**RESEARCH ARTICLE**

RSP Science Hub

International Research Journal on Advanced Science Hub
2582-4376
www.rspsciencehub.com
Vol. 06, Issue 12 December

Check for updates

http://dx.doi.org/10.47392/IRJASH.2024.049

# GreenThumb Advisor: Smart Farming Solutions for Higher Yields and Informed Decisions

*Mrs.M.Vinitha[1], Mr.Mallikarjuna Nandi[2], Dr.B.Nagaraja Naik[3], Mr.V.Baladithya[4], Mr.B.Yedukondalu Naik[5]*

*[1,2,3]Assistant Professor, Department of CSE, RGUKT, Ongole, Andhra Pradesh, India.*

*[4,5]Student, Department of CSE, RGUKT, Ongole, Andhra Pradesh, India.*

***Emails:*** *vinithamarlabeedu@gmail.com[1], nandimalliap@gmail.com[2], bnn@rguktong.ac.in[3], vakabaladithya@gmail.com[4], yedukondalunaik12345@gmail.com[5]*

**Article history**

*Received: 06 November 2024*
*Accepted: 25 November 2024*
*Published: 09 December 2024*

***Keywords:***

*Crop Selection [2]; Farm Management; Fertilizer Recommendations; Market Price Tracking [4]; Yield Forecasting*

**Abstract**

*GreenThumb Advisor is a Python-driven application [1] designed to enhance agricultural productivity by providing Indian farmers with actionable, data-informed insights. Leveraging advanced machine learning techniques, the application recommends optimal crop [2] selections based on vital soil and environmental indicators—such as nitrogen, phosphorus, potassium levels, pH, humidity, and rainfall—to align with region-specific conditions. Yield forecasting, powered by historical crop data, offers farmers predictive insights into potential harvest outcomes, supporting informed financial planning. In addition to crop guidance, GreenThumb Advisor integrates a 30-day weather forecast, enabling farmers to plan agricultural activities around forecasted weather patterns [3]. Real-time notifications ensure farmers receive critical updates through SMS and email, minimizing weather-related risks. The application also supports practical farm management with features such as emergency service mapping, tailored fertilizer and pesticide recommendations, market price tracking and a library of awareness videos. With its intuitive interface, GreenThumb Advisor empowers farmers to improve yield, make data-driven decisions, and foster sustainable agricultural practices.*

## 1. Introduction

Green Thumb Advisor is an innovative solution designed to tackle the pressing challenges faced by farmers in today's agriculture industry. Traditional farming practices, coupled with limited access to accurate and timely information, often lead to suboptimal decision-making, crop failures, and financial losses. Additionally, farmers grapple with issues such as unpredictable weather patterns, inadequate knowledge of suitable crops, fluctuating market prices, and the spread of crop diseases.To address these critical challenges, Green Thumb Advisor leverages the power of advanced Machine Learning and real-time data integration. The system provides actionable recommendations and insights without requiring users to supply complex datasets. It seamlessly combines modern technologies to deliver tailored crop recommendations, real-time weather updates, market price predictions, and emergency assistance for adverse conditions. In agriculture, the application excels at predicting the most suitable crops based on soil and weather data, automating market price retrieval for better

financial planning, and detecting potential diseases or pest threats. By integrating tools for fertilizer and pesticide suggestions, as well as providing yield predictions and emergency contact resources, Green Thumb Advisor empowers farmers to make informed decisions with ease. With a user-friendly interface and intelligent backend, Green Thumb Advisor transforms farming into a more efficient and sustainable endeavor. It represents a groundbreaking step in harnessing technology to overcome traditional farming challenges and ensure a prosperous future for farmers worldwide.

### 1.1 Objective

The objective of the Green Thumb Advisor project is to create a holistic and intelligent agricultural assistance system that leverages Machine Learning and advanced technologies to deliver accurate, actionable insights and support for farmers. Specifically, the project aims to:

1. Automate and optimize agricultural decision-making by utilizing trained models for crop selection, yield prediction, and market analysis.
2. Provide precise recommendations for suitable crops based on soil and weather conditions, along with tailored suggestions for fertilizers and pesticides.
3. Enhance financial planning by delivering real-time market price data for crops.
4. Assist in emergency situations through integration of weather alerts, emergency contact details, and location mapping.
5. Support sustainable farming practices by providing tools for disease detection and mitigation.

Green Thumb Advisor is designed to improve efficiency and outcomes for farmers while offering a simple, user-friendly interface. This initiative marks a significant step forward in applying technology to address critical challenges in agriculture and ensure sustainable farming practices for the future.

## 2. Methodology

The Greenthumb Adviser system is designed to empower farmers and agricultural enthusiasts by integrating cutting-edge technology to address critical challenges in modern agriculture. The techniques mentioned in [5] [6] are used to summarize the data from web srcapping.This methodology outlines the systematic approach employed to deliver real-time, data-driven insights across various aspects of farming, such as crop recommendation, yield prediction, weather forecasting, and market price tracking. By leveraging advanced algorithms, machine learning models, and interactive interfaces, the system ensures an intuitive and reliable user experience, enabling informed decision-making for sustainable agricultural practices.

### 2.1 Location Finder

This module helps users find geographical coordinates and addresses for villages or areas. The Location class uses geocoding APIs like MapQuest to retrieve latitude, longitude, and human-readable addresses. These details are displayed in a text box and visualized on an interactive map using TkinterMapView. Figure 1 shows Project Architecture.

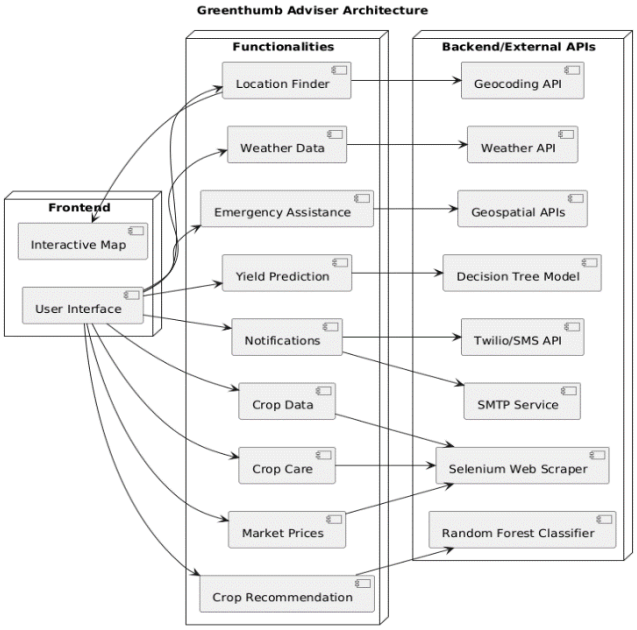


**Figure 1 Project Architecture**

### 2.2 Weather Data

The Weather Data feature fetches weather details based on user location. The WeatherData class utilizes APIs like OpenWeatherMap to retrieve temperature, humidity, and forecasts. Outputs are shown in tables and graphs, such as temperature trends over time, for better visualization.

### 2.3 Crop Recommendation

This feature suggests suitable crops based on soil parameters like nitrogen, phosphorus, and potassium levels. The RFClassifier class uses a Random Forest [7] model to recommend crops with

confidence scores. Users also get insights into market demand and average yield for the recommended crop.

### 2.4 Market Prices

Market Prices [4] offers real-time crop pricing information using Selenium for web scraping. The Scrape Price class retrieves location-specific prices and trends from trusted portals. Results are displayed in a sortable table with trend indicators for easy analysis. Figure 2 shows Deployment Diagram.

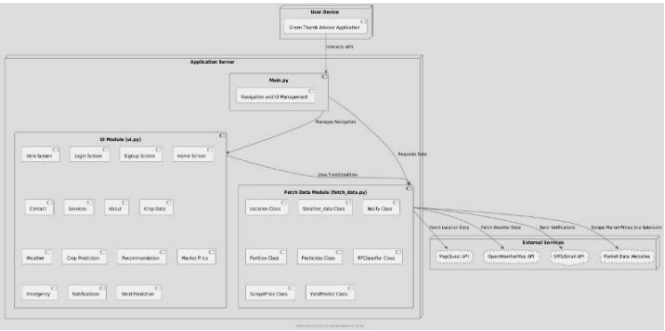

**Figure 2 Deployment Diagram**

### 2.5 Crop Care

The Crop Care module provides fertilizer and pesticide recommendations for selected crops. The Fertilize and Pesticides classes fetch relevant products, usage instructions, and purchase links. This ensures optimal crop growth and pest management.

### 2.6 Notifications

Notifications keep users updated on weather alerts, crop yield updates, and emergencies via SMS or email. The Notify class uses Twilio and SMTP to send asynchronous alerts based on user preferences, ensuring timely delivery with a history log for reference.

### 2.7 Yield Prediction

Yield Prediction estimates crop yields using soil attributes, weather data, and crop types. The YieldPredict class employs a Decision Tree Regressor to provide predictions in tons per hectare. Historical yield comparisons are included for context.

### 2.8 Emergency Assistance

This feature helps users find nearby emergency services during crises. The Emergency class uses geospatial APIs to locate shelters, hospitals, and police stations. Results are displayed on an interactive map with navigation links for easy access.

### 2.9 Crop Data

The Crop Data module provides comprehensive crop information, including lifecycle, planting methods, and pest management. The CropData class fetches data from agricultural APIs and presents it via text, charts, and videos, with links to additional resources.

### 2.10 Integration

The modules of Greenthumb Adviser work together to deliver seamless and location-specific insights. For instance, coordinates from the Location Finder feed into Weather Data and Yield Prediction, while Crop Recommendation leverages soil and weather data. This interconnected design ensures an efficient and intuitive tool for agricultural management. Figure 3 shows Class Diagram of GreenThumb Adviser

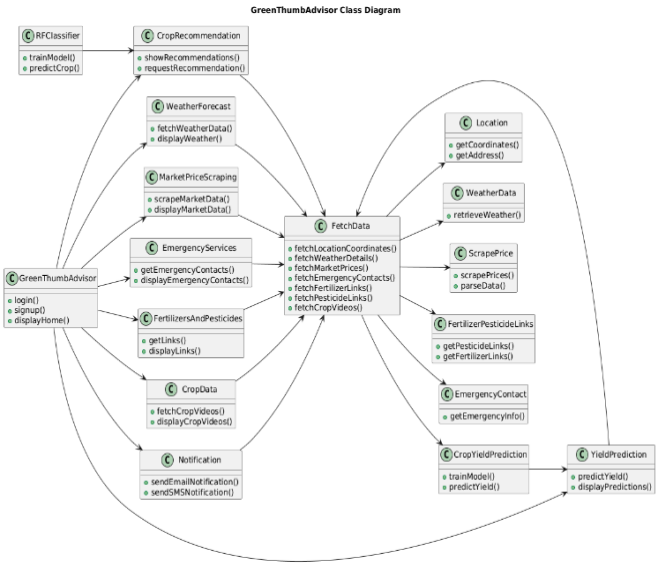


**Figure 3 Class Diagram of GreenThumb Adviser**

## 3. Prerequisits

- **Python 3.0+** [1]**:** Primary language for backend development in GTA, used for integrating machine learning models, handling data, and automating workflows.
- **Customtkinter** [8] [9]:A modernized version of Tkinter, it creates visually appealing and responsive UIs, enhancing user experience.
- **CTkMessagebox** : A tool for displaying customizable message boxes, providing alerts and notifications for various events or errors in the application.

- **JSON**:Facilitates reading and writing JSON files, useful for storing user preferences, crop data, and predictions, ensuring data persistence across sessions.
- **PIL (Pillow)**: A library for image processing, used for displaying crop images, weather icons, and other media content within the UI.
- **TkinterMapView**: Enables the display of interactive maps, showcasing geographical locations, weather patterns, and crop-specific data.
- **Tkdial**: Creates meter-style UI elements for visual representations of weather data or crop yield predictions.
- **TkinterVideo** [10]:Embeds videos into the Tkinter UI, displaying instructional content related to crop care, fertilizers, and pest control.
- **Webbrowser**: Used to open web pages in the default browser, facilitating user access to external resources like market prices and crop information.
- **CTkListbox** : A customizable listbox for displaying interactive lists such as crop suggestions, weather data, or market prices.
- **Requests** [3]: Handles HTTP requests to external APIs for fetching weather data, crop market prices, and other relevant information.
- **Datetime**: Manages date and time operations for tasks like weather forecasting, crop predictions, and processing real-time data.
- **Smtplib: Enables** sending emails via SMTP, used for notifying users about crop care, weather updates, or market price changes.
- **Pandas** [11]**:** A library for data manipulation and analysis, crucial for processing and managing data like crop recommendations and historical production data.
- **sklearn.preprocessing (LabelEncoder)** :Encodes categorical variables into numerical labels, essential for training machine learning models like Random Forest and Decision Tree.
- **sklearn.ensemble (RandomForestClassifier)** :A machine learning algorithm used for classification tasks such as recommending crops based on soil type, weather, and user inputs.
- **Twilio**: A platform for sending SMS and email notifications, used for alerting users about weather updates, crop recommendations, and market prices.
- **Selenium** :Automates web data scraping, useful for gathering real-time market prices, weather forecasts, and crop-related data.
- **selenium.webdriver** [4] :Interacts with web pages during scraping, enabling automation of data extraction for market trends and crop prices.
- **Time**:Adds delays during code execution to manage scraping and API interactions effectively, preventing server overload.
- **sklearn.tree (DecisionTreeRegressor)** [7] :A regression algorithm predicting crop yields based on historical data, weather patterns, and other factors.

## 4. Results And Discussion

### 4.1 Results

The Greenthumb Adviser project effectively validated its core functionalities across various modules. The system demonstrated accurate location mapping, reliable weather forecasting, and precise crop recommendations powered by machine learning. Real-time market price tracking and actionable insights for crop care and yield prediction were achieved with clear visual outputs. These results highlight the system's potential to support farmers with data-driven decision-making and improved agricultural practices. (Figure 4-14) shows the results of the proposed system.


**Figure 4 Login Page**


**Figure 5 Home Page**

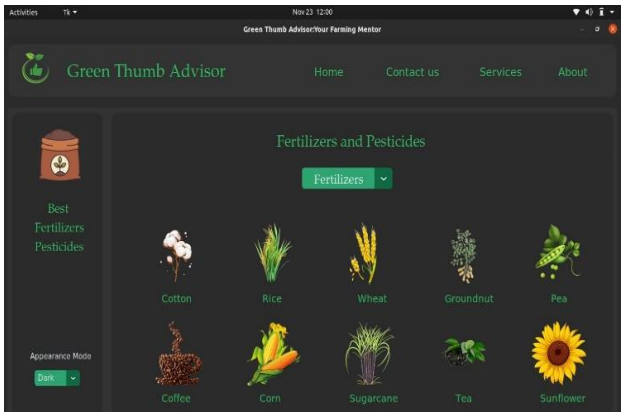


**Figure 6** Crop Data Page

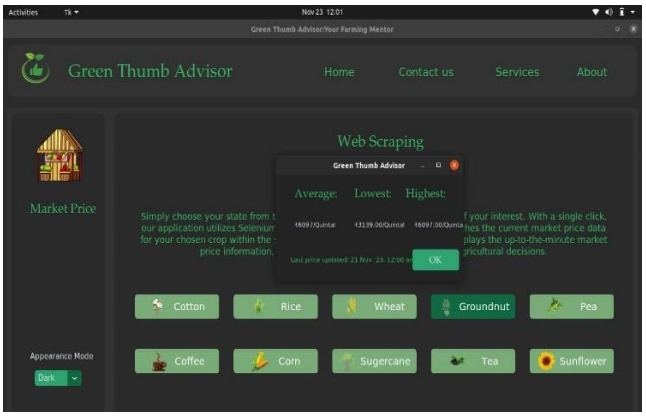


**Figure 10** Crop Market Price Prediction Page

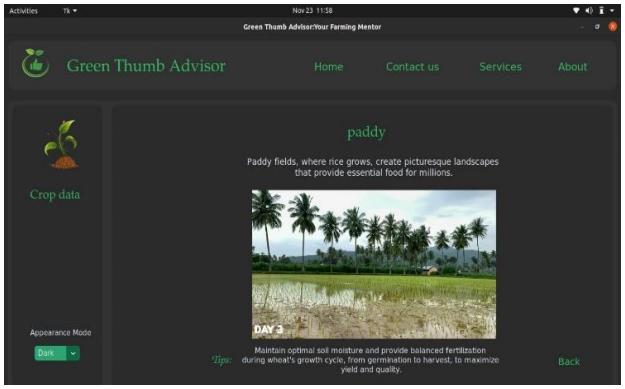


**Figure 7** Web scrapped Crop data


**Figure 11** Emergency Access Page

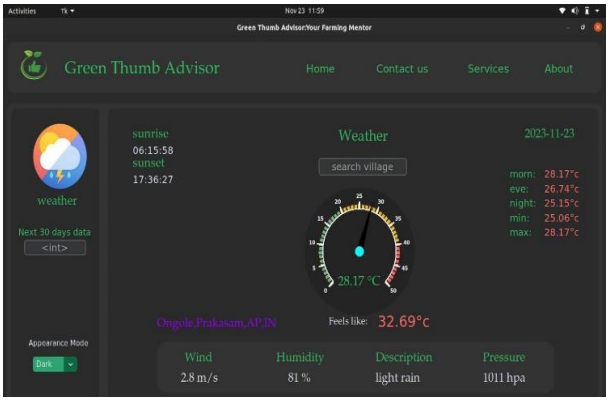


**Figure 8** Weather Page

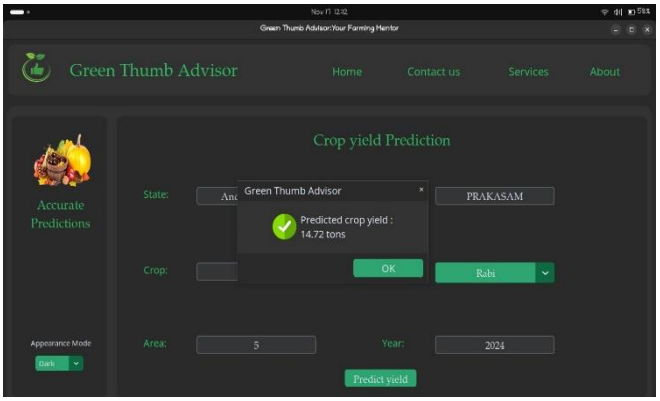


**Figure 12** Crop Yield Prediction Page

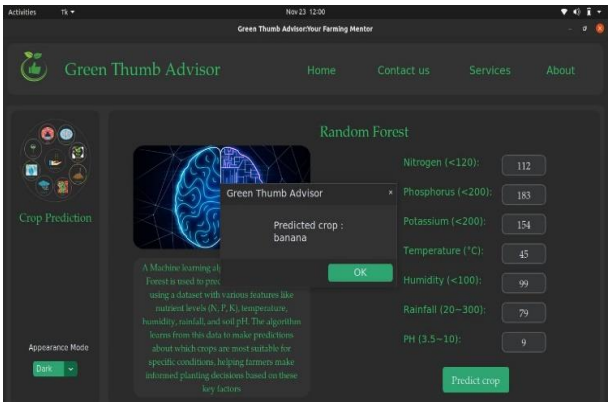


**Figure 9** Crop Prediction Page

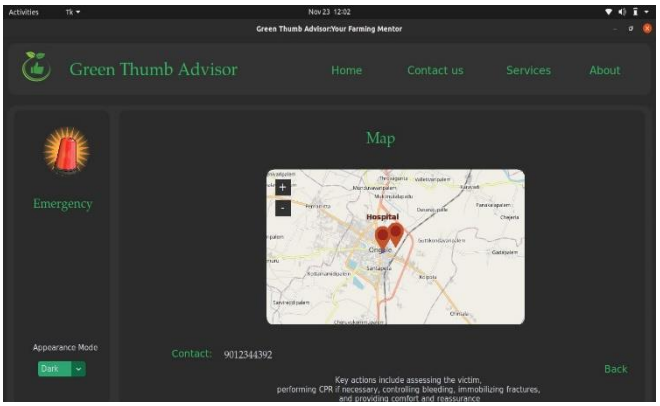


**Figure 13** Map Response For Nearby Farm Utils Access

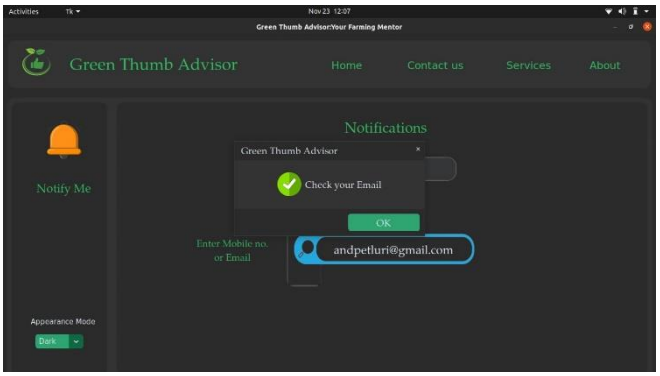


**Figure 14 Personalized notification**

### 4.2 Discussion

The results of the Greenthumb Adviser project highlight the potential of combining geospatial data and machine learning to address key agricultural challenges. The system's ability to provide precise recommendations, real-time updates, and visualizations confirms its effectiveness in supporting informed decision-making for farmers. These outcomes emphasize the value of integrating advanced technologies into agriculture, particularly in enhancing productivity and sustainability. However, the results also reveal areas for improvement. The reliance on external APIs introduces concerns about data availability and latency, underscoring the need for offline capabilities or redundant data sources. The accuracy of predictions depends on the quality of user inputs, suggesting that user training or automated data validation mechanisms could further improve outcomes. These insights indicate that while the system shows promise, addressing scalability, localization, and user-centric design will be essential for its long-term impact

## Conclusion

The Greenthumb Adviser project effectively addresses the challenges faced in modern agriculture through the integration of machine learning, geospatial data, and real-time systems. Results confirm its ability to deliver practical solutions, such as accurate crop recommendations, weather forecasts, and market price tracking, aiding farmers in making well-informed decisions. The discussion highlights dependencies on user-provided data and external APIs, emphasizing the importance of enhancing resilience and localization in the system. These findings validate the project's focus on bridging technology with agricultural needs, demonstrating the system's potential to tackle the identified problems. While challenges like data accuracy and external reliance remain, they offer opportunities for future enhancements. Ultimately, Greenthumb Adviser lays a strong foundation for advancing sustainable agricultural practices through innovative, data-driven solutions.

## Acknowledgements

The authors would like to express their sincere gratitude to Mrs. M. Vinitha, Mr. N. Mallikarjuna, and Dr. B. Nagaraj Naik for their exceptional guidance and mentorship throughout the course of this project. Their valuable insights, expertise, and continuous support were instrumental in the successful completion of this work. We also wish to acknowledge their generous financial contribution, which enabled the development of the Greenthumb Adviser project. Their unwavering commitment has played a pivotal role in the realization of this research. [5]

## References

[1]."Python," [Online]. Available: https://docs.python.org/3/library/json.html.
[2].B. Naik, "Omnicare," Omnicare:A Comprehensive ML/DL-Based , vol. 6, no. International Research Journal on Advanced Science Hub 2582-4376, p. 5, 2024.
[3]."Requests API," [Online]. Available: https://requests.readthedocs.io/en/latest/.
[4].B. Muthukadan, "Selenium Web Scrapping," [Online]. Available: https://selenium-python.readthedocs.io/.
[5].V. .. Vinitha .M, "An Efficient Ant Colony Optimization Optimized Deep Belief Network Based," An Efficient Ant Colony Optimization Optimized Deep Belief Network Based , vol. 17, no. International Journal of Intelligent Engineering and Systems, p. 15, 2024.
[6].V. Vinitha.M, "Review on Recent Advances on Text summarization Techniques," in Proceedings of the 2nd International Conference on Cognitive and Intelligent Computing. ICCIC 2022. Cognitive Science and Technology. Springer, Singapore. https://doi.org/10.1007/978-981-99-2742-5_70, 2023.
[7]."scikit Learn documentation," [Online]. Available: https://scikit-learn.org/stable/.
[8].tomschimansky, "Custom tkinter docs,"

[Online]. Available: https://customtkinter.tomschimansky.com/.
[9]. Akascape, "Custom Tkinter," [Online]. Available: https://github.com/Akascape/CTkMessagebox.
[10]. PaulleDemon, "tkVideoPlayer," [Online]. Available: https://github.com/PaulleDemon/tkVideoPlayer/blob/master/Documentation.md.
[11]. ["Pandas Library Documentation," [Online]. Available: https://pandas.pydata.org/docs/.