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Digitization of Traditional Medicinal Knowledge through Interactive Web Platforms

Sanika Algude
MIT Art Design and Technology University, Loni Kalbhor
sanikaalgude24@gmail.com

Jatin Bhujbal
MIT Art Design and Technology University, Loni Kalbhor
jatinbhujbal6402@gmail.com

Pratik Bevnale
MIT Art Design and Technology University, Loni Kalbhor
pratikbevnale51@gmail.com

Roopam Wadkar
MIT Art Design and Technology University, Loni Kalbhor
roopamwadkar219@gmail.com

Dr. Mansi Bhonsle
MIT Art Design and Technology University, Loni Kalbhor
mansi.bhonsle@mituniversity.edu.in

***Abstract*—This paper presents a digital platform that serves as a comprehensive resource for the study of medicinal plants used in Ayurveda (Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy). It provides detailed information on the characteristics and uses of these plants, aimed at students, physicians, and those interested in natural medicine. The platform combines traditional knowledge with modern technology, fosters a deeper understanding and appreciation of medicinal plants, and preserves this valuable wisdom for future generations.**

***Index Terms*—Digital platform, medicinal plants, AYUSH, Ayurveda, Yoga and Naturopathy, Unani, Siddha, Homeopathy, traditional medicine, natural healing, plant properties, herbal knowledge, education.**

I. Introduction

For centuries, plants have been at the heart of healing traditions across the world. Long before the advent of modern pharmaceuticals, people turned to nature to treat ailments, maintain wellness, and achieve balance within the body and mind. Every leaf, root, flower, and seed carries a story — a story of discovery, healing, and connection between humans and the natural world. From the aromatic spices that flavor our kitchens to the vibrant herbs that thrive in home gardens, medicinal plants have always been silently enriching our lives. They are nature's own pharmacy, waiting to be explored, understood, and preserved.

In today's fast-paced and technology-driven world, traditional systems of medicine like AYUSH — Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy — continue to stand as pillars of holistic health and wellness. Each of these systems emphasizes the harmony between the body, mind, and environment. Ayurveda, for example, draws on plant-based formulations to maintain balance and vitality. Yoga and Naturopathy focus on natural healing through body-mind discipline, while Unani, Siddha, and Homeopathy bring forward centuries of accumulated wisdom grounded in the healing powers of herbs and minerals. Despite their diverse origins, these systems share one common foundation — the use of medicinal plants as natural remedies for promoting health and well-being.

Our digital platform has been thoughtfully designed to serve as a comprehensive guide to the world of medicinal plants and their role in the AYUSH systems of medicine. It is intended not just as a database but as an interactive learning resource for anyone curious about natural healing — whether you are a student exploring the subject, a researcher seeking accurate data, a healthcare practitioner integrating traditional wisdom into modern practice, or simply someone passionate about natural living. Through this initiative, we aim to make authentic information about medicinal plants accessible, understandable, and engaging.

This platform compiles a wide range of data — from plant identification and medicinal properties to therapeutic applications and sustainable cultivation practices. Each entry provides insights into how plants are used across various traditional systems, illustrating the interconnectedness of ancient practices and modern science. By doing so, we seek to bridge the gap between age-old traditions and contemporary digital knowledge systems, allowing users to explore the timeless wisdom of nature through the lens of modern technology.

Our mission extends beyond education — it is about inspiring collaboration, innovation, and preservation. The heritage of traditional medicine is a living legacy that thrives when shared and respected. By bringing this knowledge to digital spaces, we aim to preserve it for future generations and encourage young minds to engage with sustainable, nature-based healthcare solutions. The platform thus becomes a space where tradition meets innovation, creating opportunities for learning, research, and community engagement.

In an era when digital transformation shapes how knowledge is shared and consumed, this initiative emphasizes how technology can democratize access to traditional wisdom. Through digital documentation, visualization, and open educational content, we can empower individuals from diverse backgrounds to learn about the healing power of plants. This not only strengthens cultural appreciation but also promotes sustainable practices that align with environmental and societal well-being.

Ultimately, this paper serves as the foundation for understanding the evolving role of digital platforms in preserving, promoting, and expanding access to traditional medicinal knowledge. By integrating information technology with the ancient science of AYUSH, we aim to build awareness, support research, and inspire action towards a healthier and more sustainable future. Together, we can celebrate the timeless relationship between humans and nature, ensuring that the wisdom of medicinal plants continues to nurture and heal generations to come.

II. Literature Survey

1. 3-D plant modelling virtual-plant frameworks

Early and foundational reviews (Visser et al.) and later work on functional–structural plant models (FSPMs) frame 3-D modelling as a combination of architectural (geome- try/ topology) and physiological (growth, resource allocation) components. These studies show that realistic 3-D models support both visualization and simulation of plant growth, and that adopting such models improves analysis of canopy structure, light interception and phenotype-to-function links. Practical systems combine botanical correctness with visualization tools; however, many commercially available models prioritize appearance over scientific fidelity.

Implication for your project: 3-D architectural representations (or simplified L-system abstractions) can be used to visualize plant state, teach users about morphology, or drive automated care recommendations (e.g., estimating light needs from leaf area).

2. L-systems and web visualizations of arborized structures

Recent work has focused on extracting higher-level grammar (L-systems) from arborized 3-D models and exposing that via web interfaces. van Nielen et al. (BIOSTEC/ArXiv / bachelor thesis) demonstrate a pipeline that extracts centerlines (using VMTK), generates L-system abstractions, and renders interactive 3-D scenes in the browser (A-Frame). This approach makes complex branching structures more interpretable and portable in web applications.

Takeaway: L-system abstractions are useful for compactly representing plant architecture in web UIs and for enabling topology-aware analyses (e.g., pruning suggestions, structural health checks).

3. Computer-vision for species identification diagnostic tasks

Wa¨ldchen et al.'s 2018 PLOS Computational Biology review synthesizes the state of automated plant species identification: classical feature-based pipelines gave way to deep-learning methods, but real-world deployment is hindered by dataset bias, intraspecific variation, and environmental noise. The review highlights the importance of curated datasets, multi-view images, metadata (location/phenology), and explainability to move research into usable tools. Subsequent studies (including AI approaches for indigenous medicinal plants and herb-benefit prediction) build on these foundations with domain-specific models and hybrid pipelines.

Relevance: For a Digital Herbal Garden, CV models can power plant ID, verify specimens users upload, and link species to remedies — but they must be trained/validated on regional, phenologically diverse datasets to perform reliably.

4. Web-based leaf disease detection applied monitoring interfaces

Several recent conference and journal papers describe web applications that accept leaf images and return disease classification (Kadam et al.; similar works in 2024–2025). Typical pipelines use image preprocessing, feature extraction or CNNs, and a web front-end that uploads images to a model endpoint. These projects emphasize farmer-oriented UX and alerting, but commonly note limited evaluation across crop varieties and field conditions. Related applied systems also integrate sensor data and dashboards for greenhouse/potted-plant monitoring.

Design note: Combining image-based diagnostics with sensor telemetry (soil moisture, temperature) and scheduled care reminders yields a more robust decision support tool than either alone.

5. Web applications for monitoring potted-plant growing conditions

Buraczyn´ska et al. present a web application architecture for monitoring potted plants' growing conditions (database schemas, UX, sensor integration). These systems typically use simple threshold rules plus historical trending to issue alerts (watering, light). The literature shows practical adoption of cloud-backed dashboards, role-based admin views, and exportable logs for research or educational purposes.

Opportunity: Personalised alerts (in-app, email, push) and admin analytics (usage/feedback charts) are standard expectations and can be implemented on top of the sensor + rule ML stack.

6. Herbal-medicine reviews validation concerns

Reviews of herbal medicine (classic mini-reviews and recent short reviews) stress that plant remedies have long empirical histories but need rigorous phytochemical, pharmacological and clinical validation to meet modern safety and efficacy standards. Standardization, quality control, dosage studies, and interaction testing (with pharmaceuticals) are recurrent recommendations. The reviews also note the growing interest in integrating herbal knowledge with data science and genomics to accelerate discovery.

Implication for your site/paper: When presenting home remedies, include caveats about dose, contraindications, and citation to validated sources; consider linking each remedy to primary literature or authoritative pharmacopeia entries.

7. Education / virtual garden applications

Work such as Suwandi et al. (2023) shows that virtual garden platforms are effective learning tools: students report improved engagement and conceptual understanding when interacting with simulated or web-based gardens. These platforms combine visualization, guided activities, and assessment features.

Design idea: A “virtual garden” tour or simulation can complement real-world plant care guides and provide a low-risk environment for users to learn pruning, watering schedules, and remedy preparation.

8. AI for medicinal-plant identification, disease detection, and herb-benefit prediction

Several recent conference papers (Paulson Ravishankar 2020; Senanayake Silva 2022; Begum et al. 2022) explore AI pipelines for identifying indigenous medicinal plants, detecting fungal diseases, and predicting herb benefits from datasets. Methods range from classical ML with handcrafted features to CNNs and hybrid deep models; results are encouraging but authors repeatedly call out dataset scarcity, need for cross-region generalization, and the importance of expert-annotated ground truth.

Practical caution: Models intended for public use should include uncertainty estimates, a human-in-the-loop for questionable cases, and mechanisms to collect labeled images to continuously improve the models.

III. Related Work

A New Comprehensive Database: The proposed system aims to develop a comprehensive and structured database encompassing medicinal plants and their therapeutic applications within the Ayurveda, Siddha, and Unani systems of medicine. This digital repository will serve as a centralized knowledge hub, integrating traditional wisdom with modern scientific research. Each plant entry will include detailed information such as its botanical name, common names, medicinal properties, active compounds, and practical uses. The database is envisioned as a reliable reference for researchers, healthcare professionals, and individuals interested in the scientific validation and traditional significance of medicinal flora.

Updated and Expanded Platform: To ensure the platform remains relevant and scientifically accurate, continuous updates and expansions will be implemented. Newly published research findings, verified data, and user-driven insights will be incorporated periodically. This dynamic approach promotes the integration of emerging trends in herbal medicine, sustainable practices, and AYUSH-based healthcare. By maintaining an adaptive and evolving information system, users will have constant access to the most recent and credible knowledge on medicinal plants, thereby bridging the gap between ancient practices and contemporary scientific advancements.

Modular and Scalable Design: The platform architecture follows a modular and scalable design framework, allowing seamless integration of additional components and functionalities. This adaptability ensures efficient incorporation of advanced technologies such as artificial intelligence, machine learning-based plant identification, and personalized care alert systems. The scalable structure not only facilitates technical growth but also enhances user experience and system sustainability. As interest in herbal medicine and digital healthcare continues to expand globally, this design approach enables rapid responsiveness to new research, technological innovation, and user requirements.

IV. Methodology

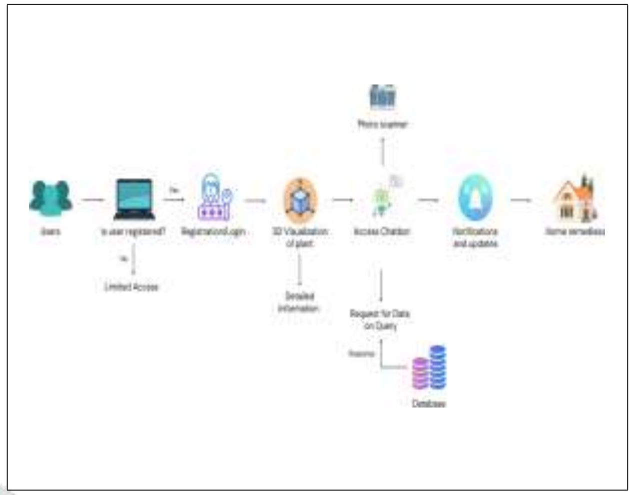

Fig. 1: Overview of the System

Project Requirements

1. Functional Requirements

The proposed system is designed to provide an interactive and intelligent platform for users to explore, identify, and learn about medicinal plants. The major functional requirements include:

User Registration and Authentication: The system shall provide secure user registration and login functionalities to ensure personalized access. Each user will have a unique account to maintain data privacy and customized interaction.

Plant Identification: Users shall be able to upload or scan images of plants for automated identification. Image processing and machine learning algorithms will be employed to analyze plant features and predict their species with high accuracy.

Plant Profiles: The system shall maintain comprehensive profiles for each plant, including scientific and common names, physical characteristics, medicinal properties, traditional uses, and plant care tips.

Notification Service: The platform shall include a notification module to inform users about newly added plants, updated research, and suggested home remedies. Notifications may be delivered via in-app alerts, emails, or push messages.

Chatbot Support: A real-time chatbot interface shall be integrated to assist users with queries related to plant identification, medicinal uses, and platform navigation. The chatbot will utilize natural language processing (NLP) for contextual and conversational interaction.

2. Non-Functional Requirements In addition to the core functionalities, the system must satisfy several non-functional requirements to ensure performance, reliability, and scalability.

Scalability: The platform architecture shall support horizontal and vertical scaling to accommodate a growing number of users, data records, and plant profiles without performance degradation.

Front-End Development: The user interface will be designed using modern web technologies such as HTML5, CSS3, JavaScript, and React.js, ensuring a responsive and user-friendly experience across devices.

Back-End Development: The server-side logic will be implemented using Python (Django/Flask) or Node.js, enabling efficient data handling, request processing, and integration with external APIs.

Database Management: The system shall utilize MongoDB or PostgreSQL for managing structured and unstructured data, including plant profiles, user accounts, and activity logs, ensuring high availability and reliability.

Cloud Infrastructure: Cloud platforms such as Amazon Web Services (AWS), Google Cloud Platform (GCP), or Microsoft Azure will be employed for hosting, data storage, and system scalability. This ensures robust performance, high uptime, and efficient resource management.

V. Results and Discussion

1) User Registration:

Unregistered Users:-

They are able to use the system with restricted functionalities. They can, in turn, only perform basic identifications of plants or get limited information.They have no option of saving their identified plants and receiving personalized notifications.

Registered Users:-

An account would be created with username, email address, and password. Additional features, such as single sign-on (SSO), would be available to make registration easier. Benefits. All feature will be available that their saved identified plant will be saved in a personal list. Personalized notifications and updates on the saved plants. History of identified plant.

2) Plant Identification:

Core Functionality: This feature employs the camera of the device to identify plants from photos taken by the user.

Photo Scanner:-

Enable users to upload a picture of a plant, or scan the plant in real-time using the live camera feature. The image will be processed within the system, with algorithms based on AI model.

3D Visualization:-

The system will make an interactive 3D model of the plant following identification. It enables users to rotate, zoom, and look at the plant from different angles.This increases the accuracy of the identification of the plant and serves a very visual and interactive way.Technologies involved with this are photogrammetry or 3D modeling tools.If the identification is inconsistent, the user can either scan or even provide suggestions to enhance the system.

3) Information and Support: Goal: Provide all-inclusive information on the care of plants and enhanced features that will enable the user to handle the plant. —

All Information The system automatically loads the profile of an identified plant which includes: Common name and scientific name Origin/ Description of the growth habits and characteristics. Ideal growing conditions, such as lighting,

Fig. 2: Plant Identification

soil, water, and temperature. Tips for its propagation and maintenance. Potential pests, diseases, and fixes.

4) Home Remedies:

Medicinal plants are nature's healing treasures, offering safe and effective solutions for many everyday ailments. Rich in bioactive compounds such as alkaloids, flavonoids, and essential oils, these plants exhibit powerful antioxidant, antimicrobial, and anti-inflammatory properties. Rooted in Ayurvedic wisdom and traditional folk medicine, they help restore balance between mind, body, and spirit through natural means. Remedies such as herbal teas, soothing pastes, and infusions are easy to prepare and integrate into daily life — providing relief from stress, cold, indigestion, and skin issues without side effects. Each plant possesses its own therapeutic essence — for instance, Tulsi enhances immunity, Ashwagandha reduces stress, Ajwain supports digestion, and Neem purifies the skin. Embracing these remedies not only nurtures personal well-being but also promotes a sustainable and holistic approach to healthcare, inspired by nature's own wisdom.

5) Notifications and Updates: Personalized alerts are an innovative feature that enhances smart plant management by ensuring each plant receives the right care at the right time. By monitoring parameters such as soil moisture, sunlight exposure, watering schedules, and temperature, the system can analyze individual plant needs and generate timely notifications. These alerts help users maintain optimal growing conditions and prevent issues like overwatering or nutrient deficiency. Notifications can be received as in-app alerts, emails, or push notifications, ensuring users stay informed anytime and anywhere. This intelligent approach not only simplifies plant maintenance but also encourages sustainable gardening practices by promoting efficient use of resources and proactive care.

6) Chatbot Interface: Goal: To make it accessible for customers to have a simple conversational interface to make inquiries and seek help. User Experience: The user can interact with the chatbot on following grounds: Seeking information related to plant care. Access data from plants identified before. Obtain assistance with problem-related plant health.

Fig. 3: Herbal Assistant

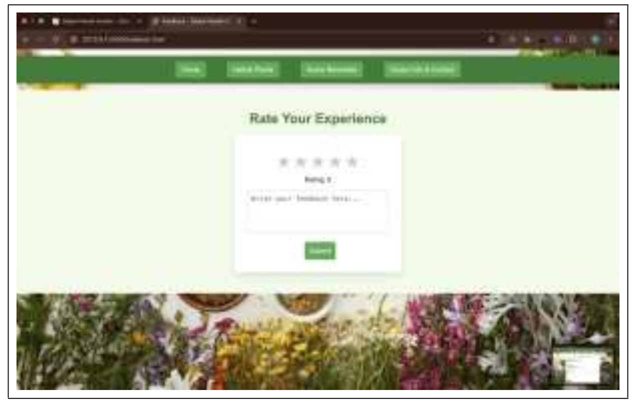

Fig. 5: User Feedback

7) Docter Info and Contact: This section of the Digital Herbal Garden website connects users with certified Ayurvedic, Unani, Siddha, and Homeopathic doctors, providing verified details such as their qualifications and contact information. It also shares expert herbal tips on safe dosages, effective combinations, and precautions to ensure responsible use of remedies. The platform guides users on when to seek medical advice instead of relying solely on home treatments, especially for chronic conditions, allergies, or pregnancy. Users can also submit health queries online and receive professional guidance. Overall, this feature promotes safe, informed, and holistic wellness by bridging traditional healing wisdom with modern healthcare awareness.

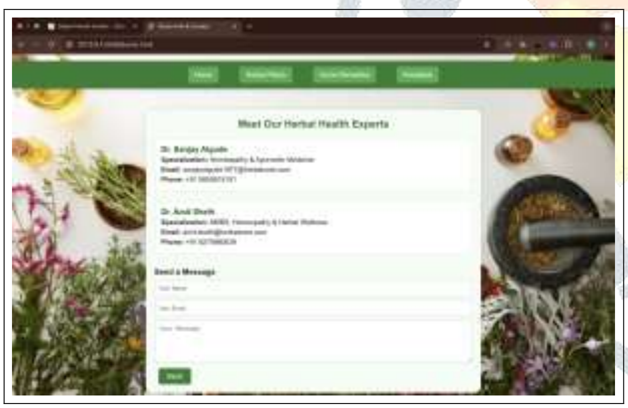

Fig. 4: Doctor Info and Contact

8) Feedback System: The feedback feature of the Digital Herbal Garden website acts as a vital link between users and developers, allowing visitors to share their experiences, suggestions, and ideas for improvement. It helps identify strengths, resolve challenges, and enhance user engagement, ensuring the platform evolves to better meet community needs. By encouraging open communication, the website not only improves its functionality and design but also builds a sense of belonging—transforming it into a collaborative space that promotes learning, wellness, and sustainability through shared user experiences.

9) Database Interaction:

The robust database stores such data as plant profiles, user data, and care tips that power the chatbot. It employs natural language processing (NLP) algorithms to ensure prompt and precise replies. NLP allows the chatbot to interpret the user's queries even if laid down in ordinary language.

10) Advanced Features:

The help of multilingual support reaches users in all parts of the world. Voice Recognition: Interacts with users via voice commands. Learning Capabilities: It keeps on improving itself and becomes more personalized and accurate as it involves more learning from user interactions over time.

VI. Analysis

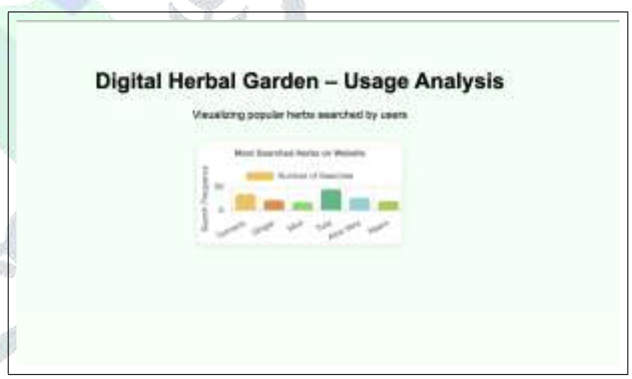

Fig. 6: Popular herbs searched by users

We analyzed user interaction data and identified the top herbs searched using our chatbot. As shown in Figure 6, Tulsi received the highest attention, followed by Turmeric and Aloe Vera, which confirms user inclination toward familiar and commonly recommended remedies. The chatbot's ability to quickly offer detailed insights into these popular herbs indicates the users' preference for well-known medicinal plants that are frequently used in daily health practices.

We analyzed the frequency of user requests for remedies related to common health issues such as cold, stress, acne, digestion, and immunity, and the results are depicted. As

Fig. 7: Bar chart showing the most frequently searched herbal plants by users.

shown, the majority of users searched for remedies for cold, followed by stress, digestion, and immunity. This highlights the high demand for cold-related remedies, suggesting that users are more likely to seek natural solutions for seasonal illnesses and everyday health concerns. The lower search interest in remedies for acne and immunity indicates that while important, these issues are not as pressing for users compared to common ailments like cold and stress.

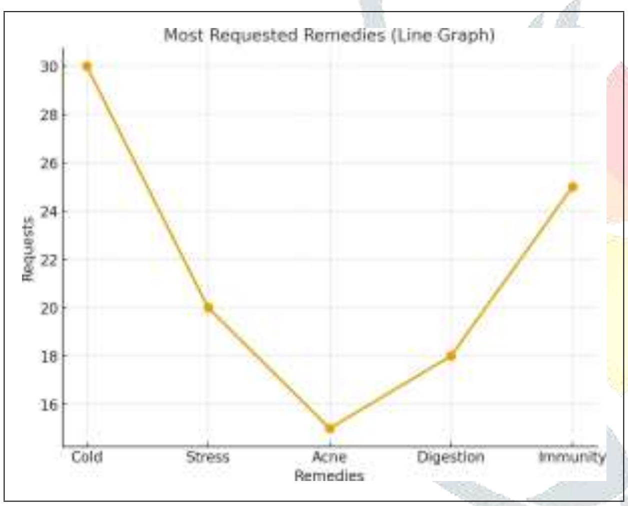

Fig. 8: Line graph illustrating the distribution of remedy queries.

Figure 9 illustrates the analysis of user feedback ratings. It is evident from the chart that a significant portion of users rated the website experience positively, with the majority giving a rating of 4 or 5 stars. This shows that the platform is well-received by the users, indicating satisfaction with the information provided and overall user experience.The positive ratings also reflect the effectiveness of the layout, ease of navigation, and the valuable information offered.

VII. Conclusion

The developed platform offered here is the bridge between traditional wisdom and modern technology, and offers a simple but comprehensive resource for the study of medicinal plants

Fig. 9: Line graph of user feedback ratings over time.

in Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy.

The platform caters to various audiences, including students, health professionals, and natural medicine enthusiasts which provides user-friendly features .

This initiative is not only opening up the availability of ancient knowledge but also making it sustainable for the future.

Through the platform, innovation and commitment therefore encourage deeper awareness and appreciation of how medicinal plants play a role in holistic health and wellness.

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