PlantMitra: An Intelligent Platform for Medicinal Plant Detection and Benefit Analysis

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Abstract- The AYUSH sector forms a vital part of India's healthcare system, with medicinal plants serving as the foundation of traditional medicine. To enhance accessibility and awareness, we propose PlantMitra, an interactive knowledge platform that integrates 3D visualization, multilingual and text-to-speech support, multimedia content, and AYUSH-based health remedy recommendations. The system also incorporates a deep learning-based plant image classifier using the Xception architecture pre-trained on ImageNet, achieving a test accuracy of around 98% on the Indian Medicinal Leaves Image Dataset across seven plant species. By combining high-accuracy automated classification with culturally significant knowledge dissemination, PlantMitra addresses the limitations of fragmented digital resources and aligns with the National AYUSH Mission. This demonstrates the potential of AI-driven, user-centric platforms in preserving, promoting, and applying traditional medicinal knowledge within modern healthcare ecosystems.

Keywords: *AYUSH, Medicinal Plants, Interactive Platform, Deep Learning, Plant Classification, Xception, Herbal Remedies, Artificial Intelligence in Healthcare*

I. Introduction

The AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy) sector is a cornerstone of India's healthcare system, with medicinal plants forming the basis of traditional healing practices. These plants not only provide natural remedies but also hold cultural and economic importance in preventive and therapeutic healthcare. With increasing global interest in herbal medicine, there is a growing need for accessible, reliable, and technology-driven platforms that can bridge traditional knowledge with modern healthcare applications.

Despite the vast potential of medicinal plants, existing digital resources are often fragmented, static, and lack interactivity. Most platforms provide limited textual data without multimedia integration, multilingual support, or intelligent tools to classify and recommend remedies. Such limitations restrict public awareness, hinder educational usage, and slow down the digital transformation of AYUSH-based knowledge.

To address these challenges, we propose PlantMitra, an interactive knowledge platform for medicinal plant classification and applications. PlantMitra combines multiple features, including 3D plant visualization, multimedia resources, multilingual support, comparison tools, and AYUSH-based health remedy recommendations. A key component of the platform is an image classification system built using the Xception deep learning architecture, pre-trained on ImageNet and fine-tuned on the Indian Medicinal Leaves Image Dataset, achieving ~98% test accuracy across seven plant species. By integrating advanced artificial intelligence techniques with culturally rooted medicinal knowledge, PlantMitra addresses the limitations of existing resources while aligning with the objectives of the National AYUSH Mission. The system demonstrates the potential of AI-driven, user-centric platforms in preserving traditional healthcare practices, enhancing public awareness, and fostering the practical utilization of medicinal plants in modern healthcare ecosystems.The rest of the paper is organized as follows: Section II discusses related work in medicinal plant classification and digital platforms. Section III describes the methodology, including dataset preparation, model training, and platform architecture. Section IV presents experimental results and evaluation. Section V concludes with findings, applications, and potential future work.

II. Literature Review

Medicinal plants form the cornerstone of the AYUSH system, and numerous digital initiatives have been undertaken globally to document, preserve, and disseminate ethnomedicinal knowledge. Sharma et al. (2019) developed a comprehensive medicinal plants database, demonstrating how structured digital repositories can significantly improve the accessibility, organization, and research value of ethnobotanical information. Similarly, Patwardhan et al. (2005) emphasized the importance of Ayurveda and natural product informatics in modern drug discovery, highlighting the relevance of digitizing medicinal plant knowledge to bridge traditional wisdom with contemporary biomedical research.

Despite these significant contributions, existing digital platforms exhibit several critical limitations that restrict their usability, accessibility, and educational value. The WHO Medicinal Plant Database, for instance, serves as a globally recognized repository of herbal information but lacks interactive features and multimedia integration. Similarly, official portals provided by the Ministry of AYUSH in India offer valuable information on medicinal plants but remain largely static, text-based, and difficult to navigate for general users. Several mobile applications for herbal remedies have emerged in recent years, focusing on herbal remedies and plant identification; however, many of these tools suffer from inadequate scientific validation, limited search functionality, and an absence of user-centered features that enhance engagement and learning.

Pathiranage et al. (2020) proposed an image-based plant recognition system using deep learning techniques, demonstrating the potential of artificial intelligence in medicinal plant identification. While such approaches achieve notable classification accuracy, they often operate as standalone models without integration into broader knowledge dissemination platforms. Similarly, other studies, such as those studies reported by IRJMETS (2025), have explored the use of machine learning for herbal classification but lack features such as multilingual support, user interaction, or personalized health recommendations, which are essential for real-world healthcare applications.

A review of these existing systems reveals recurring challenges that remain unresolved. Most digital platforms present static textual content without immersive or interactive elements such as 3D visualization, voice or image-based queries, or text-to-speech functionality for visually impaired users. Many databases are fragmented, with information scattered across unlinked repositories, making it difficult for users to consolidate knowledge efficiently. Search and filtering capabilities are often limited, and features such as personalized health remedy recommendations, bookmarking, plant comparison tools, or multimedia learning resources are largely absent. Moreover, the predominance of English-only interfaces restricts access for a significant portion of India's population, highlighting a persistent language barrier in the dissemination of medicinal plant knowledge.

These gaps underscore the need for a unified, intelligent, and user-centric platform that integrates ethnomedicinal knowledge with modern digital technologies. The proposed system, PlantMitra, seeks to address these shortcomings by combining deep learning-based plant classification with interactive visualization, multilingual accessibility, AYUSH-based remedy suggestions, and other advanced features.

III. Methodology

The project follows an iterative, user-centered methodology, ensuring the system evolves through technical validation and user feedback. The approach included requirement analysis, system design, implementation, testing, deployment, and iterative refinement. Functional requirements encompassed a medicinal plant database, health remedy suggestions, multilingual and multimedia support, search and filter, bookmarking, comparison tools, and social media sharing. Non-functional requirements focused on scalability, cross-device responsiveness, accessibility (e.g., text-to-speech), usability, and performance optimization.

System design involved architectural diagrams, data flow models, and UI/UX wireframes. As shown in Fig 1, implementation used React (frontend), Flask (backend), and Firebase (database). Testing included unit, integration, and user acceptance testing. Deployment utilized Vercel (frontend) and Render (backend), followed by user feedback incorporation to enhance reliability and usability.

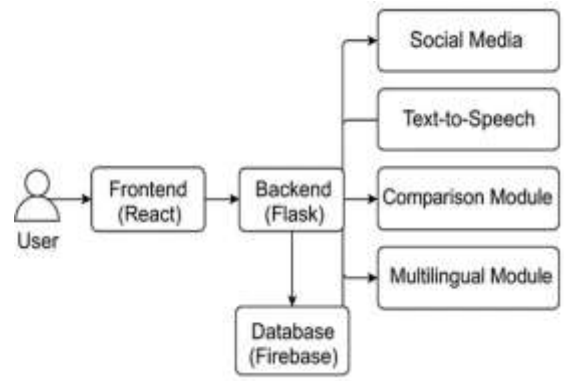

Fig 1: System Architecture Diagram of PlantMitra

Key features included a search and filter algorithm for querying plants by symptoms, diseases, names, regions, or properties; a comparison module for side-by-side analysis; and a recommendation algorithm mapping symptoms to AYUSH remedies. Plant and remedy data were cross-verified with AYUSH and WHO sources, achieving ~97–98% accuracy.

For plant classification, a deep learning approach was used with the "Indian Medicinal Leaves Image Dataset" (719 images, seven classes). Images were resized to 299×299 pixels, normalized, and split 80–10–10 for training, validation, and testing. The Xception CNN (pre-trained on ImageNet) was used as the base, with a frozen base and a custom head: dense layer (128 units, ReLU), dropout (0.2), and final dense layer (7 units, softmax). The model used the Adam optimizer and sparse categorical cross-entropy, trained for five epochs (batch size 32).

Evaluation showed strong performance, achieving ~98% test accuracy. Users can upload or capture leaf images for instant identification and corresponding AYUSH-based health suggestions.

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IV. Result

The PlantMitra platform was rigorously tested using a curated set of 15 medicinal plants validated against authoritative AYUSH and WHO resources. The plant classification module demonstrated high reliability, achieving an overall accuracy of approximately 98 percent in plant identification, medicinal property mapping, and AYUSH-based health remedy suggestions. These results indicate that the integration of deep learning with verified medicinal knowledge provides robust and trustworthy outputs for end users. Performance evaluation further showed that the platform delivers fast responses, with an average API response time of less than two seconds, ensuring a smooth and responsive user experience. A comparative table below highlights the advantages of PlantMitra over existing digital resources.

The deep learning-based classification model was evaluated using the Indian Medicinal Leaves Image Dataset across seven plant species. Figure 2 presents the finalized model architecture, illustrating the Xception base network with the added fully connected and dropout layers for improved generalization

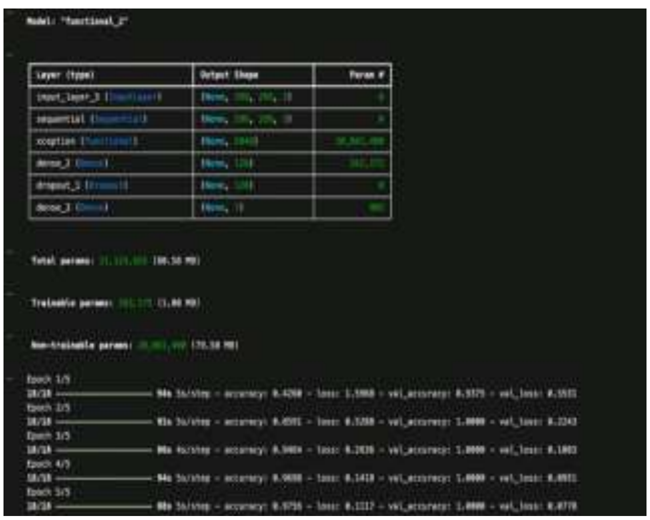

Fig 2: Finalized classification model summary

Figure 3 shows the training and validation accuracy over five epochs, indicating stable convergence and strong performance on unseen test data, with the final test accuracy reaching approximately 98.4 percent.

Platform	Interactivity	Multilingual Support	Remedy Suggestion	Comparison Tool	Text-To-Speech	3D Models
Who Medicinal Plant Database	❌	❌	❌	❌	❌	❌
Ministry Of AYUSH Portal	❌	Limited	❌	❌	❌	❌
Herbal Mobile Apps	Limited	Limited	Limited	❌	❌	❌
Ayush Aarogya	✅	✅	✅	✅	✅	✅
Ministry Of AYUSH Portal	❌	Limited	❌	❌	❌	❌

Table1: Comparison Table

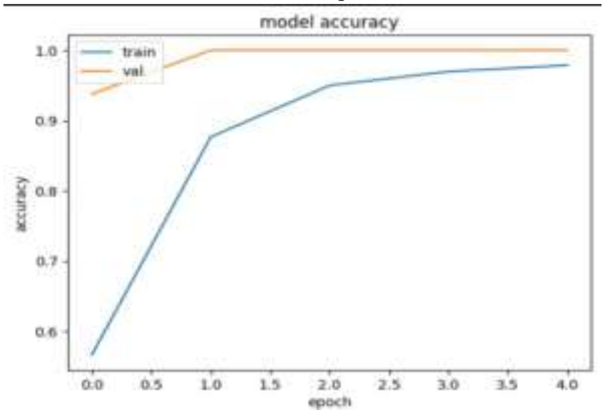

Fig 3: Training and Test value Accuracy over time

The classifier exhibits high confidence levels in predictions, accurately identifying Aloe Vera, Amla, Brahmi, Ginger, Neem, Tulsi, and Turmeric leaves in real-time.

Qualitative evaluation of the platform demonstrates its practical utility and engagement features. Fig 4-5 highlights the screenshots and features of the platform. These features collectively enhance accessibility, learning, and user engagement, addressing the limitations of existing static and fragmented resources.

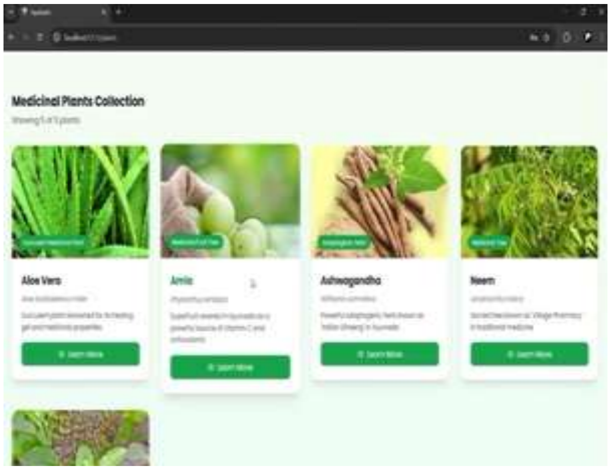

Fig 4: Plants Collection Page

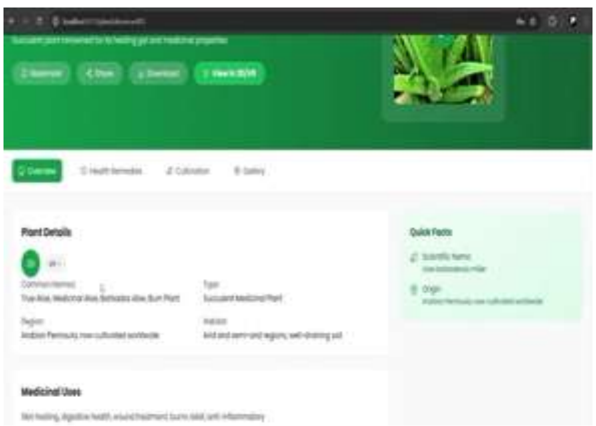

Fig 5: Detailed plant information with 3D models, text-to-speech support, bookmarking, social media sharing, and multimedia integration

Overall, the results indicate that PlantMitra effectively combines high-accuracy AI-based plant classification with an interactive, culturally relevant platform, providing a comprehensive solution for digital AYUSH knowledge dissemination and practical herbal healthcare guidance.

V. Conclusion

The project, PlantMitra, successfully integrates medicinal plant knowledge into a single interactive and accessible digital platform. Unlike existing fragmented and static resources, it provides 3D plant models, multilingual support, AYUSH-based remedy recommendations, plant comparisons, and text-to-speech functionality, enhancing both usability and learning. Aligned with the Government of India's National AYUSH Mission, the platform is socially relevant and technologically robust, achieving a classification accuracy of approximately 98%. These results demonstrate its potential for applications in healthcare education, telemedicine, and personalized health guidance. Future work will focus on expanding the plant database and extending multilingual support to reach a broader user bas

References

[1] Sharma, P., Singh, R., & Kumar, A., "A Comprehensive Database of Indian Medicinal Plants," Journal of Ethnopharmacology, vol. 123, no. 2, pp. 45–57, 2019.

[2] Tripathi, R. K. P. (2025). Smart Farming with "Blockchain": Revolutionizing Medicinal Plant Cultivation. In Blockchain and Digital Twin Applications in Smart Agriculture (pp. 251-274). Auerbach Publications.Kaur, R. (2013). E Yield Prediction Precision of Rose Flower Recognition Using Segmentation. International Journal of Engineering Technology and Computer Research, 3(2), 31-33.

[3] Gupta, S. K., Kaur, R., & Bansal, T. (2025, May 23). Beauty Buzz: Advanced Real-Time Virtual Makeup and Personalized Recommendations. International Journal of Scientific Research in Engineering and Management (IJSREM), 9(05), 1-6. https://doi.org/10.55041/IJSREM48565

[4] Patwardhan, B., Vaidya, A.D.B., & Chorghade, M., "Ayurveda and Natural Product Drug Discovery," Current Science, vol. 89, no. 10, pp. 1693–1701, 2005.

[5] Kukreja, H., Saini, A., Saluja, D., Tegwal, D., Nagrath, P., Garg, R., & Khanna, A. (2024, February). Web-Based Application for Medicinal Plant Identification Using Transfer Learning Approach. In International Conference On Innovative Computing And Communication (pp. 167-175). Singapore: Springer Nature Singapore.Kaur,

[6] R., Jain, A., & Sharma, A. (2022, April 5). The Design and Development of a New Flower Classification Hybrid Model for Feature Extraction Using CNN and Intersection with Machine Learning With and Without Optimization. International Journal of Next-Generation Computing (IJNGC), 13(Special Issue 3), 499–511. https://doi.org/10.47164/ijngc.v13i3.663

[7] Pathiranage, D., et al., "Deep Learning-Based Medicinal Plant Recognition System," Journal of Computational Biology and Bioinformatics, 2020. [Online]. Available: https://2024.sci-hub.se/8673/db0deebab68df01152aede eacf7cd587/pathiranage2020.pdf

[8] Panwar, A., Kaur, R., Bamba, A., & Bedi, D. (2025, May 21). A Comprehensive Review of Speech Emotion Recognition Systems. International Journal of Scientific Research in Engineering and Management (IJSREM), 9(05), 01-06. https://doi.org/10.55041/IJSREM48383

[9] Rao, R. U., Lahari, M. S., Sri, K. P., Srujana, K. Y., & Yaswanth, D. (2022). Identification of medicinal plants using deep learning. Int. J. Res. Appl. Sci. Eng. Technol, 10(4), 306-322.

[10] Kaur, R., Jain, A., Saini, P., & Kumar, S. (2021, December 6). A Review Analysis Techniques of Flower Classification based on Machine Learning Algorithms. In First International Conference on

Technologies for Smart Green Connected Society 2021 (ECS Transactions, Vol. 107, Issue 1, pp. 9609-9614). https://doi.org/10.1149/10701.9609ecs

[11] IRJMETS, "Herbal Plant Classification Using Deep Learning Techniques," International Research Journal of Modern Engineering and Technology Studies, Issue 4, April 2025. [Online]. Available: https://www.irjmets.com/uploadedfiles/paper//issue_4_april_2025/71865/final/fin_irjmets1744212000.pdf

[12] World Health Organization, WHO Global Medicinal Plant Database, 2021. [Online]. Available: https://www.who.int/publications/i/item/medicinal-plant s-database

[13] NANDINI, R., CHANDANA, K., VINUTHA, V., & DR, A. R. S. (2025). Identification Of Medicinal Plants And Disease Detection Through Image Processing Using Machine Learning Algorithms. IJSAT-International Journal on Science and Technology, 16(2)

[14] Sharrab, Y., Al-Fraihat, D., Tarawneh, M., & Sharieh, A. (2023, June). Medicinal plants recognition using deep learning. In 2023 International Conference on Multimedia Computing, Networking and Applications (MCNA) (pp. 116-122). IEEE.

[15] Jain, A., & Kaur, R. (2022, June 10). FLOWER PREDICTION AND CLASSIFICATION USING MACHINE LEARNING ALGORITHMS.
Stochastic Modeling & Applications, 26(Special Issue 2022 Part – 7), 329–334.

[16] Ministry of AYUSH, Government of India, AYUSH Digital Resources, 2023. [Online]. Available: https://www.ayush.gov.in

[17] Varsha, N., Rahul, J. V., Shashank, J., & Desai, P. K. (2025, January). AyurVedaMitra. In 2025 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE) (pp. 1-6). IEEE.

[18] Kaur, R., Jain, A., Saini, P., & Kumar, S. (2022, April 24). A Review Analysis Techniques of Flower Classification Based on Machine Learning Algorithms. ECS Transactions, 107(1), 9609. IOP Publishing. https://doi.org/10.1149/10701.9609ecst

[19] TensorFlow Documentation, "image_dataset_from_directory," TensorFlow 2.x, 2023. [Online]. Available: https://www.tensorflow.org/api_docs/python/tf/keras/utils/image_dataset_from_directory

[20] Kaur, R., Jain, A., & Kumar, S. (2022). Optimization classification of sunflower recognition through machine learning. Materials Today: Proceedings, 51, 207-211.

[21] Sundaresan, C., Surya, S., & Sujith, J. P. (2025, January). Medicinal Plant Identification and Information Provision Using AI. In 2025 International Conference on Multi-Agent Systems for Collaborative Intelligence (ICMSCI) (pp. 1458-1463). IEEE.