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AI-Driven Crop Management System with Integrated Farmer Support: Price Insights, Article Recommendations, and Disease Detection via Image Recognition

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Abstract - Agriculture remains the backbone of many economies, especially in developing regions, where a significant portion of the population depends on farming for their livelihood. However, farmers often face multiple challenges & hurdles, including volatile crop prices, limited access to trustworthy agricultural information, and delayed or wrong diagnosis of crop diseases. These challenges hinder productivity, profitability, and sustainability. In response to these crucial needs, this research introduces an advanced **AI-driven Crop Management System** designed to empower farmers through a comprehensive digital platform. The system integrates real-time crop price tracking, informational article recommendations, and a powerful crop disease diagnostic tool using state-of-the-art image recognition tools and techniques.

The core objective of this system is to leverage artificial intelligence and machine learning technologies to enhance agricultural decision-making, reduce crop losses, and improve farmers' access to vital information. One of the primary modules of the system is the **Crop Price Monitoring Feature**, which fetches and displays real-time price information for a variety of crops across multiple regions. This data is sourced from agricultural markets and government databases to ensure accuracy, reliability and timeliness of the data provided. By presenting this information through a farmer-friendly interface, the system helps farmers make informed decisions about when and where to sell their produce for optimal returns in the local market.

Another integral component is the **Article Recommendation Engine**, which uses A.I to deliver tailored content based on user activity, location, crop preferences, and farming practices. This includes best practices related to specific crops, climate conditions, and seasonal patterns. The recommendation system employs collaborative and content-based filtering methods to ensure that the information presented is both relevant and practical. By continuously learning from user interactions, the engine improves over time, offering increasingly personalized suggestions that can directly support better farm management.

Perhaps the most innovative feature of the platform is the **Crop Doctor Module**, which enables farmers to diagnose plant diseases through image recognition. Farmers can capture and upload images of affected plants using a smartphone, and the system processes these images using convolutional neural networks (CNNs), a subset of deep learning optimized for visual data analysis. The model is trained on a large dataset of annotated plant disease images covering a variety of crops such as rice, wheat, tomato, and maize. Once an image is processed, the system identifies the disease, estimates its severity, and suggests possible treatments or preventive actions. In cases where image recognition is inconclusive, the system can redirect the query to an expert or community forum for further review.

To ensure accessibility, the system is designed with a mobile-first interface and supports multiple local languages. This allows rural farmers, who may not have access to computers or fluency in English, to benefit from the full range of services offered. Offline capabilities are also considered to ensure basic features like saved articles and past diagnoses remain accessible without internet connectivity. The user interface prioritizes simplicity, with intuitive icons and navigation that accommodate users with limited digital literacy.

***Key Words*:** mobile agriculture app, artificial intelligence in agriculture, real-time market data, plant disease detection, farmer app, a.i farmer platform.

1.INTRODUCTION

Agriculture is among the most crucial industries in the world, especially in the developing world where a large percentage of people rely on agriculture for income. Contrary to its significance, the agricultural industry is still plagued by some very critical issues—ranging from uncertain market prices and poor access to professional guidance to untimely or incorrect diagnosis of plant diseases and poor agricultural information. These challenges significantly affect smallholder farmers, who often lack the technical tools, infrastructure, and support

systems needed to optimize their practices and ensure stable yields.

Pest and disease outbreaks can cause a decrease in crop yield, quality, and even total crop loss, and therefore threaten food security and the direct livelihood of farmers and national economic stability [1]. This is addressed through the application of a.i diagnosis based on actual time images of the crop and sending it to the farmer app.

This study suggests a holistic, AI-based Crop Management System that has been specifically crafted to support farmers in making essential decision-making and everyday operations more effective through a convenient digital portal.

The system proposed here amalgamates several features into one coherent ecosystem, such as:

- **Crop Price Monitoring:** Real-time exposure to fluctuating crop prices throughout regions to allow farmers to make more informed selling decisions in line with current market trends.
- **Article Recommendation Engine:** Customized agricultural information such as tutorials, government notices, and seasonally-appropriate best practices for every user's crops, location, and behavior through the application of a.i algorithms.
- **Crop Doctor Module:** An AI-driven disease diagnostic module incorporating image recognition via convolutional neural networks (CNNs) in order to diagnose plant diseases based on images submitted by users and provide immediate feedback and treatment recommendations.
- **Community Forum:** An interactive farmer-focused forum in which users are able to pose questions, exchange experiences, share tips, and collaboratively resolve agrarian issues.

The Forum Community is crucial in promoting co-learning and peer-to-peer support. Whereas AI modules give real-time, data-based advice, the forum stimulates human interaction, local expertise sharing, and community-based solutions. Farmers can ask questions and discuss various issues—from pests to fertilizer application—while also gaining insights from other farmers in the same climatic areas.

The whole system is accessed through a mobile-first interface that has multiple local languages, making it inclusive for remote or rural users with limited digital literacy. Offline access to stored articles and diagnostic results also adds to the usability in places with poor internet connectivity.

In contrast to most current digital agriculture platforms that are either marketplace logistics-oriented or stand-alone knowledge delivery, this platform is farmer-focused and seeks to deliver end-to-end support for daily farm operations, knowledge creation, and community engagement. It is scalable and adaptable for smallholder farmers.

This article discusses the technical design, implementation, and testing of the system. It describes the methodology employed for image-based disease identification, the article recommendation algorithm design, and the integration of real-time market information.

The addition of a community forum not only increases user interaction but also constructs social resilience and shared knowledge—key elements in a climate of uncertainty, pest outbreaks, and market volatility.

2. OBJECTIVE

The objective of AI-driven Crop Management System(ADCMS) is to develop a user-centric digital platform that enhances the decision-making capacity of farmers by providing them with timely, localized, and actionable agricultural data and information. The ADCMS aims to:

- Improve agricultural productivity through AI-powered disease diagnosis and crop care guidance.
- Enable farmers to make informed economic decisions based on real-time market data.
- Promote awareness and access to government schemes and financial incentives.
- Facilitate peer knowledge-sharing and expert support through community and call-based interaction.
- Reduce dependency on scattered information sources by filtering and integrating essential services into a single, accessible platform.

By achieving these goals, ADCMS intends to foster a more resilient, profitable, and sustainable agricultural ecosystem, particularly for small and marginal farmers in developing regions.

3. METHODOLOGY

Design and implementation of ADCMS use a modular and scalable architecture incorporating several technologies and data sources. The system comprises the following core modules:

2.1 Dashboard (Central Navigation Hub)

An interface that acts as the central entry point to all system modules. It presents summaries of recent articles, present crop prices, ongoing government schemes, and crop health notifications. The dashboard is designed to focus on simplicity and ease of understanding for farmers of different literacy levels of a digital platform.

2.2 Article Recommendation Engine

This module utilizes region, crop type, and user activity to suggest articles on best practices such as farming, seasonal advice, and new trends. Articles are taken from vetted agricultural extension agencies and translated into local languages. A recommender system assists in personalized content for every user.

2.3 Market Intelligence: Chosen Crop & Locality Rates

A dynamic pricing engine retrieves crop rates from local agricultural markets and provides filtered localized price information. Farmers may choose a specific crop to see current and historical pricing patterns. Real-time visibility allows for improved harvest and sales planning, mitigating exposure to price volatility.

2.4 Government Schemes & Subsidy Updates

This module collates information from state and national agricultural departments to inform farmers of pertinent schemes, subsidies, insurance schemes, and registration dates.

The system employs a tagging algorithm to recommend only relevant schemes depending on farmer location, crop, and landholding size.

2.5 Crop Care and Disease Diagnosis

A two-component system consisting of:
•Knowledge Base: Crop-specific manuals on irrigation, fertilization, pest management, and sustainable agriculture practices.
• AI-Based Disease Diagnosis: Planters take pictures of infected crops through the app. A Convolutional Neural Network (CNN) model analyzes the picture to detect diseases and provides remedial action. This is trained on a vast labeled dataset of infected crop images.

2.6 Call Support Service

For farmers who are inclined or need direct support, the platform has a telephonic support line manned by agricultural specialists and field officers. This provides support to non-literate users or critical issues that cannot be addressed via static content.

2.7 Community Forum

An integrated social platform where farmers can post questions, share solutions, and connect with others based on crop type, region, or farming issues. Moderated discussion ensures relevance and accuracy.

2.8 Localization and Accessibility

The application supports multilingual content, regional dialects, and offline data caching for low-connectivity areas. A simplified design and voice navigation options are also integrated to ensure accessibility across user demographics.

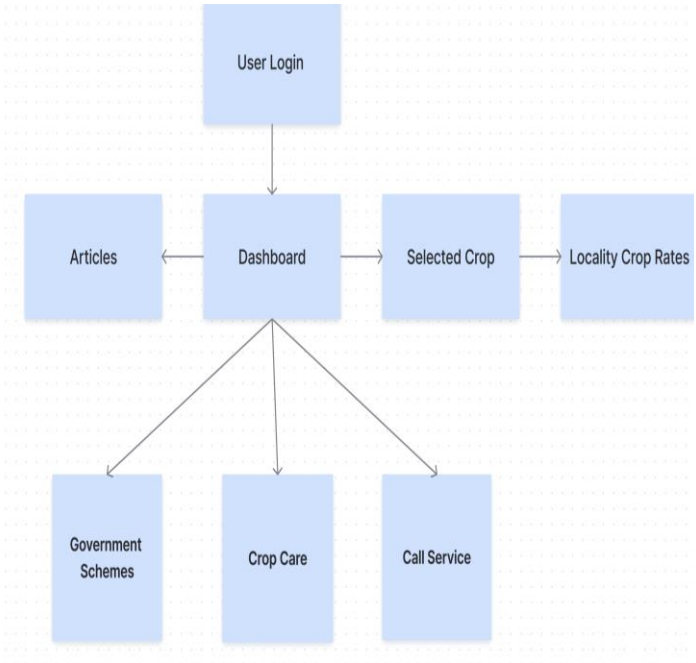

Figure 1: ADCMS architecture diagram

3. Expected Results and Impact

The implementation of ADCMS is projected to yield the following outcomes:

3.1 Enhanced Decision-Making

With access to localized crop prices and government scheme data, farmers are empowered to make informed choices about planting cycles, crop diversification, and sales strategies. This reduces reliance on middlemen and improves financial autonomy also the integration of A.I will help in precision farming & analysis quite easily.
precision farming is one of the most discussed areas in farming today. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields Etc. Computer vision technology, IOT and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming. Companies like Aerial tronics have implemented IBM Watson IoT Platform and the Visual Recognition APIs in commercial drones for image analysis in real time[2]

3.2 Improved Crop Yields and Health

Traditional fixed feature extraction techniques often fail to acquire valuable features for image segmentation [3].
The integration of AI-based crop disease detection, coupled with curated guidance on best practices, enables early intervention and efficient resource use. This is expected to result in improved crop health, reduced pesticide misuse, and higher yields.
The integration of AI-powered image processing in agriculture has enabled rapid, automated detection of plant diseases with high accuracy. The following outlines the step-by-step process used in our system:

1. Image Acquisition
High-resolution images of affected plant leaves are captured using smartphone cameras or low-cost sensors. These images serve as the raw data for further processing.

2. Image Preprocessing
Captured images undergo preprocessing to normalize lighting, reduce noise, and enhance relevant features. Techniques such as histogram equalization, Gaussian blur, and resizing are used to standardize inputs for the model.

3. Segmentation
Leaf segmentation isolates the plant region from the background. Methods like thresholding or edge-based segmentation (e.g., Sobel or Canny) help to focus only on leaf tissue for accurate analysis.

4. Feature Extraction
The model identifies key features such as lesion size, shape, color, and texture. These features are crucial for distinguishing between various plant diseases.

5. Classification with Deep Learning
A trained Convolutional Neural Network (CNN) processes the features to classify the disease. The model has been trained on

labeled datasets of common crop diseases to achieve high precision.

6. Output and Recommendation
The system displays the diagnosed disease, confidence score, and recommended treatments. It may also suggest links to articles or connect to experts via the platform's support system.

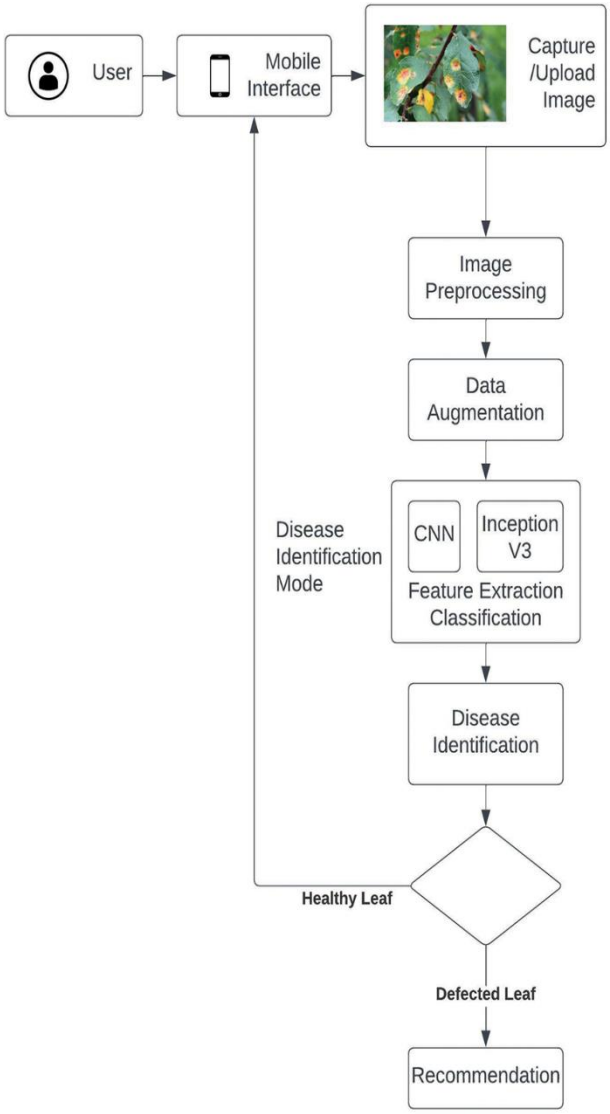

Figure 2: Flow diagram of ADCMS using A.i processing [5]

3.3 Economic Upliftment

Through the integration of many information, including past prices, weather trends, soil data, and socioeconomic aspects, machine learning models offer predictive insights that enable farmers to make more informed choices [4].

Real-time market analytics and scheme awareness reduce cost inefficiencies and open access to subsidies. With better planning and pricing insights, farmers can optimize input costs and maximize profit margins.

ADCMS aims to provide all the real-time market analytics and scheme to serve quality information to farmers using localized market trends and expand awareness about market volatility and trends in the farmer community.

3.4 Time Efficiency and Reduced Information Gaps

By centralizing diverse services—price monitoring, government updates, expert support, and education—into a single platform, ADCMS reduces the time and effort farmers spend seeking critical information.

As discussed in sec.2.1 ADCMS aims to provide all the real-time market analytics and scheme which reduces the information gaps and spreads awareness, which reduces time wastage happening due to in-person searching and misinformation which can lead to heavy losses in the agricultural sector.

3.5 Empowerment Through Knowledge and Community

Small-scale farmers, constituting a substantial portion of the agricultural workforce, often encounter formidable challenges in accessing modern equipment and resources [7]. Articles and forums encourage a learning culture where farmers gets a boost in their confidence in adopting scientific methods. The platform bridges generational and literacy gaps, supporting knowledge transfer across age groups and regions which significantly influence the quality of farmer productions and efficiency in the agriculture sector.
Limited access to infrastructure, digital literacy barriers, and affordability constraints pose significant obstacles to technology adoption among small-scale farmers [7].
In today's rapidly evolving agricultural landscape, access to localized knowledge and shared community experiences is as vital as access to tools and technology. Our platform, **ADCMS**, leverages digital connectivity to empower farmers by:

1. Knowledge Sharing
- Curated articles tailored to regional crops and seasons provide **evidence-based, actionable insights**.
- Educational content on sustainable practices, pest management, and climate resilience fosters **continuous learning**.

2. Community Forum
- Farmers can engage in **peer-to-peer discussions**, share successful techniques, report challenges, and request advice.
- This feature cultivates a **supportive environment**, reducing isolation and promoting collaborative problem-solving.

3. Real-Time Alerts and Updates
- Timely notifications on **crop prices, disease outbreaks**, and **government policies** ensure farmers make **informed decisions**.

4. Inclusive Access
- The platform is built with **multilingual support** and mobile optimization, ensuring accessibility to **underserved rural communities**.

By integrating education with community participation, ADCMS moves beyond simple crop management—it becomes a **catalyst for empowerment, equity, and resilience in agriculture**.

3.6 Policy Feedback and Data Insights

In the dynamic world of digital agriculture, the combination of policy consciousness and evidence-based decision-making has become inevitable. A tool such as ADCMS is essential to fill the gap between top-down agricultural policies and ground-level realities faced by farmers. By incorporating real-time dissemination of policies and feedback loops in the digital process, it enhances governance and enhances farmer outcomes by more focused and responsive interventions.

One of the most important aspects of the system is that it can provide current information regarding government schemes to farmers in a personalized and accessible manner. Several agricultural schemes and subsidies do not reach their intended recipients not because of lack of intent, but because of lack of awareness and accessability. ADCMS overcomes this problem by putting all the concerned schemes in a centralized manner and filtering them on the basis of the farmer's profile, crop choice, and location. It makes sure that a user growing cotton in Maharashtra, say, gets notifications solely about cotton-linked insurance schemes, fertilizer subsidies, or procurement policies applicable to the region.

The design of the system ensures that information is not only available but also contextual. Through multi-language support and mobile responsiveness, the platform facilitates easier access to the content by farmers from different regions and levels of literacy. This personalization greatly enhances the likelihood of scheme uptake, ultimately improving the economic and operational efficiency of farmers.

Apart from providing policy information, ADCMS also incorporates a formal policy feedback mechanism. Conventional policy-making has often been hampered by a deficiency in contemporary, grassroots-level responses from its target population. Having a feedback module allows farmers to register their experiences with scheme accessibility, bureaucratic lag, application difficulty, and success stories. These feedbacks are tabulated and converted into qualitative and quantitative datasets that provide policymakers with useful insight into the actual performance and effect of agricultural programs.

For instance, if there is low enrollment in a given subsidy scheme for a district, the system would be able to review feedback information and determine whether the cause of low enrollment lies in digital illiteracy, procedural complexity, or lack of outreach. The insights can then be anonymized and reported back to agricultural departments, allowing them to adjust implementation strategy or provide extra support wherever necessary.

Additionally, the system uses these findings to optimize its own performance. For example, common complaints can be indicated to moderators, and guidance posts or customer care services can be revised accordingly. This establishes a feedback loop that not only improves the quality of service provision but also leads to ongoing improvement in user experience.

By integrating real-time data analysis with grassroots feedback, ADCMS converts policy engagement into a two-way communication process from a one-way channel. This fosters more inclusive agricultural growth, strengthens institutional trust, and ultimately results in more responsive, efficient, and equitable policies. The model provides a benchmark for how digital agriculture platforms can enable participatory governance and evidence-based decision-making at scale.

The aggregated usage data (e.g., frequent issues, popular crops, scheme inquiries) can be anonymized and used by policymakers to fine-tune regional policies, extension services, and subsidy programs.

4. DISCUSSION

The case of ADCMS reflects the great promise of combining digital technology, especially artificial intelligence and real-time data analysis, with conventional methods of farming. The strength of the platform is its multi-faceted feature of covering disease identification through AI-driven image analysis, real-time crop price monitoring, region-based article reading, and government scheme data. This analysis assesses the efficacy, constraints, and wider implications of the system for small and marginal farmers, digital take-up, and sustainable agriculture.

The idea of using AI technique in crop management was first proposed in 1985 by McKinion and Lemmon [6].

One of the most notable achievements of the system is its image processing module, which empowers farmers to detect crop diseases early and accurately.

Using AI-powered image recognition trained on large datasets, the system can classify common diseases across a variety of crops. This feature reduces dependency on physical visits from agricultural officers or local experts and enables faster intervention, potentially preventing significant yield losses. Although pilot usage results have indicated high accuracy in disease image classification, the quality of disease detection remains user-clarity and angle-image-dependent. This actually highlights the need for educating users on the proper use of the system.

The addition of localized crop prices is another positive benefit. Volatility of markets and lack of transparency tend to compel farmers to sell their crops at exploitable prices. By offering real-time market rates by location and crop type, ADCMS assists farmers in making more informed selling decisions. Ensuring the integrity of this data, though, necessitates ongoing integration with government market feeds and private aggregators. The danger of delayed or incorrect price updates can diminish confidence and impact the credibility of the system.

The policy feedback component offers a significant step toward participatory governance of agriculture. Farmers are able to report on scheme availability and effectiveness, enabling policymakers to receive real-time feedback. Although the feature is novel, success is contingent on local government's willingness to take up and respond to this feedback. Without institutional backing, such insights might be underutilized.

Community functions, such as discussion forums and the call service, have improved user interaction and enabled peer-to-

peer knowledge sharing. The tools facilitate both informal and formal learning, particularly for less digitally literate users who take advantage of voice interaction and community support. Community moderation is necessary to avoid the dissemination of misinformation or irrelevant subjects. High-quality interactions may necessitate collaboration with agricultural universities or professional moderators.

Overall, the platform shows how data and AI can enhance not only productivity but also farmer empowerment. Combining educational materials, image diagnosis, and economic information places ADCMS not only as a tool but as a decision support system. Nevertheless, the scalability of these platforms relies on infrastructure preparedness, including internet connectivity, smartphone penetration, and digital literacy in rural India and other agrarian economies.

As a whole, the system is a promising vision for future smart agriculture. Farmers' positive initial reactions indicate high acceptability but long-term success will rely on ongoing improvement, collaborative work with stakeholders, and adaptive learning. Future research should investigate integration into IoT devices, predictive analytics-based climate risk management, and language support for more inclusive user groups.

4.CONCLUSION

ADCMS development and launch represent an important milestone in revolutionizing conventional agriculture using the might of artificial intelligence, access to data, and community interaction. This platform aggregates several farmer-friendly tools into one easy-to-use interface that solves key agricultural problems—everything from early detection of diseases and crop planning to price prediction and policy management.

The inclusion of AI-driven image recognition enables timely detection of crop diseases, lowering the threat of major yield loss and minimizing reliance on outside diagnostic assistance. Real-time access to crop commodity prices, coupled with current information on government schemes and subsidies, enables farmers to make economically and strategically sound decisions. These facilities are augmented by well-filtered agricultural articles and crop care advice, promoting ongoing learning and the embracement of green practices.

In addition, the provision of a feedback channel and community platform facilitates two-way communication between farmers and institutions. The participatory nature not only gives greater voice to small and marginal farmers but also allows for more responsive and inclusive policy refinement. The availability of a call service and multiple languages ensures that the platform remains accessible to a broad demographic with limited digital literacy.

Although the system has shown good potential, its wider impact awaits some external developments, such as digital infrastructure, smartphone penetration in rural areas, and continued partnerships with agricultural scientists, policymakers, and technology suppliers. Overcoming these challenges will be critical in ensuring long-term scalability and efficiency.

In sum, ADCMS is an integrated response to digital agriculture—fusing technological innovation and localized knowledge, economic understanding, and community empowerment. By filling the chasm between technology and conventional agricultural practices, the platform not only enhances farm productivity but also helps towards the overall aims of rural development, sustainability, and food security. As the system matures, future research and development can be directed towards predictive analytics, satellite and sensor integration, and regional customizations to suit the varied requirements of farmers in various agro-climatic zones.

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