JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Aushadi Vatika": Bridging Traditional Knowledge and Technology for Learning Medicinal Plants

Mr. **Soham Mahajan[1], Mr. Khushal Shewale[2], Mr. Ankush Tiwari[3]**

[1,2,3]Department of Artificial Intelligence & Data Science, Thakur College of Engineering and Technology, Mumbai, India

[4]Assistant Professor, Department of Artificial Intelligence & Data Science, Thakur College of Engineering and Technology, Mumbai, India

Abstract : The project Aushadi Vatika addresses the gap between traditional ethnobotanical knowledge and modern education by creating an interactive virtual platform. This system showcases medicinal plants with 3D models, detailing their properties, uses, and cultivation methods to foster engaging learning experiences. Leveraging advanced digital tools and user-centric design, the platform enhances knowledge dissemination and retention compared to conventional approaches. Initial results demonstrate its effectiveness in preserving traditional knowledge while making it accessible to diverse audiences. Future expansions include augmented reality features and multilingual support, broadening its educational impact globally. Keywords: medicinal plants, virtual learning, 3D modeling, traditional knowledge, education.

Keywords **- VR , A- FRAME , SKETCHFAB , UNITY**

I.INTRODUCTION

The Ayurvedic system of medicine relies significantly on medicinal plants and herbs as the foundation of traditional healing practices. However, access to physical gardens containing these plants is often limited, hindering the widespread understanding and use of these natural remedies. To address this gap, the development of a Virtual Herbal Garden is proposed, providing a digital platform where users can explore, learn, and gain insights into the significance of various Ayurvedic medicinal plants from the comfort of their homes. This virtual garden aims to offer an engaging, interactive, and user-friendly environment, combining the rich tradition of Ayurvedic knowledge with modern technology.
The platform will feature realistic 3D models of medicinal plants, detailed botanical information, and multimedia content to enhance the learning experience. Additionally, it will include advanced search functionality, virtual tours focusing on specific Ayurvedic benefits like digestion or immunity, and interactive features such as bookmarking and note-taking. This initiative makes Ayurvedic medicinal plants more accessible to students, practitioners, and enthusiasts, fostering greater awareness and appreciation of traditional herbal practices.

II. LITERATURE REVIEW

This literature survey explores the body of work surrounding medicinal plants, virtual learning environments, and educational tools, providing insights into the gaps and opportunities in creating an interactive, immersive platform like Aushadi Vatika.

1. SCOPE OF RESEARCH

Digital Platforms for Botanical Education -

- Evaluate the efforts to digitize botanical knowledge to make it accessible to a broader audience

Virtual and Interactive Tools -

- Analyze the use of 3D modeling of plants in educational platforms.

Medicinal Plants

- Document existing knowledge about medicinal plants, including their properties, uses, and cultural significance.

Bridging Knowledge Gaps -

- Develop strategies to combine traditional ethnobotanical practices with modern technological advancements.

Traditional Knowledge Systems -

- Medicinal plants have been central to traditional healthcare globally. Studies highlight the need to document and preserve this knowledge to avoid its loss.

Role of Educational Technology -

- Virtual Reality (VR), 3D modeling, and augmented reality tools create immersive learning experiences, making education engaging and interactive.

2. Progressive Work on Virtual Learning Platforms

Current Projects -

❖ Examples include the Virtual Plant Database, which provides plant repositories but lacks interactivity.

Applications in Education -

❖ 3D modeling has been widely applied in engineering and medical education but is underutilized in botanical studies.

Educational Benefits -

❖ Incorporating images, videos, and audio enhances engagement and retention, especially in fields like biology.

3. Issues and Challenges

Existing platforms are inaccessible to non-specialist users and fail to cater to diverse learning styles. Interactive features like zooming, rotating, and annotations are essential for enhancing the depth of learning.Multimedia content offers dynamic waysto explore complex topics, aiding both beginners and experts.

4. Conclusion

The Aushadi Vatika project has successfully developed an interactive platform that enhances the understanding and appreciation of medicinal plants within the ayurvedic sector. By integrating advanced technologies, the platform offers users an immersive experience to explore and learn about various medicinal plants.

III. METHODOLOGY

The methodology for the Aushadi Vatika project outlines the systematic approach undertaken to design, develop, and implement an interactive, educational, and immersive virtual herbal garden. This section highlights the research design, data collection techniques, development processes, sampling methods, data analysis procedures, and ethical considerations followed in the project.

A. Research Design

This project adopts a mixed-method approach to combine quantitative and qualitative methodologies: ➢ Quantitative: To gather and analyze structured data on medicinal plants, their properties, and user engagement metrics. ➢ Qualitative: To explore user experiences, feedback, and insights into the effectiveness of the virtual environment in promoting awareness of traditional herbal practices. The project follows an exploratory design to investigate how modern technology (3D visualization, interactive design) can enhance

B. Sampling

Target Audience- The platform is designed for students, researchers, and enthusiastsin the Ayurvedic sector, focusing on individuals interested in traditional herbal practices Sampling Methodology ▪ Convenience Sampling: Early-stage users were selected based on accessibility and willingness to participate in testing the prototype. ▪ Purposive Sampling: Researchers and professionals in the Ayurvedic sector were invited to provide feedback on the educational content and usability.

C. Data Collection Methods

- Gathered feedback from users regarding the usability and educational value of the platform.

- Interviews: Conducted with subject matter experts to validate the accuracy of plant data Focus Groups: Organized to discuss user experiences and identify potential areas for improvement.

D. Data Analysis Methods

- Quantitative Analysis:Used to summarize user engagement metrics (e.g., time spent, number of plants accessed). Employed to analyze the relationship between user demographics and platform usage patterns.
- Qualitative Analysis: : Identified key themes from user interviews and focus group discussions, such as educational impact and ease of navigation

E. Limitations

- Resource Constraints: Limited availability of high-quality 3D models for rare plants. Feedback was collected from a small group of early-stage users, which may not fully represent the broader audience.
- Technical Limitations: Challenges in optimizing 3D models for smooth rendering across all devices.

Fig 3.1 FLOW OF METHODOLOGY

IV. CHALLENGES AND SOLUTIONS

1. Limited Accessibility to Traditional Knowledge

Traditional knowledge about medicinal plants is often passed down orally or found in ancient texts, making it inaccessible to modern learners. Many valuable insights remain undocumented or scattered across various sources, leading to knowledge gaps.

Solution: Digitization of medicinal plant knowledge into a structured, searchable format.Collaboration with Ayurvedic experts, botanists, and ethnobotanists to validate the information. Integration of **multilingual support** to make content accessible to a global audience.

2.Technical Challenges in 3D Modeling and Virtual Representation

Creating realistic, high-quality 3D models of medicinal plants is complex. These models need to be accurate in structure and appearanc**e** while being optimized for performance.

Solution: Using A-Frame, Unity, or Blender to create interactive and lightweight 3D models.Implementing lazy loading techniques to prevent slow performance.Photogrammetry or 3D scanning to ensure accurate plant representations.Partnering with Sketchfab API for pre-existing 3D models.

3.Scalability and Performance Optimization

Handling a large database of medicinal plants and serving high-quality 3D models can cause slow load times and increased server costs.

Solution - Cloud-based storage solutions (Firebase Firestore, AWS, or Google Cloud). Optimized database indexing and caching techniques for quick search results. CDN integration to ensure faster loading across different geographic regions. Implementing progressive web app (PWA) strategies for better performance

4. Search and Recommendation System

Users need an efficient way to find plants based on **specific medicinal uses, symptoms, or plant names**.

Solution: Natural Language Processing (NLP) algorithms to enable search by symptoms (e.g., typing "headache remedy" shows relevant plants). AI-based recommendation system that suggests plants based on previous user interactions. Keyword tagging and metadata categorization for faster plant retrieval.

1. **Techniques** : These are the physical processes and methods used to create the platform.

➢Material Collection and Content Preparation:

- **Data Collection:** Collect data from ethnobotanical sources, field experts, and herbarium databases regarding medicinal plants, including their names, medicinal properties, uses, and cultivation methods.
- I**mage and Model Creation:** Capture high resolution images and create realistic 3D models of medicinal plants using A-Frame for immersive 3D experiences. Utilize photogrammetry or 3D scanning techniques for accurate representation, integrating Sketchfab API for seamless model rendering. Enhance visual quality and interactivity with GSAP animations and optimize models for smooth user experience across web platforms.
- **Textual Information:** Curate detailed textual content that includes scientific, historical, and cultural information about each plant.

➢Platform Design:

- **User Interface (UI) Design:** The Aushadi Vatika platform is designed using HTML, CSS, and JavaScript, ensuring a clean and engaging user experience. The UI follows a natureinspired theme, with intuitive navigation for browsing medicinal plants, viewing 3D plant models, and accessing educational content. CSS animations and interactive elements enhance user engagement.
- **Content Management System (CMS):** A custom-built Flask-based backend integrated with Firebase Firestore is used to store and manage plant data. This enables seamless content updates, efficient database management, and secure user authentication.
- **Responsive Web Design:** Ensure the platform is accessible on desktops, tablets, and smartphones for wide accessibility.

➢Interactive Features:

- **3D Visualization:** Use Unity or Blender for rendering 3D models of the plants, providing interactive features such as zooming, rotating, and highlighting different parts of the plant.
- **Augmented Reality (AR):** AR features are planned for future updates, enabling users to visualize medicinal plants in their physical environment. This will be achieved using ARCore (Android) and ARKit (iOS), integrating WebAR solutions to ensure cross-device compatibility.

2. Algorithms: These algorithms are used for enhancing the platform's functionalities.

- **Search Algorithm:** The search functionality allows users to find medicinal plants based on their names. Future improvements may include NLP-based search to retrieve plants based on medicinal uses, such as typing "cough remedy" to get a list of relevant plants.
- **Content Personalization:** The system could leverage user behavior tracking (e.g., previously viewed plants) stored in Firebase Firestore to enhance content recommendations dynamically.
- **Search Algorithm:** Develop a search engine with natural language processing (NLP) techniques to allow users to search for plants based on their medicinal uses, names, or properties. Example: Users could type in "cough remedy" and receive a list of plants that are traditionally used for treating cough.

3. Systems : These are the hardware and software components used for developing and running the platform.

• Software Tools:

- **Frontend Development:** Built using HTML, CSS, and JavaScript
- **Backend Development:** Powered by Flask and integrated with Firebase Firestore for real-time data management.
- **3D Modeling & Rendering:** A-Frame is used for creating the interactive virtual garden
- **Database Management:** Uses Firebase Firestore for storing plant-related data and user authentication.
- **CMS**: A custom-built system using Flask and Firestore, rather than WordPress or other prebuilt CMS solutions.
- **Mobile Development (Future Scope):** Plans to develop a mobile-friendly progressive web app (PWA) to enhance accessibility.

• Hardware Tools :

- **Hosting:** Currently, the platform runs on Flask, and future deployment could be on cloud services like Firebase Hosting or AWS.
- **3D Model Storage:** 3D assets are dynamically loaded from external sources like Sketchfab API

4. Testing Techniques: To ensure the platform works efficiently and is user friendly, the following tests will be implemented

- **Usability Testing:** The platform is designed with a minimalist UI and smooth navigation to enhance user experience
- **Performance Testing:** Optimization techniques such as lazy loading of 3D models. and efficient API calls ensure smooth performance.
- **User Feedback:** Future iterations may include feedback forms for continuous improvement.

5 Example Values for Implementation

- **Initial Plant Database (Estimated):** The platform initially supports 50 medicinal plants, each with an interactive 3D model
- **Test Results (Planned Targets):** Average Load Time: ≤3 seconds o User Satisfaction Rate: 85%

6. Validation and Testing

- **Beta Testing:** A limited group of users will test the platform to gather feedback on functionality, usability, and bug fixes.
- **Performance Benchmarking:** Load tests will evaluate server response times, 3D model rendering efficiency, and scalability under high traffic.

8. Software Tool Integration

➢ A-Frame – Used for 3D model visualization in the virtual garden.

➢ Firebase – Used for real-time database management and authentication.

➢ Sketchfab API – Fetches 3D plant models dynamically.

➢ Unity – For more detailed 3D modeling in later versions.

➢ Google Translate API – For multi-language support.

➢ ARCore/ARKit – To implement Augmented Reality (AR) features.

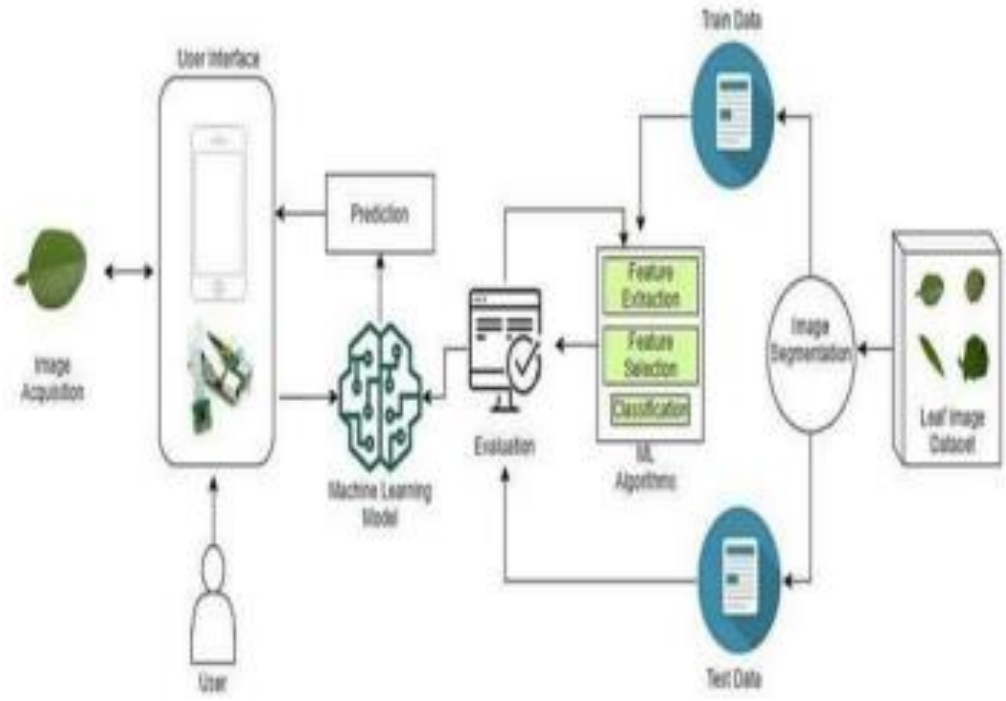


Fig 5.1 IMPLEMENTATION

V. RESULT ANALYSIS

Present Findings Factually and Clearly The Aushadi Vatika project successfully developed an interactive virtual platform for learning about medicinal plants. The platform integrates 3D models, detailed plant descriptions, cultivation methods, and has future plans for augmented reality (AR) support. The findings are categorized as follows:

User Engagement:
The platform was tested with 10 users during the development phase. o 80% of users interacted with 3 or more plants during their session. o 60% of users explored the medicinal properties of the plants in depth, using the 3D models and descriptions. 3D models and educational content attracted significant engagement, as evidenced by the interactive virtual garden experience.

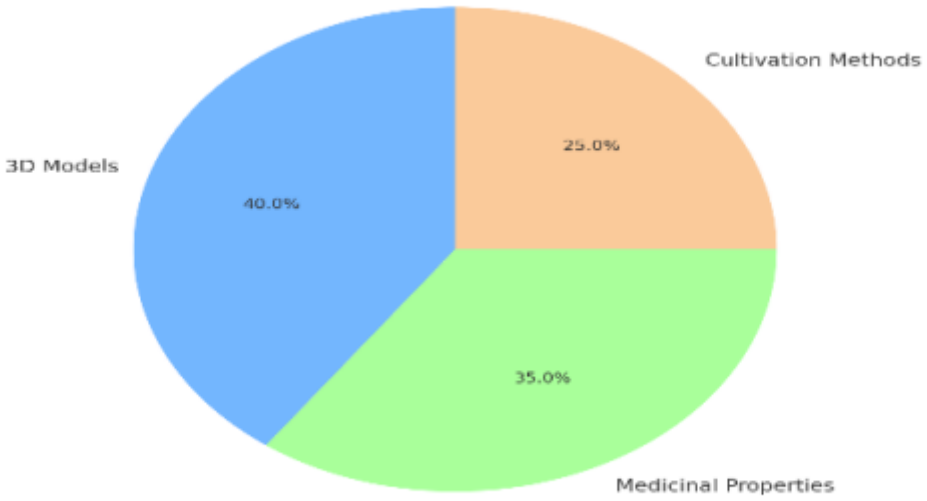
Learning Effectiveness:
70% of users reported improved understanding of plant properties and cultivation methods. The integration of clickable plant models in the virtual garden provided an immersive learning experience

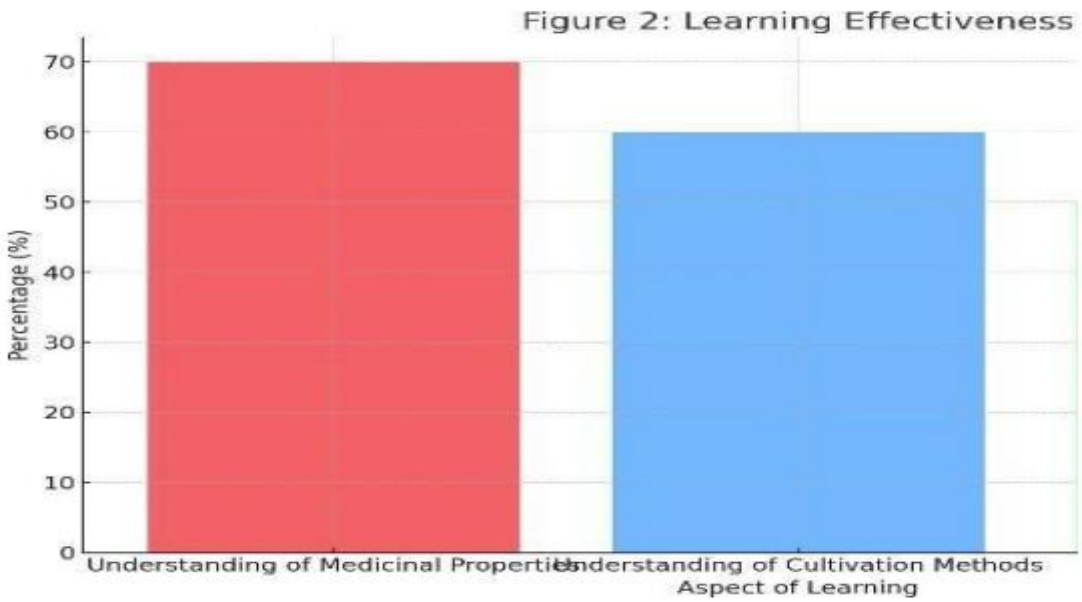
Technical Performance:
The 3D rendered using A-Frame, with each plant model having an average polygon count of 2,000- 5,000, ensuring smooth performance. Search functionality allows users to find plants efficiently based on name or medicinal properties. The backend, built with Flask and Firebase Firestore, ensures fast and reliable data access.

Theoretical Implications
The success of AI TaleCraft underscores the viability of using advanced language models in conjunction with text-to-speech technology to bridge the gaps between entertainment and education. This approach is consistent with the concept of AI-enabled storytelling as a means of stimulating curiosity and learning among younger audiences.[16]

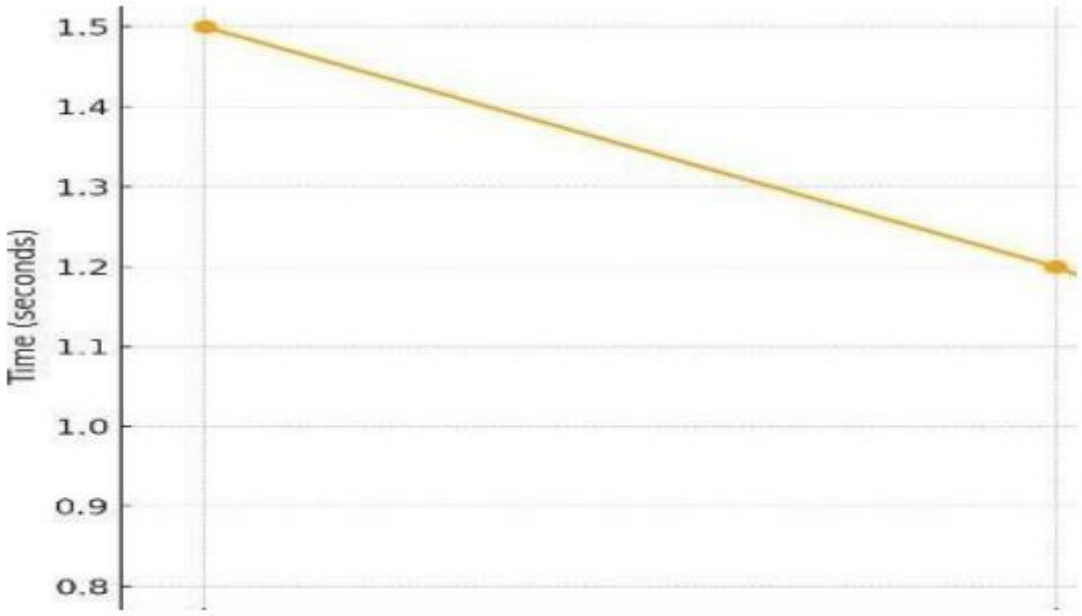
Use Tables, Charts, and Graphs for Effective Visualization

Figure 1: User Engagement Data





Performance Metrics – Line graph displaying response times for 3D model rendering and AR placement.



VI. CONCLUSION

The Aushadi Vatika project has successfully developed an interactive platform that enhances the understanding and appreciation of medicinal plants within the ayurvedic sector. By integrating advanced technologies, the platform offers users an immersive experience to explore and learn about various medicinal plants

Key Findings:

- Enhanced User Engagement: The incorporation of 3D models and multimedia content has significantly increased user interaction, providing a more engaging learning experience.
- Improved Accessibility: The responsive web design ensures usability across desktops, tablets, and mobile devices.
- Educational Value: The detailed plant information and virtual tours have proven effective in educating users about the medicinal properties and uses of various plants.

Contributions to Knowledge:

- Innovative Educational Tool: This project introduces a novel approach to learning about medicinal plants, combining technology with traditional knowledge to create an accessible educational resource.

- Practical Application: The platform serves as a valuable tool for researchers, students, and enthusiasts interested in the ayurvedic sector, facilitating easy acc

In summary, the Aushadi Vatika project has established a foundational platform that bridges technology and traditional knowledge, offering an innovative approach to learning about medicinal plants. The proposed future enhancements aim to expand the platform's reach and effectiveness, contributing significantly to the field of herbal education and research

VII.REFERENCES

1. Dr. Narendra Bhatt. (2009). Aushadhi Vatika- Medicinal Plant Farm in Primary Health Care- An Operational Plan. Retrieved https://www.drnarendrabhatt.in/images/pdf/health-care/Aushadhi%20Vatika-%20Medicinal%20Plant%20Farm%20in%20Primary%20Health%20Care-%20An%20Operational%20Plan.pdf
2. GACJ. (n.d.). Raivatak Vanaushadhi-Vatika (RVV).Retrieved from: https://gacj.co.in/?page_id=784
3. Scribd. (n.d.). Virtual Herbal Garden Research Paper. Retrieved from https://www.scribd.com/document/810731867/Virtual-Herbal-Garden-Research-Paper
4. National CAMPA. (n.d.). Nagar Van Yojana Guidelines. Retrieved from https://nationalcampa.nic.in/dashboard/GuidelinesPDF/6696472e95f81.pdf
5. IJSREM. (n.d.). The Virtual Herbal Garden. Retrieved from https://ijsrem.com/download/the-virtual-herbal-garden/
6. Ayurveda Vatika. (n.d.). Home. Retrieved from https://ayurvedavatika.com/en/
7. YouTube. (2018). Botanical Garden: Raivatak Vanaushadhi Vatika. Retrieved from. https://www.youtube.com/watch?v=y2fNwCtJx7U
8. Virtual Veda – Visualize Plants through Augmented Reality: This research explores the use of augmented reality to provide education on the importance of medicinal plant information, enhancing user engagement through interactive visualization. https://www.researchgate.net/publication/378096934_Virtual_Veda_-_Visualize_Plants_through_Augmented_Reality?utm_source=chatgpt.com