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Crop Recommendation System for Farmers

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ABSTRACT: The production of crops plays an important role in our country. Bad quality crop production is often due to either excessive use of fertilizer or using not enough fertilizer. The proposed system of IoT and ML is enabled for soil testing using the sensors, is based on measuring and observing soil parameters. This system lowers the probability of soil degradation and helps maintain crop health. Different sensors such as soil temperature, soil moisture, pH, NPK, are used in this system for monitoring temperature, humidity, soil moisture, and soil pH along with NPK nutrients of the soil respectively. The data sensed by these sensors is stored on the microcontroller and analyzed using machine learning algorithms like random forest based on which suggestions for the growth of the suitable crop are made. This project also has a methodology that focuses on using a convolutional neural network as a primary way of identifying if the plant is at risk of a disease or not.

KEYWORDS: Profit,Farmer,Crop suggestion, Fertilizer suggestion,Machine Learning.

I. INTRODUCTION

Agriculture crop recommendation is a new generation bubble that is engaging the masses. In most of the cases, the farmers are not well aware of the kind of crops they should be growing in their farms. This leads to a lot of confusion and affects the productivity. This is why we are focusing on figuring out the best crop to grow in order to get optimum yield. We have gathered a dataset built by augmenting datasets of rainfall, climate and fertilizer data available for India. This will give us a better idea of the trends of crops considering different environmental and geographical factors. We can use this dataset to create a machine learning model for predicting the best suitable crop to grow at a particular place. Machine learning can prove to be the turning point of the agriculture industry. By predicting the right crop to be grown, we will help the farmers to decide the raw materials and other resources required much earlier than they would have figured it out otherwise. This will eradicate the problem of nutrients deficiency in fields occurring because of planting wrong crops which can scale down the production efficiency in a compound manner. India is still lacking behind in finding technological solutions for agriculture which is the primary source of income for about 50% people in the country. Promoting more scientific solutions is the need of the hour in order to take the agriculture industry of India to greater heights. Agriculture is the basic source of food supply of all the countries of the world—whether underdeveloped, developing or even developed. The world population is estimated to be about 9.7 billion by 2025. This added with unpredictable weather conditions makes it difficult to ensure food sustainability. Fortunately there is a solution for this problem as for many others. Crop Recommendation System takes the N-P-K (Nitrogen, Phosphorous and Potassium) and pH values along with the temperature, humidity values as input and recommends the optimal crop to the farmer, hence ensuring that the farmer takes an informed decision before cultivation. In this system , we train the model using Random Forest , Decision Tree and KNN neighbor . We compare the accuracy of this models and choose the best out of it and store that specific model using pickle module and deploy the machine learning model using Flask. A user can input the various parameters like Nitrogen , Phosphorous , potassium , PH value , Rainfall and Location by interacting with user interface to predict the appropriate crop.

II. LITERATURE SURVEY

Rashi Agrawal, Prof. Neepa Shah This study proposed the Crop Selection Method (CSM) to address the crop selection problem, maximise the crop's net production rate throughout the season, and achieve maximum economic growth for the cou ntry. The proposed strategy has the potential to increase crop net production rates.

Kumar, Y. Jeevan Nagendra "Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector". In this proposed system crop yield prediction can be done from the past historical data which includes factors such as temperature, humidity, ph, rainfall, crop name. Under this system, maximum types of crops will be covered

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across different districts of India. By applied this proposed system, we can predicted best crop according to the field weather conditions. This crop prediction can be done by random forest algorithm and decision tree. By applying random forest algorithm got best accurate value result. More accuracy results gave more profit to the crop yield."
Reddy, D. Anantha, Bhagyashri Dadore, and Aarti Watekar"Crop recommendation system to maximize crop yield in ramtek region using machine learning". This proposed system worked on three parameters: soil characteristics, soil types and crop yield data collection based on these parameters suggesting the farmer suitable crop to be cultivated. This proposed system worked on different machine learning algorithms like random forest, CHAID, K-Nearest Neighbour and Naïve Bayes.

II. EXISTING SYSTEM Existing system involves image analysis that is used for detecting land type based on which further analysis is carried out. Though this method is environmentally safer, it does not provide accurate results as soil conditions are not considered and hence is not feasible. It is a time taking process and also has some added complexity which may not be beneficial and accessible to farmers at all times. The following are the drawbacks of the Existing System: Time Taking Process• Complicated to use for practical purposes by farmers.• Not accurate• III. PROPOSED SYSTEM We aim to create a system that can accurately tell the farmer the suitable crop to be grown based on the input features of the soil and the temperature conditions of the region. In this system, the models will be trained on a textual data set which will be engineered carefully after performing the feature engineering. The user can interact with the model through a website which takes the necessary inputs and loads the trained model. Based on the input data, the model makes a prediction on the optimum crop to be cultivated. The result is then displayed to the user. Instead of directly taking the temperature and humidity values from the user, the website asks the user for their location. By using a weather API, the system automatically retrieves the temperature and humidity values for that region.

II. PROPOSED SYSTEM

The main ideology of the research revolves around the concept of identifying the most suitable crop to be grown with the help of a machine learning model. Thus, the results can prove to be exceedingly beneficial for the agriculture farmers. We have used a dataset from Kaggle containing 2200 values of 22 unique crops. We have applied machine learning algorithms on the dataset. The dataset is used to train the model according to the actual values and then test the model for its accuracy.There may be a chance of wrong selection of crops for cultivation which will reduce their income. So, we have also included graphical user interface to make it seamless and attractive to operate for even the first-time users who have no prior experience of using any such app or facility. The GUI has been added using the Tkinter library of python. Our research aims to take into consideration the ground reality reflecting the actual requirements instead of assuming any of the factors. Since we are mainly catering to uneducated farmers, we have made it more and more visual and easier to operate. This process is laying the foundation for further evaluation through addition of secondary factors having an impact on deciding the crop to be grown on a particular field in a particular place.

Collection of Datasets The data sets include specific soil features that are collected for Warangal test area in the soil test laboratory, Warangal, Telangana State India. In addition, similar online general crop data sources were also used. Crops considered in our model include Pulses, Banana, Sugar Cane, Cotton, Vegetables, Rice, and White Corn. The number of cases of each crop available in the training set. Attributes of depth consideration, soil texture, soil color, permeability, drainage, water holding and corrosion. The following are the datasets used for training and testing the prediction model built.

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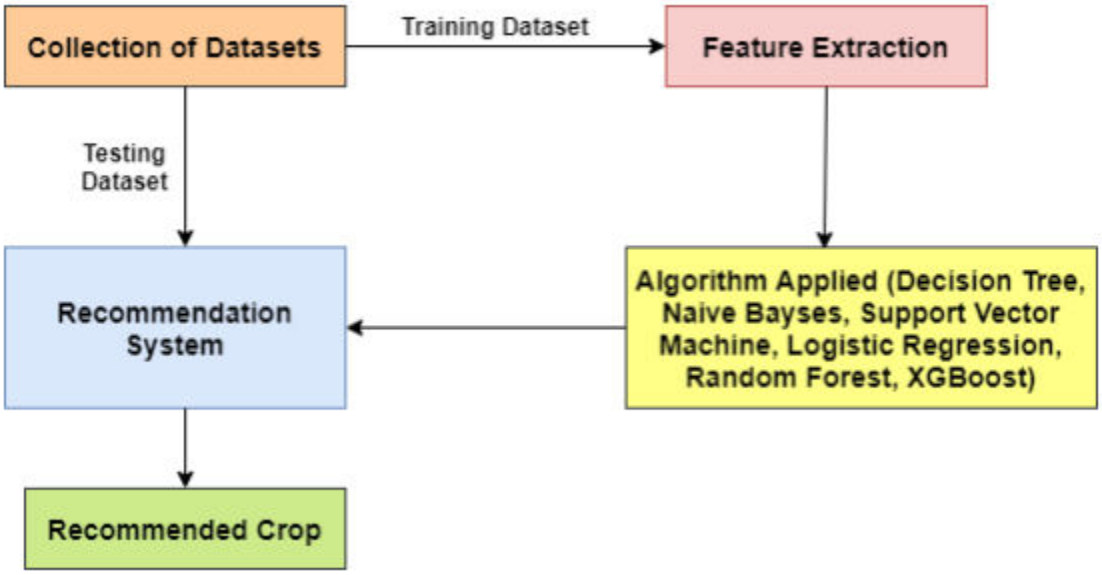

In this proposed system applied different Machine Learning algorithms like Decision Tree, Naïve Bayse (NB), Support Vector Machine (SVM), Logistic Regression (LR), Random Forest (RF) and XGBoost.
Feature Extraction This step is focus on identifying and using most relevant attribute from the dataset. Through this process irrelevant and redundant information is removed for the application of classifiers.

IV. METHODOLOGY

The proposed work can be demonstrated using the Visual Studio platform which can easily work on a normal PC or laptop with 4GBs of RAM. We use DOTNET framework and uses the programming language C#.NET .MS SQL server as backend to store database of yield prediction of previous years.

Selection of agriculture field: Consider any agriculture field for the crop yield Prediction system.
Selection of crop: Consider any crop of choice which will be shown in that field.
Input data: Data may include information regarding soil (Nitrogen (N), Phosphorus(P), Potassium(K) Content, micro nutrients present in soil, moisture in soil etc) which is collected over some period of time.
Pre-processing: Data which is collected should be preprocessed. • Attribute Selection: Important Features have to be extracted.
Classification Algorithm: Two efficient algorithm as been employed. Naive Bayes Algorithm for Crop yield prediction. This algorithm provides us high accuracy and KNN Algorithm is used for Fertilizer Recommendation.

Naïve Bayes Algorithm formulae:

$$P(\text{attribute value(ai)/subject value(vj)}) = \frac{(n\_c + mp)}{(n+m)}$$

KNN Algorithm formulae:

$$\text{Distance} = \text{Sqrt}\left[(q1-p1)^2+(q2-p2)^2+(q3-p3)^2\right]$$

Result: Prediction and recommendation can be provided to the farmers based on the results obtained.

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V. SYSTEM ANALYSIS

This System Analysis is closely linked to the requirements analysis. It's also "an explicit formal inquiry done to aid someone (referred to as the decision maker) in discovering a better course of action and arriving at a better conclusion than he would have reached on his own." Breaking down the system into distinct components to assess the situation, reviewing project goals, breaking down what needs to be constructed, and engaging users to determine particular requirements are all part of this process **Functional Requirement Specification**:The System after careful analysis has been identified to be present with the following modules.

Administration Module: The administrator forms the core of the system. Administrator is responsible for training the models on the data and loading the model when desired by the user. When a user submits the input data, the administrator loads the trained model and displays the result. Another responsibility of the Administrator is to fetch the weather data using the weather API.
User Module: This module represents the user of our system. The user can submit the input data to the admin. The data includes the N-P-K, pH values and rainfall. The user then waits for the response from the Administrator module.

Machine Learning Model Module: The machine learning model is trained on the dataset. After satisfactory results are obtained, it is saved for later retrieval. It is invoked by the Administrator and performs prediction on the data supplied to it.

VI. FUTURE WORK

1) The main future work's aim is to improved dataset with larger number of attributes.
2) We need to build a model, which can classify between healthy and diseased crop leaves and also if the crop has any disease, predict which disease is it.
3) To build website and mobile app for easy to use.
4) Based on the system's recommendations, a farmer can plant different crops in different districts. As a result, by utilizing the method, every farmer will have the opportunity to maximize their produce and profit. Even though we are a developing country, our fundamental goal is to create more with less.
5) We are virtually out of resources trying to keep up with the rest of the world's info. Furthermore, any contribution to agriculture can be helpful to both the country and its people.

VII. CONCLUSION

India has a nation where agriculture plays a major role. In the flourishing of farmers, exploration of the nation. So our work will help farmers sow the right seeds based on soil requirements to increase productivity and gain profit from this technique. Thus, the farmer planting the right crop increases its yield as well increase the overall productivity of the nation. Our Future work is aimed at an improved data set of large number of attributes the yield prediction. This paper summarizes an effective recommendation system for fertilizers and crops based on NPK values and the region. If widely used, it will benefit farmers in terms of crop production. The application is very user friendly everyone can use it.

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