
Web-Based 360 Degree Virtual Tour Video for Promoting Cultural Tourism at Pura Puseh and Pura Desa Batuan

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Abstract

Pura Puseh and Pura Desa Batuan in Gianyar Regency are prestigious National Cultural Heritage sites characterized by ancient Balinese architecture and deep historical roots dating back to 1020 AD. Despite their significance, a reliance on conventional promotional media has resulted in a lack of immersive experiences for tourists, often causing the site to be overlooked as a mere transit point. This study addresses this gap by designing and developing an immersive, web-based Virtual Tour 360 Video platform using the systematic ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The production utilized 360-degree 4K panoramic videos, edited with Adobe Premiere and 3DVista, integrating hotspot navigation and AI-animated characters to enhance storytelling. Technical validation via Black Box Testing on 6 functional test cases (BB-01 to BB-06) resulted in a 100% "Succeed" status, confirming that all features operate seamlessly. Furthermore, usability testing conducted with 30 respondents using the System Usability Scale (SUS) yielded an average score of 83.1, placing the platform in the "Excellent" category. The findings confirm that 360-degree virtual tour technology is an effective and accessible medium for digital cultural heritage promotion, with implications for the development of immersive tourism platforms for other heritage sites.

1. Introduction

As a premier global destination, Bali exemplifies the synergy between world-class tourism and deep-rooted cultural heritage. Gianyar Regency stands as a focal point of this cultural landscape, maintaining an extensive array of traditional arts and historical legacies. A notable highlight within this area is Batuan Village, a specialized art hub widely recognized for its distinguished painting and carving traditions [1]. Furthermore, this village houses significant cultural and religious landmarks, specifically the Pura Puseh and Pura Desa Batuan temples.

Beyond its role as a primary tourist destination, Pura Puseh Batuan holds official status as a protected National Cultural Heritage site. As a constituent of the *Tri Kahyangan Desa Pakraman*, it is recognized as one

of Bali's earliest Puseh temples, with its origins dating back to 1020 AD (944 Saka). The site is distinguished by its sophisticated architectural design and elaborate carvings. Furthermore, its reliefs illustrate the Ramayana epic, embodying the profound philosophical principles of *Satyam Sivam Sundaram* representing truth, holiness, and aesthetic beauty [2]. Managed by the Batuan Customary Village (*Desa Adat*), this destination draws significant interest from both domestic and foreign travelers, with empirical data indicating a consistent upward trend in visitor numbers.

Notwithstanding its profound historical and cultural significance, there is a notable scarcity of compelling digital information concerning Pura Puseh and Pura Desa Batuan. Currently, a significant portion of visitors treat the site as a transit point en route to Ubud, thereby missing the opportunity for an immersive exploration of its cultural heritage. This lack of innovative and interactive promotional tools prevents tourists from fully comprehending the intricate uniqueness and philosophical principles embedded within the temple complex [3].

In the current era of digital transformation, the utilization of technology has become a necessity to support tourism marketing activities. As an effective innovation, Virtual Tour 360 Video offers a digital simulation of an environment. This system integrates various components, such as a series of 360-degree images or videos, enriched with other multimedia elements like audio narration, informative text, and music. This technology allows users to explore destinations in an immersive and interactive manner, providing an experience as if they were "present" at the location through a monitor screen. Its use is proven effective as an innovative promotional medium, a travel alternative, and a stimulus for physical visitation motivation [4].

Driven by the aforementioned urgency, the present study focuses on designing and developing a web-based "Virtual Tour 360 Video for the Promotion of Pura Puseh & Pura Desa Batuan Cultural Tourism." The deployment of this platform is intended to function as a competitive and far-reaching promotional tool. By employing innovative, creative, and communicative strategies, the application aims to showcase the architectural splendor, historical significance, and cultural heritage of Pura Batuan, offering the public a more profound and captivating digital experience [5].

2. Research Method

Adopting the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), this study employs a structured approach to virtual tour production. As a robust instructional design framework, ADDIE facilitates a logical progression through the development stages, thereby guaranteeing a high-quality and functional end-product that meets predefined objectives. [6].

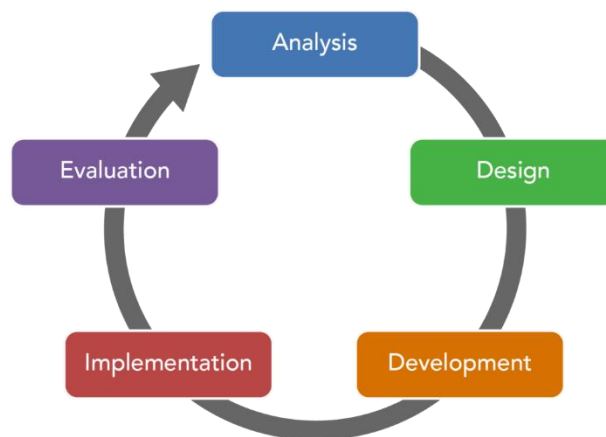


Figure 1. ADDIE Method Diagram

2.1. Analysis

The analysis phase serves as the preliminary stage, primarily concerned with defining core problems, research objectives, and user needs. During this phase, the following activities are performed:

- a) Problem Identification

Assessing the inadequacy of existing digital promotional resources, which fails to effectively communicate the cultural and philosophical narratives of Pura Puseh and Pura Desa Batuan to a global audience.

b) Analysis of User Requirements

This step involves defining the target audience including tourists, students, and the general public and determining their specific information needs, such as historical backgrounds, architectural details, the philosophical symbolism of reliefs, and geographical accessibility.

c) Initial Data Gathering

Carrying out a comprehensive literature study, on-site observations, and in-depth interviews with authoritative sources, such as the *pemangku* (temple priests), to establish a solid contextual framework and collect essential primary data.

2.2. Design

The design phase establishes the technical foundation for the virtual tour production. The detailed technical specifications for the hardware, software, and output parameters are summarized in Table 1.

Table 1. Technical Specifications for Virtual Tour Development

Component	Specification / Parameter
Camera Hardware	Insta360 One RS (360-degree lens)
Video Resolution	4K (3840 x 2160 pixels)
Frame Rate	30 fps
Audio Format	AAC Stereo, 48kHz
Editing Software	Adobe Premiere Pro 2023 & Adobe Photoshop 2023
Authoring Tool	3DVista Virtual Tour Pro v.2023.2
Interactivity	Hotspot Navigation & AI-Animated Characters
Hosting & Server	LiteSpeed Server (balivirtually.com)

2.3. Development

This phase represents the transition from conceptual design to physical production. It focuses on the assembly of the virtual tour application through the following systematic processes:

a) Material Collecting

Conducting 360-degree panoramic imaging and video capture across the Pura Batuan area, recording audio narrations based on interview data and literature studies, and gathering supporting photographs.

b) Multimedia Content Production

Executing the refinement and assembly of 360-degree panoramic media, supplemented by the creation of visual design elements to enhance the web-based application's interface.

c) System Integration and Development

This phase involves consolidating all media assets and content into the web-based architecture. It focuses on engineering the navigational framework, implementing interactive hotspots, and developing other functional features to create a cohesive and fully operational virtual tour system.

2.4. Implementation

In this stage, the virtual tour application is subjected to user acceptance testing (UAT) involving a specific sample of the target demographic. This process aims to assess system performance within a live environment and capture empirical user feedback. To facilitate this, the platform is hosted on a web server, providing seamless online access for registered participants to evaluate the system's interactive features.

2.5. Evaluation

Evaluation is conducted to measure the effectiveness and feasibility of the virtual tour product. This evaluation is both formative (carried out at the end of each stage for improvement) and summative (conducted after implementation to assess the final outcome). The evaluation methods to be used are:

a) Technical Black Box Evaluation

This stage involves a developer-led assessment to validate the application's functionality. It focuses on ensuring that navigational links and interactive buttons are fully operational and aligned with system specifications, free from technical bugs.

b) Usability Assessment

To measure user interaction, the System Usability Scale (SUS) is employed as the primary evaluative instrument. Data is gathered from 30 participants through structured questionnaires to quantify ease of use, user satisfaction, and overall system adoption. The resulting SUS score determines the definitive feasibility and usability of the virtual tour application.

3. Result and Discussions

In line with the initial stage of the research, the analysis process is executed to establish the core conceptual framework for the Virtual Tour. The following table summarizes the key analytical findings.

Table 2. The Virtual Tour Conceptual Framework

No	Component	Explanation
1	Name	Virtual Tour 360 Video of Puseh Temple & Batuan Village Temple
2	Objective	Acting as an interactive promotional medium to virtually showcase the architectural grandeur and cultural significance of Pura Batuan to a global audience, including both domestic and international tourists.
3	Category	Digital Heritage Promotion Media
4	Genre	Simulation / Educational Tour
5	General Overview	An immersive digital experience designed to showcase the sacred precincts of Pura Puseh and Pura Desa Batuan through high-resolution 360-degree videography.
6	Extended Description	By merging 360-degree immersive media with informative audio-visual overlays, this application provides a detailed exploration of Batuan's signature architectural aesthetics. It offers a high-fidelity virtual alternative that allows for in-depth observation of the site's cultural assets from any location.
7	Age Range	15 – 60 Years Old (Tourists, Students, and Cultural Researchers)
8	Platform	Web-based
9	Publisher	Research Team of Primakara University
10	Control	Gyroscope sensor (mobile), Drag-and-click mouse (desktop), and Hotspot navigation.
11	Graphic	Photorealistic (High-resolution 4K video)
12	Feature	Spatial Audio, Information Points (Pop-up text), Auto-rotation, and Scene Selection.

The subsequent phase involves conceptualizing the virtual tour through detailed storyboarding and structural mapping. This includes an intuitive navigation scheme designed to streamline movement between various temple sections. Additionally, the architectural design incorporates interactive information points, programmed to display contextual data when activated by the user.

Table 3. Hotspot Storyboard

Areas	Explanation	Duration
<i>Nista Mandala</i> (Outer Zone / <i>Jaba Sisi</i>)	Cinematography Specification: The camera remains on standby in the open-space area to document the majestic split gateway (<i>Candi Bentar</i>). The production focus is directed toward the spatial atmosphere of the site, highlighting visitor	45-60 Seconds per Spot

Areas	Explanation	Duration
	engagement and the ornamental aesthetics of the temple's architecture.	
	Navigational Hotspots: Interactive triggers are strategically positioned at the <i>Candi Bentar</i> gateway, enabling seamless user transition into the <i>Madya Mandala</i> (middle courtyard).	
	Knowledge Triggers: The interface incorporates interactive information points that trigger a comprehensive temple floor plan and granular data pop-ups for an enriched educational experience. Cinematic Specification: The camera remains stationary at the heart of the courtyard to document the majestic scale of the <i>Kori Agung</i> gateway. This scene emphasizes the symmetry of the temple's core structures and their immediate environment.	
<i>Madya Mandala</i> (Middle Zone / <i>Jaba Tengah</i>)	Navigational Hotspots: Interactive triggers are positioned at the <i>Kori Agung</i> (main gateway), serving as the primary transition point for users to access the <i>Utama Mandala</i> , the temple's most sacred inner sanctum.	45-60 Seconds per Spot
<i>Utama Mandala</i> (Area Suci/ <i>Jeroan</i>)	Knowledge Triggers: These triggers provide comprehensive data on the architectural functions of the <i>Bale Agung</i> and associated <i>peelingih</i> (shrines). To enhance engagement, an animated character acts as a virtual guide, delivering narrated insights to the user. Cinematic Specification: A centralized 360-degree camera placement within the <i>Jeroan</i> (inner courtyard) to capture the architectural prominence of the <i>Meru Tumpang Tiga</i> and the <i>Padmasana</i> shrine. The visual narrative is specifically curated to evoke a serene and high-sanctity atmosphere, reflecting the spiritual nature of the site.	45-60 Seconds per Spot

Areas	Explanation	Duration
	Navigational Hotspots: Placed at the main altar, throughout the individual shrines, and facing the <i>Ramayana</i> reliefs to provide contextual information and detailed visual overlays. Knowledge Triggers: Dedicated triggers that offer textual and visual explanations concerning the iconography of the shrines and the <i>Ramayana</i> narrative reliefs.	

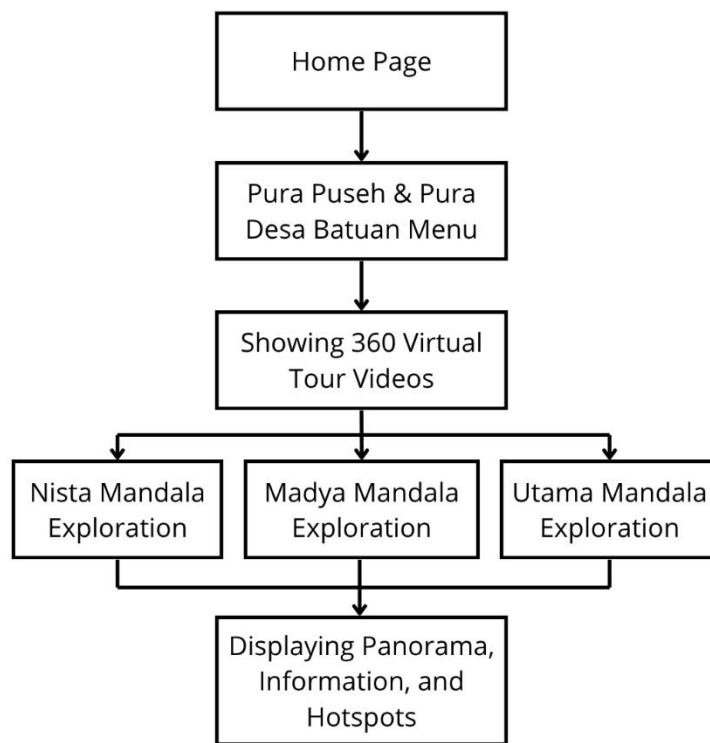


Figure 2. Sitemap of the Virtual Tour Platform

The figure above illustrates the sequential navigation process of the website. The process begins when the user enters the homepage and selects the Pura Puseh and Pura Desa Batuan menu. Upon selection, the user is directed to a page displaying the 360-degree Virtual Tour Video. On this page, users can freely explore the temple areas of Pura Puseh and Pura Desa Batuan, guided by a virtual avatar. Throughout the virtual journey, users can also access and read various provided information.

The third stage is the Development phase, which involves creating a functional prototype of the 360-degree Virtual Tour Video. This stage produces a virtual tour website equipped with edited 360-degree panoramic video assets, audio narration, AI characters, and background music to support the user experience.

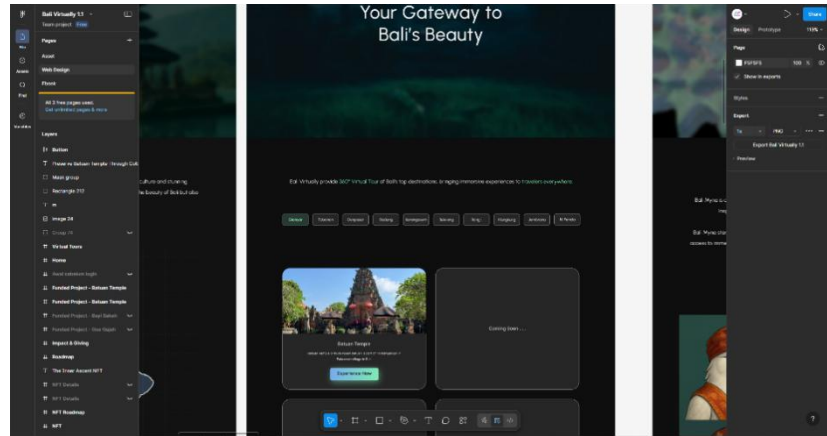


Figure 3. Website UI Design Implementation Process

The illustrated process highlights the development of the virtual tour's landing page interface. Utilizing Figma as the primary design tool, the project resulted in a functional, interactive prototype that has been integrated into a live web environment under a specific domain address www.balivirtually.com.

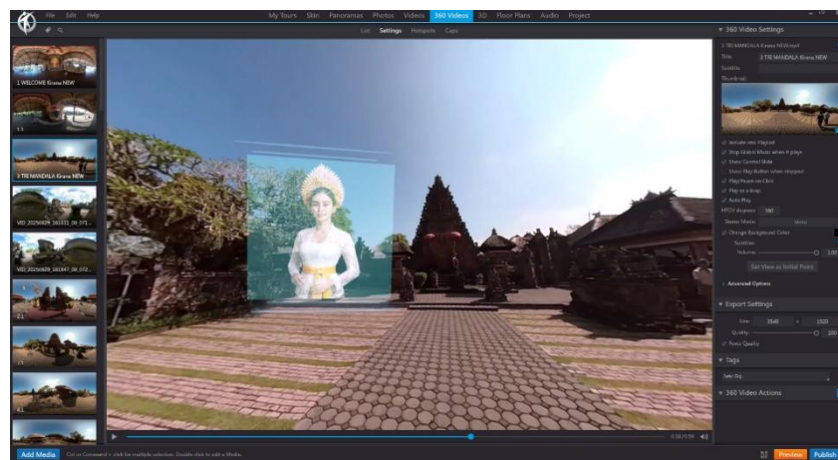


Figure 4. Development Workflow of the 360-Degree Virtual Tour

Figure 3 illustrates the development of the 360-degree virtual tour through the integration of multiple interactive hotspots across the Pura Puseh and Pura Desa Batuan complex in Gianyar. This navigational framework enables seamless and dynamic transitions between various spatial coordinates within the virtual environment.

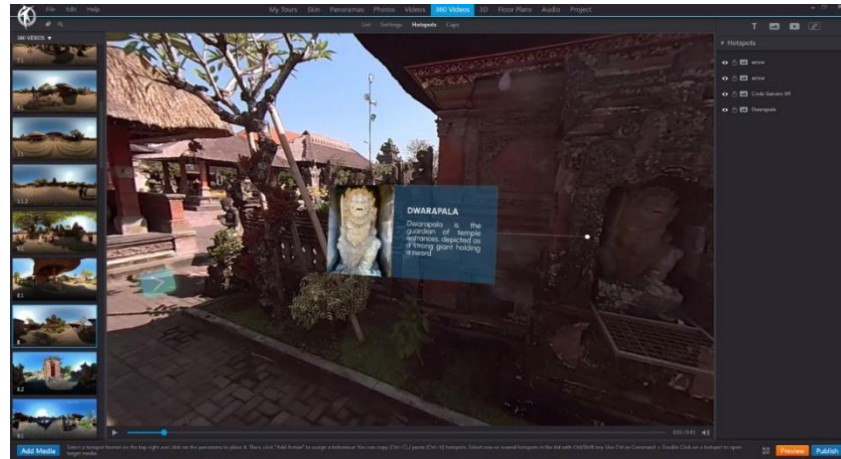


Figure 5. Development of Interactive Informational Popups

The figure above illustrates the creation process of information pop-ups for each unique object within the Pura Puseh and Pura Desa Batuan complex in Gianyar. This feature is designed to facilitate user interaction and provide an understanding of the significance of various objects, such as statues, carvings, and sacred structures, within the temple area virtually. The fourth stage is the Implementation phase, where the developed system is ready to be published online and accessed by tourists (users) [8]. At this stage, all components developed in the previous phases such as the navigation structure, 360-degree panoramic video assets, audio narration, AI characters, and other interactive elements have been integrated into the website platform. More than just a visual medium, this virtual tour serves as an interactive platform that facilitates digital exploration throughout the temple area. Users have the freedom to transition between navigation hotspots independently, access information on specific objects, and gain an exploration experience that resembles a direct visit to the cultural tourism site [9]. The finalized virtual tour, featuring immersive 360-degree footage of the Pura Puseh and Pura Desa Batuan heritage sites, has been deployed on a dedicated web portal. The interactive experience can be accessed through the following link: <https://www.balivirtually.com/360user/vtbatuan>. This web-based platform enables users to perform a virtual exploration of the temple complex across multiple internet-enabled devices, ensuring a seamless experience for a wider audience.

As the concluding stage of the ADDIE framework, this phase involves a rigorous assessment of the deployed virtual tour. The evaluation encompasses two primary methodologies: Black Box Testing, aimed at validating the system's functional integrity, and Usability Testing, utilized to quantify user accessibility and overall interface efficiency [7]. These evaluation procedures serve to uncover potential functional gaps while ensuring the system consistently adheres to the established design requirements.

Table 4. Black Box Testing

ID	Features / Functions	Test Items	Expected Results	Status
BB-01	Website Access	URL https://www.balivirtually.com/360user/vtbatuan	During the initial testing phase, the website demonstrated optimal responsiveness, ensuring that all core assets were fully and successfully initialized upon access.	Succeed
BB-02	Navigation Between Areas	Triggering the navigational arrow hotspots (<i>Nista</i> , <i>Madya</i> , and <i>Utama Mandala</i> zones).	Upon interaction, the interface triggers a seamless transition to the intended temple	Succeed

ID	Features / Functions	Test Items	Expected Results	Status
			area, adhering to the predefined navigational flow.	
BB-03	360 Video	Drag or pan the video screen.	The 360-degree panoramic perspective executes seamless rotation, maintaining consistent frame stability without graphical artifacts or technical glitches.	Succeed
BB-04	Information Hotspots	Click the information icon ("i" symbol or specific objects).	The system successfully deploys a pop-up window that provides users with pedagogical content, including textual historical accounts and detailed visual documentation of the temple's architecture.	Succeed
BB-05	Audio and Narration	Executing the narrative audio/background music feature.	High-clarity audio output is successfully triggered, maintaining perfect temporal alignment with the displayed scene.	Succeed
BB-06	UI Control	Fullscreen, Zoom In/Out Buttons	The system exhibits high responsiveness by realigning the video scale according to specific user commands, ensuring an optimized viewing experience.	Succeed
BB-07	Network Resilience	Access on slow/intermittent network connection	System displays a loading indicator and maintains video playback stability	Succeed
BB-08	Browser Compatibility	Access from an outdated browser without WebGL support	System displays a compatibility warning or a prompt to update the browser	Succeed

Based on the successful outcomes of the functional Black Box Testing, it is evident that the virtual tour aligns with the projected conceptual framework. To further validate the system, a Usability Testing session was conducted to measure user accessibility and interaction effectiveness. The evaluation involved 30 participants with diverse backgrounds, including tourists, students, and researchers. The detailed demographic profile and technical characteristics of these respondents are summarized in Table 5.

Table 5. Characteristics of SUS Respondents (n=30)

Category	Characteristic	Frequency (n)	Percentage (%)
Gender	Male	18	60%
	Female	12	40%
Age Group	18 – 25 years	15	50%
	26 – 35 years	8	26.7%
	> 35 years	7	23.3%
User Category	Students	12	40%
	Tourists (Domestic/Intl)	15	50%
	Researchers/Academics	3	10%
Device Used	Mobile (Smartphone)	18	60%
	Desktop (Laptop/PC)	12	40%
Prior Experience	First-time User	21	70%
	Experienced	9	30%

Table 6. Questionnaire Statements

No	Statement
1	I think that I would like to use this system frequently.
2	I found the system unnecessarily complex.
3	I thought the system was easy to use.
4	I think that I would need the support of a technical person to be able to use this system.
5	I found the various functions in this system were well integrated.
6	I thought there was too much inconsistency in this system.
7	I would imagine that most people would learn to use this system very quickly.
8	I found the system very cumbersome to use.
9	I felt very confident using the system.
10	I needed to learn a lot of things before I could get going with this system.

Table 7. SUS Questionnaire

Respondent	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Score Total
R1	4	1	5	1	4	2	5	1	5	1	92.5
R2	4	2	4	1	5	1	4	2	4	1	85.0
R3	5	1	5	2	4	1	5	1	5	2	92.5
R4	3	2	4	2	4	2	4	2	4	2	72.5
R5	4	1	4	1	4	1	5	1	4	1	85.0

Respondent	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Score Total
R6	5	2	5	1	5	2	5	1	4	1	92.5
R7	4	1	4	1	4	2	4	1	5	1	87.5
R8	3	2	3	2	3	2	4	2	3	2	60.0
R9	5	1	5	1	5	1	5	1	5	1	100.0
R10	4	2	4	1	4	1	4	1	4	1	85.0
R11	4	1	4	2	4	1	5	2	4	1	80.0
R12	5	2	5	1	4	1	4	1	5	1	92.5
R13	4	1	4	1	4	2	4	2	4	2	72.5
R14	4	1	5	1	5	1	5	1	4	1	95.0
R15	3	3	4	2	3	2	3	2	4	2	60.0
R16	4	1	4	1	4	1	5	1	4	1	85.0
R17	5	1	5	1	5	1	5	1	5	1	100.0
R18	4	2	4	2	4	1	4	1	4	2	77.5
R19	4	1	4	1	4	1	4	1	4	1	85.0
R20	4	2	4	2	3	2	4	2	4	2	67.5
R21	5	1	5	1	4	1	5	1	5	1	97.5
R22	4	2	4	1	4	1	4	1	4	1	85.0
R23	4	1	4	2	4	1	5	2	4	1	80.0
R24	4	1	4	1	5	1	4	2	4	1	85.0
R25	3	2	4	2	3	2	4	2	4	2	65.0
R26	5	2	5	1	4	1	5	1	4	1	92.5
R27	4	1	4	1	4	1	4	1	4	1	85.0
R28	4	2	3	2	4	2	3	2	4	2	60.0
R29	4	1	4	1	4	1	5	1	4	1	85.0
R30	5	1	5	1	5	1	5	1	5	1	100.0
Total Average Score											83.1

The analysis of 30 respondent evaluations resulted in an average SUS score of 83.1, with a standard deviation of 11.2, placing the platform in the 'Excellent' category. Although the overall result is high, the scores ranged from a minimum of 60.0 to a maximum of 100.0. Specifically, three respondents (R8, R15, and R28) provided a score of 60.0, which falls into the 'Marginal' usability category. Analysis of these outliers reveals that these respondents were first-time virtual tour users accessing the platform via older mobile devices with slower internet connections. This suggests that while the interface is intuitive, technical performance on low-end hardware remains a minor limitation that needs to be addressed for broader accessibility. Within the framework of SUS interpretation, this performance confirms that the Batuan Temple virtual reality application achieves; the evaluation results categorize the application under an 'Excellent' adjective rating, a 'Grade A' on the grade scale, and an 'Acceptable' status in terms of overall usability. This evaluation confirms that the structural design and 360-degree implementation are fully functional, meeting user expectations and establishing the application as an effective medium for digital heritage promotion. The 83.1 score also compares favorably against other SUS evaluations of virtual tour applications, such as the campus-based virtual tour reported by Wibowo et al. (2022), which scored 64 and fell into a markedly lower acceptability

band, underscoring how content design and interaction quality shape perceived usability even within the same application category [18].

Through a series of testing phases conducted, results indicate that the 360 Video Virtual Tour application demonstrates strong performance, both in terms of functionality and user experience. Through Black Box Testing evaluation, it is confirmed that the main functionalities of the application including area navigation, information hotspots, 360-degree video controls, and narrated audio operate optimally and are free from system anomalies. These findings show that the implementation of 360-degree video-based Virtual Tour technology is capable of providing an immersive and interactive experience for users [10]. These results corroborate prior research emphasizing that virtual tour technology significantly enhances user engagement. Specifically, the SUS score of 83.1 in this study demonstrates a competitive usability level comparable to the 360-degree virtual tour of Pura Luhur Batu Panes developed by Dewi et al. (2023) [3], which achieved a score of 83.17. Although the numerical results are nearly identical, the current study introduces distinct technical advancements that contribute to a more sophisticated exploratory experience. While prior systems, such as those by Dewi et al. (2023) and the Kiara Artha Park virtual tour by Kurniawan and Ramadhan (2023) [9], focused primarily on 360-degree image mapping, the integration of AI-animated characters and spatial audio in this platform significantly elevates the sense of presence, a direction consistent with the growing use of virtual human guides and narrative agents to deepen visitor engagement in museums and heritage sites [19].

This study further builds upon the 3D-based virtual tour framework for campus environments previously explored by Trimannula and Suteja (2017). While their prior work established the foundation for institutional orientation using 3D modeling, this research advances the application by integrating high-definition 360-degree video to address the complexities of cultural heritage storytelling, demonstrating a significant evolution toward more immersive and interactive digital environments [17]. By delivering a high-fidelity experience that closely emulates physical presence at the site, these interactive features bridge the gap between static visual observation and immersive cultural storytelling [11]. In promoting cultural heritage, the immersive nature of the application serves as a significant asset. It enables a transition from passive viewing to active virtual presence, where users can perceive the authentic atmosphere of the landmark [12].

The primary strength of this platform is the cohesive integration of panoramic 360-degree video, synchronized voiceovers, and interactive informational hotspots. By facilitating concurrent visual and auditory processing, this approach significantly enhances the user's grasp of the historical and cultural significance of Pura Puseh and Pura Desa Batuan. Furthermore, the synchronized narration alleviates cognitive load by reducing the need for continuous reading. These results provide empirical support for the Cognitive Theory of Multimedia Learning, suggesting that dual-channel information delivery fosters superior comprehension and long-term memory retention [13], a finding consistent with more recent syntheses of multimedia learning theory that continue to confirm dual-channel processing as a core mechanism for meaningful learning across video-based instructional formats [20]. Consequently, the virtual tour transcends its initial purpose as a marketing tool, evolving into a sophisticated digital educational ecosystem that offers comprehensive insights into the subject matter.

Despite the positive outcomes, this study acknowledges certain constraints. First, the sample size of 30 participants for usability evaluation may not comprehensively represent the broader demographic of potential users. Second, the web-based nature of the platform inherently limits the degree of immersion compared to dedicated Virtual Reality (VR) hardware. Furthermore, the content scope is restricted to a single landmark, necessitating future expansion to encompass a wider array of Balinese cultural destinations. These limitations align with previous scholarly discourse, which suggests that the efficacy of virtual experiences is significantly influenced by hardware capabilities and content breadth [14], including findings that headset-based displays consistently provide a stronger sense of immersion and presence than screen-based viewing of the same 360-degree content [21], [22].

This research highlights the substantial potential of 360-degree immersive video to serve as a transformative digital promotion platform for cultural heritage destinations [15]. By utilizing this technology, tourism destination managers can provide an initial experience to tourists before they visit in person. Furthermore, this application functions as a learning tool to instill cultural and historical understanding, specifically designed to reach the younger generation who are accustomed to the digital ecosystem. In addition to being a promotional medium, this technology also has the potential to encourage the formation of a new, inclusive digital economic ecosystem, particularly in supporting the development of community-based tourism [16], mirroring how digital storytelling initiatives at other heritage sites have similarly functioned as low-cost, locally driven channels for sustaining cultural narratives and community economic activity [23].

4. Conclusions and Future Works

This research successfully developed a 360-degree video-based Virtual Tour application for Pura Puseh and Pura Desa Batuan, adhering to the systematic ADDIE development model. Technical evaluations via Black Box Testing demonstrated a 100% success rate for all primary features, including inter-mandala navigation, narration audio synchronization, and user interface controls, confirming a robust system free of technical anomalies. Empirical validation through the System Usability Scale (SUS) with 30 respondents yielded an average score of 83.1. According to SUS assessment parameters, these results categorize the application under "Excellent" for its Adjective Rating, "Grade A" on the Grade Scale, and "Acceptable" (Highly Feasible) for its Acceptability level. These findings confirm that the navigation structure and 360-video implementation function optimally and are well-received by users as an effective digital promotion medium. Nevertheless, limitations remain regarding the limited respondent sample size and the constraints of a web-based platform, which does not yet fully replicate the immersion provided by dedicated Virtual Reality (VR) hardware. Future works should focus on enhancing the technological and demographic scope of the platform. Technically, the current 3DVista-based architecture should be optimized for Head-Mounted Display (HMD) integration, specifically targeting standalone platforms such as Meta Quest 3 or HTC Vive to provide a fully immersive 6DOF (Six Degrees of Freedom) experience. This would require a transition from web-based 360 video to high-bitrate stereoscopic rendering. Furthermore, content coverage should be expanded to include other significant Balinese cultural heritage sites, such as Goa Gajah in Gianyar and Pura Besakih in Karangasem, due to their intricate architectural details and status as primary UNESCO-recognized cultural landmarks. Finally, future studies should aim for a more robust validation by expanding the respondent pool to at least 100 participants across broader demographic groups to ensure more precise System Usability Scale (SUS) findings and long-term user retention analysis.

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