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Soil Based Fertilizer Recommendation System for Crop Disease Prediction System

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ABSTRACT
Agriculture is the main aspect for the economic development of a country. Agriculture is the heart and life of most Indians. But in recent days, the field was going down due to various natural calamities. In order to overcome the problem, various issues in this field need to be addressed. The soil type, fertilizer recommendation, diseases in plants and leaves. All these features need to be considered. Our proposed system was organized in such a way, to analyze the soil type, diseases in the leaves and finally to recommend the appropriate fertilizer to the farmers, that may be of great help to them. Plant disease, especially on leaves, is one of the major factors that reduce the yield in both quality and quantity of the food crops. Finding the leaf disease is an important role to preserve agriculture. Smart analysis and Comprehensive prediction model in agriculture helps the farmer to yield right crop at the right time. The main benefits of the proposed system are as follows: Yield right crop at the right time, Balancing the crop production, control plant disease, Economic growth, and planning to reduce the crop scarcity. Hence to Detect and recognize the plant diseases and to recommend fertilizer it is necessary to provide symptoms in identifying the disease at its earliest. Hence the authors proposed and implemented new fertilizers Recommendation System for crop disease prediction.
Keywords: Soil nutrients, Fertilizers, Long or Short term memory algorithm, Sensors.

I. INTRODUCTION

India is an agricultural country and depends on agricultural products for their wellbeing. It is agriculture that promotes the economic growth and the development of our country. But recently many problems have been faced by the farmers due to certain natural calamities. Apart from these major calamities, they were also in lack of sufficient knowledge about the nutrients present in their soil. The characteristics of the soil type vary accordingly based on its nutritive value. Not only the soil type, the climatic condition and the usage of fertilizer also play a major role. Certain varieties of crops can be cultivated based on the climatic condition in their locality and accordingly the fertilizers can be preferred. In certain situation the usage of fertilizers also affects the cultivation. Under a climatic condition the cultivation of a right crop, usage of right fertilizer to the soil gives better yield.

Mostly, fertilizers were recommended based on the nutrients present in the soil. Hence while preferring fertilizer the farmer needs to consider the soil type, the crop and the pesticides. On using chemical fertilizer the quality or the nutrients present in the soil was degraded, that promotes a decrease in the nutritive value of the soil. Another major factor to be considered is the disease in the crop cultivated. Identifying the disease in the plants and preferring appropriate fertilizer by the agriculturist to the farmers plays a major role. In earlier days, all these process were carried out manually. But with the advancement of technology the entire system was digitalized. But even then there exist various problems that need careful attention. On considering all these the authors proposed a new framework that can be used in real life, which enables the farmers in solving certain problems.

II. RELATED WORKS

In 2018, Komal Bodake et al [2], developed a soil based fertilizer recommendation system that can be used for regional soil analysis. The advanced farming involves various techniques as IOT, Cloud computing and data mining. This helps the farmers to gather details regarding the fertilizers he can use from his soil sample. The tool was constructed in such a way involving regional languages. This makes it understandable to all the farmers and yield maximum production.

In 2019, R.Neela et al [4], proposed a new method for finding leaf diseases in plants. Plant disease, especially on leaves, is one of the major factors for reduction in both quality and quantity of the food crops. Finding the leaf disease is an important role of agriculture preservation. To identify the disease the image of the affected leaf is fed as input into the system. As a first step pre-processing of the image is carried out using median filter. The filtered image then undergoes segmentation, which is carried out by Guided Active Contour method. Classification of the leaf disease was performed by using Support Vector Machine. They compared the performance of their proposed method with the existing CNN method. With the same set of given images for CNN was 0.7 and 0.8 for SVM. The accuracy in the identification of the disease was 0.6 for CNN and 0.8 for SVM.

In 2020, Shravani V et al [12], proposed a suggestion for crop and soil classification using machine learning approach. The results of such classification can be further combined with crop dataset to predict those crops that are suitable for the soil series of a particular region and its climatic conditions. Soil and crop dataset used by them comprises of chemical attributes and geographical attributes. In the proposed method algorithms like SVM and Ensembling technique were used to classify the soil series data and predict the suitable crops.

In 2019, Santosh Mahagaonkar [9] proposed and implemented a system to predict crop yield from previous data. They achieved this by applying machine learning algorithms like Support Vector Machine and Random Forest on agricultural data and recommended fertilizer that is suitable for every particular crop. They focuses on the creation of a prediction model which will be used for future prediction of crop yield. It presented a brief analysis of the crop yield prediction using machine learning techniques. Random Forest was good with accuracy of 86.35% for soil classification when compared to Support Vector Machine. Predictive Support Vector Machine was good with an accuracy of 99.47% for crop yield when compared to Random Forest algorithm. Their work can be extended further to add mobile applications by helping farmers in uploading the image of farms. Also to implement Smart Irrigation System for farms to get higher yield.

In 2017, Rohit Kumar Rajak et al [8], proposed a new method for crop recommendation system to maximize the crop yield using machine learning technique. Their method was characterized by a soil database collected from the farm, crop provided by agricultural experts and the achievement of parameters such as soil quality through soil testing lab dataset. The data from the soil testing lab was fed to the recommendation system that will use the collected data and do ensemble model with majority voting technique using support vector machine (SVM) and ANN as the learners to recommend a crop for site specific parameter with high accuracy and efficiency. Their future work was to improve their data set with large number of attributes.

In 2019, Viviliya B et al [15], proposed a hybrid model for recommending crops to south Indian states by considering various attributes. Their recommender model was built as a hybrid model using the classifier algorithm such as Naive Bayes, J48 and association rules. Based on the appropriate parameters, their system will recommend the crop. Their approach considered 15 attributes and 2 algorithms for the recommendation and their system was enhanced with more classifier algorithms. Technology- based crop recommendation system for agriculture helps the farmers to increase the crop yield by recommending a suitable crop for their land with the help of geographic and the climatic parameters. Their proposed hybrid recommender model was found to be effective in recommending a suitable crop.

In 2020, Yoganand S et al [13], addressed the problem of preventing crop disease using a naïve model which was monitored with the help of sensors. Internet of things (IoT) is a promising technology which provides efficient and relevant solutions towards the modernization of agricultural domains. Humidity and Temperature sensor was deployed to verify the humidity and the atmospheric temperature of the plant. Similarly soil moisture sensor was deployed to get status of the soil. Sensors, webcam, GSM and Controllers were used by them for receiving the data from the groundnut farm. The received data was analyzed using machine learning models (XG boost) and so the prediction of crop disease was done. Thus a novel approach for preventing the crop disease (Groundnut Crop) was proposed and their prediction was intimated to farmers through SMS/E-mail.

III. EXISTING METHOD

In most of the existing methods, the process of finding the soil type, identifying the leaf disease and preferring the fertilizer were all carried out manually. The method was prone to various disadvantages. Even when the framework was digitalized, it has certain problems as, predicting a diverse fertilizer for a soil type, certain files regarding the leaf disease or soil type or fertilizer

may not be updated. In other situation the system may not provide the needed support. Hence in order to overcome some of these issues, the authors proposed a new approach.

IV. PROPOSED METHOD

The proposed approach was organized in such a manner, that it is universal to all the users in the world.

- The first step involves the registration phase, where the user has to present his personal details, details of land and the soil type.
- In the second step the user will upload the soil test report into the system for soil analysis. In this step, if the soils test report was not submitted by the user, soil analysis will be carried out by the sensors. Sensors measure the nutrients level of the soil and the data was stored within the database.
- In the third step, the corresponding crops infection status will be analyzed and recorded.
- In the fourth step, comparison and classification of the soil type was carried out using Long or Short term Memory algorithm. Finally the fertilizers are recommended.

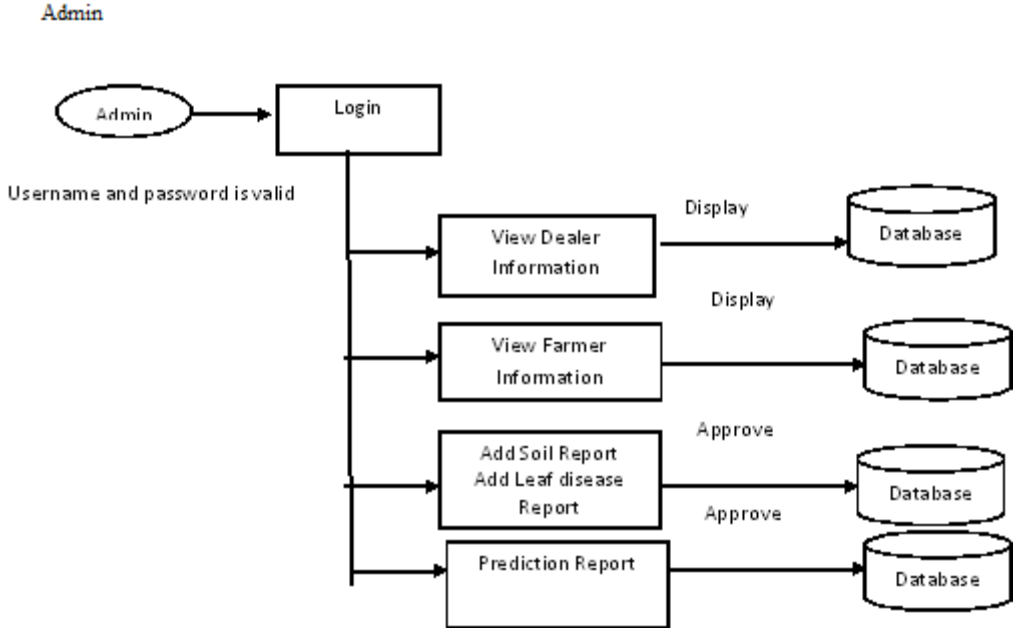
The proposed approach was data centric and connected through the cloud. The main advantage of our proposed system is that, it was user friendly and highly efficient. The proposed system maintains privacy and also predicts accuracy.

V. RESULTS AND DISCUSSION

The individual steps involved in the proposed method was organized as follows,

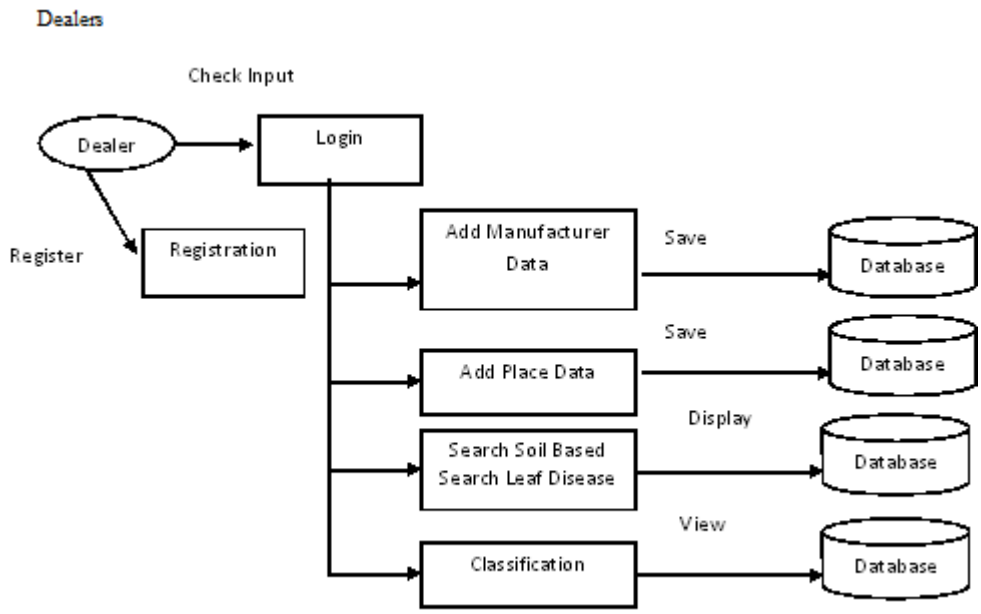
Step 1: Importing the data

The data in this case was linked with the other steps for predicting the content, soil, fertilizer, finance/billing, workflow, etc. Hence, before recording the data, the basic information regarding the soil must be recorded. The user then register his personal details and the details of the land.

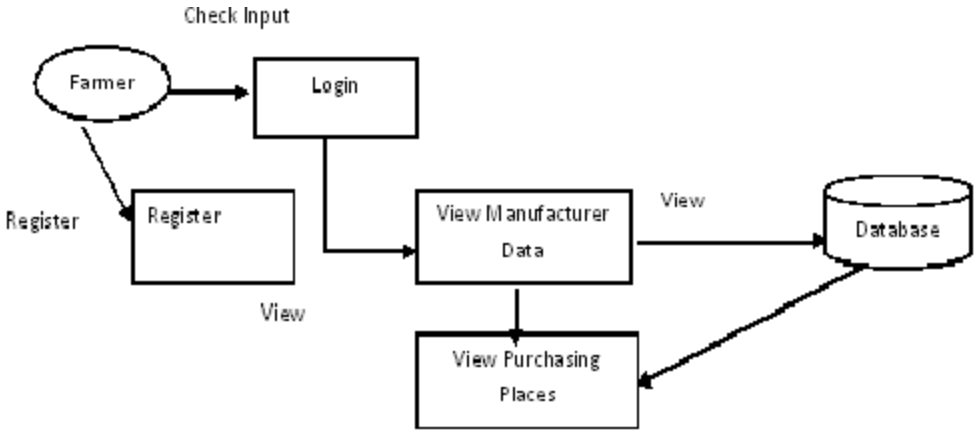


Step 2: Soil Analysis

The soil test report will be analyzed in this step. The nature of the soil, nutrients present in it, will be analyzed. Based on this analysis, fertilizers will be predicted accordingly.



Farmers



Step 3: Leaf Disease Identification

In this step, the leaf disease present in the corresponding crop will be analyzed and the data will be recorded.

Step 4: Prediction of the fertilizer through comparing and classification

In order to carry out the classification process, the data from the soil report was compared with the data stored in the database using Long or Short Term Memory algorithm. Finally, the fertilizers are predicted relevant to the soil type.

VI. CONCLUSION AND FUTURE WORK

The authors proposed a new approach for the soil based fertilizer prediction system. The proposed system was able to analyze the soil nutrient type efficiently, kind of leaf disease present in the crop and predict the fertilizer in a proficient manner. The approach was flexible, and can be extended to the needs of the users in a better manner. The proposed method was carried out with five different crops. As a future work, the method can be extended to include diverse varieties of crops to be cultivated and to analyze its performance.

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