Visualizing Babad Lombok Ancient Manuscript Through Augmented Reality For Public Autreach In Indonesia

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Abstract

Babad Lombok is a special ancient manuscript of Lombok, the rhymes included in the manuscript are about Sasak history and multidisciplinary content (myth, belief, and royal genealogy). The manuscript is believed to have been created in the 18 AD, the current situation of this manuscript was threatened physical damage causing it hard to be access as well as scientific worth due to the development of media entertainment that defeated it existence in the new generation of society. Through the advancement of technology this research is trying to tackle the current issue by suggesting innovation through utilizing augmented reality and creative approach to enhance public outreach. Integrating augmented reality and visualizing Babad Lombok manuscript aims to make Babad Lombok easy to understand, accessible and more interactive for the public. Otherwise, this study purpose is not only focuses on establishment accessibility of the manuscript for the public but also as cultural preservation by introducing it into new generation. The study will conduct a mix-method which gathered two types of research methodology items' data to validate the investigation. The primary data will be gathered by survey on the user media repertoire and user preferences to build the visual design. In addition, particular academic literature, books, and online sources will collect as secondary data of the study.

Keywords – Augmented reality, ancient manuscript, Babad Lombok, Creative approach, Cultural preservation

1. Introduction

Indonesia, once referred to as Nusantara in prehistoric times, is a group of islands inhabited by various ethnic groups. Nusantara's cultural history is extensive and intricate but also abundant and multifaceted. The lineage of these ethnic groups can be traced back to the earliest forms of written language, which began with simple symbols found in ancient caves. Over time, these symbols evolved into more complex inscriptions that utilized language and script. As these inscriptions developed into manuscripts documenting historical civilizations' special events and customs, they became known as ancient manuscripts.

Ancient manuscripts have served as historical documentation. Ancient manuscripts provide valuable insights into past civilizations' history, culture, and languages (Hashim et al., 2014). As a characteristic, ancient manuscripts are classified as part of a cultural heritage collection that should be preserved. *According to UNESCO (2009), cultural heritage includes artifacts, monuments, a group of building sites, and museums with diverse values, including symbolic, historical, aesthetic, ethnological, scientific, and social significance. It includes tangible and intangible that are embedded into the cultural value of some society culture (Anonim, 2009).*Most cul heritage and ancient manuscripts are stored in the museum as a tool to preserve, conserve, and disseminate knowledge about the country's history to citizens.

Along Nusantara history, during the reign of Hindu, Buddhist, and Islamic kingdoms, the literacy culture of Nusantara was influenced by Indian, Chinese, and Arab cultures. This influence is evident in developing ancient Indonesian scripts like Brahmi, Jawi/Kawi, and Hanacaraka. For instance, the Kakawin Negarakertagama is a famous manuscript from the Majapahit kingdom, Nusantara's largest and most powerful empire. The script describes the social and political activities of King Hayam Wuruk during his trips along his ascendant period (Purwaningsing, 2018). The Kakawin Negarakertagam is likely the most famous ancient manuscript from the East Java province. By the same token, Lombok as part of the West Nusa Tenggara province, is also considered Indonesia's sixth largest contributor of Indonesian ancient manuscripts (Ediyono et al., 2019). Despite being a relatively small province, West Nusa Tenggara has many ancient manuscripts that showcase unique linguistic

characteristics.

The Babad Lombok manuscript is an ancient manuscript of Lombok. It is incredibly unique due to its distinct characteristics and valuable insights into the rich cultures of the island. These manuscripts are written in a Kawi (Old Java language) and Lombok archaic language that reflects the island's historical journey, namely as the main record of literacy of Sasak (Lombok society) history.

The manuscript was preserved in the West Nusa Tenggara State Museum. This ancient manuscript was translated into *Bahasa Indonesia* in 1979 by Lalu Wacana and in 1994 by Gede Suparman and was published by the Ministry of Culture and Education of Indonesia and available in Europe (e.g., Leiden and Paris), Australia

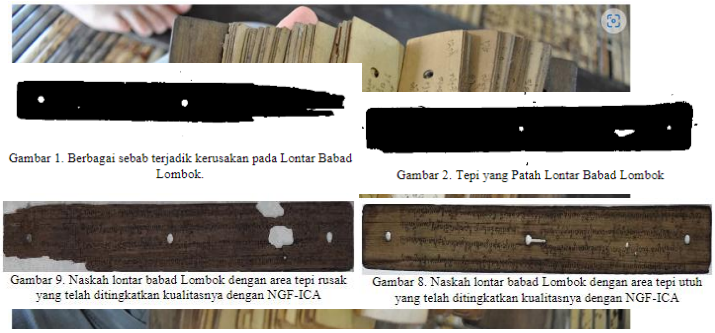


Figure SEQ Figure * ARABIC 2. Current Babad Lombok Condition

(National Library of Australia), and Indonesia (Yogyakarta and State Museum of West Nusa Tenggara) (Mutaqin & Lavigne, 2021).

Referring to the image above, accessing and studying ancient manuscripts can be challenging due to their fragility, rarity, and diversity of scripts and languages. It is too risky for ancient manuscripts collections to be exhibited as a fine display. According to Anwar, Hidayat, and Adil (2021), they found that some sheets of Babad Lombok have suffered physical damage, their research was focused on computerization and capturing the physical into digital form by enhancing natural Riemannian structure through Gaussian density generalization (Anwar et al., 2021).

Many ancient manuscripts made of palm leaves in West Nusa Tenggara, particularly in Lombok, are crucial for preserving physical and scientific worth. However, due to their relatively old age, these manuscripts are susceptible to damage from climate and weathering. The region is also located on the ring-fire route coordinate and is prone to earthquakes, which can destroy manuscripts. In 2018, almost all the residents' homes were destroyed by a powerful earthquake, leading to the damage, burial, and loss of many ancient manuscripts. Furthermore, the manuscripts are fragile and can be easily destroyed by wind or insects.

As a result, in 2023, the National Library Department of the Indonesian Republic began digitizing ancient manuscripts to preserve them for future generations. However, of the 418 manuscripts in Lombok's West Nusa Tenggara State Museum collection, only 62 were successfully converted into digital images (Wilanda, 2023) and only 10% of museum collections were displayed in post-earthquake (Anonim, 2018).

Regrettably, the digital images of Babad Lombok have not been made available to the public. As a precaution, the original manuscript of Babad Lombok has been temporarily stored in a specially designed box and not displayed publicly ((Ediyono & Ridwan, 2018). Furthermore, due to lack attention between west and east Indonesia ancient manuscript, a philologist researcher from the Netherlands has emphasized the importance of giving due attention to the ancient manuscripts of Lombok despite their exceptional cultural significance. He has suggested that philologists should take a keen interest in studying these manuscripts, considering that many have yet to discover their existence. However, these manuscripts will likely be lost due to physical damage and

their scientific worth (Meij, 2021).

Fortunately, technology continues to advance and bring many benefits to human life. Since 2016, the virtual world has been accessible to the public through mobile devices, revolutionizing industries such as gaming, entertainment, business, healthcare, retail, and education. By integrating virtual objects into the real world, we can explore anything more expansively and gain detailed information about them.

Augmented and virtual reality have become valuable tools in the heritage field, by adding virtual content into real object can enrich the information due to the limited accessibility of heritage collection, as well as enhancing the museum experience and providing visitors with interactive information about historical objects (Jung et al., 2018). In 2019, augmented reality was particularly popular, allowing users to fully engage with exhibits while maintaining control over their navigation (Coates, 2023).

This research project aims to visualize the essence of Babad Lombok, a cultural heritage of Sasak people in Indonesia, in a 3D format and project it into augmented reality to raise awareness among the Indonesian public and promote cultural preservation. The author will focus solely on topics related to Babad Lombok, Sasak Culture to ensure unbiased and reliable data. This research focus on developing the design process for the product, and one of the main chapters of Babad Lombok will be chosen to represent the design model. The research will delve into the technical aspects of constructing the visual design, in line with the scope of the research title. A mix of research methods are used to gather the necessary data and support the design, including data mining to realize the research goal.

A. Problem Statement

In West Nusa Tenggara, ancient manuscripts made of palm leaves in Lombok are at risk of damage from climate, weathering, and earthquakes. The local government can preserve them by creating digital copies and studying their contents. In June 2023, the West Nusa Tenggara Museum State received financial assistance to preserve and rehabilitate the library's collection of ancient manuscript materials. Despite their cultural significance, there is a lack of interest from philologists in studying them.

Research

B. Research Question and Objective

The research objectives of this study are to identify public interest and engagement about ancient manuscripts, acquaint the important visualization points to maintain their historical and cultural value and produce a visual augmented reality of ancient manuscripts for more immersion and engagement for the public. The research questions are focused on how to create interesting and engaging visual content of an ancient manuscript for the public, the important points in designing visual content through the augmented reality application, and how to produce visual content of ancient manuscripts through augmented reality.

C. Research significant and Purposed

The aim of this study is to make ancient manuscripts more accessible by transforming them into visual forms. This can help people understand and appreciate their cultural heritage and provide an interactive experience through augmented reality.

2. Methodology

This study employs a combination of qualitative and quantitative methods, including a thorough literature study, a pilot test, and post-test surveys. The pilot test will be conducted with a sample size of 101 respondents with the criteria are Indonesian, 18 years above, from different background and Province, followed by a post-test survey that includes 10% of the calculated pilot test sample and an open-ended survey of expertise. The data collected from these surveys will be analyzed using descriptive data analysis techniques, which will help to summarize and present the findings.

The ultimate goal of this research is to evaluate the effectiveness of a design prototype of Babad Lombok's ancient manuscript. By using a combination of different data collection and analysis methods, the study aims to

provide a holistic understanding of the research object and its potential impact through an understanding of the current situation in the public, user media repertoire, and visual style preferences. The findings of this research will not only contribute to the existing body of knowledge and help researchers to determine the design process of visualizing Babad Lombok through augmented reality.

3. Finding and Discussion

To create a successful product, understanding the user's needs is essential. The design thinking process was applied within involves five steps: Empathize, Define, Ideate, Prototype, and Test (Zainal Abidin, 2020). Empathizing includes understanding the issue at hand by reviewing literature studies and conducting surveys. In this case, a pretest survey was conducted among 100 Indonesian respondents to gauge user interest and needs related to ancient manuscripts.

3.1 Developing Ideas

Table 1. Pretest Result

Ancient Manuscript knowledge	Familiar	Not Familiar
Familiarity on Indonesia ancient manuscript	18.8%	81.2%
Familiarity on Lombok ancient manuscript	13.9%	86.1%
Level of Interest in Ancient Manuscript	Interest	Not Interest
Indonesia ancient manuscript	65.4%	34.6%
Lombok ancient manuscript	84.2%	15.8%

During the pretest, we presented various ancient manuscript topics to the public and found that history topics were the most popular among respondents. Many expressed a desire to better understand their local cultural history. Additionally, we evaluated the media preferences and habits of the public in relation to mobile technology. It was discovered that a significant number of respondents preferred to learn about ancient manuscripts through short movies on social media, specifically YouTube. However, for interactive experiences, the majority favored 3-dimensional visual art installations in museums.

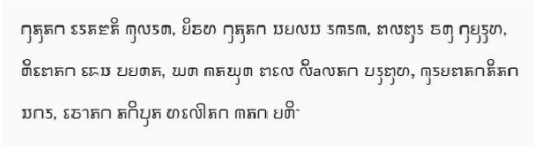
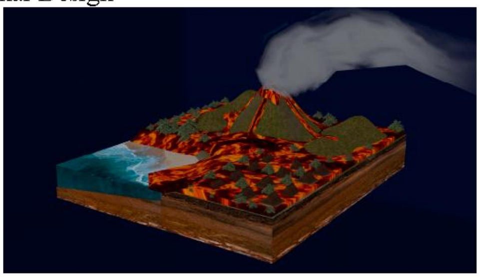
In order to advance the research to the next stage, it has been decided that the pretest data obtained will serve as a parameter in constructing the product design. This approach is commonly adopted in academic research to ensure that the product design is aligned with the research objectives and meets the needs of the target users. By incorporating the pretest data, the product design is expected to be more effective in achieving the desired outcomes and meeting the expectations of the end-users.

3.2 Technical Setup

3.2.1 Narration

This study will focus solely on one rhyme from Babad Lombok that features a significant historical event. Specifically, recounts the massive eruption of Samelas Mountain, a noteworthy occurrence in Lombok's past. This devastating event was believed to have punished the community's rejection of the first belief in Tauhid and changed into Weratsari, which brought many despicable behaviors, serving as a valuable lesson for the Sasak society and leaving a lasting impact on their history. The details of this phenomenon are documented in rhyme 274.

Table 1. Babad Lombok Rhyme Translation

Translation	Rhyme 274
Mount Rinjani collapsed, and Mount Samalas collapsed, a flood of thunderous rocks fell on Pamatan village, other mud houses collapsed, floating in the ocean, many of its residents died.	
Storyboard	Final Design 

3.2.1 Visual References

The concept output will be an interactive media which augmented reality applied as a media in transmitting the meaning of the rhyme, through three dimensional will support the information of the rhyme meaning in explicit way. The refence concept will adopt diorama style display that can be explored 360 degrees, user can control to navigate their accessibility in understanding the narration of the rhyme. In the narration above were included many object represent the phenomenon: the object used will be related to the related cultural representation iconic of Lombok society culture.

3.2.2 Three-Dimensional Asset Setup

Figure 2. Real Babad Lombok Display

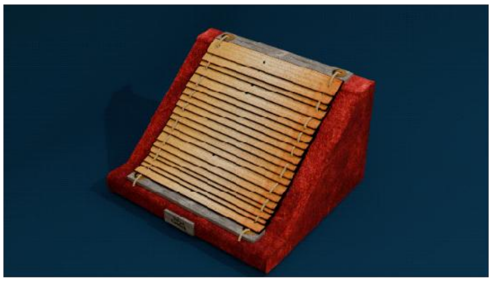


Figure 1. 3D Asset of Babad Lombok

The 3D assets Figure 3-6 were built by using 3D blender software, with the consideration of Low poly and geometry. It because after conducting numerous tests on the importation of 3D models into various augmented reality applications, it has been concluded that the most compatible and acceptable form of modeling for system machines in AR applications is low poly modeling. Additionally, it is imperative to limit coloring to light shading and textures, and during the rendering stage, each asset should be rendered using the EVEE rendering system.

This quality approach aims to produce results that are not excessively realistic, so as to ensure that they can be accepted by the AR application system. It is important to note that this approach is particularly beneficial for users who are seeking to optimize their AR experience and maintain a smooth, uninterrupted workflow.

3.2.1 Augmented Reality set-up

Upon the completion of 3D asset creation, the next step involves their integration into an augmented reality (AR) application. Adobe Aero, a beta version AR application, has been selected as the implementation tool to make the 3D visual more interactive. Compared to other AR applications, Adobe provides a more diverse range of asset support files. These files include PSD, JPEG, OBJ, GLB, FBX, GIF, PNG Sequence, WAV, and MP3, which can be imported into the application seamlessly.

Adobe Aero is equipped with a behavior pane in its AR building feature. This allows users to code the navigation options to suit their desired needs. Additionally, the scale and placement of the camera are highly supportive, enabling users to access all points of view and easily navigate through the 3D objects in 360 degrees. After the AR creation process is completed, Adobe generates a QR code and MP link, allowing users to access the output

of the completed AR. This feature facilitates the ease of access and distribution of AR content to users.

After testing the prototype into the user, the feedback of respondents were mostly emphasized the importance of interactivity and learning, suggesting that interactive museum installations involving multiple senses could be more fun and engaging for the audience. Additionally, the respondents' opinions and needs regarding the visualization of Babad Lombok highlighted the importance of maintaining accuracy, authenticity, and artistic style used. The importance of narration and appropriate visualization was also highlighted, as it helps the audience understand the story and get maximum results from the visualizations.

Furthermore, the respondents emphasized the need to maintain the original essence of the manuscripts while visualizing them. The visualizations should be able to capture the essence and philosophy of the ancient manuscripts so that they feel like they are still ancient manuscripts, not modern visualizations. The respondents also suggested that the visualizations should have a local identity, such as Lombok identity, and that the choice of colors should be suitable for the original condition of the manuscripts, with small details improved without changing them too much to remain true to the original.

De Saussure's semiotic theory and aesthetic design principles were implemented to define the product's design. Through this theory, the content, context, and visual form can be projected accurately, including the art style, coloring, and iconic elements used to serve the respondent's needs regarding the visualization of Babad Lombok. Finally, the implementation of user and expert feedback through post-test surveys guided the researcher to produce a fit Augmented reality. The post-test involved 10% of the respondents in the pilot test; 60% had never interacted with augmented reality content. The results showed that 50% of the total participants stated that this augmented reality content could help them understand the contents of the ancient Babad Lombok manuscript. Meanwhile, 60% of the test participants stated that their ability to navigate AR content was at an intermediate level for the navigation evaluation.

4. Conclusion & Recommendations

The creation of visualizations of ancient manuscripts using augmented reality (AR) technology presents both opportunities and challenges. While AR technology can make it easier for the public to understand and appreciate cultural heritage, the limited compatibility between systems poses significant obstacles in developing and integrating AR technology. To overcome these challenges, interdisciplinary collaboration among experts from various fields is necessary to create high-quality visualizations of ancient manuscripts through AR technology. The collaborative efforts of the local government, academia, and industry will play a crucial role in the preservation and promotion of cultural heritage.

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