AgriConnect: AI-Powered Smart Agriculture Marketplace

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ABSTRACT

Agricultural trading faces challenges such as dependence on intermediaries, price uncertainty, limited market access, and difficulties in verifying crop quality. To address these issues, this paper proposes AgriConnect, an AI- and blockchain-based smart agricultural marketplace that connects farmers and buyers directly. The platform enables farmers to list crops and buyers to purchase products, compare prices, and communicate through voice calls, video calls, or a chatbot.

A Convolutional Neural Network (CNN) is proposed to detect visible crop quality defects using freshly captured images through the application's camera, without allowing gallery uploads for quality analysis. Random Forest Regression will estimate crop prices using historical market data and relevant crop, date, and location features, enabling comparisons between selected agricultural markets. Blockchain technology and smart contracts will support transparent digital agreements and tamper-evident transaction records. Product images and other large files will be stored off-chain where appropriate, while relevant verification hashes and transaction references may be recorded on-chain.

The proposed system will be evaluated using precision, recall, F1-score, and a confusion matrix for quality classification, and Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R^2 for price prediction. AgriConnect aims to improve agricultural market transparency, support informed purchasing decisions, and reduce unnecessary intermediaries through the integration of artificial intelligence, direct communication, location-based price estimation, and blockchain technology. Actual system performance will be established through implementation and experimental testing.

Keywords— AgriConnect, Smart Agriculture, CNN, Random Forest Regression, Crop Quality Detection, Price Prediction, Blockchain, Smart Contracts.

I. INTRODUCTION

Agriculture plays an important role in the economy, but farmers often face challenges such as limited market access, dependence on intermediaries, price uncertainty, and difficulties in assessing crop quality. Buyers may also struggle to find reliable products, compare market prices, and establish transparent agreements. These challenges create a need for a digital platform that connects farmers and buyers while improving transparency and decision-making.

AgriConnect is a proposed AI- and blockchain-based agricultural marketplace that enables farmers to list their crops and allows buyers to browse, compare, and purchase products directly. The platform will support communication through voice calls, video calls, and a chatbot. A Convolutional Neural Network (CNN) will identify visible crop defects from freshly captured camera images, while Random Forest Regression will estimate crop prices using historical market data and location-related features.

The system will also provide location-based market price comparisons and use blockchain technology and smart contracts to support transparent digital agreements and tamper-evident transaction records. Product images will be stored off-chain where appropriate, while relevant verification information may be recorded on-chain. By integrating artificial intelligence, direct communication, and blockchain, AgriConnect aims to support informed agricultural trading and reduce unnecessary intermediaries. The

system's effectiveness will be determined through implementation and testing.

II. PROBLEM STATEMENT AND RESEARCH OBJECTIVES

A. Problem Statement

Farmers often face difficulties in reaching buyers directly, obtaining fair prices, and accessing transparent market information. Buyers may struggle to verify crop quality, compare prices across locations, and establish reliable agreements. Existing agricultural trading methods may lack integrated facilities for AI-based quality detection, location-based price prediction, direct communication, and blockchain-supported agreements. Therefore, an integrated platform is needed to improve transparency, product assessment, and direct agricultural trading.

B. Research Objectives

The main objectives of AgriConnect are:

- To develop a digital marketplace connecting farmers and buyers directly.
- To enable crop quality assessment using a CNN model and freshly captured camera images, without gallery uploads.
- To estimate crop prices using Random Forest Regression and compare prices across selected agricultural markets.
- To provide direct communication through voice calls, video calls, and a chatbot.
- To implement blockchain and smart contracts for transparent digital agreements and tamper-evident transaction records.
- To evaluate the proposed models using appropriate classification and regression metrics.
- To improve transparency, support informed purchasing decisions, and reduce unnecessary intermediaries in agricultural trading.

III. LITERATURE REVIEW AND RESEARCH GAP

A. Literature Review

Cao et al. [1] studied blockchain-based platforms in agricultural supply chains and highlighted their potential to improve transparency, traceability, and trust. However, blockchain adoption and operational costs must also be considered. Nayak et al. [2] investigated machine learning and deep learning approaches for forecasting prices of tomato, onion, and potato in India, demonstrating the importance of historical prices and external factors in agricultural price prediction. Their work supports the use of data-driven models for agricultural market analysis.

CNN-based image classification provides a suitable approach for identifying visual patterns and defects in agricultural products. Random Forest Regression can model relationships between historical market prices and relevant features to estimate crop prices. These techniques provide a foundation for integrating crop quality assessment and price prediction into a digital agricultural marketplace.

B. Research Gap

Existing agricultural marketplace and supply-chain approaches do not necessarily combine direct farmer–buyer communication, camera-based crop quality detection, location-based price prediction, and blockchain-supported agreements in one platform. AgriConnect addresses this gap by integrating CNN-based visual quality assessment, Random Forest price estimation, market comparison, voice and video calls, chatbot communication, and blockchain smart contracts. The proposed system aims to provide buyers with quality assessment reports and both parties with more transparent trading and agreement records. Its effectiveness will require implementation and experimental evaluation.

IV. PROPOSED SYSTEM AND SYSTEM ARCHITECTURE

A. Proposed System

AgriConnect is an AI- and blockchain-based agricultural marketplace designed to connect farmers and buyers directly. Farmers can list their crops with details such as crop name, quantity, price, location, and quality

information. Buyers can browse available products, compare estimated prices across selected markets, and communicate with farmers through voice calls, video calls, or a chatbot.

The system uses a Convolutional Neural Network (CNN) to assess visible crop quality defects from images captured directly through the application's camera. Gallery uploads are not permitted for this quality-analysis feature. Random Forest Regression is used to estimate crop prices from historical market data and relevant features, including crop type, date, and location.

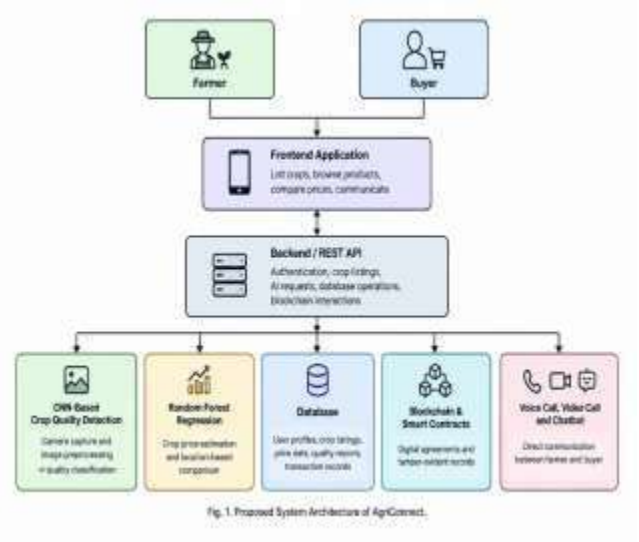
Blockchain technology and smart contracts support transparent digital agreements and tamper-evident transaction records. Large files, such as crop images, may be stored off-chain, while relevant verification hashes and transaction references can be recorded on-chain.

B. System Architecture

The proposed architecture consists of five main layers:

1. User Interface Layer: Provides separate interfaces for farmers and buyers to list, browse, compare, and purchase crops.
2. Application and API Layer: Handles authentication, crop listings, communication features, and requests between the frontend and backend.
3. AI Processing Layer: Uses the CNN model for visual quality assessment and Random Forest Regression for crop price estimation.
4. Database Layer: Stores user profiles, crop listings, historical price data, quality reports, and transaction references.
5. Blockchain Layer: Uses smart contracts to manage digital agreements and maintain tamper-evident records of relevant transactions.

These layers work together to provide direct agricultural trading, AI-assisted decision-making, location-based price comparison, and blockchain-supported transparency. The actual performance and integration of each component must be verified through implementation and testing.



V. METHODOLOGY

A. CNN-Based Crop Quality Detection

The Convolutional Neural Network (CNN) is used to classify visible crop quality conditions from images captured directly through the application's camera. The application requests camera permission, captures an image, and displays a preview before sending it to the model. Gallery uploads are disabled for this feature.

The image is resized and normalized before being passed to the trained CNN. The model extracts visual features and predicts a quality category based on its training classes. The resulting classification is displayed to the user as a quality assessment report. The model's performance will be evaluated using precision, recall, F1-score, and a confusion matrix. Its predictions are limited to visible features and do not guarantee the absence of internal defects or contamination.

B. Location-Based Crop Price Prediction

Random Forest Regression is used to estimate crop prices using historical market data. Relevant input features may include crop type, historical price, date, and market location. The dataset is cleaned, missing values are handled, and categorical features are encoded where required. The data is divided into training and testing sets to evaluate model performance.

The trained model estimates prices for selected crops and locations, helping users compare

expected prices across markets. Prediction performance will be measured using Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and the coefficient of determination (R^2). Predicted prices are estimates and must be distinguished from verified live market prices.

C. Blockchain and Smart Contract Workflow

When a farmer and buyer agree on a transaction, the platform records the relevant agreement details through a smart contract, according to the implemented contract rules. Transaction references and verification hashes can be stored on the blockchain to support record integrity and traceability. Personal information and large files should remain off-chain where appropriate to reduce privacy and storage risks.

The system can verify recorded transaction information against its stored reference. Blockchain records help make unauthorized changes detectable but do not independently verify the physical quality of crops or guarantee that the information originally entered was correct.

D. Integration and Evaluation

The frontend communicates with the backend through APIs. The backend manages user authentication, crop listings, AI-model requests, price predictions, and blockchain interactions. Database records connect users, products, quality reports, and transactions.

Testing will cover camera permissions and image capture, model predictions, price estimation, market comparison, user communication, smart-contract operations, and data integrity. Model metrics and functional test results will be reported after experiments are completed; numerical performance results will not be assumed in advance.

VI. IMPLEMENTATION, TESTING, RESULTS AND DISCUSSION

A. Implementation

AgriConnect follows a modular architecture consisting of a frontend, backend APIs, database, AI models, and blockchain smart contracts. The frontend supports crop listings, product browsing, price comparison, and farmer–buyer communication. The backend manages application requests and coordinates database operations, AI processing, and blockchain interactions.

The CNN module processes camera-captured crop images to classify visible quality defects, while the Random Forest Regression module estimates crop prices from historical market data. Smart contracts support digital agreements and tamper-evident transaction records. The final implementation status of each module depends on completed development and integration.

B. Testing and Evaluation

Functional testing will verify user registration, crop listing, product browsing, camera permissions, image capture, quality classification, price prediction, market comparison, communication features, and smart-contract operations.

CNN performance will be evaluated using precision, recall, F1-score, and a confusion matrix. Price prediction will be evaluated using MAE, RMSE, and R^2. Security testing will examine authentication, access control, input validation, and the integrity of stored transaction references.

C. Results and Discussion

The proposed integration of AI and blockchain is intended to support crop quality assessment, price estimation, and transparent agricultural transactions. The marketplace may help farmers reach buyers directly and allow buyers to make more informed purchasing decisions.

However, the reliability of quality classification depends on the training dataset and image conditions. Price estimates depend on the accuracy, coverage, and freshness of historical market data. Blockchain provides tamper-evident records but cannot guarantee the correctness of information entered into the system. Quantitative results and claims of improved performance must be established through actual experiments.

VII. CONCLUSION AND FUTURE SCOPE

AgriConnect proposes an integrated agricultural marketplace that combines artificial intelligence, location-based price estimation, direct farmer–buyer communication, and blockchain technology. CNN-based image classification can support the assessment of visible crop quality defects, while Random Forest Regression can estimate crop prices using historical market data. Smart contracts can support transparent digital agreements and tamper-evident transaction records. The platform aims to improve market accessibility and help farmers and buyers make informed decisions. Its effectiveness must be established through implementation, testing, and quantitative evaluation.

Future work may include expanding crop image datasets, improving model performance, integrating verified real-time market price feeds, strengthening multilingual chatbot support, and conducting field trials with farmers and buyers.

REFERENCES

[1] Y. Cao, C. Yi, G. Wan, H. Hu, Q. Li, and S. Wang, “An analysis on the role of blockchain-based platforms in agricultural supply chains,” *Transportation Research Part E: Logistics and Transportation Review*, vol. 163, Art. no. 102731, 2022, doi: 10.1016/j.tre.2022.102731.

[2] G. H. Harish Nayak et al., “Exogenous variable driven deep learning models for improved price forecasting of TOP crops in India,” *Scientific Reports*, vol. 14, Art. no. 17203, 2024, doi: 10.1038/s41598-024-68040-3.

[3] L. E. Chuquimarca, B. X. Vintimilla, and S. A. Velastin, “A review of external quality inspection for fruit grading using CNN models,” Artificial Intelligence in Agriculture, vol. 14, pp. 1–20, 2024. DOI: 10.1016/j.aiia.2024.10.002