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Design and Implementation of Price Forecasting System for Agricultural Commodities using Machine Learning

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ABSTRACT - *India is an country which has agriculture as it's backbone. The recent trends in agriculture is extremely devastating and show huge loss in crops. The profit, too is very low. There are various reasons which affect the profit. We take into consideration those various factors so that the crop market prediction is accurate. The system is based upon Machine Learning Techniques. The algorithm used for crop price prediction is Decision Tree Regression technique. It is used to predict the crop value using the data trained from authentic data sets and forecast the price of the commodity for the next year. This implementation proves to be promising with about >70% accuracy rate.*

Keywords– *Machine Learning, Decision Tree Regression, Prediction, Data Set, Annual Rainfall, WPI Index.*

I. INTRODUCTION

The Indian economy is a thriving one among the world nations which depend upon agriculture. Since agriculture is an age old technique, it is always in the trend. The various global catastrophes have stopped many industries but not agriculture. Since agriculture provides crops to people. They are very much important to any nation. Hence the government takes many measures to make the agriculturists and farmers profitable in any way possible. Nowadays, there are many issues which affect the profit of the farmers. The agricultural industry thrives upon various climatic and economical factors. These various factors play a major role in the crop price in the market. Nowadays farmers are spending a lot on the crops such as fertilisers, seeds, motor, irrigation. Thus the cost of labour is very much higher. The farmers spend day and night in the field ploughing and labour charges too are a burden for them. All of these are already stressful for the farmer. The only hope is the selling profit of the crops. But the crops are affected by the rainfall, WPI Index and other factors. Thus the farmers are not able to sell the crops in a profitable manner. This leads to many famers suicide and leads to loss in the agricultural industry. Nowadays technology has been helping human in any possible way. In the age of Machine Learning, the various errands of human are now solved by machines and AI. The machine learning concept works by using datasets and a specific algorithm. Here, in this proposed system, we collect the dataset of the various crop prices over a period of 10 years. Hence, using the machine learning technique, we can easily solve this issue. Using this, the farmers can easily analyse the crop commodity price for the next few months. The farmer can gain an insight on the various price fluctuation over a period of time. The farmer can then analyse his plans and then accordingly sow the seeds and crops which might be profitable to him. The overall idea of this system is to give an detailed and clear insight to the farmer on various crops and which crop to sow to reap maximum profit.

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II. RELATED WORKS

There are a lot of yield prediction systems out there for farmers and agriculturalists to use and analyse data. But all such systems help farmers only up till the crops are grown and reach the market. Cenas P.V [1] explains that an accurate prediction can be obtained by using a combination of filtering methods to predict prices. He also insists that the datasets collected also play a large impact on affecting the performance of the model. Geetha M [2] in her thesis, has explained low data mining techniques play an integral and a vital role in solving agriculture related issues for farmers. She insists the usage of Decision Tree, Naive Bayes, K- Nearest Neighbours and Random Forest algorithms can help predict yield in production. Haoyang Wu[3] explains that price prediction of agricultural commodities is possible with the help of machine learning techniques like time series analysis and several others. Dr.Isakki [4] explains how crop yield prediction using classical techniques can be achieved using specific machine learning models and data mining tools. Their views and approaches can also be inculcated in predicting the price of the agricultural commodity.

III. SYSTEM OVERVIEW

The system consists of a dashboard with three modules which are then integrated into one. The user enters the system to be shown the Top Gainers – which show the top 5 crops. They are classified based on price per quintal and the change percentage. The Top 5 Losers show the least profitable crops. The Star Commodity column shows the high usage crop and it's forecast for the next 6 months. The individual commodities can also be viewed for info. On clicking the specific commodity, the details like crop type, crop origin, current price. The Brief Forecast shows the month in which the crop had maximum and minimum profit. On clicking the specific commodity crop, the forecast for that crop is shown. This forecast is produced from the Decision Tree Regression Technique. The dataset which is fed into the model, is obtained from the reliable government websites like data.gov.in. The forecast is shown for the next 12 months along with the price per quintal along with the change percentage. Based upon the forecast values, the graph is plotted which graphically shows the rise and fall of the crop price over the course of 12 months.

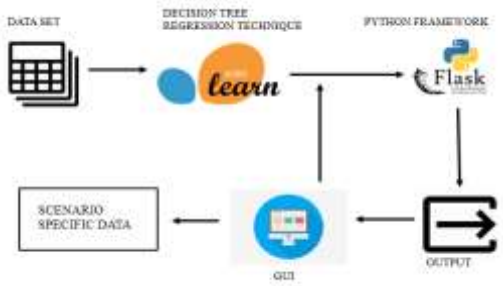

Figure 1: System Architecture

IV. PROPOSED SYSTEM:

The proposed system consists of 3 modules, which are:

A. DATA COLLECTION AND PREPROCESSING:

The datasets which are used are obtained from verified sources and government published websites like data.gov.in etc. They consist of data for 23 different varieties of agricultural commodities (crops) from the past 8-10 years. This data is then processed in order to remove the missing and noisy data. Manual methods were followed in cleaning the data sets by either removing the tuples with missing values or by taking the mean/median of the values thus making the data ready to use to train the machine learning model

B. *PRICE PREDICTION OF COMMODITIES:*

The cleaned datasets are put to train the machine learning model which predicts the price of the agricultural commodity. Decision tree regressor is used in order to predict the price of the crops .Polynomial multivariate regression is used in order to provide better accuracy with the prediction. The factors which are used to predict are rainfall and wholesale price index. The decision tree regressor is much faster than the linear regression techniques which are primarily used for price forecasting. It takes the month, year and the rainfall received as prediction parameters and predicts the WPI index for the necessary month or the portion of the year. The current price is then calculated form the WPI index using respective mathematical formulae. Graphs regarding the rise and fall of prices year wise and month wise are also plotted so as to give a clear picture of how the price has shown variation. The algorithm predicts to about 70%-75% accuracy across several crops with respective change of factors such as natural calamities, pandemics etc.

C. DASHBOARDING OF RESULTS:

The predictions given by the Decision Tree Regressor algorithm are fetched and plotted as graphs so as to give better understanding to the users. Using Flask, a lightweight Python based framework, a dashboard is designed inorder to showcase the results of the predictions. For development purposes, sqlite3 database is used and the application is set up on a particular port. Here the users can find the predictions regarding each and every crops's current price and information about top five gainers and top five losers, year wise graphs depicting the increase and decrease of crop price are also displayed with the help of Chart.js, a javacript framework that helps in visualzing the data in a graphical manner. The user interface is designed in such a manner which enables the common man to use and retrieve the data he requires.

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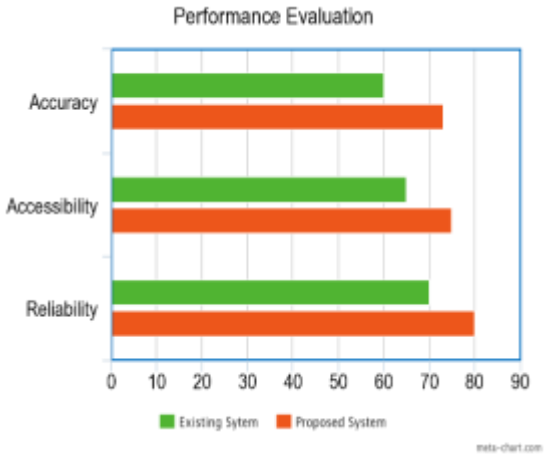

Figure 2: Performance Evaluation

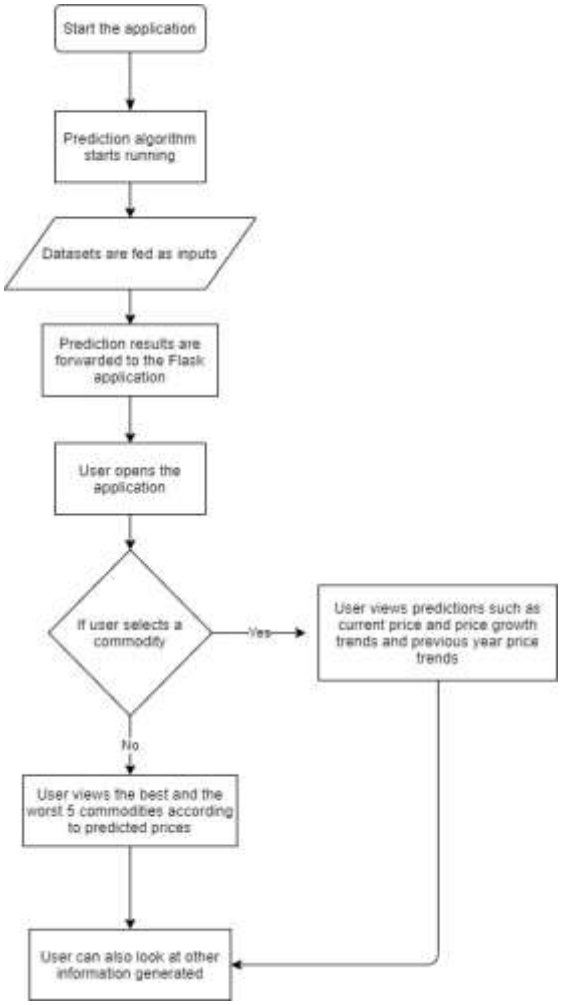

Figure 3: System Flow Diagram

V. OUTPUT RESULTS

Figure 4 shows us the individual crop details which consists of the crop origin, price per quintal and the crop price brief forecast.

Figure 4: Individual Crop Details

Figure 5 shows the graph of the previous 12 month crop price along with the crop price forecast for the next 12 months.

Figure 5: Graph of Yearly Forecast

Figure 6 shows us the crop price forecast for the individual months for the next one year.

Month	Price (per Qtl.)	Change
May 20	₹1564.65	-0.6% ▼
Jun 20	₹1528.2	-2.92% ▼
Jul 20	₹1497.6	-4.86% ▼
Aug 20	₹1497.6	-4.86% ▼
Sep 20	₹1497.6	-4.86% ▼
Oct 20	₹1476.9	-6.17% ▼

Figure 6: Price Forecast Details

VI. FUTURE WORKS

Data from more sources can be obtained in order to provide a better and a more accurate prediction of crop prices. The suggested price prediction technique for agricultural commodities can be enhanced by automating the data collection process. Also, the manual pre processing of datasets can be changed using better data cleaning techniques provided we receive more input than the current system handles. User sign up feature can be added so each farmer can view only the necessary data according to his needs and plan accordingly. The dashboard can also be made available in all vernacular languages to give a better reach to more farmers across the country.

VII. CONCLUSION

The proposed system aims at guiding the farmers by predicting the crop price of various agricultural commodities over the next 12 months. The forecast is also graphically represented. The system provides various info about the crop origin along with the price change percentage over the months.

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