AI-Based Agriculture Advisory System

[1]Dr. A. Tirupataiah, [2]P. Yesu Dasu, [3]P. Dolanand, [4]V. Stephen

[1]Associate Professor, Dept of Computer Science and Engineering, St. Ann's College of Engineering and Technology, Chirala-523187, India.

[2,3,4]B. Tech Student, Dept of Computer Science and Engineering, St. Ann's College of Engineering and Technology, Chirala-523187, India.

ABSTRACT- ***Agriculture is a vital sector that supports economic growth and ensures food security. Farmers often face challenges in selecting suitable crops due to variations in soil nutrients, changing weather conditions, and limited access to expert agricultural guidance. The AI Based Agriculture Advisory System is a web-based application developed to assist farmers in making accurate crop selection decisions using Artificial Intelligence (AI) and Machine Learning (ML). The system analyzes important agricultural parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall to recommend the most suitable crop for cultivation. It is developed using Python, Flask, HTML, CSS, and JavaScript, with a Machine Learning model trained on the Agricultural Recommendation Dataset. The application provides a simple and user-friendly interface that enables farmers to enter soil and environmental data and receive instant recommendations. The proposed system improves prediction accuracy, reduces manual effort, promotes efficient resource utilization, and supports sustainable farming practices, helping farmers increase productivity and make informed agricultural decisions.***

KEYWORDS: Artificial Intelligence (AI), Machine Learning (ML), Agriculture Advisory System, Crop Recommendation, Sustainable Agriculture, Python, Flask, Soil Nutrients.

INTRODUCTION

Agriculture is one of the most important sectors contributing to the economy and food security, especially in countries like India where a large population depends on farming for their livelihood. Agricultural productivity is influenced by factors such as soil fertility, nutrient levels, rainfall, temperature, humidity, and crop selection. Choosing an unsuitable crop can result in low yield, poor soil health, and financial losses. Traditional crop selection methods

mainly rely on farmers' experience and expert advice, which may not always provide accurate recommendations under changing environmental conditions. The AI Based Agriculture Advisory System is a web-based application developed to assist farmers in selecting the most suitable crop using Artificial Intelligence (AI) and Machine Learning (ML). The system analyzes soil nutrients such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall to recommend suitable crops. Developed using Python, Flask, HTML, CSS, and JavaScript, the system provides accurate and timely recommendations, helping farmers improve productivity, optimize resource utilization, and promote sustainable agricultural practices.

LITERATURE SURVEY

Recent research in Artificial Intelligence (AI) and Machine Learning (ML) has shown significant improvements in agricultural decision-making, particularly in crop recommendation systems. Several studies have focused on predicting suitable crops by analyzing soil nutrients such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall. Machine Learning algorithms, including Decision Tree, Random Forest, Support Vector Machine (SVM), and K-Nearest Neighbors (KNN), have been widely used to improve prediction accuracy and support scientific farming practices. These systems help farmers select crops that are best suited to existing soil and climatic conditions, resulting in higher productivity and efficient resource utilization. Researchers have also developed web-based agricultural advisory systems to make these recommendations easily accessible to farmers. However, many existing systems are either complex or lack a user-friendly interface. The proposed AI Based Agriculture Advisory System addresses these limitations by combining an accurate Machine Learning model with a simple web application, enabling farmers to make informed crop selection decisions and promote sustainable agricultural practices.

RELATED WORK

Several researchers have developed AI and Machine Learning-based crop recommendation systems to help farmers select suitable crops using soil nutrients and weather conditions. Algorithms such as Random Forest, Decision Tree, SVM, and KNN have been widely used to improve prediction accuracy. These systems support scientific farming and increase agricultural productivity. However, many existing solutions are complex or require additional hardware. The proposed **AI Based Agriculture Advisory System** provides a

simple web-based platform that delivers accurate crop recommendations using Machine Learning, making it easy for farmers to make informed and sustainable farming decisions.

EXISTING SYSTEM

In the existing system, farmers mainly rely on traditional farming practices, personal experience, and expert advice to select crops. These methods often do not consider important factors such as soil nutrients, pH, temperature, humidity, and rainfall. As a result, incorrect crop selection can lead to low productivity, excessive fertilizer usage, and financial losses. Existing agricultural advisory services provide only general recommendations and may not be suitable for every farm. They lack real-time analysis and personalized crop suggestions. Therefore, the existing system is less efficient, less accurate, and does not fully support data-driven farming decisions.

PROPOSED SYSTEM

The proposed AI Based Agriculture Advisory System is a web-based application that uses Artificial Intelligence (AI) and Machine Learning (ML) to recommend the most suitable crop based on soil and environmental conditions. The system analyzes parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall to generate accurate crop recommendations. Developed using Python, Flask, HTML, CSS, and JavaScript, it provides a simple and user-friendly interface for farmers. The system delivers instant and reliable recommendations, improves crop productivity, optimizes resource utilization, and promotes sustainable farming practices.

SYSTEM ARCHITECTURE

The AI Based Agriculture Advisory System follows a simple web-based architecture consisting of the User Interface, Flask Server, Machine Learning Model, and Dataset. The user enters soil and environmental parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall through the web interface.

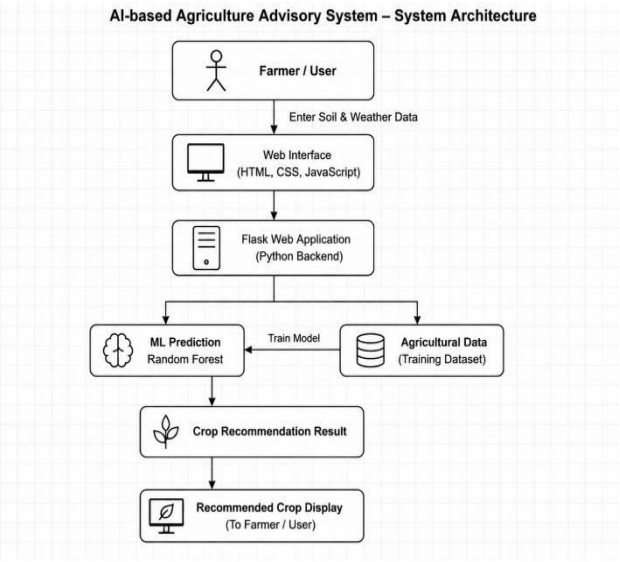

Fig 1: System Architecture

METHODLOGY DESCRIPTION

The AI Based Agriculture Advisory System uses a Machine Learning model to recommend suitable crops based on soil and weather conditions. The agricultural dataset is used to train the model using parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), soil pH, temperature, humidity, and rainfall. Users enter these values through a Flask-based web application, and the trained model predicts the most suitable crop. The system provides instant and accurate recommendations, helping farmers make informed decisions and improve agricultural productivity.

RESULTS AND DISCUSSION

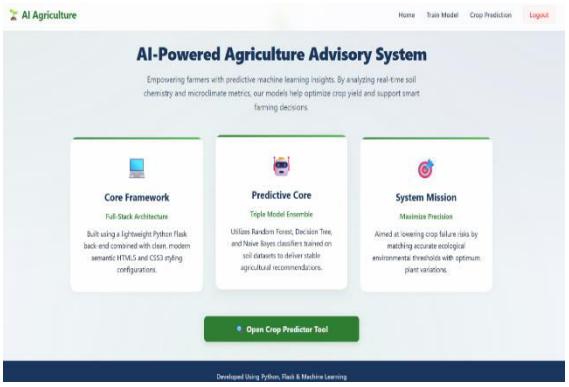

Fig 2: Home Page

The Home page provides an overview of the **AI-Powered Agriculture Advisory System** and its key features. It highlights the Flask-based architecture, Machine Learning prediction models, and the system's objective of providing accurate crop recommendations. Users can navigate to train the model, perform crop prediction, or access other modules through the navigation menu. The "Open Crop Predictor Tool" button allows users to start the crop recommendation process quickly.

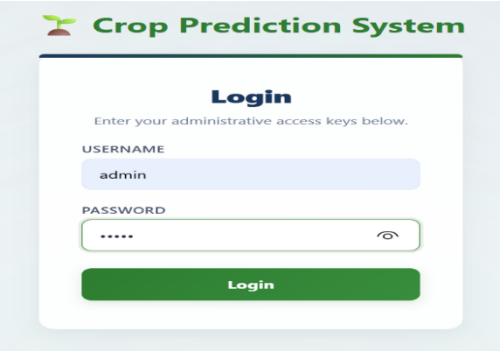

Fig 3: User Login

The Login Page provides secure access to the AI-Based Agriculture Advisory System for authorized users. Users enter their username and password to authenticate and access the application's features. This ensures that only valid users can use the crop prediction and model management modules.

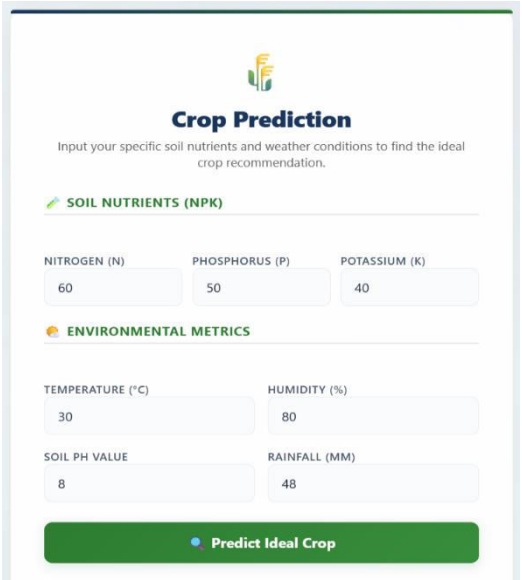

Fig 4: Crop Prediction

The Crop Prediction Page allows users to enter soil nutrient values (N, P, K) and environmental parameters such as temperature, humidity, soil pH, and rainfall. The system processes these inputs using the trained Machine Learning model to predict the most suitable crop. It provides quick and accurate recommendations to support informed farming decisions.

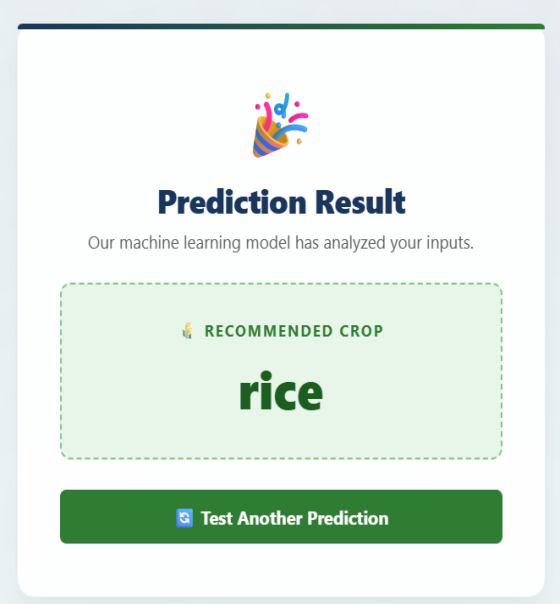

Fig 5: Prediction Result

The Prediction Result Page displays the crop recommended by the trained Machine Learning model based on the user's input values. It provides the predicted crop clearly and allows users to perform another prediction using the "Test Another Prediction" option. This helps farmers make informed crop selection decisions quickly and accurately.

CONCLUSION

The AI Based Agriculture Advisory System provides an intelligent and efficient solution for recommending suitable crops based on soil nutrients and environmental conditions. By using Artificial Intelligence and Machine Learning, the system improves the accuracy of crop selection and supports data-driven farming decisions. Its user-friendly web interface enables farmers to obtain instant crop recommendations with minimal effort. The system helps optimize resource utilization, increase agricultural productivity, and reduce cultivation risks. Overall, it promotes sustainable farming practices and contributes to the modernization of agriculture.

FUTURE SCOPE

The AI Based Agriculture Advisory System can be enhanced by integrating real-time weather forecasting to improve the accuracy of crop recommendations. Future versions can include fertilizer and pesticide recommendations based on soil conditions and crop requirements. The system can also be integrated with IoT sensors to collect real-time soil moisture and nutrient data automatically. Mobile application support and regional language interfaces can make the system more accessible to farmers. Additionally, advanced Deep Learning models and satellite imagery can be incorporated to provide disease detection, yield prediction,

and precision farming recommendations.

REFERENCES

[1] P. Harini, "Sms based wireless e-notice board," *International Journal of Emerging Technology and Advanced Engineering,* vol. 3, no. 3, pp. 181-185, 2013.

[2] P. Harini, "Enhanced packet delivery techniques using crypto-logic riddle on jamming attacks for wireless communication medium," *Int. J. Latest Trends Eng. Technol,* vol. 2, no. 4, pp. 469-478, 2013.

[3] P. Harini, "[Retracted] Machine Learning Algorithms Are Applied in Nanomaterial Properties for Nanosecurity," *Journal of Nanomaterials,* vol. 2022, no. 1, p. 5450826, 2022.

[4] C. M. Bishop, *Pattern Recognition and Machine Learning*. New York, NY, USA: Springer, 2006. **Link:** https://link.springer.com/book/10.1007/978-0-387-45528-0

[5] T. Hastie, R. Tibshirani, and J. Friedman, *The Elements of Statistical Learning*, 2nd ed. Springer, 2009. **Link:** https://hastie.su.domains/ElemStatLearn/

[6] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. MIT Press, 2016. **Link:** https://www.deeplearningbook.org/

[7] S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. Pearson, 2020. **Link:** https://aima.cs.berkeley.edu/

[8] F. Pedregosa *et al*., "Scikit-learn: Machine Learning in Python," *Journal of Machine Learning Research*, vol. 12, pp. 2825–2830, 2011. **Link:** https://jmlr.org/papers/v12/pedregosa11a.html

[9] W. McKinney, *Python for Data Analysis*, 3rd ed. O'Reilly Media, 2022. **Link:** https://wesmckinney.com/book/

[10] M. Grinberg, *Flask Web Development*, 2nd ed. O'Reilly Media, 2018. **Link:** https://www.oreilly.com/library/view/flask-web-development/9781491991725/

[11] A. Géron, *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*, 3rd ed. O'Reilly Media, 2022. **Link:** https://github.com/ageron/handson-ml3

[12] J. Han, M. Kamber, and J. Pei, *Data Mining: Concepts and Techniques*, 3rd ed. Morgan Kaufmann, 2011. **Link:** https://www.sciencedirect.com/book/978

0123814791/data-mining

[13] Food and Agriculture Organization (FAO), *The State of Food and Agriculture 2023*. Rome, Italy: FAO, 2023. **Link: https://www.fao.org/publications/sofa**

[14] Ministry of Agriculture & Farmers Welfare, Government of India, *Agricultural Statistics at a Glance 2023*. **Link: https://agricoop.nic.in/**

[15] Python Software Foundation, *Python 3 Documentation*. **Link: https://docs.python.org/3/**

[16] Flask Development Team, *Flask Documentation*. **Link: https://flask.palletsprojects.com/**

[17] Scikit-learn Developers, *Scikit-learn Documentation*. **Link: https://scikit-learn.org/stable/**

[18] Kaggle, "Crop Recommendation Dataset." **Link: https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset**

[19] UCI Machine Learning Repository, "Machine Learning Repository." **Link: https://archive.ics.uci.edu/**

[20] NumPy Developers, *NumPy Documentation*. **Link: https://numpy.org/doc/**