DEVELOPMENT AND USABILITY ANALYSIS OF EFLORACYNTOK: A DIGITAL BOTANICAL REPOSITORY FOR HERBAL PLANT CONSERVATION

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ABSTRACT

The Digital Botanical Repository at Universiti Utara Malaysia (UUM), known as eFloraCyntok, was developed to address challenges in traditional data management and limited accessibility to herbal plant information within UUM's herbal garden. Physical access restrictions to the garden necessitated a digital platform to enhance the dissemination and usability of plant information. The primary objective of eFloraCyntok is to support conservation, research, and educational initiatives by improving data management, accessibility, and user engagement. The repository was developed through a structured process that included user requirement analysis, the design of a botanical database and high-resolution image storage, the creation of an intuitive user interface, database-interface integration, and the implementation of advanced search functionalities. Usability testing, conducted using the Website Analysis and Measurement Inventory (WAMMI) framework, revealed both strengths and areas for improvement. Findings indicate that users found the repository effective in information retrieval and visually engaging, with 49% agreeing the structure was logical and 67% noting ease in finding information. However, challenges in navigation, error tolerance, and introductory explanations were identified, impacting ease of learning and initial user experiences. Despite these limitations, eFloraCyntok significantly enhances accessibility to botanical knowledge, supports academic research, and promotes public awareness of herbal plants and their medicinal uses. By addressing usability issues and incorporating user feedback, the repository can evolve into a model digital platform, contributing to the preservation and utilization of herbal resources while bridging the gap between physical and digital botanical gardens.

Keywords: Digital botanical repository, herbal plant conservation, usability testing, educational resources, biodiversity preservation.

INTRODUCTION

Universiti Utara Malaysia (UUM) established an herbal plant garden in the northern region of Malaysia to support biodiversity conservation and promote environmental sustainability. Located in a region with favourable weather and fertile soil, the garden cultivates various herbal plants native to the area. It serves as an important resource for education, research, and community engagement, contributing to the preservation of herbal plants and their cultural and medicinal significance.

Herbal plants have long been valued in traditional medicine for their therapeutic properties, aiding in the treatment of various health conditions (Farzaneh & Carvalho, 2015). They also play a critical role in modern medicine, forming the basis of many pharmaceutical products and natural remedies (Munir et al., 2024). Preserving and documenting these plants is vital to conserving biodiversity, advancing medical research, and maintaining cultural heritage.

Despite its potential, the herbal garden faces limitations in accessibility and data management. Visitors must be physically present to benefit from its resources, which restricts its use for educational and research purposes. Additionally, the traditional methods of recording plant information make it difficult to efficiently manage and share data.

To address these issues, this study introduces eFloraCyntok, a digital botanical repository for UUM's herbal garden (Mohd-Nawi et al., 2023). This platform aims to digitize the garden's collection, making it accessible online with detailed plant profiles and advanced search functions. Users can explore the garden virtually, learn about individual plants, and access information about their medicinal uses and ecological roles.

The objective of eFloraCyntok is to improve data management, accessibility, and information dissemination related to herbal plants. This initiative supports research, education, and community awareness by making herbal plant information widely available. It also positions UUM's herbal garden as a significant resource for botanical conservation and sustainable development.

LITERATURE REVIEW

Digital repositories serve as platforms for storing, managing, and providing access to digital content, including scholarly works, research outputs, and specialized data. Acting as digital archives, they facilitate the collection, preservation, and dissemination of information while ensuring accessibility to a broader audience. These platforms often adhere to international standards for metadata and content management, providing user-friendly interfaces for content deposit and retrieval (Nwokedi & Nwokedi, 2018; Pampel, 2023).

Repositories are employed across diverse domains, including academic institutions, research organizations, public sector entities, and specialized research areas. Academic repositories, such as those at the University of North Texas and Louisiana State University, store and distribute research outputs, student projects, and faculty publications (Waugh et al., 2015; Lercher, 2008). Research organizations leverage repositories to manage and share scientific data, exemplified by Ziegler et al.'s (2015) repository for ecological research and decision-making. Public institutions like national libraries use repositories to preserve cultural and historical materials, such as the National Archives of India's Abhilekh Patal (Charan & Sharma, 2021). Similarly, domain-specific repositories cater to specialized research needs, including botanical studies (Chouhan et al., 2019), ethnobotany (Munir et al., 2024), and medicinal plant conservation (Mohanlal & Krishnaswami, 2017).

Key features of digital repositories enhance their functionality and usability. These include digital preservation to ensure long-term data integrity (Geetha et al., 2016), metadata management for efficient organization and retrieval (Ullah, 2015; Verma & Kumar, 2018), and user-friendly interfaces with advanced search options (Clobridge, 2010; Che-Mohd-Sakri & Ishak, 2024). Open-access functionality promotes unrestricted global knowledge dissemination and collaboration (Nwokedi & Nwokedi, 2018).

Additionally, repositories often support diverse content types, such as multimedia and datasets, catering to various academic and research needs (Pampel, 2023).

Repositories provide numerous benefits, particularly in enhancing research, education, and knowledge-sharing efforts. By archiving and disseminating scholarly work, repositories increase visibility and impact, as seen in Trinity University's student work archives (Nolan & Costanza, 2006). Collaborative repositories, such as those for nursing education, further evidence-based practices (Heselden et al., 2019). Cost-effective access to information is another key benefit, particularly for institutions with limited resources (Sharma, 2022). National repositories like Abhilekh Patal preserve historical documents to support education and cultural heritage research (Charan & Sharma, 2021). Specialized repositories, such as those in botanical and medicinal plant studies, play a critical role in biodiversity conservation and advancing research in ethnobotany (Chouhan et al., 2019; Mohanlal & Krishnaswami, 2017).

Despite their benefits, repositories face challenges. Usability issues, such as poor navigation and limited user engagement, deter effective usage, as highlighted in usability studies of Abhilekh Patal and other repositories (Charan & Sharma, 2021; Waugh et al., 2015). A lack of scalability and user-specific features is another limitation, particularly in repositories designed for specialized domains like botanical research (Mohanlal & Krishnaswami, 2017). Addressing these challenges is crucial to improving repositories' effectiveness and ensuring they meet the needs of diverse user groups.

For the development of a digital botanical repository for UUM's herbal garden, these findings emphasize the importance of addressing usability, scalability, and accessibility challenges. By integrating advanced search features, metadata management, and user-centric designs, the repository can achieve its objectives of promoting herbal plant conservation, education, and research.

RESEARCH METHODOLOGY

The development of the Digital Botanical Repository followed a structured approach, encompassing several critical phases to ensure its functionality, usability, and alignment with user needs (Figure 1). Figure 2 illustrates an example of interfaces from the repository.

Phase 1: User Requirements Analysis
A thorough analysis of user requirements was conducted to identify specific needs and desired features. This phase involved engaging key stakeholders, including researchers, and botanical garden staff, through interviews, and focus group discussions. The insights gathered informed the repository's objectives, such as supporting research, promoting education, and fostering public engagement. Essential features like detailed plant profiles, high-resolution images, and robust search capabilities were prioritized in this study.

Phase 2: Database Design and Development
The database architecture was carefully designed to store a vast array of botanical data, including scientific classifications, local names, medicinal uses, and geographic distribution. High-resolution images of plants were incorporated to enhance visual appeal and educational value. The database structure employed standardized metadata formats, to ensure consistency and interoperability with other digital repositories.

Phase 3: User Interface Design
A user-friendly and responsive interface was developed to provide seamless interaction across various devices. The design focused on intuitive navigation, accessibility for users with diverse needs, and support for multilingual content to broaden the repository's reach. Wireframes and prototypes were created and refined through iterative feedback from stakeholders.

Phase 4: System Integration and Feature Implementation
The database and user interface were integrated, with advanced search functionality implemented to enhance navigation and operational efficiency. Search features included are keyword search, search history-based filters.

Phase 5: Usability Testing
To evaluate the repository's effectiveness, usability testing was conducted using the Website Analysis and Measurement Inventory (WAMMI) framework. Participants from diverse backgrounds were invited to perform various tasks, such as searching for specific plants and accessing medicinal information. Metrics such as efficiency, error rate, and user satisfaction were assessed. Feedback from this phase informed refinements to improve ease of use, error tolerance, and learning curve.

Phase 6: Deployment and Continuous Improvement
After usability validation, the repository was deployed. Plans for ongoing updates, such as integrating user-generated content and virtual tours, were established to ensure the repository remains relevant and user-focused.

Figure 1
Phases of the methodology

Figure 2
Example of the repository interfaces

(a) Search facility

(b) Search results

(c) Herbal plant information

FINDINGS AND DISCUSSION

The findings (Table 1) from the user feedback survey on eFloraCyntok provide insights into its performance across five usability categories: Effectiveness, Efficiency, Engagement, Error Tolerance, and Ease of Learning.

Table 1

Findings from usability testing

Category	Items	Frequency				
		1	**2**	**3**	**4**	**5**
Effectiveness	This website seems logical to me.	0	0	11	35	14
	This website helps me find what I am looking for.	0	0	9	38	13
	Easy to tell if this website has what I want.	1	15	21	20	3
	I get what I expect when I click on things on this website.	0	0	16	36	8
Efficiency	I can quickly find what I want on this website.	0	0	9	43	8
	This website is fast.	0	3	26	25	6
	I feel efficient when I'm using this website.	0	1	20	32	7
	This website has no annoying features.	1	9	18	23	9
Engagement	This website has much that is of interest to me.	0	2	10	41	7
	The pages on this website are very attractive.	0	1	17	33	9
	I like using this website.	0	1	12	37	10
	Using this website is worth it.	0	0	7	39	14
Error Tolerance	It is easy to move around this website.	0	2	19	30	9
	I feel in control when I'm using this website.	5	10	22	21	2
	Learning to find my way around this website is not a problem.	0	5	18	29	8
	Remembering where I am on this website is not difficult.	0	4	18	29	9
Ease of Learning	This website's introductory explanations are sufficient.	4	20	25	8	3
	I can easily contact the people I want to on this website.	1	9	24	20	6
	Using this website for the first time is easy.	0	1	20	30	9
	Everything on this website is easy to understand.	0	0	19	33	8

The findings align with and extend the insights presented in the literature on digital repositories. Digital repositories are designed to facilitate access, engagement, and usability for diverse users by providing

logical structures, efficient search functionalities, and user-friendly interfaces (Nwokedi & Nwokedi, 2018; Pampel, 2023). In line with these goals, eFloraCyntok demonstrated strong Effectiveness and Efficiency in helping users retrieve information quickly and logically. The majority of users (85%) agreed that the website was logical and supported task completion, reflecting similar findings by Verma and Kumar (2018), who emphasised that effective metadata organisation in repositories plays a crucial role in ensuring efficient retrieval.

However, the challenges reported by eFloraCyntok users, such as difficulties in determining whether the site had the information they needed (38%) and frustrations with navigation (26%), echo concerns raised by Clobridge (2010) about the need for intuitive navigation and straightforward content presentation in digital repositories. These findings highlight the importance of continuously refining repository design to minimise ambiguity and improve usability, as Che-Mohd-Sakri and Ishak (2024) recommended.

The engagement category showed that eFloraCyntok was largely successful in providing content that interested users (80%) and a visually appealing interface (70%), supporting Heselden et al.'s (2019) argument that attractive and engaging design elements enhance user satisfaction. However, the mixed satisfaction levels (11% dissatisfaction) point to opportunities for improvement, aligning with the observations of Ullah (2015), who noted that consistent design and content quality are critical to sustaining user interest in repositories.

Issues related to Error Tolerance and Ease of Learning highlight areas for further improvement in eFloraCyntok. The literature underscores the importance of providing clear navigation aids and introductory materials to help users adapt to repository interfaces (Clobridge, 2010; Geetha et al., 2016). The findings that only 38% of users felt in control while navigating and 40% struggled with the site's structure reflect similar challenges noted in repositories where navigation support and onboarding processes were insufficient. As Charan and Sharma (2021) highlighted, repositories with robust user guidance systems—such as tutorials and clear structural cues—enhance user confidence and reduce navigation errors.

Finally, the insufficient introductory explanations reported by eFloraCyntok users align with Sharma's (2022) emphasis on supporting first-time users with detailed onboarding materials. While the site scored well in terms of efficiency and accessibility, addressing these onboarding and navigation challenges can help eFloraCyntok achieve the comprehensive usability standards discussed in the literature.

CONCLUSION

The proposed Digital Botanical Repository, eFloraCyntok, represents a significant stride in the conservation and study of herbal plants. eFloraCyntok is vital in storing, managing, and providing access to digital content. This aligns with the primary aim and purpose of digital repositories: to store and disseminate scholarly works and digital outputs (Nwokedi & Nwokedi, 2018; Pampel, 2023). Through eFloraCyntok detailed plant profiles and advanced search capabilities, the repository has markedly enhanced accessibility and user engagement. This improvement aligns with the functionalities of repositories at academic institutions, research organizations, and libraries, which support knowledge accessibility and research endeavors (Waugh et al., 2015; Lercher, 2008; Charan & Sharma, 2021). However, findings from usability testing have pinpointed areas that require attention, particularly in improving efficiency, error tolerance, and ease of learning. Addressing these concerns is pivotal to refining the repository's usability and enhancing overall user satisfaction.

By implementing these enhancements, eFloraCyntok can better support conservation efforts, academic research, and educational initiatives, effectively bridging the gap between physical botanical gardens and digital users. This digital platform, similar to other specialized repositories in botanical research and medicinal plants, promotes environmental sustainability and public health (Chouhan et al., 2019; Mohanlal & Krishnaswami, 2017).

Looking forward, there are several aspects for further enriching eFloraCyntok. Introducing interactive educational tools like virtual tours and augmented reality features could provide a more immersive learning experience. Incorporating user-generated content, such as personal anecdotes and experiences with herbal plants, could diversify and deepen eFloraCyntok's content while fostering a sense of community among users. Multilingual support would expand accessibility and global interest in the botanical garden, reflecting the benefits of open access in promoting global knowledge dissemination and collaboration (Nwokedi & Nwokedi, 2018). Collaboration with other botanical institutions to share resources and information could enhance the repository's comprehensiveness and utility, much like repositories that support knowledge sharing among researchers (Heselden et al., 2019). Ongoing integration of user feedback and regular updates will be essential to maintaining the repository's responsiveness to user needs and technological advancements. By focusing on these future initiatives, eFloraCyntok can continue evolving as an invaluable conservation, research, and education resource, contributing significantly to botanical knowledge and environmental stewardship.

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