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Seasonal Crop Price Prediction using LSTM

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Abstract: Predicting agricultural crop prices is a critical task that helps farmers and agricultural stakeholders make informed decisions regarding cultivation, storage, and marketing strategies. Crop prices are influenced by various factors, including seasonal changes, weather conditions, market demand, and supply fluctuations. Due to the complex and dynamic nature of these factors, accurate forecasting remains a significant challenge. This project proposes a Seasonal Crop Price Prediction system using Machine Learning and Long Short-Term Memory (LSTM) networks.

The system analyzes historical crop price data along with environmental and market-related parameters such as temperature, rainfall, humidity, production levels, and previous price trends. LSTM, a powerful recurrent neural network architecture, is capable of capturing temporal patterns and long-term dependencies within time-series data, enabling more precise price predictions. The developed model assists farmers, traders, and policymakers by providing early insights into future market prices, helping reduce risks and improve planning. By leveraging advanced deep learning techniques, the proposed solution contributes to the development of data-driven and sustainable agricultural practices

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

I. INTROCUCTION

Agricultural markets are highly dynamic, and crop prices often vary due to multiple factors such as seasonal conditions, weather changes, market demand, supply levels, and economic influences. These fluctuations create uncertainty for farmers, making it difficult to decide which crops to cultivate and when to sell their produce. As a result, inaccurate pricing decisions can reduce profits and increase financial risks in the agricultural sector. Forecasting crop prices in advance can help stakeholders make better decisions related to farming, storage, distribution, and marketing. However, predicting agricultural prices is a challenging task because crop markets generate large amounts of historical data with complex patterns that are difficult to analyze using traditional forecasting techniques. The emergence of Machine Learning and Deep Learning technologies has provided new opportunities for improving prediction accuracy.

These techniques can analyze historical trends and identify hidden relationships within large datasets. Among them, Long Short-Term Memory (LSTM) networks have proven to be highly effective for time-series forecasting because they can capture both short-term and long-term dependencies in sequential data. This project focuses on developing a Seasonal Crop Price Prediction system using LSTM networks. The model utilizes historical crop price records and related factors such as rainfall, temperature, humidity, production volume, and market trends to estimate future crop prices. By learning from past data patterns, the system aims to provide accurate forecasts that assist farmers, traders, and agricultural authorities in planning and decision-making. The proposed solution supports the adoption of data-driven agriculture by reducing uncertainty in crop pricing and helping stakeholders respond more effectively to changing market conditions. Through the application of advanced deep learning methods, the project contributes to improving agricultural productivity, profitability, and sustainability.

II. LITERATURE SURVEY

Crop price prediction has been widely studied to support agricultural planning and decision-making. Earlier, traditional methods such as Linear Regression and ARIMA were used for forecasting crop prices, but they had limitations in handling complex seasonal and market patterns.

Later, Machine Learning techniques such as Decision Tree, Random Forest, Support Vector Machine (SVM), and K-Nearest Neighbor (KNN) improved prediction accuracy by analyzing historical data and market factors. However, these models often struggled with long-term time-series dependencies. Recent research has focused on Deep Learning models, particularly Long Short-Term Memory (LSTM) networks. LSTM can effectively learn sequential patterns from

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historical crop prices, weather conditions, rainfall, temperature, humidity, and market trends. Due to its high forecasting accuracy, LSTM has become a popular choice for seasonal crop price prediction in smart agriculture.

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III. METHODOLOGY

The proposed Seasonal Crop Price Prediction system utilizes a Long Short-Term Memory (LSTM) model to forecast future crop prices using historical agricultural and weather-related data. The methodology involves several stages, including data collection, preprocessing, feature selection, model training, prediction, and evaluation. Initially, data is gathered from agricultural market records and public datasets containing historical crop prices, rainfall, temperature, humidity, production levels, and seasonal information. The collected data is then preprocessed by removing duplicate records, handling missing values, and normalizing the data to improve model performance.

After preprocessing, relevant features such as previous crop prices, weather parameters, seasonal factors, and production data are selected for analysis. These features are used as inputs to the LSTM model, which learns patterns and trends from historical data to predict future crop prices. Finally, the model is trained and tested using the prepared dataset. The prediction results are evaluated using performance metrics to measure accuracy and forecasting effectiveness. The developed system helps provide reliable crop price forecasts for better agricultural planning and decision-making.

IV. FINDINGS AND TRENDS

The analysis of historical agricultural data revealed several important trends affecting crop prices. Factors such as rainfall, temperature, humidity, seasonal demand, production quantity, and previous market prices were found to have a significant impact on price fluctuations. Seasonal patterns showed that crop prices tend to vary during different harvesting and marketing periods. The LSTM model successfully identified these trends and learned the relationships between environmental conditions and market behavior.

V. FIGURES AND TABLES

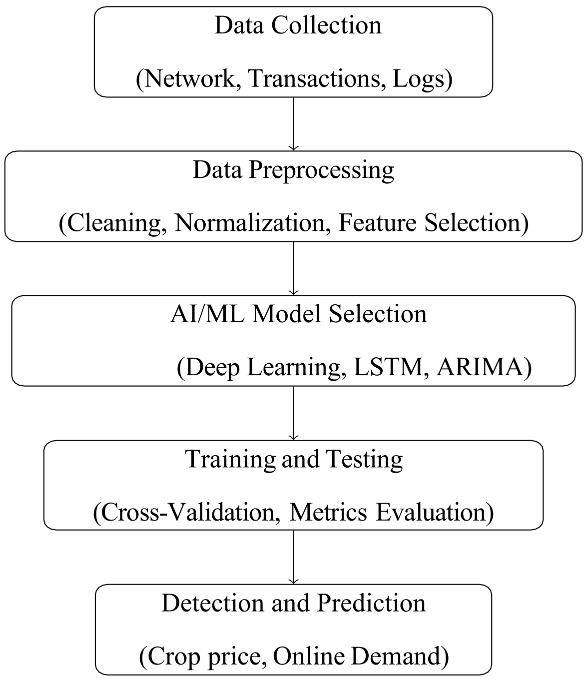

Figure 1: Workflow of Seasonal Crop Price Prediction using AI/ML

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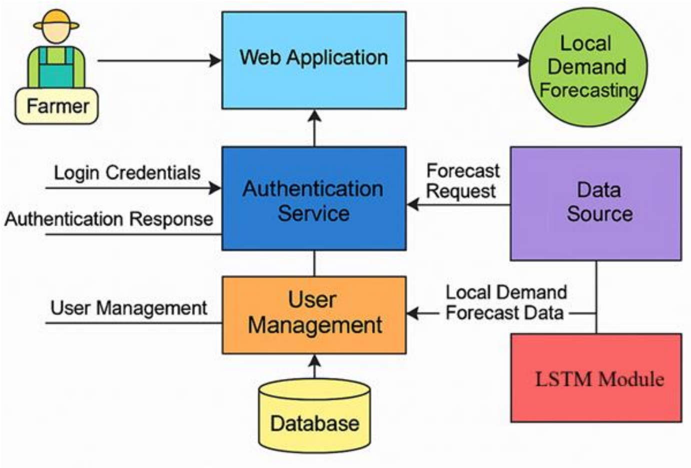

Figure 2: System Architecture of Seasonal Crop Price Prediction using LSTM

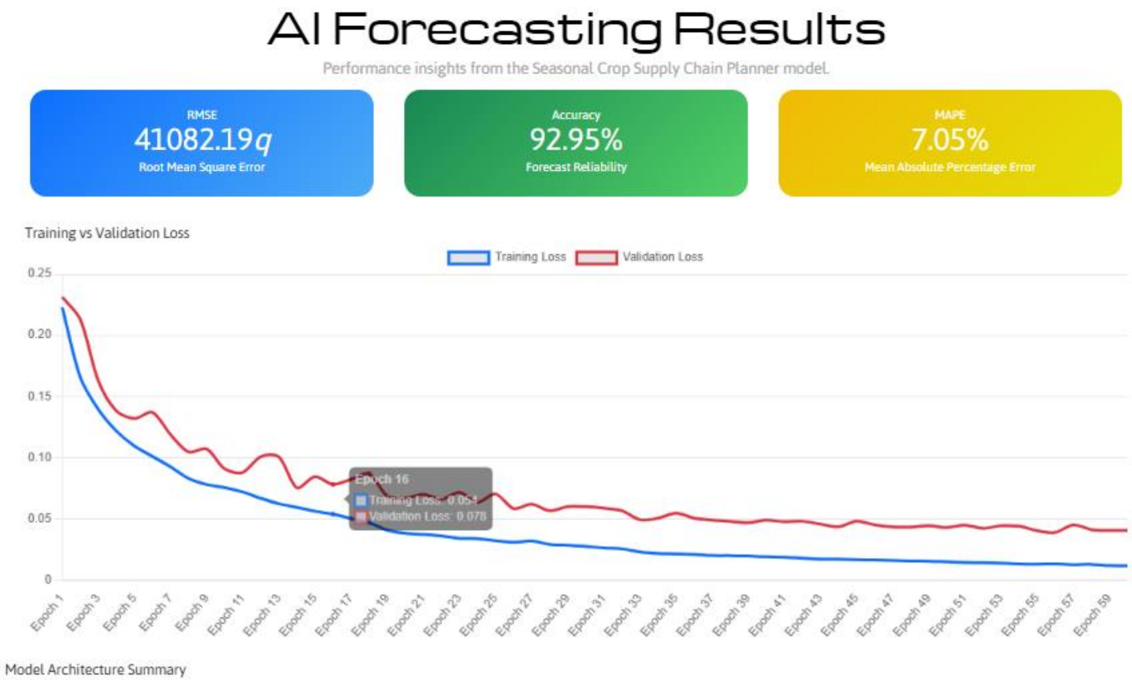

Figure 3: System Result of Seasonal Crop Price Prediction using LSTM

VI. CONCLUSION

Conclusion

The Seasonal Crop Price Prediction system developed using the Long Short-Term Memory (LSTM) model proved an effective solution for forecasting future crop prices. By utilizing historical price records along with environmental and market-related factors such as rainfall, temperature, humidity, production quantity, and seasonal demand, the model was able to accurately identify price trends and patterns. The study demonstrated that LSTM networks are well suited for agricultural time-series forecasting due to their ability to capture long-term dependencies and seasonal variations within the data. The implementation of data preprocessing, feature selection, and deep learning techniques further enhanced the prediction performance of the system.

The evaluation results, measured using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE), indicated that the proposed model provides reliable and accurate forecasts. Accurate crop price prediction can help farmers make informed decisions regarding cultivation, storage, and marketing, thereby reducing financial uncertainty and improving profitability. In conclusion, the proposed LSTM-based crop price prediction system contributes to the advancement of smart agriculture by providing a data-driven approach for agricultural market forecasting. Future enhancements may

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include incorporating real-time market information, government policy data, and advanced deep learning models to further improve prediction accuracy and decision support capabilities.

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