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TILLAGE : An Ensemble-Based Agricultural Crop Recommendation System

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ABSTRACT

India is primarily an agricultural nation, and both the Indian economy and people's daily lives are heavily reliant on agriculture. In our research One flaw we discovered was that many of them thinks on one aspect (weather or soil) to judge whether crops would grow successfully.This paper presents the precision agricultural recommendation system with more parameters helps to farmer to choose right crops for their field with the help of ensemble majority voting techniques like SVM, Naive bayes, Random Forest, KNN and a Convolutional neural network and also it provide valid fertilizers and pesticide to reduce the farmer's burden in selection right things to their field.

Keywords : Recommender System, Machine Learning, Ensemble Techniques, Data Acquisition, Convolutional Neural Network

I. INTRODUCTION

The act of tillage celebrates the devotion, grit, and morality of Indian farmers. Farmers contribute to the nation's ability to feed its approximately 1.4 billion citizens, but the productivity of farms is at risk due to different natural elements that harm the crops and the farmers' ability to make a living.

Tillage is a tiny endeavour that improves agriculture making wise judgments that take into account the field's demography, the elements impacting the crop, as well as how to maintain the farm's health for an outstanding output.

The implementation of this will take the shape of a website that offers functionality for crop recommendation, fertilizer recommendation, and pesticide recommendation based on site-specific parameters.

Tillage is a website designed specifically for farmers that provides crop recommendations based on N, P, K, temperature, rainfall, relative humidity, and pH levels. In general, choosing the wrong crop results in soil degradation and decreased productivity, but Tillage

makes this decision incredibly simple by using the ML model to generate the real-time prediction.

The second function is fertilizer forecasting. If the farmer decides not to alter the crop in accordance with the land, he can continue with the same crop and use fertilizer that will be suggested by Tillage based on N, P, and K values and crop values. Pesticide Suggestion is the last implemented feature, and it is really helpful.

Although a serious problem, pests can be controlled.Farmers are only required to upload a picture of the pest that clearly depicts it, and Tillage will identify the insect using CNN's DL Model and suggest the appropriate pesticide together with the necessary dosage to control the pests and protect the crop. If the farmer is aware of the pest, he or she can choose the pest and a suitable pesticide would be suggested. Tillage is sort of the farmers' next step because it is typically observed that soil tests are performed by the Indian government and results come within a few days, but farmers really don't know much on what to do next.

II. LITERATURE REVIEW

India relies largely on agriculture as a way to earn a living, and Indian farmers work tirelessly to make ends meet for their families.The majority of ML models employ Random Forest, while some make use of Decision Tree and Ensemble techniques via Majority Voting Mechanism. In the field of AI, fertilizer recommendation is not very effective. The primary cause can be corrupted data, although Tillage gathered all of the information from many sources.

Data mining is used by Tripathy[1] to offer a system for managing pesticides used in crop agriculture.With the aid of clustering algorithms, an automated system was created [2] to collect data on the nature of the soil and the meteorological conditions, which farmers may utilize to cultivate their crops. In today's environment, using mobile devices to transmit knowledge quickly, communication among farmers is facilitated by ICT.A web-based recommendation system created by Kiran Shinde [3] helps farmers select the best fertilizers and crops for rotation. Data processing employs a multi-tier client-server design. Crop identification is done using the Random Forest Algorithm, which has a rating system and 90% accuracy on the datasets utilized.Utilized is Shreya S. Bhamose's [4] Crop and Yield Prediction Model.The number of crops that will be harvested and how much water will be needed for crops are predicted by a modified k-means clustering method. A disease prediction module for tomato crops is also being created; it detects the tomato blight disease and alerts farmers.The type of the soil is a crucial component for agricultural study. In India, there are many different types of soil. Depending on the type of soil on the area, different crops are cultivated. It is addressed how soil might improve crop cultivation [5].Techniques for data mining are used to analyze the soil parameter.Using JRip, J48, and Naive Bayes approaches yields more trustworthy findings when assessing red and black dirt [6].To increase production, the effects of agricultural variables on crop management are being researched [7]. The methods being utilized to investigate the agricultural aspects include fuzzy logic, big data, fuzzy computing, and neural networks.In order to do a spatiotemporal analysis with crop estimation, Pritam Bose [8] constructed an SNN model.Commuting via ICT fills the gap between farmers, for example, mobile devices today's society swiftly communicates knowledge. Farmers can quickly learn about crop ideas thanks to Semantic Web-based Architecture [9] and GIS technology.GIS transmits information about geographical features and climate conditions. Farmers can then access this information using any ICT device. Through the use of GIS and spatial technology, one can learn about the economic development of the universe [10].By using mining, it is possible to uncover vital information that has been concealed and to anticipate the future. To encourage farmers to select between crops, recruit new farmers, and correlate the crops, data is categorized, associated, and clustered

[11].Research in agriculture is now using data mining in an innovative way [12].In order to make recommendations for agricultural productivity and planting in 15 Bangladeshi areas, Shakil Ahamed [13] employed clustering and classification algorithms.A useful engine for presenting appropriate products to users while taking other criteria into account is the recommendation system. This is expanded to include the agriculture sector in its support [14].Using the Internet and a The recommendations provided by this recommendation engine enable farmers to make informed crop recommendations [15]. In order to monitor temperature, NPK, soil moisture, and humidity, sensors have been fixed. Focused content-based recommendation techniques help farmers make informed decisions about which crop to raise and how to do so.

III. PROPOSED SYSTEM

Agriculture is a disjointed industry, and no single platform offers all of the services of crop advice, fertilizer recommendation, and pesticide recommendation at once. "Tillage" is a one-stop shop for all of the issues that farmers face, and the feedback mechanism truly helps to improve and adapt to meet those demands. The work in the field of pests is only restricted to pest detection, but "Tillage" expands the concept of pest identification to pesticide recommendations in accordance with the matching pest discovered, which is a practical use of pest detection. Also, the datasets is more specific with regard to Indian farms, each of which are distinctive in their own right. The insecticides are in compliance with ISO standards, and the fertilizers suggested are organic fertilizers.

“Tillage” has three different modules. Methodology for all the modules.There are

a) Crop Recommendation
b) Fertilizer Recommendation
c) Pesticide Recommendation

The system workflow architecture shown in Figure 1 of Tillage.

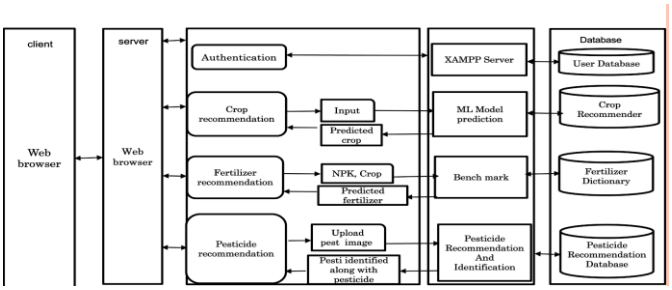

Figure 1 : System Architecture

a) Crop Recommendation

This module can be implemented by these method.Datasets can be acquired from kaggle to train and test the data for tillage.Values are taken by the following site-specific factors are required of users: pH, N, P, and K (all of them in%), temperature (in °C), relative humidity (in%), and rainfall (in mm).The ensemble model with majority voting method serves as the basis for the recommendation system. These are the component models: SVM, Random Forest, Naive Bayes,KNN. After the model is trained, a .pkl file is created.In order to suggest the crop based on input, a.pkl file is imported. Then user can get the predicted crop based on their inputs.

b) Fertilizer Recommendation

Four actions can be taken to implement this module:After gathering information from the dependable sources mentioned below, a datasets will be manually created: The Fertilizer Association of India,Indian Institute of Water Management & Kaggle.N, P, K (all of them in%), and crop are the components of the datasets.The site-specific parameters N, P, K (all of them in%), and crop are anticipated to be entered by users (select from list - only 22 crops supported).There are three potential outcomes for each of the three nutrients based on the difference between the desired value of N, P, and K as determined by the crop and the farm's actual value:High,Low,Up to the mark.A dictionary-based

solution (organic fertilizers) will be presented based on the results from the previous stage.

c) Pesticide Recommendation

Implementing this module involves four stages.Datasets will be produced by automatically scraping pictures from Google using a Selenium and Chrome Driver script. Pest stickers will also be offered alongside that.In order to remove useless material, the Google data must first be manually cleaned. There are a few pictures of "beetle-named cars" when it comes to scraping images of pests with the same name. Later, the sample must be expanded to add more variability.In order to remove useless material, the Google data must first be manually cleaned. There are a few pictures of "beetle-named cars" when it comes to scraping images of pests with the same name. Later, the sample must be expanded to add more variability.The.h5 model will be loaded to recognize the pest, and based on the results, a suitable pesticide will be suggested using a dictionary-based approach.

IV. IMPLEMENTATION & RESULTS

Tillage has majorly 3 modules namely

- Crop Recommendation
- Fertilizers Recommendation
- Pesticide Recommendation

Following will discuss the implementation setup for all the three modules by :After creating an account on the website, the user can check in as many times as needed to use any of the three services. The user must have an email account in order to register. The user will also supply any login and password (minimum 8 characters and maximum 20 characters). If authentication is effective, the user may use any of the three services. The user must enter values for N, P, and K (all in ratio), temperature (in °C), relative humidity (in%), rainfall (in mm), and pH for the first module, which is crop suggestion. The user will then be given advice on what crop would be best for the user's particular plot of property.The user must enter N, P, and K values and choose the product in the second module's Fertilizer Recommendation section before natural fertilizers are suggested based on whether there is an excess or shortage of nutrients.If the user is familiar with the pest, they can choose to select it manually for the third module, in which case a corresponding pesticide will be recommended. If not, they can submit a photo of the pest to the system, which will identify it in the back-end and recommend the appropriate pesticide..The user can provide optional feedback after all the tasks. Later, he or she can visit "Home" once more and search for services or log out.The suggested "TILLAGE" model can be assessed from a variety of angles. First, for crop recommendations. Since ML models are used to predict the crop that would be best suited based on site-specific parameters, accuracy score is helpful in determining how successful the solution is. The consensus voting method was used with an ensemble model. Random Forest, KNN, SVM, and Naive Bayes are the classifiers. The result was a 96.44% accuracy score. The ML model was able to reach 96.44% accuracy, which is significantly higher than the desired accuracy of >= 90%.Fertilizer Recommendation is founded on the team's research because it is just a dictionary-based solution. The final lesson is pesticide advice. If the user chooses to submit a picture, a pesticide will be suggested after the pest has been identified. Pests are recognized using the DL model, which is CNN. Here, training and validation accuracy and training and validation loss serve as success metrics.The Figure 2: shows accuracy of the model.

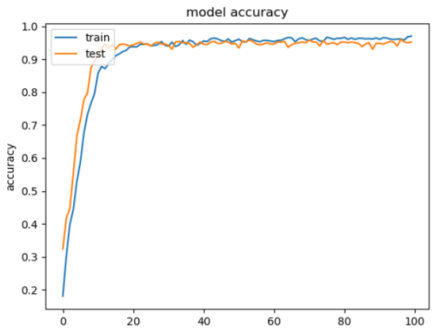

Figure 2: System accuracy

V. CONCLUSION & FUTURE SCOPE

Farmers in India are working arduously. They contribute to the nation's nearly 1.4 billion people being fed. However, some natural phenomena that have the power to destroy their crops and way of life put their output in jeopardy.

Therefore, this solution (Tillage) will help farmers increase agricultural output, decrease soil degradation in cultivated areas, have knowledgeable guidance on organic fertilizers/other fertilizers, and also know about the right crop by taking into account various attributes. As a result, both farmers and the environment would gain from this complete prediction. Additionally, this endeavour would be a significant step towards resolving the problem of pest control.

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