

Designing and Manufacturing Virtual Museum Applications "Museum Keris Nusantara" based on Virtual Reality (VR)

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Abstract: Museum of Keris Nusantara is one of museums located in Surakarta City. Unfortunately, the people of Surakarta and the surrounding area are still not well informed about this museum. This is due to the lack of publication to the public. How to make the community interested in visiting museum is a challenging matter to be solved. This study presents a virtual reality of Museum Keris Nusantara Surakarta as a tool for interactive publication that can introduce the various cultural heritage offered by the museum. By implementing the interesting features, the virtual museum application provides many fascinating experiences in exploring the virtual world of Museum Keris Nusantara Surakarta. Hence, this application can increase the number of museum visitors.

1 INTRODUCTION

Indonesia has a lot of cultural heritage that need to be preserved. According to the Ministry of Education and Culture (2017) Indonesia has approximately 434 museums (Sekjen Kemdikbud, 2017) and more than 54 museums are in Central Java. The museum is managed by the government and private companies. Museums are valuable assets as well as a medium for the cultural preservation and as the tourist attraction. According to government regulation (PP) number 6 of 2015 the museum has a function as a place of research, educational facilities and recreational tourism (Peraturan Pemerintah Republik Indonesia Nomor 66 Tahun 2015 Tentang Museum).

Surakarta City is one of the cultural cities in Central Java that has 9 museums. One of them is the Museum Keris Nusantara. Museum Keris Nusantara (see Figure 1) was inaugurated on August 9, 2017. This museum is located at Jalan Bhayangkara No. 2 Surakarta, Central Java Province, precisely behind Sriwedari R.Maladi Stadium. The area of the Museum is $\pm 6,968$ square meters. The museum has 5 floors. Each floor has a unique name except for the basement in the lowest floor. The 2nd floor is the Wedharing Wacana, which includes the main door, administration section (counter) and information, custody of goods, office and audio room. In the 3rd

floor named by Purwaning Wacana, we can find showrooms, libraries, play rooms for children, and kris restoration rooms. The Cipta Adihulung is on the 4th floor consists of the diorama room, and the blessing of the area while the Esthining Lampah is on the top floor has the space for the creativity and the storage of kris, swords, spears and other traditional

tools.)



Figure 1: Museum Keris Nusantara

Based on the results of interviews with the manager of the museum, there were some problem that need to be solved. The main problem faced by the museum was the declining of the number of visitors. Bambang MBS, the Head of the UPT Museum of Culture in Solo, said that at the beginning of the opening of the kris museum, the number of visitors was quite a lot, but it decreased over time as well as

the number of visitors at the book counter. Visitors of the museum usually have an interest in kris or in unique historical objects.

This work provides a solution to the museum problem by optimizing the latest technology. The solution is to create a virtual museum in the form of interactive mobile media applications based on mobile virtual reality technology. Virtual Reality (VR) is a technology that combines 3D objects with hearing and stereotypical vision that produces user effects as if in a virtual and real environment. By using a special electronic equipment, VR is the computer-generated simulation of 3D environment, which can produce things that seem alive to anyone who sees them (Linowes, 2015).

2 RESEARCH METHODOLOGY

In this study, the Multimedia Development Life Cycle (MDLC) proposed by (Sutopo, 2012) is used to produce a virtual museum application. The procedure is depicted in Figure 2 and presented below:

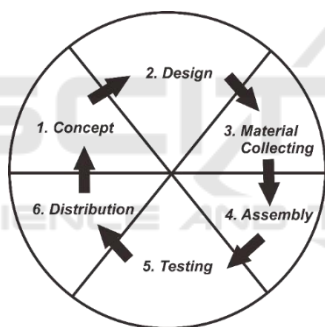


Figure 2: Multimedia Development Life Cycle (MDLC) (Sutopo, 2012)

2.1. Determine the object of research

In this study, we take the objects in the form of kris, wangka kris, spear, and weapons from various regions in Indonesia. The museum has nearly 2000 kris so we just took several dozens of kris to be used as modeling objects.

2.2 Data collection

We carry out the data collection techniques which consist of several ways, namely:

2.2.1 Interview

We do direct interviews with the managers of the Nusantara Keris Museum and visitors.

2.2.2 Observation

We do direct observations at the location. Calculate the number of visitors and observe the character of visitors when visit the museum.

2.3 The Process of Developing Applications

The process of developing applications that consist of six stages, they are:

2.3.1 Concept

The basic concept is organized based on the data. In this stage we use cases, activity diagrams and flowcharts to explain the planning of making this virtual museum. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal (Rumbaugh, 1998). Activity diagrams are graphical representations of workflows of stepwise activities and actions (Chaudhuri, 2008).

2.3.2 Design

At this stage, we make an application design starting from making an application menu in the form of a storyboard. Storyboard is a medium that is used to provide an overview from the beginning to the end of the design for each object created (Simon, 2005). Storyboard is used as a reference for making this application.

2.3.3 Material Collecting

We create and collect image, audio, icon, and 3D objects. In this process, we use the tools like Coreldraw, Adobe Photoshop, Unity and Blender.

2.3.4 Assembly

This stage is the stage of making all 3D objects based on the designs that have been made previously. In the Assembly process can include covering the process of making 3D objects and creating virtual reality showrooms.

2.3.5 Testing

Testing stages are carried out to test the functionality of the applications. The testing method used in this research is a black box test. Black-box testing is a

method of software testing that examines the functionality of an application without peering into its internal structures or workings (Liu, 2009). The first test was carried out by an internal team and is followed by several users. The users are asked to fill out the questionnaire containing the evaluation of the application being tested.

2.3.6 Distribution

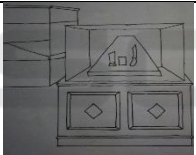

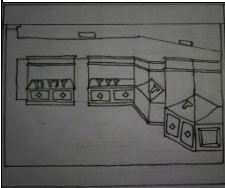

In this stage the process of packaging the application results are done so that the user can enjoy it easily. One of them is by uploading it to Google Play store to facilitate Android phone users.

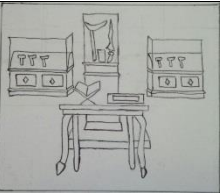

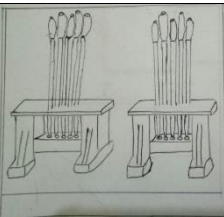

3 RESULTS AND DISCUSSION

3.1 Storyboard Making Process

Storyboard is a visualization of ideas from an application that will be built, so that it can provide an overview of the application that will be produced.

Table 1: Sample Storyboard

Draft	Real
	
<p>When visitors have entered the museum, they will see a cube-shaped table on which there is glass. Inside the glass there is a storage place or display of a conical keris and when the user approaches one of the kris, information from the kris will appear.</p>	
	
<p>The left side of the visitor will see a row of storage or display of a keris collection and when the user approaches one of the kris, an information will appear from the kris.</p>	

	
<p>The right side and the middle part of the room the user will see 2 pieces of storage or a medium and small size keris display placed in the middle. And when the user approaches one of the kris, information from the kris will appear.</p>	
	
<p>Visitors will be able to see 2 packages for spear-type weapons. When the user approaches one of the spears, audio information about the object will appear.</p>	

3.2 Use Case

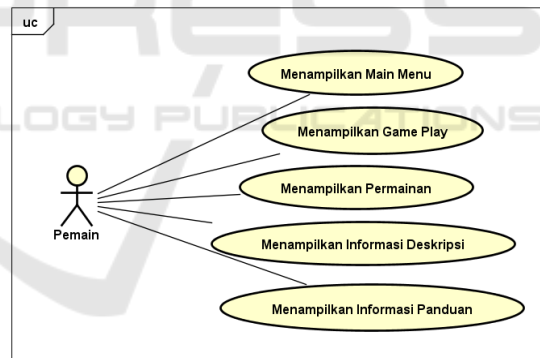


Figure 3: Use Case Diagram User

This use case diagram describes the relationship between the player and the system, which displays each menu (see Figure 3 and Figure 4) contained in the museum's virtual application. This can be selected by the user.

The following is a use case diagram that describes functions that can be used by actors or system users

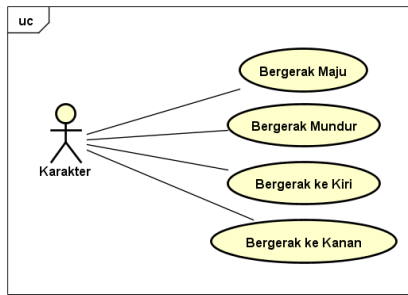


Figure 4: Use Case Diagram Character

3.3 Activity Diagram

This activity diagram explains the flow of the works or the activities of the virtual museum application that the player first chooses a menu starting and then the system will display the virtual reality games and players can run the game (see Figure 5).

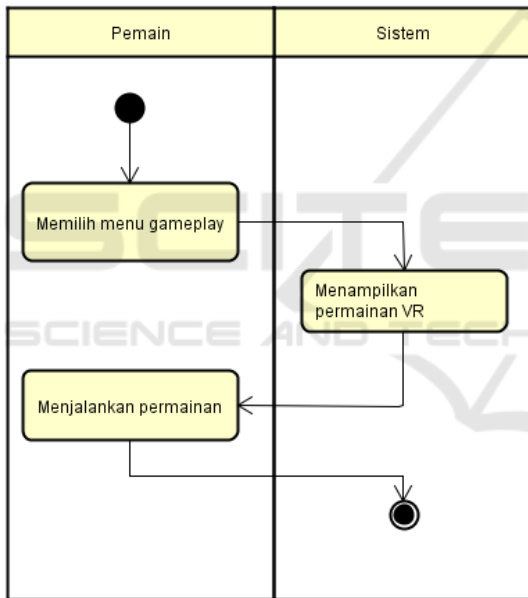


Figure 5: Activity Diagram

3.4 Flowchart

A flowchart is a type of diagram that represents an algorithm, workflow or process. It shows the steps in the form of the various kinds of boxes, and connects them with arrows according to their order (Chaudhuri, 2005)

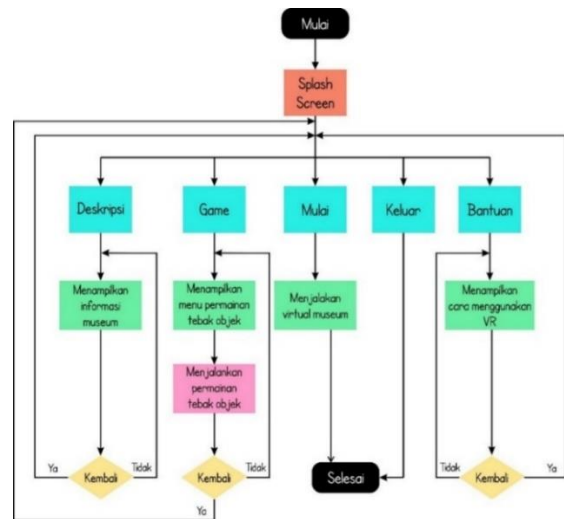


Figure 6 : Application Flowchart

3.5 Implementation

We designed the Virtual Museum application menu as follows:



Figure 7: Splash Screen

When the application is run, the first display that will come out is the logo of Museum Keris (see Figure 7)



Figure 8: Main Menu Virtual Museum

This is the main view of the application of the 3 Dimensions of the Virtual Reality Museum Keris Nusantara. (see Figure 8)



Figure 9: 3D images from user exploration

This image is an example of a display animation when a user travels in a virtual museum using the right and left eye (see Figure 9)



Figure 10 : Main Menu of Games Tebak Warisan

The virtual museum application also provides games for user education (see Figure 10)



Figure 11: The museum manager is testing VR products

3.6 Testing

The device we use is a cellphone that has a Gyro sensor. We configure the equipment in the headset and control it with a bluetooth joystick (see Figure 11). We use the black box method to test the function of this virtual museum. Black box testing is also called as functional testing. A functional testing technique designs the test cases based on the information from the specification (Simon, 2005).

Table 2: Test Results by Blackbox method

No	Input	Expected output	Result	Conclusion
1	Display Splash Screen	Splash Screen The keris museum logo appears successfully	As Expected	[√] Valid

2	Display and press the main menu button	Each pressed key can display the display menu	As Expected	[√] Valid
3	Move with the joystick	Users can move positions as desired	As Expected	[√] Valid
4	Switch walking scan space	Users can move from the initial room to the next room	As Expected	[√] Valid
5	Turn on the wardrobe lights	The user turns on the wardrobe light when the object is approached	As Expected	Valid
6	Issues narrative audio sound	There is a narrative sound when the user approaches the object	As Expected	[√] Valid
7	Showing educational games	The result is if the answer is correct then it gets a value of 10, if it gets a value of 0	As Expected	[√] Valid
8	Pressing the button asks for help	Each menu button is pressed to display help information	As Expected	Valid

The test was successful because of the eight testing scenarios that were run it had produced the expected success output

3.7 Evaluation

The internal testing process has been carried out successfully. The next step is to test the visitors and managers directly by trying the virtual museum application and then being able to fill out the questionnaire. There were 40 respondents who were willing to test and write questionnaire answers

Table 3: Evaluation by questionnaire

No	Aspects	Percentage	Number of Respondents
1	Aspects of knowledge about virtual museums		
	a. Strongly agree	61 %	24
	b. Agree	39 %	16
	c. Simply Agree	0 %	-
	d. Less Agree	0 %	-
2	Aspects of Ease of Using Virtual Museums		
	a. Strongly agree	31 %	12
	b. Agree	63 %	26
	c. Simply Agree	6 %	2

	d. Less Agree	0 %	-
	e. Disagree	0 %	-
3	Aspects of completeness of information		32
	a. Strongly agree	83 %	4
	b. Agree	13 %	2
	c. Simply Agree	2 %	2
	d. Less Agree	2 %	-
4	e. Disagree	0 %	-
	Aspects of design excellence		22
	a. Strongly agree	54 %	16
	b. Agree	44 %	2
	c. Simply Agree	2 %	-
d. Less Agree	0 %	-	
	e. Disagree	0%	-

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4. CONCLUSION

The conclusion of the Designing and Manufacturing Virtual Museum Applications "Museum Keris Nusantara" based on Virtual Reality (VR) is as follows:

1. This Virtual Museum application is based on Android using Virtual Reality technology provided that there is a gyroscope sensor that is embedded in the smartphone.
2. This Virtual Museum application is created using the Multimedia Development Life Cycle (MDLC) method.
3. This application is tested functionally using the blackbox method
4. Based on the results of the questionnaire shows that according to the 40 respondents the application provides convenience to aspects of knowledge, facilitation aspects, aspects of information, and aspects of good design, this can be concluded that this application is able to provide visitors convenience in exploring the museum.

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