Virtual Tour As A Tourist Attraction Promotion Media Using Multimedia Development Life Cycle

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Abstract . This study is dedicated to the development of a comprehensive web-based virtual tour application known as the "Virtual Tour Application for Lembah Rembulan Tourist Attraction," designed to function as an information hub. Despite possessing diverse attractions and geographical advantages, the local tourism sector is inadequately promoted due to limited utilization of digital technology. The research follows the Multimedia Development Life Cycle (MDLC) methodology. Notably, the virtual tour website developed in this study provides a website profile, social media information, contact details for the tourist destination operator, and reviews, serving as valuable considerations for prospective tourists. Another noteworthy feature is the dynamic nature of information in the virtual exploration component, enabling tourist attraction operators to make real-time adjustments. It is anticipated that the Virtual Tour Application for Lembah Rembulan Tourist Attraction will serve as a platform for information sharing, fostering immediate community interest in visiting Lembah Rembulan Tourist Attraction. Black-box testing results affirm the effective construction of the system based on proposed scenarios, with two testing roles: visitors and tourist attraction operators.

Keywords: virtual tour; tourism; tourist attraction, multimedia development life cycle; black box testing

INTRODUCTION

The issue of low visitor numbers faced by the Lembah Rembulan tourist destination can be attributed to an ineffective promotional strategy. Currently, tourism promotion efforts are limited to sharing pictures on the timeline and status of Lembah Rembulan's Facebook and Instagram accounts, without utilizing advertising services. Such a promotional approach has a limited reach and is not appealing to the public. Considering technological advancements, it is crucial for people to keep up with these developments and make use of various facilities, including the presence of a website. In this context, it is important to realize that a website can be an effective means for conducting advertisements and promotions accessible to various segments of the population (Dairoh et al., 2022).

In addition to the issue of promotional media, people also struggle to find reviews on the internet about Lembah Rembulan tourism. Yet, nowadays, tourists consider reviews of a tourist attraction as a basis for choosing a destination to visit (Choiron, 2017). Word-of-mouth promotion is also ineffective because the number of tourists visiting this attraction is still limited. Based on the outlined issues, it can be concluded that the interest of tourists in visiting Lembah Rembulan is not primarily influenced by recommendations from others. Therefore, an interactive promotional platform is needed to provide a comprehensive overview of Lembah Rembulan tourism to the public, covering its natural conditions, on-site facilities, and the overall pleasant atmosphere.

Tourism plays a crucial role in enhancing regional income and fostering economic development (Haryana, 2020) (Lemy, Teguh, & Pramezwary, 2019). The promotional methods currently employed for disseminating information about tourism, such as brochures, posters, and word of mouth, demand special attention. However, these traditional approaches prove ineffective for reaching a significant number of tourists and often involve high costs, limiting their impact to those who have already visited. Additionally, the lack of utilization of digital technology by local governments and tourism operators hinders the dissemination of information about tourist attractions. The absence of an effective directional sign system further compounds the issue, leaving many potential tourists unaware of the locations, facilities, and accommodations available at these attractions. Furthermore, there is currently no dedicated website providing information about tourist attractions.

In past research on virtual tours, information was embedded or explicitly written in the source code, posing a challenge for tourist attraction operators to alter content or descriptions easily. This difficulty arises because developers, who are programming experts, are typically required for modifications (Napolitano, Scherer, & Glisic, 2018) (Loaiza Carvajal, Morita, & Bilmes, 2020). This becomes problematic when details about a location, such as pricing or contact information, may undergo changes. However, this study represents a significant advancement by offering tourist attraction operators the broadest flexibility to update information whenever necessary.

Earlier studies on creating virtual tours primarily emphasized incorporating features for virtual exploration (Mah et al., 2019) (Maines & Tang, 2016). Specifically, for tourist sites in the Tegal Regency, there is a need for media that can convey the tourism profile since they lack a publicly accessible online presence. Consequently, there is a necessity for a website application that integrates both virtual tours and profile information.

Several previous studies have utilized Virtual Tours (VT) to enhance tourists' interest in a particular destination (Acosta et al., 2022). As virtual tours create the sense of firsthand experience, they may inspire individuals to consider future travel. VT also functions as a tool for comprehensively exploring tourist attractions and can help determine whether a visit in person is worthwhile (El-Said & Aziz, 2022). Generally, virtual tours provide the illusion to viewers that they have virtually visited a location merely by observing it on a screen (Gutowski & Klos-Adamkiewicz, 2020) (Syukur, Dewie, & Oktarina, 2022). Past research has shown a positive reception of virtual tours by the public (Anita, Wijaya, Sarastiani, Kusumo, & Santi, 2021). Building on this, the current study aims to advance virtual tour technology using tourist

villages in Tegal Regency, Central Java, Indonesia, for promotional purposes and brand improvement.

Voronkova (2018) conducted a study on virtual tours within the context of the digital economy. However, the research lacks a specific focus, as it relies solely on black-box testing to examine the relationship between virtual tours and the digital economy (Voronkova, 2018). In a separate investigation, Romanian researchers (Bran, Bautu, & Popovici, 2020) integrated real-world museums with technology to create virtual museum tours. This study illustrates how virtual museum tours simplify the understanding of museum locations and collections for visitors. Nonetheless, a limitation of this research is the absence of a proper virtual tour interaction, making it challenging for users to navigate. The present paper evaluates the quality of each virtual museum tour in Poland conducted during the COVID-19 pandemic. The study determines the maximum number of visitors to a virtual tour during a pandemic and compares the quality of each virtual museum tour in Poland. The assessment reveals that visitors prioritize engaging and interesting content in virtual museum tours.

Virtual Reality (VR) stands as an advanced technology that allows users to interact with computer-generated simulations, providing a sense of immersion in an alternate reality. This research utilizes a virtual reality (VR) height simulation to evaluate the anxiety levels of potential staff members in a college setting (Winarsim, Amaliah, & Suprianto, 2021). The simulation is structured into three levels, with participants considered to have a phobia if they cannot successfully complete the initial obstacle within the specified time frame. The Multimedia Development Life Cycle (MDLC) method is employed to construct a novel system and develop the associated software. Virtual reality (VR) serves as an effective tool for assessing phobia severity and mitigating work-related incidents arising from phobias. The functionality and appearance of the VR application are evaluated using Black Box Testing and the Likert Scale. Proper alignment of the 3D objects within the application with the actual building is crucial to accurately represent the work environment for prospective employees.

In conclusion, our research affirms the reliability of the MDLC model for the development of a virtual tour application, leading us to embrace this model in our development process. Moreover, although several software testing methods are available, the evidence from multiple studies supports the appropriateness of Black Box Testing for scrutinizing individual functions within the system. Additionally, the Likert scale is identified as a suitable tool for assessing user perceptions of the system.

The cutting-edge technology in virtual tours represents an informational and promotional medium, designed to facilitate a better understanding of tourist attractions for the general

public. Our study endeavors to advance virtual tours into a comprehensive tourism information platform, specifically the Virtual Tour Lembah Rembulan Application, using the Multimedia Development Life Cycle (MDLC) (Hanief & Supuwiningsih, 2020) (Winarsim et al., 2021) (Dian, Yosua, Dian, & Yosua, 2023). A key innovation in our research is the creation of a virtual tour website that goes beyond the norm by incorporating a profile website, social media details, contact information for the tourist destination manager, and reviews that can be valuable for potential tourists. Another distinctive feature is the dynamic nature of the information provided in the virtual exploration feature, enabling operators to make necessary updates. The Virtual Tour Lembah Rembulan Application is envisioned not only as a hub for disseminating information about tourism sites in the Tegal region but also as a potential alternative platform for branding and promotion, capturing public interest and encouraging visits to these tourist spots.

METHODOLGY

Figure 1: The Multimedia Development Life Cycle Model
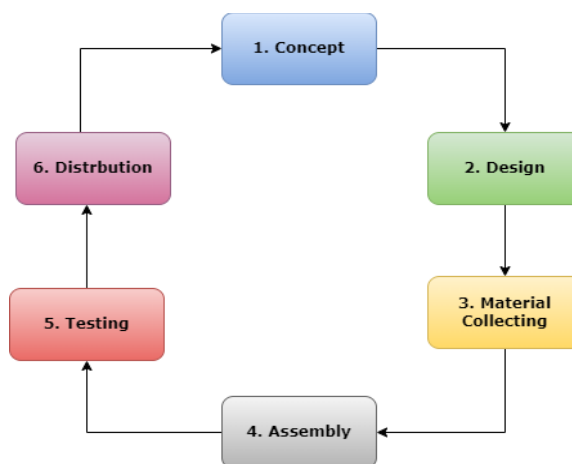
The Multimedia Development Life Cycle (MDLC) methodology by Luther is employed in this research due to its effectiveness in enhancing the multimedia production process. Luther's MDLC consists of six stages, including concept, design, material collection, assembly, testing, and distribution, as depicted in Fig. 1 (Yuly, Nugrahani, Lazuardi, Rijalullah, & Ramadhan, 2022).

1. **Concept**

    In the initial phase, the concept is formulated by outlining the fundamental aspects of the multimedia work to be produced, with a specific focus on the target and type of project. This includes determining the program's purpose, scope, and user specifications, along with describing the types of applications involved. The outcome of this step is typically

a document that provides a clear objective to articulate the project's goal (Rahayu, Fujiati, & Dewi, 2019).

2. **Design**

The second stage of MDLC is the design phase, where the project's designer or developer intricately analyzes the work to be undertaken (Winarsim et al., 2021). Tasks such as creating scripts, defining navigation, and implementing other design procedures are completed in detail. This stage is crucial for specifying the program's architecture and style (Martono, Prasetijo, & Distira, 2022).

3. **Material Collection**

The third stage involves gathering multimedia files, including audio, video, and images, based on project development requirements (Winarsim et al., 2021). This step can be carried out simultaneously with the assembly phase. Various images, such as logos, icons, and background designs, are generated (Hanief & Supuwiningsih, 2020). During this phase, data is collected at different locations within the tourist villages of Tegal Regency. The collected data consists of images from tourist spots captured using a 360-degree camera.

4. **Assembly**

In the assembly stage, all multimedia elements are created and compiled. Additional materials that have been gathered are assembled, aligning with the layout specified in the architectural system, navigation, and functionality (Winarsim et al., 2021). The software Pano2VR is employed to merge all elements, including those collected and created, into distinct scenes (Martono et al., 2022). Assembly involves utilizing the Pano2VR software, a program capable of generating 360-degree panoramic images. To establish a virtual tour on a website showcasing a 360-degree panoramic view of each point of interest, this process requires the Three.js library (Yuly et al., 2022).

5. **Testing**

Testing, defined as the process of evaluating a software program to ensure its intended functionality, was a key aspect of our research (Mubarak A, 2020). Our testing approach encompassed two methods. Firstly, the implementation of black box testing was conducted to verify the proper functioning of each system feature (Ramadiani et al., 2021). Secondly, the Likert scale was employed to gauge user perceptions of the system (Intana & Sriraksa, 2019).

Black Box Testing is a form of software testing conducted based on functional specifications, without delving into the program's design and code. In this approach, the

tester only examines the external appearance without knowledge of the internal workings, assessing the interface and functionality while remaining unaware of the detailed processes (limited to input and output understanding) (Sitokdana, Tanone, & Tanaem, 2019). Some objectives of Black Box Testing include enhancing software quality, ensuring that the system aligns with requirements, and identifying vulnerabilities, errors, and flaws in the program.

6. **Distribution**

    The distribution phase involves the incorporation of virtual tours into the online website, providing accessibility for users. Following this, administrators responsible for managing tourist attractions can update and monitor application information. Additionally, the virtual tour will be seamlessly integrated with Google Maps, utilizing the keyword "Lembah Rembulan". Developing a virtual tour also necessitates consideration of digital marketing strategies, including leveraging social media platforms and placing advertisements on websites like Instagram, Facebook, or even YouTube, utilizing the adsense feature (Suroso et al., 2022).

RESULTS AND DISCUSSION

1. **The Outcome of Conceptual Phase**

    Identification of issues is conducted by directly interviewing pertinent sources. In this interview method, the sources involved are the Managers of the Lembah Rembulan Tourist Attraction designated by the Tourism Department. Proof of activities related to problem identification and needs analysis is available in the appendix. Throughout the interview process, in addition to addressing current issues, a discussion on needs analysis that may serve as a solution for these problems is also conducted. The outcomes of both problem identification and needs analysis are detailed in Table I.

Table 1: Result of Problem Identification

Informant	Problem Identification	Needs Analysis
Tourist Attraction Operators of Lembah Rembulan	The pandemic frequently leads to the closure of tourist attractions in Lembah Rembulan.	Information about the operational status of the Lembah Rembulan tourist attraction is required.
	Difficulty in promoting the Lembah Rembulan tourist attraction with a wide reach.	A promotional channel accessible to a broader audience is needed.

Through the identification of issues and an analysis of needs, it becomes possible to articulate the objectives of the virtual tour project and understand the essential requirements for its development. The conceptual stage yields a document that encompasses project specifications, detailed in Table II.

Table 2: Outcome of Concept Stage

Project Name	The Lembah Rembulan Tourist Attraction Virtual Tour Application functions as a medium for providing tourism information.
Objective	Developing an interactive virtual tour application designed to present tourist attractions in Lembah Rembulan, providing a 360-degree perspective.
User	Lembah Rembulan Tourist Attraction Oprators, and Visitors.
Virtual Object	Utilizing multimedia elements like 360-degree photos.
Input	Incorporating 360-degree photos, textual information about tourist attractions in Lembah Rembulan, and audio.
Output	Creating a network of 360-degree photos, textual details about tourist attractions in Lembah Rembulan, along with audio/music.

Earlier studies (Hanief & Supuwiningsih, 2020) discovered that the conceptual process failed to clearly define specific problem identification. Similar to the study by (Yuly et al., 2022), our research identifies the problem at the outset, even before constructing the application concept. This suggests that our research's conceptual framework is rooted in the challenges faced by users and aligns with their needs.

2. The Outcome of Design Phase

The design phase dictates the necessary actions for developing a virtual tour, emphasizing that effective product development relies on a comprehensive design process. This phase involves crafting a system architecture, illustrated in Figure 2, for the Lembah Rembulan Tourist Attraction Virtual Tour Application.

As depicted in Figure 2, users have access to two primary segments of the virtual tour application: the virtual tour section and a counterpart resembling a website profile. This section provides diverse details about tourist attractions in Lembah Rembulan. The virtual tour segment encompasses a 360-degree panorama of each point of interest in Lembah Rembulan, accompanied by descriptive information for each location and navigational features for a seamless virtual tour experience. The initial part is presented as a website profile, containing information about tourist attractions in Lembah Rembulan, route maps, contact details, a compilation of visitor reviews, and feedback.

Illustrated in Figure 2, there are two user tiers: visitors and tourist attraction managers. Visitors (potential visitors) have the opportunity to explore the online tour offered by the tegaltourism.com website and utilize the features of the website profile. Tourist Attraction Managers have the authority to manage the information presented on the homepage of the website profile and update details on the virtual tour page. Accounts with privileges, encompassing tourist attraction managers, are administrable.

Figure 2: The System Architecure
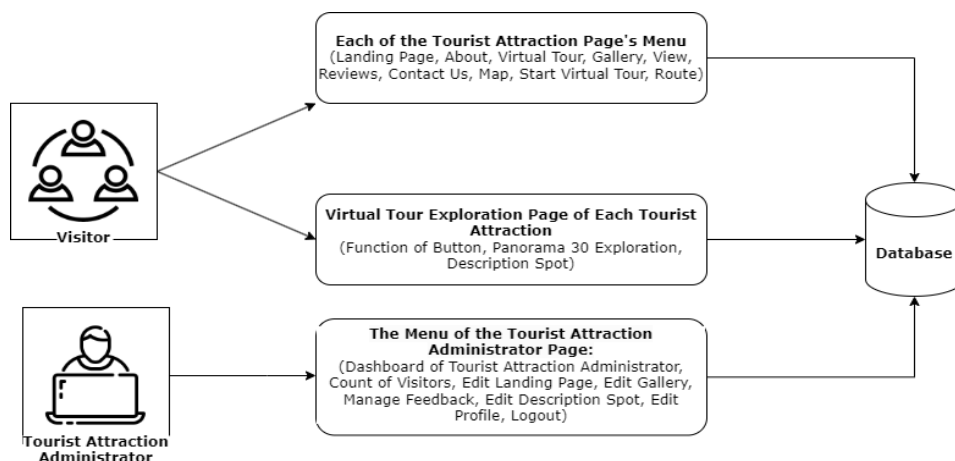
Prior studies have employed diverse approaches in generating designs. Tools such as storyboard games (Rahayu et al., 2019), UML (Unified Modeling Language) (Hanief & Supuwiningsih, 2020), and user interface design (Yuly et al., 2022) have been utilized in different research endeavors. In a separate prior investigation (Tan, Lam, Faburada, & Pavel, 2023), during the development of virtual reality applications, the design process involved creating a system architecture. This parallels our own research, which similarly adopts system architecture, underscoring its suitability for the entire design phase.

3. The Outcome of Material Collecting Phase

Information is directly gathered from the Lembah Rembulan Tourist Attraction through interviews, encompassing details about tourist attractions in Lembah Rembulan intended for incorporation into a virtual tour. Following the reception of this information, the subsequent step involves conducting firsthand observations of the Lembah Rembulan tourist attractions. During this phase, materials are acquired to generate 360-degree images for each area within the Lembah Rembulan tourist attractions. Employing a 360-degree camera and tripod for photography, the total collected data comprises approximately 428 photos in 360-degree format.

During the observation process, the collected data includes 360-degree images that will be integrated into the virtual tour presentation. Following this, various multimedia files like standard photos, audio, or music will be employed. This information is sourced from the tourist site's manager and covers aspects such as the history of tourist attractions, operating hours, admission costs, visitor amenities, and more. The diverse multimedia asset collection took place during the material collection stage, aligning with practices from several previous studies (Hanief & Supuwiningsih, 2020) (Winarsim et al., 2021)(Winarsim et al., 2021) (Rahayu et al., 2019).

4. **The Outcome of Assembly Phase**

Following interviews with the Lembah Rembulan Tourist Attraction, it has been identified that existing promotional media lacks comprehensive information regarding the location, facilities, and specific areas of the tourist attractions in Lembah Rembulan. Consequently, based on this information, the researcher intends to develop a virtual tour application that provides thorough details about Lembah Rembulan tourist attractions.

The assembly process involves compiling multiple photos into a panorama to construct a tour route. Utilizing Pano2VR Software, this assembly process creates panorama photos for the virtual tour application, showcasing a 360-degree panorama along with additional features like Google Maps and Tiny Planet.

Moreover, the Three.js library is essential for developing a website-based virtual tour that exhibits a 360-degree panorama of Lembah Rembulan tourist attractions, including control bar information, details about each tourist attraction, and a map of tourist attractions with internet support. Users can explore the application by selecting hotspot features (footprints) serving as links to other locations. Accessible at online portal, the virtual tour application offers an interactive experience.

Figure 3: The profile tourist attraction page

The Lembah Rembulan Tourist Attraction virtual tour application guides users to the tourist attraction's website profile section. The website profile page showcases the homepage and menu, providing essential information about tourist destinations upon selecting a menu. The menu options include Home, About Us, Virtual Tour, Gallery, Reviews, Contact, Map, Start Tour, and View Route. This page is illustrated in Figure 4.

The exploration page for virtual tours of tourist attractions is accessible through the "Start Tour" option. This page offers a 360-degree panorama, spot descriptions, and navigation buttons, making it easier for visitors to embark on a virtual tour. The illustration of this page is provided in Figure 5.

Figure 4: The virtual tour exploration page
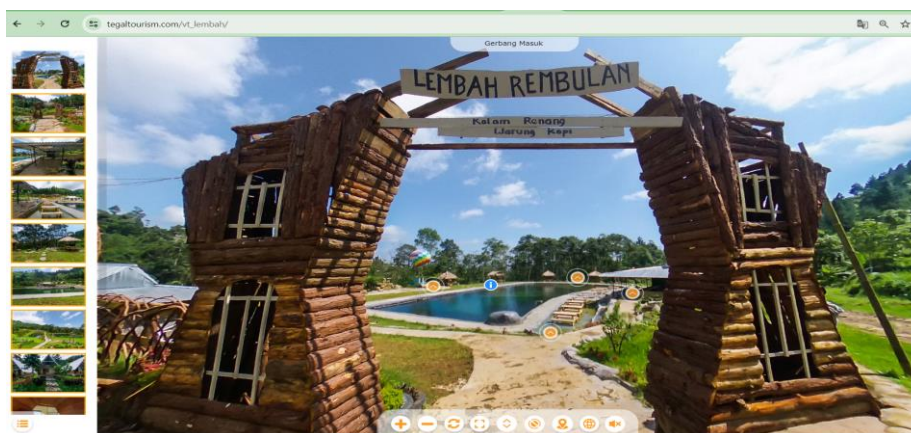
In the assembly phase, pages for tourist attraction managers are established. Visitors can navigate to pages linked to the manager pages. Managers have the ability to control the information displayed on visitor pages.

Throughout the assembly stage, the Pano2VR program was employed in this study for image stitching, a technique utilized in various previous research endeavors (Rodrigues & Cheiran, 2020) (Cirulis, De Paolis, & Tutberidze, 2015). The study concludes that Pano2VR proves to be a suitable tool in the assembly process for creating virtual tours.

During the assembly phase, pages for managing tourist attractions are also created. Visitors can access pages linked to the manager pages. Managers have the capability to oversee the information displayed on visitor pages. Throughout the assembly process, the Pano2VR program was utilized for image stitching, a practice observed in several prior studies (Rodrigues & Cheiran, 2020) (Cirulis et al., 2015). The findings affirm that Pano2VR is a fitting tool in the assembly process of developing virtual tours.

5. Result of The Testing Stage

Testing employed during the development of the virtual tour website includes assessments of functionality and usability aspects. Functionality testing, specifically black box testing, concentrates on the functional requirements of the software. This enables software developers to derive a set of input conditions that comprehensively fulfill the functional requirements of a program (Yuly et al., 2022). The outcomes of functionality tests are outlined in Table III.

Table 3: The Result of Black Box Testing

Role as Visitors		
Simulation Test	**The Result**	**Status**
The profile tourist attraction page	All menus of the tourist destination can be selected, showcase information related to the design navigation menu, and operate effectively.	Success

Virtual tour exploration page	Observe a 360-degree panorama at each location in the tourist destination, showcase navigation buttons, and present spot descriptions.	Success
Navigation button for exploring the tour	Navigation buttons are interactive, allowing users to rotate, move forward, zoom in, and zoom out to explore different positions.	Success
Description button for each spot area	The information button is interactive, allowing users to click and access detailed information about each specific area of the tourist attractions.	Success
Role as Tourist Destination Administrator		
Simulation Test	**The Result**	**Status**
Dashboard of tourist attraction administrator and count of visitors menu	The dashboard is capable of presenting a summary of visitor counts and showcasing thumbnails of tourist destinations.	Success
Menu of landing page, gallery, feedback, spot description menu in each of tourist destination administrators page	Tourist destination administrators have the ability to modify information and refresh images across various menus, including the landing page, gallery, feedback, and spot description menus.	Success
Logout button	The logout button is interactive, allowing users to click and log out as tourist destination administrators.	Success

CONCLUSION

Integrating virtual tours into the web infrastructure allows for their dissemination. Users may easily access the virtual tours via the internet with this way. Virtual tours and profile information are integrated into a website application. By providing tourist attraction owners with the most freedom to update information as needed, this research also marks a significant development. Additionally, creating virtual tours may be done via the MDLC approach. The system's effective construction based on scenarios is confirmed by the results of black-box testing, which involved two testing roles: tourists and operators of tourist attractions.

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