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DESIGN AND IMPLEMENTATION OF A METAVERSE-BASED PLATFORM FOR THEMATIC TOURISM VILLAGES

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Abstract

This research investigates the integration of metaverse technology into the design of thematic tourism villages to address the declining appeal of such destinations and the limited adoption of digital tools for promotion and education. Using the Kayutangan Heritage Village in Malang as a case study, the study employs a Design Thinking approach to identify challenges, ideate solutions, and develop a metaverse-based platform prototype. This platform leverages immersive 3D environments to enable users to explore cultural heritage and historical narratives in a virtual context. The findings highlight the platform's ability to create resilient, engaging, and educational tourism experiences that attract diverse audiences while supporting local economies. By offering innovative, interactive ways to connect with cultural heritage, the metaverse platform demonstrates its potential as a transformative tool for digital tourism. The research contributes to the broader discourse on sustainable tourism by showcasing the metaverse's role in preserving cultural heritage and enhancing digital connectivity. Its impact is evident in fostering a deeper understanding of cultural assets and promoting digital tourism innovations that align with contemporary market demands, thus paving the way for the widespread adoption of metaverse technology in similar contexts.

Keywords: *Metaverse, Sustainable Digital Tourism, Smart Village, Thematic Tourism Village, Virtual Reality*

DESAIN DAN IMPLEMENTASI PLATFORM BERBASIS METAVERSE UNTUK DESA WISATA TEMATIK

Abstrak

Penelitian ini menyelidiki integrasi teknologi metaverse ke dalam desain desa wisata tematik untuk mengatasi menurunnya daya tarik destinasi wisata dan terbatasnya adopsi alat digital untuk promosi dan edukasi. Dengan menggunakan Desa Pusaka Kayutangan di Malang sebagai studi kasus, penelitian ini menggunakan pendekatan Design Thinking untuk mengidentifikasi tantangan, mencari solusi, dan mengembangkan prototipe platform berbasis metaverse. Platform ini memanfaatkan lingkungan 3D yang imersif untuk memungkinkan pengguna menjelajahi warisan budaya dan narasi sejarah dalam konteks virtual. Temuan ini menyoroti kemampuan platform untuk menciptakan pengalaman wisata yang tangguh, menarik, dan edukatif yang menarik audiens yang beragam sekaligus mendukung ekonomi lokal. Dengan menawarkan cara-cara yang inovatif dan interaktif untuk terhubung dengan warisan budaya, platform metaverse menunjukkan potensinya sebagai alat transformatif untuk pariwisata digital. Penelitian ini berkontribusi pada wacana yang lebih luas tentang pariwisata berkelanjutan dengan menunjukkan peran metaverse dalam melestarikan warisan budaya dan meningkatkan konektivitas digital. Dampaknya terlihat jelas dalam mendorong pemahaman yang lebih dalam tentang aset budaya dan mempromosikan inovasi pariwisata digital yang selaras dengan permintaan pasar kontemporer, sehingga membuka jalan bagi adopsi teknologi metaverse secara luas dalam konteks yang sama.

Kata kunci: Metaverse, Pariwisata Digital, Desa Cerdas, Kampung Wisata Tematik, Realitas Virtual

1. INTRODUCTION

Tourism is one of the driving economic sectors in Indonesia. However, to maintain economic sustainability, tourism needs to be managed wisely so that economic growth does not lead to environmental and social degradation. Sustainable tourism ensures long-term revenue, where natural and cultural resources are preserved, attracting more tourists who value natural and cultural preservation.

The tourism industry is currently growing rapidly in almost all corners of the country, including East Java. East Java Province is listed as

one of the regions with the rapid development of the tourism industry, both nationally and internationally [1], [2]. Malang is the second largest city after Surabaya in East Java, and is one of the best colonial urban planning outcomes of the Dutch East Indies and also known as a tourist city supported by the existence of thematic city villages [3]. Tourism development in Malang continues to grow, driven by the rising number of visitors. To meet the increasing tourist demand, local governments need to innovate by creating thematic villages [4]. The development of thematic villages each has the aim of overcoming poverty, encouraging the local economy and improving the quality of the community's living environment [5]. Since it was initiated in 2016, there has been no significant movement from either the community or the government regarding the development of thematic villages [6]. Even until 2023, there are only a few thematic villages that can survive, namely Jodipan Colorful Village, Dinoyo Ceramic Village, Sanan Tempe Village and Kayutangan Heritage Village.

This research was conducted with the object of Kampung Heritage Kayutangan Malang City, East Java. The potential of Kayutangan Heritage Village can be the basis for making this area a tourist destination [7]. There are potentials that are clearly known and utilized by the community to strengthen the heritage label embedded in Kayutangan Village. According to figure 1, This Kayutangan Heritage Tourism Village offers numerous potentials, including tourism that includes Dutch colonial art, local and international tourists' favorite culinary, and cultural and religious aspects.

Figure 1. Kayutangan Thematic Village in Malang City
(Source: [8], [9])

The COVID-19 pandemic, which led to social distancing activities, has implications for the decline in tourism activities [7], [10]. The potential for other common disasters such as floods, strong winds and earthquakes also needs to be anticipated. The presence of information technology offers tremendous potential to support tourism preservation [11], [12], [13]. One technology that has adequate facilities as an interactive learning and literacy media is Metaverse [14]. Metaverse technology is a virtual world that allows its users to interact with each other in a three-dimensional environment [15], [16], [17], [18], [19], [20]. This immersive technology integrates physical and virtual realities, creating a seamless fusion of both. It offers users contextualized experiences by blending the tangible and digital worlds, allowing for dynamic interaction within specific environments [21]. The presence of metaverse technology is expected to improve the user experience in the process of sustainable thematic village tourism, as well as being an informative and interactive educational tool for visitors related to history and other fields of study.

Tourism functions as a driving force for global community development, fostering cultural exchange while simultaneously fueling economic growth [22]. The objective of this research is to implement the concept of resilient digital tourism that can be integrated in the design of Metaverse-based Thematic Tourism Village. This research has significant urgency in the midst of the tourism paradigm shift towards an increasingly dominant digital environment. With the development of digital technology, the integration of metaverse in the design of thematic tourism villages is important to create an attractive tourism experience and in accordance with market needs for the importance of digital connectivity. Metaverse-based thematic tourism village design can also increase the resilience of tourism destinations by presenting a resilient tourism experience by offering a new business model to generate the creative economy of the local community [23].

Digital tourism is digital support both before, during and after tourism activities that allow tourists to pour all real-world travel experiences into the digital dimension [24]. In line with the development of technology, the concept of digital tourism is also slowly changing its perspective and experience [25], [26]. State-of-the-art regarding the concept of digital tourism has been carried out by several previous researchers. Research conducted by [17] which this research builds an AR-based metaverse design with markerless user defined targets. This research utilizes any flat object nearby as a medium for AR realization. Furthermore, there is research conducted by [27] Where this research answers the problem of using Roblox for virtual tourism applications. The same thing was also done by [12] who built a metaverse-based interactive website to preserve traditional houses. Furthermore, digital tourism research with the concept of green economy has been conducted by [28] Where this research builds the concept of a digital tourism village based on green economy as an effort to develop an environmentally sound area. Then there is research conducted by [29] Where this research conducts the adoption process of metaverse innovation diffusion in digital museums. The novelty of the research that will be proposed will be the concept of a thematic Tourism Village that elevate the metaverse as the

main media through a platform that allows user interaction through the virtual world [30].

2. RESEARCH METHOD

This research was conducted using the Design Thinking approach. According to figure 2, Design Thinking is an approach used in the process of innovation and development of products, services, or solutions to complex problems [31].

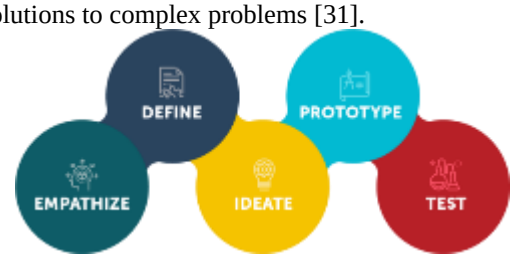

Figure 2. Design Thinking Approach (Source: [31])

The Design Thinking approach is rooted in design principles and is widely applied in a variety of contexts, ranging from physical product development to digital user experience. Figure 3 shows the research flow**.**

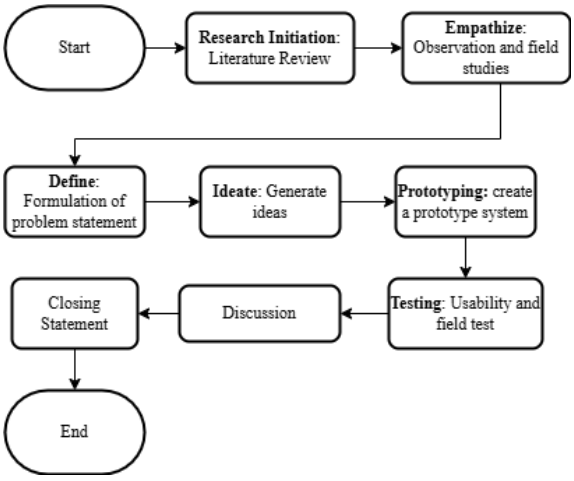

Figure 3. Research Flow (Source: [32])

The following is a description of the research process:

1. Research Initiation
   At this stage, a review of scientific literature is carried out to understand the position of the research and clarify the research gap.
2. Empathize
   At this stage, observations and field studies were carried out to understand the initial needs and mapping of problems in each Thematic Village. This stage also included interviews with local leaders to understand the current condition of the village.
3. Define
   From the results of interviews with informants and observation of the object of research, this stage functioned for the formulation of research problems. The problems raised are: (1) The declining popularity of thematic villages. (2) Lack of utilization of information technology in supporting the marketing process and as a means of education for visitors.
4. Ideate
   This stage begins to generate ideas that are oriented towards the solution of the problems that have been stated. The solution offered is the design and creation of a Metaverse-based thematic tourism village design. This stage also discusses the general concept of the interface and key features of the metaverse and mobile applications that will be used. In addition, the metaverse infrastructure that will be used is also designed.
5. Prototyping
   After the design stage is complete, the next step is to create a prototype system that will be ready to be tested in the field. The prototyping stage is the stage of making mobile applications as a metaverse interface system and creating a metaverse world for Thematic Tourism Villages.
6. Testing
   This stage is the testing stage of the metaverse system that has been created. The testing phase includes functionality testing, which means testing whether the functions and features contained in the metaverse system are running properly [33], [34].

3. RESEARCH RESULT

As mentioned earlier, the opportunity offered by Kayutangan Tourism Village is the image of Malang City as a cultural tourist spot that has colonial building heritage as a strength to increase tourists [35]. Virtual media design is carried out to be a form of innovation in the development of ways to introduce Indonesian culture and history to all elements of society that can be accessed from anywhere and only requires a set of computers. This virtual media brings the characteristics and attractiveness of Kayutangan Tourism Village from the real world to the 3D-based digital world so that the character and identity of the cultural heritage building is still stored in this virtual media. This virtual media also has an inspection system that allows players to see the details of all stones in the 3D world. In this inspection system, there are also various kinds of accurate information taken from books published by the Malang City Culture and Tourism Office regarding historical heritage.

This section will explain the stages of creating virtual media for the creation of the required assets. Making 3D designs adjusts the profile and details of

each heritage building. This stage includes 1) in-depth observation of each building object both outside and inside. 2) After scanning the profile and contours of the building, then proceed to the stage of making 3d objects using Blender and Unity software. In this process, the 3d object is made in the concept of digital twin, which makes the object as similar as possible to the original building. This process includes RAW creation of the base building, colouring, detailing and lighting, and adding supporting objects. Figure 3 shows the making one of the 3d object in Kampung Kayutangan.

Figure 4. 3D Object of Rumah Hamur as a Heritage Site in Kayutangan Village
(Source: Research Result)

As can be seen in figure 4, Kedai Kopi Hamur Mbah Ndut, which is the first coffee shop in Kampoeng Kajoetangan. This place still serves a traditional menu, including tubruk coffee, milk coffee, sekoteng, and pocket-friendly onde-onde. Figure 5 shows the transformation the 3D object to metaverse world.

Figure 5. 3D Object in Metaverse World
(Source: Research Result)

Figure 5 in the document presents the transformation of a 3D object into the metaverse world. This figure serves as a visual representation of how virtual tourism spaces, specifically for the Kayutangan Heritage Village, are integrated into an immersive metaverse environment. The design process starts by creating detailed 3D models of heritage sites such as Rumah Hamur, including aspects like texture, lighting, and color, to ensure the digital twin is as close as possible to the real-world counterpart.

The purpose of this transformation is to allow users to experience the tangible cultural heritage of Kampung Kayutangan virtually. Through the metaverse, users can interact with the environment, explore historical narratives, and engage with the village's cultural assets. The 3D object's transition into the metaverse not only highlights its aesthetic and architectural details but also provides a platform for educational and promotional activities, supporting the village's tourism potential while maintaining the heritage's authenticity. In this context, figure 4 symbolizes the bridge between traditional cultural elements and advanced digital technologies, showcasing the metaverse's role in preserving and promoting heritage tourism. It also emphasizes the importance of interactivity and engagement in creating an immersive experience for tourists, which is a critical component of digital tourism sustainability.

4. DISCUSSIONS

Final phase is represents the evaluation stage of the developed VR application system, encompassing comprehensive functionality assessments. The objective is to determine whether the system's features and capabilities operate as intended [33], [34]. The evaluation was conducted through the distribution of online questionnaires to 100 respondents from Malang, who had both viewed the video and interacted with the virtual media. The results of this testing are detailed in Table 1.

Table 1. User Testing Result
(Source: adoption from [36] and research result)

No	Questions	Score					Total
		1	2	3	4	5	
	Attractiveness						
1	How attractive is the visual interface in this VR media?	0	0	0	30	70	470
2	How well does it combine elements of reality with your surroundings?	0	0	15	40	45	430
3	How satisfied are you with this VR media in providing in displaying the object?	0	0	0	30	70	470
	Efficiency						
4	How easy was it for you to navigate the apps user interface?	0	0	0	45	55	455
5	Did you find the feature in this apps easy to understand and use?	0	0	23	45	32	409
	Impact						
6	How effective this VR media in introducing the kampung kayutangan?	0	0	0	43	57	457
7	Does this media make you feel interested and want to explore more about kampung kayutangan?	0	0	0	44	56	456

8	Do you feel that this VR media provides an immersive experience in introducing the kampung kayutangan as a cultural heritage?	0	0	0	36	64	464
9	Do you agree that using this VR media will increase your understanding about the basic knowledge of tangible cultural heritage, especially kampung kayutangan?	0	0	0	36	64	464
10	Do you feel that this VR media has a positive impact on promoting and maintain the sustainability of digital tourism in Indonesia?	0	0	13	38	49	436

The developed metaverse system represents an innovative approach to digital tourism, offering a distinct advantage over traditional web-based AR/VR technologies. Unlike AR/VR systems that typically rely on specific markers or predefined interfaces, the metaverse platform integrates immersive 3D environments and real-time interactivity, allowing users to engage deeply with cultural and historical narratives. Additionally, metaverse technology provides a scalable framework, enabling seamless updates and expansion to include more features, such as multiplayer interactions or integration with external digital tools, which are often limited in web-based systems.

The overall results from Table 1 are overwhelmingly positive, indicating that the VR system successfully met its goals in terms of visual appeal, ease of use, and its ability to promote and sustain kampung kayutangan tourism. The high scores in the impact category demonstrate that the system not only provides an immersive experience but also educates users effectively, which is a key aspect of sustainable digital tourism. In Table 1, the user testing results provide a comprehensive evaluation of the VR media's performance based on several key dimensions: Attractiveness, Efficiency, and Impact. Each dimension was assessed using a five-point Likert scale, with scores ranging from 1 to 5, representing the respondents' levels of satisfaction with various aspects of the VR experience.

The result shows a highly positive response, with 70 respondents giving it the highest score (5), and 30 respondents rating it as 4, yielding a total score of 470. This indicates that the majority of users found the visual design of the VR system to be engaging and well-executed, which is crucial for any immersive digital experience. Like the first question, 70 respondents rated it a 5 and 30 rated it a 4, yielding a total score of 470. This demonstrates that the system was effective in presenting virtual objects in a visually satisfying manner, which is key to maintaining user engagement. This metaverse system can be adapted for other thematic tourism villages across Indonesia by tailoring its content to the unique cultural and historical attributes of each location. For instance, the digital twin model used for Kampung Kayutangan could be replicated in other villages, incorporating their distinctive heritage sites, folklore, or culinary traditions. The adaptability of the metaverse framework ensures that diverse tourism destinations can benefit from increased visibility and interactive storytelling.

Efficiency refers to how easily and intuitively users can navigate and interact with the VR media. This high score of ease of navigation indicates that the majority of users found the system's interface easy to use, which is essential for ensuring users stay engaged without frustration. The total score of understanding and using feature is slightly lower at 409, with 32 respondents rating it a 5, 45 rating it a 4, and 23 rating it a 3. While still positive overall, the lower score suggests that some users found certain features less intuitive, indicating room for improvement in the clarity or accessibility of certain functionalities.

The user testing results for the VR media focused on Kampung Kayutangan highlight its effectiveness in providing an immersive and educational experience. Users rated the system highly in terms of visual appeal and ease of navigation, with particularly strong feedback on its ability to introduce the cultural heritage of Kampung Kayutangan. The system sparked interest among users, encouraging them to explore more, which is a critical measure of engagement. For local tourism stakeholders, the implementation of this system holds significant practical implications. By attracting a broader audience, particularly tech-savvy millennials and international tourists, the metaverse platform can drive higher visitor numbers, generating increased revenue for local economies. Moreover, the immersive cultural experiences offered by the system promote a deeper appreciation and understanding of cultural heritage, contributing to its preservation. For local artisans, businesses, and community members, the metaverse provides opportunities to showcase and monetize their products or services within the digital space, fostering economic empowerment and sustainability.

5. CONCLUSIONS

This study highlights the transformative potential of integrating metaverse technology into thematic tourism villages to promote sustainable digital tourism. By using Kampung Heritage Kayutangan as a case study, the research demonstrates that metaverse platforms can attract broader audiences, enhance cultural preservation, and create engaging, immersive experiences. The implementation of these platforms also supports

local economies by fostering creative industries around heritage tourism.

To maximize the benefits of these findings, local governments can adopt metaverse platforms to enhance tourism strategies. Specifically, they could incorporate the platform into regional marketing campaigns, develop partnerships with technology providers, and offer training programs for local communities to manage and sustain the platform effectively

Future research should focus on expanding the application of metaverse technology to other thematic villages in Indonesia, integrating interactive features like real-time visitor interaction and gamification to enhance user engagement. Additionally, studies could explore community involvement in platform management to boost economic and cultural sustainability, while comparative analyses with traditional digital tourism models would provide insights into cost-efficiency and long-term impacts..

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REFERENCES

[1] H. Luchman and N. Nakagoshi, "PLANNING FOR NATURE-BASED TOURISM IN EAST JAVA: RECENT STATUS OF BIODIVERSITY, CONSERVATION, AND ITS IMPLICATION FOR SUSTAINABLE TOURISM," *ASEAN Journal on Hospitality and Tourism*, vol. 7, no. 2, pp. 155–167, 2016.

[2] N. B. Kumoro *et al.*, "Pemetaan Potensi Seni dan Budaya untuk Mendukung Industri Pariwisata," *Berdikari: Jurnal Inovasi dan Penerapan Ipteks*, vol. 9, no. 2, pp. 120–142, Aug. 2021, doi: 10.18196/berdikari.v9i2.10553.

[3] L. Mulyadi, B. Fathony, and E. Prikasari, *Potensi Kampung Heritage Kayutangan sebagai Destinasi Wisata di Kota Malang*, 1st ed., vol. 1. Malang: Deazha, 2019.

[4] N. Insani, Y. Ariani, E. V K Ningrum, and F. R A'rachman, "Developing a Tourism Strategy for Heritage Villages in the Kayutangan Area," *KnE Social Sciences*, Oct. 2022, doi: 10.18502/kss.v7i16.12166.

[5] I. Sasongko, *KAMPUNG WISATA KOTA MALANG*. PT. Muara Karya (IKAPI), 2023.

[6] A. R. Afdholy and H. Hamka, "STRATEGI PENGEMBANGAN KAMPUNG KOTA TEMATIK DI KOTA MALANG Studi Parameter Pendekatan (3B) Berkelanjutan, Berketahanan dan Berkearifan," *Vitruvian : Jurnal Arsitektur, Bangunan dan Lingkungan*, vol. 12, no. 2, p. 169, Feb. 2023, doi: 10.22441/vitruvian.2023.v12i2.006.

[7] I. H. Idris, T. Narawida, R. D. Agustin, D. Oktaviani, and M. B. Hidayat, "Analisis RAPFISH Pada Studi Keberlanjutan Pembangunan Kawasan Wisata Heritage Kajoetangan di Kota Malang," *Brawijaya Journal of Social Science*, vol. 2, no. 02, Jun. 2023, doi: 10.21776/ub.bjss.2023.002.02.1.

[8] A. Widyarthara and A. R. Afdholy, "Karakteristik Permukiman Kampung Tematik di Kota Malang," *Pawon: Jurnal Arsitektur*, vol. 6, no. 1, pp. 95–108, Jan. 2022, doi: 10.36040/pawon.v6i1.4439.

[9] Y. A. Yusran, "Contextualizing Modernization in the Kayutangan Towards Its Images as a Heritage Town Area of Malang," in *Proceedings of the International Conference of Heritage & Culture in Integrated Rural-Urban Context (HUNIAN 2019)*, Paris, France: Atlantis Press, 2020. doi: 10.2991/aer.k.200729.016.

[10] M. R. Setiawan, M. A. Gustalika, and M. L. L. Usman, "IMPLEMENTATION OF VIRTUAL TOUR USING IMAGE STITCHING AS AN INTRODUCTION MEDIA OF SMPN 1 KARANGKOBAR TO NEW STUDENTS," *J. Tek. Inform. (JUTIF)*, vol. 4, no. 5, pp. 1089–1098, 2023, doi: https://doi.org/10.52436/1.jutif.2023.4.5.968.

[11] E. Erlin, Y. Nuron, T. A. Fitri, and A. Agustin, "Riau Heritage Digital Library sebagai Sarana Informasi dan Inventaris Warisan Budaya Nusantara berbasis Web," *Digital Zone: Jurnal Teknologi Informasi dan Komunikasi*, vol. 9, no. 2, pp. 172–181, Nov. 2018, doi: 10.31849/digitalzone.v9i2.2027.

[12] M. Minarni, E. T. Kirana, and J. P. Risma, "Pengembangan Website Interaktif untuk Meningkatkan Pengalaman Virtual di Metaverse Betang Tumbang Gagu," *Jurnal Teknologi Informatika dan Komputer*, vol. 9, no. 2, pp. 936–950, Sep. 2023, doi: 10.37012/jtik.v9i2.1781.

[13] R. Amarulloh, M. Muslih, and N. D. Arianti, "IMPLEMENTATION OF THE TOGAF FRAMEWORK ON A VIRTUAL TOUR OF WEB-BASED CILETUH GEOPARK TOURIST ATTRACTIONS," *Jurnal Teknik*

Informatika (Jutif), vol. 3, no. 5, pp. 1329–1336, Oct. 2022, doi: 10.20884/1.jutif.2022.3.5.357.

[14] G.-J. Hwang and S.-Y. Chien, "Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective," *Computers and Education: Artificial Intelligence*, vol. 3, p. 100082, 2022, doi: 10.1016/j.caeai.2022.100082.

[15] R. H. Alinata and M. Marsudi, "Pemanfaatan Roblox sebagai Media Promosi Sekolah Metaverse SMP Negeri 3 Sumenep," *MALCOM: Indonesian Journal of Machine Learning and Computer Science*, vol. 4, no. 1, pp. 57–70, Dec. 2023, doi: 10.57152/malcom.v4i1.1011.

[16] D. Buhalis and N. Karatay, "Mixed Reality (MR) for Generation Z in Cultural Heritage Tourism Towards Metaverse," in *Information and Communication Technologies in Tourism 2022*, Cham: Springer International Publishing, 2022, pp. 16–27. doi: 10.1007/978-3-030-94751-4_2.

[17] S. Dewi Andriana and F. Damayanti, "Desain Metaverse: The Future of Tourism Pariban Berbasis Augmented Reality Menggunakan Metode Markerless User Defined Target," *Jurnal UNITEK*, vol. 16, no. 2, pp. 172–182, 2023, doi: https://doi.org/10.52072/unitek.v16i2.668.

[18] S.-M. Park and Y.-G. Kim, "A Metaverse: Taxonomy, Components, Applications, and Open Challenges," *IEEE Access*, vol. 10, pp. 4209–4251, 2022, doi: 10.1109/ACCESS.2021.3140175.

[19] H. Wang *et al.*, "A Survey on the Metaverse: The State-of-the-Art, Technologies, Applications, and Challenges," *IEEE Internet Things J*, vol. 10, no. 16, pp. 14671–14688, Aug. 2023, doi: 10.1109/JIOT.2023.3278329.

[20] H. Duan, J. Li, S. Fan, Z. Lin, X. Wu, and W. Cai, "Metaverse for Social Good," in *Proceedings of the 29th ACM International Conference on Multimedia*, New York, NY, USA: ACM, Oct. 2021, pp. 153–161. doi: 10.1145/3474085.3479238.

[21] K. A. Nastiti, H. B. Santoso, K. Junus, M. Ahmad, and E. P. Purwandari, "THE EFFECT OF IMMERSIVE TECHNOLOGY ON ENHANCING STUDENT LEARNING:," *JITK (Jurnal Ilmu Pengetahuan dan Teknologi Komputer)*, vol. 9, no. 2, pp. 208–217, Feb. 2024, doi: 10.33480/jitk.v9i2.4775.

[22] A. Trihandoyo, R. Hesananda, K. Kushandajani, and F. Muhksin, "THE ROLE OF INFORMATION SYSTEMS IN ADVANCING SMART VILLAGES: A RURAL TOURISM CASE STUDY," *JITK (Jurnal Ilmu Pengetahuan dan Teknologi Komputer)*, vol. 9, no. 2, pp. 308–322, Mar. 2024, doi: 10.33480/jitk.v9i2.5044.

[23] C. Koo, J. Kwon, N. Chung, and J. Kim, "Metaverse tourism: conceptual framework and research propositions," 2023, *Routledge*. doi: 10.1080/13683500.2022.2122781.

[24] H. Ernawati and K. Hananto, "PARIWISATA DIGITAL: PERSPEKTIF DAN AGENDA RISET MASA DEPAN," *Kepariwisataan: Jurnal Ilmiah*, vol. 17, no. 2, pp. 144–156, 2023.

[25] N. Akhtar *et al.*, "Post-COVID 19 Tourism: Will Digital Tourism Replace Mass Tourism?," *Sustainability*, vol. 13, no. 10, p. 5352, May 2021, doi: 10.3390/su13105352.

[26] D. T. Putra, T. Mahmudin, N. G. M. Wiartha, I. M. S. Adnyana, and A. A. I. M. Septiviari, "The Existence Of The Metaverse Tourism In Indonesia: Between Opportunities And Threats," *Reslaj : Religion Education Social Laa Roiba Journal*, vol. 6, no. 3, pp. 2291–2300, Jan. 2024, doi: 10.47467/reslaj.v6i3.6162.

[27] R. Farta Wijaya, V. Tasril, R. E. Putri, D. N. Putri, and M. R. Sipayung, "Virtual Tourism in Berastagi Based on Roblox Metaverse Post-Covid-19 Pandemic," *International Journal of Computer Sciences and Mathematics Engineering*, vol. 2, no. 2, 2023.

[28] V. M. M. Siregar and Mhd. A. Hanafia, "PERANCANGAN APLIKASI AUGMENTED REALITY UNTUK EDUKASI PENERAPAN KONSEP GREEN ECONOMY DALAM PENGEMBANGAN DESA WISATA SEBAGAI UPAYA MEWUJUDKAN PEMBANGUNAN BERWAWASAN LINGKUNGAN," *Jurnal TEKINKOM*, vol. 6, no. 2, pp. 339–348, 2023, doi: 10.37600/tekinkom.v6i2.950.

[29] R. S. Amalia, W. A. Arindawati, and R. Kusumaningrum, "Proses Adopsi Metaverse Melalui Augmented Reality Yang Diterapkan Oleh Museum Digital Bekasi," *Innovative: Journal of Social Science Research*, vol. 3, no. 3, pp. 529–542, 2023.

[30] R. I. Firmansyah, A. Aditya, and M. Kartikasari, "GAME EDUKASI SISTEM TATA SURYA BAGI SISWA SEKOLAH DASAR BERBASIS VIRTUAL REALITY," *Jurnal Simantec*, vol. 9, no. 2, pp. 39–44, Jun. 2021, doi: 10.21107/simantec.v9i2.9912.

[31] A. Abdurrohman, A. Aditya, and R. Nurfitri, "Perancangan Desain Maskot Kabupaten Situbondo Dengan Pendekatan Design Thinking," *MAVIS: Jurnal Desain*

Komunikasi Visual, vol. 5, no. 1, pp. 38–46, Jul. 2023, doi: 10.32664/mavis.v5i01.757.

[32] F. A. Widodo, A. Aditya, and R. Kurniawan, "Enhancing Tangible Cultural Heritage Preservation through Virtual Reality: A Case Study of Watu Gong Sites in Indonesia," in *2024 11th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)*, IEEE, Sep. 2024, pp. 729–734. doi: 10.1109/EECSI63442.2024.10776179.

[33] D. A. S. Sugiono, A. Aditya, H. N. Hadi, and F. E. Purwiantono, "Analisis Usability Testing Guna Meningkatkan Efisiensi Kerja (Studi Kasus: Website Lo Kreatif)," in *Seminar Nasional Sistem Informasi dan Teknologi (SISFOTEK)*, IAII, 2022, pp. 64–68.

[34] H. N. Hadi, A. Aditya, F. E. Purwiantono, and S. W. P. Listio, "PENGUJIAN PERFORMA PADA WEBSITE LOMBA NASIONAL KREATIVITAS MAHASISWA," *Jurnal Informatika*, vol. 22, no. 1, pp. 100–110, Jun. 2022, doi: 10.30873/ji.v22i1.3194.

[35] Moch. N. L. Khakim, M. U. U. Putri, W. Suktianto, and N. A. Budi, "Urgensi pengelolaan pariwisata Kampung Heritage Kajoetangan Malang," *Jurnal Teori dan Praksis Pembelajaran IPS*, vol. 4, no. 1, pp. 15–22, May 2019, doi: 10.17977/um022v4i12019p015.

[36] A. W. P. Arista, D. S. Hendra, F. P. Juwono, H. Abdillah, and F. Permana, "Preserving Indonesian Culture in the Digital Age: Implementing Augmented Reality to Address Cultural Appropriation Issue," in *Procedia Computer Science*, Elsevier B.V., 2023, pp. 762–771. doi: 10.1016/j.procs.2023.10.581.