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Original Article

Artificial Intelligence Based Recommendation System for Farmers

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Abstract *- In an agro-based country, the main goal of agricultural planning is to achieve the maximum yield rate of crops using land resources. The selection of crop yield is maximized by considering the proportion of nutrients present in the soil. In this paper, the farmer/beginner will predict crop cultivation based on their weather, monsoon, soil type, and pH level. The cultivation process is recommended in audio, video, and text in three languages, namely Hindi, English, and Tamil, for the chosen crop. During the cultivation of crops, the number of fertilizers, insecticides, and fungicides are analyzed using Machine Learning Technique. Here, K-Nearest Neighbor Algorithm is used to recommend nearby shops using adjacent maps to buy and sell products to the farmers. Finally, the farmers will have a well-guided approach to farming using this system.*

Keywords *- ML as Machine Learning, A.I. as Artificial Intelligence, RFA as Random Forest Algorithm, KNN as K-Nearest Neighbor Algorithm, D.B. as DataBase, E.D. as Euclidean Distance, E.F. as Euclidean Function.*

I. INTRODUCTION

To maximize crop yield by knowing the proportion of nutrients present in the soil, predict the seeds and plant according to the variety of soil and monsoon with the help of a technique called RFA, which recommends the farmer about the crop and fertility of the soil. The farmer must feed the input as soil type and season; this RFA classifies the soil type into low, medium, and high [1]. According to the range of soil, crops will recommend to the farmers [2]. Once the farmer chooses the crop, the cultivation process will be displayed in the format of audio, video, and text in basic languages like Tamil, English, and Hindi. If there is any disease occurrence, the system will also suggest the required fungicides and pesticides be used by using the technique. For buying fertilizers, pesticides, and fungicides, nearby markets will be shown on maps with the help of KNN[4]. This system will also recommend the shop for the farmers to buy seeds and fertilizers for their yielding and sell their cultivated crops.

II. RELATED WORK

Real-time data has been gathered, processed, and analyzed to help the farmers. They informed about their farms' conditions and risks earlier to take proper counter-measures and protect their crops/livestock and overall production [2]. The prediction models have been created utilizing correlation information about the number of insecticides and fungicides used [4]. It notifies the user about the infection rates according to temperature and humidity [7]. Connections are made among agronomists, farmers, and crops regardless of their geographical differences through sensor networks [1]. The weather is predicted using a modified k-Nearest Neighbour (NN)approach [5]. The soil's pH level is being considered for the prediction of crops [6]. The sensor network is used for smart agriculture techniques [8]. Traditional agriculture methods are being implemented to provide tasks like spraying fertilizers, pesticides, and fungicides [3]. The diseases are identified by classifying the symptoms present in crop cultivation [9]. The diseases are analyzed, and solutions are provided to overcome the disease [10]. The crop is classified based on the Algorithm for prediction [11]. The plant disease is detected by considering the symptoms in crops [12]. Considering factors such as weather may result in efficient farming [13]. The daily weather report is listed out for better cultivation [14].

III. CURRENT ISSUES

Now a day, beginners cannot predict the suitable crop for their soil type season. Also, they cannot predict weather conditions accordingly, so they cannot decide which crop is to be sown in which monsoon [5]. Choosing the wrong crops leads to poor cultivation. Beginners are unaware of the presence of diseases and pests that can also be analyzed by the system and provide corresponding suggestions to kill those diseases and pests [9]. Farmers are also not able to know the prices of their buying products. Beginners are unaware of using the right amount of fertilizers, pesticides, and fungicides on their land [3].

IV. WORKING PROCEDURE

Initially, the farmers and dealers will log into the system by registering their details. As soon as registration is completed, the admin will store their details in D.B. With the help of A.I., and the weather can be predicted for the next few days. The farmer will enter the sand and monsoon type as input [11]; if the given data is trained, the RFAwill decide by categorizing the sand quality into low, medium, and high to classify the crops. This classification is based on the pH level of the soil. The classified crops will be processed parallel to predict and recommend the best result to the farmers for better cultivation. If there is no match in the trained dataset, that particular input should be fed into the suggestion box for updating. The system will analyze the symptoms to indicate the disease present in the crop with the help them and suggest corresponding pesticides and fungicides as a solution for maintaining the crop's health. The KNN is used to show the nearby shops on the maps to both farmers and dealers for buying and selling the products.

V. ALGORITHM USED

A. Random Forest

RFA is based on MLand it is a bagging technique for classifying a huge number of crops into different clusters based on monsoon, soil type, and pH level by making optimal decisions. The decision is made by segregating crops into several branches according to the input. A parallel process will take place to predict the best result in a short time. In our system, this Algorithm is also used to determine the diseases and pests that appeared on the crop plants based on their symptoms.

B. Pseudocode

1. Select ‘r’ features randomly from total features, Where r<<d
2. From the ‘r’ features, node ‘m’ is calculated using the optimal cut point.
3. Using the optimal cut-point, the node is split into child nodes.
4. Until the best solution is achieved, 1 to 3 steps will repeat.
5. The previous steps have to be repeated to create an 'n' number of trees.
6. By considering the test features, the predicted outcome will be listed down.
7. For each predicted outcome, PROBABILITY will be calculated.
8. For the RAF, the final prediction will be considered as BEST PROBABILITY.

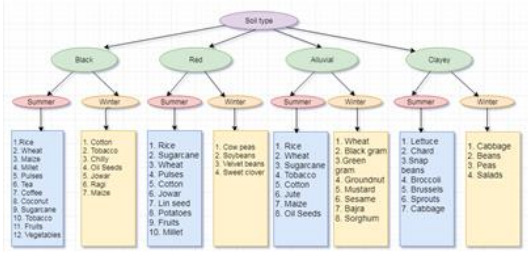


Fig. 4.1 Random Forest Workflow

C. K- Nearest Neighbor

A Sample-based learning technique called KNN is used to predict and suggest solutions for new input samples with the help of historic data [5]. It applies Euclidean, Manhattan, and Minkowski distance functions to determine the nearest dealer's shops for the farmers to buy the products like fertilizers, pesticides, and fungicides. This will also show the nearest farmer's shop to the consumers to buy the cultivated crops from the farmers using map facilities. The use of EFis to determine the K-nearest neighbor shops of the target data. The weight will be assigned as a probability weight from the smallest to the largest E.D. order for each distance.

$$d_k = \sqrt{\left[\sum_{k=1}^{d} W_k (R_{ik} - R_{sk})^2\right]}$$

Where d_k is theED, R_{ik} is the kth component of either of the vectors (feature i, historicals), d is the number of locations, and W_k is weighted. The weight function is calculated as:

$$W_k = \frac{1/k}{\Sigma_{k=1}^{n} 1/k}, \text{ k=1,....,n}$$

VI. SYSTEM ARCHITECTURE

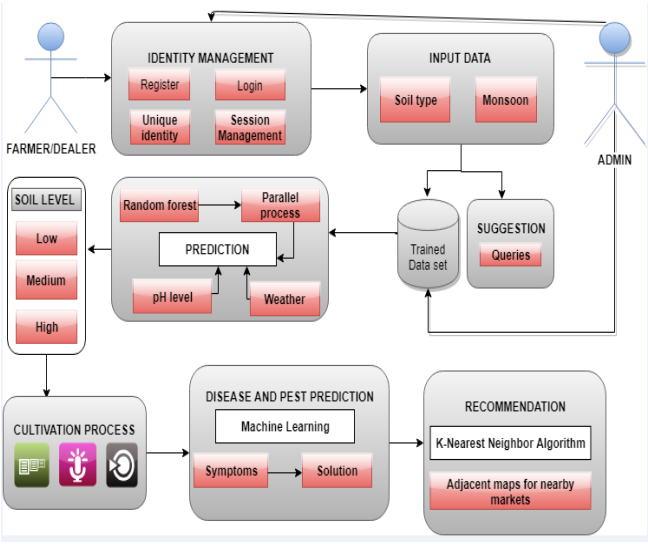


Fig. 5.1 Simple Architecture

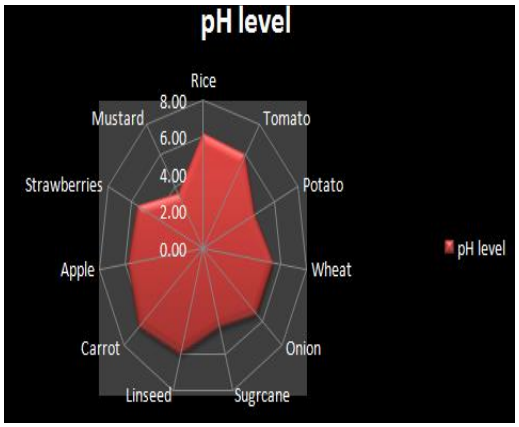
VII. MODULES

A. *Identity management*

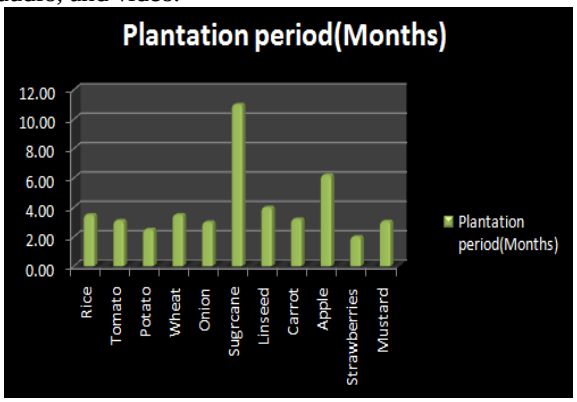
The actors are Admin, Farmers, and Dealers. Both the farmers and dealers should enter their details in the field accordingly for registration. As soon as registration is completed, their data will be stored in D.B. An admin manages the D.B.; the admin will provide a unique identity for the farmers and dealers. Once the user logs into the system, session management will be for 20 minutes. If the time exceeds, the user will be logged out to the home page. The admin will also maintain future sudation. This will be supported for 3 basic languages Tamil, English, and Hindi. The text will be presented in the form of 70 languages using Google translate.

B. *Ai recommendation*

RFA is used to predict the weather for a few days (10 days) [5]. This helps the farmers become better acquainted with the weather [14] earlier [7]. The farmers should feed their input as soil type and monsoon [11]. The RFAwill predict the crops based on the farmer's input. Each soil type should be spitted into low, medium, and high based on the soil pH level [6].



A list of crops will be recommended in each category. From the list, the farmer can choose the crop. Once the crop has been selected, the cultivation process will be shown to the farmers in the format of text, audio, and video.



If the farmer's input is unavailability, that will be stored as a query in the suggestion box. The admin will try to find out the solution for those queries and update it in the system.

VIII. DISEASE PREDICTION AND ITS CONTROL MEASURES

During farming, there is more probability of pests and diseases, which will reduce the nutrients level in the crop. It is important to kill the pests and diseases, so we use ML to analyze the symptoms to identify which type of disease and pest will affect the crop [9]. Knowing the type of pest and disease, the corresponding pesticides, fungicides, and how much quantity they have to bring into play will be suggested by the system to the farmers [4].

IX. FARMER GUIDANCE

KNN is used to show the nearby shops in the form of maps to farmers to buy seeds, fertilizers, pesticides, and fungicides [3]. This will also provide brand names, prices of the product, and the address of the shops. The list of cultivated crops, quantity, and the price will be displayed for dealers and consumers. This will help the farmers, dealers, and consumers to buy and sell their crops, pesticides, fertilizers, and fungicides from their nearby shops. Also, they can buy online by clicking the buy badge.

LOW	MEDIUM	HIGH
(2-7)	(8-14)	(15-20)

X. IMPLEMENTATION

A. *Input*

Here, we recommend suitable crops for growing on their land; the farmers/beginners have to feed the soil type and monsoon input. Because some beginners will not have enough knowledge about cultivating crops in the corresponding monsoon and soil [8], the farmers will use this system efficiently to cultivate profitable crops to achieve their economic level [13].

Our system will predict the crops based on their soil type and monsoon. Then, it will recommend the list of crops according to their input and the soil's pH level.

PREDICTED VALUE

Low(2-8pH)	Medium(9-14pH)	High(15-20pH)
BLACKGRAM	SOYBEAN	MUSTARD

Fig. 7.2 Output HTML page

B. *Additional functionalities*

Once the farmer chooses the crop, they will redirect to the cultivation process. The symptoms will be examined to find the diseases and pests [12]. By knowing them, the system will suggest corresponding pesticides and fungicides kill [10].
Adjacent shops were displayed for efficiently buying and selling products from farmers, dealers, and consumers.

FUTURE ENHANCEMENT

The cultivation progress cannot be monitored frequently. Using cameras or drones to monitor the cultivation methods will incur high costs. Prediction of multiple crops at the same time is difficult. The shops are listed for buying fertilizers, pesticides, and fungicides for a short distance. We aim to address these factors in future work, making "Artificial Intelligence Based Recommendation Systemfor Farmers" flexible and adaptable to every farming scenario.

X. CONCLUSION

Knowing the proportion of nutrients present in the soil maximized the crop yield. To bring knowledge to the new farmers, the soil type and the monsoon play a vital role in predicting which crops are sown in the cultivable land. The farming conditions will be made aware to the farmers/beginners. The correct usage of pesticides and fungicides kills diseases and pests. Shops for buying and selling their products in their nearby location are displayed on maps.

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