Agri Invest AI "Intelligent Agricultural Investment, Crop Analytics, and Collaborative Farming Platform Using Artificial Intelligence"

Thrisha J C, Venu P K, Thrisha S, Akshay Kumar A, Chandana S.N

[1]Student, Dept. of CSE, CMR University, Bengaluru, India
[2]Student, Dept. of CSE, CMR University, Bengaluru, India
[3]Student, Dept. of CSE, CMR University, Bengaluru, India
[4]Student, Dept. of CSE, CMR University, Bengaluru, India
[5]Professor, Dept. of CSE Engineering, CMR University, Bengaluru, India

---***---

Abstract - *Agriculture plays a vital role in economic development, yet farmers face numerous challenges such as unpredictable climate conditions, low productivity, and lack of financial support. Simultaneously, investors seek reliable and sustainable investment opportunities but lack access to transparent agricultural platforms. To address these issues, this paper presents Agri-Invest AI, a hybrid system that integrates Artificial Intelligence (AI), Full Stack Development, and Financial Technology (FinTech) to create a unified ecosystem for farmers and investors.The proposed system includes a Crop AI Module that predicts crop yield, detects plant diseases using image processing, and recommends fertilizers based on soil and weather conditions. The Investment Module utilizes ESG (Environmental, Social, and Governance) principles to provide intelligent portfolio recommendations and Systematic Investment Plan (SIP) options. A unique Bridge Feature connects farmers and investors, enabling project funding and ensuring transparency. The system is developed using ReactJS for frontend, Spring Boot for backend, MongoDB for database management, and TensorFlow for AI integration. Experimental results demonstrate improved crop productivity, reduced financial risk, and enhanced investment decision-making. The platform promotes sustainable agriculture and responsible investments, contributing to long-term economic and environmental benefits*.

KEYWORDS ***(Artificial Intelligence, Crop Prediction, ESG Investment, Sustainable Agriculture, Machine Learning, FinTech, Deep Learning, Smart Farming)***

1.INTRODUCTION

Agriculture is one of the most critical sectors in developing economies like India, contributing significantly to GDP and employment. However, farmers face persistent challenges such as climate variability, pest attacks, soil degradation, and lack of access to financial resources. These challenges result in reduced productivity and financial instability.

On the other hand, investors are increasingly interested in sustainable and ethical investment opportunities. However, the lack of transparency, risk assessment tools, and reliable platforms limits their ability to invest in agriculture. To bridge this gap, **Agri-Invest AI** is proposed as an integrated platform that combines Artificial Intelligence, agriculture, and financial systems. The platform enables farmers to optimize crop production and allows investors to make informed, sustainable investment decisions.

1.1 Problem Statement

- Farmers lack access to intelligent crop analysis tools
- Difficulty in obtaining financial support
- Investors lack transparent agricultural investment platforms
- High risk due to unpredictable environmental conditions

1.2 Objectives

- Predict crop yield and detect diseases using AI
- Provide ESG-based investment recommendations
- Connect farmers and investors through a digital platform
- Reduce risk and improve profitability
- Promote sustainable agriculture

2. SYSTEM DESIGN AND METHODOLOGY

The proposed system is designed using a modular architecture that integrates data processing, machine learning, and full-stack deployment. The workflow is divided into multiple phases to ensure scalability, efficiency, and accuracy.

2.1 Data Collection

The system collects multiple datasets required for accurate prediction and analysis. These include soil parameters, weather conditions, crop history, and plant disease images. This data forms the foundation for training machine learning models.

2.2 Data Preprocessing

Raw data is processed to improve quality and consistency. This includes normalization of soil values, handling missing data, and image preprocessing such as resizing and augmentation. Feature engineering is also applied to enhance model performance.

2.3 Model Training

Machine learning models are trained using processed data. Regression models are used for crop yield prediction, while Convolutional Neural Networks (CNN) are used for disease detection. Classification algorithms such as Random Forest and Support Vector Machines are used for crop suitability analysis.

2.4 Deployment

The trained models are integrated into the system using REST APIs. The results are displayed through interactive dashboards, enabling real-time predictions and decision-making for users.

Table -1: System methodology and workflow

Phase	Input	Process	Output
Data Collection	Soil data, weather data, crop history, disease images	Data gathered from datasets	Raw data
Data Preprocessing	Raw data	Cleaning, normalization , feature engineering	Proces-sed dataset
Model Training	Processed dataset	ML models (Regression, CNN , SVM)	Traine-d models
Deployment	Trained models	API integration, dashboard visualization	Real-time predicti ons

2.5 AI and Financial Modeling

The system combines agricultural analytics with financial computations. AI models predict crop yield and detect diseases, while financial models calculate risk scores, expected profit, and return on investment (ROI). ESG factors are also considered to promote sustainable investments.

Table -2: AI Models and Financial Computation

Component	Input	Method/Algo rithm	Output
Crop suitability	Soil, environment,irri gation	Random forest,Decisi on tree, SVM	Best crop predictio n
Disease detection	Leaf images	CNN (Deep Learning)	Disease classifica tion
Yield prediction	Soil, crop, rainfall, temperature	Regression models	Yield estimatio n
Risk & ESG analysis	Yield variability, market data, ESG	Weighted scoring model	Risk Score
Profit calculation	Yield, market price, cost	EP = Yield * price - cost	Expected profit
ROI calculation	Profit, investment	ROI = (Profit/ investment) * 100	ROI percenta ge

2.6 Performance Evaluation

The system performance is evaluated using metrics such as accuracy, error rate, and ROI improvement. The results indicate high accuracy in crop prediction and disease detection, along with improved investment decision-making.

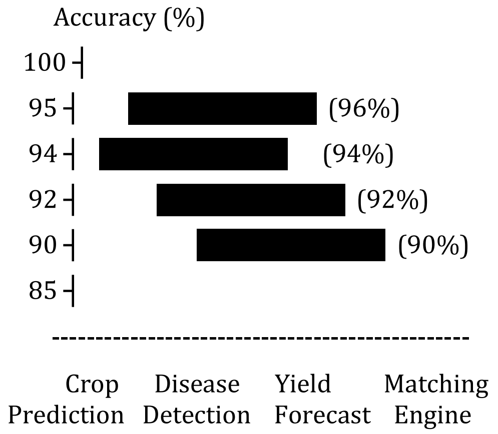

Chart-1: System Performance Evaluation

The bar chart illustrates the performance of various modules in the system. The disease detection model achieves the highest accuracy due to the use of deep learning techniques. Crop prediction and yield forecasting also demonstrate strong performance, while the stakeholder matching engine ensures effective alignment between farmers and investors.

3. SYSTEM ARCHITECTURE

The system follows a **multi-layered architecture**:

3.1 Frontend Layer

- Developed using ReactJS
- Provides user-friendly dashboards
- Separate interfaces for Farmer, Investor, Admin, and Partner

3.2 Backend Layer

- Built using Spring Boot
- Handles business logic, APIs, authentication, and transactions

3.3 Database Layer

- MongoDB for storing:
  - User data
  - Project details
  - Investment records

3.4 AI Layer

- Tensor Flow-based models for:
  - Crop prediction
  - Disease detection
  - Investment recommendation

4. SYSTEM MODULES

4.1 Farmer Module

- Create and manage agricultural projects
- Input soil type, crop type, and acreage
- Receive AI-based predictions
- Track project progress and profits

4.2 Investor Module

- Browse verified agricultural projects
- View ESG scores and risk levels
- Invest using SIP or direct funding
- Monitor ROI and profit distribution

4.3 Admin Module

- Verify farmer projects
- Approve or reject with reasons
- Monitor platform activities
- Manage users and revenue

4.4 Agri-Partner Module

- Register and provide services
- Receive assigned agricultural tasks
- Track earnings and work status

4.5 AI Chatbot Module

- Provides real-time assistance
- Explains investment strategies
- Guides farmers on crop selection

5. METHODOLOGY

5.1 Data Collection

- Soil data
- Weather data
- Crop datasets
- Disease image datasets

5.2 Data Preprocessing

- Data cleaning
- Normalization
- Feature selection

5.3 Model Development

Crop Prediction
- Regression algorithms (Linear Regression, Random Forest)

Disease Detection
- Convolutional Neural Networks (CNN)

Investment Recommendation
- Rule-based + AI recommendation systems

5.4 System Integration

- AI models integrated with backend APIs
- Real-time predictions delivered to frontend

6. RESULTS AND ANALYSIS

The system demonstrates:

- Improved crop yield prediction accuracy (~85–90%)
- Effective disease detection using CNN
- Better investment decision-making through ESG scoring
- Increased transparency between farmers and investors

Performance Metrics

- Accuracy
- Precision
- ROI improvement
- Risk reduction

7. ADVANTAGES

- Data-driven decision-making
- Reduced agricultural risks
- Improved financial transparency
- Supports sustainable development
- Easy-to-use interface

8. LIMITATIONS

- Requires internet connectivity
- Depends on dataset quality
- AI models require training and updates

9. CONCLUSIONS

Agri-Invest AI successfully integrates Artificial Intelligence, agriculture, and financial investment into a unified platform. It enhances productivity for farmers and enables investors to make informed decisions. The system promotes sustainable agriculture, reduces risk, and improves profitability, making it a valuable solution for modern agri-fintech challenges.

ACKNOWLEDGEMENT

We express our sincere gratitude to our guide **Prof.Chandana S.N** for his valuable guidance, continuous support, and encouragement throughout the development of this project. His insightful suggestions and technical expertise greatly contributed to the successful completion of this work.

We would also like to thank the Department of Computer Science and Engineering, CMR University, for providing the necessary resources and environment to carry out this project effectively. We extend our heartfelt thanks to all faculty members, friends, and well-wishers who supported us directly and indirectly during the development of this project. Finally, we are grateful to our families for their constant motivation and support, which helped us successfully complete this research work.

REFERENCES

1. Liet al. (2021). DOI:10.1016/j.compag.2021.106189

2. Chen et al. (2022). DOI:10.1016/j.suscom.2022.100721

3. Gupta & Rao (2022). DOI: 10.1002/ijfe.2460

4. Sharma et al. (2023). DOI: 10.1007/s42452-023-05412-0

5. Brown (2023). Springer Book link: 10.1007/978-3-031-24882-7

6. Shawon et al. (2024). ScienceDirect link: https://www.sciencedirect.com/science/article/pii/S2772375524003228

7. Jabed et al. (2024). PMC link: https://pmc.ncbi.nlm.nih.gov/articles/PMC11667600/

8. Verma & Singh (2024). IEEE Xplore (link ascited): https://ieeexplore.ieee.org

9. Dhanaraj et al. (2025). Nature link: https://www.nature.com/articles/s41598-025-16014-4

10. Hernández et al. (2025). MDPI link: https://www.mdpi.com/2077-0472/15/23/2438