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AI-Driven Crop Recommendation for Agri Tech

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Abstract: ***In India, agriculture plays a crucial role in the economy, accounting for approximately 18% of GDP and employing nearly half of the nation's workforce. A significant challenge faced by Indian farmers is the selection of crops unsuitable for their land soil conditions, resulting in reduced yields. A potential solution is precision agriculture, which utilizes data-driven methods to tailor crop management to the specific characteristics of each field. Nevertheless, India's agricultural output remains below the global average, potentially correlating with the high rate of farmer suicide in rural regions. This study introduces a yield-prediction model aimed at assisting farmers in making informed decisions regarding crop selection and expected harvests. By inputting the relevant information, the system can recommend the most appropriate crops for a given field and forecast their potential yields. Among the various machine learning techniques evaluated, the random forest algorithm demonstrated the highest accuracy, with a 95% success rate. Furthermore, the system provides guidance on the optimal timing of fertilizer application for enhancing crop productivity.***

Keywords: Agricultural yield prediction, machine learning techniques, Kaggle database, seed information, farming.

I. INTRODUCTION

The increasing threat of climate change to crop yields is causing financial strain and presents a significant challenge to farmers. Mathematical and statistical methods can be employed to identify the most suitable crops for various land types to enhance profitability and to address these challenges. Machine learning is a powerful tool for evaluating multiple factors, such as soil nutrients, pH, temperature, humidity, and precipitation, to deliver precise crop recommendations. This study utilized the Kaggle crop recommendation dataset to examine a range of crops including rice, maize, and various fruits. By implementing machine learning algorithms such as Decision Trees, Naïve Bayes, and Random Forest, this study enhances the accuracy of crop recommendations, ultimately fostering improved agricultural practices and outcomes.

II. OBJECTIVES

1) Integrating and examining multiple data sources, including historical crop data, climate patterns, and soil properties.
2) Enhanced crop yield forecasting precision compared to traditional methods.
3) Adapting to shifting environmental conditions and crop variety
4) Provide farmers with valuable information for effective resource utilization, long-term planning, and enhancement of agricultural techniques.
5) Supports sustainable farming growth by increasing productivity and minimizing financial risks for agricultural producers.

III. LITERATURE SURVEY

The study "Crop Recommendation System Using Machine Learning"[1] investigates the application of machine learning algorithms, including Random Forest, Support Vector Machines (SVM), and Artificial Neural Networks (ANN), to enhance crop yield forecasting and provide farmers with decision support, with Random Forest playing a significant role.[2] This research emphasizes the importance of agriculture in India's economy, highlighting the necessity of appropriate crop selection. This study examines how machine learning can improve decision-making processes and maximize crop yields, thereby contributing to economic growth. [3] This comprehensive framework integrates the Internet of Things (IoT) and machine learning with Unmanned Aerial Vehicle (UAV) technology to precisely identify crop diseases. The analysis of multispectral imagery enables effective monitoring, data handling, and information exchange, resulting in enhanced disease prediction. [4] IoT and machine learning technologies utilize soil sensors and sophisticated algorithms to optimize fertilizer application, monitor crop health, and detect diseases, thereby improving crop quality and yield. Additionally, water requirements can be predicted using machine learning models applied to static datasets containing water-related variables.[5] Alexa's capabilities can be expanded by incorporating them into a local area network (LAN) through an Android application, thereby enhancing its functionality and usability.

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IV. METHODOLOGIES

1) *Support Vector Machine (SVM):* This supervised model can be applied to both classification and regression tasks.
2) *Logistic Regression (LR):* Logistic Regression is a widely used statistical model that, in its basic form, applies a logistic function to model a binary outcome. There are also various more complex extensions of this model.
3) *KNN (K-Nearest Neighbors):* A straightforward algorithm that assigns a label to data points by examining the majority label among their 'k' nearest neighbors in the dataset.
4) *Random Forest (RF):* This generates multiple decision trees during training. For classification tasks, the final output was based on the majority vote of these trees, whereas for regression tasks, it averaged the results to make predictions.

V. FLOW CHART

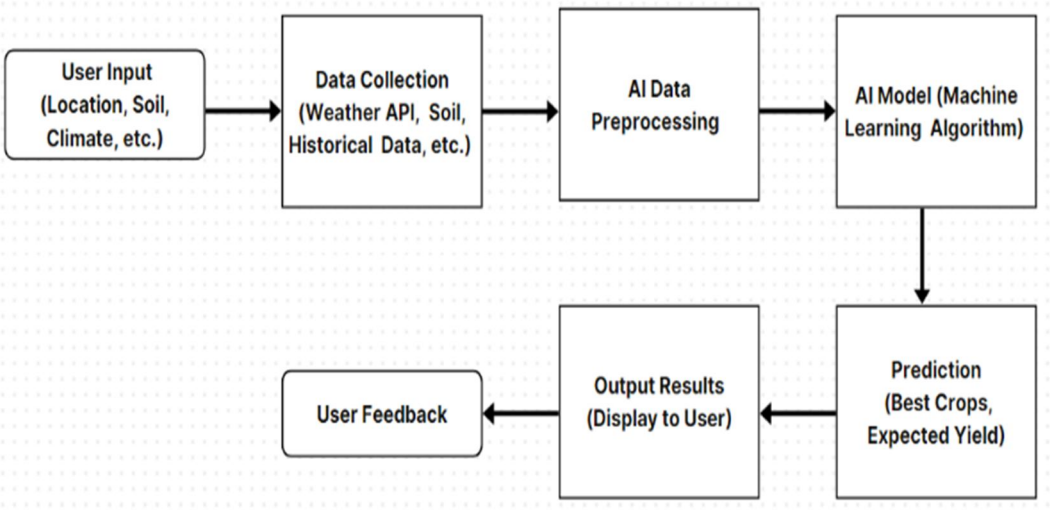


Fig. Flow Chart for the Process

This diagram outlines the procedure for utilizing artificial intelligence and data analytics to forecast agricultural outcomes, such as ideal crop selection or anticipated yields, based on user-supplied information and supplementary data sources.

1) *Initial User Data:* The process begins with the user providing basic details such as geographic location, soil characteristics, and climate conditions. This information serves as the foundation for subsequent analysis.
2) *Data Collection:* Pertinent data were acquired from multiple sources. Weather API such as current and projected meteorological information. Soil Data such as details of soil makeup, acidity levels, moisture content, and nutrient composition.. This phase ensured a comprehensive dataset for precise predictions.
3) *AI Data Preparation:* The collected information was cleaned, standardized, and prepared for analysis. Addressing gaps or inconsistencies in the data. Convert data into formats suitable for AI algorithms. This step guarantees that the data are ready for machine-learning applications.
4) *AI Algorithm:* A machine learning algorithm processes the prepared data to generate predictions. Depending on the objective, the algorithm can be Determine the most suitable crops for the given conditions. Estimate expected crop yields based on historical and environmental factors.
5) *Forecast:* The algorithm produced the following results. Suggestions for optimal crop selection. Projected yields, assisting users in planning agricultural activities.
6) *Result Presentation:* The findings are displayed to the user in an easily understandable format such as graphs, charts, or summaries. This ensures that users can readily interpret and act on predictions.
7) *User Response:* Users provide input on the system's precision and ease of use, enabling enhancements to Algorithm performance (incorporating additional data or refining the model). User interface (by improving the design and output presentation). This cyclical process ensures ongoing improvement, aiding users in making informed agricultural decisions.

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VI. RESULT

A. Home Page

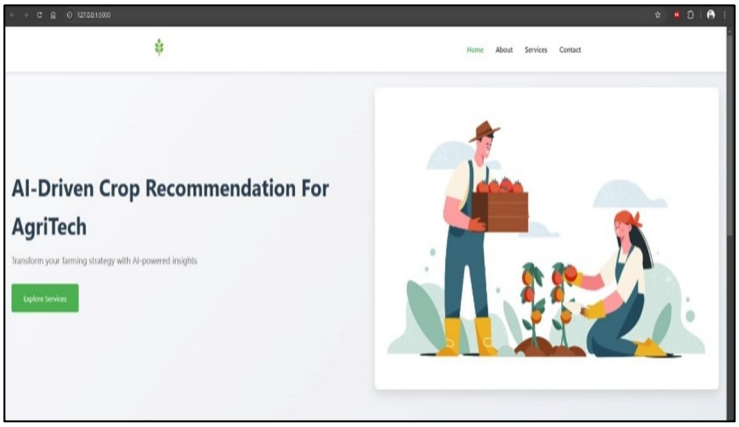


Fig. Home Page

On the homepage, you'll find primary sections: Predict yield, Crop study, and Blog.

B. About Us

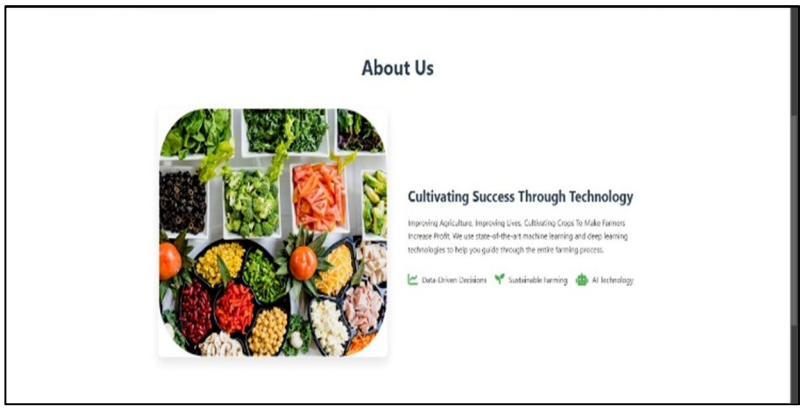


Fig. About Us

C. Crops

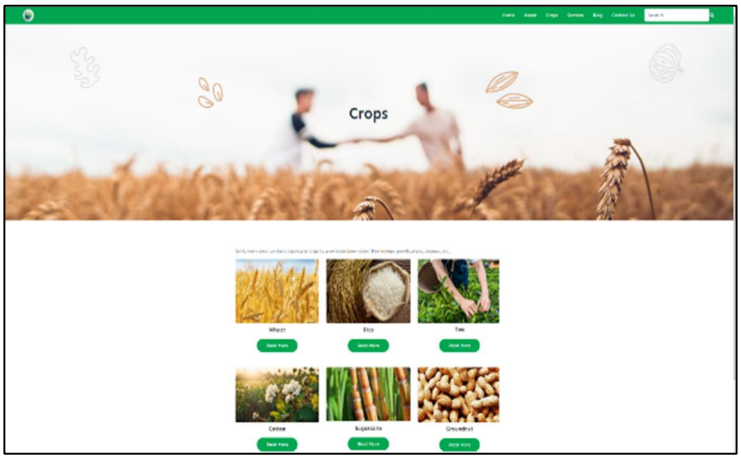


Fig. Crops

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D. Services

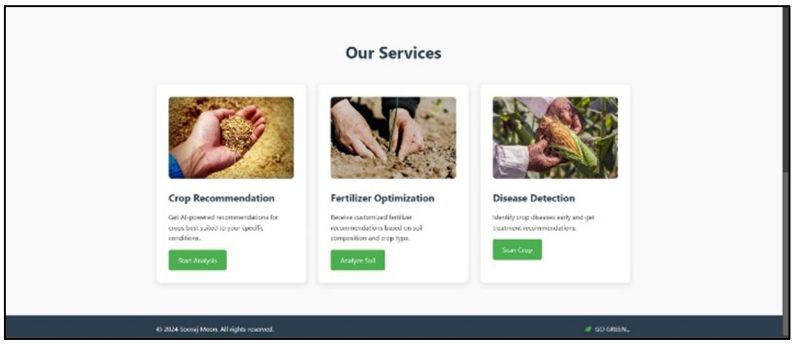


Fig. Services

It includes section like Crop recommendation and Crop yield Prediction.

E. Crop Recommendation Input

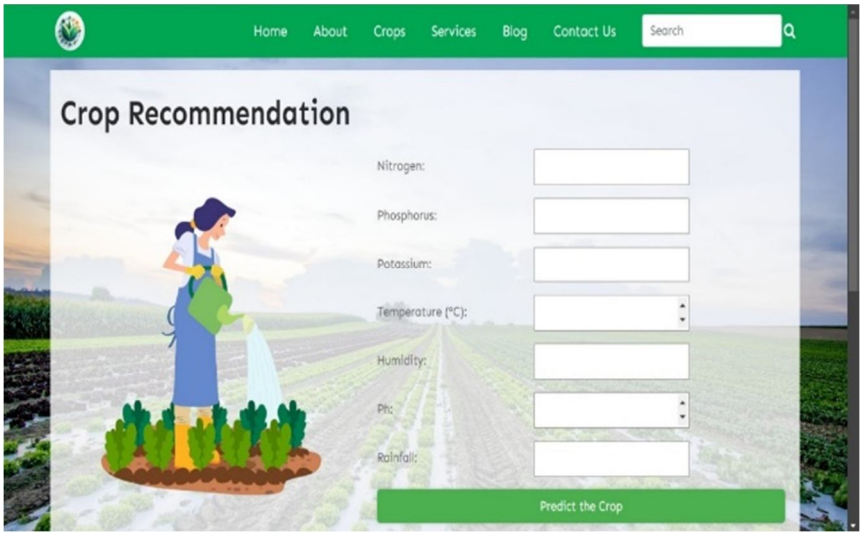


Fig. Crop Recommendation input

This includes various soil parameters to recommend suitable crops and predicts yield based on this factors.

F. Result Page

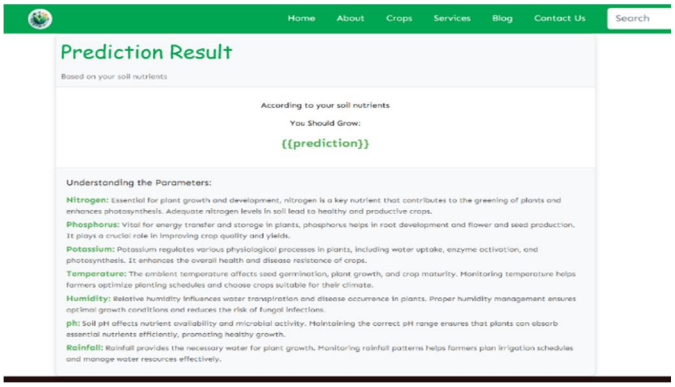


Fig. Result Page

The "Result" section showcases the findings of the crop**.**

VII. OUTPUTS

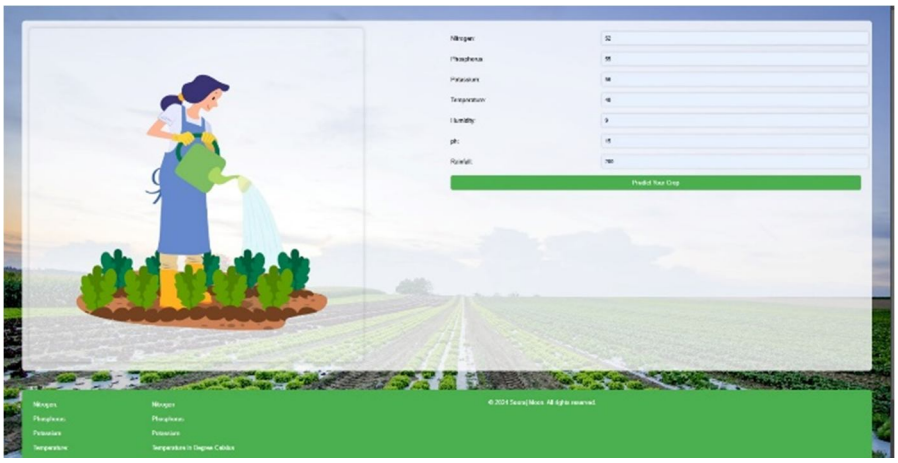


Fig.7.1

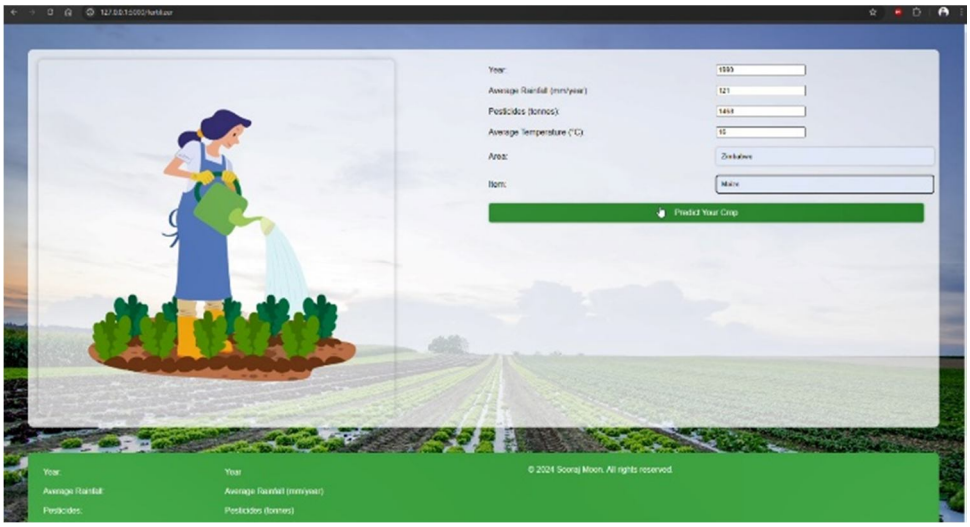


Fig.7.2

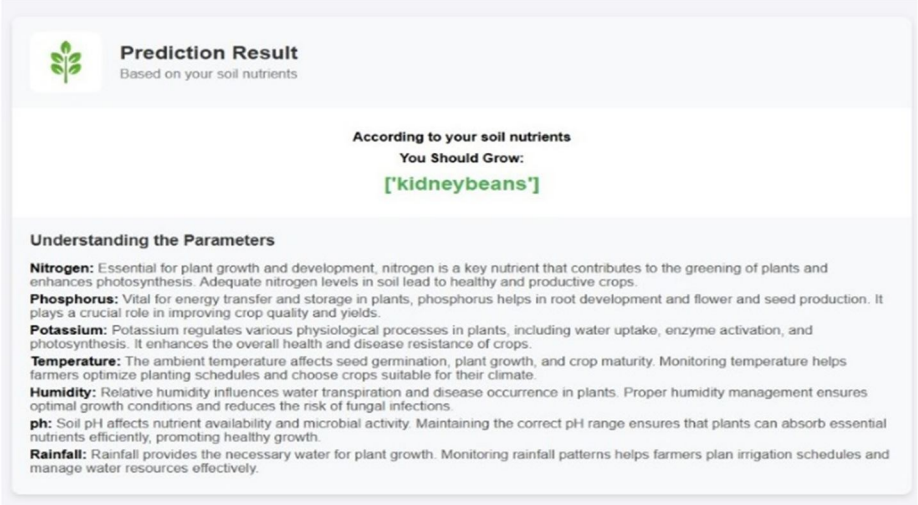


Fig.7.3

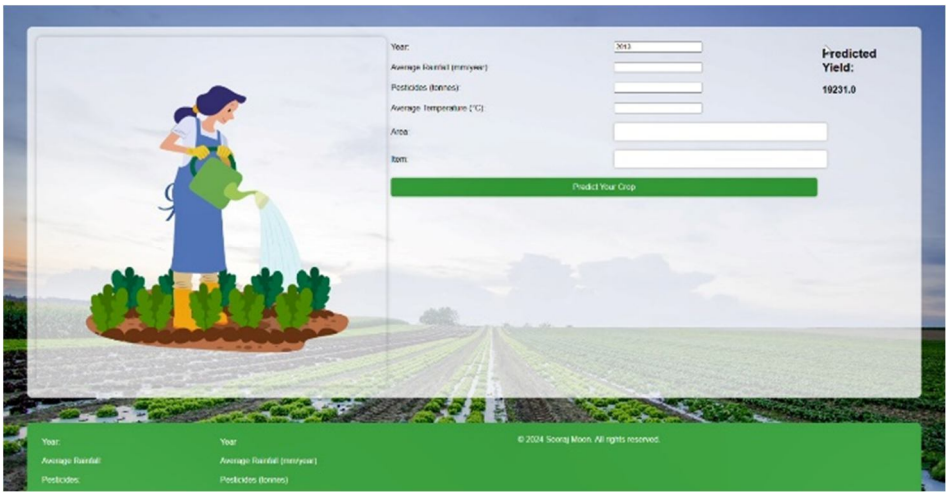


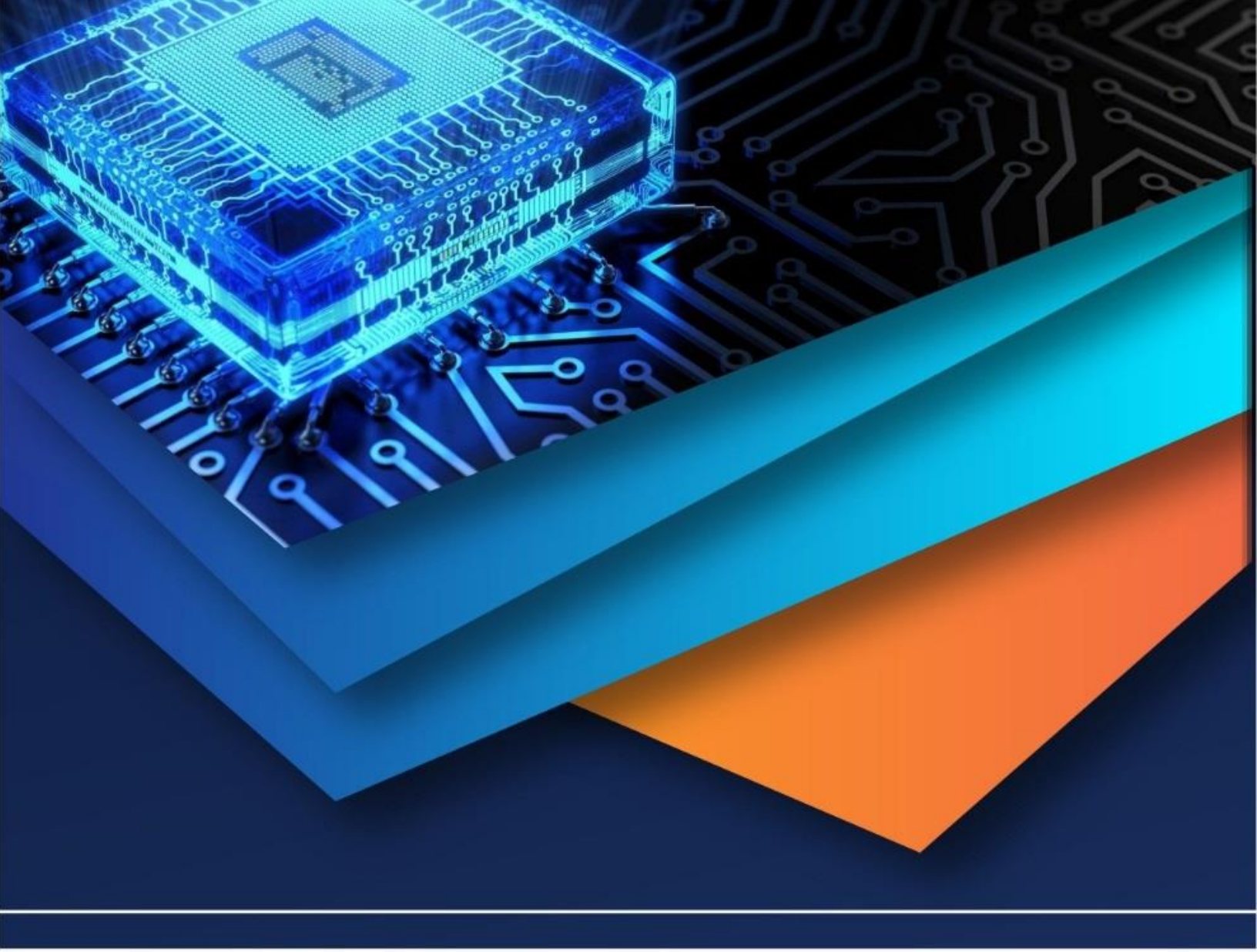
Fig.7.4

VIII. CONCLUSION

This study highlights the role of precision agriculture in tackling the challenges Indian farmers face, especially regarding crop selection and productivity. By applying machine learning techniques, the developed yield prediction model, with Random Forest achieving a top accuracy of 95%, provides dependable crop recommendations and guidance for optimal fertilizer application. This accessible solution provides farmers with data-driven insights for boosting yields and alleviating financial challenges, ultimately supporting the sustainability of the agricultural sector.

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