DEVELOPING A VIRTUAL REALITY APPLICATION OF THE LAWANG SEWU BUILDING AS EDUCATIONAL MEDIA FOR THE SUBJECT OF HISTORY

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ABSTRACT

Lawang Sewu is one of the Dutch colonial heritage building in Indonesia that has unique architecture as the main attraction. This building is located in Semarang, Central Java, Indonesia. Potentials of Lawang Sewu has not been conveyed due to lack of recognition efforts to society. One of the effort that can be done is to utilize virtual reality (VR) technology to provide information and enhance tourist objects. Virtual reality allows the user to interact with virtual objects as if in real life. This paper discusses about making virtual reality application which is applied as a means of introducing Lawang Sewu. This study was categorized as research and development (R&D). This application runs on mobile devices running on android operating system equipped with gyroscope sensors. This application must be accompanied with an enhancement of VR cardboards. Virtual reality allows users to view and interact virtually with tourism object. The purpose of making this application is to introduce about Lawang Sewu for all of people especially students.

Keywords: android, lawang sewu, virtual reality

INTRODUCTION

Tourism is one of the fastest growing industries in line with population growth and global society entry to Indonesia. Therefore, the manager of the tourism object needs to make development efforts to increase the attractiveness of tourists, both local tourist and foreign tourist (Soebagyo, 2012). Various analyses suggested that tourism will become the largest industry with a rapid growth in line with the growth of information technology industry. World Tourism Organization also predicted world tourist mobility will continue to increase, especially in the Asia Pacific region which will become the world's main tourist destination. (Siregar, 2010)

Indonesia is one country that has a diversity of religions, tribes, and cultures. Indonesia also has various tourism objects. Semarang city is the capital of Central Java province which is a tourist destination. Some of Semarang City's tourism objects include Goa Kreo, Central Java Grand Mosque, Maron Beach, Lele Park, Marina Beach, Curug Lawe and Sam Poo Kong (Minarti & Sumiyatun,

2014). Semarang is also one of the Dutch colonial heritage cities that still have a number of colonial buildings. One of historical tourist object from Dutch colonial heritage is Lawang Sewu building. Lawang Sewu is located in Semarang city, Central Java, Indonesia. This building has unique architecture design that became the main attraction. The government of Semarang City incorporated Lawang Sewu as one of 102 ancient historical buildings in Semarang City to be protected as a cultural heritage. It becomes valuable historical tourist attraction. It was built in 1904 and completed in year 1907. The name of Lawang Sewu was derived from Javanese language that means thousand doors. This building is called Lawang Sewu because it has many rooms in which each has many doors and windows (Handinoto et al, 2012).

Tourism development effort can be conducted with the use of multimedia technology as an innovative promotional tool. There are various types of multimedia technology that can deliver the information about tourist objects more interactively and attractively (Farmukhit et al, 2013). One of

multimedia technology is virtual reality. Virtual reality (VR) is one of technology that allows users to interact virtually with an environment simulated by a computer (Sihite, 2013). Simulated environments are similar to the real world. Virtual reality (VR) technology incorporates simulated three dimensional (3D) combinations of sensory (visual, audio, touch) that can make users virtually involved. Virtual reality can be run on desktop and mobile devices.

Virtual Reality on mobile devices should run in an android operating system. Android is the first open and comprehensive platform aimed for mobile devices. This operating system combines several components as follows: (1) The operating system is open source for mobile devices, (2) An open source platform for creating mobile applications, and (3) the devices, especially mobile phones, which run the android operating system and applications (Suryanto et al, 2016). The device also should be supported by availability of gyroscope sensors and enhancements VR Cardboards. The use of VR in the field of tourism will facilitate the manager to introduce a tourism object to local and foreign tourists intensively.

The application has been recommended in the world of entertainment, design, simulation, training, and tourism sectors. Developed countries like Europe have used virtual reality technology for the preservation of historic buildings. This prompts the tourism sector grow rapidly. One of the cities that managed to exploit the VR for the preservation of its historic building is Cluny in France. Cluny is a medieval Roman city that has an important site for Europe and is protected by UNESCO (Bahar, 2014). In addition, Arief and Umniati (2012) suggested that VR is expected to provide alternative learning strategies for students that are interesting and easy to understand. Purwoko (2008) added that VR learning media is able to motivate every student to be active and concentrate during the learning process

METHOD

This study used research and development (R&D) method. This method is commonly used in the engineering field where almost all technology such as electronic devices, hardware, vehicles, aircraft, weapons and modern household tools. This method is also used in natural science, administration, and social science (Suryanto et al, 2016). The purpose of this method is to produce a particular product and test the effectiveness of the product. The R&D method requires needs analysis and effectiveness testing to test whether the product works effectively. The study was started with a requirement analysis consisting of the formulation of potential and problems, data collection, software analysis, and hardware (Sugiyono, 2013). The next step is product design. The process of designing this application used sketchup and unity 3D. Products that have been made will be tested by several testing stages. The research procedure is allustrated in Figure 1.
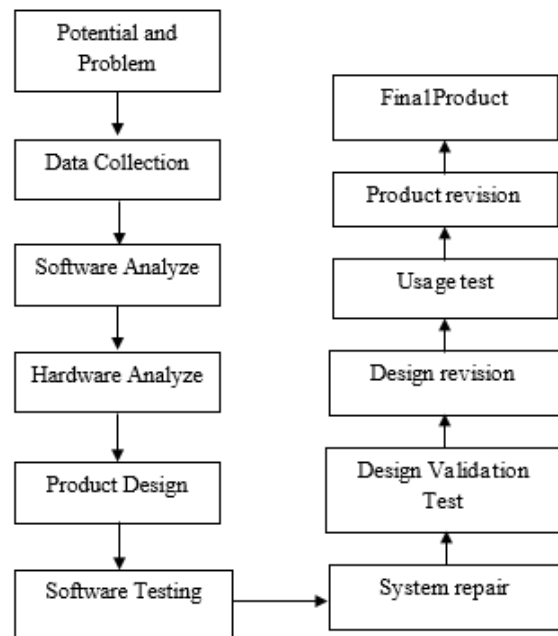

Figure 1. Research Procedure

This application is expected to perform functions as follows: (1) It visualizes Lawang Sewu building into 3D objects, (2) It displays

information about building and history of Lawang Sewu with Indonesian and English narration, (3) It display virtual reality technology that allows the user to explor the building like in the real life. The application should be run on mobile devices equipped with a gyroscope sensor and using V R cardboards

device. The operating system that can play this application was android at least 5.0 version or android lollipop. It is controlled with gyroscope sensor. The development of this application used of diagrams namely use-case diagrams. Figure 2 illustrates about the use-case diagram of the system functionality.
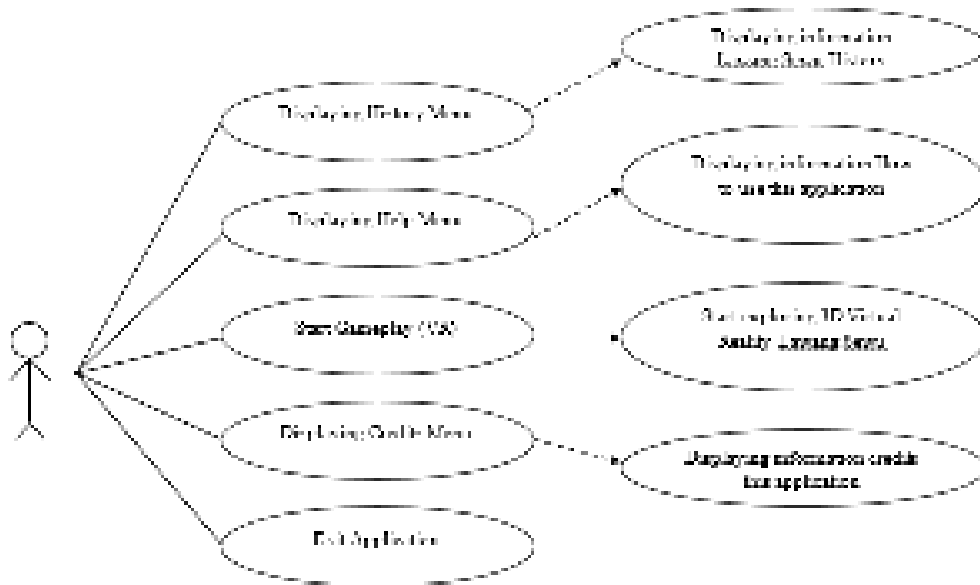

Figure 2. Use Case Diagram

The interface was designed to be user friendly and easy to understand. The interface designs were presented in Figure 3 to Figure 8.
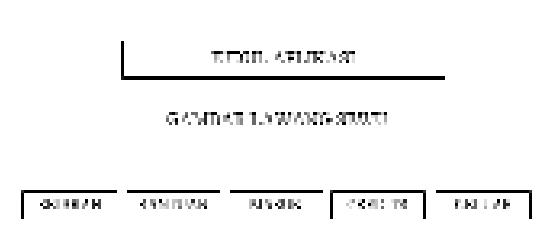

Figure 3. Language Menu
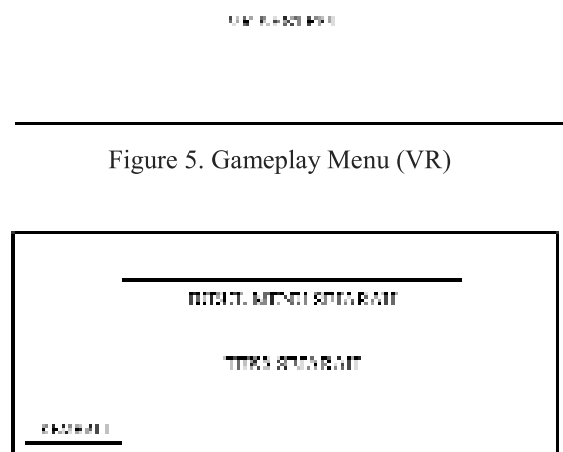

Figure 4. Main Menu

Figure 5. Gameplay Menu (VR)
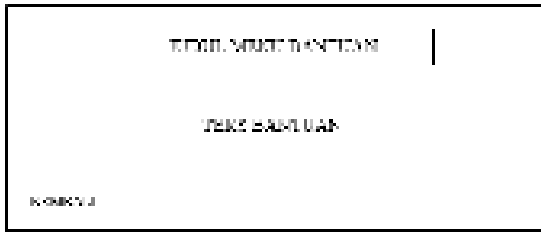

Figure 6. History Menu
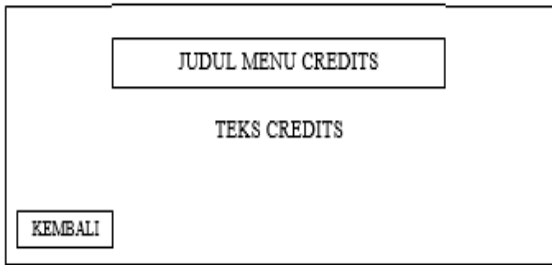
Figure 7. Help Menu

Figure 8. Credits Menu

RESULTS AND DISCUSSION

The VR application of Lawang Sewu has minimum specifications that consists of processor with clock speed at least 1.5 GHz, Quadcore, highend GPU series and RAM 2GB. The interface implementation was conducted according to the predetermined user interface designs. The final user interface designs are presented in Figure 9 to Figure 15.

The menu of selecting the language presented in Figure 9 consists of 2 buttons that are the choices of Indonesian language and English. If the user presses the Indonesian button, then the entire game is in Indonesian.

Figure 9. Choose Language

The main menu presented in Figure 10 consists of 5 keys namely History, Help, Enter, Credits, Exit. The enter key brings the user to the main gameplay of VR Lawang Sewu.

Figure 10. Main Menu Scene

The history menu presented in Figure 11 displays the text of the history of Lawang Sewu.

Figure 11. History Menu

The help menu presented in Figure 12 shows how to use VR Lawang Sewu application using VR Cardboards.

Figure 12. Help Menu

The credits menu presented in Figure 13 displays anything that contributes to the

production of VR Lawang Sewu applications such us application developers, source URLs of music background and sound effects, and applications that used in production process.

Figure 13. Credits Menu

The modeling Lawang Sewu building is made using Sketchup software, after it is imported into Unity game engine. It is illustrated in Figure 14.

Figure 14. Lawang Sewu Building Virtual Using Sketchup

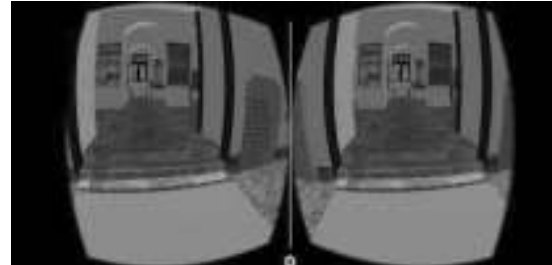Gameplay is a virtual environment view of Lawang Sewu, users can walk around Lawang Sewu.

Figure 15. Gameplay Scene 1 (VR)

The evaluation of the application was divided by three steps:(1) software testing; (2) design testing; (3) user response testing. The first step was software testing using a black box method. This step was run to discover system functional errors. The software testing results showed the system runs effectively and there are not functional errors. The result of black box testing is presented in Table 1.

Table 1. Black Box Test Results

Step	Test Case	Expected Results	Actual Result	Status
1	Press the Indonesia button	It displays the Indonesian main menu	It displays the Indonesian main menu succesfully	Pass
2	Press the English button	It displays the English main menu	It displays the English main menu succesfully	Pass
3	Press the History button	It displays the history menu	It displays the history menu succesfully	Pass
4	Press the Help button	It displays the help menu	It displays the help menu succesfully	Pass
5	Press the Credits button	It displays the credits menu	It displays the credits menu succesfully	Pass
6	Press the Enter button	It displays the gameplay (vr mode)	It displays the gameplay (vr mode) succesfully	Pass
7	Player walking through the exit door virtually	It exits from the gameplay menu and enter the main menu	It exits from the gameplay menu and enter the main menu succesfully	Pass
8	Press the narration button in History Menu	It plays the narration audio	It playing narration audio succesfully	Pass

The second step was design validation testing. Design validation testing was performed by material experts who comprehend the overall design of the tourist objects. The data analysis technique used in the design validation test and user usage testwas based on likert scales.

The results of the design validation testing showed the percentage of assessment of 90.56% which was categorized as good. The last step was the user testing. This step conducted by giving assessment papers to 20 sample users to use all the features in this application. The result of user response testing showed the percentage assessment of 80.56% which is categorized as good.

CONCLUSION

The developed Virtual Reality application of Lawang Sewu Building as Educational Media for History Subject has proved the ability to effectively introduce the historical building to the users especially students. This application has passed several stages of testing. The tests showed the percentages of the design testing and the user testing were 90.56% and 80% respectively which both of them were categorized as good.

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