A FRAMEWORK FOR PREDICTING THE CROP YIELD IN ACCORDANCE WITH SOIL PARAMETERS

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Abstract

In India, agriculture is both a common and low-paying profession. By changing the revenue scenario by cultivating the best crop, machine learning can lead to a boom in the agricultural sector. This study combines a variety of machine learning approaches to forecast the crop's output. Based on mean absolute error, these methodologies' results are contrasted. By taking into account the image of the soil the forecast provided by machine learning algorithms would assist farmers in choosing which crop to grow to receive the maximum yield.

Keywords: optimum, information, Machine learning, detect, yield

I. INTRODUCTION

Precision agriculture emerged as a consequence of technical progress during the 20th century. Currently, precision farming is commonly linked with the utilization of GIS, unmanned aircraft, drones, variable rate of application, GPS and satellite navigation, along with advanced and intricate computer systems and software. However, the main question pertains to the feasibility, efficiency, and likelihood of these technologies being embraced. The study aims to analyze the prevailing precision farming theories and assess the technical and economical feasibility of different technologies through a literature review. The results indicate a significant relationship between the farmer's perspective and requirement for institutional support and the use of precision farming technologies. In order to address the numerous economic and environmental challenges and achieve sustainable development and environmentally-friendly growth, it is imperative for the Common Agricultural Policy to actively encourage precision farming.

The phrase "precision farming" has been widely used in agricultural science and practice for an extended period of time. Ever since the inaugural precision farming workshop held in Minneapolis in 1992, following conferences have consistently centered around this topic. Australia has been the site of a precision agriculture conference since 1997. In 1997, the US Congress formally acknowledged and accepted the concept and definition of precision farming within the country. To fully understand the evolution of precision agriculture, it is crucial to consider some fundamental characteristics. During the era of small-scale family farms, farmers were able to observe the regional variations in soil composition and how it affected crop yields. Consequently, they controlled the crop production in response to the fluctuations. Consequently, the implementation of mechanization in agriculture enabled the efficient management of crops across large areas while maintaining uniform input utilization. A farmer possesses a lesser amount of agronomic expertise compared to 10 farmers who previously cultivated the same area but now engage in farming larger regions with consistent management practices. The progress of the Global Positioning System (GPS) enabled the cessation of the process. In order to advance precision agriculture, it is essential to combine GPS technology with specialized equipment capable of measuring the variability and application of inputs such as fertilizers and pesticides. By employing appropriate agricultural techniques such as crop rotation, utilizing certain crop types, carefully monitoring crops, and adjusting chemical and fertilizer inputs, farmers can obtain optimal yields, minimize resource usage, and maximize profitability. It is also important to consider the variations in circumstances both within and between fields.

II. PROBLEMDEFINITION

The main challenge confronting the Indian Agriculture sector is the successful incorporation of technology to achieve the desired outcomes. The introduction of new technology and excessive utilization of non-renewable energy sources have disrupted patterns of rainfall and temperature. The erratic fluctuations resulting from the adverse impacts of global warming pose a significant challenge for farmers in accurately forecasting temperature and rainfall patterns, thereby impacting their agricultural production productivity. To achieve precise forecasting and address inconsistent fluctuations in temperature and rainfall, one can employ various machine learning algorithms such as RNN, LSTM, etc., to identify patterns. It would enhance the agricultural growth in India and collectively improve the quality of life for farmers. In the past, numerous researchers have utilized machine learning approaches to augment agricultural productivity in the country.

III. OBJECTIVES

- To focus on predicting the yield of the crop by applying various machine learning techniques.

- To compare the techniques on the basis of mean absolute error.
- To make prediction made by machine learning algorithms will help the farmers to decide which crop to grow.
- To get the maximum yield by considering soil image.

IV. LITERATURE SURVEY

Sree et. al. [1] states that agriculture is the primary source of cultivation. Crop productivity is a significant contributor to the Indian economy. It is crucial to disseminate accurate and valuable information regarding new technologies in order to enhance the rate of crop output, which is of utmost importance in the field of agriculture. Crop selection is a crucial aspect in agricultural planning. The selection of crops is influenced by various factors, including market price, production rate, and government policies. The Indian economy can be enhanced by the implementation of several reforms in the agricultural sector. Machine learning techniques can be utilized to enhance agriculture in the farming sector. The objective of this article is to apply a crop selection strategy and explore specific applications of machine learning techniques to optimize crop productivity and enhance the Indian Economy. The primary concern in the agriculture industry is to forecast crop production. The primary goal of agricultural planning is to optimize crop yield rate while working within resource constraints. Several machine learning methods can enhance crop yield generation. When faced with unfavorable conditions that result in loss, we can mitigate the losses by employing the crop selection approach. Additionally, it can be advantageous in enhancing the crop yield rate under favorable circumstances, thereby contributing to the improvement of India's economy. We possess some factors that impact the rate of agricultural yield. The two factors are seed quality and crop selection. Prior to sowing, it is imperative to do a quality assessment of the seeds. The choice of crops is influenced by favorable and unfavorable conditions, which can be enhanced by the application of hybridization techniques. Utilizing machine learning techniques can enhance agricultural yield. The geographical features of the region, such as rivers, hilly terrain, and fertile soil, contribute to the productivity of crop cultivation. Weather factors such as humidity, precipitation, temperature, and cloud cover play a beneficial role on crop productivity. Various forecasts can be generated by employing diverse methodologies for distinct crops.

Mishra et. al. [2] conducted a study to reevaluate the research conducted on the applicability of machine learning techniques in the field of agricultural crop production. Methodology/Statistical Analysis: This method is a novel strategy for the implementation of agricultural crop management. Precise and timely predictions of crop output for significant policy determinations such as import export, pricing, marketing, and distribution, which areprovided by the directorate of economics and statistics. However, it is important to note that these previous estimations are not the definitive figures, as they rely on extensive descriptive evaluation of several qualitative aspects. Therefore, it is necessary to create a statistically reliable and unbiased method for predicting crop yield. According to **Manjula et. al** [3] states that data mining is a growing area of research in the analysis of crop output. Yield prediction is a crucial concern in agriculture. Every farmer is interested in determining the anticipated yield of their crops. Previously, yield prediction was conducted based on the farmer's expertise regarding specific fields and crops. The accurate estimation of crop yield is a significant challenge that has yet to be resolved with the currently accessible data. Data mining techniques are the optimal choice for this purpose. Agricultural data mining employs many ways to assess and forecast agricultural productivity for upcoming years. This study presents and deploys a method to forecast agricultural output based on historical data. The application of association rule mining on agriculture data allows for the achievement of this goal. This study aims to develop a predictive model that may be utilized for forecasting future crop yields. This study provides a concise examination of crop yield forecast in the district of Tamil Nadu, India, using a data mining technique based on association rules. The experimental results demonstrate that the suggested method effectively forecasts agricultural yield production.

Dahikar et. al. examined different scenarios of climatological processes impacting regional weather patterns throughout diverse regions of the globe. The meteorological conditions directly impact the crop output. Multiple studies have been conducted to investigate the correlations between large-scale climatological occurrences and crop productivity. Artificial neural networks have proven to be potent instruments for modeling and prediction, hence enhancing their efficacy. The crop prediction system utilizes soil and atmospheric parameters to accurately anticipate the most suited crop. The parameters to consider include soil type, pH level, levels of nitrogen, phosphate, potassium, organic carbon, calcium, magnesium, sulphur, manganese, copper, and iron, as well as factors such as depth, temperature, rainfall, and humidity. We utilize artificial neural networks (ANN) for this purpose. Gonzalez et al. highlight the crucial need for precise yield estimation of many crops in agricultural planning. Machine learning (ML) is a crucial method for attaining practical and efficient solutions to this challenge. Several evaluations of machine learning approaches for yield prediction have been conducted in order to identify the most precise strategy. Typically, the quantity of assessed crops and processes is insufficient and fails to offer adequate information for agricultural planning objectives. This study examines the predictive precision of machine learning (ML) and linear regression methods in forecasting crop yield across ten different crop datasets.

V. USE CASE DIAGRAM

A use case diagram in the Unified Modelling Language (UML) is a type of behavioral diagram that is derived from and defined by a use-case study. The purpose of this is to present a visual representation of a system's functioning, including actors, their aims (represented as use cases), and any interdependencies between these use cases. The fundamental purpose of a use case diagram is to determine the specific system functions that are performed for each actor involved. The roles of the system's actors can be used to depict them.

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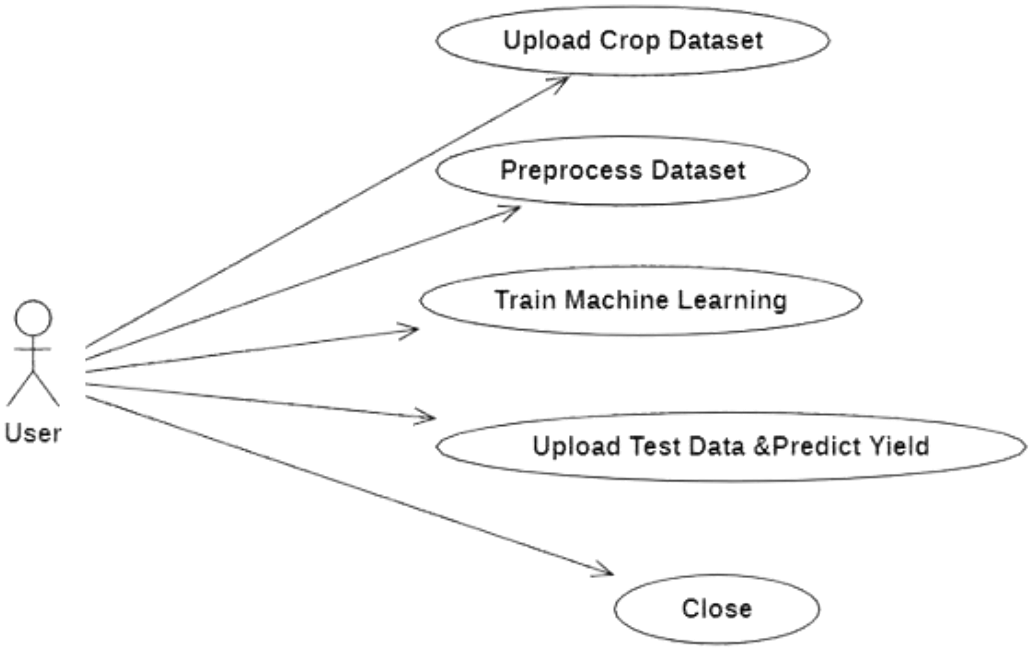

Fig. 1. Use case diagram

VI. ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows that incorporate decision-making, repetition, and simultaneous execution through the use of activities and actions. Activity diagrams are a useful tool in the Unified Modeling Language for illustrating the operational and business operations of system components. An activity diagram illustrates the complete sequence of control flow.

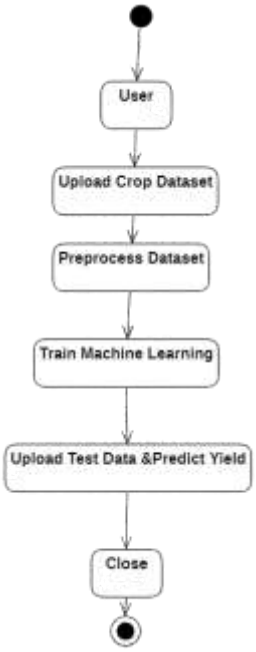

Fig. 2 Activity Diagram

VII. MODULES

The dataset including crop production information is inputtedinto classification and regression algorithms to forecast thecrop's name and yield. Perform dataset preprocessing.

Experiments were performed on a dataset from the Indian government, and it has been determined that the Random Forest Repressor achieves the maximum level of accuracy in predicting yield. The Simple Recurrent Neural Network, when used as a sequential model, demonstrates superior

performance in predicting rainfall. On the other hand, LSTM models are more effective in predicting temperature. Yield projection for a specific district can be generated by considering factors such as rainfall, temperature, season, and area.

Train the machine learning model. This study aims to estimate agricultural yield at the district level based on the specific crop grown in each district. Predictions are being made for the yield of specific crops in different districts, as well as identifying the crops with the highest yield.

The results indicate that Decision tree is the most effective classifier when all parameters are combined. This will not only assist farmers in selecting the appropriate crop to cultivate in the upcoming season, but also serve to connect technology with the agricultural industry.

VIII. FLOWCHART

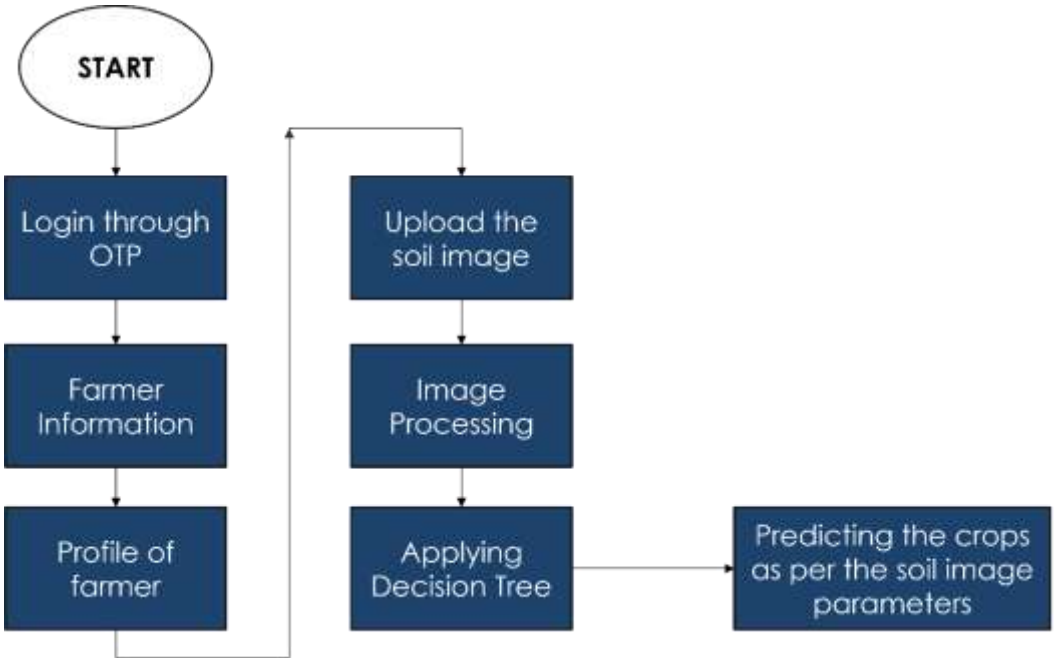

Fig. 3 Flowchart of the system

IX. RESULT

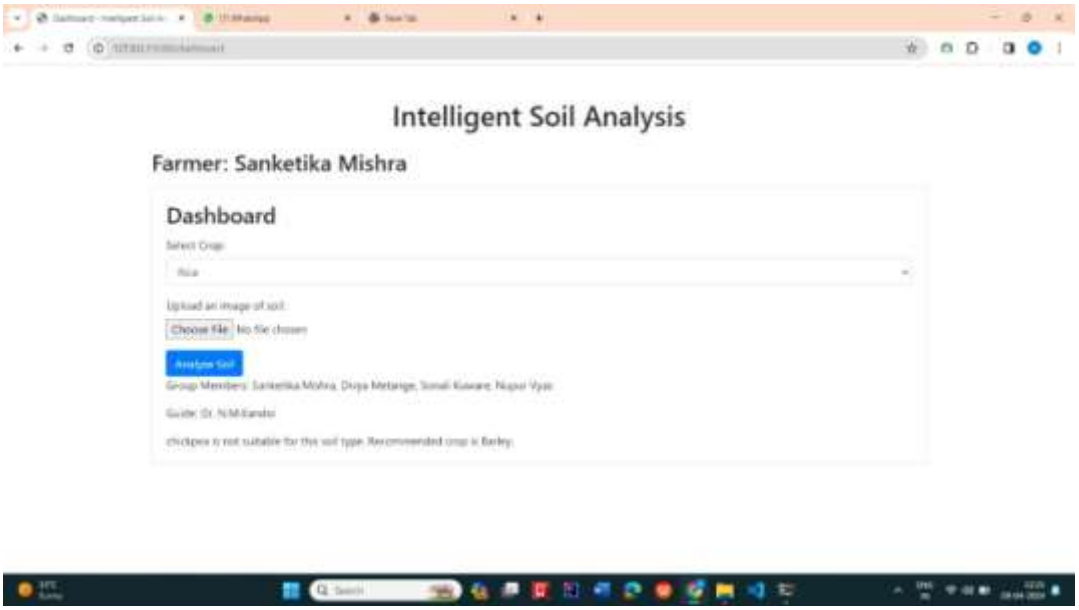

Fig. 4Crop predicted Barley depending upon soil image

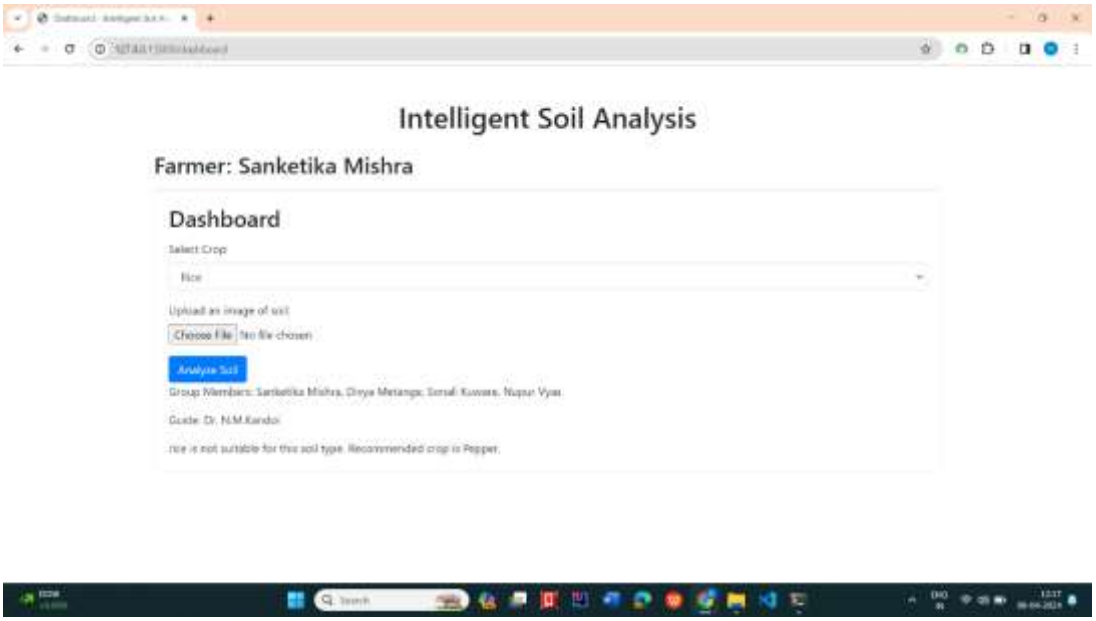

Fig. 5 Crop predicted pepper depending upon soil image

IX. CONCLUSION

A. Conclusion:

The system explored various machine learning techniques for predicting agricultural productivity using soil imagery. Research utilizing data from the Indian government has demonstrated that the Random Forest Regressor has the highest level of accuracy in predicting crop yields. The Simple Recurrent Neural Network, which is a sequential model, outperforms the LSTM model in predicting rainfall, whereas the LSTM model is less effective in predicting temperature. Predicting the crop output for a certain region can be achieved by taking into account variables such as precipitation, temperature, as well as other factors including the time of year and the size of the area. After considering all parameters, the findings indicate that Random Forest is the most optimal classifier. This will not only aid farmers in choosing the optimal crop to plant in the future season, but it will also bridge the technical divide between the agriculture industry and the general people.

B. Future Scope

There are various approaches to utilize connectivity in order to improve crop monitoring and care. Integrating meteorological data with irrigation, fertilizer, and other systems can enhance resource utilization and boost crop yields by accurately identifying and predicting deficiencies. Soil condition sensors can use LPWAN to communicate with sprinkler controllers and adjust the amount of water and nutrients applied. To assist farmers in making more informed and timely decisions, sensors can transmit imagery from remote sections of fields, providing early indicators of problems such as disease or pests.Smart monitoring can help farmers optimize the harvesting time. The proliferation of diverse data on the Internet is a significant challenge for spam detection systems. However, by monitoring crops for specific quality parameters such as sugar content and fruit color, farmers may optimize their harvests and maximize their earnings.

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