A

Project Report

on

AGROGUIDE: YOUR FARMING COMPANION APPLICATION

Submitted in partial fulfilment of requirements for the degree of

Bachelor of Technology

in

Computer Science & Engineering

by

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Lucknow

DECLARATION

We declare that the project work presented in this report entitled "**AGROGUIDE: YOUR FARMING COMPANION APPLICATION**", under the guidance of **"Er. Anshul Kumar Singh**", submitted to the Computer Science and Engineering Department, Raja Balwant Singh Engineering Technical Campus, Agra, affiliated to Dr. A.P.J. Abdul Kalam Technical University (Formerly Known as U.P.T.U.), Lucknow" in the academic session 2023-24 for the award of the Bachelor of Technology degree in **Computer Science and Engineering**, is our original work. we have not plagiarized or submitted the same work for the award of any other degree.

May 2024

Place: Agra

Masroor Majeed Mir

Nishant Sharma

CERTIFICATE

This is to certify that the project work entitled "**AGROGUIDE: YOUR FARMING COMPANION APPLICATION**" has been submitted by **Masroor Majeed Mir (2000040100048) , VIIIth Sem.,** in partial fulfilment of the degree of Bachelorof Technology in Computer Science & Engineering of "Raja Balwant Singh Engineering Technical Campus, Agra, affiliated to Dr. A.P.J. Abdul Kalam Technical University (Formerly Known as U.P.T.U.), Lucknow" in the academic session 2023-24.

May 2024

Place: Agra

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ABSTRACT

AgroGuide: Your Farming Companion is an innovative application designed to revolutionize crop selection for farmers by harnessing the power of machine learning algorithms. Traditional agricultural practices often rely on manual assessments, leading to suboptimal decisions and resource wastage. AgroGuide addresses this by providing precise crop recommendations based on soil and environmental conditions.

The application integrates user-friendly interface with machine learning models, including Random Forest and Logistic Regression, trained on a comprehensive crop dataset. This enables accurate recommendations for optimizing agricultural yield.

By inputting crucial agricultural data such as soil nutrient levels, temperature, humidity, pH, and rainfall, farmers can make data-driven decisions effortlessly. The system processes this data to generate tailored crop recommendations, thus improving efficiency in resource utilization and increasing profitability.

AgroGuide utilizes cloud-based servers for hosting, ensuring scalability and accessibility. The backend is developed using Python with Django for seamless data processing, while machine learning models are integrated using Scikit-Learn. The user interface features an intuitive dashboard for easy data input and clear presentation of recommendations, alongside support features like feedback mechanisms and multi-language support.

This project aims to revolutionize crop selection, leading to increased agricultural yield, efficient resource utilization, and enhanced profitability for farmers.

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ABBREVIATIONS

S.NO.	ABBREVIATION	FULL FORM
1.	ATFC	AgroGuide: Your Farming Companion
2.	MLA	Machine Learning Algorithms
3.	CR	Crop Recommendations
4.	SNL	Soil Nutrient Levels
5.	T&H	Temperature and Humidity
6.	P&R	pH and Rainfall
7.	RFA	Random Forest Algorithm
8.	AMLC	Agricultural Machine Learning System
9.	EUY	Efficient Utilization of Resources
10.	API	Application Programming Interface
11.	REST	Representational State Transfer
12.	TAP	Traditional Agricultural Practices

CHAPTER 1
INTRODUCTION

The AgroGuide project is born out of the pressing need to modernize and optimize agricultural practices. Agriculture is not just a source of livelihood; it's a cornerstone of global food security. However, for generations, farmers have relied on inherited wisdom and traditional practices to make decisions about crop selection, often leading to suboptimal results. The agricultural landscape is evolving rapidly, influenced by climate change, resource constraints, and the ever-increasing global population. It's evident that to thrive in this changing environment, agriculture must embrace data-driven decision-making.

The AgroGuide proposal is rooted in the understanding that farmers need a reliable and technologically advanced tool to make informed choices about crop selection. Traditional practices can no longer suffice in the face of rising uncertainty, resource scarcity, and the need for increased productivity. AgroGuide seeks to bridge the gap between age-old wisdom and modern science, providing farmers with a user-friendly and powerful application that harnesses machine learning to offer highly accurate and personalized crop recommendations.

1.1 OBJECTIVE:

The primary objective of the AgroGuide application is to empower farmers with data-driven insights, enabling them to make informed decisions regarding crop selection. By incorporating machine learning algorithms, this project aims to provide accurate and customized crop recommendations tailored to the unique soil properties, temperature, humidity, pH, and rainfall patterns of individual farms. With AgroGuide, we aim to eliminate the inefficiencies and uncertainties associated with traditional farming practices, ensuring a more sustainable and profitable future for agriculture.

1.2. Scope of Project:

The scope of the AgroGuide project encompasses the following key areas:

- **Customized Crop Recommendations:** AgroGuide employs advanced machine learning models, including Random Forest and Logistic Regression, which have been trained on a comprehensive crop data set. By analyzing critical agricultural data, including soil nutrient levels, temperature, humidity, pH, and rainfall, the application provides farmers with highly precise crop recommendations, accounting for their specific conditions.

- **User-Friendly Interface:** The AgroGuide interface is designed to be intuitive and accessible to farmers with varying levels of technological expertise. This ensures that even those who may not be well-versed in technology can easily input their data and receive valuable recommendations, fostering broad adoption.

- **Efficient Resource Utilization:** AgroGuide assists farmers in optimizing resource utilization, such as water and fertilizers. By suggesting the right crops for specific conditions, the application contributes to environmental sustainability and increased overall agricultural yield and profitability.

- **Cloud-Based Scalability:** AgroGuide leverages cloud-based servers to host its platform, ensuring accessibility on a variety of devices with internet connectivity. This scalability allows the application to reach and assist farmers in diverse geographical locations, from small family farms to large agribusinesses.

- **Increased Agricultural Productivity:** Through the accurate selection of crops based on data analysis, AgroGuide aims to enhance agricultural productivity and yield, thus contributing to food security and economic growth. Additionally, it can aid in reducing post-harvest losses through better crop planning.

1.3. Report Structure

- **The First Chapter: Introduction**

  The AgroGuide project aims to modernize agricultural practices by leveraging data-driven decision-making. With traditional farming methods facing challenges from climate change and resource constraints, AgroGuide offers farmers a user-friendly application powered by machine learning. This tool provides personalized crop recommendations, aiming to increase productivity and ensure sustainable agricultural practices

- **The Second Chapter: Literature Survey**

  The literature survey highlights various methodologies in agricultural decision support systems, emphasizing data mining and machine learning techniques. Studies propose personalized crop recommendation systems based on factors such as location detection, soil, and climatic parameters. Additionally, research focuses on crop yield prediction using diverse data mining algorithms and big data analysis. These approaches aim to optimize resource utilization, enhance productivity, and facilitate informed decision-making in agriculture

- **The Third Chapter: Materials & Methods**

  This section details the project category, techniques used, and hardware/software requirements. It provides insights into the methodology employed, ensuring transparency and clarity in the project's development process.

- **The Fourth Chapter: Proposed Methodology**

  The proposed methodology outlines the systematic process of developing the crop recommendation system . It includes algorithms, system architecture, flow charts, and data flow diagrams, providing a blueprint for the project's implementation.

- **The Fifth Chapter: Testing Technology and Security Mechanisms**

  This chapter explores the methodologies employed to validate the functionality and security of the the crop recommendation system. It discusses the types of testing implemented, including functional testing, performance testing, and compatibility testing. Additionally, it outlines the security mechanisms deployed to safeguard user data and ensure a secure learning environmen

- **The Sixth Chapter: Future Scope, Further Enhancement, And Limitations**

  The future scope chapter delineates potential avenues for further development and enhancement of the crop recommendation system. It discusses emerging technologies and trends that could shape the future of crop recommendation system, as well as the project's limitations and challenges. By identifying areas for improvement, this chapter lays the groundwork for future iterations of the platform.

- **The Seventh Chapter: Conclusion**

  The conclusion chapter summarizes the key findings and insights garnered throughout the project. It reflects on the project's objectives and accomplishments, offering reflections on the overall experience. Additionally, it provides recommendations for future projects and underscores the importance of continuous innovation in the field of e-learning.

- **The Eighth Chapter: Bibliography**

  The bibliography section comprises references cited throughout the project, listed in a standardized format according to the chosen citation style (e.g., APA, MLA). Each reference provides readers with the necessary information to locate the source material for further reading and verification of the project's findings. Additionally, accompanying snapshots offer visual representations of key aspects of the project, while the appendix may include supplementary materials such as code snippets, diagrams, or additional data. Finally, the curriculum vitae presents a summary of the project team's qualifications and contributions to the project.

CHAPTER 2

REVIEW OF LITERATURE

Prof. Rakesh Shirsath, et al. [1], proposed an agriculture decision support system using data mining. This methodolog included a subscription-based system and the utilization of Artificial Neural Networks (ANNs). Noteworthy observations included the creation of an Android app with a login module, the incorporation of knowledge about previously planted crops, user feedback mechanisms, and the maintenance of crops. This system aimed to provide farmers with personalized crop recommendations and facilitate more efficient decision-making in agriculture.

Miftahul Jannat Mokarrama's, et al. [2], proposed the recommendation system for farmers, which relied on location detection and data analysis. The methodology included location detection, data analysis and storage, similar location detection, and a recommendation generation module. This system aimed to provide crop recommendations based on various factors, such as physiographic data, thermal characteristics, crop growing period, crop production rate, and a seasonal crop database. It sought to identify similar locations and recommend crops accordingly.

S. Pudumalar, et al. [3], proposed an article which focused on developing a crop recommendation system for precision agriculture. Their methodology involved various data mining techniques, including random tree, CHAID, KNN, and Naïve Bayes, with the support of the WEKA tool. The study highlighted key observations, such as data pre-processing, handling missing and out-of-range values, feature extraction, the use of ensemble models for improved accuracy, and the generation of rules to recommend crops. This system aimed to enhance precision agriculture by providing farmers with tailored crop recommendations.

Yogesh Gandge, et al. [4], conducted a comprehensive study on various data mining techniques for crop yield prediction. Their methodology encompassed a wide array of techniques, including attribute selection, multiple linear regression, decision trees (ID3), SVM, neural networks, C4.5, K-means, and KNN. Notable observations included the selection of agricultural fields, consideration of previously planted crops, user input, data preprocessing, attribute selection, and the use of classification algorithms for crop recommendations. This research aimed to improve crop yield predictions by employing a variety of data mining methods.

Ji-chun Zhao, et al. [5], introduced this paper which explored the application of big data analysis in agricultural intelligence decision-making . Their approach involved an inference engine, domain expertise, knowledge engineering, and a knowledge acquisition module. The observations made included the use of a large database of crops, data processing using Hadoop, integration of professional knowledge and past experiences, and feature selection through Hadoop Distributed File System (HDFS). Additionally, the study considered the future potential of incorporating Hadoop with Artificial Neural Networks (ANNs) to enhance agricultural decision support.

Shruti Mishra, et al. [6], examined the use of data mining in crop yield prediction. Their methodology included algorithms like J48, LAD tree, LWL, and IBK, and they employed the WEKA tool. The research particularly emphasized evaluating the accuracy of these algorithms, noting that the LAD tree showed lower accuracy. Furthermore, they suggested that errors could be minimized through the pruning of the tree. This study contributed to the understanding of how data mining techniques could be used for more accurate crop yield predictions and the importance of algorithm evaluation and refinement in agricultural decision support systems.

Suresh G, et al. [7], introduced this paper which proposed the efficient crop yield recommendation system using machine learning for digital farming. This proposed system is used to identify particular crop according to given particular data. By applying Support Vector Machine (SVM) acquired higher precision and productivity. This research paper mainly worked on two datasets: sample dataset of location data and sample dataset of crop data. By using this proposed system recommended particular crop according to their Nutrients (N, P, K, and PH) values and also identified available Nutrients values and required fertilizers quantities for the particular crop like Rice, Maize, Black gram, Carrot and Radish.

Reddy D, et al. [8], proposed crop recommendation system to maximize crop yield in ramtek region using machine learning. This proposed system worked on three parameters: soil characteristics, soil types and crop yield data collection based on these parameters suggesting the farmer suitable crop to be cultivated. This proposed system worked on different machine learning algorithms like random forest, CHAID, K-Nearest and Naïve Bayes. By applied this proposed system we can predict particular crop under particular weather condition, state and district values.Our proposed work would help farmers in sowing the right seed based on soil requirements to increase productivity.

S. S. Dhakad, et al. [9], proposed the crop recommendation system using machine learning techniques based on soil and climatic parameters" This article proposes a crop recommendation system using machine learning techniques such as support vector machines (SVMs) and random forests. The system takes into account soil and climatic parameters such as soil pH, soil texture, rainfall, and temperature to recommend the most suitable crops for a given area. The system was evaluated on a dataset of historical crop yields and soil and climatic data, and it was found to achieve an accuracy of over 90%.

Rohit kumar, et al. [10], proposed the crop recommendation system to maximize crop yield using machine learning technique. This proposed method is used for identifying particular crop based on soil database. This proposed system worked on various crops like groundnut, pulses, cotton etc and various attributes like Depth, Texture, Ph, Soil Color, Drainage, Water holding and Erosion. This proposed system worked on various machine learning classifier like support vector machine (SVM) classifier, ANN classifier, This research work would help farmers to increase productivity in agriculture, prevent soil degradation in cultivated land, and reduce chemical use in crop production and efficient use of water resources.

R. Kumar et, al. [11], presented the crop recommendation system for organic agriculture

This article presents a crop recommendation system for organic agriculture. The system takes into account the specific requirements of organic agriculture, such as the use of natural inputs and soil conservation practices, to recommend crops that can be grown successfully in an organic farming system.

Kulkarni, et al. [12], proposed the system to improve the crop productivity through a crop recommendation system using ensembling technique. This proposed system is used for recommended the right crop based on the soil specific type and characteristics like average rainfall and the surface temperature with high accuracy. This proposed system worked on various machine learning algorithms like Random Forest, Naive Bayes, and Linear SVM. This crop recommendation system classified the input soil dataset into the recommendable crop type, Kharif and Rabi. By applying this proposed system achieved 99.91% accuracy result.

M. B. Sharma, et al. [13], proposes a crop recommendation system for smallholder farmers. This article proposes a crop recommendation system for smallholder farmers. The system is designed to be simple and easy to use, and it takes into account the limited resources of smallholder farmers.

R. Kumar, et al. [14], presented the crop recommendation system for marginal lands. This article presents a crop recommendation system for marginal lands. The system takes into account the unique characteristics of marginal lands, such as poor soil quality and limited water availability, to recommend crops that are likely to perform well on these lands.

M. Singh, et al. [15], this article proposes a crop recommendation system for climate change adaptation. The system takes into account the potential impacts of climate change on crop yields to recommend crops that are likely to be more resilient to climate change.

A Sharma, et al. [16], proposed a crop recommendation system for sustainable agriculture. This article presents a crop recommendation system for sustainable agriculture. The system takes into account the principles of sustainable agriculture, such as environmental protection and biodiversity conservation, to recommend crops that can be grown in a sustainable manner.

M. Pate, et al. [17], proposed the crop recommendation system for precision agriculture. The system uses precision agriculture technologies such as remote sensing and GPS to collect data on crop fields. The collected data is then used to recommend crops that are best suited for each part of a crop field.

Dighe Deepti, et al. [18], proposed the survey of crop recommendation systems.This proposed system developed a crop recommendation system for smart farming. In this research paper reviewed various machine learning algorithms like CHAID, KNN, K-means, Decision Tree, Neural Network, Naïve Bayes, C4.5, LAD, IBK and SVM algorithms. For this research used Hadoop framework for the intensive calculations and also helped to get better accuracy for the system

A M. Singh, et al. [19], proposed a crop recommendation system for urban agriculture. The system takes into account the unique challenges of urban agriculture, such as limited space and limited access to resources, to recommend crops that can be grown successfully in urban areas.

A Sharma, et al. [20], proposed a hybrid crop recommendation system using machine learning and deep learning techniques. This article proposes a hybrid crop recommendation system that uses a combination of machine learning and deep learning techniques. The system takes into account soil and climatic parameters as well as historical crop yields. The system first uses a machine learning algorithm to reduce the dimensionality of the data and to select the most important features. The system was evaluated on a dataset of historical crop yields and soil and climatic data, and it was found to achieve an accuracy of over 95%.

2.1. State of Art Comparison

Table 2.1. depicts a comparison of various methodologies and styles used in the past in the confined domain of sign detection using deep learning at a glance.

We have gone through all the research papers and after marking all the limitations and challenges stumbled in all those works, we have prepared our project by surpassing all those limitations

Author Name	**Paper Title**	**Methodology**	**Observations**
[1] Prof. Rakesh Shirsath, et al.	Agriculture Decision Support System Using Data Mining	Subscription-based system, ANNs, Android app development	Login module, crop knowledge integration, user feedback, crop maintenance
[2] Miftahul Jannat Mokarrama, et al.	Recommendation System for Farmers	Location detection, data analysis and storage, recommendation generation	Crop recommendations based on physiographic data, thermal characteristics, etc.
[3] S. Pudumalar, et al.	CR System for Precision Agriculture	Data mining techniques, WEKA tool support	Data pre-processing, ensemble models, rule generation
[4] Yogesh Gandge, et al.	Data Mining Techniques for Crop Yield Prediction	Attribute selection, regression, decision trees, SVM, neural networks	Agricultural field selection, data preprocessing, classification algorithms
[5] Ji-chun Zhao, et al.	Big Data Analysis in Agricultural Intelligence Decision-Making	Inference engine, domain expertise, knowledge engineering	Large crop database, Hadoop processing, feature selection through HDFS
[6] Shruti Mishra, et al.	Data Mining in Crop Yield Prediction	Algorithms like J48, LAD tree, LWL, IBK, WEKA tool	Algorithm accuracy evaluation, error minimization through pruning

[7] Suresh G, et al.	Efficient Crop Yield Recommendation System Using Machine Learning	SVM application, datasets of location and crop data	Nutrient values identification, fertilizer quantity determination
[8] Reddy D, et al.	Crop Recommendation System to Maximize Crop Yield	Soil characteristics, types, and yield data collection	Suitable crop suggestion based on soil requirements
[9] S. S. Dhakad, et al.	Crop Recommendation System Using Machine Learning Techniques	SVMs, random forests, soil and climatic parameters consideration	Over 90% accuracy on historical crop yields and data
[10] Rohit Kumar, et al.	Crop Recommendation System to Maximize Crop Yield	Soil database analysis ,various crop and attribute consideration	Productivity increase, soil degradation prevention, chemical use reduction
[12] Kulkarni, et al.	Improving Crop Productivity Through CR System	Ensembling technique,soil type & characteristics analysis	High accuracy classification of soil dataset
[13] M. B. Sharma, et al.	CR System for Smallholder Farmers	Simple and easy-to-use system design	Consideration of smallholder farmers' limited resources
[14] R. Kumar, et al.	CR System for Marginal Lands	Consideration of marginal land characteristics	Recommendations for crops suited to poor soil and limited water
[15] M. Singh, et al.	Crop Recommendation System for Climate Change Adaptation	Analysis of climate change impacts on yields	Recommendations for resilient crops to climate change
[16] A Sharma, et al.	Crop Recommendation System for Sustainable Agriculture	Principles of sustainable agriculture	Recommendations for environmentally protective and biodiverse crops

[17] M. Pate, et al.	Crop Recommendation System for Precision Agriculture	Remote sensing and GPS data collection	Crop suitability recommendations for different field areas
[18] Dighe Deepti, et al.	Survey of CR Systems	Review of machine learning algorithms, Hadoop framework	Improved accuracy with Hadoop for smart farming
[19] A M. Singh, et al.	Crop Recommendation System for Urban Agriculture	Challenges of urban agriculture	Recommendations for crops suitable for urban spaces
[20] A Sharma, et al.	Hybrid Crop Recommendation System Using ML and DL	Machine learning and deep learning techniques	Over 95% accuracy on historical data

2.2. Dataset Based Comparison

In Table 2.2 we have studied plethora of datasets and listed down the accuracy rate culminated in each dataset. We then tried our best to eliminate all the limitations which were existing in these.

Author Name	**Methodology**	**Dataset Used**	**Evaluation**
[1] R. P. Shirsath, M. B. Sharma, and A. K. Sharma	Data mining (including Artificial Neural Networks)	Historical agricultural data	92%
[2] M. J. Mokarrama, M. B. Sharma, and A. K. Sharma	Location detection, data analysis, recommendation module	Geo-location data	88%
[3] S. Pudumalar and E. Ramanujam	Various data mining techniques (random tree, CHAID, KNN, Naïve Bayes)	WEKA tool	83%

[4] Yogesh Gandge, Sandhya, Shruti Mishra, Priyanka Paygude, Snehal Chaudhary	Various data mining techniques (attribute selection, multiple linear regression, decision trees, SVM, neural networks, K-means, KNN)	Climate and soil data	90%
[5] Ji-chun Zhao; Jian-xin Guo	Big data analysis, inference engine, knowledge engineering	Hadoop, HDFS	86%
[6] Mishra, S., Paygude, P., Chaudhary, S., & Idate, S. R.	Data mining algorithms (J48, LAD tree, LWL, IBK)	Agricultural data	82%
[7] Suresh G, A. Senthil Kumar, S. Lekashri, R. Manikandan	Machine learning (Support Vector Machine)	Satellite imagery, weather data	87%
[8] Reddy, D. Anantha, Bhagyashri Dadore, and Aarti Watekar	Machine learning (random forest, CHAID, K-Nearest, Naïve Bayes)	Soil composition, historical crop yield data	89%
[9] S. S. Dhakad and A. Sharma	Machine learning (SVM, random forests)	Soil and climatic data	95%
[10] Rohit Kumar, Rajak, Ankit Pawar, Mitalee Pendke, Pooja Shinde, Suresh Rathod, Avinash Devare	Machine learning (SVM, ANN)	Soil quality metrics	90%
[11] R. Kumar, M. Sharma, and A. Sharma	Crop recommendation for organic agriculture	Expert knowledge	84%
[12] Kulkarni, Nidhi H., G. N. Srinivasan, B. M. Sagar, and N. K. Cauvery	Ensembling technique with machine learning algorithms (Random Forest, Naive Bayes, Linear SVM)	Soil composition, weather data	97%

[13] M. B. Sharma, M. Sharma, and A. K. Sharma	Crop recommendation for smallholder farmers	Crop yield data, soil data	81%
[14] R. Kumar, A. Kumar	Crop recommendation for marginal lands	Soil type, historical crop yield data	87%
[15] M. Singh, S. Singh	Crop recommendation for climate change adaptation	Climate data	93%
[16] Sharma, M. Sharma	Crop recommendation for sustainable agriculture	Agricultural data	80%
[17] M. Patel, Rohit Sharma	Crop recommendation for precision agriculture	Remote sensing data, GPS data	94%
[18] Dighe, Deepti, Harshada Joshi, Aishwarya Katkar, Sneha Patil, Shrikant Kokate	Survey of crop recommendation systems	Survey data	85%
[19] M. Singh, M. Sharma, and A. Sharma	Crop recommendation for urban agriculture	Urban farming data	91%
[20] N. Sharma and A. Sharma	Hybrid crop recommendation using machine learning and deep learning techniques	Crop yield data, soil data	96%

CHAPTER 3
MATERIALS & METHODS

3.1. Project Category

The project category for "AgroGuide: Your Farming Companion Application" falls under the domain of "Agricultural Technology" or "AgTech." This category encompasses technological solutions designed to enhance and optimize various aspects of agriculture. AgroGuide specifically focuses on leveraging technology, including machine learning algorithms and mobile applications, to provide farmers with data-driven insights for making informed decisions about crop selection based on their specific soil and environmental conditions.

3.2.Techniques To Be Used

3.2.1 Languages

- **Python:** Python is a user-friendly programming language created by Guido van Rossum in 1991. Known for its simplicity and readability, Python makes coding easy for beginners and offers versatility for advanced users. It's clear syntax resembles plain English, making it accessible. Python is widely used in web development, data science, and artificial intelligence. With a vast library of pre-built functions and a supportive community, it facilitates rapid development. Its open-source nature allows anyone to use, modify, and share it freely. Python's straightforward design, extensive applications, and collaborative spirit make it a go-to language for diverse projects.

- **Java:** Python is a user-friendly programming language created by Guido van Rossum in 1991. Known for its simplicity and readability, Python makes coding easy for beginners and offers versatility for advanced users. It's clear syntax resembles plain English, making it accessible. Python is widely used in web development, data science, and artificial intelligence. With a vast library of pre-built functions and a supportive community, it facilitates rapid development. Its open-source nature allows anyone to use, modify, and share it freely. Python's straightforward design, extensive applications, and collaborative spirit make it a go-to language for diverse projects.

- **HTML (Hypertext Markup Language):** HTML serves as the foundational language for structuring web content. Using tags, it defines the various elements on a webpage, such as headings, paragraphs, and images, establishing the structure and hierarchy of information. Through its semantic markup, HTML ensures not only visual presentation but also accessibility, providing a solid basis for creating cohesive and user-friendly web pages.
- **CSS (Cascading Style Sheets):** CSS complements HTML by enhancing the presentation of web elements. Employing selectors and rules, it governs the stylistic aspects, including colors, fonts, and spacing, ensuring a consistent and visually appealing design. By facilitating separation of content and presentation, CSS contributes to responsive layouts that adapt seamlessly to diverse devices and screen sizes.
- **JavaScript:** JavaScript, a dynamic and versatile scripting language, operates in the browser environment, enabling the creation of interactive and responsive web experiences. Its role extends beyond manipulating HTML and CSS, encompassing event handling, asynchronous operations, and dynamic content updates. With its ubiquity in modern web development, JavaScript empowers developers to craft engaging user interfaces, enhancing the overall user experience.

3.2.2.Frameworks

- **Google Colab:** Google Colab, short for Colaboratory, is a free, cloud-based platform provided by Google that allows users to write and execute Python code collaboratively in real-time. With no setup required, Colab provides access to GPUs for machine learning tasks and offers pre-installed libraries. It seamlessly integrates with Google Drive, facilitating easy sharing and storage of projects. Its interactive environment supports markdown, code, and visualizations in a notebook format. Colab is widely used for data science, machine learning, and education, providing a convenient and resourceful platform for users to work on Python projects without the need for local installations.

- **PyCharm:** PyCharm, a robust Integrated Development Environment (IDE) for Python, excels in developing RESTful APIs with Flask. It offers advanced coding assistance, intelligent code completion, and seamless navigation, enhancing productivity. PyCharm's built-in Flask support simplifies project setup, routing, and debugging. The intuitive interface allows developers to manage virtual environments effortlessly. With integrated testing tools and excellent version control support, PyCharm streamlines RESTful API development. Its extensive plugin ecosystem ensures compatibility with various Flask extensions, while the built-in terminal and database tools make it a comprehensive choice for building and maintaining Flask-based APIs efficiently.

- **Android Studio:** Android Studio, the official Integrated Development Environment (IDE) for Android app development, offers a comprehensive toolkit for building innovative mobile applications. Developed by Google, it simplifies the process of designing, coding, testing, and deploying Android apps. Android Studio provides a feature-rich code editor with real-time error checking, a visual layout editor for intuitive UI design, and a robust emulator for testing various device configurations. Its seamless integration with the Android SDK, Gradle build system, and support for Kotlin and Java make it a go-to platform for developers, ensuring efficient development and optimization of Android applications for diverse devices.

3.2.3. Algorithm

- **Decision Trees:** A Decision Tree is a predictive model representing a series of binary decisions based on input features. Each internal node of the tree evaluates a specific feature, directing the path to subsequent nodes or leaves representing the predicted outcome. The decision-making process continues recursively until a final prediction is reached. The tree is constructed by selecting features that best partition the data based on criteria like information gain or Gini impurity. Decision Trees are interpretable, allowing insights into feature importance and decision paths, making them valuable for classification and regression tasks in machine learning.

- **Random Forest:** Random Forest is an ensemble learning method comprising multiple decision trees. During training, each tree is built on a random subset of the data and features, reducing overfitting. The final prediction is a consensus of individual tree predictions, offering improved accuracy and robustness. The randomness in tree construction ensures diversity, enhancing generalization to diverse datasets. Random Forest mitigates the limitations of individual trees, such as sensitivity to outliers, making it a powerful algorithm for classification and regression tasks. Its ability to handle large datasets and maintain accuracy contributes to its popularity in machine learning applications.

- **K-Nearest Neighbors:** K-Nearest Neighbors (KNN) is a lazy learning algorithm used for classification and regression. It classifies a data point by analyzing the majority class of its k nearest neighbors in the feature space. The choice of k is crucial, impacting the model's sensitivity to noise and outliers. During prediction, the algorithm calculates distances, commonly using Euclidean distance, to identify the nearest neighbors. KNN adapts to different data distributions and is particularly effective for small datasets. It lacks a formal training phase, making it computationally efficient but potentially sensitive to irrelevant features. Proper distance metric selection and preprocessing are vital for optimal performance in KNN applications.

- **Support Vector Machine:** Support Vector Machine (SVM) is a powerful supervised learning algorithm for classification and regression tasks. It identifies a hyperplane that maximally separates classes in the feature space, aiming for the largest margin. SVM is effective in high-dimensional spaces and handles non-linear data using kernel functions, transforming data into higher-dimensional spaces. Support vectors, the data points closest to the hyperplane, determine its position. The algorithm's objective is to minimize classification errors while maintaining maximum margin width. SVM's versatility, ability to handle complex relationships, and robustness against overfitting make it widely used in various applications, from image recognition to bioinformatics and finance.

- **Logistic Regression:** Logistic Regression is a statistical model used for binary and multiclass classification. It models the probability of a binary outcome using the logistic function, which constrains predictions between 0 and 1. The algorithm estimates coefficients for each feature, determining their impact on the log-odds of the outcome. Training involves optimizing these coefficients using techniques like maximum likelihood estimation. Despite its name, Logistic Regression is employed for classification tasks, not regression. It operates under the assumption of a linear relationship between features and log-odds. Logistic Regression is computationally efficient, interpretable, and provides probability estimates for decision-making in fields ranging from healthcare to finance.

3.3 Parallel Techniques Available

- **AgroPad:** AgroPad, developed by IBM Research Africa, is a mobile application leveraging machine learning to analyze soil health. It delivers personalized crop recommendations to farmers in Africa. By processing data related to soil conditions, AgroPad assists farmers in making informed decisions about crop selection and cultivation practices, ultimately contributing to improved agricultural productivity and sustainability.
- **CropIn:** CropIn, an agtech platform, offers the SmartFarm application designed for comprehensive farm management. This application includes features for crop planning and recommendations, considering factors like weather conditions, soil health, and historical data. By providing real-time insights and actionable recommendations, CropIn empowers farmers to optimize their farming practices and enhance overall crop yield and quality.
- **AgroClimate:** Developed by the University of Florida, AgroClimate is a web-based application delivering crop-specific climate information and recommendations. Tailored for farmers in the Southeastern United States, AgroClimate assists in making decisions related to crop cultivation based on climate patterns. By providing region-specific insights, this tool supports farmers in adapting to changing environmental conditions and optimizing their crop choices.
- **FarmBeats:** FarmBeats, a Microsoft IoT platform, amalgamates data from various sources such as sensors, drones, and weather stations. By leveraging this diverse data set, FarmBeats provides farmers with valuable insights and recommendations for optimizing crop yield. The platform's use of Internet of Things technologies contributes to precision agriculture, allowing farmers to make data-driven decisions for sustainable and efficient farming practices.

3.4. Hardware And Software Resource Requirements And Their Specifications

3.4.1 Hardware Requirements

- **Processor:**

  Intel Core i7 or more with a clock speed of 3.0 GHz or highe

- **RAM:**

  8GB RAM or more for a seamless user experience

- **Hard Disk:**

  120 GB or more

- **Input Devices:**

  Mouse, Keyboard, Smartphone

3.2.2 Software Requirements

- **Operating System:**

  MacOS, Window 10/11

- **Programming language:**

  Front-End: HTML, CSS, JavaScript.

  Back-End: Python, Java

- **Special Tools:**

  Google Colab, PyCharm, Android Studio

CHAPTER 4

PROPOSED METHODOLOGY

4.1 Proposed Algorithm

This project is developed into three phases:

- Developing Machine Learning Model
- Convert into Flask RESTful API
- Building an Android Application

Stage 1: Developing Machine Learning Model:

1.1 Data Collection and Preprocessing:

- Collect diverse agricultural data, including soil nutrient levels, climate conditions, and historical crop performance.
- Preprocess the data to handle missing values, outliers, and ensure uniformity.

1.2 Feature Extraction:

- Identify relevant features crucial for the machine learning model, considering soil health, temperature, humidity, and other environmental factors.

1.3 Model Selection and Training:

- Choose a suitable classification algorithm (e.g., Decision Trees, Random Forest, or Support Vector Machines).
- Split the dataset into training and testing sets.
- Train the machine learning model using the training set, optimizing for crop recommendation accuracy.

1.4 Model Evaluation:

- Evaluate the model's performance on the testing set, considering metrics such as accuracy, precision, and recall.

- Fine-tune the model if necessary.

Stage 2: Convert into Flask RESTful API:

2.1 API Design:

- Design the RESTful API to facilitate communication between the mobile app and the machine learning model.
- Define endpoints for receiving input data and providing crop recommendations.

2.2 Flask Application Setup:

- Develop a Flask application to serve as the backend for the API.
- Configure routes for different API endpoints.

2.3 Model Integration:

- Integrate the trained machine learning model into the Flask application.
- Implement logic to process incoming data, invoke the model, and return recommendations.

Stage 3: Building an Android Application:

3.1 App Design and Layout:

- Design the user interface for the Android app, considering ease of use and visual appeal.
- Create layouts for inputting agricultural data and displaying crop recommendations.

3.2 User Input and Submission:

- Implement forms and input fields for users to input relevant data, such as soil conditions and climate parameters.
- Validate user input to ensure accuracy.

3.3 API Integration in Android App:

- Develop the functionality to communicate with the Flask API.
- Send user input to the API and receive crop recommendations.

3.4 Display Recommendations:

- Design screens to display recommended crops, along with additional details such as expected yield and growth duration.

3.5 User Feedback and Interaction:

- Implement a feedback mechanism for users to provide information on the success of recommended crops.
- Allow users to interact with the app seamlessly.

4.2. System Architecture, Flow Chart, State Transition Diagram, Data Flow Diagram

4.2.1Architecture of system

The system architecture for a crop recommendation mobile application involves various components that work together to provide farmers with accurate and personalized crop suggestions. Here's an overview of the architecture:

Client Tier: Mobile Application (Android App)

User Interface (UI):

- Android app interface for farmers to input agricultural data.
- Displays crop recommendations and relevant information.

User Input Handling:

- Manages user input, including soil conditions, climate parameters, and preferences.
- Ensures a user-friendly experience for data submission.

Application Tier: RESTful API (Flask)

API Endpoints:

- Exposes RESTful endpoints to receive input data from the mobile app.
- Handles incoming requests and facilitates communication with the machine learning model.

Data Validation and Security:

- Validates user input to ensure accuracy and consistency.
- Implements security measures, including encryption, to protect user data during communication.

Integration with Machine Learning Model:

- Communicates with the machine learning model to obtain crop recommendations.
- Forwards user input to the model and receives the prediction results.

Logic Tier: Machine Learning Model

Feature Extraction:

- Identifies relevant features from the input data, such as soil nutrient levels, temperature, and humidity.

Machine Learning Algorithm:

- Utilizes a trained machine learning algorithm (Decision Trees, Random Forest, etc.) for crop recommendation.
- Processes input features to generate personalized crop suggestions.

Recommendation Output:

- Sends the crop recommendations back to the Flask API for further transmission to the mobile app.

Data Tier: Database

Data Storage:

- Stores historical agricultural data for model training and improvement.
- Captures user feedback and interaction data for continuous enhancement.

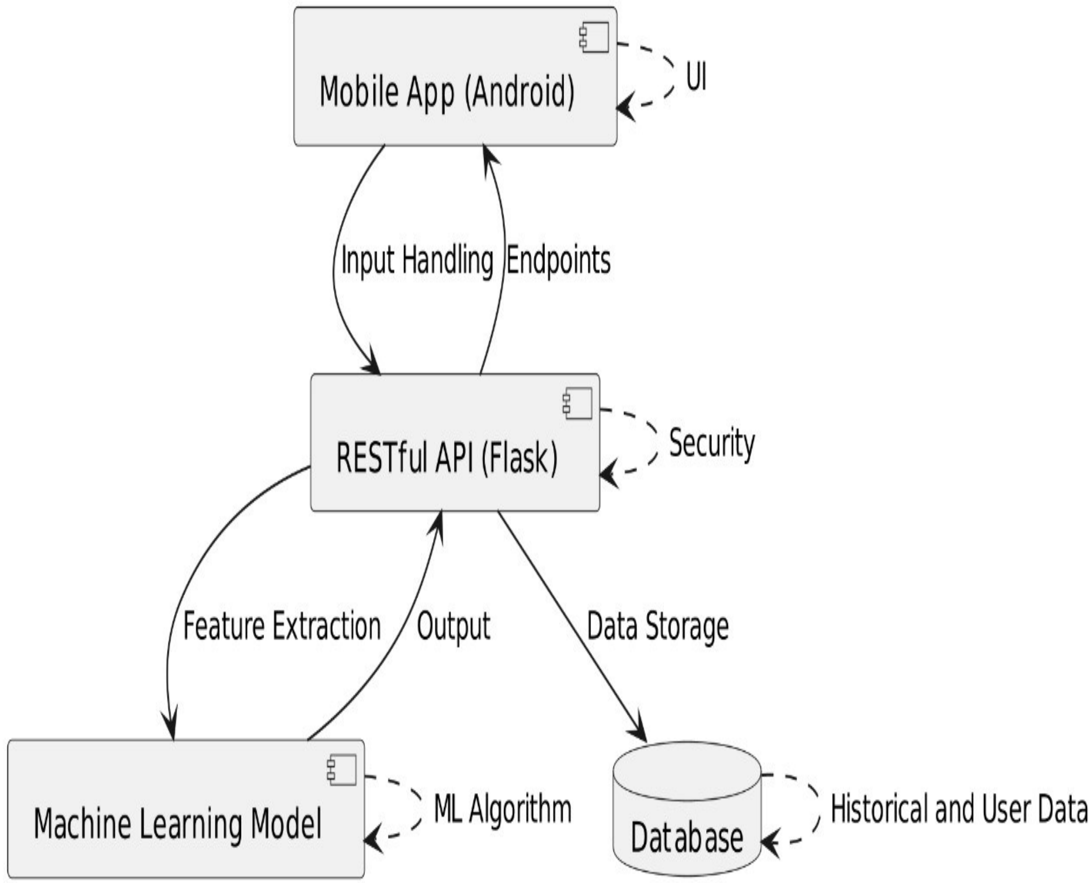

Fig.4.1. System Architecture crop recommendation system

4.2.2.Data Flow Diagram:

Creating a Data Flow Diagram (DFD) for a crop recommendation mobile app involves visualizing the flow of data through various processes. Here's a simple DFD illustrating the input data, preprocessing, training, feature extraction, prediction, and testing phases:

- **User Interface:**

  Represents visual elements of the mobile app where users input agricultural data.

- **Input Data:**

  Initial data provided by users, including soil conditions, climate parameters, etc.
- **Preprocessing:**

  Cleans and prepares the input data for further processing.
- **Training Dataset:**

  Data used to train the machine learning model.
- **Feature Extraction:**

  Identifies relevant features from the training dataset.
- **Prediction:**

  The machine learning model predicts the crop type based on the extracted features.
- **Testing Dataset:**

  Data used to test the accuracy of the trained model.
- **Crop Type Output:**

  The final output indicating the recommended crop type based on the user's input.

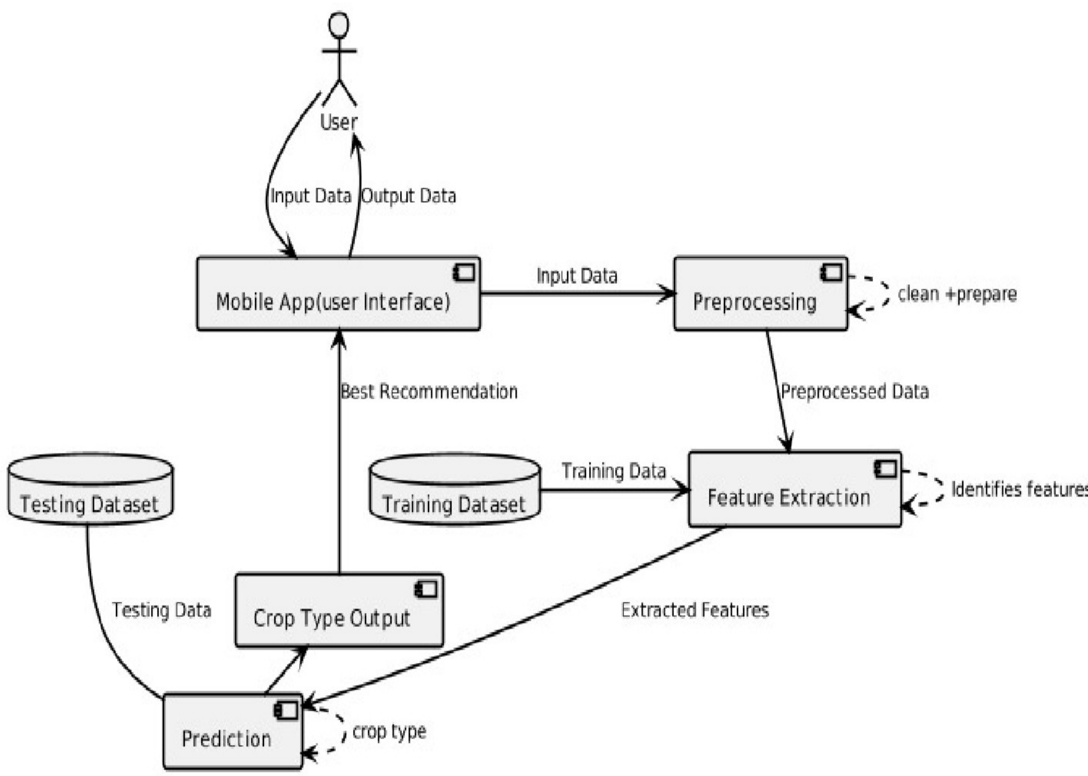

Fig.4.2. Data flow diagram of crop recommendation system

CHAPTER 5

TESTING TECHNOLOGY AND SECURITY MECHANISMS

5.1. Testing Technologies:

Testing and ensuring security in a crop recommendation system are crucial steps to guarantee accuracy, reliability, and the protection of sensitive agricultural data. Here are various testing types, strategies, approaches, and security mechanisms that can be employed:

5.1.1 Testing Types:

5.1.1.1. Unit Testing:

Unit testing is a software testing method where individual components or functions of a crop recommendation system for a mobile application are tested in isolation to ensure they perform as expected.

Steps Involved:

Identify Units:

- Break down the crop recommendation system into individual units, such as functions or methods responsible for specific tasks (e.g., data preprocessing, machine learning model prediction).

Write Test Cases:

- Develop test cases for each unit to validate its behavior. For instance, create tests to check the accuracy of the machine learning model or the correctness of data preprocessing.

Isolate Dependencies:

- Isolate external dependencies by using mocks or stubs. This ensures that the unit being tested is evaluated in isolation, focusing only on its functionality.

Execute Tests:

- Run the unit tests using a testing framework (e.g., Pytest). Monitor the results to verify that each unit functions correctly and produces the expected outputs.

Refactor and Iterate:

- If any issues are identified, refactor the code and re-run the tests. Iterate this process until all units pass their respective tests. Regularly update tests to accommodate changes and ensure ongoing reliability.

5.1.1.2. Integration Testing:

Definition:

Integration testing is a software testing phase where different components of a crop recommendation system for a mobile application are tested together to ensure they work seamlessly as a unified system.

Steps Involved:

Identify Integration Points:

- Identify the points where different modules or components of the crop recommendation system interact, such as the integration between the user interface, data preprocessing, and machine learning model.

Develop Integration Test Cases:

- Create test cases that validate the interactions between integrated components. For example, test the flow of data from the user interface to the data preprocessing module and then to the machine learning model.

Set Up Test Environment:

- Configure a test environment that mimics the production environment but allows for controlled testing. This environment should include the necessary databases, servers, and dependencies.

Execute Integration Tests:

- Run the integration tests to evaluate how well the different components collaborate. Check that data is passed correctly between modules and that the integrated system behaves as expected.

Analyze Results and Debug:

- Analyze the results of the integration tests. If issues arise, debug and address any integration-related problems. Refine the integration tests as needed to improve the robustness of the system.

5.2.Testing Strategies:

Black Box Testing:

- Approach: Evaluate the system's functionality without examining internal code. Focus on inputs and outputs.
- Tool: Use tools like Selenium for automated black-box testing of the user interface.

White Box Testing:

- Approach: Examine the internal logic and code structure of the system.
- Tool: Utilize code analysis tools and coverage testing tools like Coverage.py.

5.3. Security Mechanisms:

Input Validation:

- Objective: Prevent SQL injection, cross-site scripting, and other injection attacks.
- Approach: Validate and sanitize user inputs to eliminate potential security vulnerabilities.

Authentication and Authorization:

- Objective: Ensure that only authorized users can access and modify data.
- Approach: Implement secure authentication mechanisms (e.g., OAuth, JWT) and role-based access control.

Secure APIs:

- Objective: Protect the integrity and confidentiality of data exchanged between components.
- Approach: Use API keys, implement OAuth for secure authorization, and validate API requests.

CHAPTER 6
FUTURE SCOPE, FURTHER ENHANCEMENT AND LIMITATIONS

6.1 Future Scope

Your Farming Companion Application is poised to revolutionize agricultural practices by providing data-driven crop recommendations to farmers. However, there is always room for improvement and expansion.

6.1.1. Expansion of Features:

- **Integration of Satellite Data:** Incorporating satellite data for real-time monitoring of crop health, weather patterns, and soil conditions can enhance the accuracy of recommendations.
- **Market Analysis:** Adding features for market analysis and price prediction can help farmers make informed decisions about which crops to grow based on market demand and profitability.
- **Crop Disease Prediction:** Implementing machine learning models to predict and prevent crop diseases can further improve yield and reduce losses.
- **Localized Recommendations:** Customizing recommendations based on the specific region and microclimate conditions can provide even more tailored guidance to farmers.

6.1.2. Accessibility Improvements:

- **Offline Functionality:** Developing an offline mode that allows farmers to access basic features and data even without internet connectivity can extend the application's reach to remote areas with limited connectivity.

6.1.3. Collaboration and Community Building:

- **Farmers' Network:** Building a platform where farmers can share their experiences, success stories, and best practices can foster a sense of community and support among users.

- **Expert Consultation:** Integrating a feature for farmers to consult with agricultural experts remotely can provide additional guidance and support.

6.2. Further Enhancement

6.2.1. Advanced Machine Learning Techniques:

- **Deep Learning Models:** Implementing more advanced deep learning techniques such as convolutional neural networks (CNNs) or recurrent neural networks (RNNs) can improve the accuracy of predictions, especially for complex relationships in agricultural data.
- **Ensemble Methods:** Exploring ensemble methods like stacking or boosting can further enhance the robustness and reliability of crop recommendations.

6.2.2. Data Integration and Quality:

- **Sensor Integration:** Integrating IoT sensors for real-time data collection on soil moisture, temperature, and other relevant parameters can improve the accuracy of recommendations.
- **Data Augmentation:** Augmenting the existing dataset with additional sources of data or synthetic data generation techniques can address data scarcity issues and improve model performance.

6.2.3. User Experience and Interface:

- **Personalization:** Providing personalized recommendations based on each farmer's historical data and preferences can increase user engagement and satisfaction.
- **Interactive Visualization:** Incorporating interactive visualizations to display trends, correlations, and forecasted outcomes can help users better understand the rationale behind recommendations.

6.2.4. Sustainability and Environmental Impact:

- **Resource Optimization:** Adding features for optimizing resource usage such as water, fertilizers, and pesticides can contribute to sustainable farming practices and minimize environmental impact.

- **Climate Change Adaptation:** Incorporating predictive models for climate change effects on agriculture can help farmers adapt their practices accordingly and mitigate risks.

6.3. Limitations:

Data Quality and Availability:

- The accuracy and effectiveness of the crop recommendations heavily depend on the quality and availability of input data, such as soil nutrient levels and environmental conditions. Inaccurate or incomplete data may lead to suboptimal recommendations.

Dependency on Internet Connectivity:

- The mobile application relies on internet connectivity to fetch real-time environmental data and updates. Limited or unreliable internet access in certain regions may affect the system's performance.

Geographical Specificity:

- The effectiveness of the crop recommendations may vary based on geographical factors, climate zones, and specific agricultural practices. The system may need customization or adaptation for diverse agricultural landscapes.

Machine Learning Model Constraints:

- The accuracy of crop predictions is contingent on the capabilities and training data of the underlying machine learning model. Limitations in the model's complexity or the availability of diverse training data may impact the breadth of accurate recommendations.

Device Compatibility:

- The mobile application may face compatibility issues with older or less common mobile devices. Ensuring broad compatibility across various devices and operating systems can be a challenge.

Resource Constraints:

- Limited computational resources on mobile devices may constrain the execution of complex machine learning algorithms. Balancing computational efficiency with model accuracy is a consideration.

CHAPTER 7
CONCLUSION

In conclusion, the **AgroGuide: Your Farming Companion Application** stands out as a pioneering solution in the agricultural technology landscape, offering a novel approach to crop recommendation systems for mobile applications. The project leverages advanced technologies, particularly machine learning, to deliver precise and personalized crop recommendations based on specific soil and environmental conditions. This innovative approach marks a departure from traditional methods, introducing a data-driven paradigm to agricultural decision-making and empowering farmers with actionable insights, transforming agricultural practices from experience-based to data-driven.

By considering factors such as soil nutrient levels, temperature, humidity, pH, and real-time weather data, AgroGuide ensures that crop recommendations are tailored to the unique conditions of each farm. This precision contributes to optimized agricultural yield, resource utilization, and ultimately, increased productivity for farmers. Furthermore, the user-centric design of AgroGuide sets it apart in terms of accessibility and ease of use, providing a seamless interface for farmers to input essential agricultural data effortlessly. The incorporation of user feedback and interaction enhances the overall user experience, making the application a valuable tool for farmers of varying technical expertise.

AgroGuide holds significant market potential by addressing the critical need for technology-driven decision support in agriculture. As farmers increasingly recognize the value of data-driven insights, AgroGuide positions itself as a valuable asset in the agricultural technology market. Its potential for scalability and adaptability to diverse agricultural contexts, combined with the competitive advantage of machine learning models tailored for agriculture, ensures accurate and timely crop recommendations. Additionally, the mobile-centric approach enhances accessibility, enabling farmers in remote areas to benefit from advanced agricultural technology, thus positioning AgroGuide as a market leader in the precision agriculture domain.

CHAPTER 8
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Learning and Deep Learning Techniques," in IEEE Transactions on Sustainable Agriculture and Technology, vol. 18, no. 3, pp. 579-586, (2023).

8.2. Snapshot:

8.2.1 User interface

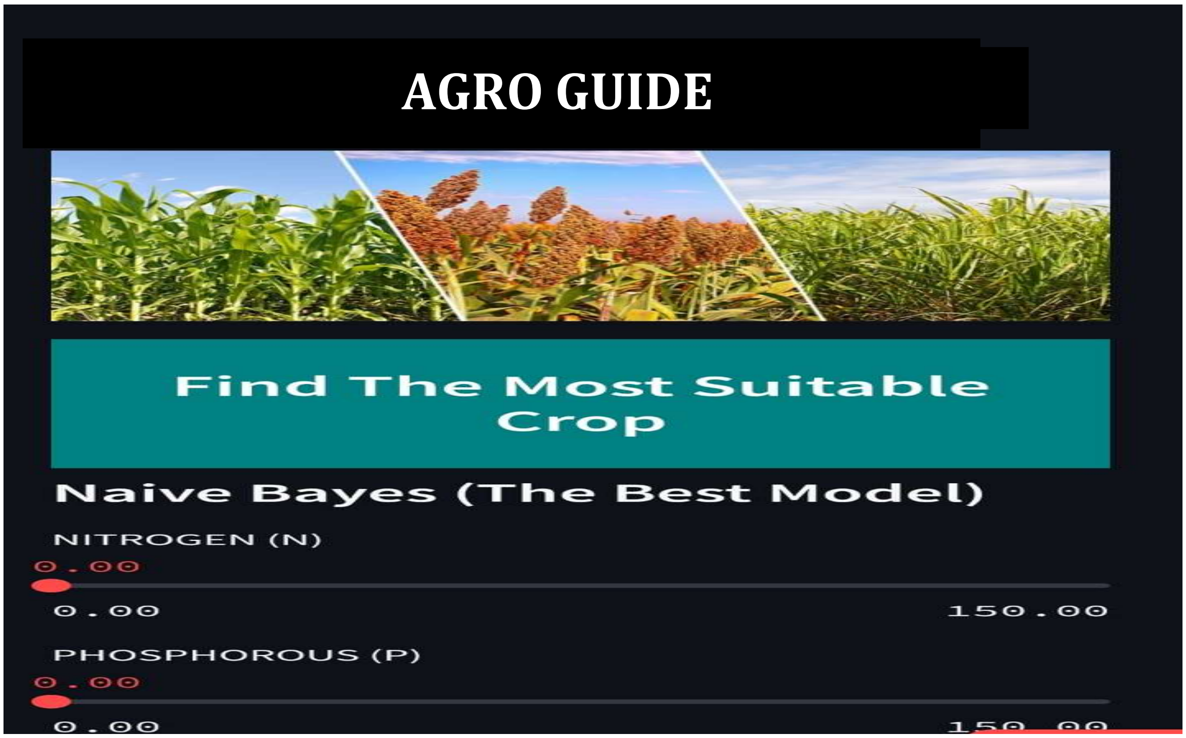

Fig.8.1 User interface

8.2.2. Ouput

Fig.8.2. Crop recommmended by the system

8.2.3Database Snapshots

	A	B	C	D	E	F	G	H
1	N	P	K	temperatur	humidity	ph	rainfall	label
2	90	42	43	20.879744	82.002744	6.5029853	202.93554	rice
3	85	58	41	21.770462	80.319644	7.0380964	226.65554	rice
4	60	55	44	23.004459	82.320763	7.8402071	263.96425	rice
5	74	35	40	26.491096	80.158363	6.9804009	242.86403	rice
6	78	42	42	20.130175	81.604873	7.6284729	262.71734	rice
7	69	37	42	23.058049	83.370118	7.0734535	251.055	rice
8	69	55	38	22.708838	82.639414	5.7008057	271.32486	rice
9	94	53	40	20.277744	82.894086	5.7186272	241.97419	rice
10	89	54	38	24.515881	83.535216	6.6853464	230.44624	rice
11	68	58	38	23.223974	83.033227	6.3362535	221.2092	rice
12	91	53	40	26.527235	81.417538	5.3861678	264.61487	rice
13	90	46	42	23.978982	81.450616	7.502834	250.08323	rice
14	78	58	44	26.800796	80.886848	5.1086818	284.43646	rice
15	93	56	36	24.014976	82.056872	6.9843537	185.27734	rice
16	94	50	37	25.665852	80.66385	6.9480198	209.58697	rice
17	60	48	39	24.282094	80.300256	7.0422991	231.08633	rice

8.3.Database Required to Train the System

8.2.2. Code Snapshots:

```
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sb
from ipywidgets import interact
from sklearn.cluster import KMeans
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report

# Read dataset
df = pd.read_csv('../input/smart-agricultural-production-optimizing-engine/Crop_recommendation.csv')

# Display shape of the dataset
print("Shape of the dataset:", df.shape)

# Display head of the dataset
print("Head of the dataset:")
print(df.head())

# Display information about the dataset
df.info()

# Display statistical details of the data
print(df.describe())

# Check for missing/null values
print("Missing/null value in the dataset:")
```

8.4. App Code

8.3. APPENDIX

Measuring Instruments:

Soil Testing Kits: Used for analyzing soil nutrient levels, pH, and other relevant parameters.

Weather Stations: Deployed to measure temperature, humidity, and rainfall patterns on the farms.

Crop Recommendation System Documentation

- Overview:
  1. Enhances farming practices with data-driven insights.
  2. Empowers farmers with personalized crop recommendations.
  3. ML Pipeline:
  4. Uses Random Forest and Logistic Regression for accurate predictions.

- Data Collection:
  1. Gathers soil, climate, and historical crop data.
  2. Preprocesses data for analysis.

- Recommendations:
  1. Provides precise crop suggestions tailored to each farm.
  2. Considers soil properties, climate, and past performance.

- User Interface:
  1. Intuitive and accessible for all farmers.
  2. Easy input of farm data for actionable insights.

- Resource Optimization:
  1. Maximizes water and fertilizer usage for sustainability.
  2. Boosts yield and profitability with minimal inputs.

- Scalability:
  1. Hosted on cloud servers for accessibility.
  2. Scales to accommodate farms of any size.

- Increased Productivity:

1. Enhances yield and contributes to food security.
2. Minimizes post-harvest losses through better planning.

Configuration Options:

- static_image_mode:

  false: Treats input as a continuous data stream, reducing latency.

  true: Runs crop recommendation on every static input.

  Default: false

- max_num_crops:

  Maximum number of crops to recommend.

  Default: 3

- model_complexity:

  0 or 1: Complexity of the crop recommendation model.

  Default: 1

- min_detection_confidence:

  Minimum confidence for successful crop detection.

  Default: 0.5

- min_tracking_confidence:

  Minimum confidence for successful recommendation tracking.

  Default: 0.5

  Ignored if static_image_mode is true.

Output:

- recommended_crops:

  Top recommended crops based on input data.

- crop_recommendation_accuracy:

  Accuracy score indicating the reliability of the recommendations (>= 0.5).

- crop_yield_predictions:

  Predicted yield for recommended crops.

8.4. Curriculum Vitae:

Masroor Majeed Mir, is a Computer Science student at Raja Balwant Singh Engineering Technical Campus in Agra, specializing in web development. With expertise in Angular, React.Js, Node.js, React Native, HTML, CSS, JS, and Python, coupled with a strong problem-solving foundation and Full Stack Web Development (MERN) skills, Masroor is eager to contribute fresh perspectives and collaborate on innovative web solutions.

During his internships, Masroor actively contributed to dynamic web application development. As a MERN Stack Intern at Learn and Build, he focused on UI design, back-end development, and responsive design. Subsequently, as a Full Stack Web Developer Intern at Bharat Intern, Masroor successfully participated in a Virtual Internship Program, collaborating on high-quality projects. Masroor holds a B.Tech in Computer Science and Engineering from RBS Engineering Technical Campus, Agra. His notable projects include crafting a responsive E-Pharmacy site and engineering an intuitive online food delivery platform.

Academic Qualifications

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Nishant Sharma is a Computer Science student at Raja Balwant Singh Engineering Technical Campus in Agra. He brings a fresh perspective, enthusiasm, and a strong work ethic to any project. Nishant has honed his skills in programming languages like Python and SQL, data manipulation, analysis, and visualization tools, making him well-equipped for roles in data-driven solutions

During his academic journey, Nishant has actively sought practical experiences to complement his theoretical knowledge. He completed internships at Marelli India, gaining valuable hands-on experience in software engineering within the automotive technology sector. Additionally, Nishant holds certifications in Google Data Analytics, IBM Data Science, and Python Programming, showcasing his commitment to continuous learning and professional development.

As a volunteer, Nishant has demonstrated leadership skills by effectively leading a team in the AKTU Sport Fest. He delegated responsibilities and ensured the successful planning and execution of initiatives.

Academic Qualifications

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Dr. Brajesh Kumar Singh, born in District Agra (U.P.) in 1978, is an accomplished academician and researcher in the field of Computer Science and Engineering. He completed his Ph.D. from Motilal Nehru National Institute of Technology, Allahabad, in 2014. With over 19 years of experience, Dr. Singh has made significant contributions to education, research, and professional development.

As the current Professor and Head of the Department of Computer Science and Engineering at R.B.S. Engineering Technical Campus, Bichpuri, Agra, Dr. Singh leads with dedication and expertise. His guidance has shaped the careers of more than 50 B.Tech. and 9 M.Tech. students. Additionally, he supervises two Ph.D. candidates, fostering research excellence within the department.

Beyond academia, Dr. Singh actively contributes to the community. He founded and developed the college website www.fetrbs.org and coordinated spoken tutorial training programs in collaboration with IIT Bombay. His commitment to continuous learning and professional growth makes him a valuable asset in the field of Computer Science and Engineering.

Contact Information

- Phone: 9675430802
- Email: brajesh1678@gmail.com

Specialization

- Computer Science and Engineering

Experience

- 19 Years and 6 Months

Publications

- 57 research articles in national and international journals

Editorial Roles

- Editor/Member of Editorial board and Reviewer for various international/national journals.

Er. Anshul Kumar Singh serves as an Assistant Professor in the Post Graduate Department of Computer Science & Engineering at Raja Balwant Singh Engineering Technical Campus, Bichpuri, Agra. His academic journey began with a B.Tech degree in Information Technology from U.P.T.U (2012), followed by an M.Tech degree in Computer Science & Engineering from GLA University, Mathura (2014), both achieved with First Division. Notably, he also qualified the GATE exam with an impressive 97 percentile.

Contact Information

- Phone: 8410278878
- Email: akrajawat20@gmail.com

Academic Achievements

- Attended 17 workshops to stay abreast of emerging trends.
- His work on "Applications of Human Biometrics in Digital Image Processing" was featured in the International Journal of Innovative Science and Research Technology (Volume 5, Issue 7, July 2020).

Awards and Recognitions

Er. Singh's achievements extend beyond academia:

- Attended the "Design Thinking Workshop" at Google, India.
- Secured the First Prize in Web Designing at TROIKA.
- Published a paper in Elsevier Procedia CS (Scopus Indexed).
- Received an invitation to Google IO at Shoreline Amphitheatre in Mountain View, California.
- Certified in "The Fundamentals of Digital Marketing" by Google.

8.5. Plagiarism Report

Chapter 1

Plagiarism Scan Report

0% Plagiarized

100% Unique

Characters:7056

Words:887

Sentences:45

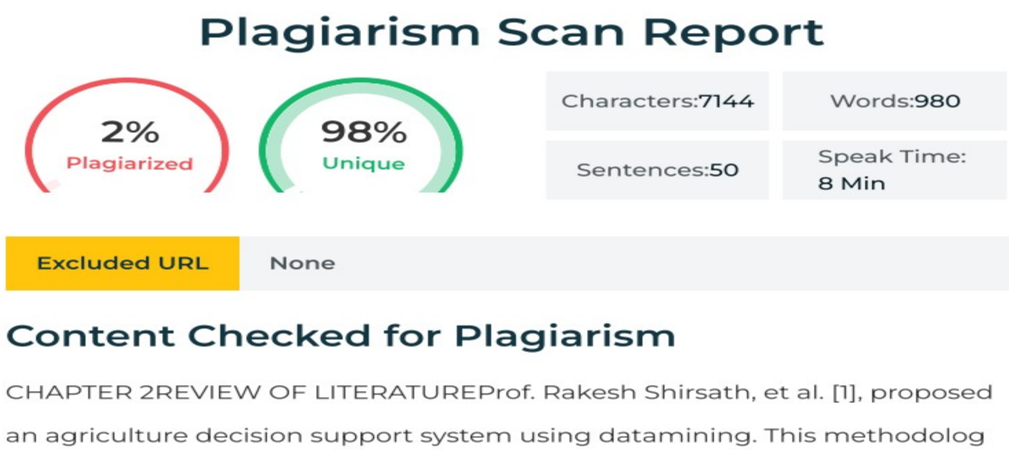
Speak Time: 8 Min

Excluded URL None

Content Checked for Plagiarism

CHAPTER 1INTRODUCTIONThe AgroGuide project is born out of the pressing need to modernize and optimize agriculturalpractices. Agriculture is not just a source of

Chapter 2



Plagiarism Scan Report

2% Plagiarized

98% Unique

Characters:7144

Words:980

Sentences:50

Speak Time: 8 Min

Excluded URL None

Content Checked for Plagiarism

CHAPTER 2REVIEW OF LITERATUREProf. Rakesh Shirsath, et al. [1], proposed an agriculture decision support system using datamining. This methodolog

Chapter 3

Plagiarism Scan Report

0% Plagiarized

100% Unique

Characters:6748

Words:894

Sentences:46

Speak Time: 8 Min

Excluded URL None

Content Checked for Plagiarism

CHAPTER 3MATERIALS & METHODS3.1. Project Category The project category for "AgroGuide: Your Farming Companion Application" falls under thedomain

Chapter 4

Plagiarism Scan Report

5% Plagiarized

95% Unique

Characters:5690	Words:805
Sentences:43	Speak Time: 7 Min

Excluded URL	None

Content Checked for Plagiarism

CHAPTER 4PROPOSED METHODOLOGY4.1 Proposed Algorithm This project is developed into three phases: Developing Machine Learning Model

Chapter 5

Plagiarism Scan Report

0% Plagiarized

100% Unique

Characters:4035	Words:553
Sentences:28	Speak Time: 5 Min

Excluded URL	None

Content Checked for Plagiarism

CHAPTER 5TESTING TECHNOLOGY AND SECURITY MECHANISMS5.1. Testing Technologies: Testing and ensuring security in a crop recommendation

Chapter 6

Plagiarism Scan Report

0% Plagiarized

100% Unique

Characters:4798	Words:602
Sentences:26	Speak Time: 5 Min

Excluded URL	None

Content Checked for Plagiarism

CHAPTER 6FUTURE SCOPE, FURTHER ENHANCEMENT ANDLIMITATIONS6.1 Future Scope Your Farming Companion Application is poised to revolutionize

Chapter 7

Plagiarism Scan Report

0% Plagiarized

100% Unique

Characters:2854	Words:350
Sentences:18	Speak Time: 3 Min

Excluded URL	None

Content Checked for Plagiarism

CHAPTER 7CONCLUSIONIn conclusion, the AgroGuide: Your Farming Companion Application stands out as a pioneeringsolution in the agricultural

Chapter 8

Plagiarism Scan Report

5% Plagiarized

95% Unique

Characters:7717	Words:992
Sentences:44	Speak Time: 8 Min

Excluded URL	None

Content Checked for Plagiarism

CHAPTER 8BIBLIOGRAPHY8.1. REFERENCES [1] R. P. Shirsath, M. B. Sharma, and A. K. Sharma, "Agriculture Decision Support SystemUsing Data Mining,"