Visualization of morphology Keraton Kasepuhan Cirebon Siti Inggil complex through virtual reality technology

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Abstract

Kasepuhan Palace in Cirebon City is known for its history during the leadership of Sunan Gunung Jati in the 15th century. As the oldest palace in Cirebon, especially the Siti Inggil area, this study highlights efforts to digitize and visualize the area through 3D and virtual reality (VR) technology. With a focus on the front area of Keraton Kasepuhan, this study used qualitative analysis methods, including observation, measurement, and interviews with the management. As a result, a 3D model of the Kasepuhan Palace area was created with Building Information Modeling (BIM) technology and Lapentor application, creating an immersive virtual experience. It is hoped that the results of this research can be used as edu technology to introduce Keraton Kasepuhan to the wider community, increasing interest especially among the younger generation.

Keywords

Visualization, Morphology, Siti Inggil complex, Virtual reality

Introduction

Indonesia, with its natural wealth from Sabang to Merauke, offers great tourism potential. Tourism is a major contributor to the country's income thanks to the high number of tourist visits, both local and foreign. In addition to natural wealth, cultural diversity is also a major attraction. Cirebon in eastern West Java is one of the areas with cultural tourism potential that is rich in history. The influence of Hindu-Buddhism since the 4th century and the development of Islam in the 15th century, especially with the construction of Kasepuhan Palace by Sunan Gunung Jati, created significant changes in the history and architecture of the palace. This article reviews three main periods: 14th-16th century Cirebon Kingdom, 16th-18th century Dutch East Indies Colonial, and 18th-18th century NKRI to the present, with each period reflecting adaptations to social, political, economic and cultural changes (Figure 1).

Keraton Kasepuhan Cirebon, founded in the 14th to 16th centuries by Sunan Gunung Djati, played a crucial role in the inception of the Islamic kingdom in Cirebon, influencing

its distinct characteristics and governance. The subsequent Islamic Kingdom period brought significant developments in art, architecture, and governance, fostering cultural diversity. The Dutch East Indies era further altered the landscape, blending European architectural styles with local elements in Keraton Kasepuhan. The Siti Inggil complex, integral to the Kasepuhan Palace, remains a center for religious and cultural activities, preserving traditions across generations. Leveraging Virtual Reality (VR) technology for digital preservation, this research aims to create a lasting digital copy of Siti Inggil's morphology, providing broader access. The visualization of morphological changes integrates Building Information Modelling (BIM), enhancing user experiences with detailed and accurate information about the structure and its evolution [1], [2].
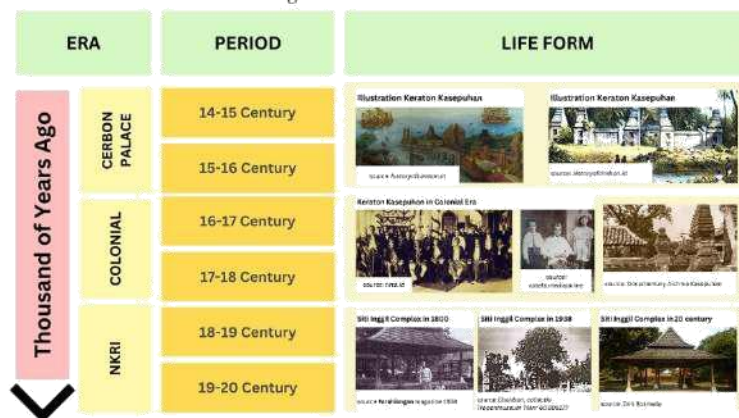

Figure 1. Overview of the Three Periods of Cirebon Kasepuhan Palace from Time to Time

Methods

In the implementation of this research, the RAD (Rapid Application Development) method is a software design approach that emphasizes a short application development cycle (Figure 2). This method can be considered a rapid adaptation of the waterfall method. This method is based on the need to optimize the development time of Virtual Reality (VR) Siti Inggil Keraton Kasepuhan Cirebon. This method has several stages.
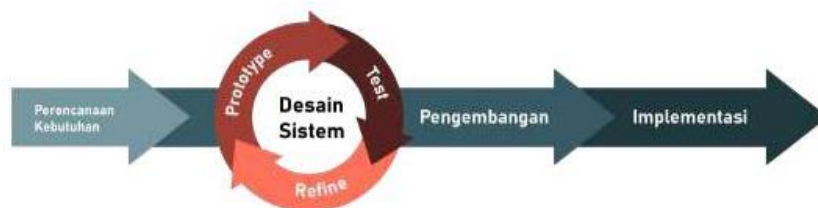

Figure 2. Schematic of Rapid Application Development Method (RAD)

The initial planning for VR Siti Inggil Keraton Kasepuhan involved identifying needs, determining features, and conducting field measurements for preliminary data. Subsequent steps included prototyping and modeling, creating a 3D model for accurate visual representation, and integrating it with Lapentor to combine detailed BIM information with visualization capabilities. Iterative development refined the VR based on user and stakeholder feedback. Following revisions, trial and evaluation tested VR functionality, ensuring proper operation of all features. The final stage involved

implementation and digital preservation, applying last changes and updates to maintain authenticity and long-term accessibility of Siti Inggil Keraton Kasepuhan VR.

Results and Discussion

To the south of Alun-alun is a podium-shaped red brick building known as Siti Inggil. "Siti" means land, while "Inggil" means high in the Cirebon language. Siti Inggil is surrounded by a red brick wall adorned with the Candi Bentar Archway. The gate of Candi Bentar in the north is called Gapura Adhi, while the one in the south is called Gapura Banteng. Underneath the Banteng Gate is a Candra Sengkala with the inscription "Kuta Bata Tinata Banteng," which if interpreted shows the year of construction of Siti Inggil in 1451 Saka or 1529 AD (Figure 3).

(a)   (b)

Figure 3. (a) Gapura Candi Bentar, (b) Gapura Banteng

Morphology of Siti Inggil

The morphology of Siti Inggil as an integral part of Keraton Kasepuhan Cirebon, plays a crucial role in reflecting the evolution and changes that have occurred since its establishment in the 16th century by Sultan Sepuh I, or Sunan Gunung Djati (Figure 4).

In general, Siti Inggil serves as the center of power. As part of the palace complex, it served as a place for important meetings, decision-making, and various religious or state ceremonies related to leadership. Building changes in the Siti Inggil complex, Keraton Kasepuhan Cirebon, can include a number of adaptations and transformations during various historical periods. During the Cerbon Kingdom period, especially in the mande karesmen building, the Cerbon Kingdom period and the colonial period, especially the VOC period, had similarities. Changes began to occur during the colonial period, especially the Dutch East Indies period, where there were additions to the Mande Karesmen building. Then during the NKRI period, there were several changes and additions to the architectural elements of the building. These changes are generally almost the same in other buildings in each period.

Implementation of Siti Inggil Complex Modeling

The implementation of the virtual representation of Siti Inggil Complex in Keraton Kasepuhan Cirebon through VR technology is a multifaceted journey that blends history, technology, and cultural preservation. Beginning with meticulous research and advanced technologies such as 3D scanning, this digital reconstruction meticulously

captures the intricacies of Siti Inggil's architecture and historical evolution. At the heart of this implementation lies an immersive Virtual Reality experience, where users can navigate through rooms and corridors, uncovering the rich history of Cirebon's cultural jewel. This digital odyssey is enriched with multimedia elements, including period photographs of Siti Inggil along with its historical background, with the intention of creating a harmonious blend of technology and cultural storytelling.

Figure 4. Periodic Table of Morphology Siti Inggil Complex

In the early period (1445-1667), Siti Inggil in Keraton Kasepuhan Cirebon displayed distinctive architectural characteristics, seen in Mande Karesmen's absence of umpak, tile-shaped roof, and east-west orientation (Figure 5). Mande Malang Seminar maintained simplicity with a roof made of tiles and an elevation at 0.00 level. This consistency marked Siti Inggil's identity. In the colonial era, Siti Inggil evolved with additions like bamboo columns in the Mande Semar Tinandu period and artistic enhancements at Gapura Adhi, blending traditional and colonial influences (Figure 6). The third period, reflecting societal dynamics, introduced structural changes like umpak at Mande Karesmen, shingles, a re-oriented roof, and a stacked structure (Figure 7). The

fourth period, aligning with the NKRI, witnessed architectural transformations such as a north-south-oriented roof at Mande Karesmen, Palimanan stone tiles, and increased steps at Gapura Adhi. Fauna ornaments were removed, and symbolic steps at Gapura Banteng connected to local traditions.

Figure 5. Implementation of First Periodic Siti Inggil Complex (1445-1667)

Figure 6. Implementation of Second Periodic Siti Inggil Complex (1808-1942)

Figure 7. Implementation of Third Periodic Siti Inggil Complex (1945-Now)

Morphology and Virtual Reality

This research digitally reconstructs the Siti Inggil complex in Keraton Kasepuhan Cirebon, tracking morphological changes across historical periods (Figure 8). Utilizing Virtual Reality (VR) technology enhances the interactive exploration, allowing users to immerse themselves in architectural and historical details. The design process involves creating a VR model using the Lapentor platform, offering users various locations within the Siti Inggil complex, consisting of seven buildings aligned with historical periods.

(a)   (b)
Figure 8. (a) Siti Inggil Home Page in Lapentor, (b) Welcoming Banner

Next, visitors have the option to select a specific location based on the historical period they wish to explore. While at Mande Karesmen, visitors will be shown the differences that occurred in each period, accompanied by historical explanations (Figure 9).

(a) (b)

Figure 9. (a) Explanation of Lingga Yoni and Building Condition in Kasepuhan Cirebon Palace, (b) VR Poster Scan

The use of VR paves the way for further investigation into this complex morphology, allowing users to understand transformation and change through an unprecedented level of depth. Direct interaction with the virtual environment provides an opportunity to delve deeper into the cultural, artistic, and historical values embedded in Siti Inggil. In essence, through the merging of morphology and VR, this research not only creates an accurate visual representation of Siti Inggil, but also revitalizes it in an immersive virtual dimension, so that this cultural heritage can be accessed and understood by a wider audience.

Conclusion

The research on "Visualization of Siti Inggil Complex Morphology in Keraton Kasepuhan Cirebon Based on VR Technology" explores the complex history of Keraton Kasepuhan Cirebon, emphasizing the need for Virtual Reality (VR) representations, specifically focusing on Siti Inggil's morphology. Established in the 16th century, Keraton Kasepuhan has witnessed various historical periods, from the Wali Sanga era to the Dutch East Indies and the Unitary State of the Republic of Indonesia (NKRI). These transformations span social, political, economic, and cultural dimensions, with the Siti Inggil complex serving as a crucial focal point. Facing threats from weathering and potential document loss, the physical morphology of Siti Inggil urgently requires digital preservation through VR. VR offers an innovative solution, preserving the morphology and enabling users to explore historical nuances firsthand. This research addresses the challenges of cultural heritage preservation, creating a durable archive and providing a profound understanding of Keraton Kasepuhan Cirebon's rich history and culture. Overall, integrating VR technology to comprehend Siti Inggil's morphology is a pertinent and crucial step in preserving and sharing this valuable cultural heritage.

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