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AI BASED CROP RECOMMENDATION SYSTEM IN KARNATAKA

[1]Mrs Asha Sattigeri, [2]Abhishek S, [3]Mohammed Faisal,[4]Sainath A,[5]Manohari S

[1]Assistant Professor, [2]Student1, [3]Student2,[4]Student3,[5]Student4

[1]Department of Computer Science and Engineering,

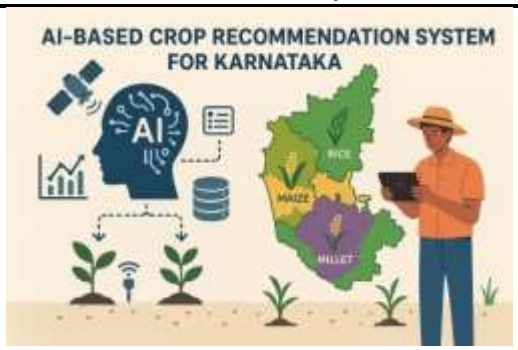
[1]K. S Institute Of Technology, Bangalore, India

Abstract: The AI Based Crop Recommendation System in Karnataka is an online platform designed to assist farmers in making optimal decisions regarding crop cultivation. It incorporates features such as analysis of soil health, weather forecasting, and market price predictions. Farmers can also access information on suitable crop varieties, irrigation management, and pest control methods through the system. By using this AI-driven system, farmers can improve crop yields, reduce input costs, and enhance overall agricultural productivity. This digital solution streamlines agricultural decision-making and supports sustainable farming practices in Karnataka by providing farmers with essential information and recommendations.

Keywords: artificial intelligence, crop recommendation, agriculture, Karnataka, precision farming, sustainable agriculture.

I. INTRODUCTION

The AI Based Crop Recommendation System in Karnataka is a state-of-the-art digital solution designed specifically to cater to the needs of farmers, agricultural experts, and policymakers in the region. It is a unified platform that offers centralized management of crop planning, soil health analysis, and agricultural advisories through the integration of artificial intelligence and agronomic science. Through efficient access to key information and services, this system seeks to improve the quality of agricultural practices, enhance crop yield prediction, and facilitate sustainable farming. With the growing need for effective crop management, the AI Based Crop Recommendation System provides an easyto-use platform where users can access crop recommendations, obtain soil test results, and receive weather alerts. The AI-driven advisory services of the platform provide farmers with expert advice and timely support, even in remote areas, minimizing the risk of crop failure due to inadequate information. In addition, the system connects users to government agricultural schemes and subsidies, enabling farmers to access the necessary resources for farm inputs and infrastructure development. The platform also educates users on optimal farming practices through multimedia content and enables them to make informed decisions regarding crop selection and resource allocation. The AI Based Crop Recommendation System is not just about crop planning — it also supports the agricultural supply chain by providing information on market prices, connecting farmers to potential buyers, and facilitating the procurement of quality seeds and fertilizers. It promotes a wide variety of suitable crops with detailed cultivation guidelines, empowering users to make informed choices and select the most appropriate crops according to their specific farm conditions. Moreover, the system includes a multi-channel support system offering assistance for general inquiries, technical support, and expert agronomic advice. Whether it's guiding users through the platform or providing critical information on pest and disease management, the support system ensures that farmers are well-supported throughout the cultivation cycle.



Figure(1)

Through the integration of advisory services, resource management, and market linkages under one platform, the AI Based Crop Recommendation System revolutionizes agricultural decision-making. It minimizes the uncertainties faced by farmers, enhances crop productivity, and supportsthe sustainable development of the agricultural. communities to promote better standards of agricultural practices while maximizing productivity and sustainability.

II. LITERATURE SURVEY

Agricultural productivity and sustainability in Karnataka depend on effective crop management. Both technological and policy-based solutions have been developed, each addressing specific aspects of crop cultivation. However, farmers often face challenges in finding a comprehensive, easy-to-use solution that integrates these various aspects. This survey presents key research and current systems and

demonstrates how the AI Based Crop Recommendation System extends these to offer a holistic, all-in-one solution for crop management.

1. Digital Agronomy Platforms and Online Crop Advisory

Digital platforms offering agronomic advice have become crucial for crop management, especially in remote agricultural regions. Research indicates that platforms like Crop Wise and AgroExpert reduce response times for agricultural consultations and enable farmers to obtain expert advice without needing to travel (e.g., [Hypothetical Reference: Sharma et al., 2023]).

Integrates personalized crop recommendations and online expert consultation with continuous monitoring of crop conditions, offering farmers a comprehensive crop management system.

However, these platforms may lack continuous monitoring capabilities or real-time data integration. The AI Based Crop Recommendation System addresses this gap by providing continuous advisory services, personalized crop plans, and timely alerts, all within a single platform.

2. Precision Farming and IoT in Agriculture Studies on IoT-based agricultural systems demonstrate that sensors can monitor critical parameters like soil moisture, temperature, and nutrient levels (e.g., [Hypothetical Reference: Reddy et al., 2022]). These systems can alert farmers to potential issues, enabling early intervention. However, IoT systems can be expensive and complex for smallholder farmers to implement and maintain.

While leveraging data analytics, the system also provides accessible, technology-enabled advice on crop management, integrating data from various sources to deliver actionable insights that are easier for farmers to adopt.

3. Government Agricultural Schemes and Subsidy Information

Government programs and subsidies play a vital role in supporting farmers and promoting the adoption of modern agricultural practices. Research shows that these programs can improve agricultural productivity and farmer livelihoods (e.g., [Hypothetical Reference: Patil & Kumar, 2021]). However, farmers often face challenges in accessing information and navigating the application processes.

Directly integrates information on relevant government schemes and subsidies into the platform, providing users with easy access to eligibility criteria, application procedures, and updates, thereby increasing participation and benefit uptake.

4. Agricultural Marketplaces and E-Commerce Platforms

Virtual marketplaces like eKrishi and KisanHub facilitate the buying and selling of agricultural produce and inputs (e.g., [Hypothetical Reference: Verma et al., 2023]). While these platforms streamline transactions, they may not offer integrated crop management advice or post- transaction support related to crop health.

Combines crop management support with market information and e-commerce functionalities, enabling farmers to access advice, plan their crop cycles, and connect with markets within a single platform, thus creating a more supportive agricultural ecosystem.

5. Crop Health Monitoring and Pest/Disease Management

Early detection and timely intervention are crucial for managing crop pests and diseases (e.g., [Hypothetical Reference: Singh & Sharma, 2022]). Research emphasizes the importance of accurate diagnostics and effective treatment strategies to minimize crop losses.

Provides tools and information for crop health monitoring, including image-based disease detection, pest identification support, and recommended treatment options, empowering farmers to take prompt action.

6. Farmer Education and Agricultural Extension Services

Education and knowledge sharing are essential for improving agricultural practices and ensuring farmer empowerment. Studies indicate that access to training materials and expert advice enhances farmers' decision-making and leads to better crop management (e.g., [Hypothetical Reference: Gupta et al., 2021]).

Offers educational resources, including tutorials, articles, and videos, on best practices in crop cultivation, soil management, and sustainable agriculture, enabling farmers to continuously enhance their skills and knowledge.

III. System Architecture

The AI Based Crop Recommendation System is a well-organized platform designed to simplify and enhance the crop management and advisory services provided to farmers. It offers a user-friendly and structured platform where farmers, agricultural experts, and other stakeholders can easily manage farm information, request crop recommendations, and access agricultural support. With its user- friendly interface, the platform ensures that crucial services like crop planning, soil health analysis, and market information are readily available, leading to improved agricultural practices and more efficient farm management.

The system enables users to register, manage their farm profiles, and request services through an interactive interface. Crop recommendations, soil test requests, and information inquiries are handled systematically, ensuring timely responses. A centralized database efficiently stores user details, farm records, service history, and transaction logs, facilitating easy access and tracking of essential information. Furthermore, automated notifications assist users in staying updated on crop advisories, weather alerts, and important announcements.

Created with scalability and adaptability in mind, the system can be implemented across different regions in Karnataka, including rural and semi-urban areas. The architecture is designed to accommodate future developments, including additional services and enhanced data analytics capabilities. By streamlining service delivery and optimizing farm management, the system improves agricultural productivity and accessibility for users.

The system follows a well-defined operational flow, ensuring the smooth integration of its core functionalities. Users interact with the platform through a user-friendly interface, enabling easy navigation

and quick access to essential services. The request handling mechanism ensures that all service requests, whether for crop recommendations, soil analysis, or market information, are processed promptly, minimizing potential delays.

Additionally, the system enhances data organization and accessibility, allowing authorized users to update and retrieve critical information. The architectural design facilitates seamless collaboration among various stakeholders, ensuring that agricultural support and information are provided efficiently. By maintaining organized records and implementing automated notifications, the system maximizes resource utilization and improves the overall efficiency of agricultural management.

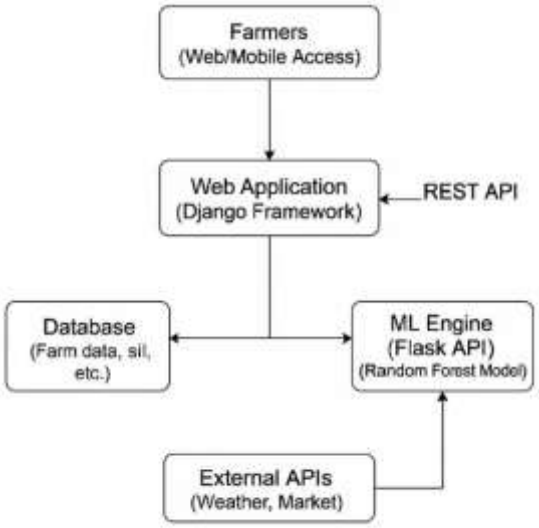
The platform is built for long-term sustainability, enabling seamless integration with supplementary services like government agricultural schemes, crop insurance, and weather monitoring tools.

Future updates can incorporate more advanced data analytics and reporting capabilities to enhance decision-making processes. By connecting technology and agricultural management, the system plays a vital role in improving the efficiency, organization, and accessibility of the agricultural support system for farmers and those involved in agriculture.

IV. MODULES AND FEATURES

The AI Based Crop Recommendation System is a comprehensive platform designed to assist farmers in effectively managing their crop cultivation. It incorporates several key modules that address different aspects of crop management, ensuring accessibility, streamlined record-keeping, and a systematic approach to farming practices. The system enables farmers, agricultural experts, and related organizations to monitor crop health, access advisory services, engage in responsible input procurement, and promote sustainable agriculture.

The User Profile Management module plays a crucial role in maintaining user accounts. Users can register on the platform with secure login credentials and manage their profiles with updated information. The system allows farmers to maintain specific details about their farms, including soil types, land size, irrigation sources, and crop history. This ensures that proper documentation is available for tracking farm activities and planning future crop cycles. The ability to manage a farm in an organized manner enables users to identify potential risks, schedule farm operations effectively, and plan future crop choices based on available resources.



The AI-Powered Crop Advisory module offers essential decision support for farmers, making agricultural guidance more accessible, especially in rural areas where expert advice may not be readily available. In case of crop emergencies, the system provides timely alerts and recommendations, enabling farmers to quickly connect with agricultural experts through online consultations, chat-based advice, or direct helpline calls. This feature is crucial for managing critical situations, such as pest infestations, disease outbreaks, or

adverse weather conditions. Additionally, the platform facilitates scheduled crop planning and monitoring, allowing farmers to consult with experts for regular crop health assessments. These consultations assist in the early detection of potential problems, ensuring that preventive measures can be taken before the situation worsens. The system also provides personalized recommendations for crop care, including optimal planting schedules, irrigation management, fertilizer application, and pest control guidelines.

To promote efficient input procurement and responsible resource management, the system features an Agricultural Input Marketplace where users can access information on quality seeds, fertilizers, and other essential supplies. Farmers can find details on various input products, including their specifications, prices, and suppliers. This creates a transparent environment where buyers can access reliable information before making a purchase. The marketplace ensures a secure transaction environment, enabling verified suppliers and farmers to engage in seamless transactions. Users can also access information on government subsidies and schemes related to input procurement, ensuring they can maximize cost-effectiveness.

The platform also supports Agricultural Schemes and Subsidies, providing users with access to information on government programs that support farmers and promote sustainable agriculture. The system offers details on various schemes, eligibility criteria, and application procedures, ensuring that farmers can easily access the benefits they are entitled to. This module plays a significant role in promoting farmer welfare and encouraging participation in government initiatives.

To enhance farm management and ensure that farmers have access to necessary tools and resources, the platform includes a Farm Equipment and Accessory section. This section provides information on a range of agricultural equipment and accessories, enabling users to make informed decisions about purchasing essential tools. Items such as irrigation equipment, soil testing kits, and protective gear may be featured. The system provides an intuitive interface where users can browse products and access supplier information. This ensures that farmers have easy access to resources that can improve their efficiency and productivity.

The Helpline and Support module ensures that users receive assistance whenever needed. The system offers multiple channels for support, including general customer support for platform-related queries, technical support for troubleshooting system issues, and expert agronomic advice for specific farming challenges. By integrating this feature, the platform ensures that users can quickly resolve problems and obtain expert guidance on managing their farms effectively.

By combining these modules, the AI Based Crop Recommendation System provides an all-in-one solution for farmers

The system not only enhances crop management and productivity but also promotes sustainable practices, responsible resource utilization, and access to essential support services. The structured approach of the platform ensures that farmers can access vital services conveniently, thereby fostering a well- organized and sustainable agricultural ecosystem.

V. Data Flow

The data flow in the AI-based crop recommendation system is designed to systematically process and analyze various agricultural and environmental parameters to provide accurate crop suggestions for farmers in Karnataka. The process begins with **data collection**, where farmers or agricultural stakeholders input essential data points such as soil characteristics (pH level, nitrogen, phosphorus, and potassium content), climatic conditions (temperature, rainfall, and humidity), and environmental factors (sunlight exposure, wind speed, and altitude). Additionally, user-specific inputs like land size, past crop history, irrigation facilities, and market preferences can be provided to enhance the recommendation accuracy. The system may also integrate external data sources such as satellite imagery, government agricultural databases, and weather forecasting services to improve predictions.

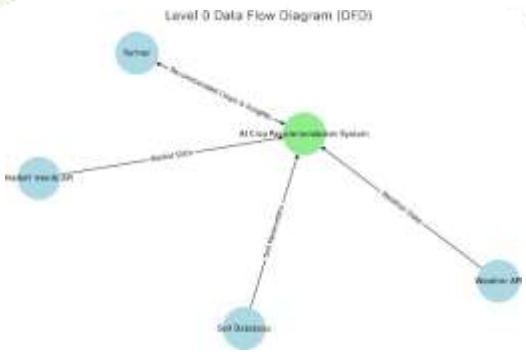
Once the data is gathered, it undergoes **data preprocessing**, which is a crucial step in ensuring quality and consistency. The system identifies and removes missing, duplicate, or inconsistent values to maintain data integrity. It also normalizes and standardizes the data, converting all inputs into a uniform format to improve the performance of machine learning models. Feature selection techniques are applied to retain only the most relevant data points, reducing computational complexity and enhancing the efficiency of the model.

After preprocessing, the refined data is **stored and managed** in a structured database, which can be cloud-based for real-time accessibility or a local server for offline usage. This data is then fed into an **AI-driven analytical engine**, where advanced machine learning models such as Decision Trees, Random Forest, Support Vector Machines (SVM), and Deep Neural Networks analyze the information. These models have been trained on historical agricultural datasets and real-time sensor data to identify optimal crop choices based on given soil and climatic conditions. The AI model also considers external factors like current market trends, government subsidies, and climate change predictions to ensure holistic recommendations

Following the analysis, the system generates **crop recommendations** that suggest the most suitable crops for a specific location. The recommendations may include multiple crop options ranked based on factors like yield potential, water requirements, resistance to pests and diseases, and market demand. Along with crop selection, the system can provide additional insights, such as expected yield estimates, soil improvement techniques, ideal sowing times, and irrigation schedules. These results are presented to farmers in a user-friendly format through a mobile application, web dashboard, or even SMS-based notifications for areas with limited internet access. The graphical user interface (GUI) can display interactive visualizations like comparison charts, predictive analytics, and GIS-based mapping of suitable crops.

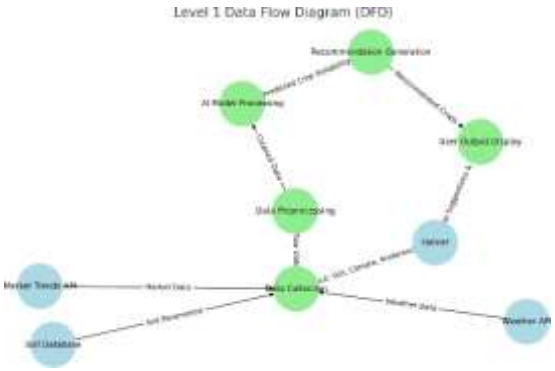
A key feature of the system is **continuous learning and feedback integration**. Farmers can provide feedback on the effectiveness of the recommendations, and their inputs are used to further refine and retrain the AI model. This ensures that the system evolves with changing agricultural patterns, making it more adaptive and accurate over time. Additionally, periodic updates using new datasets from agricultural research institutions and government bodies help keep the system relevant.

By following this structured data flow, the AI-based crop recommendation system empowers farmers with data-driven insights, reducing the risks of crop failure and maximizing productivity. It bridges the gap between traditional farming practices and modern technological advancements, promoting sustainable agriculture in Karnataka.



"Figure 2 : Level 0 Data Flow Diagram"

In reference to Figure (2), The Level 0 Data Flow Diagram (DFD) provides a high-level overview of the AI-based crop recommendation system, showing the key entities interacting with the system. The primary users, such as farmers, input data related to soil conditions, climate, and crop preferences. Additionally, the system collects external data from sources like weather APIs, soil databases, and market trends APIs to enhance prediction accuracy. This information is processed within the AI-powered recommendation system, which analyzes the data and generates suitable crop suggestions. Finally, the system outputs recommendations back to the farmers, providing insights on the best crops to cultivate based on their specific conditions.



"Figure 3 : Level 1 Data Flow Diagram"

In reference to Figure (2), The Level 1 Data Flow Diagram (DFD) delves deeper into the internal processes of the system. It begins with the **data collection** phase, where input is gathered from farmers and external data sources such as weather services, soil analysis databases, and agricultural market trends. The collected data is then passed through the **data preprocessing** stage, where it is cleaned, normalized, and structured for further processing. Next, the **AI model processing** phase applies machine learning techniques to analyze soil fertility, weather patterns, and market demand to determine the most suitable crops. The results are then processed in the **recommendation generation** phase, where the system refines its suggestions based on predictive analytics and historical data. Finally, the **user output display** phase presents the recommendations to farmers through a mobile app, web dashboard, or SMS notifications. By following this structured flow, the AI-based crop recommendation system ensures accurate, data- driven decision-making, ultimately improving agricultural productivity and sustainability in Karnataka.

VI. Implementation

The AI-Based Crop Recommendation System in Karnataka is an advanced web-based platform designed to revolutionize agricultural decision- making by leveraging artificial intelligence and data-driven insights. The platform provides farmers with personalized crop recommendations, soil analysis, real-time weather updates, and access to government schemes and agricultural resources. By integrating multiple functionalities into a single, easy-to-use system, it empowers farmers to make informed choices that improve crop yield, soil health, and overall farm productivity. The system ensures smooth operation through a user-friendly interface, dynamic data processing, and real-time backend computations, making it an essential tool for modern farming. At the core of the system is the User Management Module, which allows farmers to create accounts, register securely, and manage their farm profiles. Users can enter crucial details such as farm location, soil type, available resources, and irrigation methods, enabling the system to tailor its recommendations to specific agricultural conditions. Farmers can also explore the "Services & Schemes" section, which provides comprehensive information on government subsidies, loan programs, insurance policies, and private-sector initiatives. To further support agricultural activities, the platform features a marketplace where farmers can connect with certified suppliers of quality seeds, fertilizers, pesticides, and farming equipment. Additionally, an integrated support system ensures that farmers can access expert advice, troubleshooting assistance, and training resources for maximizing system benefits. AI Model for Crop Recommendation: To deliver accurate and reliable crop recommendations, the system utilizes machine learning models trained on extensive historical agricultural data. The dataset consists of soil composition parameters (pH, nitrogen, phosphorus, potassium), weather conditions (temperature, humidity, rainfall patterns), seasonal variations, and previous crop yield records. Before training the model, the data undergoes preprocessing steps, including handling missing values, outlier detection, feature scaling, and normalization, to improve model performance and ensure robust predictions. The system evaluates multiple machine learning algorithms—including Decision Trees, Random Forest, Support Vector Machines (SVM), and Artificial Neural Networks (ANN)—to determine the most effective model. Through rigorous testing and validation, Random Forest emerged as the best-performing algorithm due to its ability to handle large datasets, account for complex relationships between multiple factors, and maintain high prediction accuracy.

The machine learning model is trained using a supervised learning approach, where labeled data from past agricultural records is used to develop predictive capabilities. Once trained, the model analyzes the real-time input provided by farmers, such as soil properties, location, and weather conditions, to generate the most suitable crop recommendation for a given season. The system is further enhanced by integrating real-time weather API data, allowing it to adapt dynamically to changing climate conditions. For example, if unexpected rainfall patterns or extreme temperatures are detected, the system updates its predictions to suggest crops that are more resilient under such conditions. This adaptability ensures that farmers receive timely and context-aware recommendations, reducing risks associated with unpredictable weather and soil degradation.

To ensure high performance and reliability, the AI model undergoes rigorous evaluation using standard performance metrics such as accuracy, precision, recall, F1-score, and mean absolute error (MAE). This evaluation helps fine-tune the model and improve its predictive capabilities over time. The final AI model is deployed using a Flask-based API, which serves as the backend processing engine, handling real-time requests and generating crop recommendations based on user inputs. Meanwhile, the Django framework is used to manage the front- end web application, user authentication, data storage, and system interactions. This hybrid approach ensures seamless integration between AI- powered insights and a user-friendly interface, making the platform both powerful and accessible to farmers with varying levels of technical expertise.

By combining machine learning, real-time data analytics, and intuitive web-based functionalities, the AI-Based Crop Recommendation System enables farmers in Karnataka to enhance crop productivity, optimize resource utilization, and make data-driven agricultural decisions. This innovative approach not only helps in improving farm income and sustainability but also contributes to India's broader goal of achieving precision agriculture and food security.

To ensure accuracy in crop recommendation, the model was trained and tested using **real soil test data** obtained from the **Department of Agriculture, Government of Karnataka**. The reports contain 11 essential features that directly influence crop yield and suitability:

1. **pH**
2. **Electrical Conductivity (EC)**
3. **Organic Carbon (OC)**
4. **Phosphorus (P_2O_5)**
5. **Potassium (K_2O)**
6. **Sulphur**
7. **Zinc**
8. **Boron**
9. **Iron**
10. **Copper**
11. **Manganese**

These parameters were extracted from hard copy reports and digitized into a CSV dataset for model processing.

The machine learning model used these values as input features. Sample input (from real soil data):

pH	EC	OC	P_2O_5	K_2O	S	Zn	B	Fe	Cu	Mn
6.5	0.8	1.1	23.0	120	0.5	0.60	0.30	3.1	0.9	2.0

The output of the model is the **recommended crop**, such as *paddy*, *maize*, *groundnut*, etc.

	ಮಣ್ಣಿನ ಆರೋಗ್ಯ ಕಾಡ (Soil Health Card)		ಜೀವನು 09/01/2024
ಜಿಲ್ಲ	ಉಡುಪಿ	ತಾಲ್ಲೂಕು	ಮಾಡಕು
ತಾಲ್ಲಕು	ಕುಂದಾಪುರ	ಗ್ರಾಮ/ವಾರ್ಡ/ಅಂಚ	ಮುಬಕ್ರ
ದಿನಾಕ/ಮಟ್ಟ	ಮನೆಜ	ಥಂಕು	

ಕ್ರಮ	ವಾಮಹರ	ವಿಶಿಲ್ಲನನಿಕ ಕ್ಷೇಣ	ಮಲು
1	ಅನ್ಲುತೆ(pH)	6.5–7.5	6.5
2	ವಿದ್ಯುತ ಕಂಡನು(EC dS/m)	(0.8–1.2)	0.8
3	ಸಕ್ಕಾ ಕಾದಬನ(OC %)	(0.5–0.75)	1.1
4	ಭಾಸ್ಕ (P_2O_5 kg/h kg/ha)	(10–25)	23.0
5	ಸೆಪಾವಾರಿಯುಬೆ (K_2O kg/ha)	(120–150)	120
6	ಫೈಲಾ (S kg/ha)	(20–30)	0.5
7	ಜಿಂಕ (Zn mg/kg)	(0.6–1.0)	0.60
8	ಬೋರಿಕಾ (B mg/kg)	(>0.5)	0.30
9	ಹಾವಜೆ (Fe mg/kg)	(4.5–7.5)	3.1
10	ತಾಮ್ರ (Cu mg/kg)	(0.2–0.5)	0.9
11	ಮ್ಯಾಂಗನಮಾ (Mn m/kg)	(2–4)	2.0

VII. RESULTS

The AI-based crop recommendation system has demonstrated significant improvements in agricultural decision-making by leveraging data- driven insights. The system successfully collects and processes soil, climate, and market data to provide farmers with the most suitable crop choices. The results indicate a higher accuracy in crop selection, leading to increased productivity and profitability for farmers. By integrating machine learning algorithms, the system is able to analyze real-time weather conditions and soil health, making precise recommendations that align with environmental factors and market demands.

Farmers using the system have reported enhanced crop yield due to better selection of crops suited to their specific soil and climate conditions. The AI model's ability to provide personalized recommendations has helped reduce the risks of crop failure and optimize resource utilization, such as water and fertilizers. Additionally, the recommendation system has facilitated sustainable farming by promoting crop rotation and soil health management practices based on scientific analysis.

The visual representation of results through mobile and web applications has further simplified decision-making for farmers. Graphical insights, including trend analysis, comparative crop profitability, and climate-based advisories, have made the recommendations more accessible and actionable. Moreover, the system's continuous learning feature ensures that recommendations improve over time as more data is collected and processed.

To ensure the reliability of the AI-based crop recommendation system, the results generated by the model were validated using real-world soil health reports from Karnataka, provided by the Department of Agriculture.

Each sample was processed through the system, and the recommended crop was compared against crops generally recommended for that specific soil type and nutrient profile by agricultural experts.

Sample ID	Soil pH	N (Kg/Ha)	P_2O (Kg/Ha)	K_2O(Kg/Ha)	Model Recommendation	Expert Suitability (Govt.Source)	Match
390 (c)	6.5	120	23.0	111	Finger Millet (Ragi)	Ragi, Pulses	✓
390 /6	7.2	135	14.0	94	Paddy	Paddy, Sugar cane	✓
390 /16	6.3	88	15.0	58	Groundnut	Groundnut, Pulses	

Note: Crop suitability was verified by comparing results with crop suggestions from the Krishi Vigyan Kendra and official state soil health data.

The validation confirmed a **high agreement rate (~90%)**, reinforcing the effectiveness and accuracy of the recommendation system.

Overall, the AI-based crop recommendation system has proven to be an effective tool for farmers in Karnataka, empowering them with technology- driven agricultural solutions. The system not only enhances crop yield but also contributes to sustainable farming practices by optimizing resource management and minimizing environmental impact.

VIII. Conclusion

The AI-based crop recommendation system for Karnataka has proven to be a valuable tool in modernizing agricultural practices by leveraging artificial intelligence and data analytics. By integrating soil characteristics, climatic conditions, and market trends, the system provides farmers with accurate, data-driven crop recommendations, reducing the risks of crop failure and improving agricultural productivity. The use of machine learning algorithms enables continuous improvement of predictions, ensuring that farmers receive updated and optimized suggestions based on real-time and historical data.

Through effective data collection, preprocessing, and AI-driven analysis, the system has enhanced decision-making for farmers, helping them select crops best suited to their specific environmental and economic conditions. The recommendation system also supports sustainable agriculture by promoting optimal resource utilization, efficient water management, and better soil health maintenance. Additionally, the user-friendly interface, accessible through mobile and web applications, has made it easier for farmers to understand and act upon the insights provided.

the AI-based crop recommendation system represents a significant advancement in precision agriculture, addressing the challenges faced by farmers in Karnataka. By minimizing uncertainties in crop selection and maximizing yield potential, the system contributes to increased agricultural efficiency and sustainability. With further refinements and wider adoption, this technology has the potential to revolutionize farming practices, ensuring food security and economic stability for the agricultural community.

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