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Harvest Helper: Maximizing Crop Yields With Data-Driven Recommendations

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Abstract: Agriculture forms the backbone of India's economy, with a significant portion of the population reliant on it for livelihood. However, despite its importance, farmers face numerous challenges in optimizing crop selection and fertilizer management to maximize yield rates. This project addresses these challenges by implementing an intelligent system aimed at assisting farmers in making informed decisions regarding crop selection and fertilizer usage. The project also focuses on user interface development, incorporating a user-friendly interface tailored for farmers' ease of use. Through comprehensive testing, validation, and continuous improvement efforts, the system aims to revolutionize agricultural practices, ultimately contributing to increased crop yields, reduced input costs, and improved livelihoods for farming communities.

Keywords— Harvest Helper – Agriculture System , Centralized Database , Central Government Websites Access , Crop Recommendation , Interface Between Farmers And Digital Crop Recommendation.

I. INTRODUCTION

India is an agricultural nation, where the population is over 1.2 billion, out of which around 70% of the population depends upon agriculture. Agriculture is a primary source of earning for Indian citizens and agriculture also has made an influence on India's economy. Agriculturists have an immeasurable variety to choose equitable products of the soil crops The selection of the crop by the farmer plays a vital role in the economical returns to the farmer. In this project , we have implemented an intelligent system which intends to assist the farmers in making an informed decision about which crop to grow and which fertilizer used depending on the soil characteristics as well as environmental factors such as temperature and rainfall. In the crop recommendation application, the user can provide the soil data from their side and the application will predict which crop should the user grow. For the fertilizer recommendation application, the user can input the soil data and the type of crop they are growing, and the application will predict what the soil lacks or has excess of and will recommend improvements.

A. **Problem Definition Problem Identified:** Addressing Challenges in Agricultural Optimization. Despite advancements in agricultural technology, farmers still face challenges in optimizing crop selection and fertilizer management to maximize yield rates. Existing methods often lack precision and fail to consider the intricate relationship between environmental factors, soil nutrient content, and crop suitability. This project aims to address these challenges by 3 developing a comprehensive system that leverages data analysis techniques to provide tailored crop recommendations based on soil nutrients, rainfall, humidity, and temperature.

B. **Objectives of the Study: This** research aims to develop a secure, scalable, and userfriendly Farmer Helper Website that: 1. To provide data-driven crop recommendations, the system will analyze soil nutrient levels, rainfall patterns, temperature ranges, and other environmental factors to suggest the most suitable crops for the user's specific agricultural context. 2. To optimize fertilizer usage and enhance crop

productivity, the system will develop algorithms to predict the optimal fertilizer type and application rates based on the crop's nutrient requirements and the soil's existing composition.

II. **RELATED WORK** : CROP RECOMMENDATION SYSTEM USING MACHINE LEARNING Study 1: In this project, the authors used various machine learning algorithms for crop recommendation, including Decision Tree, Naive Bayes, Support Vector Machine, Logistic Regression, Random Forest, and XGBoost. The highest accuracy of 99.31% was achieved using the XGBoost algorithm on a dataset containing information about 22 different crops . Study 2: In this study, two machine learning algorithms, Random Forest and Decision Tree, were employed for supervised learning tasks involving classification and regression problems. Random Forest, which leverages the ensemble learning technique, utilizes multiple decision trees trained on random subsets of data and averages their predictions to improve model accuracy and reduce overfitting.

Sr No.	Title	IEEE	Algorithms	Parameters	Findings	Limitations
1	Crop Prediction using Machine Learning	This paper is published in IRE Journals, Volume 6,Issue 9(March 2023)	The paper uses the following Machine Learning (ML) algorithms for crop prediction: K-Nearest Neighbors (KNN) Decision Tree Random Forest The Decision Tree algorithm was found to be the most accurate and was selected for final predictions.	The model considers various environmental and soil parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Humidity, Rainfall Soil Condition: pH value	The system helps farmers choose the best crop based on soil and weather conditions. Decision Tree performed better than KNN and Random Forest.	Data Dependency: The accuracy of predictions depends on the quality and availability of soil and weather data. Farmer Input Needed: The model requires farmers to input data manually, which may lead to errors.
2	A Machine Learning Approach for Crop Yield Prediction Using Weather Condition	Published in the 2024 International Conference on Advancement in Renewable Energy and Intelligent Systems (AREIS), IEEE.	Decision Tree (DT) Random Forest (RF) The model uses Decision Tree combined with Random	The model considers real- time environmental parameters for crop prediction, including: Temperature Humidity Soil Moisture	Random Forest performed better than Decision Tree in terms of accuracy and precision. The crop prediction accuracy reached approximately 98% using RF.	Overfitting in Decision Trees: The use of multiple decision trees led to overfitting, which was resolved

			Forest (DT-RF) to improve accuracy and reduce overfitting.	Rainfall		using Random Forest. Dependency

						on Real-Time Data: The model requires constant sensor input for accurate predictions, making it reliant on IoT systems.
3	A Machine Learning-based Approach for Crop Yield Prediction and Fertilizer Recommendation	Published in the Sixth International Conference on Trends in Electronics and Informatics (ICOEI) 2022, IEEE.	The study uses two machine learning algorithms: AdaBoost (for crop yield prediction) Random Forest (RF) (for fertilizer recommendation)	The model considers two sets of parameters: For Crop Yield Prediction: State District Season Crop type Area Production	AdaBoost achieved 82% accuracy in crop yield prediction. Random Forest had a 95% accuracy in fertilizer recommendation.	AdaBoost has lower accuracy (82%) compared to other boosting algorithms like Gradient Boosting. Random Forest requires large datasets and may not generalize well to different soil

4	Agricultural Crop Recommendation System	Published in the 2023 3rd International Conference on Intelligent Technologies (CONIT), IEEE.	The study utilizes three machine learning algorithms: Random Forest Support Vector Machine (SVM) Logistic Regression	The model considers several parameters to recommend suitable crops: Soil Type Rainfall Temperature Geographical Location Soil pH	The Random Forest classifier provided the highest accuracy in crop recommendation. The system successfully suggests crops based on soil and climate conditions, helping farmers make informed decisions.	Data Dependency: The accuracy of predictions depends on the quality and availability of soil and climate data. Limited Crop Variety: The study focused on a limited number of crops, which may restrict its applicability in diverse farming conditions.
5	An Efficient Crop Yield Prediction System Using Machine Learning	Published in EAI Endorsed Transactions on	The study applies various	The model considers agricultural	Random Forest Regressor achieved the	Data Dependency: The model relies on historical data

		Internet of Things (2024)	regression-based machine learning models: Linear Regression Kernel Ridge Regression (KRR) Lasso Regression Random Forest Regression K-Nearest Neighbors (KNN) Regression	and environmental factors, including: Crop Type Average Temperature Average Rainfall Amount of Pesticides Used (in tonnes)	highest R^2 score (0.98), RMSE (0.45), and MAE (0.1088). 98% of the variability in crop yield can be explained by the selected parameters.	from the Kaggle repository, which may not reflect real-time conditions. Limited Crop Variety: Only certain crops were considered, which may affect generalization to other regions.
6	Crop Prediction Model Using Machine Learning Algorithms	Published in Applied Sciences (MDPI), 2023, Volume 13, Article 9288	The study applies 15 different machine learning algorithms, with a focus on the best-performing models: Bayes Net (Best accuracy: 99.59%) Naïve Bayes Classifier (Accuracy: 99.46%) Hoeffding Tree (Accuracy: 99.46%) Random Forest (Accuracy: 99.46%) Decision Tree (J48)	The model considers multiple agricultural and environmental factors: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Rainfall, Humidity Soil Condition: pH value Crop Labels: 22 different crop types	Bayes Net and Naïve Bayes outperformed other models, achieving nearly 99.5% accuracy. Random Forest and Hoeffding Tree also performed well, with accuracy exceeding 99%.	Data Dependency: The model relies on historical data from Kaggle, which may not reflect real-time conditions. Computational Complexity: Deep learning models like Multilayer Perceptron require high processing power.

7	Crop and Fertilizer Recommendation System Applying Machine Learning Classifiers	Published in IEEE International Conference on Emerging Research in Computational Science (ICERCS'23)	The study applies multiple machine learning algorithms, including: Logistic Regression Naïve Bayes Random Forest Decision Tree Support Vector Machine (SVM)	The model considers various soil and environmental parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Rainfall, Humidity	Random Forest and SVM showed the highest accuracy for crop prediction. Naïve Bayes and Decision Tree performed well for fertilizer recommendation.	Data Dependency: The model relies on historical data from Kaggle, which may not always be up-to- date. Lack of Real-Time Integration: The system does not yet incorporate real- time weather or soil sensor data.
8	Crop Recommendation Based on Soil Properties: A Comprehensive Analysis	Published in 14th IEEE International Conference on Computing, Communication, and Networking Technologies (ICCCNT), 2023	The study applies multiple machine learning algorithms, including: Decision Tree (Accuracy: 90%) Naïve Bayes (Accuracy: 99.09%) Support Vector Machine (SVM) (Accuracy:	The model considers various soil and environmental parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Humidity, Rainfall	XGBoost achieved the highest accuracy (99.32%) among all models tested. Naïve Bayes and Random Forest also performed well with over 99% accuracy.	Data Quality and Availability: The model relies on historical soil test data from Kaggle, which may not always be up-to-date. Regional Generalization Issues: Crop recommendations may not generalize well to regions wit

			10.68%)			h different soi l properties.
9	Crop Recommendation System Using Ensembling Technique"	Published in 2022 International Conference on Breakthrough in Heuristics And Reciprocation of Advanced Technologies (BHARAT), IEEE	The study uses an ensemble learning approach, combining multiple machine learning models for better accuracy: Random Forest Support Vector Machine (SVM) Logistic Regression Naïve Bayes Gradient Boosting	The model considers various soil and climate parameters, including: Soil Nutrients: Nitrogen	The Ensemble Model outperformed individual algorithms in terms of accuracy and reliability. Random Forest and Gradient Boosting models contributed the most to improving prediction performance.	High Computational Cost: The ensemble approach requires more computational power than individual models. Lack of Real-Time Integration: The model is trained on historical data, which may not

				(N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Humidity, Rainfall Soil pH Level Moisture Content Previous Crop Grown		always be up-to- date.
10	Crop Recommendation Based on Soil Properties: A Comprehensive Analysis	Published in 14th IEEE International Conference on Computing, Communication, and Networking Technologies (ICCCNT), 2023	The study applies multiple machine learning algorithms, including: Decision Tree (Accuracy: 90%) Naïve Bayes (Accuracy: 99.09%) Support Vector Machine (SVM)	The model considers various soil and environmental parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Parameters: Temperature, Humidity, Rainfall	XGBoost achieved the highest accuracy (99.32%) among all models tested. Naïve Bayes and Random Forest also performed well with over 99% accuracy.	Data Quality and Availability: The model relies on historical soil test data from Kaggle, which may not always be up-to-date. Regional Generalization Issues: Crop recommendations may not generalize well to regions with different soil properties.
11	Crop	This paper	The study	The	Decision	Dataset

	Recommendation System using Machine Learning	appears to be from an academic conference but does not have an IEEE DOI. It was presented at Devang Patel	applies four supervised machine learning algorithms for crop recommendation: Decision Tree (DT) Support Vector Machine (SVM) Logistic	dataset considers the following soil and climate factors: Soil Nutrients: Nitrogen (N),	Tree and Gaussian Naïve Bayes performed best, achieving 99.5% training accuracy and 99.3% validation	Limitation: The system relies on historical data from Kaggle, which may not reflect real-time agricultural conditions.
		Institute of Advance Technology and Research, CHARUSAT, India.	Regression (LR) Gaussian Naïve Bayes (GNB)	Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Value	accuracy. Soil nutrients (NPK) and pH levels are the most significant factors in crop selection.	No Real-Time Data Integration: The model does not incorporate live weather or soil sensor data

12	Crop Recommendation Using Machine Learning	Published in 2023 International Conference on Data Science and Network Security (ICDSNS), IEEE	The study applies three machine learning algorithms for crop recommendation: Support Vector Machine (SVM) Random Forest Naïve Bayes	The dataset considers the following soil and climate parameters: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Level	Naïve Bayes achieved the highest accuracy (99.09%), outperforming Random Forest and SVM. Soil nutrients (NPK) and humidity were the most important parameters influencing crop selection.	Data Dependency: The model relies on historical soil and weather data, which may not always be up to date. Lack of Real-Time Integration: No real-time IoT sensor data is incorporated for dynamic updates.
13	Crop Yield Prediction using Machine Learning Algorithm	Published in 2021 Fifth International Conference on Intelligent Computing and Control Systems (ICICCS), IEEE	The study applies several machine learning and deep learning algorithms for crop yield prediction: Artificial Neural Network (ANN) Convolutional Neural	The dataset considers multiple agricultural and environmental parameters, including: Soil Features: Soil type, soil maps, and soil nutrient	Deep Neural Network (DNN) provided the most accurate results for crop yield prediction. CNN and ANN- based models were able to capture non-linear relationships between input parameters and yield.	High Computational Cost: Deep learning models like CNN and DNN require significant computational power. Data Dependency: The model relies on historical data

			Network (CNN)	content (Nitrogen, Phosphoru		
			Support Vector Machine (SVM) Random Forest	s, Potassium) Weather		
14	Development of a Machine Learning-Based System for Optimizing Crop Recommendations	Published in 2024 1st International Conference on Advances in Computing, Communication and Networking (ICAC2N), IEEE	The study applies several machine learning algorithms for crop recommendation : Decision Tree Classifier Random Forest Classifier Naïve Bayes Classifier Support Vector Machine (SVM) K-Nearest Neighbors (KNN)	The dataset considers multiple agricultural and environmental parameters, including: Soil Characteristics : Nitrogen (N), Phosphorus (P), Potassium (K), pH level Weather Conditions: Temperature, Humidity, Rainfall Crop Yield Data	Naïve Bayes performed best (99.54% accuracy), followed by Random Forest (99.31%). The system successfully provides accurate crop recommendations based on soil and weather data.	Data Dependency : The model relies on historical soil and weather data, which may not always be up to date. Lack of Real-Time Integration: No real-time IoT sensor data is incorporated for dynamic updates.
15	Intelligent Crop Recommendation using Machine Learnin	Published in 2024 International Conference on Automation and Computation (AUTOCOM), IEEE	The study applies three machine learning algorithms for crop recommendation :	The dataset considers multiple agricultural and environmental parameters, including: Soil Nutrients: Nitrogen (N)	Random Forest provided the highest accuracy (99%), making it the best model for crop recommendation. Decision	Data Dependency: The system relies on historical datasets from Kaggle, which may not reflect current conditions.

			Random Forest (RF) - Best performer (99 % accuracy) Decision Tree (DT) - 98% accuracy Logistic Regression (LR) - 95% accuracy	, Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Level	Tree and Logistic Regression also performed well, but RF was superior in terms of precision.	Limited Crop Variety: Only 11 crops were considered, limiting its adaptability to diverse farming conditions.
16	IoT Based Smart Soil Fertilizer Monitoring and ML Based Crop Recommendation System	Published in 2023 International Conference on Electrical, Computer and Communication Engineering (ECCE), IEEE	The study applies multiple machine learning algorithms for crop recommendation: Linear Regression (LR) Random Forest Regression (RFR) Decision Tree (DT) XGBoost	The dataset considers multiple soil and environmental parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Level	Random Forest Regression achieved the highest accuracy (99.09%), making it the best-performing model. XGBoost also performed well, with 98.63% accuracy.	High Computational Complexity: The XGBoost model requires more processing power than simpler models. Limited Crop Variety: Only 22 crops were considered in the dataset.

17	Optimizing Crop Recommendation System Using Threshold and Decision-Level Fusion"	Published in 2025 International Conference on Multi-Agent Systems for Collaborative Intelligence (ICMSCI), IEEE	The study introduces a Threshold-Based Crop Recommendation System (CRST), which integrates: Rule-Based Decision Fusion Ordinary Least Squares (OLS) Regression	The model considers multiple soil and environmental parameters, including: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall	CRST outperformed Random Forest and Decision Tree, achieving 90% accuracy. Seasonal adaptation improved prediction accuracy, making the system suitable for real- world use.	Complexity in Setting Thresholds: The system requires extensive data analysis to set accurate thresholds. Limited Crop Variety: The model currently focuses on specific seasonal crops.
18	Performance Evaluation of Machine Learning Algorithms for a Cluster-based Crop Recommendation System"	Published in 2023 17th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS), IEEE	The study evaluates several machine learning algorithms for crop recommendation: Random Forest (RF) - Best performer (99.52% accuracy) XGBoost - 99.48% accuracy Decision Tree (DT) - 99.03% accuracy	The dataset consists of 2200 data samples, later augmented to 6000 and 12000 samples, and includes: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Level	Random Forest achieved the highest accuracy (99.52%), making it the best-performing model. XGBoost, LGBM, and Gradient Boosting models showed close results to RF. Increasing	No Real-Time Data: The system relies on historical data from Kaggle, which may not reflect current conditions. Limited Crop Variety: Only 22 crop types were included in the dataset

			K - Nearest Neighbors (KNN) - 98.00% accuracy		dataset size did not significantly affect model accuracy, indicating a stable system.	
19	Random Forest Sampling for Crop Recommendation Based on Ambient Climate and Soil Conditions	Published in 2023 International Conference on Advanced Computing Technologies and Applications (ICACTA), IEEE	The study applies multiple machine learning techniques for crop recommendation: Random Forest (RF) - Best performer K-Nearest Neighbors (KNN) Decision Tree (DT) Linear Regression (for rainfall prediction)	The dataset includes multiple agricultural and environmental parameters, such as: Soil Nutrients: Nitrogen (N), Phosphorus (P), Potassium (K) Weather Conditions: Temperature, Humidity, Rainfall Soil pH Level	Random Forest achieved the highest accuracy, making it the best model for crop recommendations. Linear Regression was used for rainfall prediction, achieving 91 % accuracy.	No Real-Time Data Integration: The system relies on historical datasets, which may not reflect current conditions. Limited Crop Variety: Only 22 crops were included in the dataset.

20	Crop Prediction Using Machine Learning	This paper was published in the Journal of Physics : Conference Series 2161 (2022) 012033, under the conference AICECS 2021.	K-Nearest Neighbor (KNN) Decision Tree Classifier (Entropy and Gini Criterion) Random Forest Classifier (Entropy and Gini Criterion)	Nitrogen (N), Phosphorus (P), and Potassium (K) content in soil Temperature (°C) Relative Humidity (%) pH value of soil Rainfall (mm)	Random Forest Classifier with both Entropy and Gini Criterion provided the highest accuracy of 99.32%. Decision Tree Classifier using Gini Criterion showed 98.86% accuracy, slightly better than Entropy Criterion.	The dataset used was limited, which might not generalize well for all regions. Only a few machine learning algorithms were compared; deep learning models like CNN or ANN were not tested.
21	Soil-Based Crop Recommendation System Using Machine Learning	Published in the 2024 International Conference on Advances in Data Engineering and Intelligent Computing Systems (ADICS)	Decision Trees Random Forest Gradient Boosting (XGBoost or LightGBM)	Soil Parameters: pH level Nitrogen (ppm) Phosphorus (ppm) Potassium (ppm) Soil texture	The proposed Soil-Based Crop Recommendation System (SBCRS) outperformed existing systems. Performance Metrics: Accuracy: 93% (vs. 78% in the existing system) Precision: 89% (vs. 72%) Recall: 93% (vs.81%) F1 Score: 90%.	Relies on accurate soil data collection for effectiveness. Possible bias in historical crop performance data, affecting recommendations

III. PROPOSED SYSTEM

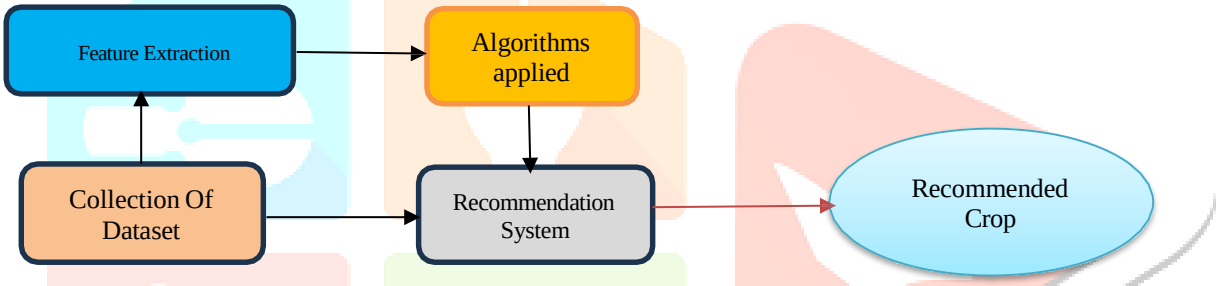
Fig 1: Block Diagram of Overall Methodology of Proposed System

In our framework, we have proposed a procedure that is separated into various stages as appeared in Figure 1. The five phases are as per the following: The five phases are as per the following:

1) Collection of Datasets
2) Pre-processing (Noise Removal)
3) Feature Extraction
4) Applied Machine Learning Algorithm
5) Recommendation System
6) Recommended Crop

Flow of the Proposed System

As demonstrated in the figure, the methodology to extract the sentiment contains the several steps that are described below:



1) Data Collection :

The dataset consists of parameters like Nitrogen (N), Phosphorous (P), Potassium (K), PH value of soil, Humidity, Temperature and Rainfall. The datasets have been obtained from the Kaggle website. The data set has 2200 instance or data that have taken from the past historic data. This dataset include twenty two different crops such as rice, maize, chickpea, kidneybeans, pigeonpeas, mothbeans, mungbean, blackgram, lentil, pomegranate, banana, mango, grapes, watermelon, muskmelon, apple, orange, papaya, coconut, cotton, jute, and coffee.

Dataset - Link: https://www.kaggle.com/datasets/atharvaingle/crop- recommendation-dataset

2) Noise Removal :

For the successful application pre-processing is required. The data which is acquired from different resources are sometime in raw form. It may contain some incomplete, redundant, inconsistent data. Therefore in this step such redundant data should be filtered. Data should be normalized.

3) Feature Extraction :

This step is focus on identifying and using most relevant attribute from the dataset. Through this process irrelevant and redundant information is removed for the application of classifiers.

4) Methodology :

In this proposed system applied different Machine Learning algorithms like Decision Tree, Support Vector Machine (SVM), Random Forest, and K- nearest neighbor (KNN).

A) Decision Tree ;

Decision tree classifiers utilize greedy methodology. It is a supervised learning algorithm where attributes and class labels are represented using a tree. The main purpose of using Decision Tree is to form a training prototype which we can use to foresee class or value of target variables by learning decision rules deduced from previous data (training data). The Decision tree can be described by two distinct types, namely decision nodes and leaves. The leaves are the results or the final end resu lts. Each node in the tree acts as a test case for some attribute, and each edge descending from that node corresponds to one of the possible answers to the test case.

We have applied Decision tree approach in our model as:

i) Importing library DecisionTreeClassifier from sklearn.tree Class.
ii) Now we create DecisionTree Classifier object
iii) In the last we fit our data

B.)Support Vector Machine (SVM) :

Support Vector Machine (SVM) is a supervised machine learning algorithm or model which can be utilized for classification and as well as for regression challenges. However, we mainly use it in classification challenges. SVM is generally represented as training data points in space which is divided into groups by intelligible gap which is as far as possible. In SVM algorithm, each data item is plotted as a point in n-dimensional space with each feature value being the value of a specific coordinate. Then the classification is performed by finding the hyper-plane differentiating the two classes.

C) KNN:

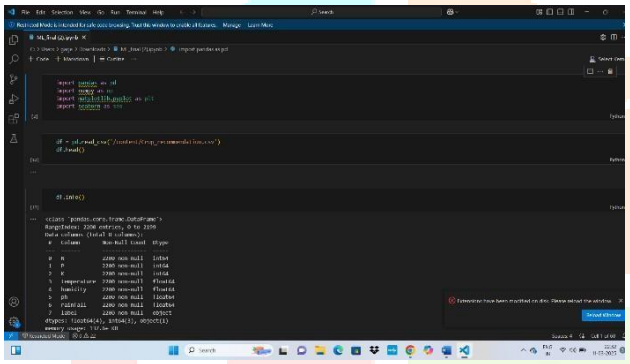
The K-Nearest Neighbors (KNN) algorithm in a crop recommendation system works by analyzing historical agricultural data, such as soil type, rainfall, temperature, and past crop yields.
The system gathers data on soil properties, climate conditions, and crop performance Relevant features like nitrogen, phosphorus, potassium (NPK) levels, pH, temperature, and humidity are chosen. The algorithm checks which crops were successfully grown in the K nearest neighbors and recommends the most frequently occurring crop.

D) Random Forest :

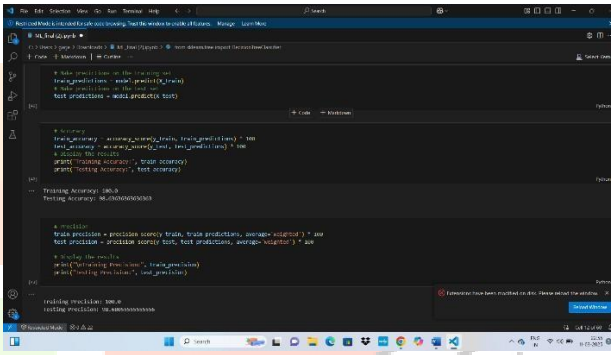
Random Forest, a machine learning algorithm, is widely used in crop recommendation systems due to its accuracy and robustness. 1. he system gathers data on soil properties, weather conditions, crop yield history, and other relevant factors. Important features such as soil pH, temperature, rainfall, and nutrient levels are selected. 3. Multiple decision trees are created using different subsets of the data. Each tree makes an independent prediction. The final crop recommendation is determined by aggregating the predictions from all trees, selecting the most frequently suggested crop.

IV. RESULT AND ANALYSIS

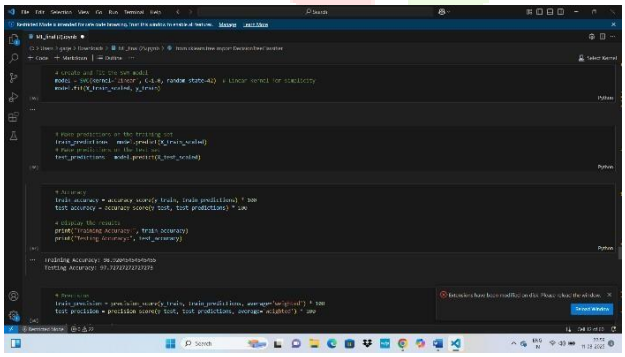
Dataset –



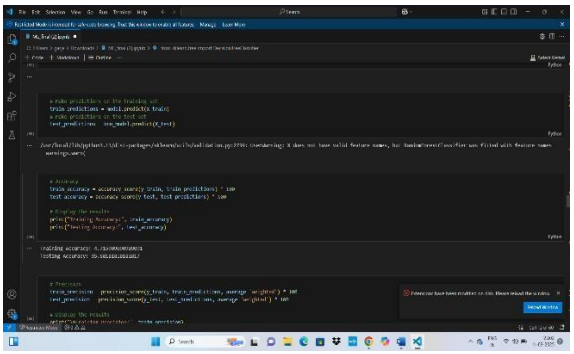
Decision Tree –



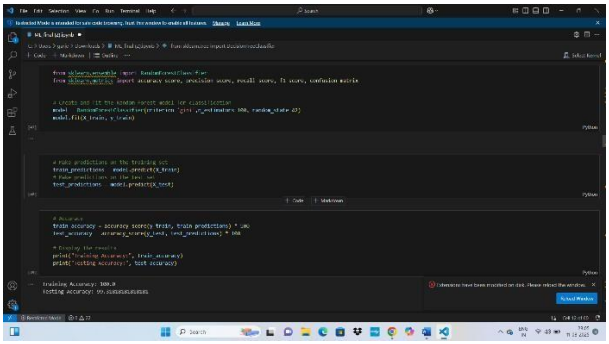
Support Vector Machine (SVM) –



KNN –



Random Forest –



Algorithms	Accuracy	Recall	Precision	F1-score
Decision Tree	98.63636363636363	98.63636363636363	98.68055555555556	98.63152866630287
SVM	97.72727272727273	97.72727272727273	97.87326467724195	97.70616589588195
KNN	95.68181818181817	95.68181818181817	96.28976143584399	95.67492608232794
Random Forest	99.31818181818181	99.31818181818181	99.37348484848485	99.31754816901672

V. CONCLUSION

We have developed and applied a smart system that can suggest suitable crops for farmers across India. This system would help the farmers choose the best crop based on factors like Nitrogen, Phosphorous, Potassium, PH Value, Humidity, Temperature, and Rainfall. By using this research we can increase productivity of the country and produce profit out of such a technique. This research can enhance the country's productivity and profitability by using this technique. This way, farmers can grow the right crop and increase their income and the country's overall earnings. We have evaluated machine learning algorithms and discovered that Decision Tree and Random had the best accuracy among them.

VI. FUTURE WORK

The system can be enhanced further to add following functionality:

- The main future work's aim is to improved dataset with larger number of attributes.
- We need to build a model, which can classify between healthy and diseased crop leaves and also if the crop has any disease, predict which disease is it.
- To build website and mobile app for easy to use.

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