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Soil Profile Based Crop Prediction System

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Abstract - *In many parts of India, farmers are experiencing problems with crop production due to soil and climate. There is no proper guide available to help them develop the right types of plants using modern technology. Due to illiteracy, farmers may not be able to take advantage of the scientific advances made in agriculture and still cling to human practices. This makes obtaining the desired yield difficult. For example, crop failure may be due to misuse of fertilizers or unwanted rainfall patterns. In such cases, the appropriate solution would be to select crops that are suitable for current soil conditions and the expected rainfall during planting. Therefore, we are introducing a 'Soil-Based Profile Profiling System' based on data mining. We provide a list of crops that a farmer can cultivate based on soil input parameters (NPK and pH) and rainfall of the farmer's area. In addition, it also proposes fertilizer that can be used to improve soil quality and thus bring more crops under successful cultivation. This desktop application is designed to solve a growing problem of crop failure.*

Key Words: **Nitrogen, Phosphorus and Potassium, Artificial Neural Networks, pH, depth, temperature, rainfall, Feedforward backpropagation, Soil.**

1. INTRODUCTION

Agriculture is an important activity in India, providing 118.6 million farmers with a livelihood by the 2011 census. Understanding soil conditions, knowing when and where to apply compost, considering rainfall, maintaining crop quality, and understanding how different factors work differently in different parts of the same field are some of the many problems farmers face before. as when plowing. A number of factors and statistics need to be taken into account when making important agricultural decisions that may be difficult to implement in their own right or at times. Implementing this program will provide a solution for Agriculture by monitoring the agricultural field, which can help farmers to grow their productivity on a large scale. Weather data obtained online, such as rainfall reserves and soil boundaries, provides insight into which plants should be planted in a particular area. This function introduces a program in a desktop-based application, which uses data analysis techniques to predict the most profitable yields in the current climate and soil conditions.The program will integrate data obtained from storage and climate department. Using a machine learning algorithm, predicting the most relevant plants based on current natural conditions was performed. This gives the farmer a variety of crops that can be grown. Therefore, the project develops a system by combining data from various sources, data analysis, and forecasting analysis, improving crop production and increasing the profit margins of farmers, helping them over time.

The farmer must take care of the soil in order to have a good harvest. Growers should be aware of the macronutrients and micronutrients present in the soil in order to get the maximum yield of a particular crop and know which fertilizer to use. Soil analysis is an important aspect of Cultivation. Most people do not know how to plant crops properly and in the right location. By analyzing parameters such as Sodium (N), Potassium (K), Phosphorus (P), and soil pH value, region, and rainfall, our project thus identifies the suitability of certain soil-based plants. mentioned above.

1.1 Proposed Solution

We proposed a desktop application that takes input as nutrients values such as N, P, K, ph and finds output as the fertility level of the soil, which crops will yield in that fertility level after adding fewer nutrients which crops can yield in that soil. Most farmers in India don't know about their soil fertility level. So he can't understand which crops to grow in that soil. So our system is most helpful to the farmers who don't know about their soil fertility level and which crops they have to see in that soil.

We took readily available datasets of crops and nutrients values to implement this system. We trained this database using SVM. When the user enters an input we process the test data and compare it with the trained dataset using the SVM algorithm and check our final output.

1.2 Problem Formulation

The system will integrate data obtained from storage, in the weather department and using a machine learning algorithm, the most accurate crop prediction based on current environmental conditions is made. This gives the farmer a variety of crops that can be grown. Therefore, the project improves the system by combining data from various sources, analyzing data, analyzing forecasts that can improve crop production and increase farmers' profit margins to help them over time.

2. WORKING

2.1 Significance of NPK, PH and rainfall

Importance of NPK and pH: The system works to identify soil, based on Nitrogen (N), Phosphorus (P), and Potassium (K) values and soil pH values as input from the farmer. Nitrogen is the key to plant growth. The addition of nitrogen to the amino acids is a major protein in the plant, and it is one of the components of chlorophyll and is required in response to several enzymes. Phosphorus is an important component of plant RNA and DNA. Phosphorus is an important factor in root growth, plant growth, and seed production. Plant growth is not directly affected by Potassium. Potassium is required for the activity of more than 80 enzymes in a plant. Soil pH affects the many physical, chemical, and environmental reactions needed for plants to survive, grow, and harvest. Nutrition is strongly influenced by pH, which makes it important to be vigilant.

Importance of regional based rainfall: In addition to soil characteristics, this program also looks at rainfall levels, which will be reflected in the farmer's area, in order to develop the most suitable crops. Water shortages are a problem in India, and many farmers are dependent on rainfall to produce good crops. Therefore, planting in terms of rainfall may be very important.

2.2 Use Case

There are three actors, which are the user and the system. Figure 2.2 contains the use case for our application. The actors for our application are the farmer and the system.

Farmer:

The farmer has three roles:

1. Entering the values for nitrogen, phosphorus, potassium and pH as well as region.
2. Entering the nitrogen, phosphorus and potassium values for Fertilizers.
3. Uploading the image for Disease Identification.

System:

The system is first trained using the dataset values. After the farmer enters the values, the system predicts the output based on the trained data.

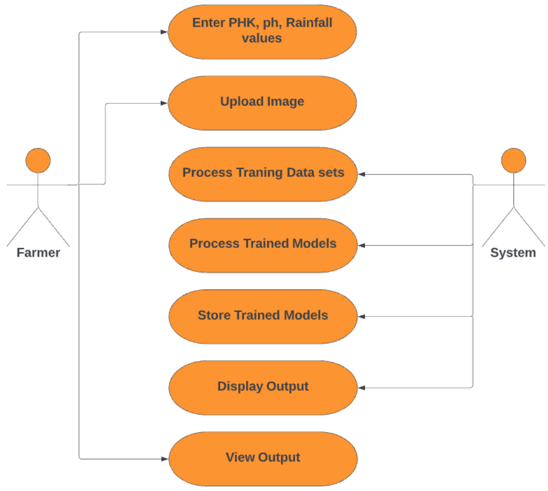

Fig -2.2.1: Use Case

2.3 System Flow

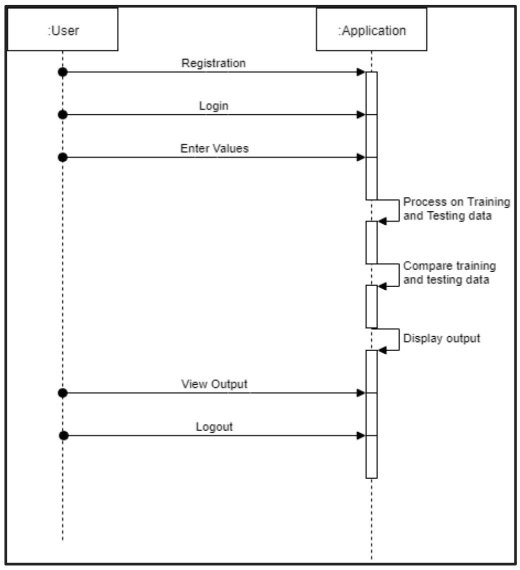

Fig -2.3.1: System Flow

The Farmer can use the system in a very simple manner. The application is user friendly and goal oriented. Here are the steps for the user to get their output:

1. The farmer will first open the application.
2. Once he is booted, he can select any feature.
3. He enters the values and then views the output produced by the application.
4. He can then close the application.

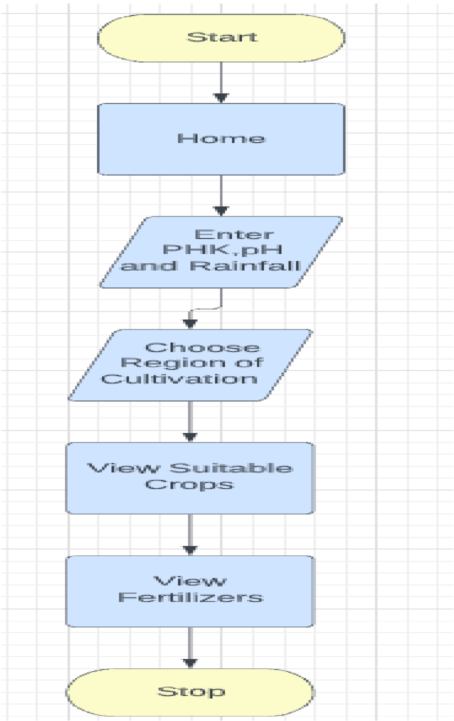

Fig -2.3.2: System Architectural Flow

The flow of system performance is shown in Figure -1. The farmer first registers in the system, then sets the NPK values and pH and production area. If you enter the details list the plants may be produced. Along with this is a list of usable fertilizers that are also produced. The farmer can then view his or her previous results.

3. RESULT

Case 1: Low Fertility

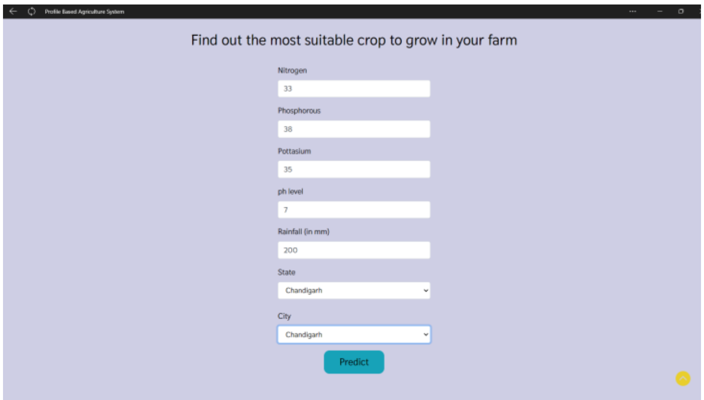

Fig -3.1: Low Fertility input

In the above image the farmer inputs the following values: N,P,K & pH (33,38,35,7 respectively). After entering the values he selects the region Chandigrah from the regions specified in the dropdown list.

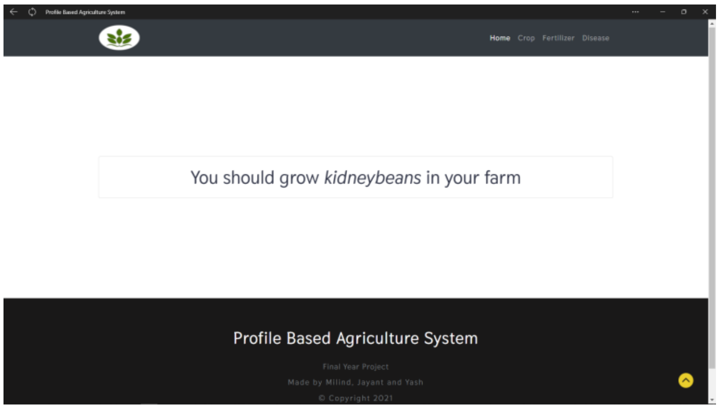

Fig -3.2: Low Fertility output

As seen in Fig 3.2 the system has predicted that kidney beams should be grown on the farm depending on region, NPK and pH values.

Case 2: High Fertility

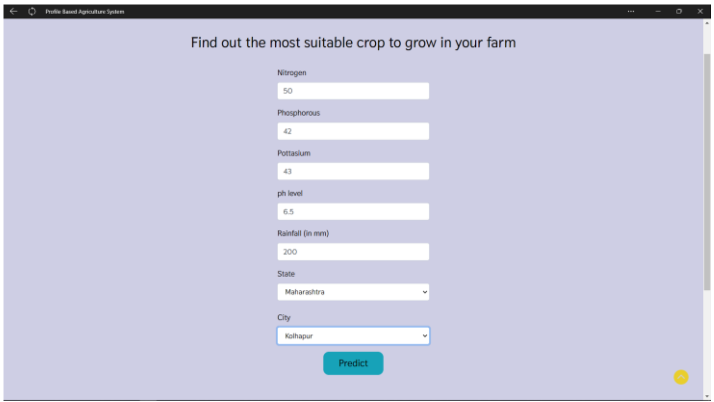

Fig -3.3: High Fertility input

In the above image the farmer inputs the following values: N,P,K & pH (72,38,135,6.9 respectively). After entering the values he selects the region as Kolhapur from the regions specified in the dropdown list.

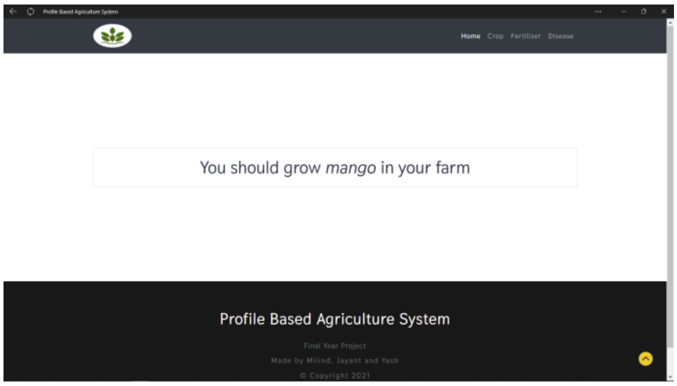

Fig -3.4: High Fertility output

As seen in Fig 3.4 the system has predicted that mango should be grown on the farm depending on region, NPK and pH values.

Case 3: Fertilizers

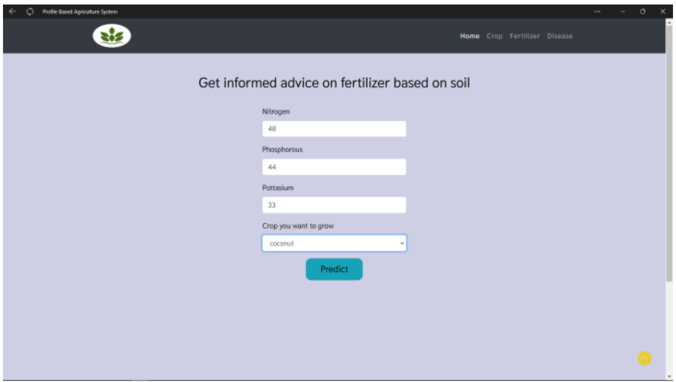

Fig -3.5: Fertilizer prediction input

The above image describes the nutrients(NPK & pH) which are less in soil based on standard values for specific crop.

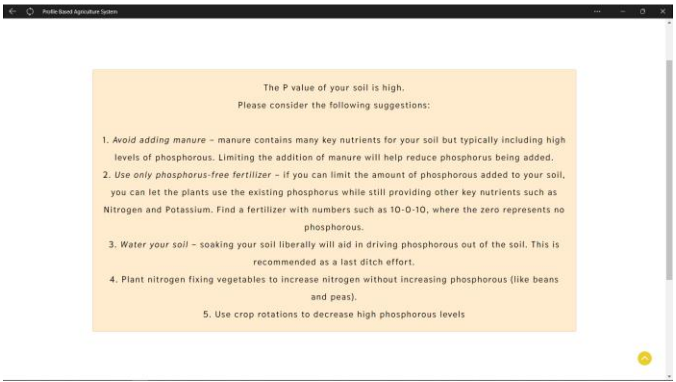

Fig -3.6: Fertilizer Prediction output

As seen in Fig 3.6 the system has predicted the fertilizers that can be added to increase the production of the crop.

Case 4: Disease Checker

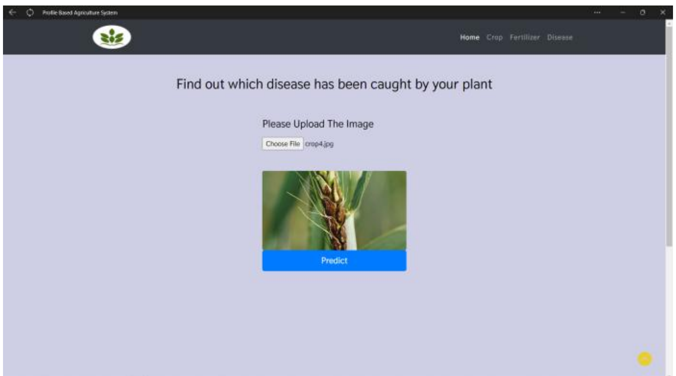

Fig -3.7: Disease checker input

The disease feature allows the farmer to understand which disease the plant is infected with. The farmer will have to upload the image and click on predict.

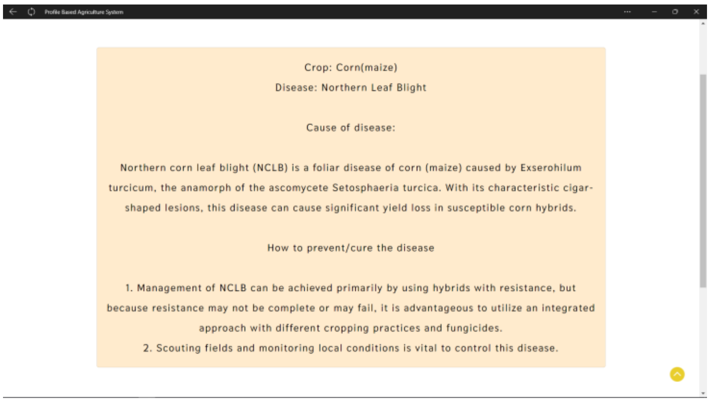

Fig -3.8: Fertilizer Prediction output

As seen in Fig 3.8 the system has predicted the cause of the disease and also shows various methods to prevent/cure the disease.

4. SYSTEM ACCURACY

We compared two SVM models with 100 training and 33 test data and we got the accuracy as 0.84375 and 0.96875 respectively. The accuracy is shown in the fig 8.14 wherein we check if our model predicts the fertility correctly and the accuracy is 0.96875.

```
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))

[[9 0 0]
 [0 9 2]
 [0 3 9]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00         9
           1       0.75      0.82      0.78        11
           2       0.82      0.75      0.78        12

   micro avg       0.84      0.84      0.84        32
   macro avg       0.86      0.86      0.86        32
weighted avg       0.85      0.84      0.84        32

print(" Accuracy:",metrics.accuracy_score(y_test, y_pred))

 Accuracy: 0.84375
```

Fig -4.1: System Accuracy 1

```
print(confusion_matrix(y_test,y_pred2))
print(classification_report(y_test,y_pred2))

[[ 9  0  0]
 [ 0 10  1]
 [ 0  0 12]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00         9
           1       1.00      0.91      0.95        11
           2       0.92      1.00      0.96        12

   micro avg       0.97      0.97      0.97        32
   macro avg       0.97      0.97      0.97        32
weighted avg       0.97      0.97      0.97        32

print(" Accuracy:",metrics.accuracy_score(y_test, y_pred2))

 Accuracy: 0.96875
```

Fig -4.1: System Accuracy 2

CONCLUSIONS

Agriculture is the backbone of India. By developing a Soil Profile-based crop prediction System, we want to provide a simple solution. Crop productivity can be improved by implementing this system. It is possible to avoid land loss due to over use of fertilizers or under use of fertilizers. It may help farmers boost their profit margins by reducing the use of superfluous fertilizers and avoiding the production of incorrect crops. The main goal of our application is to assist farmers in making better crop productivity decisions, as well as to assist farmers in deciding what crops to cultivate based on the rainfall conditions in the region. We will also assist farmers in deciding what fertilizers to apply in order to avoid over fertilization or under fertilization problems, resulting in a higher yield.

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REFERENCES

[1] Soumaya Lamrhari ; Hamid Elghazi ; Tayeb Sadiki ; Abdellatif El Faker “A profile-based Big data architecture for agricultural context”, 2016 International Conference on Electrical and Information Technologies (ICEIT) Year: 2016

[2] https://www.noble.org/news/publications/ag-news-and-views/2007/january/back-to-basics-the-roles-of-n-p-k-and-their-sources/ (Date: 25th October 2018)

[3] https://www.pioneer.com/home/site/us/agronomy/library/managing-soil-pH (Date: 25th October 2018)

[4] Data mining in Agriculture on crop price prediction: Techniques and Applications M Kaur, H Gulati, H Kundra - International Journal of Computer Applications

[5] R. Sujatha, Dr. P.Isakki,A Study on Crop Yield Forecasting Using Classification Techniques, 978-1-4673- 8437-7/16/$31.00 ©2016 IEEE.

[6] https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset

[7] https://github.com/Gladiator07/Harvestify/blob/master/Data-processed/fertilizer.csv

[8] https://www.kaggle.com/datasets/vipoooool/new-plant-diseases-dataset