Crop Recommendation and Fertilizer Purchase System

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Abstract— India is known as an agricultural country ,where the recommendations are given by traditional methods. At present, recommendations for farmers are based on communication between farmers and experts and different experts have variety of recommendations. Recommendation can be provided to farmers using past agricultural activities' data. The application provides recommendations to farmers for identification of appropriate fertilizer and crop. This system can be used by farmers android based mobile devices. The application can be used for increasing the crop yield. Also the recommended fertilizers can be purchased from the site. Suggestions regarding frequently purchased fertilizers in pair will be given to the user.

Keywords— Android, Nitrogen, Phosphorous, Potassium Crop Recommendation, Crop Rotation , Fertilizer Recommendation, Data mining .

I. INTRODUCTION

India is an agricultural country with second highest land area of more than 1.6 million square-kilometres under cultivation.

Most of the Indian population is involved in agriculture hence the economy is largely dependent on agriculture. India possesses a power potential to be a superpower in the field of agriculture. Agriculture promotes poverty upliftment and rural development. Today in India agriculture is being neglected which has led to losing hope of farmers in agriculture which has led to rise in the number of farmer suicides. There is no such universal system to assist farmers in agriculture. In India agricultural is carried out from ages and thus we have a rich collection of agricultural past data which can used for recommendation. Data mining techniques and algorithms can be used for recommending crops and also the fertilizers.

These techniques can be implemented on android operating systems on the smart phones. And the recommendation will be based on Nitrogen(N), Phosphorous(P), Potassium(K) values. This paper focuses on the development of various algorithms which can help in building an efficient recommendation system. The system which recommends the crops and the fertilizers to the farmers thereby increasing their crop production. Also it allows the farmers to purchase the suggested fertilizers from the application itself.

II. LITERATURE SURVEY

India is an agricultural country but is still using traditional ways of recommendations for agricultural purpose. Presently, recommendations for farmers are based on one to one interaction between farmers and the experts and different experts have different recommendations. The Android operating system smart phones being the most vastly used technology can be used for recommendation of the fertilizers and crops. The Android operating system is mainly used within several types of embedded & mobile platforms, including mobile phones and tablets. And the industry is investing the ability of Android within other embedded platforms, that require the ability to meet deadlines as a prerequisite for reliable operation[10][12][14]. The Nitrogen, Potassium and Phosphorous (NPK) values of the soil determine the quality of soil. Testing of the soil based on these can help in recommending of fertilizers that need to be added to the soil to increase the crop yield [1][2][3]. The android operating system can be used for creating an application for recommendation of various fertilizers based on NPK testing of the soil[5][6][7].

This system will try to reduce the gap between agriculture and technology specifically android technology [6][8][10]. Online Shopping Platform helps in buying of products online by selecting the displayed products from the website (E-Commerce site). User may choose different products based on different categories and making the buying easier and helping the vendors to reach a wider market. The recommended fertilizers can be easily bought from the site itself. The shopping of various fertilizers that are recommended can be made available for purchase on site. Also the fertilizers which are frequently purchased in pairs will be suggested to the user [9][10]. The apriori algorithm which is used to find the frequent item sets can be used for this purpose. The progress of the user will be notified to the user via Email or SMS[11][15][16]. Also the shopping process and details of the order and bill will also notified to the user.

III. MACRONUTRIENTS OF THE SOIL

The soil quality is determined by the NPK value of the soil. The 'N' is the nitrogen content of the soil, 'P' is the phosphorous content and 'K' is the potassium content of the soil. Based on the NPK contents, the value of soil can be predicted.

The nitrogen in the soil is responsible for the colour of the leaves. If low quantity of nitrogen is found in the soil then plants will have slight yellowish leaves and quantity is moderate or high it will have greener leaves. The phosphorous content in the soil is responsible for the

reproductive system of the plant. Its value will predict the growth of fruits and flowers of the plants. The potassium content of the soil is responsible for its overall growth. Its value will predict how stronger the plant roots will be and will also determine the overall growth process of the plant.
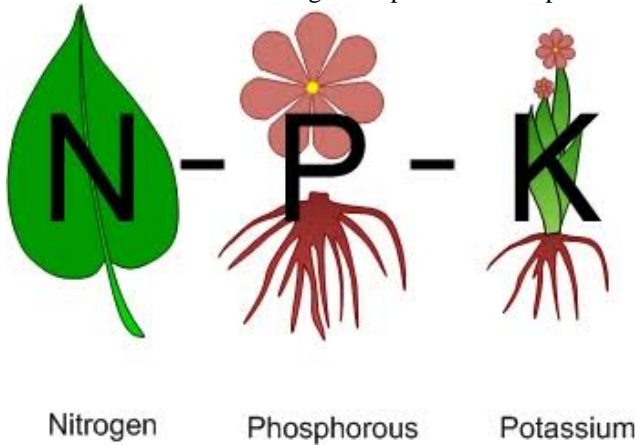

Fig. 1 NPK Nutrients

IV. SOIL HEALTH CARD

Soil Health Card Scheme was launched by the Indian Government on 17 February 2015. Under this scheme, the government planned to distribute soil cards to farmers which carry crop-wise recommendations of nutrients and fertilizers required for each farm to help farmers improve productivity . All soil samples are tested in various soil testing labs all over the country. Thereafter the experts analyse the strength and weaknesses (micro-nutrients deficiency) of the soil and suggest measures to deal with it. The result and suggestions will be displayed in the cards which will show N(Nitrogen),P(Phosphorous) K(Potassium) values along with other soil nutrients.

V. CROP RECOMMENDATION

The dataset for which we have taken the data as a training set and tried applying the algorithms on it by taking the data of past as a test set and then view the output. This obtained output is compared with the actual output. Crop with maximum points can be recommended to the farmer. The market trend of the crops is saved in the database. While recommending more than one of the crops, the first factor determined will be the year factor that will be followed by market factor and the ratio factor. For recommending the crop to the user, we are using the random forest algorithm.

A. Random Forest Algorithm:

The Naïve Bayes algorithm has 40 % efficiency on the dataset whereas the ID3 algorithm is 60%. The accuracy of the Random forest algorithm is about 80% which is greater than the ID3 as well as the Naïve Bayes algorithm.
As the recommendation of the crop has to be accurate the efficiency of the algorithm should be higher. Hence we have decided to use the Random forest algorithm for the crop recommendation.

VI. CROP ROTATION

Crop rotation returns different nutrients to the soil and restores its fertility. An element of crop rotation is the sufficient use of nitrogen, phosphorous and potassium through the use of green manure and fertilizers. Crop rotation also decreases the build-up of pathogens and pests that often occur when one type species is continuously produced. It can also improve soil structure and fertility by alternating between different leguminous plants. Crop rotation is one component of poly culture.

In agricultural field, crop rotation is very essential. A farmer can yield crops for entire year and the fertility of soil is maintained. For recommendation of crop to produce, the previous crop production by the farmer is taken as an input. We are using sequential algorithm like forest algorithm on the previous data. A pattern can be generated to find out the type of crop that has been yielded over the years.

VII. FERTILIZER PURCHASE SYSTEM

In the fertilizer purchase system, the user will be able to purchase the recommended fertilizers for the soil from the shopping portal. The fertilizers will be suggested to the users based on their past purchase. The user will get suggestions of fertilizers that are usually purchased together. For these suggestions, we are using the Apriori algorithm which is used for obtaining frequently purchased item sets.

A. Aproiri Algorithm

The Apriori algorithm is a data mining algorithm. It is used for suggestion of frequently purchased item sets. This algorithm will provide the user recommendations for purchasing the fertilizers.

```
1: procedure APRIORI_FREQUENTITEMSETS(min_sup, S)
2:     L_1 ← itemsets
3:     for k = 2; L_{k-1} ≠ ∅; k + + do
4:         C_k = aprioriGen(L_{k-1}) ▷ Create the candidates
5:         for each c ∈ C_k do
6:             c.count ← 0
7:         end for
8:         for each I ∈ S do
9:             C_r ← subset(C_k, I) ▷ Identify candidates that
    belong to I
10:             for each c ∈ C_r do
11:                 c.count + +▷ Counting the support values
12:             end for
13:         end for
14:         if c.count ≥ min_sup then
15:             L_k = L_k ∪ c
16:         end if
17:     end for
18:     return L_k
19: end procedure
```

Fig. 2 Apriori Algorithm

VIII. SYSTEM ARCHITECTURE

The user has to create an account and log into it. The random forest algorithm and fertilizer retrieval from database is used which enables crop and fertilizer recommendation to the users. The users can open their accounts to view recommended crops and fertilizers and also purchase them. To recommend the fertilizers to buy in pairs, we use apriori algorithm which give frequently purchased item sets. This application is very useful in terms of its applications as it provides both recommendation as well as the feature to purchase recommended products.
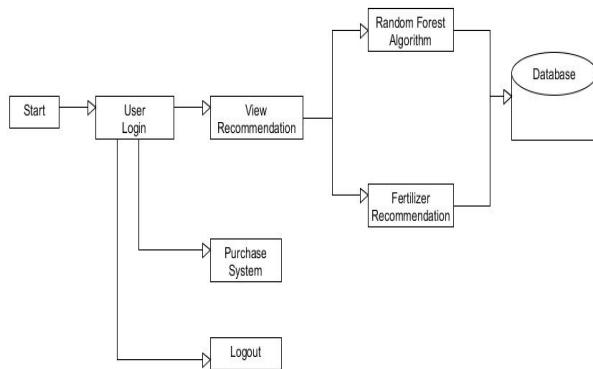

Fig. 1 System Architecture

IX. ADVANTAGES

1. It is beneficial for the farmers to increase their crop yield.
2. It is user friendly.
3. Requires less memory.
4. Available in multiple languages.
5. Convenient for buying fertilizer after suggestion.

X. APPLICATIONS

1. Fertilizers to be applied are recommended.
2. The amounts of fertilizer for various crop types are suggested.
3. The future scope of the application of this project is bridging this application for windows as well as android OS.
4. And region-wise recommendation of fertilizer quantity as well as crops depending on climate.

XI. CONCLUSION

This paper summarizes an efficient recommendation system for fertilizers and crops based on the NPK values and region. This application also allows users to purchase the recommended fertilizers from the purchase portal. If used on a large scale, it would benefit the farmers in terms of crop production. the application is user friendly so everyone can use it.

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