important sectors of the Indian economy, and digital technologies are increasingly being used to improve agricultural productivity and efficiency. Many researchers and organizations have explored the use of Information and Communication Technology (ICT) to support farmers with better information, decision-making tools, and market access. Digital agriculture platforms help farmers obtain timely information related to crops, fertilizers, weather forecasts, and government schemes. According to studies on ICT in agriculture, integrating technology with farming practices improves productivity, reduces dependency on middlemen, and enhances transparency in agricultural markets.

Several digital platforms such as e-Choupal, Kisan Suvidha, and AgriApp have been developed to provide agricultural information to farmers. These systems offer services like weather updates, crop advisory, fertilizer recommendations, and market price information. However, many existing platforms focus only on limited services or require advanced digital knowledge, making them difficult for small-scale farmers to use effectively. Therefore, there is a need for a simple and centralized platform that integrates multiple agricultural services in a user-friendly interface.

The AGRIHUB – Digital Agriculture Platform is designed to address these limitations by providing a unified system where farmers can access crop information, fertilizer recommendations, government schemes, weather forecasts, and expert advice from a single platform. The project uses modern web technologies such as HTML, CSS, and JavaScript for the frontend interface and Spring Boot with MySQL for backend data management, ensuring efficient communication between the user interface and the database system.

In the implemented system, multiple modules are designed to improve agricultural awareness and productivity. The fertilizer calculator module helps farmers determine the correct dosage of fertilizers based on crop type and land area. The government schemes module provides information about subsidies, loans, and welfare programs available for farmers. The weather module uses external APIs to display real-time weather information based on the user's location. Additionally, the crop advisor module suggests profitable crops based on season, soil type, and budget.

Previous research also emphasizes the importance of multilingual support in agricultural platforms to ensure accessibility for rural users. The AGRIHUB system incorporates language translation features to support multiple languages, making the platform easier for farmers to understand and use.

Thus, the development of AGRIHUB contributes to the growing field of digital agriculture by combining various agricultural services into one integrated platform. The system demonstrates how web technologies and ICT solutions can empower farmers with accurate information, improve decision-making, and promote sustainable agricultural development.

III. SCOPE OF THE PROJECT

The scope of the AgriHub – A Digital Agriculture Platform is to design and develop a web-based system that provides farmers with easy access to essential agricultural information and services in one place.

The platform aims to support farmers by offering reliable data related to crop cultivation, fertilizers, market prices, government schemes, and expert guidance.

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• Functional Scope:

1.The functional scope of AgriHub – A Digital Agriculture Platform defines the main operations and services that the system provides to its users. The platform is designed to support farmers, agricultural experts, buyers, and administrators by providing various features that help in improving agricultural productivity and information accessibility.

2. One of the main functions of the system is to provide crop information, where farmers can access details about different crops, cultivation techniques, seasonal suitability, fertilizers, and pest management. This helps farmers select appropriate crops and follow proper farming methods.

3. Another important function is the market price information module, which provides farmers with updated crop prices from different markets. This feature allows farmers to make better decisions regarding when and where to sell their produce, helping them receive fair prices.

4. The platform also includes a government schemes module, where farmers can obtain information about agricultural subsidies, crop insurance, loans, and welfare programs offered by the government. This ensures that farmers remain informed about financial support and development schemes available to them.

5. AgriHub also supports expert advice and guidance, where agricultural professionals can provide suggestions regarding crop selection, fertilizer usage, and disease management. This feature helps farmers solve farming-related problems with the help of expert knowledge.

6. Additionally, the system allows user interaction and information sharing through modules such as contact support, knowledge articles, and guidance resources. Administrators are responsible for managing user data, updating agricultural information, and maintaining the platform's content.

• Non-Functional Scope:

1. The non-functional scope of the AgriHub platform describes the quality attributes and system requirements that ensure the platform operates efficiently, securely, and reliably.

2. One of the key non-functional aspects of the system is usability. The platform is designed with a simple and user-friendly interface so that farmers with limited technical knowledge can easily navigate and access agricultural information.

3. Another important requirement is performance and reliability. The system must provide quick responses when users access crop information, market prices, or government schemes. Reliable system performance ensures that farmers receive timely information without delays.

4. Security is also an important factor for the platform. The system must protect user data, agricultural information, and government scheme details from unauthorized access or cyber threats. Proper authentication and data protection mechanisms are required.

5. The platform must also ensure scalability, meaning it should be capable of handling increasing numbers of users and agricultural data as the system expands. This allows the platform to support more farmers and services in the future.

6. Finally, maintainability and flexibility are important non-functional requirements. The system should allow easy updates, bug fixes, and addition of new features such as weather forecasting, AI-based crop analysis, or mobile application integration in the future.

IV. METHODOLOGY / APPROACH

The development of the AGRIHUB platform follows a Linear Sequential Model, ensuring that each phase is completed before the next begins. This structured approach ensures accuracy, reliability, and scalability.

Step 1: Problem Analysis & Requirement Gathering

The foundation of the project is based on identifying the information gap in the current agricultural ecosystem.

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To define the functional requirements of the platform, such as real-time weather tracking, fertilizer calculation, and access to government welfare schemes.

Step 2: System Architecture & Design

This phase translates requirements into a technical blueprint. The system is designed using a Three-Tier Architecture:

• Presentation Layer (Frontend): Developed using HTML, CSS, and JavaScript to provide a responsive, user-friendly interface for farmers.

• Application Layer (Backend): Built with Java and Spring Boot to manage the business logic, process user requests, and handle API integrations.

• Data Layer (Database): Uses MySQL to securely store and manage structured data like user profiles, crop details, and historical fertilizer data.

Step 3: Development & Modular Implementation

During this stage, the project is broken down into independent functional modules to ensure focused coding and easier debugging:

• Fertilizer Calculator: Implements logic to calculate dosage based on land size and crop type.

• Weather Forecast System: Uses REST APIs to fetch and display real-time climate data.

• Crop Advisor: A recommendation engine based on soil type, season, and budget.

• Government Schemes: A centralized repository of active subsidies and programs.

Step 4: Testing & Quality Assurance

Before deployment, the system undergoes rigorous testing to eliminate errors.

• Unit Testing: Each module (e.g., the calculator) is tested individually for mathematical accuracy.

• Integration Testing: Ensuring the Spring Boot backend communicates seamlessly with the MySQL database and external APIs.

• User Interface (UI) Testing: Checking for responsiveness across different devices (mobile/desktop) to ensure ease of use for the end-user.

Step 5: Implementation & Deployment

The final phase involves the actual rollout of the platform.

• Deployment: The web application is hosted on a server, making it accessible via a URL.

• Maintenance: The system provides a centralized digital environment where information is updated regularly (e.g., new government schemes or weather alerts), ensuring long term utility for the farming community.

V. ADVANTAGES

Easy Access to Information: Farmers can get crop details, fertilizers, pesticides, and market prices anytime and anywhere.

Time-Saving: It reduces the need for farmers to physically visit government offices or markets to gather information.

Government Scheme Awareness: The platform provides information about available schemes and subsidies all in one centralized place.

Digital Empowerment: It encourages rural digital literacy and actively supports e-agriculture initiatives.

Smart Crop Selection: A "Profitable Crop Advisor" helps farmers maximize their profits by recommending the best crops to plant based on the current season, local soil type, and their personal investment capacity.

Risk Management: By providing real-time weather forecasts based on the user's location, it allows farmers to safely plan their crucial sowing and harvesting activities.

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Highly Accessible: To bridge the gap between farmers and technology and promote digital literacy, the platform is multilingual, offering full translations in English, Hindi, and Marathi.

VI. APPLICATIONS

Precision Nutrient Management: Farmers can use the Advanced Fertilizer Calculator to determine the exact dosage of primary nutrients (Urea, DAP, MOP) and micronutrients (Zinc, Sulphur) required per acre. This application prevents soil degradation from over-fertilization and reduces unnecessary expenses.

Strategic Crop Selection: The Profitable Crop Advisor tool can be applied during the pre-sowing phase. By evaluating the current season (Kharif, Rabi, Zaid), local soil type, and the farmer's financial budget, it helps maximize yield and market profitability.

Weather-Responsive Farm Operations: The real-time, geolocation-based weather forecast allows farmers to strategically schedule critical daily activities. It helps them decide the optimal times for sowing seeds, applying pesticides, irrigating fields, or harvesting crops to avoid sudden weather disruptions.

Direct Access to Financial Aid: The platform acts as a centralized digital gateway for farmers to discover and navigate government support. They can use it to directly access application portals for crop insurance (PM Fasal Bima Yojana), financial support (PM-Kisan), and equipment subsidies.

Accessible Agricultural Education: With its built-in multilingual support (English, Hindi, and Marathi), the platform serves as an educational tool that bridges the digital divide, allowing farmers who may not be fluent in English to access modern agricultural data and best practices.

VII. CONCLUSION

In today's era of digital transformation, AgriHub demonstrates how technology can revolutionize traditional farming practices by providing farmers with the digital tools and information they need to succeed.By improving accessibility, efficiency, and knowledge sharing, this platform contributes toward building a smarter, sustainable, and digitally empowered agricultural ecosystem.

VIII. ACKNOWLEDGMENT

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