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AI-Based Smart Sericulture System

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ABSTRACT—

Sericulture is an important rural activity that provides income and employment to many farmers and contributes significantly to the silk industry. Farmers involved in sericulture face several practical difficulties, including changes in cocoon prices, difficulty in maintaining income and expense records, and problems in arranging materials needed for silkworm rearing. These issues can make financial planning and daily farm management difficult. This paper presents an AI-Based Smart Sericulture Management System that combines three major functions in one platform: cocoon price prediction, financial management, and resource booking. The system uses previous cocoon price information to study market patterns and estimate future prices. This information can help farmers understand possible price changes while planning the sale of their cocoons. The financial management feature allows users to record income and expenses and view basic profit or loss information. The resource booking feature helps farmers arrange materials such as mulberry leaves, rearing trays, and disinfectants in advance. By bringing these activities together, the proposed system reduces the need for separate manual processes and makes important information easier to manage. The system is intended to support better planning, efficient use of resources, and improved financial management. It also shows how AI and digital technologies can be applied to traditional sericulture practices.

Keywords— Artificial Intelligence (AI), Sericulture, Cocoon, Price Prediction, Financial Management, Resource Booking, Machine Learning, Smart Farming, Decision Support System.

I. INTRODUCTION

Sericulture is an agro-based activity that supports the livelihood of many farmers, particularly in rural areas. India is one of the important silk-producing countries, so sericulture has a significant role in the rural economy. In spite of its importance, farmers have to deal with problems such as changing cocoon prices, manual financial record keeping, and

difficulty in obtaining materials required for silkworm rearing. These problems can affect farm income and make regular management more difficult.

Artificial Intelligence can be useful in agriculture because it can process existing data and identify patterns that may not be easy to find manually. For sericulture, historical cocoon price records can be analyzed to understand earlier market movements and estimate possible future prices. Such information can give farmers an additional basis for planning when to sell their cocoons. Financial management is another important area because farmers need to know their actual income, expenses, and profit. A digital system can make it easier to enter transactions and check financial details when needed.

Resource management is also important in sericulture. Farmers require materials such as mulberry leaves, rearing trays, and disinfectants at different stages of production. A booking facility can help them arrange these resources before they are required. To meet these needs, the proposed system combines cocoon price prediction, financial management, and resource booking in a single platform. The price prediction component uses LSTM to work with historical price data, while the other modules handle financial records and resource reservations. The overall aim is to reduce manual work and provide useful information in an organized form.

II. RELATED WORK

AI and Machine Learning are increasingly being used in agriculture for prediction, analysis, and decision support. Researchers have studied different methods for using historical agricultural data to understand trends and estimate future market values. Time-series methods such as Long Short-Term Memory (LSTM) and machine-learning techniques such as Random Forest are commonly discussed for handling patterns in data. Digital financial systems have also been developed to help farmers record income and expenses, reducing dependence on notebooks and manual calculations. However, many of these systems are designed for general agricultural activities rather than the specific requirements of sericulture.

Online resource booking and inventory systems have also been used in agriculture. Such systems allow users to check or reserve items such as seeds, fertilizers, and equipment in advance. They can improve resource planning, but they usually work separately from market forecasting and financial management. Therefore, there is a need for systems that bring several related functions together for a particular agricultural sector.

Russell and Norvig provided a broad foundation for Artificial Intelligence, including intelligent agents, knowledge representation, reasoning, learning, and decision-making. These concepts are useful for agricultural decision-support systems because AI can process information and assist users in making decisions based on available data [1].

Goodfellow, Bengio, and Courville explained important ideas in deep learning and neural networks. Their work describes how layered models can learn useful patterns from large datasets. This is relevant to agricultural data because relationships between market variables may be complex and may change over time. Deep-learning methods can therefore be used as a basis for prediction applications [2].

Hochreiter and Schmidhuber introduced Long Short-Term Memory networks to handle long-term dependencies in sequential data. LSTM can retain useful information over a sequence, making it suitable for time-dependent applications. In the proposed system, historical cocoon prices can be provided to an LSTM model to identify time-based patterns and estimate future prices [3].

Breiman introduced Random Forest, an ensemble method that combines several decision trees to produce a prediction. It can be used for classification and regression and can work with multiple input variables. Because agricultural outcomes may depend on several factors, Random Forest can also be considered for agricultural decision-support applications [4].

The Food and Agriculture Organization has highlighted the importance of digital technologies, data, and AI in modern agriculture. Digital tools can provide timely information and support farmers in planning and managing agricultural activities. These ideas are relevant to systems that provide market, financial, and resource information to sericulture farmers [5].

The Central Silk Board provides information about India's sericulture sector, including silk and cocoon production, cultivation practices, and farming communities. Such sector information shows the economic importance of sericulture and the need to manage production costs and market-related changes effectively [6].

The Ministry of Textiles has discussed initiatives related to modernization and development of the Indian silk sector. These efforts include improving production, infrastructure, farmer support, and technology adoption. Digital systems can complement such developments by providing tools for market analysis, financial planning, and resource management [7].

Han, Kamber, and Pei described data-mining methods for finding useful patterns in large datasets. Their work covers preprocessing, pattern discovery, classification, clustering, and prediction. These methods can support agricultural systems where historical information needs to be analyzed to identify useful trends [8].

Mitchell explained the basic principles of Machine Learning, where computer systems learn patterns from previous data and use those patterns to make predictions for new cases. This concept provides a foundation for using machine learning with historical market information in an agricultural decision-support system [9].

Chollet presented practical methods for building deep-learning applications using Python frameworks such as TensorFlow and Keras. The process includes preparing data, creating a model, training it, evaluating its performance, and generating predictions. These approaches can support the development of the LSTM forecasting component in the proposed system [10].

Mohri, Rostamizadeh, and Talwalkar discussed the theory of machine learning, including model training, generalization, and evaluation. Their work emphasizes testing models on unseen data so that a model does not simply memorize the training dataset. These principles are important when evaluating cocoon price prediction models [11].

Sutton and Barto explained reinforcement learning, in which an agent learns actions by interacting with an environment and receiving feedback. Although the proposed system uses forecasting rather than reinforcement learning, these ideas show the wider possibilities of AI for future agricultural decision-support systems [12].

Murphy discussed probabilistic machine-learning methods for representing uncertainty and making predictions when information can vary. Agricultural conditions are often uncertain because market prices, production levels, and resource requirements change over time. These concepts can be useful when developing future systems that present predictions along with uncertainty information [13].

Domingos discussed how machine learning can be applied to real-world problems by allowing computers to find useful patterns in data. Selecting an approach based on the problem and available data is important. These ideas support the use of machine learning for analyzing historical market information in sericulture [14].

Géron described practical workflows for machine-learning and deep-learning projects, including data preparation, feature processing, training, evaluation, and deployment. These steps are useful for building an end-to-end prediction component because the quality of the data and evaluation process affects the final system [15].

Webster and Eren discussed sensing, measurement, and instrumentation technologies for collecting and processing information. Although the proposed project does not depend on IoT sensors, the importance of reliable and consistent data is still relevant. Accurate historical market and financial data are needed for useful analysis [16].

Kamilaris and Prenafeta-Boldú reviewed the use of deep learning in agriculture and described applications such as monitoring, classification, and yield-related analysis. Their work shows that deep-learning techniques can identify useful patterns in agricultural datasets. Similar approaches can be extended to sericulture and market forecasting [17].

Wolfert and colleagues studied Big Data technologies in smart farming and explained how data from different sources can support better agricultural decisions. Their work highlights the importance of collecting, integrating, and analyzing data. These ideas are relevant to a system that combines cocoon prices, financial records, and resource information [18].

Jain discussed economic factors in sericulture, including production costs, market conditions, pricing, and issues affecting farmer profitability. These factors show why a system that combines market analysis with financial management can be useful for sericulture farmers [19].

Buyya and colleagues discussed cloud computing as a flexible way to provide storage, processing, and software resources. Cloud infrastructure can allow agricultural applications to store information centrally and make it available from different locations. In a future version of the proposed system, cloud services could be used for price data, financial records, prediction results, and farmer information [20]. III.

III. RESEARCH GAP

Research in AI, Machine Learning, and Deep Learning has covered many agricultural areas such as crop prediction, disease detection, monitoring, and smart farming. However, the use of AI for complete sericulture management is less developed. Existing sericulture-related work mainly discusses production methods, cocoon quality, market conditions, and economic factors, while fewer solutions combine these areas with digital decision-support features.

Another gap is that many available systems focus on only one requirement. Cocoon prices can change and directly influence farmer income, so price forecasting can be useful for planning. At the same time, farmers need a simple way to record expenses and income and arrange the materials required for rearing. There is limited integration of price prediction, financial management, and resource booking in a single platform designed for sericulture.

The proposed system attempts to address this gap by bringing LSTM-based cocoon price forecasting, financial management, and resource booking into one application. Historical market data are used for price analysis, while the management modules help organize financial and resource-related information. Combining these functions provides a single place where farmers can access information needed for regular planning and management.

IV. PROPOSED SYSTEM

The proposed AI-Based Smart Sericulture Management System is intended to make daily sericulture activities easier to manage. It combines three main functions: cocoon price prediction, financial management, and resource booking. Historical cocoon price records are given to an LSTM model so that it can learn price patterns over time and estimate possible future prices. This information can help farmers understand market trends while planning the sale of their cocoons.

The system uses a centralized database to store the information required by the different modules. The financial management module allows farmers to enter income and expense details and provides basic profit and loss information. This gives users a clearer view of their financial position and can help them plan future expenses.

The resource booking module allows farmers to reserve materials such as mulberry leaves, rearing trays, and disinfectants when they are needed. Instead of making separate arrangements for each activity, users can access the different services through one dashboard. The main goal is to reduce manual effort, organize information, and make common sericulture management tasks more convenient.

By combining prediction and management features, the system provides a practical decision-support approach for farmers. It does not replace the farmer's own decisions; instead, it provides information that can be considered while planning sales, expenses, and resource requirements.

V. SYSTEM ARCHITECTURE OF PROPOSED SYSTEM

The proposed architecture is organized into three main layers: the Presentation and Interaction Layer, the Data Layer, and the Analytics Layer. These layers work together to collect information from users, store it, process it, and return useful results.

The Presentation and Interaction Layer is the user-facing part of the system. Farmers and administrators can access the system through a web or mobile application. They can enter information, view records, and use the available services. Requests from the application are handled by the web server, which communicates with the data layer. This layer therefore provides the connection between users and the system's internal components.

The Data Layer manages the collection and storage of system information. Records such as images, logs, financial information, price data, and other details can be stored in a central database. A backup component can be used to maintain copies of important records. The stored information can then be supplied to the analytics layer when analysis or prediction is required.

The Analytics Layer processes the available information using AI models and an analytics engine. The processed information can be used to create analysis and prediction results for farmers and administrators. For example, historical cocoon prices can be processed by the LSTM model to produce future price estimates.

The three layers follow a simple flow: users interact with the application, information is stored and managed in the database, and the stored data is analyzed to produce useful results. This structure keeps the system organized and allows the different functions to work together.

VI. ALGORITHMS USED IN EXISTING SYSTEM

The main AI technique proposed for cocoon price prediction is Long Short-Term Memory (LSTM). LSTM is a type of Recurrent Neural Network designed for sequential and time-dependent data. The model receives earlier cocoon price records and learns patterns in how prices change over time. After training, it can be used to estimate future price values and provide information about possible market trends.

Before training the LSTM model, the price dataset needs to be prepared. The data is cleaned, arranged according to time, and normalized so that the model can process the values effectively. The dataset is then separated into training and testing portions. Training data is used to learn the patterns, while testing data is used to check the model's performance on values that were not used during training.

The financial management module mainly uses basic data processing and calculations. It can add income and expense entries and calculate totals and profit or loss. The resource booking module uses database operations to search available resources, check their availability, and store booking information. Therefore, the overall system combines an LSTM prediction method with straightforward financial and database-processing functions.

VII. COMPARATIVE ANALYSIS

Traditional sericulture management often depends on the farmer's experience, local market information, and manual records. Farmers may use current market information when deciding when to sell cocoons, while income and expenses may be written in notebooks. This can make it difficult to view financial information in an organized way. The proposed system provides digital financial records and uses historical price information with an LSTM model to generate price estimates.

Resource management is another area where the two approaches differ. In traditional practice, farmers may contact suppliers or make separate arrangements to obtain required materials. The proposed system provides a resource booking feature through which users can check and reserve materials such as mulberry leaves, rearing trays, and disinfectants. This brings several activities together instead of handling each one separately.

The proposed platform therefore provides a more organized, data-based method of managing the selected sericulture activities. At the same time, the usefulness of the prediction module depends on the quality, size, and relevance of the historical cocoon price dataset. The prediction should therefore be treated as supporting information rather than a guarantee of future market prices.

VIII. LIMITATIONS OF EXISTING SYSTEM

Many existing sericulture activities are still managed manually. Farmers may depend on personal experience, local market information, and handwritten records when making decisions. Since cocoon prices can change over time, current prices alone may not provide enough information for understanding future trends. Without a prediction tool, planning the sale of cocoons can be more difficult.

Manual financial record keeping is another limitation. Income and expenses may be written in notebooks or other records, which can take time and may lead to missing or incorrect entries. When records are not organized, calculating total income, total expenses, and profit or loss becomes harder. This can also make future financial planning more difficult.

Resource management can also require separate arrangements. Farmers may need to contact different suppliers to obtain mulberry leaves, rearing trays, disinfectants, and other materials. If a required resource is not available at the right time, it can create additional difficulty. Existing methods generally do not provide one common platform for checking availability and booking resources in advance.

IX. FUTURE RESEARCH DIRECTION

The proposed system can be improved in several ways. A larger and more regularly updated cocoon price dataset from different markets and regions could be used to train the LSTM model. More data may help the model learn a wider range of price patterns. Other machine-learning and deep-learning methods can also be tested and compared as part of future work.

The financial module can be expanded with monthly reports, detailed expense categories, and graphical displays of income and expenses. The resource booking module can include more suppliers and provide updated information about resource availability and booking status. These additions could make the system more useful for regular farm management.

A future version can also be provided as a mobile application with support for regional languages. Cloud-based storage can make information available from different locations and support centralized data management. Additional AI-based recommendations could be developed using market trends and farmer records. These improvements could make the platform more accessible and practical for sericulture users.

X. CONCLUSION

The AI-Based Smart Sericulture Management System brings important sericulture activities together in one digital platform. The system combines cocoon price prediction, financial management, and resource booking to address some common management difficulties faced by farmers. The LSTM model uses historical cocoon price data to identify time-based patterns and estimate future prices, providing additional information for sales planning.

The financial management module helps users maintain income and expense records and understand basic profit or loss information. The resource booking module helps farmers arrange important materials such as mulberry leaves, rearing trays, and disinfectants in advance. By placing these functions in one platform, the system can reduce manual work and make information easier to manage.

Overall, the project demonstrates one possible way of applying AI and digital technologies to traditional sericulture practices. The system can support financial planning, resource organization, and market-related decision making. Future improvements in data collection, model evaluation, mobile access, language support, and additional features can further develop the platform into a more complete digital support system for sericulture management.

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