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Crop Prediction and Fertilizer Recommendation Using Regression Algorithms

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Abstract: ***India, a nation with a strong agricultural backbone, relies heavily on the forecast for crop production and agro-industrial products for its economy. The domain of data mining is gaining traction as a valuable tool in the analysis of crop yields. Predicting yields is a crucial aspect of agriculture, as it allows farmers to anticipate their potential harvest. This involves the examination of various relatedfactors such as the pH level, which indicates soil alkalinity. Other important elements include the percentages of essential nutrients like Nitrogen (N), Phosphorus (P), and Potassium (K), as well as the temperature, rainfall, and humidity levels in the region. These data attributes are examined and used to train a range of appropriate machine learning algorithms to create a predictive model. This system aims to provide accurate crop yield predictions and offer users specific recommendations on the type of fertilizer required. The predictions are considering the atmospheric and soil parameters of the territory, with the goal of enhancing crop yield and thereby increasing the farmer's revenue.***
Keywords: Crop yield prediction, Fertilizer recommendation, Machine learning

I. INTRODUCTION

Among the major occupations in India is farming. It's the most expansive economic sector and is essential to the nation's overall progress. It's critical to adopt modern agricultural technologies. Previous crop and yield forecasts were made using farmers' prior experience as a basis. Farmers lack sufficient understanding of the nutrients found in soil, such as potassium, phosphate, and nitrogen. The system's architecture will suggest the best crop for a certain plot of land, the kind of fertilizer to apply, and the anticipated crop output depending on variables like pH value, temperature, humidity, rainfall and the amounts of nitrogen, potassium, and phosphorus in the soil. Farmers provide the necessary input to the system. System makes use of random forest regressors, logistic regression, and support vector regressor to find patterns in the information and then handle it according to the parameters provided. There are additional requirements for the system like providing the weather report and displaying history of predictions done by the user.

II. RELATED WORK

Shivnath Ghosh [1] outline an artificial intelligence system comprising three steps: sampling, utilizing different soil properties with varying parameters; implementing the Back Propagation Algorithm; and updating weights.

P.Vinciya [2] focus on the analysis of organic and inorganic farming, plant cultivation timelines statistics on profits and losses furthermore real estate properties in a certain location. Theirgoal is to produce data models for yield prediction that are very accurate and consensus-driven.

Zhihao Hong [3] propose a data-driven approach to constructing Precision Agriculture (PA) solutions for data collection and modeling systems. They develop a responsive remote sensor node for capturing soil moisture dynamics and build a unique, site-specific predictive method for soil moisture based on AI method such as Support Vector Machine and Relevance Vector Machine.

Sabri Arik [4] propose a method for forecasting soil sample functional characteristics based on quantifiable spectral and spatial variables. The method uses the Extreme Learning Machine (ELM), an advancement of single hidden- layer feed-forward network learning techniques, along with a filter for pre-processing Methodsand experimental details.

Vanees beer Singh [5] use a variety of Machine Learning methodsto forecast crop production categories based on macro- nutrients and micro-nutrients status within the dataset obtained from Jammu. The analysis involves parameters like Macro-Nutrients (ph., Oc, Ec, N, P, K, S) and Micro Nutrients (Zn, Fe, Mn, Cu) collected from different regions of Jammu District.

E. Manjula [6] investigate soil nutrients, specifically Iron, nitrogen, sulphur, calcium, magnesium, phosphorus, and potassium employing Decision Trees, Naïve Bayes, and a combination of the two. Based on regarding precision and execution time, the classification algorithms' performances are compared.

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Rohit Kumar Rajak [7] present a methodology that makes use of a soil database, crop data from agriculture specialists, and soil properties from a dataset from a testing lab. Their recommendation system achieves great accuracy and efficiency inproposing crops for particular site attributes by utilizing an ensemble model with majority vote that employs ANNs, orartificial neural networks and Support Vector Machine as learners.

III. METHODS AND EXPERIMENTAL DETAILS

Initially, comprehensive datasets encompassing historical crop yields, soil properties, weather conditions, and fertilizer applications are collected and preprocessed to handle missing values, outliers, and categorical variables. System is trainedand tested on the preprocessed data sets using algorithms like support vector regressor, logistic regressor, random forest regressor.

A. Crop Yield Prediction

The expected crop yield is for the input data is predicted usingthe logistic regressor algorithm. And best suitable crop for thatland in view of best yield is predicted using Regressor SupportVector Algorithm

B. Fertilizer Recommendation

The type of fertilizer to be applied for the respective land considering the input data is recommended using the Random Forest Regressor algorithm.

C. Web Application

The system prioritizes seamless user interaction by enabling user registration through OTP verification with registered Email and input of essential details. Through API integration, users gain access to external functionalities like real-time weather updates. This comprehensive approach enhances user engagement, provides valuable information, and facilitates both secure interactions within the system. The server and MongoDB from backend works effectively ensuring response to the frontend without any delay. History of predictions done by the user is displayed in profile page to get rid of the need of multiple predictions on the same data.

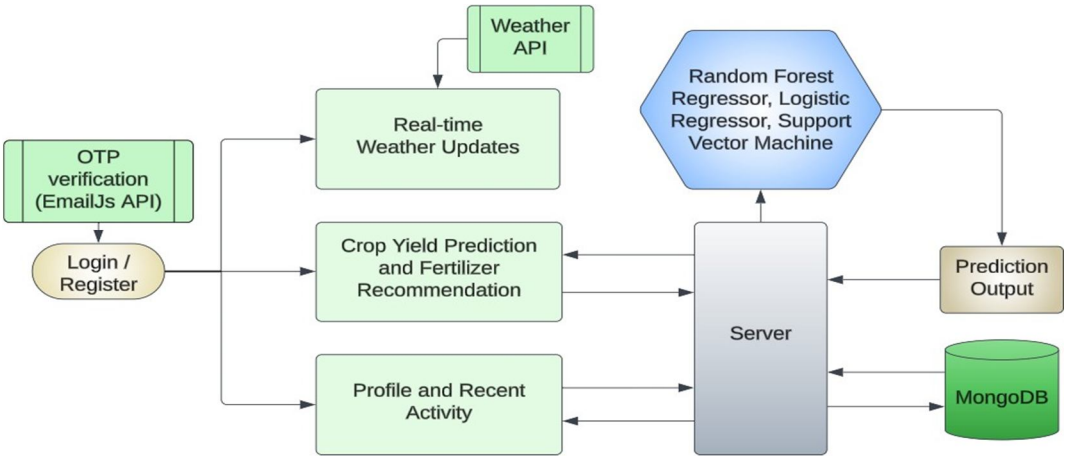


Fig.1 Flow Chart of the system

IV. RESULT AND DISCUSSIONS

This project's experimentation phase has yielded commendable results, attaining an impressive accuracy level of 92% in both forecasting crop yields and using fertilizers. The web application showcases effective user engagement, seamlessly integrating various features to deliver a user-friendly experience. The server and MongoDB from backend works effectively ensuring response to the frontend without any delay. Showing the history of prediction done through the user in profile page is beneficial for eliminate the need of multiple predictions on the same data. And the additional feature of weather forecast is works seamlessly in rendering the current meteorological information from weather API, OTP verification adds an additional security measure that ensures maintaining the authenticity of user accounts on our application. These positive outcomes are in alignment with the project's objectives, emphasizing the delivery of valuable insights for farmers to make informed decisions in their agricultural practices. As we continue to work on refining and expanding the system, these achievements underscore the potential impact of the project in revolutionizing and optimizing agricultural decision-making processes.

Interfaces

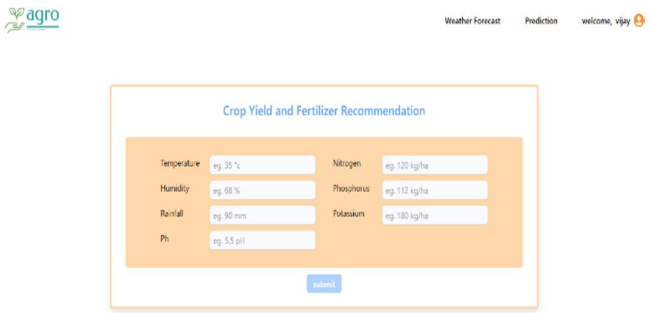


Fig.2 Prediction Page

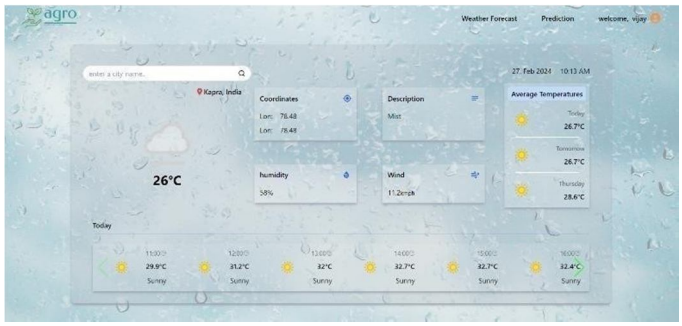


Fig.3 Weather Updates Page



Fig.4 Prediction Results Page



Fig.5 Profile Page

V. CONCLUSION

In conclusion, our proposed system marks a significant leap in precision agriculture through the seamless integration ofadvanced machine learning. By employing the Regression algorithms, the system delivers highly accurate crop yield, suitable crop predictions and fertilizer recommendations.

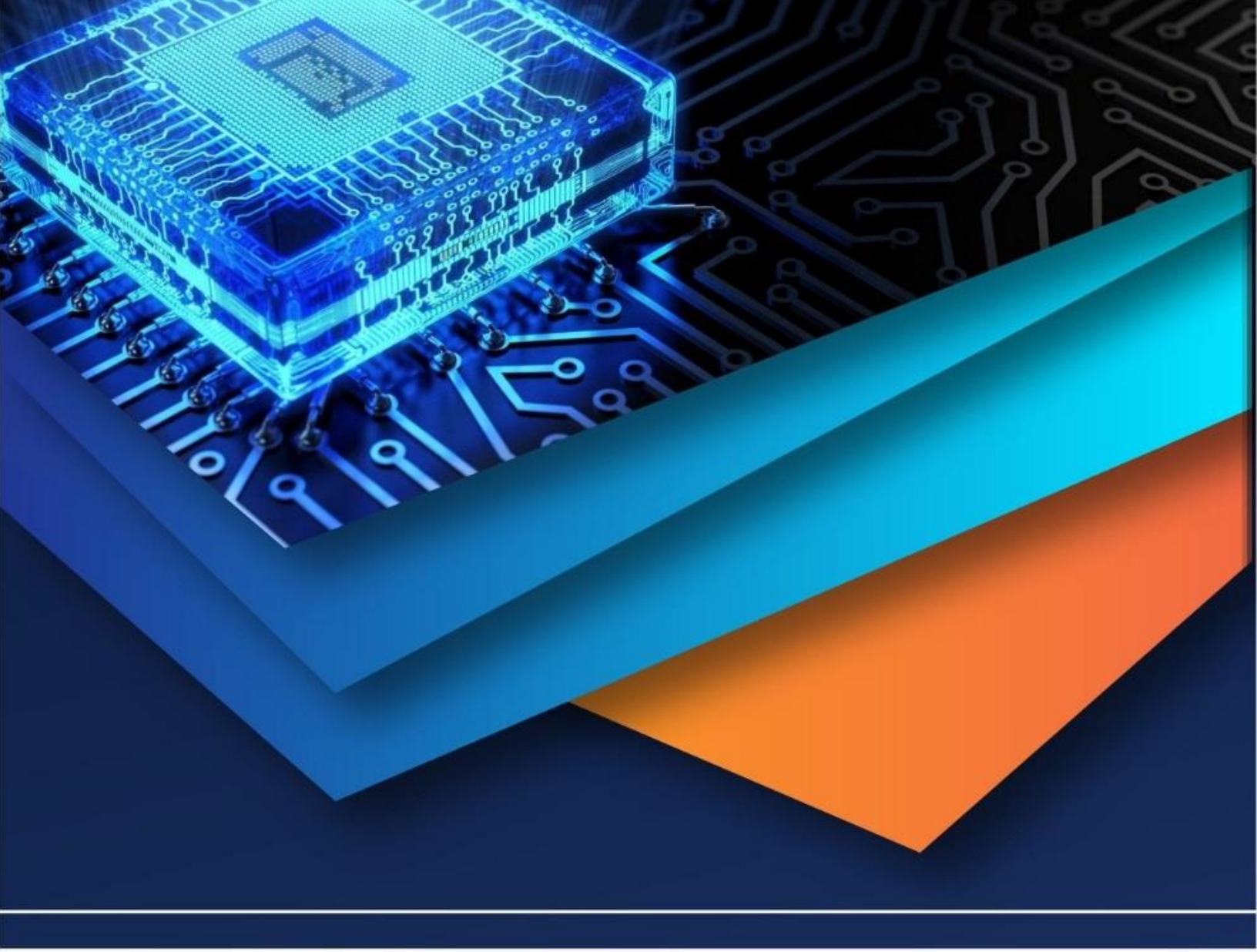
The user-friendly web interface streamlines the registration process with OTP verification and prediction process based on user input, ensuring farmers receive tailored suggestions effortlessly. The incorporation of features like real-time weather updates, user activity enhancing the overall user experience. With an impressive 92% total accuracy for crop yield prediction and 100% for fertilizer recommendation, this system stands poised torevolutionize agricultural methods, offering farmers priceless information for informed decision-making.

VI. ACKNOWLEDGMENT

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