



Heritage in Augmented Reality

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Abstract

This research explores the application of augmented reality (AR) technology to promote the historical heritage of colonial architecture in East Java, with a focus on Malang. By creating immersive 3D visualizations of iconic buildings, the project aims to document and preserve cultural heritage, raise public awareness, and support sustainable urban planning. The project aligns with Sustainable Development Goals (SDGs) 4 and 11, fostering quality education and sustainable cities.

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1. Introduction

Malang, a city in East Java, Indonesia, is home to an array of Dutch colonial heritage buildings that reflect its rich historical and architectural legacy. These buildings, constructed during the colonial era, not only represent historical aesthetics but also serve as cultural landmarks. Preserving and digitally documenting these structures is critical to promoting sustainable development, particularly in alignment with Sustainable Development Goals (SDGs) 4 and 11.

The Role of 3D Assets in Heritage Preservation

3D assets are digital representations of physical objects, created using technologies like photogrammetry, laser scanning, or 3D modeling software. For heritage buildings, these assets serve several purposes:

- Digital Preservation: Protecting the architectural integrity of buildings from environmental or human-induced threats.
- Education and Cultural Awareness: Offering an immersive way to learn about history, architecture, and cultural significance.

By creating detailed 3D assets of Dutch colonial buildings in Malang, stakeholders can ensure these landmarks remain accessible for future generations, even if the physical structures are damaged or altered.

SDG 4: Quality Education

SDG 4 aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Heritage 3D assets support this goal by:

- Enabling interactive learning for students and researchers, fostering deeper engagement with history and architecture.
- Supporting virtual field trips, especially for those unable to visit Malang in person.

- Developing digital resources for institutions worldwide to incorporate into curricula, promoting cultural diversity and historical literacy.

SDG 11: Sustainable Cities and Communities

SDG 11 emphasizes "making cities and human settlements inclusive, safe, resilient, and sustainable." 3D modeling of heritage buildings contributes to this goal through:

- Urban Planning: Assisting in city development by integrating heritage preservation into modern infrastructure projects.
- Sustainable Tourism: Encouraging responsible tourism by providing virtual tours, reducing the environmental impact of physical visitation.
- Resilience: Ensuring that cultural heritage is preserved digitally, safeguarding it against risks like natural disasters, urbanization, or neglect.

In conclusion, the development of 3D assets for Dutch colonial heritage buildings in Malang is not only a step towards preserving cultural heritage but also a strategic initiative to fulfill SDGs 4 and 11. It bridges historical conservation with modern education and sustainable city planning, fostering a harmonious balance between the past and the future.

1.1 Literature Review

Augmented reality (AR) has emerged as a powerful tool for enhancing heritage preservation, particularly in engaging younger audiences with cultural history. By integrating AR into educational frameworks, it fosters interactive learning experiences that deepen understanding and appreciation of heritage. This is particularly relevant in the context of Malang's colonial architecture, which offers a unique case for AR applications in heritage education.

Enhancing Engagement through AR

- AR applications can create immersive experiences that allow users to visualize historical events and figures, making learning more engaging (Vashisht & Sharma, 2024).
- Studies show that AR significantly boosts student motivation and academic performance compared to traditional methods (Dordio Ideas et al., 2024).

Promoting Sustainable Development

- AR can integrate historical preservation into urban planning, promoting sustainable development by enhancing the visibility of cultural heritage (Sachenko & Kit, 2024).
- Projects in urban heritage have demonstrated AR's potential to revitalize interest in historical sites, encouraging community involvement (Yi Cheng et al., 2024).

Case Study: Malang's Colonial Architecture

- The unique blend of Dutch and local influences in Malang's architecture provides an ideal backdrop for AR applications, allowing for rich educational narratives (Aziz et al., 2024).
- AR can facilitate cross-cultural communication and enhance tourist experiences, vital for regions with diverse cultural heritages (Aziz et al., 2024).

While AR presents numerous advantages for heritage education, challenges such as accessibility and the need for teacher preparedness remain critical considerations for its effective implementation.

2. Research Methods

The project involved identifying and selecting iconic colonial buildings in Malang, followed by creating detailed 3D models of these structures. The AR experience was designed to provide historical narratives and architectural insights, accessible via smartphones or AR-enabled devices. Feedback from users was collected through surveys to evaluate the effectiveness of the AR experience in promoting awareness and engagement.

3. Result and Discussion

Preliminary feedback from users suggests that AR experiences significantly enhance the understanding and appreciation of Malang's colonial heritage. Participants found the visual and interactive elements engaging, with many expressing increased interest in local history and architecture. The project also demonstrated the potential for AR to support sustainable urban planning by highlighting the integration of heritage sites into modern cityscapes. Challenges included technical limitations in rendering complex architectural details and ensuring accessibility across diverse user groups.

4. Conclusions

The "Heritage in Augmented Reality" project underscores the potential of AR technology to preserve and promote historical heritage. By providing an immersive and educational experience, the project supports SDG 4 and SDG 11, fostering awareness of cultural history and sustainable urban development. Future work could explore expanding the scope to include more buildings and integrating AR with other technologies, such as virtual reality and artificial intelligence, to further enhance user experience.

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