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CROP YIELD PREDICTION TO MAXIMIZE PROFIT USING MACHINE LEARNING

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ABSTRACT

Agriculture planning plays a significant role in the economic growth of food security of agro based country. In India, agriculture sector is going through a difficult phase due to lack of awareness in farming activities. Sometimes in most of the cases farmers are not aware about the crops which are suitable according to their soil quality, soil composition. The system takes into consideration various parameters like weather forecast, soil condition, rainfall and gives best crops which are suitable for cultivation. Crop selector could be applicable for minimizing losses when unfavorable conditions may occur and this selector could be used to maximize the crop yield rates when potential exists for favorable growing conditions.

KEYWORDS: Machine Learning, SVM (Support Vector Machine), Linear Regression, Prediction.

I. INTRODUCTION

Achieving maximum yield rates with limited land resource is the goal of agriculture planning in agro-based country. Earlier farming predictions was performed based on farmers past experience in a particular field of crops. Now-a-days as the conditions are changing there is a need of advancement in the farming activities. What happens the farmers in rural areas are not aware of new crop and their benefits while farming them? The proposed system applies machine learning and prediction algorithms to suggest the best suitable crops for the farmers. The aim of the system is to reduce the losses due to drastic climatic changes and increase the yield rates of crops. The system integrates the data obtained from the past prediction, current weather and soil condition due to this farmers gets the idea and list of crops that can be cultivated. Machine Learning methods are widely used in prediction techniques like SVM (Support Vector Machine), linear regression. This in return gives the best crop for cultivation based on the current environment condition. The proposed system considers the rainfall amount of past, current and future and also the type of soil the farmer have. Based on this parameters the suitable crops for the given condition is predicted using the machine learning algorithms more accurate prediction results are produced.

II. LITERATURE SURVEY

Monali Paul, Santosh K Vishwakarma, Ashok Verma[1]

This paper provided to predict the yielding of crops, the crops are analyzed based on analysis they are categorized. This categorization is done on data mining algorithms like KNN, Naïve Bayes. This will be beneficial for developing our project with the help of data mining.

Abdullah Na, William Isaac, Ekaram Khan[2]

In this paper a smart phone based application which will measure the pH value of soil, temperature and humidity in real time. This paper assists in remote analysis of soil through various techniques.

S. Nagini, Dr.T.V. Rajnikanth, B.V. Kiranmayee[3]

This paper theorizes an exploratives data analysis about designing various prediction models. Various regression techniques like linear regression are used for prediction for suitable crops. Using various machine learning algorithm prediction are made for most suitable crop for the farmer.

Awanit Kumar, Shiv Kumar[4]

The paper proposed techniques for prediction of crop production of current year. The system uses prediction mechanism in the form of Fuzzy Logic. Fuzzy Logic is rule based prediction logic where set of rules are applied on the land for farming, rainfall and prediction for crops. The system uses K-means can be used to analyze data set obtained.

Pooja More, Sachi Nene[5]

This paper uses advanced artificial neural network technology along with machine learning algorithms like SVM, Linear regression are used for prediction of most suitable crops.

Rakesh Kumar I, M.P. Singh[6]

The paper proposed techniques for appropriate crop selection using CSM (Crop Selection Method), and Machine Learning algorithms. It mainly focuses on increasing the profit of the farmer by selecting based suitable crops.

III. PROPOSED WORK

The systems main aim is to farmers to cultivate proper crop for yield production. It can be achieved using machine learning algorithms like SVM (Support Vector Machine), Linear Regression. Dataset will be trained by learning networks. Along with list of crops the farmer is provided with recommendation of fertilizers which are most suited for better yielding of cultivated crops. Agriculture products depends on climatic, geographical, biological, political and economic factors as these parameters are highly sensitive along with risk associated with it. The accurate information about factors that influence the crop yield rate are needed to be measured correctly for better yielding of crops.

a) Machine Learning:

Machine learning the study of algorithms and statistics models for computers which are used for the purpose of achieving a specific task. Machine learning algorithms builds a mathematical model based on sample data knows as training data for making predictions. There are basically two types of machine learning algorithms which are supervised learning algorithm and unsupervised learning algorithm.

b) Support Vector Machine (SVM):

SVM is a supervised algorithm used for classification and regression. Prediction is possible with the help of Support Vector Machine. SVM uses a linear function for learning process. It creates set of hyper plane in high dimensional space which is used for classification and regression. SVM when used for crop yield prediction is called as support vector regression. The goal is to obtained non-linear function using kernel function.

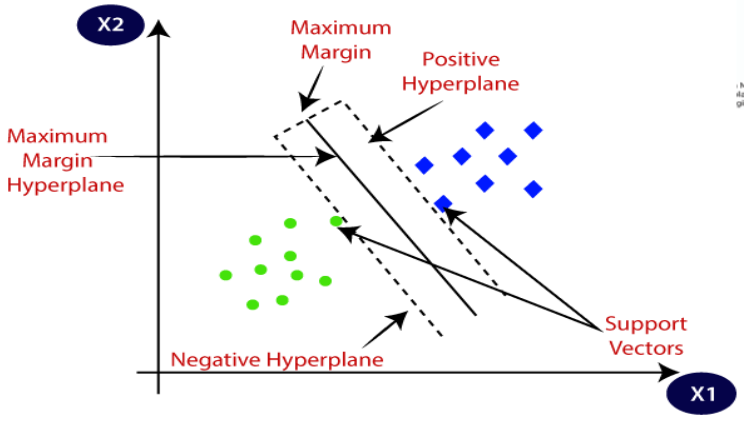

Fig-1: Support Vector Machine.

c) Linear Regression:

Regression modules a target prediction values based on independent variables and dependent variables. Regression analysis is a form of predictive modeling technique which investigates the association between a dependent variable which are targets and independent variables which are autonomous variables. Linear Regression is a machine learning algorithm based on supervised learning used to performed regression task different regression models differ based on kind of relationship between dependent and independent variables.

Linear Regression performs the task to predict a dependent variable value(y) based a given independent variable(x). Hence it models linear relationship between x (input) and y (output).

Hypothesis function for linear regression:

$$y=a + b. x$$

Where,

x= input training data,

y= output variable,

a= intercept,

b= coefficients of x.

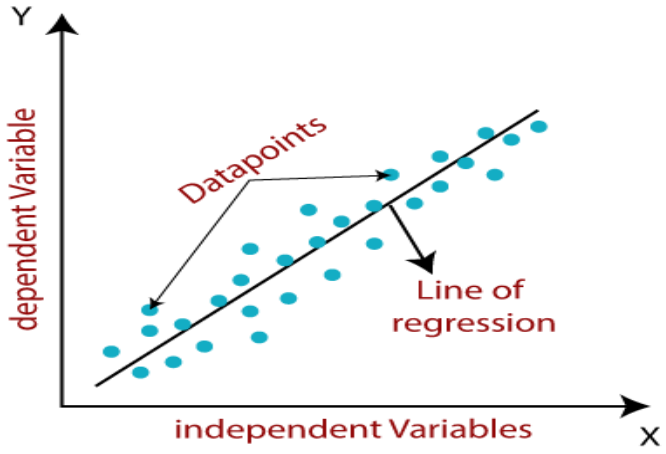

Fig-2: Linear Regression.

d) Multiple Linear Regression:

Multiple linear regression is also known as multiple regression, is a statistical technique that uses various explanatory variables to predict the output of variables also called as response variable. The multiple linear regression is mainly used to model the linear relationship between the explanatory i.e. input variable and the output variable (response variable).

IV. SYSTEM ARCHITECTURE

The crop prediction system architecture consists of various processing models for prediction. The following figure shows the system block diagram. It consists of mainly five steps which are input, data pre-processing, data processing, classification and output.

Input: The prediction of crops depends on various parameters like rainfall, soil analysis, water availability, farming types, etc. The input to the system from the farmer is soil color, previous rainfall details, the water storage available with the farmer.

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Data Pre-processing: In this step, the data gathered from the farmer is processed for extraction of data for the process of prediction.

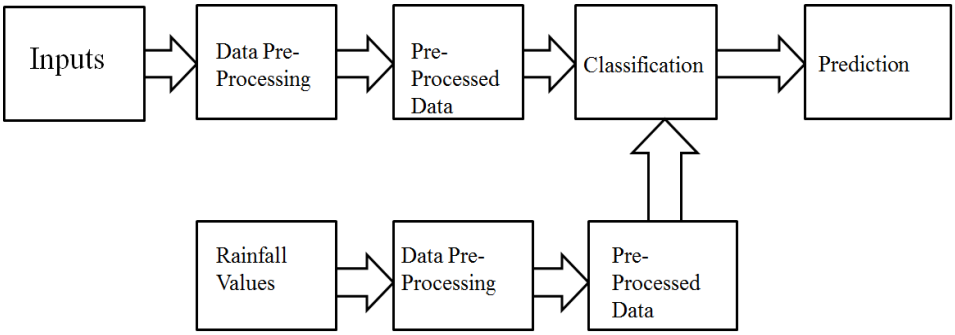

Fig-3: Block Diagram of Crop Prediction System.

Data Processing: In this step, the linear regression algorithm is used for matching the data gathered from farmer and the system database to suggest the number of crops which are suitable to be grown.

Classification: It is the step in which the crops predicted by linear regression are classified by using Support Vector Machine (SVM) to give the most suitable crops for cultivation.

Output: The list of crops are predicted in the order from high yield rates of the crops from the method of classification.

V. SYSTEM RESULT

A web based application is being developed in Machine Learning using Python 3. The backend of the system is Python 3, MySQL and front end of system is of HTML5 and CSS3. The name of our system website is (). The system is administered by a admin which new user registration, user login, and registered user login. The login and sign-up of the system is shown below:

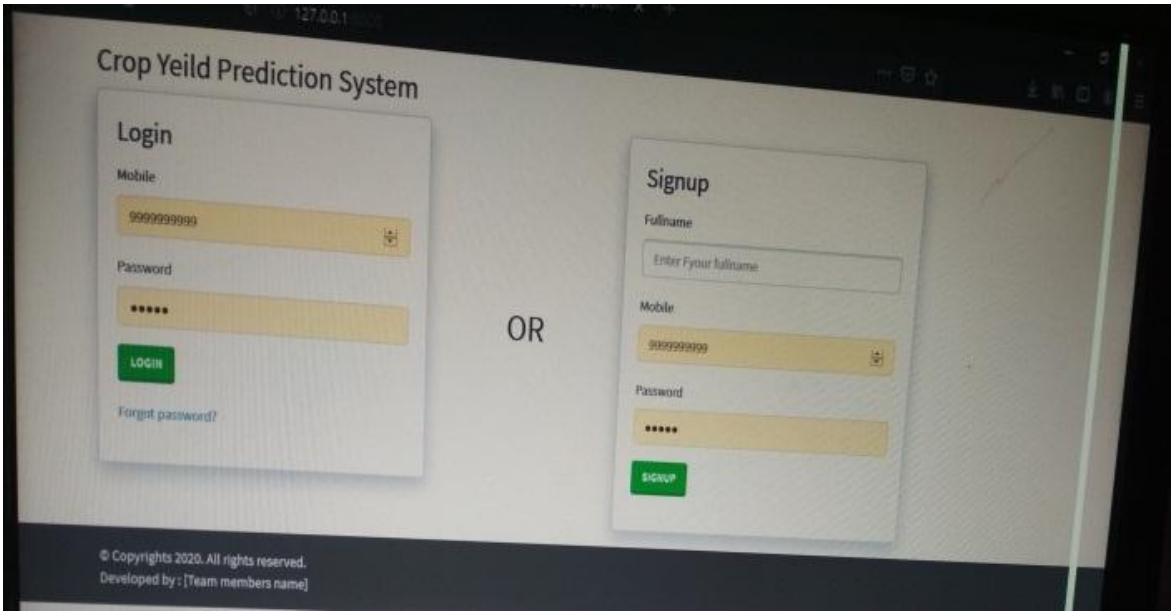

Fig-4: Login Page of Crop Prediction System

The admin or the system database is generated by the admin of the system. The database consists of details of each crop like rainfall amount, soil type, farming type and water required for the crop to grow. This database is used for prediction of the crops based on the farmers input parameters.

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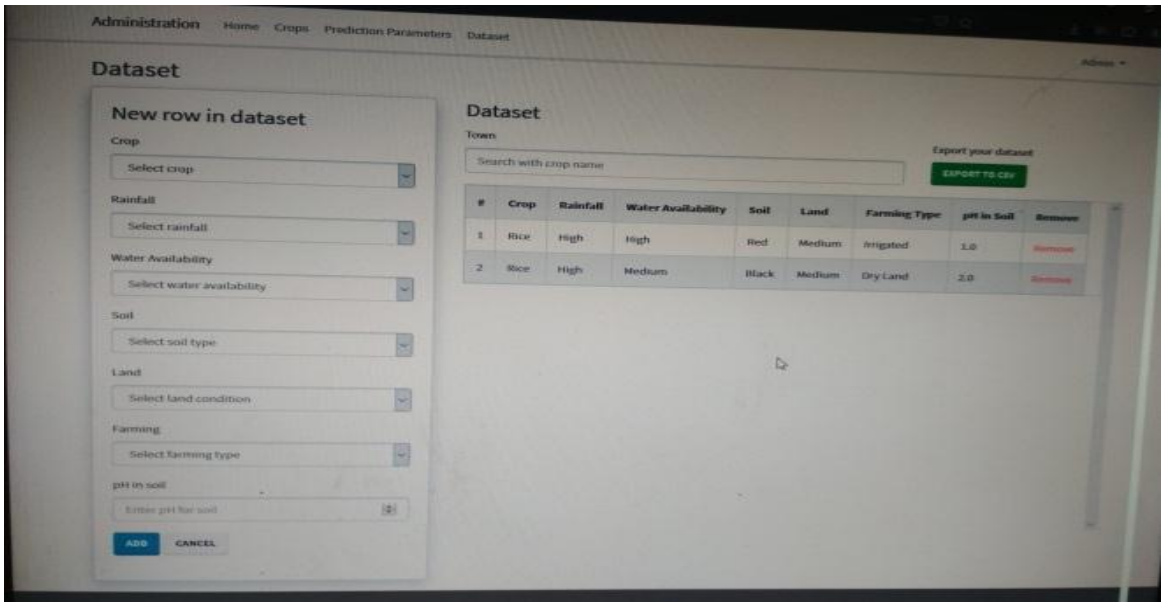

Fig-5

The output is provided in the form of list of crops in the order of high yield rates at first to the farmer. By using this system farmer also comes to know about new crops and their benefits while cultivating them. The farmer can use the system to browse about the new crops which are unknown to the farmer. It also provides full guidance about the fertilization process for the predicted crops which increased profit of farmer.

The below pictures shows the information about new crops:

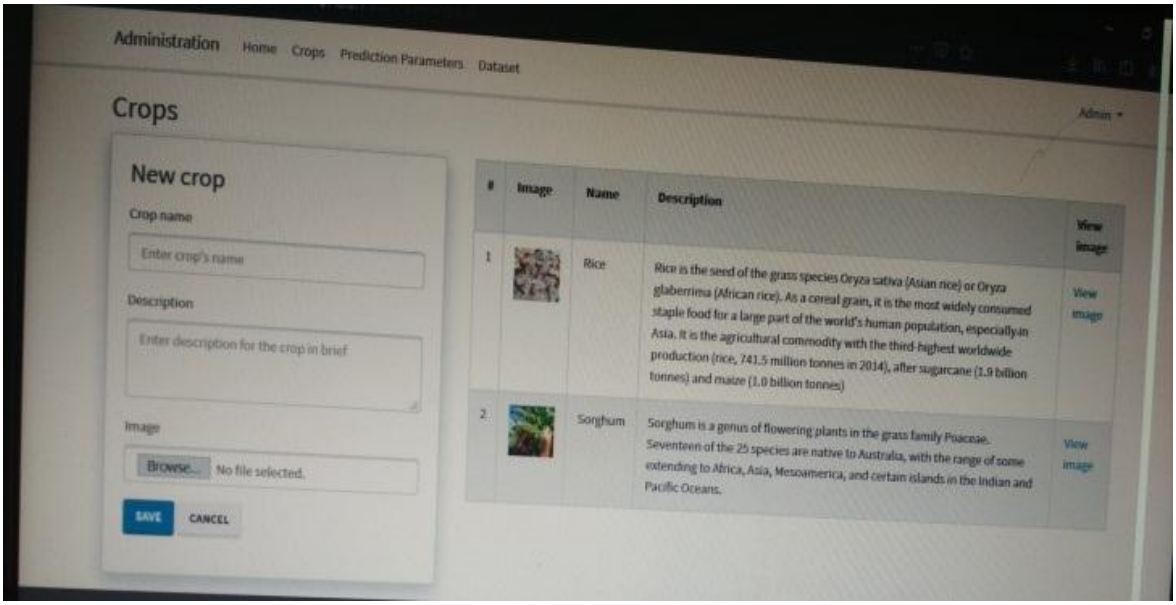

Fig-6

VI. SYSTEM MODULES

The below figure shows the modules of the proposed system. There are total four modules which are soil analysis, soil match, crop prediction and information and the last is fertilization recommendation.

In Soil analysis module, the color of soil is given as input to the system by the end user. Then the system analysis the properties of soil and generates analysis result. In the second module, based on the soil analysis and other different parameters the crop is predicted.

The third module is the prediction modules, which makes prediction of crop based on the input parameters. In addition to this the module provides the crop information for better understanding of the farmer especially in case of new crops.

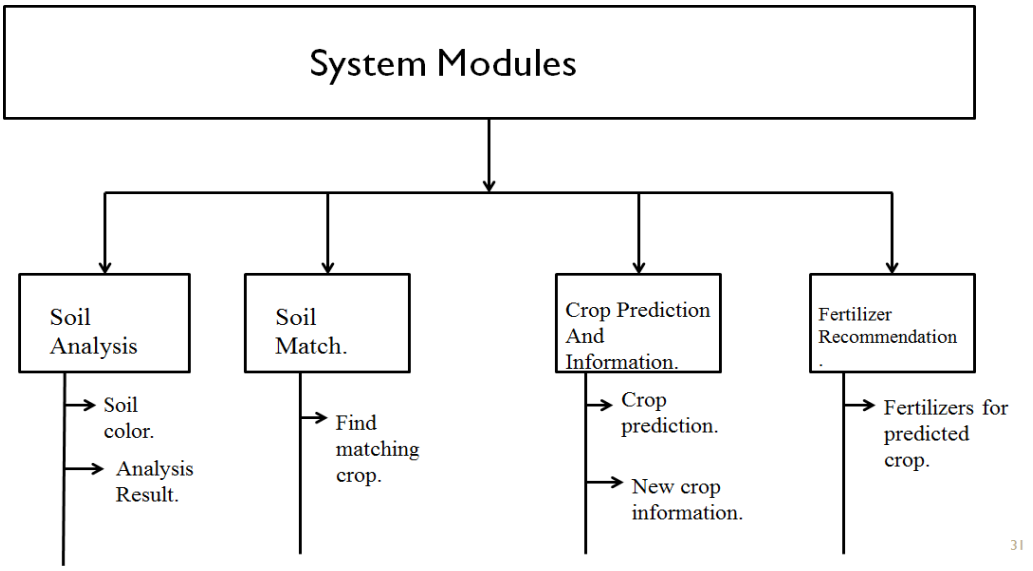

Fig-7: System Modules.

The last module is fertilization recommendation module which suggest the most suitable fertilizers for the predicted crops, to increase the quality of crops and their by yield rates to increase the profit of the farmer.

Some of the examples of crop prediction are:

1) For growing rice the type of soil required is red soil, the farming type is wet and the amount of rainfall required is high.

2) For growing wheat the type of soil required is black soil, the farming type is fertile soil and the amount of rainfall required is medium.

3) For growing onion the type of soil required is brown, the farming type is medium not more wet and not more dry and the amount of rainfall required is medium.

4) For growing maize the type of soil required is red soil, the farming type is wet and the amount of rainfall required can be high or low both can be accepted.

5) For tomato the type of soil required is black soil, the farming type is medium and the amount of rainfall required is medium.

6) For green chills the type soil required is black soil, the farming type is medium and the amount of rainfall required is also medium.

7) For potato the type of soil required can be black or brown soil, the farming type is medium and the amount of rainfall required is medium

VII. CONCLUSION

The proposed system takes into consideration data related with soil, water availability, and weather forecast and then suggest the best crops that are profitable to be grown in the current environmental condition. The proposed system solves the problem of crop selection and makes the farmer aware of the new crops which can be cultivated on their land and increase profit of the farmers. The system in advance also suggests the best suited fertilizers which can help and monitor the growth of crops. Thus, the system will help reduce the difficulties faced by farmers on the agricultural land and reduce the number of suicides attempts of the farmers due to losses. The system provides the benefits for pre-planning the agricultural activities for effective implementation to maximize yield rates and reduce losses. As the system gives the list of crops suitable to be grown, it also

gives new crops to the farmers for cultivation which saves the land of the farmers from getting infertile. The system will be of great help to the farmers to increase the accuracy of farming and increasing profit.

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