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WEB BASED AGRICULTURE ASSISTANCE USING MACHINE LEARNING

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Abstract –- Crops are grown on fields, which are depending on the quality of the soil, in agriculture, a crucial industry. In order to assist agriculture, we have developed Agriculture Assistance, a project that investigates how machine learning might help precision farming at scale using validated and trustworthy data. Crop recommendation, fertilizer recommendation, and disease prediction are the three applications that our website combines. Users may determine which crop would be most suitable to cultivate in a specific location using our Crop Recommendation tool. Users of the Fertilizer Recommendation application can enter information about the crop type and the soil to determine whether there are nutrient surpluses or shortages and obtain suggestions for improving the soil. In the Disease Prediction application, we also leverage OpenCV image recognition technology to forecast crop diseases by looking at photos. With the aid of these machine learning tools, farmers may be able to make better educated decisions that result in more effective resource utilization and maybe higher agricultural yields. We are able to offer insightful information on crop choice, planting times, irrigation, and nutrient management by analyzing data from numerous sources, such as soil samples and weather forecasts. When crop diseases are promptly diagnosed, farmers may take preventative action, reducing losses and enhancing food security. The ultimate goal of agriculture assistance is to increase agricultural output and promote economic expansion in this vital industry.

Keywords– Machine Learning, Random Forest, Decision Tree, OpenCV, Crop Recommendation, Fertilizer Recommendation, Disease Detection.

I. INTRODUCTION

One of India's most significant sectors is agriculture since it is a vital industry that provides for human beings' fundamental requirements and job possibilities. Farmers should visually evaluate their crops and fields in order to preserve a healthy diversity and refrain from using pesticides. The livelihoods of farmers, who make up around 80% of the population, can be significantly impacted by any decline in agricultural output income. Farmers in India must practice efficient and accurate cultivation. The profitability and quality of crops may be improved in several ways, which is necessary to maintain India's agricultural economic growth. In order to anticipate crop yields based on atmospheric and soil characteristics of agricultural land, one such technique is to employ machine learning, one of the most recent technology developments. Farmers now find it difficult to forecast weather and crop development using climate data because of the unpredictability of weather patterns. Machine learning may offer useful insights into crop forecasting and assist farmers in making wise decisions. Using data analysis to automate a particular model, machine learning is a subset of artificial intelligence that enables computers to learn from data and make judgements with little to no human involvement. The suggested technique use supervised machine learning to identify the class that is most likely to be selected as the potential class, in this instance the forecast crop. Once the harvest has been projected, farmers may anticipate the most economical crop for their particular plot of land, offering practical methods for more lucrative agriculture. The suggested effort has the potential to help farmers and increase India's agriculture's overall sustainability.

II. Literature Survey

In 2020,[1] Mayank Champaneri, Darpan Chachpara, Chaitanya Chandvidkar, and Mansing Rathod did a study in which they discovered that data mining can be helpful for predicting crop output production. Data mining includes analyzing data from several angles and condensing it into key information. The Random Forest method, one of the most well-liked and potent supervised machine learning algorithms, can carry out both classification and regression tasks. It works by building several decision trees during the training process and producing an output of the class, which is the mean prediction (regression) or mode of the classes (classification) of the individual trees. A technique was presented in a 2019 study by [2] D. Anantha Reddy, Bhagyashri Dadore, and Aarti Watekar to identify acceptable crops for cultivation based on three parameters: soil features, soil types, and crop yield data gathering. This technology, known as precision agriculture, aids in the reduction of non-suitable crop production, ultimately enhancing output. The approach provides a recommendation system that use an ensemble model in conjunction with majority voting techniques such as random tree, CHAID, K-Nearest Neighbor, and Naive Bayes to select suitable crops based on soil factors with high accuracy and efficiency. The categorized image formed by these algorithms is made up of ground truth statistical data, and the factors employed for prediction are weather, crop yield, state, and district-specific crops. In 2021,[3] J Madhuri and M Indiramma published research that provides a revolutionary recommendation method for selecting acceptable crops based on soil conditions, crop traits, and climatic data. To evaluate the optimum crop possibilities for a certain location, the system employs Artificial Neural Networks (ANN). The study focuses on four crops in particular: maize, finger millet, rice, and sugarcane. These crops' appropriateness is divided into four categories: Highly Suitable (S1), Moderately Suitable (S2), Marginally Suitable (S3), and Not Suitable. The degree of association and the restrictions of the elements studied are used to determine these groups. The research makes use of climatic data from the Meteorological Survey of India as well as soil data from two places in Doddaballapur (dist.), Karnataka, India: Hadonahalli and Durgenahalli. The system's user interface uses real-time input of location-specific soil qualities to select viable crops depending on input and climatic data. This unique recommendation system has the potential to considerably improve the agricultural business by supporting farmers in making educated crop selection. In 2022, [4] Navod Neranjan, Muhammad Shaifulla, Abas, and Hayathi Yassin completed research that presents an outline of AI-powered precision farming and agriculture. The researchers developed a novel cloud-based machine learning (ML) crop recommendation engine to help farmers decide which crops to harvest based on a variety of characteristics. The study compared the performance of five prediction algorithms for developing the recommendation platform: K-Nearest Neighbors (KNN), Decision Tree (DT), Random Forest (RF), Extreme Gradient Boosting (XGBoost), and Support Vector Machine (SVM). In order to promote the adoption of precision agricultural technologies throughout time, the researchers sought to provide free and open-source solutions. This research may aid farmers in making data-driven decisions that increase agricultural output and efficiency. In 2020, [5] K. Archana and Dr. K.G. Saranya developed a method that focuses on the soil's macronutrients (NPK), pH, electrical conductivity, and temperature. Crop rotation, crop yield predictions, and fertilizer advice are all combined in this method to provide a cooperative approach. An agricultural dataset is included into the proposed system, and a voting-based ensemble classifier method is employed to recommend suitable crops. Crop yield forecasting and prediction aid in raising agricultural output, and regular crop rotation raises soil fertility. The accuracy of the approach, which promotes farmer-friendly fertilization decision-making, was determined to be 92%. The suggested approach might, in general, assist farmers in making better informed decisions about crop selection and fertilization, eventually resulting in increased crop yields and enhanced soil health. In 2021, [6] Manoj Kumar D, Neelam Malyadri, Srikanth M, and Dr. Ananda Babu concentrated on the fact that agricultural output or production greatly depends on a variety of elements, including weather, environmental changes, rainfall, water management, and the usage of pesticides. As a result, farmers frequently encounter difficulty in producing the desired agricultural production. Many researchers are utilizing data mining, machine learning, and deep learning techniques to address this issue in order to increase

agricultural output and quality. Without explicit programming, machine learning algorithms may analyze big datasets and find patterns and consistencies, enhancing machine performance. Several machine learning algorithms, including Linear Regression, Gradient Boosting Regressor, Random Forest Regressor, Decision Tree Regressor, Polynomial Regression, and Ridge Regression, were used in this study to predict crop yields while taking into account datasets from different states and a variety of crops. The objective was to increase agricultural productivity in order to provide farmers a greater chance of success.

III. EXISTING METHODOLOGY

Agriculture production has been poor during the previous two decades for a variety of reasons. One of the most significant difficulties is the lack of effective prediction tools that can assist farmers in making educated decisions. Farmers now rely on generalized knowledge based on prior experiences to compute agricultural growth, identify crop disease, and choose which fertilizers to employ. This technique frequently results in farmers being unable to appropriately interpret agricultural data. Numerous implementations just employ one method and one data set, which may not produce reliable results when the data changes. Additionally, the weather has a significant impact on agricultural productivity, and no area of crop cultivation is exempt from its influence. The best crop growth, development, and yield depend on weather elements; thus it is crucial to take these into account while making agricultural decisions. Despite the development of crop yield forecasts, there are no thorough suggestions for other agricultural practices. This circumstance emphasizes the need for more sophisticated and precise prediction systems that take into account a variety of variables and may give farmers useful information to enhance crop productivity and the expansion of agriculture as a whole.

IV. PROPOSED METHODOLOGY

Our project aims to build a website that recommends fertilizer and crops based on machine learning techniques like naive Bayes, random forest, and decision trees. Users of the website can enter information about their crop and the type of soil they are using through an interactive user interface. The algorithm then makes suggestions for improvements based on what the soil needs or has in excess. A crop suggestion algorithm that forecasts which crop should be grown is also included on the website. The collecting of datasets in our suggested system allows us to train our machine learning models using useful data, which is one of its benefits. Additionally, we pre-process the data to eliminate any noise and identify characteristics important for the forecast. Our crop suggestion system offers precise advice on which crops to plant while also predicting probable crop illnesses or nutrient shortages. This early warning system allows farmers to take preventative action before issues worsen. Both crop losses and production can be decreased as a result.

Our prediction systems draw on a variety of data sources and algorithms to produce precise forecasts that assist farmers in selecting inputs wisely, resulting in increased productivity and lower costs. These algorithms may be customized to work with particular geographies, soil types, and crops, resulting in suggestions that are unique to the requirements of each farmer. By offering specialized suggestions for inputs like fertilizer and insecticides, the usage of these prediction systems can also result in a decreased environmental effect by assisting in lowering the amount of these inputs required. Additionally, these technologies can increase productivity and save costs by giving farmers data and insights. Overall, farmers can make better decisions thanks to our website and prediction algorithms, which improves crop management results and lowers risk.

V. FUNCTIONALITIES

- The evaluation of several factors, including soil type, texture, fertility, pH, and others, is a part of the soil analysis process. This thorough study aids in making precise recommendations regarding the crops that would work best with the particular soil type. To further hone the crop selection process, the algorithm also takes the local climate analysis into account. A list of recommended crops is given to farmers together with details on crop

yields, growth needs, and predicted financial success.

- Another crucial component of the system is fertilizer advice. The method gives farmers advice on the kind and number of fertilizers that would be most suited for optimum crop development based on the crop selection. In addition to assisting farmers in lowering input costs, this also makes sure that fertilizers are applied in an environmentally responsible manner.

- Another vital element of the system is disease management. The illnesses that are likely to impact the chosen crop are disclosed to farmers. This enables farmers to minimize crop losses and maximize crop yields by quickly and effectively identifying and managing crop diseases. Overall, the system is a useful tool for farmers to choose crops, utilize fertilizer, and control diseases, resulting in higher profitability and sustainable agricultural practices.

VI. LIMITATIONS

- Numerous variables may restrict the accuracy of crop, fertilizer, and disease projections. The kind and volume of data utilized to train the system is one of the most crucial elements. The forecasts might not be correct if the data is unreliable, skewed, or out of date.
- Due to the extreme variability of weather patterns, precise forecasting is challenging. While past weather trends can serve as a basis for forecasts, unforeseen weather occurrences may make them inaccurate during the current growing season.
- Within a single field, soil characteristics might differ greatly, impacting crop growth and fertilizer uptake. Despite the fact that soil sampling can reveal differences in soil parameters, it is costly and time-consuming.
- Pests and illnesses can change over time, giving rise to new strains that are resistant to traditional management approaches. Predictions may be inaccurate if they are based on past data that does not account for such alterations.
- Human mistake in data collection and input can also have an impact on prediction accuracy. Incorrect projections can be caused by inaccurate or inadequate data.
- Overall, while crop, fertilizer, and disease forecasts can be important tools for farmers, they should be used with caution and the system's limitations should be considered.

VII. ARCHITECTURE

Fig 1 – System Architecture

VIII. MODULES

Crop Recommendation: This module allows the user to forecast which crop should be planted. The programme advises the best crop for the user to cultivate by analyzing numerous data such as soil type, climate, and other aspects.

Fertilizer suggestion: The fertilizer suggestion module allows the user to enter soil information as well as the type of crop being grown. Based on this information, the programme forecasts what the soil needs or has in abundance and suggests changes. This assists farmers in optimizing fertilizer use and lowering input costs.

Crop Disease Detection: The crop disease detection module predicts illnesses by uploading photos to the website and using OpenCV. This module assists farmers in detecting infections early, allowing them to take remedial actions to avoid additional harm.

IX. RESULT AND CONCLUSION

An intelligent crop suggestion, fertilizer recommendation, and disease prediction system has been successfully applied. We can see that utilizing Random Forest, we can obtain accurate answers for crop and fertilizer recommendations. Machine learning algorithms for crop recommendation may enhance agricultural planning choices, and fertilizer suggestion aids in resource conservation and increases crop production. Farmers may effectively detect crop illnesses early with the help of crop disease prediction using OpenCV and take appropriate action to stop future crop loss. OpenCV can precisely detect and foretell the existence of agricultural illnesses by evaluating photos of crops and comparing them to a database of known diseases.

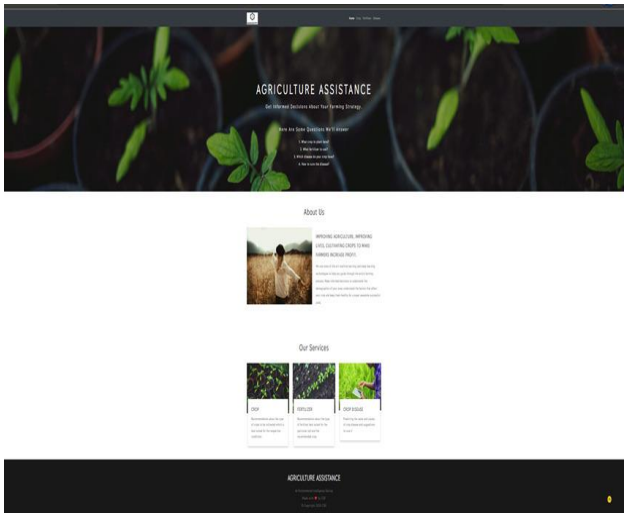

Fig 2- Home page

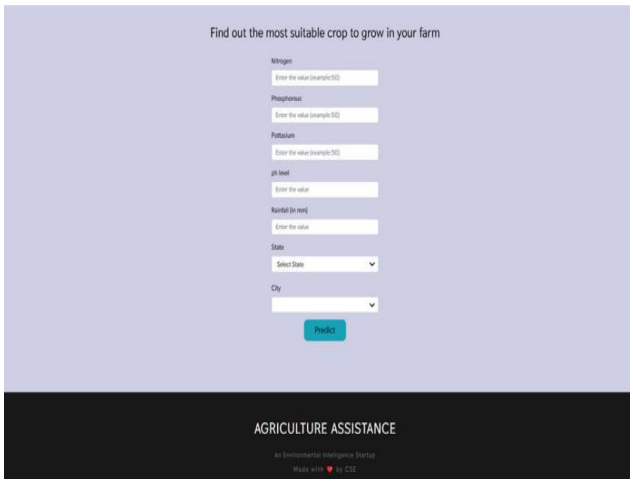

Fig 3- crop input page

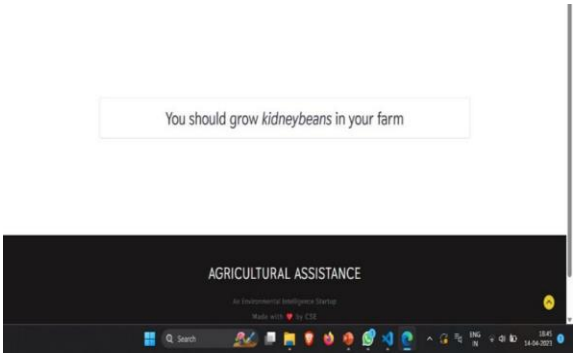

Fig 4- crop output page

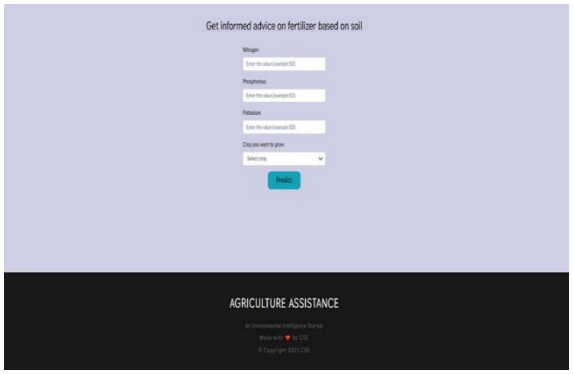

Fig 5- fertilizer input page

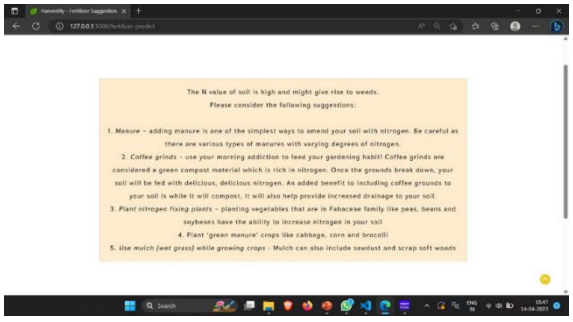

Fig 6- fertilizer output page

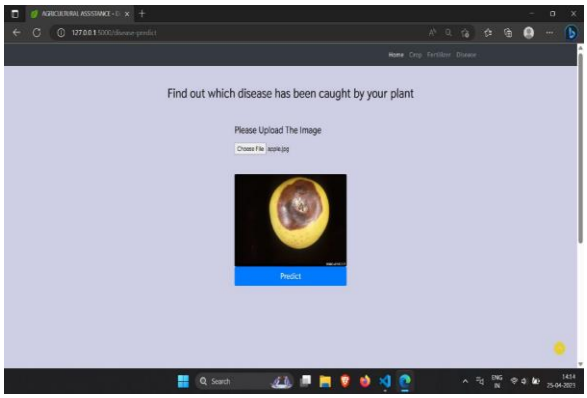

Fig 7- Disease prediction input

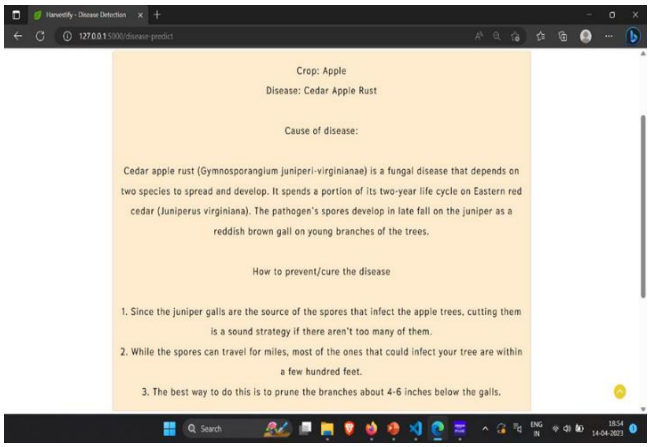

Fig 8- Disease prediction output

X. FUTURE SCOPE

We can make several improvements to our intelligent crop recommendation, fertilizer suggestion, and disease prediction systems going forward. One of the main objectives is to enhance the dataset by adding more characteristics. As a result, projections will be more accurate and suggestions to farmers will be more trustworthy. While we have created a useful website for our model, we may also want to think about developing a mobile application to increase accessibility. Farmers will be able to use their cellphones to access our system and get advice when they are out and about. We may also think about incorporating chatbots and speech recognition technology into our website to make a more dynamic user interface. Farmers will be able to interact with our system more conveniently and get advice through natural language dialogues as a result. Additionally, we can translate our website into additional languages so that farmers who do not speak English can still access it. This will make it possible for farmers from all over the world to profit from our system and ensure that it is available to a larger audience.

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