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Seasonal Crop Price Prediction using AI/ML

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Abstract: Seasonal crop price prediction plays an important role in modern agriculture by helping farmers, traders, and government agencies make better economic decisions. Traditional forecasting methods often fail to capture complex seasonal patterns, weather variations, and market fluctuations present in agricultural data. This project proposes a crop price prediction system using Long Short-Term Memory (LSTM), a deep learning technique designed for time-series forecasting. The proposed model utilizes historical crop prices along with seasonal, climatic, and market-related factors such as rainfall, temperature, humidity, and previous market trends to predict future crop prices accurately. LSTM networks are highly effective in learning long-term dependencies and sequential patterns in time-series datasets, making them suitable for agricultural price forecasting

Keywords: Seasonal Crop Price Prediction, LSTM, Machine Learning, Deep Learning, Time-Series Forecasting, Smart Agriculture, Agricultural Data Analysis.

I. INTROCUCTION

Agriculture plays a vital role in the economy of many countries, especially in India, where a large portion of the population depends on farming for their livelihood. One of the major challenges faced by farmers is the uncertainty in crop prices due to seasonal variations, climate conditions, market demand, transportation costs, and production fluctuations. Sudden changes in crop prices often lead to financial losses for farmers and affect the overall agricultural economy.

Accurate prediction of seasonal crop prices can help farmers make informed decisions regarding crop cultivation, harvesting, storage, and selling time. Traditional statistical forecasting methods are limited in handling complex and non-linear patterns present in agricultural market data. With the advancement of Artificial Intelligence (AI) and Machine Learning (ML), deep learning techniques have become highly effective for time-series forecasting applications.

Long Short-Term Memory (LSTM) is a special type of Recurrent Neural Network (RNN) that is designed to learn long-term dependencies and sequential information from historical data. LSTM models are widely used for time-series prediction because they can efficiently analyze past trends and seasonal patterns. In crop price forecasting, LSTM can process historical crop prices along with environmental and market-related factors such as rainfall, temperature, humidity, production quantity, and demand to predict future prices with improved accuracy.

II. LITERATURE SURVEY

Seasonal crop price prediction is an important research area in smart agriculture. Traditional statistical methods such as Linear Regression and ARIMA were initially used for agricultural forecasting. However, these methods were unable to effectively handle complex seasonal patterns and non-linear relationships in crop market data. Later, Machine Learning techniques such as Decision Tree, Random Forest, Support Vector Machine (SVM), and K-Nearest Neighbor (KNN) were introduced to improve prediction accuracy.

Recently, Deep Learning methods have become more popular for time-series forecasting applications. Among these techniques, Long Short-Term Memory (LSTM), a type of Recurrent Neural Network (RNN), has shown excellent performance in crop price prediction. LSTM models are capable of learning long-term dependencies and sequential patterns from historical crop price data, weather conditions, rainfall, temperature, humidity, and market demand.

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III METHODOLOGY

The proposed Seasonal Crop Price Prediction system uses the Long Short-Term Memory (LSTM) deep learning model to forecast future crop prices based on historical agricultural and environmental data. The methodology consists of several phases including data collection, preprocessing, feature selection, model development, training, prediction, and performance evaluation. Initially, the dataset is collected from agricultural market databases and government portals. The dataset contains historical crop prices, rainfall, temperature, humidity, production quantity, market demand, and seasonal information. Since raw datasets often contain missing values, duplicate records, and inconsistent data, preprocessing techniques such as data cleaning, normalization, and handling missing values are applied. Normalization scales the data between 0 and 1, improving the efficiency of the LSTM model. After preprocessing, important features influencing crop prices are selected. These features include previous crop prices, weather conditions, seasonal trends, and production levels. Feature engineering helps the model understand complex patterns and dependencies present in

IV FINDINGS AND TRENDS

The Seasonal Crop Price Prediction system using Long Short-Term Memory (LSTM) demonstrated effective performance in forecasting future crop prices based on historical agricultural and environmental data. The study found that crop prices are significantly influenced by factors such as rainfall, temperature, humidity, seasonal demand, production quantity, and previous market prices. By analyzing these parameters, the LSTM model successfully learned long-term dependencies and seasonal variations present in agricultural datasets.

One of the major findings of this research is that deep learning techniques, especially LSTM, provide better forecasting accuracy compared to traditional statistical and Machine Learning methods. Traditional approaches such as Linear Regression and ARIMA were unable to handle complex non-linear patterns effectively, while the LSTM model captured sequential trends and seasonal fluctuations more accurately.

V FIGURES AND TABLES

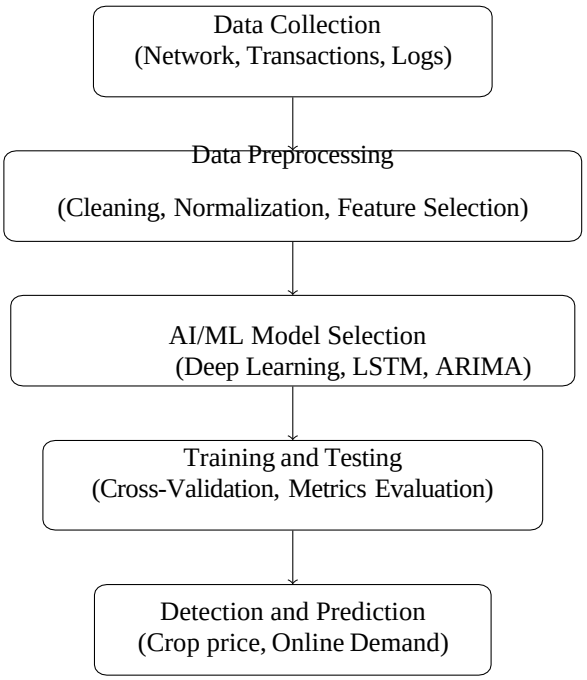

Figure 1: Workflow of Seasonal Crop Price Prediction using AI/ML

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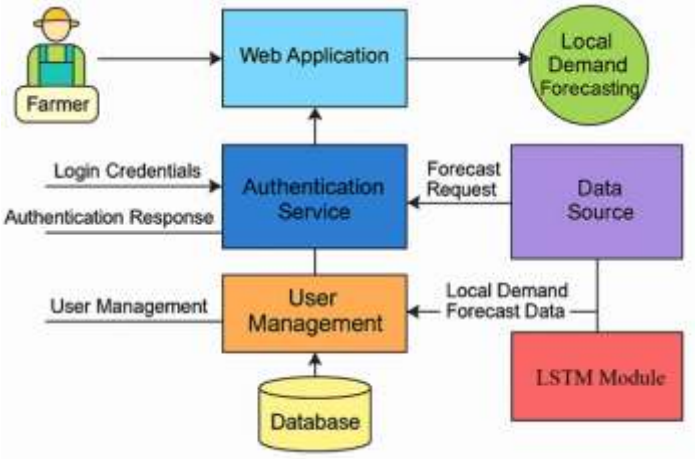

Figure 2: System Architecture of Seasonal Crop Price Prediction using AI/ML

VI CONCLUSION

The Seasonal Crop Price Prediction system using Long Short-Term Memory (LSTM) provides an effective approach for forecasting future agricultural crop prices based on historical and seasonal data. The study demonstrated that crop prices are influenced by multiple factors such as rainfall, temperature, humidity, production quantity, market demand, and previous price trends. Traditional statistical and Machine Learning methods have limitations in handling complex seasonal and sequential patterns, whereas the LSTM model efficiently captures long-term dependencies present in agricultural The proposed system successfully utilized preprocessing techniques, feature engineering, and deep learning methods to improve prediction accuracy. The performance of the model was evaluated using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE), where lower error values indicated better forecasting performance.

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