

IMPLEMENTATION OF VIRTUAL REALITY MUSEUM LONTAR PRASI BALI AS A CULTURAL EDUCATION MEDIA

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Abstract

Lontar Prasi Bali is famous for its distinctive paintings on palm leaves, a cultural heritage that must be preserved and continued. Main problem occurred because 82.5% of 189 respondents consisting of elementary school students in Denpasar Selatan stated that they did not know about Lontar Prasi Bali. The aim of collecting data from elementary school student respondents is to increase insight into Lontar Prasi and the target of this research is to introduce VR-based lontar prasi culture to children, especially elementary school students. There needs to be collaboration between culture and technology so that people understand the story and provide education about Lontar Prasi Bali, one of which is by implementing VR. The design method used is MDLC Multimedia Development Life Cycle (MDLC) which consists of concept, design, material collection, assembly, testing and distribution. The results of research using Likert scale stated that the use of VR showed that 84.75% of respondents stated Strongly Agree with the Lontar Prasi Museum Virtual Reality Application.

Keywords : Virtual Reality, Lontar Prasi, Museum, Cultural

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INTRODUCTION

Lontar Prasi Bali is an ancient literary form originating from Bali, Indonesia. Lontar Prasi Bali is writing made from palm leaves and is used as a medium to store and convey the knowledge, history and beliefs of the Balinese people from generation to generation. The writings on Lontar Prasi Bali cover various topics, such as mythology, religion, grammar, legislation, and Balinese folk tales. Lontar Prasi was originally a sacred medium, developed to meet aesthetic [1] and economic needs, and further its activities developed into an arts industry business [2]. Based on data from the Balinese language extension team, 8,239 lontars need to be saved and spread throughout Bali. The number recorded is 8,370 lontars; the details are 5,804, which are categorized as well-preserved with the lontar still readable but requiring further conservation [3]. The remaining 2,562 lontars were categorized as poorly maintained and damaged, as if they were no longer intact in terms of shape, physical form, or the contents contained therein [4]. The second problem is a lack of understanding of the content of the story told by Lontar Prasi Bali. The results of the questionnaire showed that 82.5% of 189 consisting of elementary school students in Denpasar Selatan

stated that they did not know about Lontar Prasi Bali, and 17.5% already knew about Lontar Prasi Bali.

In an effort to preserve and introduce Bali's cultural heritage to the younger generation, the use of modern technologies such as virtual reality (VR) is an attractive option. Virtual reality is an interactive technology that allows users to experience digitally created environments [5]. The results of 189 respondents stated that 95.2% were interested in Lontar Prasi Bali which was packaged with Virtual Reality. In the context of Lontar Prasi Bali, the use of virtual reality can be an effective educational medium for introducing and understanding its contents of Lontar Prasi Bali. The use of virtual reality is also helpful in the learning process and strengthens the simulation process of situations and information [6]. The advantages of using virtual reality as an educational medium for Lontar Prasi Bali include: 1) Interactive Experience: By utilizing virtual reality, users can directly experience Lontar Prasi Bali content visually and audio interactively. They can feel the atmosphere of Bali in depth, including the sounds of nature, traditional music, and the atmosphere of rituals. 2) Experience-based learning: The use of virtual reality is also helpful in the learning process and strengthens the

simulation process of situations and information. 3) Visual Reconstruction: Through virtual reality technology, users can see a visual reconstruction of the prasi lontar-lontar, including the fine details and carvings inside [7]. They can zoom, rotate, and view every angle clearly [8], making the experience more immersive and detailed [9].

Through the use of virtual reality as an educational medium, the Bali Lontar Prasi Museum is hoped to be able to channel the information contained in the stories and provide a different experience in the process of transferring knowledge to the younger generation in a more interesting and memorable way [10]. Virtual reality users can gain a deeper understanding of Balinese culture and appreciate the values contained in Lontar Prasi Bali directly and interactively.

Virtual Reality (VR) is a technology that allows users to interact in computer-simulated environment [11]. Virtual Reality (VR) is a technology that is used as if we can interact with an environment simulated by a computer. Research on the application of technology that was previously carried out by Hari Antoni Musril, Jasmientix, and Mifta Hurrahman [12] was entitled to the implementation of Virtual Reality technology in computer assembly learning media. The results of this research indicate that the validity of the product is 0.79 with valid criteria. The practicality test results obtained a score of 84.11 with very practical criteria. Meanwhile, the results of the effectiveness test obtained a value of 0.78 with high effectiveness criteria. A study entitled Metaverse for Cultural Heritages found that the use of metaverse technology and Virtual Reality in culture can improve user experience and enrich their cultural experience [13], enhancing cultural experiences, and creating more interactive and immersive cultural experiences. Designing the Metaverse: A study on inclusion, diversity, equity, accessibility, and safety for digital immersive environments states that virtual reality in the Metaverse can create new cultural experiences, and users can experience culture interactively and create new experiences. Users can explore various aspects of culture, such as art, music, dance, and traditions, in an unprecedented way [14].

Blender is free and open-source 3D creative software. Blender supports all aspects of 3D work such as modeling, rigging, animation, simulation, rendering, compositing, and motion tracking, including video editing and game creation [15]. In addition, Blender also has 3D modeling features, determines textures, adjusts the series of bones in characters (rigging), and can be used to create 3D visualizations. Unity is

a 3D game development application that allows for the creation of games in a 2D style. As a development software (software engine), Unity 3D can process various types of data, such as three-dimensional objects, sounds, and textures. The advantage of Unity 3D is its ability to handle two-dimensional and three-dimensional graphics. However, the main focus of this software is to creating three-dimensional graphics [16].

METHOD

In this study, the multimedia development lifecycle (MDLC) method was used. The Multimedia Development Life Cycle (MDLC) method is a systematic approach used in multimedia development. MDLC is a framework that describes the steps that must be followed to design, develop, and implement multimedia projects efficiently and effectively [17]. Software development for implementation in this research uses the Multimedia Development Life Cycle method, which consists of six stages according to . Pictures of the Multimedia Development Life Cycle development method [18] are shown in Figure 1.

The following is the MDLC (Multimedia Development Life Cycle) development scenario used by the author as follows [19]:

1. Concept

In this initial stage, the concept of the application to be built was designed. The steps that will be taken include creating an overview of virtual reality, flowcharts, use case diagrams, activity diagrams, and sequence diagrams.

2. Design

At the design stage, the application to be built was designed. User interface (UI) designs include splash screen displays and Virtual Museum (VR) displays.

3. Material Collecting

At this stage, the materials that will be used to build the application are collected. These materials include 3D museum objects, supporting information about Lontar Prasi, and the Ramayana story. This stage was performed before proceeding to the assembly stage.

4. Assembly

At the Assembly stage, the author combined the materials that have been collected previously. In creating this application, the author uses Unity 3D.

5. Testing

At this stage, the author used two testing methods: Blackbox Testing and Likert Scale Method. Blackbox Testing was used to check the existing functions in the application, while the Likert Scale Method was used to gain an in-depth understanding of the user experience while using the application being built.

6. Distributions

Test results are stored at the distribution stage. The finished application will be distributed via Playstore, and this application is expected to provide the benefit of knowledge about cultural values and become an interactive medium in introducing culture.

A general overview of the Lontar Prasi Museum Bali can be seen in Figure 2. It explains

that the user uses a smartphone/cellphone that has the application installed, then inserts it into the VR Box, and the user can see a 360° view containing information and storylines from Lontar Prasi. Analysis of the needs for the Lontar Prasi Bali Museum VR Application includes; 1) Requires a smartphone of at least Android 8.0, so that the application can run properly. 2) Requires a Virtual Box to place the smartphone so it can run VR applications. 3) Requires a sterile room, to avoid accidents when playing VR Museum Lontar Prasi Bali.

The application workflow or virtual reality of the Lontar Prasi Bali museum explains the VR application process when used by users, it can be seen in Figure 3.

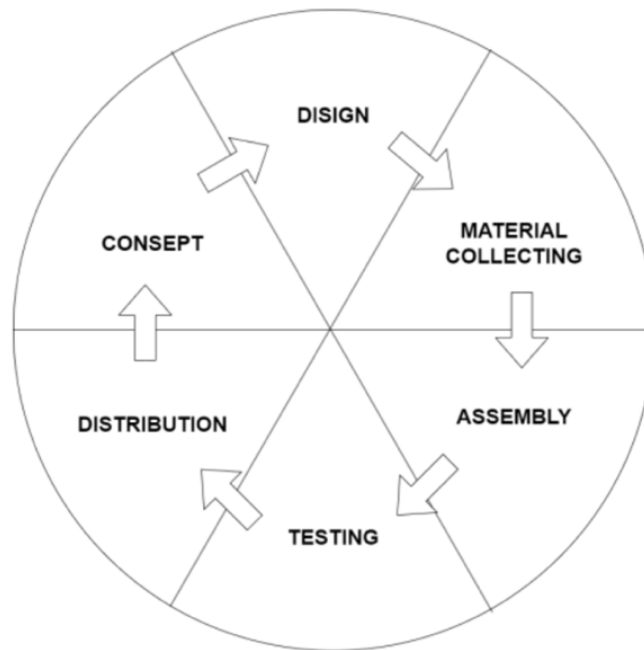


Figure 1. Multimedia Development Life Cycle (MDLC) method

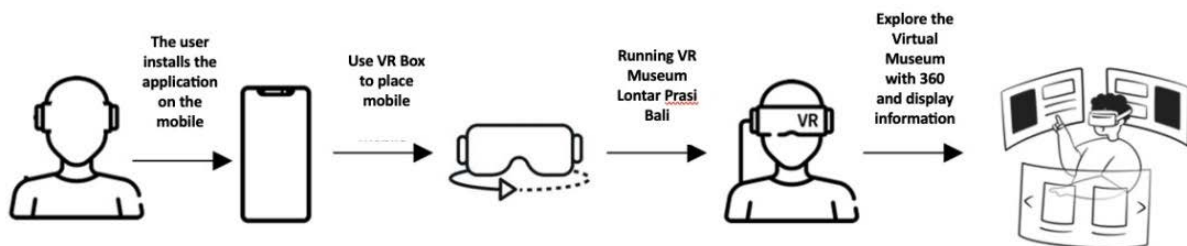


Figure 2. System Overview

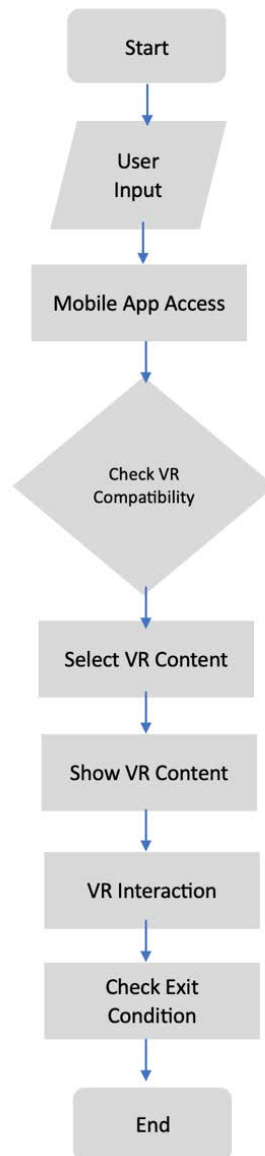


Figure 3. Flowchart VR Museum Lontar Prasi bali

RESULT AND DISCUSSION

Result

The digitalization of Lontar Prasi Bali by applying Virtual Reality technology aims to preserve, advance, and develop art and ancestral heritage so that it has appeal and understanding in the present and even into the future. Virtual Reality technology will be greatly utilized to support the digitalization process at Lontar Prasi Bali so that further development of this application can lead to Metaverse, which is currently being widely discussed and implemented. In line with this, local content will

also be valuable and can provide insight into Lontar Prasi to the wider community by utilizing this technology. The following describes how to use the Lontar Prasi Bali application based on Virtual Reality:

1. When Virtual is installed, the application opens and the Lontar Prasi Bali application user interface appears. In the standard mobile VR application used is Android version 8.0 and also prepare a virtual box to play it. This can be observed in Figure 3.



Figure 3. Lontar Prasi Bali VR User Interface

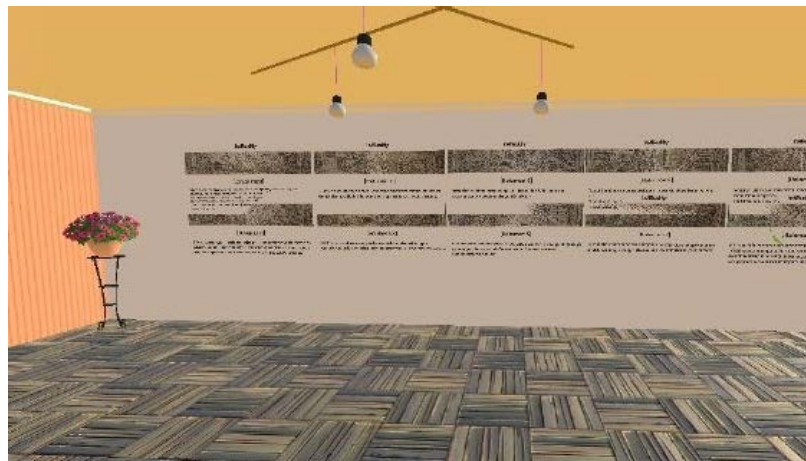


Figure 4. Information on the Lontar Prasi Bali Virtual Museum

2. To explore the Lontar museum, you can use a joystick or on a mobile device, you can "bend" to walk and "head straight" to view information. This can be observed in Figure 4.
3. When using VR on a mobile user, the display will feel an immersive environment and seem to have entered a virtual world. Can be seen in figure 5.
4. Information can be seen from each targeted Lontar page and displays the story on each Lontar page. This can be observed in Figure 8.

Documentation of the use of VR at the Lontar Prasi Bali Museum and testing on Denpasar Elementary School students. This can be seen in figure

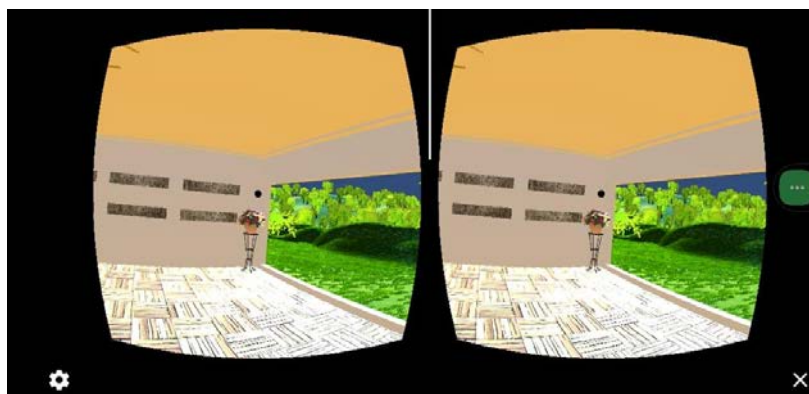


Figure 5. View of the VR Lontar Prasi Museum in Bali

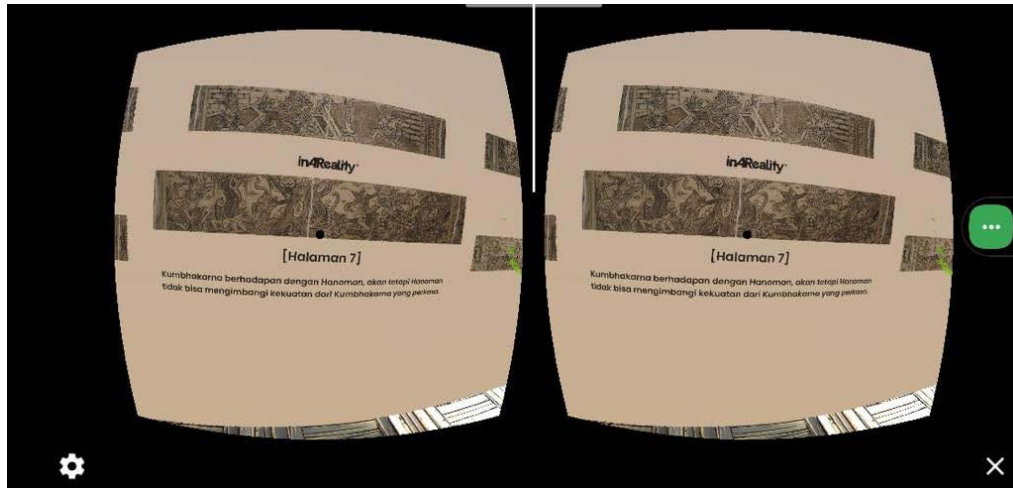


Figure 6. Information Display of the Lontar Prasi Bali Museum VR



Figure 7 Documentation of the use of VR at the Lontar Prasi Museum Bali.

Testing

1) Blackbox Testing

Blackbox testing is a Black box testing considers the value of inputs on a study and ignores the internal mechanisms of a system [20]. The following are the results of blackbox testing on Virtual Reality Lontar Prasi using the eight test scenarios shown in Table 1. The results of eight blackbox testing scenarios showed that the Lontar Prasi

Virtual Reality application was running according to the plan.

1) Likert Scale Method

The VR test at the Lontar Prasi Bali Museum was carried out using the Likert Scale method through a questionnaire administered to 30 respondents from elementary school. The respondents' responses are listed in Table 2.

Table 1. The Results of Blackbox Testing

No	Tested features	Results
1.	Install the apk to your Android smartphone	Success
2.	The application displays a Splash Screen	Success
3.	The application displays 3D objects of the Museum Building	Success
4.	The application displays a Throw object	Success
5.	When the throwing object is pressed, the application displays information in the form of text	Success
6.	When the throwing object is pressed, the application displays information in the form of sound	Success
7.	Can be seen 360 degrees	Success
8.	When the close button is pressed, the user exits the application.	Success

Table 2. Questionnaire Results of 30 Respondents

R	S1	S2	S3	S4	S5	S6	S7	S8
R1	4	4	5	5	4	4	3	4
R2	4	4	3	4	5	4	5	4
R3	4	4	4	4	4	4	4	4
R4	4	3	5	5	5	4	3	4
R5	4	3	4	4	4	4	4	4
R6	5	5	4	5	5	5	4	5
R7	4	4	4	4	4	4	4	4
R8	4	4	4	4	4	4	3	4
R9	5	5	5	5	5	4	5	4
R10	5	5	4	4	4	4	4	4
R11	5	5	5	4	4	4	4	4
R12	4	4	4	4	4	4	4	4
R13	4	4	5	4	4	4	4	4
R14	4	4	4	4	4	4	4	4
R15	5	5	5	5	4	4	4	5
R16	4	4	4	4	3	4	4	4
R17	5	5	4	5	4	4	5	4
R18	5	4	5	4	5	4	4	4
R19	4	4	4	4	4	4	4	5
R20	4	4	4	4	4	4	4	4
R21	4	4	4	4	5	5	4	5
R22	4	4	5	4	4	4	4	4
R23	5	4	5	4	5	4	4	5
R24	4	4	4	4	4	4	4	4
R25	4	4	5	4	4	4	3	5
R26	5	4	4	4	4	5	5	5
R27	4	4	4	4	4	4	4	5
R28	4	4	5	5	5	5	4	5
R29	4	4	5	4	4	5	4	5
R30	4	5	5	4	5	4	5	4

1. The Lontar Prasi Bali Museum Virtual Reality application provides an overview of the museum. From the results of questionnaire question 1, 23.3% or seven respondents said they strongly agreed, 70% or 21 respondents said they agreed, and 6.7% or two users said they were unsure. Based on these results, 93.3% (28 respondents) stated positive results related to the Virtual Reality application, helping to provide an overview of the Lontar Prasi Museum.
2. The text on the Lontar Prasi Bali Museum VR application provides clear information. From the results of the statement 2 questionnaire, 23.3% or seven respondents stated that they strongly agreed, 70% or 20 respondents stated that they agreed, and 6.7% or two respondents stated that they were unsure. So it can be concluded that 93.3% of respondents responded that the application had provided clear information.
3. Virtual-reality is easy to use. The results of the questionnaire for statement 3 showed that 43.3% (13 respondents) strongly agreed, 53.3% (16 respondents) agreed, and 3.3% (1 respondent) were unsure. From these results, it was concluded that 96.6% of 29 respondents stated that the Lontar Prasi Museum Virtual Reality application was easy to use.
4. Feeling interested in visiting the Lontar Prasi Museum after using the Lontar Prasi Museum virtual reality application. In Statement 4, 23.3% or 7 respondents stated that they strongly agreed, and 76.7% or 23 respondents stated that they agreed that respondents felt interested in visiting the Lontar Prasi Museum after using the Virtual Reality application.
5. The application Can be used as a medium for the promotion of the Lontar Prasi Museum and cultural digitalization for Lontar Prasi. From the results of the questionnaire for statement 5, 30% or 9 respondents strongly agreed, 66.7% or 20 respondents agreed, and 3.3% or 1 respondent was doubtful. Thus, it can be concluded that 96.7% of 29 respondents agreed and responded positively that the virtual reality application could be used as a media for the promotion and cultural digitalization of Lontar Prasi.
6. Interactive and attractive application displays. The results of the statement 6 questionnaire showed that 16.7% or 5 respondents strongly agreed, and 83.3% agreed. Thus, it can be concluded that the respondents stated that the Virtual reality application was interactive and interesting.
7. The 3D museum is similar to the original museum. Regarding the results of the questionnaire statement 7, 16.7% or 5 respondents stated that they strongly agreed, 70% or 21 respondents stated that they agreed, and 13.3% or 4 respondents stated that they were in doubt. This indicates that 86.7% of 26 respondents stated that the 3D museum was similar to the original museum, and four respondents were still unsure.

Table 3. Questionnaire Results

Statement	Scale					Number of respondents
	1	2	3	4	5	
S1	0	0	0	21	9	30
S2	0	0	2	21	7	30
S3	0	0	1	16	13	30
S4	0	0	0	23	7	30
S5	0	0	1	20	9	30
S6	0	0	0	25	5	30
S7	0	0	4	21	5	30
S8	0	0	0	20	10	30
TOTAL	0	0	8	167	65	240

8. After using this application, the media can provide insights. The results of the questionnaire on statement 8 showed that 33.3% or 10 respondents said they strongly agreed, and 66.7% or 20 respondents said they agreed. Thus, the conclusion for statement 8 was that all respondents stated that after using the Virtual Reality application, they could add to the respondents' insight.

The results of the questionnaire analysis used a Likert scale with the following formula.

Formula: $T \times P_n$

T = Total number of respondents who voted

P_n = Choice of Likert score numbers

So that :

a. Respondents who answered Strongly Agree.

(5)

= 65×5

= 325

b. Respondents who answered Agree (4).

= 167×4

= 668

c. Respondents who answered Doubtful (3)

= 8×3

= 24

d. Respondents who answered Disagree (2)

= 0×2

= 0

e. Respondents who answered Strongly Disagree (1):

= 0×1

= 0

Total score of all: 1017

Y = the highest Likert score x number of respondents x number of statements

= $5 \times 30 \times 8$

= 1200

X = lowest Likert score x number of respondents x number of statements

= $1 \times 30 \times 8$

= 240

Interval Formula

$I = 100 / \text{total score}$

Then = $100 / 5 = 20$ (the interval is the distance from the lowest 0% to the highest 100%)

Following are the criteria for interpreting scores based on intervals

a) Score 0% – 19.99% = Very much (disagree / dissatisfied / bad / not very good)

b) Score 20% – 39.99% = Disagree / Dissatisfied / Not good

c) Score 40% – 59.99% = Quite satisfied/Quite agree/Neutral

d) Score 60% – 79.99% = (Agree/Good/Satisfied/Like)

e) Score 80% – 100% = Strongly (agree/good/satisfied/like)

Completion of final results:

Index Formula % = $\text{Total Score} / Y \times 100$

= $1017 / 1200 \times 100$

= 84.75% (Strongly Agree)

Based on the results of processing with a Likert scale, the results obtained were that 84.75% of respondents stated Strongly Agree with the Lontar Prasi Museum Virtual Reality Application.

CONCLUSION

Based on research conducted regarding the implementation of the Lontar Prasi Bali Virtual Reality Museum as a medium for cultural education, states that:

1. Virtual Reality applications have high opportunities and potential to introduce culture and also provide different experiences and interactions. So as to attract the attention and understanding of the user.
2. The test results provide a very good percentage regarding understanding, knowledge and interaction provided by the Lontar Prasi Bali Museum's Virtual Reality application. The results from respondents with Likert scale processing showed 84.75% stated that they strongly agreed with the Lontar Prasi Museum Virtual Reality application.

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REFERENCES

- [1] I. Akbar Endarto, "Analisis Potensi Implementasi Metaverse Pada Media Edukasi Interaktif," *Jurnal Barik*, Vol. 4, No. 1, Pp. 37–51, 2022, [Online]. Available:

- <https://Ejournal.Unesa.Ac.Id/Index.Php/Jdkv/>
- [2] I. G. I. Sudipa, P. W. Aditama, And C. P. Yanti, "Developing Augmented Reality Lontar Prasi Bali As An E-Learning Material To Preserve Balinese Culture," *J Wirel Mob Netw Ubiquitous Comput Dependable Appl*, Vol. 13, No. 4, Pp. 169–181, Dec. 2022, Doi: 10.58346/Jowua.2022.I4.011.
- [3] I Gede Iwan Sudipa, Putu Wirayudi Aditama, And Christina Purnama Yanti, "Evaluation Of Lontar Prasi Bali Application Based On Augmented Reality Using User Experience Questionnaire," *East Asian Journal Of Multidisciplinary Research*, Vol. 1, No. 9, Pp. 1845–1854, Oct. 2022, Doi: 10.55927/Eajmr.V1i9.1531.
- [4] P. Wirayudi, P. Wirayudi Aditama, I. Gede Iwan Sudipa, And C. Purnama Yanti Pusat Studi Digitalisasi Budaya Bali, "Indigenous Bali Of Lontar Prasi Using Augmented Reality For Support Strengthen Local Cultural Content," *Eduvest-Journal Of Universal Studies*, Vol. 2, No. 11, 2022, [Online]. Available: <http://Eduvest.Greenvest.Co.Id>
- [5] T. N. Fitria, "Augmented Reality (Ar) And Virtual Reality (Vr) Technology In Education: Media Of Teaching And Learning: A Review," 2023. [Online]. Available: <https://ljcis.Net/Index.Php/ljcis/Indexjournalijcishomepage-https://ljcis.Net/Index.Php/ljcis/Index>
- [6] Z. Zulherman*, G. Amirulloh, A. Purnomo, G. B. Aji, And S. Supriansyah, "Development Of Android-Based Millealab Virtual Reality Media In Natural Science Learning," *Jurnal Pendidikan Sains Indonesia*, Vol. 9, No. 1, Pp. 1–10, Jan. 2021, Doi: 10.24815/Jpsi.V9i1.18218.
- [7] "Summary For Policymakers," In *Climate Change 2013 – The Physical Science Basis*, Cambridge University Press, 2017, Pp. 1–30. Doi: 10.1017/Cbo9781107415324.004.
- [8] C. Purnama Yanti And S. Ika Murpratiwi, "Pengembangan Augmented Reality Interaktif Untuk Pengenalan Jajanan Tradisional Bali Dengan Marker Based Tracking," Vol. 6, No. 2, Pp. 2622–4615, 2021, Doi: 10.32493/Informatika.V6i2.12084.
- [9] 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.
- [10] M. Zallio And P. J. Clarkson, "Designing The Metaverse: A Study On Inclusion, Diversity, Equity, Accessibility And Safety For Digital Immersive Environments," *Telematics And Informatics*, Vol. 75, P. 101909, Dec. 2022, Doi: 10.1016/J.Tele.2022.101909.
- [11] D. Rama Aulia, "Penerapan Teknologi Virtual Reality Pada Simulasi Sistem E-Ticketing Di Stasiun Kereta Api Bogor," 2019.
- [12] H. A. Musril, J. Jasmienti, And M. Hurrahman, "Implementasi Teknologi Virtual Reality Pada Media Pembelajaran Perakitan Komputer," *Jurnal Nasional Pendidikan Teknik Informatika (Janapati)*, Vol. 9, No. 1, P. 83, Apr. 2020, Doi: 10.23887/Janapati.V9i1.23215.
- [13] M. M. North And S. M. North, "Virtual Reality Therapy," In *Computer-Assisted And Web-Based Innovations In Psychology, Special Education, And Health*, Elsevier, 2016, Pp. 141–156. Doi: 10.1016/B978-0-12-802075-3.00006-1.
- [14] S. Yang, "Storytelling And User Experience In The Cultural Metaverse," *Heliyon*, Vol. 9, No. 4, P. E14759, Apr. 2023, Doi: 10.1016/J.Heliyon.2023.E14759.
- [15] M. Afique Bin Mohamed Aziyen And E. Musa Ahmed, "Determinants Of Blender 3d (Open Source) Usage In Malaysian Animation Industry," 2020.
- [16] A. O. Bebko And N. F. Troje, "Design And Control Of Experiments In Virtual Reality And Beyond," *Iperception*, Vol. 11, No. 4, Jul. 2020, Doi: 10.1177/2041669520938400.
- [17] F. N. Kumala, A. Ghufron, P. P. Astuti, M. Crismonika, M. N. Hudha, And C. I. R. Nita, "Mdlc Model For Developing Multimedia E-Learning On Energy Concept For Primary School Students," *J Phys Conf Ser*, Vol. 1869, No. 1, P. 012068, Apr. 2021, Doi: 10.1088/1742-6596/1869/1/012068.
- [18] Y. Wilve, B. Woda, I. Dua Reja, And G. G. Rizky, "Application Of The Multimedia Development Life Cycle Method For The Development Of Android-Based E-Learning As An Alternative Learning Media During The Covid-19 Pandemic," 2022, [Online]. Available:

- [Http://Infor.Seainstitute.Org/Index.Php/Infokum/Index](http://Infor.Seainstitute.Org/Index.Php/Infokum/Index)
- [19] P. Studi Manajemen Informatika Politeknik Palcomtech, J. Basuki Rahmat No, And B. Palembang, "Rancang Bangun Aplikasi Sumsel Museum Berbasis Mobile Menggunakan Metode Pengembangan Multimedia Development Life Cycle (MDLC)," vol. 8, no. 1, 2018.
- [20] Supriyono, "Software Testing with the approach of Blackbox Testing on the Academic Information System," *International Journal of Information System & Technology*, 2020.