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Crop Recommendation and Disease Prediction System for Kitchen Garden

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Abstract: *Having a kitchen garden not only benefits us by producing required vegetables, moreover it helps economically and makes us healthy by consuming things that are grown on our own. All the vegetables can't be grown in kitchen garden. It depends on factors like weather, soil, and water. To check what plants can be grown, a model is created which recommends top crops based on live coordinates of the user, weather, water and soil parameters. In addition to this, details like how to prepare the field, what materials can & can't be used for composting and steps to grow a seed are prescribed. Every plant can't grow successfully without care. Disease Prediction System takes care of the plant by recommending suitable remedies for the affected disease.*

Key Words*: Kitchen Garden, Crop Recommendation, Field Preparation, Disease Prediction, Soil, Organic*

I. INTRODUCTION

India is the second largest producer of food. In spite of that, India ranks top in the list of undernourished population with over 194.4 million people malnourished. Out of these, most of them are from lower- or middle-class background. Based on a study, it can be concluded that food insecurity is one of the major causes for malnutrition. To eradicate food insecurity, as well as to increase the nutrition intake, one of the most efficient ways that is also affordable for lower and middle class background is to have a Kitchen Garden and grow required vegetables. Having a kitchen garden not only create food security, but it also creates additional ways to generate income. It also acts as a source of cheap vegetable, which reduces the amount of money spent on buying vegetables. Kitchen garden also provides options to diversify crops, which means that all types of crops like pulses, cereals and green leafy vegetables can be grown. This in turn improves the nutrient intake and creates healthy lifestyle.

India ranks 101st position in 2021 Global Hunger Index with a score of 27.5. Population of the India is expected to reach 1.5 billion by the end of 2030. But the amount of cultivable land can't be expected to grow. In order to feed the entire population, the most efficient and sustainable way is to have a Kitchen Garden wherever it is possible. This would not only boost the production of vegetables but also protects the environment.

With these advantages, it is obvious that having a Kitchen Garden has numerous benefits. Having a Kitchen Garden alone won't reap all these benefits. It is equally important to plant the right crops. Crop recommendation system does this by considering parameters like Temperature, Humidity, Soil Temperature, Water Availability, Water Quality, Water Quantity, Area of Kitchen Garden, Soil type and if tested the soil then Soil ph. During the growth of a plant, there may be diseases that would be affecting the plant and for this, Disease Prediction System comes to the rescue by predicting the disease and suggesting remedies for that disease.

II. LITERATURE SURVEY.

The paper [1] (Pramanik et al., 2018) affirms that assumption of divergent alternated cultural operation compute in vegetable farming followed by several curation methods like mechanical techniques, operate of predators, freeloader, vegetable-based derivation, etc., In inclusion, Analysis is also on pressure today in organic cultivation system and several opaque inventive can be awaited as a result of the growth of plant yielding practices. The demur for other organic cultivator and investigators has been to find sets of context-specified method that, in mixture, are impressive in preventing budgetary pest affliction.

The paper [2] (X. Liu et al., 2006) states that the intense processes that control soil standard are tangled and they control through moment at divergent place and condition. Soil organic matter is the pair a cause of carbon discharge and a drain for carbon segregation. Farming and grassland can minimize and maintain allocation of SOC while an applicable crop revolving can enlarge or maintain the best of SOM and enlarge physical properties and soil chemical.

The paper [3] (Sangakkara et al., 1995) states that the best of SOM like animal plant food has bigger impacting the effects, disregarding season. The utility of several low quality of common organic stock like rice stalk doesn't improve effect

quickly, however an extensive profitable yield. Effective Micro-organisms (EM) becoming well-liked most of the countries exalt effect of the organic methods. Effective Micro-organisms like builds up organic matter of soil.

The paper [4] (Anthony Lyon & Leicha A Bragg, 2011) states that the improvement of a kitchen garden supplied the students with a perception into the high quality of assigning mathematical clearance to real-life conditions. Kitchen garden has also elevated the cognizance of sustainable living, food and plants, eating like healthy, and motivate the students to invent home gardens and try their hands at cooking using elements from the home garden.

The paper [5] (Krull et al., 1999) states that the separate SOC can impact specific loam functions and the particular values are needed to reach better outcomes. The complete SOC is required to the distinct into natural significant value of the carbon pools of everyone to the whole loam quality. The significance of the SOC changes in pools is same to the complete carbon indulge.

The paper [6] (Emiru & Gebrekidan, 2013) states that the changes in natural ecosystem into organized agroecosystem progressed in notable conversion in the aspect of soil resources. These high growing soils crucially proceeded to conversion in area use over salient soil aspect which initiate soil assets ruling soil productivity and fertility. This intends the phosphorus and nitrogen nutrients subsidence through farming uses should be restore and get back to the scheme to maintain the nutrient stably distant from negative.

The paper [7] (Cooperband, 2000) states that the fertilizing of organic sewages is an eco-friendly sounds resources of deflecting organic sewages from junkyard and yielding admirable soil modifications. Fertilizing is a microbially supervised process that is necessary for particular set of physical and chemical conditions. Fertilize can be used in horticulture, home gardens, agriculture, silviculture production, etc.

The paper [8] (Coleman et al., 1989) states that the administration of organic input requirements to be as predictable and computable as administration of inorganic inputs in cultivation system. The variance of polar beginnings and cultivation system supplies sample concatenations of harvest and organic inputs for draught in satisfactory agroecosystem.

The paper [9] (Seiter & Horwath, 2016) states that the nutrient administration target at the plot level needed as such plans as higher return of organic appliances, permanent and cover harvest are used, and lowered framework. These methods contribute to the source of the working fragment of the organic matter, which is important for sustainable administration of nutrient tandem of agroecosystem.

The paper [10](R.D.B. Lefroy et al., 1994) states that the effect of harvest residue in harvesting system is possibly to vary particularly from north to south. Variance in harvesting system, and drizzle patterns are such that balance food prevail in northern systems while balance of food and forage beans are returned in greater quantities of southern systems. Affirmation so far propose that these schemes will not arrest the important falloff in N productivity evident in northern harvesting systems.

III.PROPOSED WORK

The proposed work consists of two modules:

i. Crop Recommendation:

Here top 10 Kitchen Garden crops are recommended on the basis of parameters like Temperature, Humidity, Soil Temperature, Water Quantity, Water Quality and Soil Type. Similar to other parameters, Water Quality is also important because, salinity in water has a direct effect on plant growth (Kotuby-Amacher, 2000). Crop Recommendation is done individually for two categories,

- Soil hasn't been tested:

  In this category, crops will be recommended based on the above-mentioned weather and soil parameters. To extract the weather details, user must give access to their live location and also enter the necessary details.

- Soil has been tested:

  In this category, along with all the above-mentioned weather and soil parameters, user will also be required to enter the pH value of the soil. Access to their location is also essential, using which the forecasted weather parameters for next 7 Days would be retrieved.

Image 1. Crop Recommendation Flow Diagram

After Crop Recommendation, there is a phase called **Field Preparation** in which there would be instructions to improve the organic content in the soil. Soil Organic Matter is an essential factor for plant growth, as it ensures that all the micro and macro nutrients are absorbed by the plants. In order to show the difference in Plant Growth while using normal soil and soil with high organic content, an experiment is done in which two samples of Mint Plant are grown and below are the observations.

DAY 1:

Black Pot *– Soil with organic content*

DAY 25:

Brown Pot *– Normal soil*

In Day 25, observation is that the growth of mint plant in black color pot (in which Soil with Organic matter is used), is more than that of Brown color pot (in which normal soil is used).

ii. Disease Prediction:

This System predicts some of the common disease that affects the Kitchen Garden plants and suggests remedies to cure those diseases. Here the user needs to upload the picture of part of the plant which is affected by that disease and the result will be the ways to cure that disease.

Image 2 Disease Prediction Flow Diagram

IV. IMPLEMENTATION

For Crop Recommendation, weather parameters are extracted using coordinates through Open Weather API and Ambee API. Logistic Regression and SVM were the two models used. And out of these, Logistic Regression had 95% test accuracy, whereas SVM had a test accuracy of 100%. Since SVM is also a probabilistic model, top 10 crops based on probability can be recommended. Crop Recommendation is followed by Field Preparation stage in which instructions that are verified by subject matter expert is showed so that if the user follows those steps, then the probability of that crop growing successfully will be high.

For Disease Prediction, based on the image uploaded by the user, disease will be predicted and in case of no disease then 'crop is healthy' message will be displayed. Following deep learning models have been tried,

Table 1: Shows accuracy. Model size, Precision and Recall for all models

MODEL NAME	VAL ACCURACY	MODEL SIZE	VAL PRECISION	VAL RECALL
Inception v3	72%	92 MB	0.65	0.63
Vgg 19	81%	80 MB	0.8	0.8
Resnet 152 v2	78%	239 MB	0.78	0.77

Based on the above inference, Vgg 19 model has been selected, since it's validation accuracy is high as well as it's size is less when compared with other prominent models like Inceptionv3 and Resnet152 v2.

V.CONCLUSION

The suggested method will not only used to recommend crops for Kitchen Garden, rather it is a complete guide using which the user can get to know what crops can be planted along with details like how to prepare the field such that it has high organic content and how to grow the seed into sapling and also suggests remedies if incase the plant gets affected by disease.

In future, local nurseries can be linked with the application, so that if any particular crop is recommended then it can also be ordered from the nearest local nursery.Also, many varities of crops can be added to the dataset, so that user can have a wide range of crops to choose from.

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