Enhancing Urban Tourism: A Gamified Design for Sustainable User Engagement

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ABSTRACT

Urban tourism faces significant challenges, including overcrowding and environmental degradation, necessitating innovative approaches to enhance visitor experiences and promote sustainable practices. This research aims to investigate how gamification can enhance urban tourism by encouraging the exploration of lesser-known areas and local businesses, thereby promoting sustainable user engagement. The problem of low engagement with local attractions and businesses is considered by developing a gamified tourism application that incorporates game elements such as challenges, rewards, and interactive storytelling. The application employs the System Development Life Cycle methodology, which includes stages of planning, analysis, design, implementation, and testing to ensure a user-centered approach. Through user feedback and usability testing, the research findings reveal that these gamification strategies significantly enhance user satisfaction and promote responsible tourism behaviors. The application not only enriches the immediate travel experience but also encourages ongoing interaction with the destination, extending engagement beyond the visit. This research contributes to the information systems field by demonstrating how gamified solutions can effectively address contemporary urban tourism challenges, ultimately supporting sustainable practices and strengthening community ties.

Introduction[*]

Urban tourism has significantly contributed to the economies of many cities worldwide. However, its rapid expansion has resulted in problems like overcrowding, environmental harm, and standardization of tourist experiences [1]. To address these issues, innovative solutions are required to enhance visitor satisfaction and promote sustainable tourism practices.

The COVID-19 pandemic has brought the global tourism industry to a grinding halt, causing unprecedented disruptions and challenges [2]. Indonesia's tourism industry has been severely impacted by the pandemic, experiencing a decline in tourist arrivals, closures of tourist sites, and reduced revenue. After the pandemic, travelers want new and exciting travel experiences [3].

Tourism is a business that helps to drive economic growth, cultural exchange, and social development. However, the rapid expansion of tourism has created several issues, particularly in urban areas, such as overpopulation, environmental degradation, and social upheaval [4]. As a result of these issues, there is an increasing emphasis on sustainable tourism, which aims to balance economic growth with environmental conservation and social inclusion. Sustainable tourism seeks to ensure that the beneficial effects of tourism exceed the negative ones by encouraging responsible tourism practices and involving local people [5].

Urban tourism has gained significant prominence in recent years, driven by the increasing popularity of city destinations and the recognition of their

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economic and cultural importance. Urban tourism research and industry discussions, as cities worldwide strive to balance the benefits of tourism with the challenges it presents. The growing body of literature on urban tourism, coupled with the increasing number of academic conferences and industry events dedicated to this topic, further underscores its centrality in the evolution of the tourism field of study [6].

Extensive research has been conducted on the economic and socio-cultural impacts of urban tourism. The study [7] has investigated the socio-cultural motivations of tourists, understanding the factors that influence their travel choices and behaviors. In [8] studies have investigated the impacts of tourism on local communities, focusing on economic benefits, socio-cultural changes, and environmental consequences. For the quality of life of the community, the study of [9] found that while economic and environmental factors negatively affected the community, socio-cultural impacts positively influenced their well-being, highlighting the importance of balancing economic growth with community well-being in tourism development. The study [10] found that the development has positively impacted the local community's economy by creating new jobs and business opportunities. However, it has also led to income inequality among community members. Additionally, the research identified socio-cultural impacts, both positive and negative, resulting from tourism development in the area. Studies have highlighted the significant role of tourism in generating revenue, creating jobs, and revitalizing urban areas [11]. However, the rapid growth of urban tourism has also led to various challenges, including overcrowding, environmental degradation, and the homogenization of tourist experiences. The study [12] emphasizes the need for cultural preservation. It suggests that collaborative efforts between local communities, organizations, and tourists are crucial to ensure a sustainable future for Bali's cultural heritage.

To address the challenges facing urban tourism, such as overcrowding, environmental impact, and the homogenization of experiences, innovative and creative solutions are essential. In recent years, gamification has emerged as a promising technique for achieving these objectives. Gamification refers to incorporating game-like themes and mechanics into non-game environments to increase user engagement, motivation, and behavior [13].

Gamification, the application of game design elements in non-game contexts, has emerged as a promising strategy for enhancing user engagement and motivation. By incorporating game mechanics such as points, badges, and leaderboards, gamification can transform mundane tasks into fun and rewarding experiences [14]. Some features such as challenges, rewards, and interactive storytelling. Gamification can be a powerful tool to enhance employee engagement and motivation, and well-designed gamification patterns can improve business performance and competitiveness. [15]. Recent studies have shown that gamification can significantly improve user satisfaction and foster responsible tourism behaviors, making it a valuable tool for revitalizing urban tourism.

Gamified tourism presents a promising solution to engage tourists and enhance their post-pandemic travel journeys [16]. By blending interactive gameplay elements with travel experiences, gamified tourism offers a unique opportunity to rebuild confidence, promote safety measures, and create unforgettable adventures. Gamified tourism provides an immersive platform that transforms ordinary sightseeing into exciting quests. Gamification adds an element of fun and competition, making the journey more enjoyable and memorable, ultimately revitalizing the tourism sector [17].

Gamified tourism can serve as a tool to engage and educate users about sustainability, encourage behavior change, and enhance their overall involvement in creating a more sustainable urban environment. It aims to empower individuals by providing them with information, resources, and interactive features that enable them to make informed choices and actively participate in sustainable initiatives within their urban communities [18]. An investigation of the analysis and design of a gamified tourist application that targets at sustainable user engagement is required [19]. This will concentrate on developing an interactive and user-centric application using gamification concepts to promote sustainable practices among tourists visiting large destinations [20].

Creating a gamified tourist application requires a methodical and well-structured approach, and software engineering approaches give the required tools and processes [21]. There are several stages at which software engineering methods are used to construct gamified tourism apps. The first stage of software development is the gathering and analysis of

requirements. To understand the needs and expectations of stakeholders such as tourists, destination management organizations, and local communities, software developers collaborate closely with them. This data serves as the foundation for the design and development of the application [22].

Several System Development Life Cycle (SDLC) methods are suitable for developing gamified tourism applications. The iterative and user-focused SDLC methods like RAD and the Spiral Model are ideal for developing gamified tourism applications. These approaches enable continuous improvement, collaboration with stakeholders, and responsiveness to user feedback, resulting in a captivating and impactful urban user experience that promotes sustainable tourism engagement [23].

To create engaging and effective gamified tourism experiences, it is crucial to prioritize user experience design. By collaborating with software engineers, UX designers can develop intuitive interfaces and interactive features that attract tourists and encourage active participation. Gamification mechanics such as points, badges, and challenges can further enhance user engagement and motivate sustainable behaviors.

The problem addressed in this research is the lack of effective and engaging tools to encourage sustainable tourism practices. Many tourists are unaware of the impact their actions have on the local communities and the environment. Some tourism applications often provide basic information about tourist attractions but fail to motivate users to act responsibly and engage in sustainable practices. There is a need to promote sustainable tourism practices that balance economic growth with social and environmental responsibilities.

To address this gap, this present research seeks to analyze the current state of gamification in tourism, with a focus on sustainable practices in urban environments. By investigating the design and implementation of gamified tourism applications, this study aims to identify best practices, challenges, and opportunities to engage tourists in sustainable behaviors.

This research aims to create an analysis and design of applications that use gamified elements to engage and educate individuals about sustainable practices while experiencing tourism. This research will investigate how gamification can influence urban lifestyle behavior change, foster sustainable habits, and contribute to the overall well-being of urban communities.

The remainder of this paper is organized as follows. Section Methods outlines the research methodology, including the research design, data collection methods, and data analysis techniques. Section Result and Discussions presents the results of the study, including the findings from quantitative and qualitative data analysis. Then discuss the implications of the findings and the contributions of the research to the field of information systems. Finally, Section Conclusion concludes the paper and suggests directions for future research.

Methods

The initial step in the research methodology involves collecting data from potential users through interviews and conducting a thorough literature review. This data is then analyzed to identify the specific requirements and expectations of users, which will serve as the foundation for the design and development of the gamified tourism application.

To collect data for this research, a mixed-methods approach will be employed. Primary data will be collected through user surveys to understand tourists' demographics, preferences, and perceptions of gamified tourism. Additionally, usability testing will be conducted to evaluate the application's effectiveness and identify areas for improvement. Secondary data will be sourced from a comprehensive literature review on gamification, tourism, and sustainable development, as well as case studies of successful gamified tourism initiatives. To analyze the collected data, both quantitative and qualitative methods will be utilized. Quantitative analysis will involve statistical techniques to analyze numerical data from surveys and user testing, while qualitative analysis will involve thematic analysis to interpret qualitative data from interviews and focus groups. This combined approach will provide a holistic understanding of the potential of gamification in urban tourism and inform the development of effective gamified applications.

To develop the gamified tourism application, we will employ a structured System Development Life Cycle (SDLC) approach [24].

The following phases will be described (**Figure 1**):
Planning: Clearly defining the application's objectives, identifying the target audience, and creating a detailed project plan.

Analysis: Conducting market research to understand user needs, determining the most effective gamification elements, and analyzing sustainable tourism practices to align the application's features.

Design: Creating an intuitive user interface, developing wireframes and prototypes, and designing the database schema to store relevant information.

Implementation: Developing the front-end and back-end of the application, integrating gamification elements, and ensuring seamless user experience.
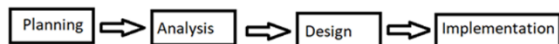
Planning ⟹ Analysis ⟹ Design ⟹ Implementation

Figure 1. SDLC Model

By following this structured approach, the research aims to develop a gamified tourism application that promotes sustainable practices, enhances the tourist experience, and contributes to the overall well-being of urban communities.

Results and Discussions

Results of Analysis of User Requirement:

The user requirements analysis for the platform focused on understanding how users interact with a tourism-based gamified website and what features would be essential for maximizing engagement and educational impact. Here are some key findings from this analysis:
1. **Target User Needs**: The platform caters to a diverse audience, including tourists, students, and locals of all ages. The absence of an age limit ensures that anyone can access and benefit from the content, whether to learn about West Java's tourism or enjoy the interactive game features.
2. **Multi-User Interaction**: The requirement for multi-user functionality stemmed from the need for collaborative or competitive gameplay, allowing 2 to 4 users to participate simultaneously. This feature encourages group participation and interaction, making tourism exploration a social experience.
3. **Educational Content Integration**: Users expressed a need for tourism content that is both informative and engaging. Application integration of detailed information about tourism sectors (land, maritime, regional destinations, food, and traditional games) meets this requirement by blending education with gameplay.
4. **Technology Compatibility** A key requirement was to ensure that the platform is accessible across various devices (smartphones, tablets, and computers), making it flexible and convenient for users. The use of responsive web design and technologies like React ensures compatibility across these devices.
5. **Security and Data Management**: User authentication was identified as a critical requirement to ensure data security, particularly for tracking user achievements and progress. Firebase is employed for real-time data management, ensuring that users can log in securely and experience consistent gameplay across sessions.
6. **Game Mechanics and UI/UX**: Users expected intuitive navigation and visually engaging gameplay. The design of gamification with achievements and challenges, adds to user engagement. Icons, buttons, and interface elements were optimized for user-friendly interaction.

The analysis revealed a strong demand for a gamified, interactive platform that not only entertains but also educates users about tourism in West Java,

Result of Design Gamified User Experience:

The NusaQuest website is designed to promote tourism in West Java through an interactive and educational platform. The core feature of the site includes a gamified experience, with games such as Snakes and Ladders and an educational card game called Nuca (Nusa Card). These games focus on five main tourism sectors: land tourism, maritime tourism, regional destinations, local cuisine, and traditional games in West Java. The information from these sectors is analyzed in depth and integrated into the platform as content for both games, where users answer questions and face challenges centered around these aspects.

Key Features of NusaQuest:
•Responsive Design: The website will be accessible on various devices like tablets, smartphones, and laptops, offering an optimal gaming experience across platforms.
•Multi-user System: The site supports 2 to 4 users simultaneously in interactive gameplay.
•User Authentication: Users will need to log in, ensuring data security and game progress tracking.
•Detailed Tourism Information: In-depth content about the five tourism sectors will be provided, enhancing user knowledge and interest in West Java tourism.
•Integrated Promotional and Educational Content: Educational content related to tourism will be woven into the games to keep users engaged while learning.

•Achievement System: Players can unlock achievements and earn items, promoting deeper exploration of West Java's tourism features.

Technology Stack:
•Front-end: Built with React, utilizing Bootstrap for consistent UI, and React-Konva for handling graphic elements like game boards and cards.
•Back-end: Uses Firebase Realtime Database to store user data, game content, and tourism information. Firebase SDK handles real-time synchronization across devices and manages user authentication.
•Additional Technologies: Google APIs for location services and translations, Font Awesome for UI icons.

The combination of responsive design, interactive gameplay, and rich, educational content makes NusaQuest a unique platform for both locals and international tourists to explore and learn about West Java's diverse tourism offerings.

The findings from the NusaQuest project, which focuses on promoting tourism in West Java through interactive games like Snakes and Ladders and Nusa Cards, reveal that this innovative approach enhances user engagement with tourism content. By integrating five key sectors of West Java tourism (land, maritime, regional destinations, local food, and traditional games), NusaQuest provides a comprehensive platform that combines educational and entertaining elements.

NusaQuest's standout features include:
•Educational Content: The platform integrates comprehensive information about West Java's key tourist attractions into the gameplay, offering users an engaging way to deepen their knowledge of the region as they play.
•Enhanced Interactivity: Supporting up to four players simultaneously, NusaQuest's multi-user functionality fosters a more engaging, interactive gaming experience, catering to both local and international users.
•Advanced Technology Integration: The platform is built with modern tools like React for dynamic front-end design and Firebase for real-time data management, ensuring responsiveness and compatibility across various devices, including tablets, smartphones, and computers.
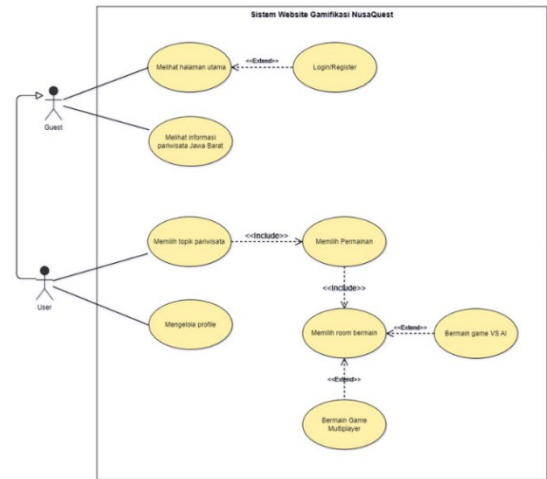

Figure 2. Use Case Analysis

The NusaQuest gamified tourism application is designed to start with a login page, as illustrated in Figure 3.
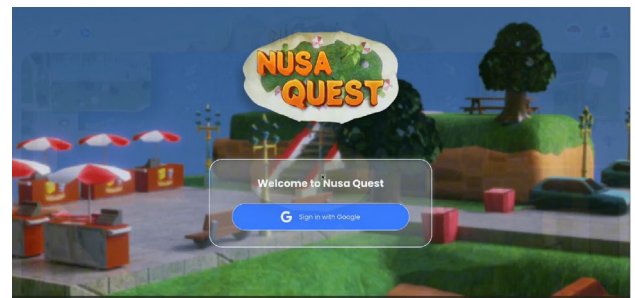

Figure 3. NusaQuest Login Page

After logging in, users can select a card-based game to play, such as "Snakes and Ladders" or the educational "Nusa Card" game. These games incorporate information about West Java's tourism offerings, including land tourism, maritime tourism, regional destinations, local cuisine, and traditional games. By playing these games, users can learn about the region's cultural heritage and natural attractions while having fun.

Figure 4. Users select the type of game
When users select the "Nusa Card" game, users can play against other online players or compete against

AI opponents. The game's interface displays both the user's cards and the opponent's cards, creating a dynamic and engaging gameplay experience.

Figure 5. Users select their opponent

After selecting an opponent, whether human or AI, the game begins with a series of trivia questions about West Java. Players take turns answering questions, and correct answers earn points. The questions cover various topics, including history, culture, geography, and local cuisine. This gamified approach makes learning about West Java fun and engaging.

Figure 6. Users play the game

The game finishes when all the cards have been drawn. The final scores are then calculated, and the winner is announced.

Figure 7. The game ends with the winner

Discussion

The research involved a comprehensive analysis of user requirements to identify the key features and functionalities needed for a gamified tourism platform. This analysis highlighted the importance of creating a platform that is accessible to a diverse audience, supports multi-user interaction, integrates educational content, and is technologically compatible.

Based on these findings, the NusaQuest platform was designed to offer an interactive and engaging experience for users. Key features include responsive design, multi-user capabilities, user authentication, detailed tourism information, and a gamified learning experience through games like Snakes and Ladders and Nusa Cards. The platform leverages modern technologies like React and Firebase to ensure a seamless user experience.

The research findings suggest that gamified tourism platforms like NusaQuest can effectively engage users and promote tourism destinations. By integrating educational content with interactive gameplay, these platforms can provide a unique and enjoyable way to explore and learn about different regions. Future research could explore further the impact of gamification on user behavior, engagement, and knowledge retention.

Conclusions

The analysis and design of tourism applications reveal its potential to significantly enhance user engagement while promoting sustainable urban tourism practices. This research highlights the importance of integrating gamification elements into the tourism experience, making it enjoyable but also educational. Using game mechanics such as points, badges, and leaderboards, NusaQuest effectively motivates users to explore and learn about local attractions while fostering environmentally friendly behaviors. Furthermore, the application demonstrates that storytelling and narrative can play a vital role in creating a deeper emotional connection with users. This connection encourages users to not only participate in the gameplay but also to internalize the values of sustainability and cultural preservation. The emphasis on collaboration through challenges promotes a sense of community among users, reinforcing collective responsibility for sustainable tourism. Technological integration is another key aspect of NusaQuest, ensuring accessibility and responsiveness across various devices. This feature enhances user experience and engagement, allowing users to enjoy the application anytime and anywhere. Data analytics enable continuous improvement,

providing insights into user behaviors and preferences, which can inform future updates and enhancements to the application.

Author Contributions
The author's contribution to this research is as follows: Conceptualization, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; methodology, Johannes Siregar, Rufman Akbar, Augury El Rayeb; software, Johannes Siregar, Augury El Rayeb, and Chaerul Anwar; validation, Johannes Siregar, and Chaerul Anwar; formal analysis, Johannes Siregar, Rufman Akbar, and Chaerul Anwar; investigation, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; resources, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; data curation, Johannes Siregar.; writing—preparation of original draft, Johannes Siregar; writing—review and editing, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; visualization, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; supervision, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar; project administration, Johannes Siregar; obtaining funding, Johannes Siregar, Rufman Akbar, Augury El Rayeb, and Chaerul Anwar. All authors have read and approved the published version of the manuscript.

Conflicts of Interest
The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

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