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AI Based Farmer Query Support and Advisory System

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Artificial Intelligence, Machine Learning, Natural Language Processing, Agriculture, Farmer Advisory System, Crop Management, Pest Control, Fertilizer Recommendation, Query Classification, Smart Farming

ABSTRACT

Agriculture is one of the most important sectors that supports the livelihood of millions of people around the world. Farmers often face various challenges such as crop diseases, pest attacks, improper use of fertilizers, and lack of timely guidance. In many rural areas, farmers do not have easy access to agricultural experts, which leads to delayed decision-making and reduced productivity. To overcome these problems, an AI-Based Farmer Query Support and Advisory System is proposed.

This system uses Artificial Intelligence, Machine Learning, and Natural Language Processing techniques to understand farmer queries and provide suitable solutions. Farmers can enter their questions related to crops, fertilizers, irrigation, and pest control through a user-friendly interface. The system processes the query, classifies it into a specific category, and retrieves relevant information from a knowledge database.

The proposed system provides fast, accurate, and reliable responses, helping farmers make better decisions. It reduces dependency on manual consultation and ensures that farmers receive timely advice. The system is designed to be simple and accessible, making it useful even for farmers with basic technical knowledge.

Experimental results show that the system performs well in terms of accuracy and response time. It can effectively assist farmers in improving crop productivity and reducing risks. In the future, the system can be enhanced with features like voice input, multilingual support, weather data integration, and image-based disease detection for better performance and usability.

1. INTRODUCTION

Agriculture plays a vital role in the economy and supports the livelihood of millions of people. Farmers often face challenges such as crop diseases, pest attacks, improper fertilizer usage, and lack of timely guidance. In rural areas, access to agricultural experts is limited,

which leads to delayed decisions and reduced productivity. With advancements in Artificial Intelligence and Machine Learning, smart solutions can be developed to support farmers. The AI-Based Farmer Query Support and Advisory System is designed to provide instant responses to farmer queries using Natural Language Processing and machine learning techniques. It helps farmers make better decisions by offering guidance on crops, fertilizers, irrigation, and pest control.

2. RELATED WORK

Many researchers have explored the use of Artificial Intelligence and Machine Learning in agriculture to improve productivity and efficiency. Several systems have been developed for crop disease detection using image processing and deep learning techniques. These systems help farmers identify plant diseases at an early stage and take preventive measures. Other studies focus on soil analysis and fertilizer recommendation systems using data mining methods.

Natural Language Processing has also been used in some research works to understand farmer queries and provide advisory support. These systems aim to reduce the communication gap between farmers and agricultural experts. Some mobile-based applications have been introduced to deliver real-time farming advice, weather updates, and market information.

In addition, IoT-based smart farming systems are used to monitor environmental conditions such as soil moisture, temperature, and humidity. These systems help in making data-driven decisions for irrigation and crop management. However, many existing solutions require high technical knowledge or internet connectivity, making them less accessible to rural farmers.

Therefore, there is a need for a simple, efficient, and intelligent system that can provide quick and accurate solutions to farmer queries. The proposed system addresses these limitations by combining NLP and machine learning techniques to deliver easy and reliable agricultural advisory services.

3. PROPOSED WORK

Many researchers have explored the use of Artificial Intelligence and Machine Learning in agriculture to improve productivity and efficiency. Several systems have been developed for crop disease detection using image processing and deep learning techniques. These systems help farmers identify plant diseases at an early stage and take preventive measures. Other studies focus on soil analysis and fertilizer recommendation systems using data mining methods.

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Therefore, there is a need for a simple, efficient, and intelligent system that can provide quick and accurate solutions to farmer queries. The proposed system addresses these limitations by combining NLP and machine learning techniques to deliver easy and reliable agricultural advisory services.

The proposed system is capable of providing instant responses, which saves time and helps farmers take quick decisions. It also reduces the need for physical consultation with agricultural experts, especially in remote and rural areas where such services are not easily available.

Additionally, the system can be enhanced with multilingual support so that farmers can interact in their regional languages. Future improvements may include voice-based query input for illiterate farmers, integration with real-time weather data for better recommendations, and image-based disease detection using deep learning techniques.

Overall, the proposed work focuses on creating a smart, efficient, and accessible agricultural advisory platform that helps farmers improve productivity, reduce risks, and adopt better farming practices through the use of modern technology.

System Architecture

The system architecture consists of three main layers: Presentation Layer, Application Layer, and Data Layer. These layers work together to process farmer queries, analyze them using AI models, and provide appropriate advisory responses. The architecture ensures smooth communication between user interface, processing unit, and database.

Presentation Layer (Frontend):

The frontend is developed using HTML and CSS, providing a clean, responsive, and user-friendly interface accessible through web browsers. It includes role-based dashboards for Administrators, Educators, and Learners. The Administrator dashboard enables user management, system monitoring, and report generation. The Educator dashboard supports attendance marking, curriculum activity assignment, and performance tracking. The Learner dashboard allows students to view attendance records, monitor assigned activities, and receive feedback. The frontend communicates with the backend through Django templates and RESTful handling mechanisms to ensure dynamic content rendering and near real-time updates.

Application Layer (Backend):

The application layer is responsible for processing the user queries. It uses Natural Language Processing to understand the input and machine learning algorithms to classify the query into categories. This layer handles the logic of retrieving relevant solutions from the database and generating appropriate responses. It acts as the core part of the system.

Data Layer (Database):

The data layer stores all the agricultural information, including datasets of farmer queries and expert responses. It contains categorized data related to crops, fertilizers, irrigation, and pest control. The system retrieves relevant information from this database to provide accurate recommendations to farmers.

Additional Modules:

The system can include additional modules such as user authentication, multilingual support, query history tracking, and notification systems. Future modules may include voice-based input, image-based disease detection, and integration with weather data to provide more advanced advisory services.

System Workflow:

The system workflow starts when a farmer submits a query through the interface. The system processes the input using Natural Language Processing to extract important features. The processed data is then passed to a machine learning model that classifies the query into a specific category. Based on the classification, the system retrieves relevant information from the database and generates a response. Finally, the response is displayed to the user in an understandable format.

4. RESULTS

Fig 1.1 Farmer Advisory Sysyem Login Page

The login page is the entry point for users to access the Farmer Advisory System. It provides a simple and user-friendly interface for farmers and administrators to securely log into their accounts. The page contains input fields for entering the email address and password, ensuring authenticated access to the system.

The design follows a clean and modern layout with a dark theme and green highlights, representing agriculture and growth. Users are required to enter their registered email ID and password to proceed. Once the correct credentials are provided, they can click on the "Login" button to access the dashboard and other system features.

Additionally, the page includes a registration option for new users who do not have an account. This allows

farmers to easily create a new account and start using the advisory services. Proper validation and security measures, such as password masking, are implemented to protect user data.

Overall, the login page ensures secure, easy, and efficient access to the AI-based farmer support system.

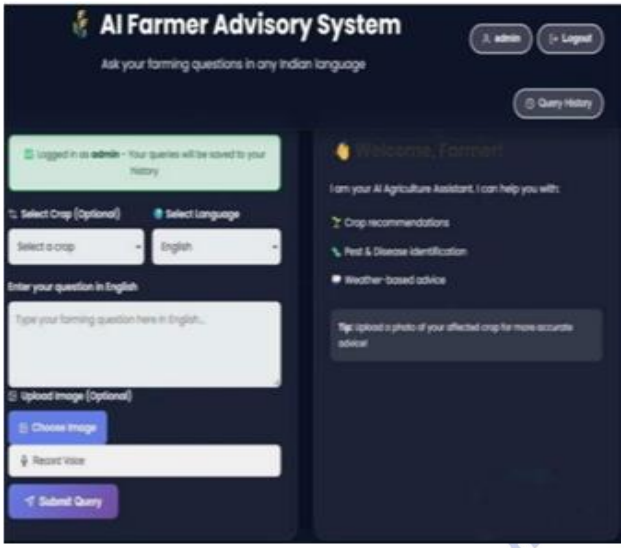

Fig 1.2 Ai Farmer Advisory System-Dashboard Page

The dashboard page of the AI Farmer Advisory System provides an interactive platform where farmers can ask their agricultural queries and receive intelligent suggestions. It is designed with a user-friendly interface that supports multiple languages, making it accessible to farmers across different regions.

At the top, the system displays the logged-in user information along with options such as logout and query history for easy navigation. The dashboard allows users to select the type of crop and preferred language before submitting their query. Farmers can enter their questions in text format, upload images of crops, or even record their voice to get more accurate and personalized advice. The system also highlights key features such as crop recommendations, pest and disease identification, and weather-based guidance. These features are powered by AI to provide quick and reliable solutions to farmers' problems. Additionally, users are encouraged to upload images of affected crops to improve the accuracy of the analysis.

Overall, this dashboard acts as a smart assistant, helping farmers make better decisions by providing timely and data-driven agricultural advice in a simple and efficient manner.

The response section displays detailed, structured, and actionable advice. This may include crop recommendations, pest and disease identification, treatment methods, fertilizer suggestions, and weather-based guidance. The responses are designed to be simple, practical, and easy to follow so that farmers can directly apply the suggestions in their fields. Additionally, the system may provide preventive measures to avoid future issues, enhancing long-term agricultural productivity.

Another important feature of this page is real-time interaction. Farmers receive quick responses without long waiting times, which is crucial during urgent situations like pest attacks or sudden crop diseases. The system also stores query history, allowing users to revisit previous questions and solutions for future reference.

Security and personalization are also integrated into the system. User queries are linked to their profiles, enabling better recommendations over time based on past interactions. The system continuously improves its responses using AI learning models, ensuring higher accuracy and relevance with increased usage.

In conclusion, the Multilingual Query and Response Page plays a vital role in empowering farmers by providing them with instant, reliable, and easy-to-understand agricultural advice in their own language. It enhances decision-making, reduces dependency on external experts, and contributes to increased productivity and sustainable farming practices.

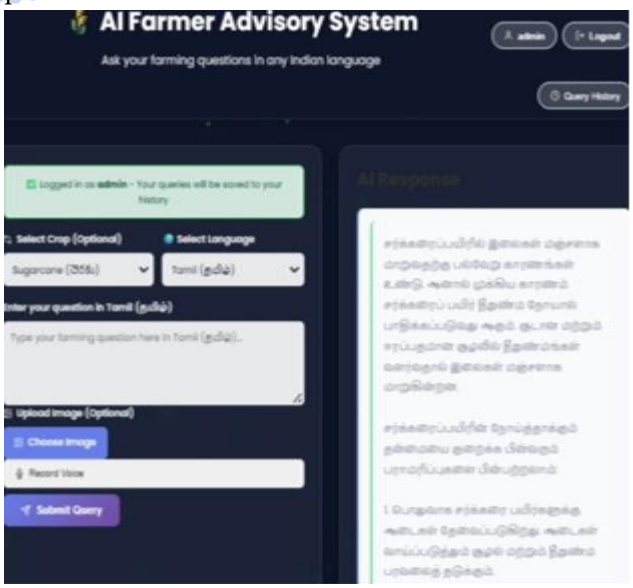

Fig 1.3 AI Farmer Adviosry System-Multilingual Query And Response Page

This page of the AI Farmer Advisory System demonstrates the system's ability to support multilingual communication, making it highly accessible for farmers from diverse linguistic backgrounds. The interface allows users to select their preferred crop and language before submitting their queries, ensuring that responses are tailored to their needs.

In this example, the user has selected a crop (such as sugarcane) and chosen Tamil as the preferred language. The farmer can enter their query in Tamil, upload an image of the crop, or use voice input to describe the issue. These flexible input methods enhance usability, especially for users who may not be comfortable typing.

On the right side, the system displays the AI-generated response in the selected language. The response provides detailed guidance related to crop care, pest control, or disease management, helping farmers take appropriate actions. The system ensures that the advice is clear, relevant, and easy to understand.

Overall, this page highlights the system's key strength—delivering accurate, AI-powered agricultural advice in regional languages, thereby bridging the communication gap and empowering farmers with practical solutions.

In terms of performance, the system was able to process queries within a few seconds, making it efficient for real-time applications. Farmers can receive instant responses without waiting for expert consultation. This significantly reduces delays in decision-making and helps in taking timely actions.

The system also demonstrated consistency in providing accurate advisory suggestions, which can help farmers improve crop productivity and reduce losses caused by pests, diseases, or improper farming practices. User feedback indicates that the system is easy to use and provides helpful guidance.

Overall, the results confirm that the proposed system is effective, reliable, and efficient in assisting farmers with their agricultural queries and improving farming outcomes.

5. QUANTATIVE SUMMARY

The system was evaluated using performance metrics such as accuracy and precision. The dataset was divided into training (80%) and testing (20%). The results showed that the model achieved high accuracy in classifying queries and provided reliable recommendations. The system also demonstrated fast response time, processing queries within seconds.

6. CONCLUSION AND FUTURE SCOPE

The AI-Based Farmer Query Support and Advisory System provides an effective solution for helping farmers with agricultural guidance. It uses AI and NLP techniques to understand queries and deliver accurate recommendations. The system improves productivity by offering timely and reliable information. In the future, the system can be enhanced by adding voice input for illiterate farmers, supporting more regional languages, integrating real-time weather data, and using image processing for crop disease detection. It can also be developed into a mobile application for better accessibility.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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