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LEARNINGFOR IMPROVED CROP MANAGEMENT, PRICE PREDICTIONANDEFFICIENT RESOURCE UTLIZATION

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***Abstract*:** The agricultural industry is the most important pillar of our country's economy. In recent decades, the price of grain has changed significantly due to climate change and changes in relative prices. Farmers have neglected these investments and suffer from poor harvests and huge losses. They do not know which plant species will bring them the most profit. Plants suffer from a lack of information about the condition of the plants and their special processing. It gives accurate results when calculating processing costs. The system uses a machine-assisted decision tree analysis algorithm to calculate processing costs. The characteristics considered in the analysis are discounts, a list of non-commercial costs, month and time. As a result, the system provides fetal antibodies to farmers, optimizing crop yields and improving the economics of the agricultural industry. The system also includes modules for drip monitoring, planting suggestions, fertilizer recommendations, storage, security and monitoring capabilities.

***Keywords*:** *Agriculture, Food security, Machine learning, Crop Price, Crop Management.*

INTRODUCTION

India is a rural country and hence its economy is heavily dependent on agricultural yields and uniform agricultural development. Currently, there is a rapid development towards specialization. India is currently undergoing rapid technological development. Smart agriculture is changing the face of agriculture in India. Technology can provide solutions to most of the challenges faced by farmers. It can predict the weather more accurately, reduce waste, increase production, and increase profit margins. As it stands, farmers and consumers in the real world find it difficult to determine the exact price of their crops without knowing the fluctuating price trends and weather conditions in advance. Hence, innovations will ultimately benefit agriculture. The objective of this paper is to predict crop prices in advance. The work is based on finding an appropriate regional dataset that will help achieve high accuracy and better performance. Our system, Agro-Genius, uses machine learning to create price prediction models. In recent years,

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agricultural crop prices have been highly volatile. As a result, crop failure rates have been increasing year by year. The main purpose of this forecasting system is to help farmers get a better idea of their yields and manage value risk. The weather has also been very unstable recently. This also affects the crop yield. The proposed system will also predict the weather and help farmers take the right decisions regarding tillage, harvesting etc. Fertilizer also plays an important role. Fertilizer provides the soil with the necessary nutrients which plants extract from the soil. Without the use of fertilizers crop yield and production will decrease significantly. For this reason, fertilizers are used to enrich the nutrient reserves of the soil with minerals that can be readily absorbed and utilized by the plants. Our system displays the fertilizer consumption of various crops and provides a portal where users can purchase fertilizers and seeds from their current location. The exact location can also be obtained along with the address of the fertilizer and seed stores. The fertilizer provided provides additional benefits to the farmers from the crops suggested by the farming system. It also displays the best crops based on the cultivation date, cultivation month and location details to maximize the yield. We provide multilingual and region-specific guides for farmers. Farmers who are new to this field and want to get information from their ancestors but want to document the same methods will benefit greatly from this. We also provide maps to farmers so they can expand their knowledge. Our system provides two different types of maps so farmers can know how the land is managed and where they should start farming. The irrigation map shows the irrigated and non-irrigated areas of the country. The farmland map provides an overview of the farmland available in different states of India and helps farmers analyze the non-farm land that can be further improved. This map makes it easy for farmers to understand that by simply hovering over the state they want to farm in, they will get information about that state and can decide to change their location or start farming. This is perfect for farmers who are new to this field, as the most important thing in farming is to first select the land and location where they will farm. Moving in the same direction, our system will have an integrated chat application that will help in exchanging information. Often farmers have certain questions that they are unable to answer due to their limited knowledge. So, we are building a platform where they can exchange information. Language can be a barrier for users. As Hindi is the first language of the majority of non-English speaking farmers in India, we expect that these resources, once developed, can be translated into other languages. Hence, to make the website user-friendly, we provide language translation. Farmers need to know their location and the growing date of their crops. Our system is a web application developed based on machine learning concepts. The proposed system applies machine learning and predictive algorithms such as Naïve Bayer, Decision Tree, and K-Nearest Neighbor to identify the most accurate model and process it. This also helps in predicting the crop price.

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RELATED WORK

Our system integrated the latest technologies to create a comprehensive solution aimed at improving agricultural decision-making and encouraging collaboration among farmers. Python served as the central programming language for all modules, ensuring seamless development and functionality. The application was hosted using Flask, a lightweight web framework that provides an easy-to-deploy platform with a user-friendly interface. A key feature of the system was a chat application developed using socket programming that enabled real-time communication among farmers. The tool promoted knowledge sharing and problem solving, thereby strengthening the sense of community. For data visualization, Chart.js was integrated to display important agricultural data such as weather patterns and crop distribution. JavaScript was used throughout the system for validation to ensure accurate data entry and avoid errors. To further improve functionality, external APIs were used to identify weather forecasts and the location of nearby fertilizer storage facilities. These APIs provided timely information to help farmers plan activities such as planting and irrigation, and provided access to critical resources. We also developed a crop recommendation model using machine learning and linear regression based on a custom dataset to help farmers select the best crops for their regions. Additionally, a fertilizer recommendation system analyzed the data and suggested the most effective fertilizers to treat diseases affecting the crops.To ensure accessibility, making the system easy to use for farmers from different linguistic backgrounds

S.NO	YEAR	TITLE	AUTHORS	Journal/Conference Name	Proposed Methods	Findings/Results (Precision, Recall, Accuracy, F1-score)
1	APR 2019	Crop Price Forecasting System Using Supervised Machine Learning Algorithms	Rachana, Rashmi, Shravani, Shruthi, Seema Kousar	International Research Journal of Engineering and Technology (IRJET)	Supervised Machine Learning algorithms	Predicted crop prices based on historical data using ML algorithms

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2	JUN 2019	Prediction of Crop Yield Using Data Mining	Nishiba Kabeer, Dr. Loganathan. D, Cowsalya. T	international Journal of Computer Science and Network	Data Mining techniques (average rainfall, area of field)	Predicted crop yield based on rainfall and field area
3	JUL 2019	Agriculture TalkBot Using AI	J. Vijayalakshmi, K. PandiMeena	International Journal of Recent Technology and Engineering (IJRTE)	AI-based TalkBot	Real-time communication for agricultural knowledge sharing
4	OCT 2019	Agro-Genius: Crop Prediction Using Machine Learning	Gamage, A., Kasthurirathna, D.	International Journal of Innovative Science and Research Technology	Machine Learning algorithms	Predicts crops based on region using ML
5	2019	Decision Making Support System for Prediction of Prices in Agricultural Commodity	Vohra Aman, Nitin Pandey, S. K. Khatri	Amity International Conference on Artificial Intelligence (	Support Vector Regression (SVR), ARIMA	Predicted prices of agricultural commodities

PROBLEM STATEMENT

Agriculture forms the backbone of many developing countries and ensures the livelihood of a significant portion of the population. However, one of the biggest challenges farmers face is the unpredictability of crop prices, which are affected by a variety of factors, including changing demand, unpredictable weather conditions, and fluctuating market trends. This uncertainty makes it difficult for farmers to make informed decisions about which crops to grow and when to sell their products. As a result, farmers are often vulnerable to economic instability and risk financial losses and missing out on potential profits due to poor timing and inappropriate crop choices. Without accurate insight into market trends, farmers may over- or under-produce certain crops, leading to an imbalance between demand and supply. For example, overproduction can result in a surplus and lead to falling prices, while underproduction can result in missed opportunities due

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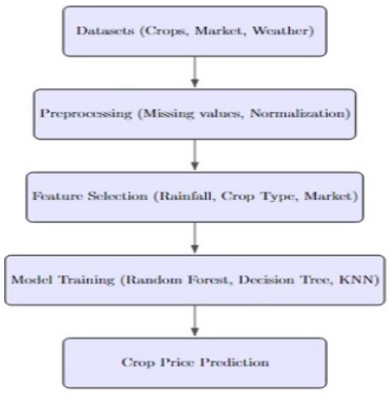
to unmet demand. Additionally, unpredictable weather patterns, especially erratic rainfall, significantly impact crop yields, further complicating farmers' decision-making process. This adds further complexity to an already uncertain environment as farmers struggle to balance agricultural production with market conditions. A lack of reliable forecasting tools exacerbates this issue, making farmers even more vulnerable to price fluctuations and market volatility. Many farmers lack access to advanced technologies that can provide real-time, data-driven insights into crop price trends, weather forecasts, and market demand. This threatens farm sustainability and limits their ability to maximize profits or avoid economic losses. To overcome these challenges, there is an urgent need for systems that can accurately forecast crop prices and provide actionable insights to farmers. Such systems would enable farmers to make better financial decisions, improve productivity, and promote sustainable agricultural practices that can withstand market fluctuations and environmental changes.

ARCHITECTURE



PROPOSED MODEL

The predictive modeling of crop prices is undertaken through Random Forest, Decision Tree, and KNN algorithms, relying on data pertaining to crops, historical prices, and rainfall conditions- notably downfall. Thepre-processed data addresses missing values, normalization, and essential features selection similar to downfall conditions and request conditions. The model learns the real training data supported by cross-validation to testify its delicacy. Once training is done, the model predicts crop prices based on the user's input, such as the type of crop and the condition of rainfall.

ALGORITHM:

Random Forest Algorithm:

The Random Forest is a method of machine learning that consists of an ensemble technique allowing for the production of multiple decision trees from randomly selected subsets of data and averaging their predictions, thus reducing the risk of overfitting. It can easily handle vast datasets with numerous variables with highly complex nonlinear relationships, like rainfall and market conditions, and potentially be very accurate and robust

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over the range of environmental and market scenarios. This would make it ideal to be used in crop price forecasting.

Decision Tree Algorithm:

Decision Trees are highly interpretable, straightforward models that progressively segment data into different classes based on features such as rainfall or crop type for the purpose of outcome prediction. The algorithm selects the features for splitting the data using either maximum gain of information or minimization of impurity, with prediction being performed by traversing from root to leaf nodes. They are computationally efficient with large data sets and are extremely useful as price predictors since they can accommodate many variables that affect crop prices.

K-Nearest Neighbors (KNN)

K-Nearest Neighbors (KNN) is a non-parametric clustering algorithm that achieves crop price prediction by constructing an average price along a theoretical line between the features of the nearest "k" datasets based on weather, market prices, and crop type. KNN compares current crop conditions against historical data to predict the price by averaging those of similar crops having been harvested from similar conditions. This simple algorithm displays good performance in small to medium-scale datasets and has been used in price prediction due to its background-based methodology.

RESULTS:

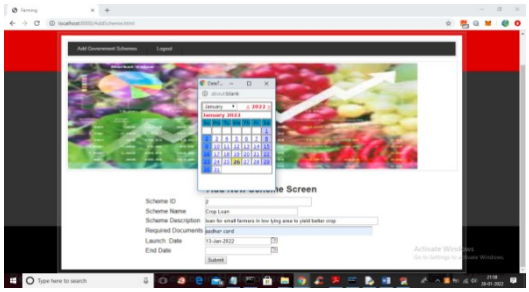

Fig:1-Submit Button

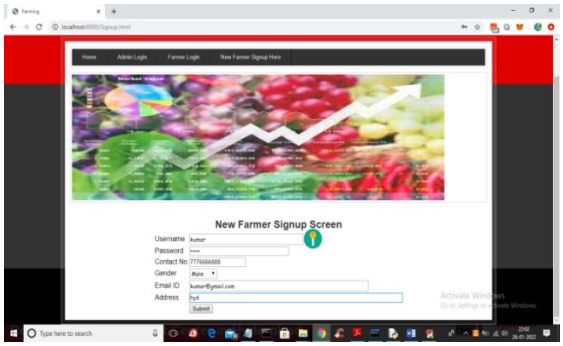

Fig:2-Signup Process for new farmer

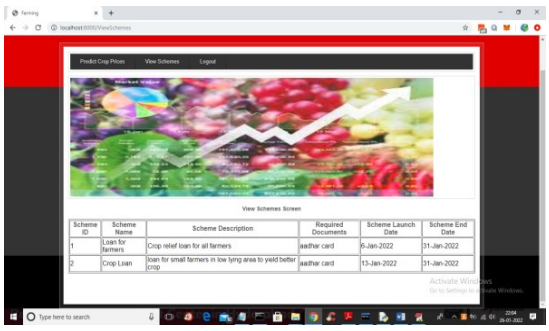

Fig:3-Predict Crop Prices' link

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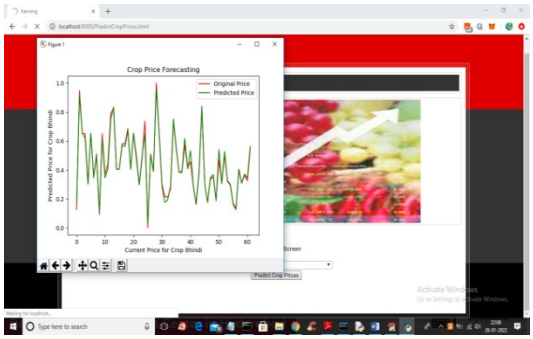

Fig:4- View Predicted Values

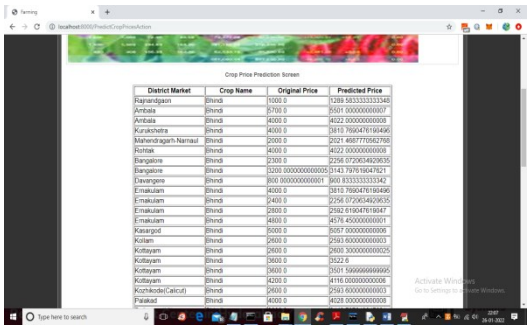

Fig:5-Predicted Accuracy

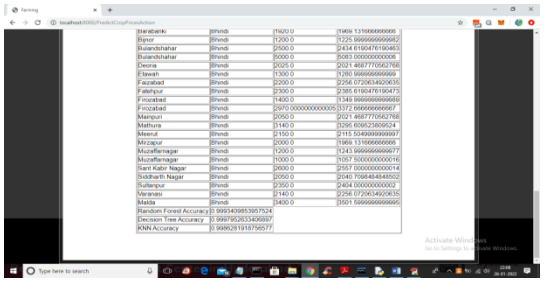

Fig:6- Crop And Get Prediction Prices

CONCLUSION

This project is carried out using machine learning to evaluate the performance using ANN, Naive Bayes, and decision tree algorithms. In our proposed model, decision tree provides better yield predictions among all three algorithms than the others. This system guarantees the most extreme yields, so farmers can learn more about yields that they could never achieve otherwise. This study demonstrated the promising use of machine learning techniques in predicting crop costs depending on specific attributes. The created web application is easy to understand and has a test accuracy of over 90%.

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