iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 Issue: IV Month of publication: April 2026

DOI: https://doi.org/10.22214/ijraset.2026.81559

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Intelligent Crop Suitability and Farming Advisory System

Konijeti Amulya[1], Vericharla Ratna Sri[2], Simhadri Vasantha Lakshmi[3], Molabanti Lakshmi Nimeesha[4]
[1, 3, 4]*Department of Computer Science and Engineering, Bapatla Women's Engineering College, Bapatla, India*
[2]*Assistant Professor, Department of Computer Science and Engineering, Bapatla Women's Engineering, College Bapatla, India*

Abstract: It is essential to understand that agriculture is one of the most important aspects concerning food security and economic stability; however, farmers sometimes have difficulty choosing appropriate crops due to lack of understanding regarding soil properties, season changes, water conditions, and fertilization needs. Therefore, this research proposes a new approach in the form of a web-based Intelligent Crop Suitability and Farming Advisory System. The presented tool will help farmers make informed decisions based on various input parameters, including soil composition, seasonality, preferred crops, and other factors. The output will contain information regarding the recommended crops, irrigation needs, fertilization needs, and other aspects related to proper farming. The system will also support both English and Telugu languages, as well as text and voice inputs, allowing more people to benefit from its features. It will use a structured database and rule-based filtering algorithms to provide reliable and accurate advice tailored specifically to individual situations. The results of experiments showed that the solution provided consistent and dependable results.
Keywords: Intelligent Crop Recommendation, Crop Suitability Analysis, Farming Advisory System, Smart Agriculture, Sustainable Farming, Soil Type Analysis, Seasonal Crop Planning, Fertilizer Recommendation, Irrigation Management, Web-Based Application, Agricultural Decision Support System, Precision Agriculture.

I. INTRODUCTION

Agriculture is one of the most important sectors that are critical in promoting food security, economic development, and sustainability, particularly in developing nations like India. The majority of the population relies on this sector for their source of income either directly or indirectly. However, the success and efficiency of agricultural activities are subject to a number of factors which include soil type, climate, seasonality, irrigation, and fertilization.

For example, in conventional agricultural practice, the choice of crops used is made on the basis of experience, instincts, and inheritance. Although this approach works to some degree, it can be detrimental when faced with different circumstances and new agricultural dynamics due to lack of scientific reasoning. In addition, poor choices in selecting crops may affect the efficiency of agricultural operations leading to high production cost, inefficiencies in the use of inputs, and even financial losses for farmers.

As digital technologies continue to advance at breakneck speed, it becomes increasingly possible to change traditional agriculture into digitized systems. Decision Support Systems and intelligent advisory systems can perform analysis based on different agricultural factors and help farmers make precise decisions. There have been numerous studies in recent years exploring Machine Learning, Fuzzy Logic and other IoT-based approaches to predicting yield and recommending appropriate crops. Yet, despite all its merits, many of those systems do not offer easily accessible interfaces or multilingual capabilities which could enable rural farmers to effectively use the platform.

For this reason, this paper suggests creating an Intelligent Crop Suitability and Farming Advisory System – a webapplication that would help users obtain crop recommendations and other useful information about farming under specific conditions. Users will be able to enter their parameters such as soil type, season and preferred crops by using either text interface or voice commands. Besides that, users will be provided with support in two languages – English and Telugu. Based on those parameters, the system will process structured agricultural data and produce appropriate recommendations including crops to choose from, irrigation, fertilizers and other important advice related to the chosen crop.

First and foremost, the purpose of this model is to make agriculture easier through the provision of accurate and easily usable advisory services. The system uses structured data in conjunction with smart filters and a web interface to improve crop yield, minimize risks associated with decisions made during agriculture and encourage sustainable practices. In addition, the system is built in a way that makes it scalable and adaptable, making room for incorporation of advanced features like real-time weather data analysis, machine learning and IoT-based soil management.

II. LITERATURE SURVEY

Mohapatra et al. developed a machine learning-based crop recommendation system using soil nutrients such as nitrogen, phosphorus, potassium, pH, temperature, and rainfall parameters. Their model applied algorithms like Random Forest and Decision Tree to predict suitable crops with good accuracy. However, the system mainly focused on prediction accuracy and did not emphasize multilingual accessibility or voicebased interaction for farmers. In contrast, the proposed system integrates bilingual support (English/Telugu) and voice input options to make crop advisory more accessible and farmer-
friendly. [1]

Ahamed et al. applied fuzzy logic and GIS-based spatial analysis to evaluate land suitability for agricultural crop planning. Their work effectively handled multiple environmental factors such as soil type, slope, and climatic conditions to generate suitability maps. However, the approach required geographic datasets and technical expertise, making it less accessible to individual farmers. In contrast, the proposed system provides a simplified web-based interface that allows farmers to receive crop recommendations without requiring GIS knowledge. [2]

Patil et al. developed a web-based crop recommendation system using classification algorithms trained on soil and climatic data. Their system predicted suitable crops based on environmental parameters. However, it mainly focused on prediction and did not provide alternative crop suggestions or detailed farming guidance. In contrast, the proposed system offers complete crop details along with additional suitable crop options for better decision-making. [3]

Ramesh et al. implemented a decision support system using Na¨ıve Bayes and SVM for crop prediction. The study improved prediction accuracy under structured datasets. However, it lacked multilingual accessibility and voice-based input support for farmers. In contrast, the proposed system integrates bilingual pages and speech input to improve usability. [4]

Kumar et al. designed a rule-based agricultural advisory system that provided fertilizer and irrigation recommendations. The system delivered structured farming suggestions based on predefined conditions. However, it did not allow flexible input selection methods for users. In contrast, the proposed system enables Crop-Based, Season-Based, and Soil-Based input options for personalized guidance. [5]

Shinde et al. applied K-Nearest Neighbor and Random Forest algorithms for crop prediction using soil parameters. Their work mainly emphasized improving algorithm accuracy. However, it did not focus on user interface simplicity or accessibility for rural farmers. In contrast, the proposed system prioritizes a simple and farmer-friendly web interface. [6]

Zhang et al. utilized deep learning models for crop classification and yield prediction. Their approach demonstrated improved prediction performance using neural networks. However, the system required large datasets and higher computational resources. In contrast, the proposed system adopts a lightweight and efficient decision-support mechanism suitable for web deployment. [7]

Rao et al. developed an intelligent farming advisory system integrating soil and seasonal data. The system provided crop recommendations based on environmental conditions. However, it lacked multilingual adaptability and voice interaction features. In contrast, the proposed system includes both English and Telugu language support with text and speech input options. [8]

Li et al. proposed a data-driven crop recommendation framework using climatic and soil datasets. Their approach improved decision-making accuracy through statistical modeling. However, it did not present detailed cultivation guidelines or alternative crop suggestions. In contrast, the proposed system provides complete crop information along with additional suitable options. [9]

Verma et al. implemented a precision agriculture model combining IoT sensors and machine learning for crop suitability analysis. The system enabled real-time environmental monitoring. However, it required hardware infrastructure and sensor deployment. In contrast, the proposed system operates using simple user inputs without dependency on IoT devices. [10]

Gupta et al. developed a cloud-based crop advisory platform analyzing historical weather and soil data. The system offered scalable backend analytics for crop planning. However, it paid limited attention to user interaction design. In contrast, the proposed system integrates intelligent backend processing with a structured and easy-to-use interface. [11]

Reddy et al. designed a regional crop planning tool using statistical analysis of government datasets. The system supported district-level agricultural planning. However, it lacked personalization for individual farmers. In contrast, the proposed system provides customized crop recommendations based on user-selected parameters. [12]

Suebsombut et al. (CropBot and related chatbot studies) designed domain-specific agricultural chatbots to answer farmer queries on crop management and pest control, demonstrating improved access to advisory content. However, many chatbot prototypes produce generic answers or require strong backend tuning for local languages and crop specifics. In contrast, the proposed system gives deterministic, rule-backed crop suitability results and supplements them with bilingual pages and voice input to avoid generic or unsafe replies. [13]

Li et al. developed probabilistic crop-type mapping and spatio-temporal cropland statistics for the European Union to support regional crop monitoring and planning. Their work is excellent for district/region-level planning but focuses on large-scale mapping and not on personalized farmer queries. In contrast, the proposed system provides individualized crop recommendations from simple farmer inputs (soil/season/crop) rather than relying on regional maps. [14]

Sharma et al. introduced a chatbot-based agricultural advisory system to answer farmer queries. The system improved communication through conversational interaction. However, responses were often generic and not specifically structured for crop suitability analysis. In contrast, the proposed system delivers condition-based and structured crop recommendations. [15]

III. METHODOLOGY

The proposed Intelligent Decision-Support System for Crop Suitability and Farming Recommendations is designed as a web-based solution that utilizes structured data and rule-based filtering techniques to generate crop recommendations based on specific conditions. The system is composed of four main modules: input acquisition, preprocessing, data matching, and recommendation generation. The architecture ensures efficient processing of user-provided data and accurate mapping with crop suitability parameters stored in the database.

A. User Access and Language Selection

The system is accessed through a web interface, where users initially select their preferred language (English or Telugu). Based on the selected language, localized content and input options are dynamically loaded. This module enhances accessibility and usability for regional users without affecting the core system functionality.

B. User Input Selection Process

The system supports three input modes: crop-based, seasonbased, and soil-based inputs. This flexible design allows users to provide either partial or complete agricultural information based on their knowledge. Depending on the selected input type, the system dynamically generates the corresponding input fields for structured data collection.

C. Text and Voice Input Handling

To improve usability, the system supports both text-based and voice-based input methods. Users can manually enter data or provide input through a Speech Recognition API. The voice input is automatically converted into text format for further processing. This feature enhances accessibility, especially for users with limited typing ability.

D. Input Acquisition and Processing

User inputs are captured through both text and voice interfaces. The captured data is validated and normalized to ensure consistency and correctness before being forwarded to the backend processing unit. This step prevents invalid or incomplete inputs from affecting the recommendation process.

E. Data Processing and Matching

The backend processing is implemented using Python. The system compares user inputs with a structured crop dataset stored in JSON format, which includes parameters such as soil type, seasonal suitability, irrigation requirements, and fertilizer recommendations. A rule-based filtering mechanism is applied to identify crops that match the given conditions. Multiple parameters are evaluated simultaneously to ensure accurate and reliable recommendations.

F. Primary Crop Recommendation

Based on the matching results, the system identifies the most suitable crop and presents it as the primary recommendation. The output includes detailed cultivation information such as suitable season, compatible soil type, water requirements, and fertilizer guidelines. This structured output supports informed decision-making.

G. Alternative Crop Suggestions

In addition to the primary recommendation, the system provides alternative crops that satisfy similar input conditions. These alternatives are displayed for comparison, allowing users to consider additional factors such as market demand and resource availability. This feature enhances flexibility and supports better risk management in farming decisions.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

IV. SYSTEM IMPLEMENTATION

The proposed system utilizes a modular web-based architecture that integrates frontend interaction, backend processing, and structured data management. The system is implemented using HTML, CSS, and JavaScript for the frontend, and Python with the Flask framework for backend processing. Each module is designed to perform a specific function within the workflow, ensuring scalability, maintainability, and efficient execution.

A. User Interface Module

The User Interface (UI) module provides a web-based platform for user interaction. It enables users to access the system, enter inputs, view results, and receive crop recommendations in a structured and understandable format. The interface ensures smooth navigation, intuitive input selection, and clear presentation of results. This module acts as the communication layer between the user and the backend processing system.

The flexible design allows users to interact with the system based on their specific farming requirements. It guides users through a step-by-step process, improving usability and personalization of recommendations.

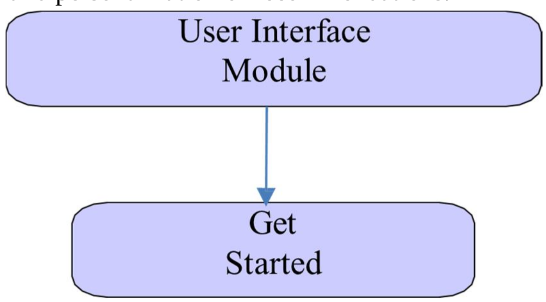


Fig. 1. User Interface Module Workflow

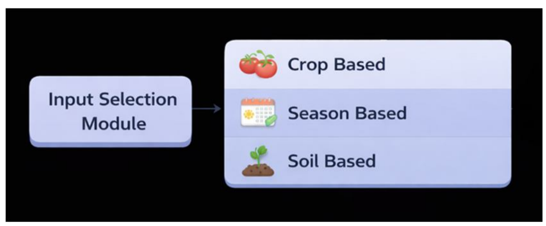


Fig. 2. Input Selection Module Workflow

B. Language Selection Module

This module enables users to select their preferred language, either English or Telugu, when accessing the system. Based on the selection, the system dynamically loads the corresponding interface and content. This enhances accessibility and ensures ease of use for regional users. The module acts as the initial gateway of the system.

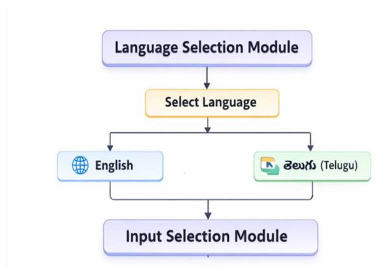


Fig. 3. Language Selection Functionality

C. Input Selection Module

The Input Selection module allows users to choose the type of recommendation based on available information. It provides three structured options: Crop-Based, Season-Based, and Soil-Based inputs. Once a category is selected, the system dynamically generates relevant input fields, ensuring structured and context-specific data collection.

D. Voice and Text Input Module

The Voice and Text Input module allows users to provide input through either manual text entry or speech-based interaction. The system integrates a Speech Recognition API to capture voice input and convert it into text format. The converted input is validated before being processed further.

This dual-input mechanism improves accessibility and ensures ease of interaction for users with varying technical abilities. It reduces dependency on typing while maintaining accuracy through structured input handling.

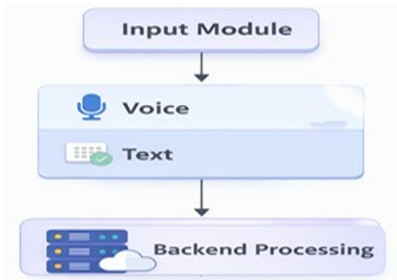


Fig. 4. Voice and Text Input Module

The processed input serves as the foundation for accurate backend analysis and reliable crop recommendation generation.

E. Backend Processing Module

The Backend Processing module acts as the core computational engine of the system. It is implemented using Python and Flask to handle server-side operations, request routing, and data processing.

Upon receiving validated input, the module applies logical filtering and condition-matching techniques. It compares user input parameters with the structured crop dataset stored in JSON format. Multiple attributes such as soil type, season, water requirements, and crop compatibility are evaluated to determine suitability. The processed results are then forwarded to the recommendation module.

F. Crop Dataset Management Module

The Crop Dataset Management module serves as the knowledge base of the system. It stores structured agricultural data in JSON format, including crop names, suitable soil types, ideal seasons, water requirements, and fertilizer recommendations.

This structured format enables efficient data retrieval and seamless integration with the backend processing module. The module supports dynamic querying based on user inputs and allows easy updates when new crop data is added. The consistency and organization of the dataset play a critical role in generating accurate and reliable recommendations.

V. ALGORITHM DESIGN

The suggested system utilizes a rule-based decision-making method to recommend crops according to various parameters including the type of soil, season, and water requirements. Every crop present in the database is checked against the user data according to a multi-parameter match.

The matching score for each crop is determined using the number of matched criteria. If *S*, *Se*, and *W* are soil match, season match, and water requirement match, respectively, the total score is obtained using:

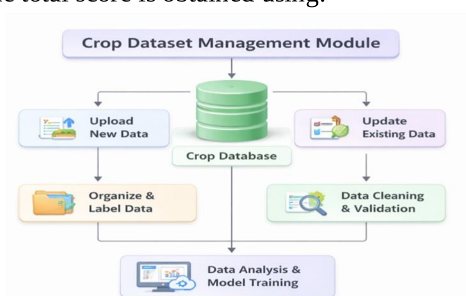


Fig. 5. Crop Dataset Management Module

$$Score = w_1S + w_2Se + w_3W$$

where w_1, w_2, w_3 are weights assigned to each parameter (typically set to 1 for equal importance).

The crop that scores the most is chosen as the main recommendation, whereas crops that score similarly are considered alternatives.

Steps in Algorithm:

1) Get user inputs (type of soil, season, and water need).
2) Initialize score for all crops available in the database.
3) Compare user inputs with values in the database.
4) Increase score if conditions match. 5) Arrange crops according to scores.
5) Recommend the highest ranked crop. 7) Recommend second-highest crops.

VI. RESULTS AND DISCUSSION

The developed Intelligent Crop Suitability and Farming Advisory System was evaluated using a structured crop dataset with soil and seasonal parameters. The complete workflow, including language selection, input handling, and recommendation generation, was tested across all modules. Performance was assessed based on recommendation accuracy and response efficiency. The system demonstrated reliable and conditionbased crop suggestions for effective agricultural decisionmaking.

A. User Interface

The interface is designed to be clean, simple, and userfriendly, ensuring easy navigation across different sections of the system. It clearly presents mission, vision, and input options such as Crop, Season, and Soil for quick access. The structured layout and intuitive design enhance user experience while supporting smooth interaction with the advisory platform. The preferred language selection interface is shown in Fig. 6.

B. Input Selection

The input provided by the user depends on the selected category (Crop-Based, Season-Based, or Soil-Based), and the system generates recommendations accordingly. Based on this selection, the system dynamically adjusts the required input fields and processes the relevant information.

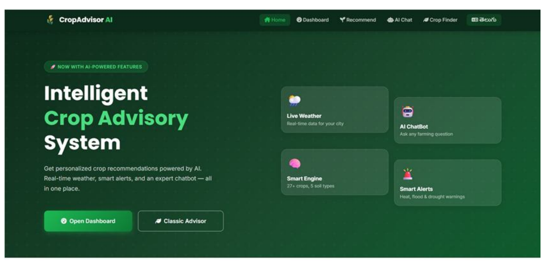


Fig. 6. User Interface and Language Selection

C. Entering Input

Based on the selected option, the user must enter the corresponding input details to ensure accurate results. Providing correct and relevant information allows the system to effectively match the input with the dataset, resulting in precise and condition-specific recommendations.

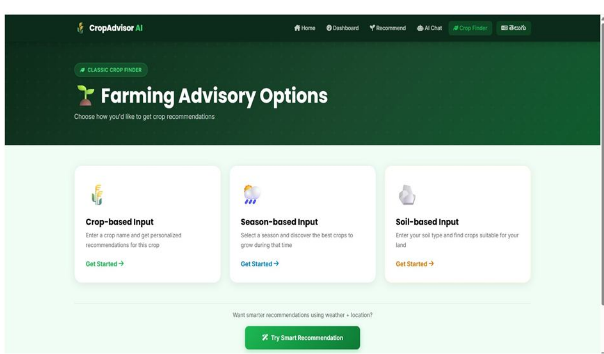


Fig. 7. Entering Input

D. Smart Recommendation Generation Module

The Smart Recommendation Generation Module converts processed input data into meaningful crop suggestions. It applies logical matching and condition-based filtering to compare user inputs with the structured crop dataset. Parameters such as soil type, season, and water requirements are evaluated to identify suitable crops. The module prioritizes maximum condition matching to ensure accurate and relevant recommendations, transforming backend analysis into practical crop advisory output.

E. Alternative Suggestion Module

The Alternative Suggestion Module displays additional crops that match the user's input conditions. Along with the primary recommendation, it presents other suitable options based on soil, season, and water requirements. These alternatives provide flexibility and support better decision-making. The suggestions are presented in a structured format for easy comparison.

F. Crop Recommendation

The Crop Recommendation and Advisory section displays the best recommended crop based on the selected input, along with details such as soil type, water requirements, and climate conditions. The system also provides fertilizer guidance and alternative crop options to support informed farming decisions.

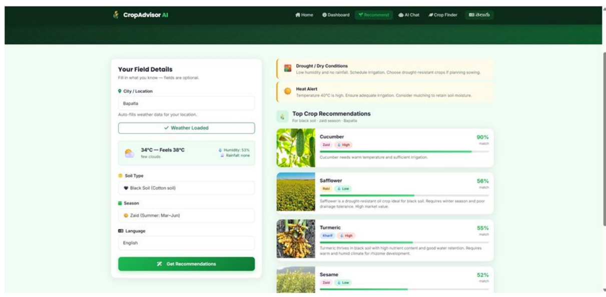


Fig. 8. Recommended Crop and Alternatives

VII. CONCLUSION

In this paper, we have discussed the development of the Intelligent Crop Suitability and Farming Advisory System designed to provide informed decisions based on the available data in agriculture. It combines structured crop databases, a dual-language user interface, and both textual and vocal modes of data entry to provide customized recommendations based on various conditions and advice on how to grow the crop.

Our proposed framework offers scalability and flexibility while maintaining user-friendliness for users of different levels of technical expertise. As shown in the experiment, the system provides relevant recommendations, thus eliminating any risks associated with uncertain decisions.

The future improvements could involve the addition of machine learning models for prediction, the inclusion of current weather data, extension of the supported languages to more regions, and implementation of IoT soil monitoring systems.

VIII. ACKNOWLEDGMENT

The authors wish to thank the faculty members, project guides, and agriculturalists who provided invaluable assistance during the entire course of developing this project. They were instrumental in improving the design of the crop recommendation system.

We also like to thank all those agricultural and educational data sources that helped us in the successful completion of this project.

REFERENCES

[1] S. K. Apat et al., "An Artificial Intelligence-based Crop Recommendation System using Machine Learning," J. Scientific & Industrial Res., vol. 82, 2023.

[2] B. N. Mohapatra, "Crop Recommendation System using Machine Learning," Int. Journal for Emerging Technologies in Computational Science & Engineering, 2024.

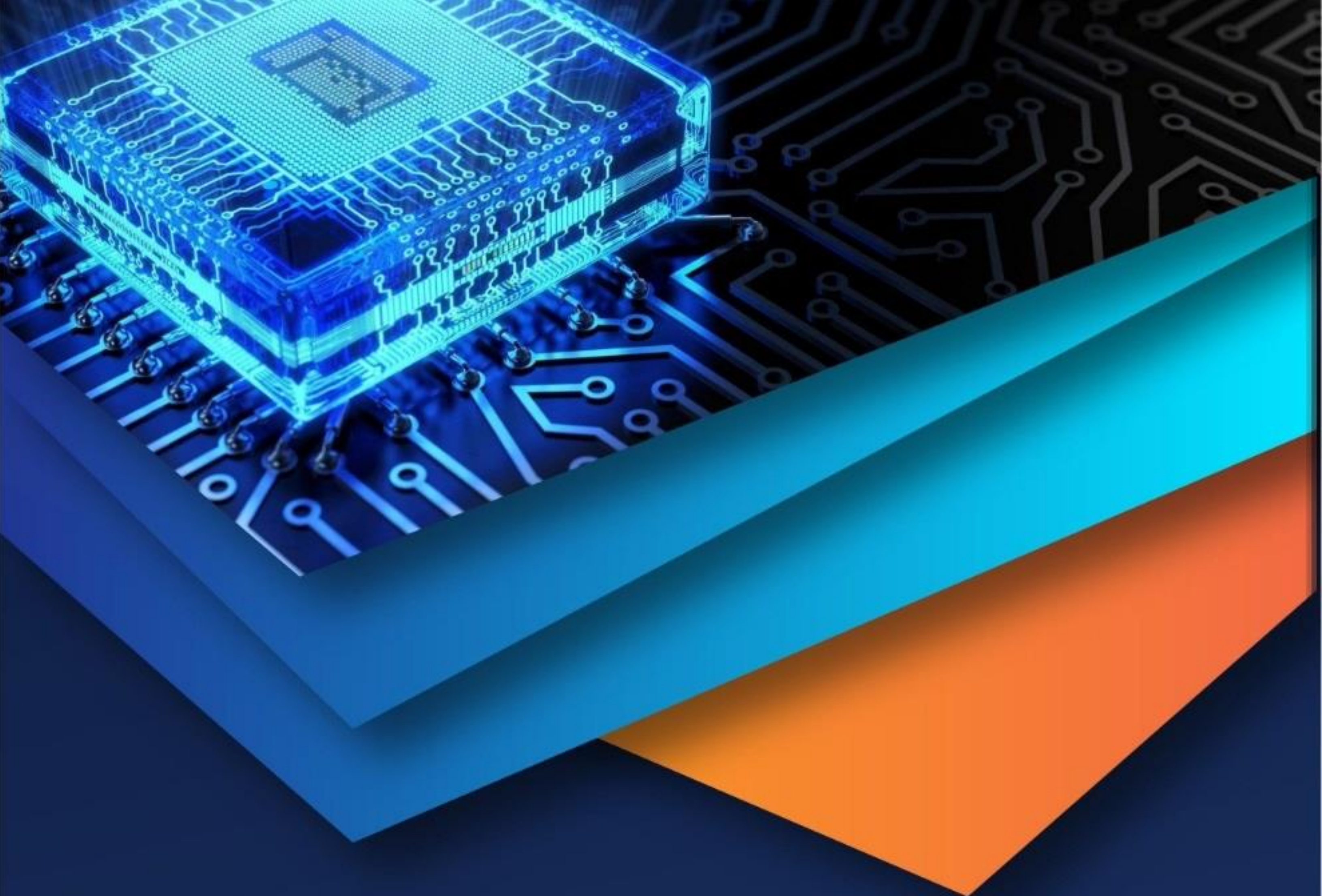
[3] "Crop Recommendation System Using Machine Learning," ResearchGate, 2023 — This system uses environmental and soil features with supervised learning to recommend suitable crops.

[4] "Crop Recommendation System Using Machine Learning," ResearchGate, 2024 — Focus on soil nutrient parameters for crop prediction.

[5] "Smart Farming: Crop Recommendation using Machine Learning with Challenges and Future Ideas," ResearchGate, 2025.

[6] B. S. Kiran, "Crop Recommendation System Using ML Through Soil Data," Hindustan Univ. Project, 2022.

[7] A. Petrash & S. Aarthi, "AI-based Smart Crop Recommendation System for Sustainable Agriculture," MASU Journal, 2025.
[8] S. Shastri et al., "Advancing Crop Recommendation System with Supervised Machine Learning," Sci. Rep. / Nature, 2025.
[9] F. S. Prity, "A Machine Learning Approach to Crop Recommendations," Sustain. Comput.: Informatics and Systems, 2024.
[10] H. Afzal et al., "Incorporating Soil Information with Machine Learning for Crop Recommendation," Sci. Rep., 2025.
[11] M. A. Bakr, "Evaluation of Learning-Based Models for Crop Recommendation," Information, vol. 16, 2025.
[12] T. van Klompenburg, "Crop Yield Prediction using Machine Learning: A Systematic Review," Comput. Electron. Agric., vol. 175, 2020.
[13] K. Sutha, I. N. Indumathi & U. Shankari, "Recommending and Predicting Crop Yield using Smart ML Algorithms," Curr. Agri. Res., 2022.
[14] Crop simulation model reference — Crop simulation models integrating weather and soil factors for agricultural decision support.
[15] "Multi-criteria Agriculture Recommendation System using ML for Crop and Fertilizer Prediction," Curr. Agri. Res., 2023.
[16] Y. Li, J. Tang, and Z. Wang, "A Data-Driven Crop Recommendation System Based on Machine Learning and Weather Features," IEEE Access, vol. 9, pp. 145632–145641, 2021.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY