Journal of Sisfotek Global
ISSN (Online): 2721 - 3161, ISSN (Print): 2088 – 1762
DOI: http://dx.doi.org/10.38101/sisfotek.v12i2.546
Vol. 12, No. 2, September 2022, pp. 126-130

Development of Virtual Reality Applications as a Media for Digitizing Cultural Heritage in the Historic Building of the Banten Caringin Mosque

Edi Junaedi [1], Fithri Wulandari[2], Icha[3]

[1,2,3] Universitas Cendekia Abditama, Jl. Islamic Raya Kelapa Dua Komplek Pendidikan Tinggi Islamic Village
Teknik Informatika[1] Teknik Elektro[2,3]
E-mail: [1]edi@uca.ac.id, [2]fithri@uca.ac.id, [3]ica@uca.ac.id

ARTICLE HISTORY

Received : September 10th, 2022
Revised : September 19th, 2022
Accepted : September 28th, 2022

KEYWORDS

Banten
The Caringin Banten Mosque
Virtual Reality
Android

ABSTRACT

The Caringin Banten Mosque is a historic relic that must be preserved and introduced to the public, but the condition of the historic mosque in Banten is no longer visible, therefore digitalization is needed so that people can know the historical events of the mosque. The technology that can be used to digitize the mosque building is Virtual Reality, which is a technology that allows users to see and interact with an environment that is simulated by a computer, so that users feel they are in that environment. Virtual Reality can be applied to various devices, one of which is currently widely used, namely Android. The purpose of this research is to produce a Virtual Reality application for the Caringin Banten Mosque based on an Android smartphone, with the hope of making it easier for the public to know and learn about the historical heritage of the Caringin Banten Mosque. This research method uses the Waterfall model from the SDLC. The stages are divided into 6 namely: System modeling, Software requirements analysis, Design, Coding, Testing and Maintenance. The author uses Blender software to create three-dimensional objects, then uses Unity software to create virtual reality applications. Based on testing, the application can run smoothly on the author's Android device. However, when tested by 10 (ten) people, the application still has some shortcomings. However, the application was successful in introducing the Caringin Banten Mosque to users.

1. Introduction

Banten is one of the provinces in Indonesia that has a lot of cultural heritage [1]. One of the reasons for the large number of cultural heritages is because Banten is a strategic area. This causes Banten to become a meeting place for several cultures and nations in one place, which then meet and produce new cultures that are passed down from generation to generation [2].

One of the historical heritages in Banten Province is the Caringi Banten Mosque which is located in Pamengkang Village, Kramatwatu District, Serang Regency, located about 700 meters to the west of the Great Mosque of Banten. According to history, this mosque was the first mosque built by Sunan Gunung Jati or Syarif Hidayatullah. Then the construction of this mosque was continued during the reign of Sultan Maulana Hasanudin in 1552-1570 AD This mosque is no longer used, because it only leaves the tower building with a square plan and the rest of the mihrab building. However, the Caringin Banten Mosque is a historic relic that must be preserved and introduced to the public so that more and more people will know and appreciate the historical heritage of the Indonesian nation, especially in the province of Banten.

One way to introduce historical heritage is by digitizing [3], namely making digital forms with object sources according to reality. The technology [4] that can be used for digitization is Virtual Reality [3], which is a technology that allows users to see and interact with an environment that is simulated by a computer, so that users feel they are in that environment [5].

Virtual Reality [6] can be applied to various devices, one of which is currently widely used, namely smartphones, with the Android platform. Virtual Reality can be used as an object of learning, information and promotion, including the introduction of historic buildings. Therefore, the author intends to design a Virtual Reality [7] application for the Caringin Banten Mosque based on Android mobile [8] in order to add a digital library of historical heritage in Banten.

2. Research Method

The virtual reality application of the caring Banten mosque is made for users to see a picture of a Caringin Banten Mosque building and enter it in a three-dimensional virtual world with a 360-degree panorama [9]. This program uses head movements to look around, and bends down 30 degrees to walk.

The three-dimensional modeling design was created using the Blender software [10]. Then processed using Unity software. With the Unity feature, you can control objects so that they respond to certain conditions and events, such as being able to walk and turn right and left according to the user's wishes.

At this stage of building the Caringin Banten Mosque application, it uses the Waterfall model from the SDLC [11]. The stages are divided into 6 namely:

- Modeling system

At this stage, the system modeling is done about what you want to make. Namely the creation of a virtual reality application based on Android mobile [12][13] which contains the object of the Caringin Banten Mosque. The application starts with a menu consisting of several buttons that lead to virtual reality, history and application information.

- Software requirements analysis

After knowing the application that you want to make, it is determined the need to make the application. Some of the needs are shooting for 3D object modeling, Android smartphones with a minimum of API version 19 to run applications, and VR Cardboard or VR Headsets to be able to feel the sensation of virtual reality.

- Design

The next stage is the process of designing and creating 3D objects. From the images that have been taken, 3D objects are made according to the image and provide color or texture. Then export the object to. fbx format.

- Coding

The exported object is then imported into Unity, and material is applied again. After that, do the settings and coding in the script to carry out several functions such as running the user when looking down, menus, and also activating virtual reality mode.

- Testing

After the application is successfully created, tests are carried out both from Unity and from Android devices directly. If deficiencies or bugs are found, they will be corrected immediately. If there are no errors, the application can be built.

- Maintenance

As more and more other Android devices use, the chances of bugs get higher and higher. Therefore, maintenance is needed after the application is successfully created. This is done in order to keep the application running properly on every device.

3. Result and Discussion

The application created in this study is a simple program where users can see a picture of a Caringin Banten Mosque building and enter it into a three-dimensional virtual world with a 360-degree panorama. In this program, the author uses head movements to look around, and looks down 30 degrees down to walk.

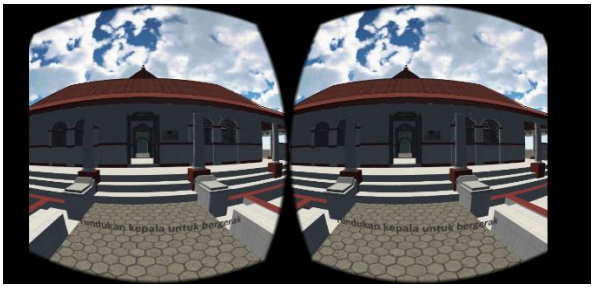

Figure 1. Virtual Reality Application View

The three-dimensional modeling design was created using the Blender software. Then processed using Unity software. With the Unity feature, you can control objects so that they respond to certain conditions and events, such as being able to walk and turn right and left according to the user's wishes.

A. Application Development Stages

In making the Virtual Reality application of the Caringin Banten Mosque, there are several stages, namely:

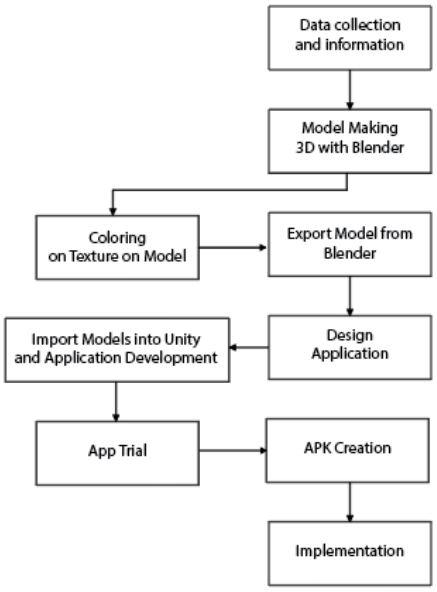

Figure 2. Virtual Reality Creation Flow

1. Information and Data Collection

In the early stages of making the Caringin Banten Mosque, it was collecting information and data ranging from history, the shape of the mosque, the ablution place to the gate.

2. Making Three-Dimensional Models with Bender
At this stage, a three-dimensional model of the Caringin Banten Mosque is made using the Blender application version 2.78c. The models made are towers, the rest of the mihrab building, tombs, wells, and gates

3. Giving Color and Texture to the Model
After all the making of the Caringin Banten Mosque model is complete, then give color and texture to each model of the building in Blender. Colors are given according to the original, so that the three-dimensional model looks the same as the original.

4. Export Model from Blender
The completed model in Blender is then exported in .fbx file format so that the model can be exported to Game Engine Unity properly.

5. Activity Diagram Design
To describe the various activity flows contained in the system being designed, activity diagrams are used.

6. Import Models into Unity and Build Apps
This stage is the stage of moving objects into the Unity 3D Game Engine and also adding the Google VR SDK package for Unity so that VR applications can run properly.

7. Test Application
The trial phase of this application was carried out in order to test the debug and error of the Virtual Reality application of the Caringin Banten Mosque which had been created directly in Unity.

8. APK Extension File Creation
This stage is to ensure that there are no errors in the application created, the application will be built to become a .apk so that it can run on Android.

9. Application Implementation
This is the final stage of making virtual reality applications. The file with the extension .apk that has been created, will be implemented on Android devices to help users see the design of the Caringin Banten Mosque directly in the form of a three-dimensional model.

B. Program Implementation

The thing to note is that to run this application, it requires Smartphone specifications as shown in Table 1.

Table 1. Minimum Smartphone specifications to run the application

Android Version	RAM	Sensor	Screen Size
Kit kat 4.4 (API 19)	1GB or above	Gyroscope	4.5 ”

If the criteria in Table 3.1 have been met, the application can run. To run the application, copy the .apk file stored in the Unity project folder to your phone, then run the installation. After the installation is complete, the application can be run immediately.

The initial implementation was carried out on the Asus Zenfone 6 Smartphone device with the following specifications:
• OS Lollipop (5.0)
• CPU Dual-core 2.0 GHz
• 2 GB RAM
• Layar 720 x 1280 pixel

The trials carried out on this application will provide an overview of each Scene in the application. At this stage, the test is carried out using the Blackbox Testing method. The Blackbox Testing method directly checks to find out the expected functions such as whether the output is generated correctly from the input, and tests whether it will perform these functions correctly. The following is a table for testing the "Virtual Reality Mosque Caringin Banten" application using the Blackbox method.

Table 2. Application Testing with the BlackBox Method

No.	Function	Out	Test Results
1	Showing Main Menu	Menu display with a background image of the Caringin Banten mosque	Succeed
2	Showing Virtual Reality Scene	Displays a Virtual Reality scene where users can see around the mosque	Succeed
3	Move forward	Moves the user when the device is lowered by more than 30 degrees	Succeed
4	Show History Menu	Displays a history menu that can be done by scrolling through the text	Succeed
5	Show Menu About Application	Displays the menu about the application	Succeed

6	Exit the App	Exit the application and the application is finished using	Succeed

C. Application Trial

At this stage, the application is given to 10 (ten) people for installation on their respective Android devices. After installation, the user is asked to fill out a form containing several questions. The first question is whether the app can be installed or not.

Table 3. Percentage of Respondents Regarding Application Installation

No	Statement	Yes	No
1	Application Successfully Installed	90 %	10 %

Furthermore, for respondents who successfully performed the installation, they were asked to try the application and then give an assessment. 1 for the worst and 5 for the best.

Table 4. Results of Respondents' Answers

No	Statement	Quality				
		1	2	3	4	5
1	Menus work fine?					
2	Caringin mosque Virtual Reality application works well?					
3	Easy to use the app?					
4	Objects that are made to resemble the original?					
5	Satisfied with the app?					

From the results of the answers given by the respondents, a table was made to determine the percentage of all questions. Each weight is multiplied by 2.2 to approach the value of 100%, because there are 9 (nine) respondents who have successfully performed the installation.

Table 5. Percentage of Overall Questions

No	Description	Percentage %
1	Very Bad	4,4
2	Bad	4,4
4	Good	41,8
5	Very Good	28,6

After the application trial was carried out, a trial of the application's benefits was also carried out, to find out whether the application could achieve the goal of providing an introduction to the Caringin Banten Mosque.

Table 6. Trial of Application Benefits

No	Statement	Yes	Maybe	No
1	Did you know about the Caringin Banten mosque before?	88,8 %	0	11,1 %
2	Knowing the Caringi Banten mosque after using the application?	77,7 %	22, %	0

4. Conclusion

The development of virtual reality technology opens up opportunities in various fields to apply the technology. One of them is in the field that the author applies, namely the introduction of the environment, learning the heritage of historical buildings, and adding digital libraries in Banten.

From this research, several conclusions can be drawn, namely:

1. The Caringin Banten Mosque Virtual Reality application was successfully built and runs smoothly on the author's Android device.
2. Virtual Reality technology in this application can be a medium for introducing and learning about historical buildings, in this case, the Caringin Banten Mosque.
3. Applications made still have shortcomings so improvements and tests need to be done with various types of Android devices to run well.

5. Suggestion

The suggestions for future research include:

1. The Caringin Banten Mosque Virtual Reality application was successfully built and runs smoothly on the author's Android device.
2. Virtual Reality technology in this application can be a medium for introducing and learning historical buildings, in this case, the Caringin Banten Mosque.
3. The application made still has shortcomings so it needs to be repaired and tested with various types of Android devices to run well.

Bibliography

[1] Aluh Shiba Hizmiakanza, Dian Rahmawati. 2018. "Strategi Revitalisasi Kawasan Banten Lama". Jurnal Tehnik ITS. Vol 7, No 2, hal. D99-D105,

[2] M J Izzati1 and Nurhayati. 2016. "Perception and Participation of Community in Supporting Keraton Kesultanan Banten The Heritage City Program in Serang, Banten". The 4th International Symposium of Sustainable Landscape Development, pp. 1-9.

[3] M. Subali, dkk. 2018. *"*Development of Banten E-Heritage using Virtual Reality Technology on Mobile Device*"*. International Prodsiding ICIC 2018

[4] M. Andriansyah. Hadi, dkk. 2018. *"*Purwarupa Digital Masjid Agung Banten dengan Teknik Virtual Realiti Berbasis Desktop Sebagai Upaya untuk Menjaga Kelestarian Peninggalan Budaya Banten*"*. Jurnal Ilmiah KOMPUTASI, Vol 17, No 2.

[5] Rakhmat Jazuli dan Nurikah Nurikah. 2022. Regulatory Policy Model For Ecotourism-Based Heritage Tourism Development In The Old Banten Region. Jurnal Unifikasi, Vol. 9 No. 1.

[6] Ririn Threesiana, et. all. 2013. Development Of Virtual Reality Gis For Cultural Heritage Conservation (Case Study: Sewu Temple). Indonesian Journal Of Geospatial Vol. 1, No. 2, pp. 17-30.

[7] Ahmad Nasikun, et. all. 2017. Virtual Reality-based Platformer Games Development for Elevating Architectural Heritage Awareness. IJITEE, Vol. 1, No. 3, pp. 93-97.

[8] Ully Asfari, Bambang Setiawan, and Nisfu Asrul Sani. 2012. *"*Pembuatan aplikasi tata ruang tiga dimensi gedung serba guna menggunakan teknologi virtual reality [studi kasus: Graha its Surabaya]". Jurnal Teknik ITS, 1(1): A540–A544.

[9] Zhi Eng, Lee. 2021. *"Building a Game with Unity and Blender"*. Packt Publishing Ltd, UK.

[10] M. F. Mustama. "Aplikasi Animasi 3D Berbasis Augmented Reality Sebagai Media Pembelajaran Metamorfosis Pada Serangga". Jurnal Teknologi Sistem Informasi dan Aplikasi, Vol. 4, No. 3. Hal. 1-9.

[11] A. P. Setiany, dkk. 2021. "Penggunaan Metode System Development Life Cycle (SDLC) dalam Analasis dan Perancangan Sistem Informasi Penerimaan Kas Sekolah". Vol 4, No 3.

[12] Agustinus Sirumapea, dkk. 2021. "Aplikasi Pembelajaran Mengenal Rumah Adat di Pulau Jawa Berbasis Android dengan Teknologi Augmented Reality". Jurnal Teknologi Sistem Informasi dan Aplikasi. JURNAL SISFOTEK GLOBAL, Vol. 11, No. 1, Hal. 15-20.

[13] Jarudin, dkk. 2022. "Pengenalan Planet-Planet Menggunakan Augmented Reality Berbasis Android". AJCSR e-ISSN: 2721 – 3161 Vol. 4 No. 1, Januari 2022, PP. 43-47.