

The Development of Malang Virtual Tourism for Preservation of Traditional Culture using React 360

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Abstract— Malang is one of the tourist destinations in East Java, and always visited by both domestic and foreign tourists. However, Malang isn't the first destination in tourism, this is due to the lack of intense promotion. Virtual tourism is a virtual reality technology for promoting tourism. Based on these problems, the researchers developed a virtual reality application that can provide immersive experiences to users assembled with tourist destinations in Malang. Application was developed using React 360 framework, because of its ease of development and can be developed for various platforms. The Software Development Life Cycle (SDLC) is the waterfall method. The implementation using VR Headset and VR Controller. In testing, researchers conducted functional testing and non-functional testing. Functional testing is done using black box testing and non-functional testing is done by the System Usability Scale (SUS) method. The results of functional testing using black box are 100% valid. In the usability test, the System Usability Scale (SUS) questionnaire obtained a score of 89. From the scores that have been obtained, this application is acceptable, with Grade A and adjective rating Excellent.

Index Terms— Tourism, Malang, Virtual Reality, Mobile Application

I. INTRODUCTION

Malang is one of the big cities in East Java. Malang is famous for its cool weather, due to its geographical conditions that surrounded by mountains,

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so it's known as Switzerland van Java. This city, which is also known as the City of Flowers, is positioned as a city that is beautiful, comfortable, friendly to live in, a tourist destination, has many heritages and culinary spots [1].

In 2018, Malang became a destination for both domestic and foreign tourists. There were 15,034 foreign tourists and 4.8 million domestic tourists throughout 2018 [2]. Compared to previous years, Malang has increased the number of tourists, both domestic and foreign. With the number increasing visitors every year, it can attract even more tourists for the next year.

In 2017, the Culture and Tourism Office has scheduled as many as 35 tourism events to be held, because Malang has interesting potential in the tourism sector. However, Malang has not become a major destination in tourism. This is due to a lack of intense promotional support [3].

Technology is one of the fields that can be used as a media for tourism promotion. One of the technologies that can be used by tourism promotion media is Virtual Reality (VR), which over the past few years has experienced an increase in the business tourism sector [4]. VR is a technology that induces the creation of experiences designed by the creator to the user in artificial sensory stimulation, when the user has little or no awareness of distraction [5]. VR allows users to interact with virtual or virtual environments created by computers. VR has the power to visualize the spatial environment, which provides an experience for the user to choose the visual, sound and most importantly the spatial aspect of the destination without actually being in place [6]. This is the advantage of VR as a medium in tourism promotion. Virtual experiences are also more effective than brochures, because they are rich in information and interactions with users [7]. The use of VR for tourism is virtual tourism. Virtual tourism can simulate tourist destinations, using a virtual environment (VE) with VR technology. With virtual tourism, it can enhance the experience for tourists, and attract new markets to tourist destinations [4].

In making VR, we can use various technologies, one

of which is web technology. With VR technology on the web or called Web-VR, it allows the accessibility of VR content widely from various platforms [8]. React 360 is a JavaScript-based framework for creating virtual reality from Facebook [9].

React 360 is one of the most widely used frameworks for developing Web-VR. React 360 can also be used to develop VR in various platforms such as desktop, mobile and VR Headset. With the help of the library from React it also makes it easier to create 3D elements and VR-based UI in React 360. One of the advantages of React 360 is that it can improve the user experience by adding 2D UI, audio, video, and 360 images [10].

Previous research on the development of virtual reality and virtual tourism was mostly done by previous researchers. The use of virtual reality for tourism facilities has also been carried out in the research “Virtual reality: Applications and implications for tourism” by [11]. The research explains the development of virtual reality for the tourism sector which is called virtual tourism. The use of virtual reality in the tourism sector can be used for planning and management, marketing, entertainment, education, accessibility and tourism.

Research on virtual tourism has also been conducted in the journal “Tourist Experience of Virtual Reality Application” by [4] which explains the use of virtual reality to attract the tourist market about one of the tourist attractions in England, namely the Lake District National Park, also provide new experiences to tourists. The results of the research were made virtual reality about the Lake District with several places in it, then equipped with natural sound or ambience sound to provide a natural experience through sound.

Based on the problems that have been described, the authors conducted research entitled the development of Malang virtual tourism. Malang virtual tourism is a VR-based application to introduce tourism destinations in Malang. Various kinds of tourist attractions in Malang are projected using 360 photos in virtual reality. So, users can interact with objects and environments in virtual reality to improve user experience. This interaction will create the experience of traveling in a virtual environment. Development of VR is using React 360 technology to increase user experience. The application goal is to introduce and provide information about tourist destinations in Malang through VR technology. So, it can be used to promote tourism in Malang and preserve the traditional cultures.

II. PROPOSED METHOD

Virtual reality that used in the tourism sector, also known as virtual tour or virtual tourism is detailed in figure 1.

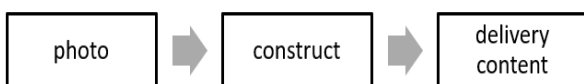


Fig. 1. Creation process of virtual tourism

The photo or capturing process is the process of capturing several images or photos in order to get a picture of the object. The photos taken are 360 photos. The Construct process is the process of making spherical photography for virtual reality based on photos that have been taken based on the previous process. The content delivery process is the process of delivering the results of the previous process through digital media such as virtual reality.

Malang is one of the cities in East Java which has a variety of potential regional assets and must be developed optimally. Malang has many places as a tourist destination. Some of them have places that have good photo objects, as well as historical sites [12].

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Fig. 2. Malang Tourism Map [13]

React 360 is a framework used to create VR. React 360 is a derivative of the framework created by Facebook called React [14]. React is a JavaScript-based framework used to create a user interface (UI) for mobile or Single Page Application (SPA). An example of VR development using React 360 is shown in Figure 3.



Fig. 3. React 360 Development example

The research conducted is an implementation of development research, in which researchers will build Malang virtual tourism applications in virtual reality using React 360 and conduct interviews with application users. The research location was conducted in Malang, by conducting studies in tourist attractions in Malang. Development is carried out using a personal

computer (PC) for the preparation of source code for research implementation. Data collection was carried out on tourists who live outside the city of Malang, and was carried out using interview techniques.

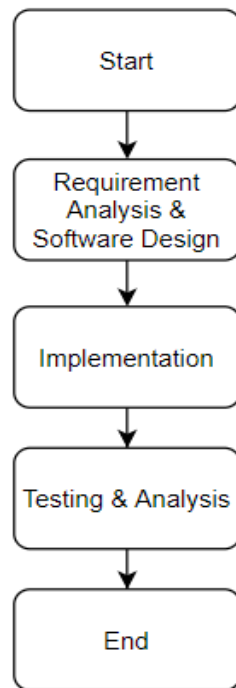


Fig. 4. Research flowchart

There are five phases of research done in this research as can be seen in figure 4. The Requirement analysis used elicitation technique with interview technique to potential users. Prospective users are selected based on their domicile outside Malang and interview questions that focus on tourist destinations in Malang and virtual tourism. Then from the elicitation results, it will be considered which ones can be used to create functional and non-functional requirements needed for system development in this study. Then identify the actors and needs by numbering each need that has been made with use case diagrams, use case scenarios, and activity diagrams. Software design phase is done by using elicitation techniques with interview techniques to users. Then from the elicitation results will be considered to make functional and nonfunctional requirements. Based on the requirements model before, transformed into a system design model and virtual reality interface design. Design software is done by system architecture design and the interface is done by designing a virtual reality sequence. At the Implementation phase, the results of program code implementation and user interface implementation will be obtained. At testing and analysis phase, a testing phase will be carried out which aims to find out whether the software is in accordance with the needs. Testing in this research are done using validation testing and reusability testing. Validation testing uses black box testing. Usability testing is carried out using the System Usability Scale (SUS) method in which respondents will

be asked to rate the system through a questionnaire. Then analysis is carried out to determine conclusions of research. Figure 4 is a flowchart of the research methodology.

III. RESULT AND DISCUSSION

In this part there are requirements that will be implemented in the application. Each requirement is described in Table 1.

Table 1. Functional Requirement

Use Case Name	Description
See tourism destination choice	System can display a choice of tourism destinations.
See 360 photos of tourism destinations	System can display 360 photos of tourism destinations
See information of tourism destination	System can display information about tourism destinations
Play tourism destinations ambience sound	System can play ambience sound from tourism destinations
See photo gallery of tourism destinations	System can display photo gallery from tourism destinations

In this study, the Malang virtual tourism system was built using web-based virtual reality using a framework with the JavaScript programming language. The purpose of making this system is to introduce existing destinations in Malang and provide a new tourist experience by providing an immersive experience. In Figure 5 is an overview of the use of the application. User uses the application using a VR Headset and enters the virtual environment. Users interact with virtual environments that exist in virtual reality. Starting from choosing a tourist destination in Malang that is in a virtual environment in the application, by inputting using a VR Controller that functions as a pointer. Then when selected, it will display 360 photos of the selected tourist destination. The selected tourist destination will also display information such as a brief explanation of the tourist destination, and can also play the ambience sound of the selected tourist destination. In the selected tourist destination there is a photo gallery. The photo gallery here has a selection of 360 photos of the tourist destinations displayed.

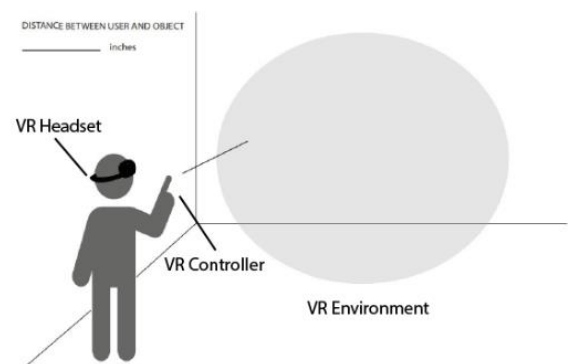


Fig. 5. System description

A. Storyboard

Storyboards are drawn to help understand the workflow of using the app. The storyboard consists of two main parts, namely the scenario and description. Figure 6 is a storyboard that explains the actor's workflow using the Malang virtual tourism application.

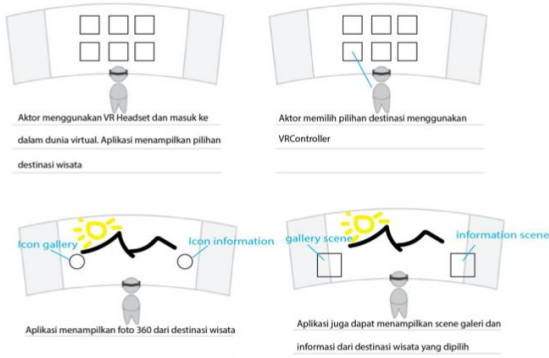


Fig 6. Storyboard

B. Interface Implementation

The interface implementation in the Main Menu scene is the interface used to select from a list of tourist destinations in the application, which can be seen in Figure 7.



Fig. 7. Main Menu Scene

The implementation of the interface on the Information Menu scene is an interface that contains information about tourist destinations selected from a list of tourist destinations, which can be seen in Figure 8.



Fig. 8. Information Menu Scene

The implementation of the interface on the Information Menu scene is an interface that contains a photo gallery of the selected tourist destination. The

photo used is a 360 photo that can be seen in Figure 9.



Fig. 9. Photo Gallery Scene

C. Functional Testing

Functional testing is carried out validation testing using Blackbox testing. Blackbox testing serves to validate the functional requirements of the software that has been made. Blackbox testing is done by designing test cases first. The design of test cases is made based on previously defined functional requirements. Then check the results of the test cases with the expected results to determine whether the status is valid or not. The results of the validation test using Blackbox testing can be seen in Table 2.

Table 2. Functional Testing

No	Test Name	Test Case	Result
1	See tourism destination choice	Login to the system	Valid
2	See 360 photos of tourism destinations	Push the tourist destination selection button	Valid
3	See information of tourism destination	Push the information menu button	Valid
4	Play tourism destinations ambience sound	Push the button plays sound	Valid
5	See photo gallery of tourism destinations	Push the photo gallery button	Valid

Based on the results of functional testing using Blackbox testing that has been carried out on the software, it is known that the output results have been tested :

1. System can display a selection of tourist destinations.
2. System can display 360 photos of tourist destinations.
3. System can display info about tourist destinations.
4. System can play sound from tourist destinations.
5. System can display photo galleries from tourist destinations.

So, it can be concluded that the results of functional testing using black box are 100% valid.

D. Usability Testing

Non-functional testing is done with usability testing by asking users to test it. After using the application, users need to fill out a questionnaire based on the System Usability Scale (SUS). There are 10 questions for users to answer. Each question contains a Likert

scale consisting of a scale of 1 to 5 which contains information between strongly disagree, disagree, neutral, agree and strongly agree [15]. Table 3 shows the result of Usability Testing using System Usability Scale questionnaire with 10 Question

Table 3. SUS Score

R	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	Usability Score
R1	4	3	4	2	2	2	2	3	3	1	34	85
R2	4	3	3	3	3	3	3	3	3	2	32	80
R3	4	1	3	2	3	3	4	4	0	1	33	82,5
R4	4	3	4	2	3	4	4	4	4	2	33	82,5
R5	4	2	3	2	3	2	4	4	3	3	34	85
R6	4	3	4	3	3	3	4	4	4	3	35	87,5
Total Score											502,5	
Average Usability Score											83,7,5	

The usability testing obtained 89 score based on the SUS measuring instrument in Figure 10, the usability system is in grade scale A category, the Adjective rate category is in Excellent category, the Acceptability Range category is in Acceptable category.

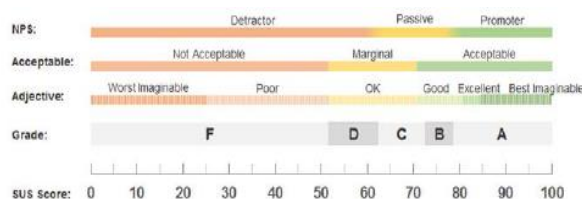


Fig. 10. SUS Instrument Measure

IV. CONCLUSION

Requirement analysis of Malang virtual tourism application begin with interviewing the respondents. The questions given are focused on the most popular destinations in Malang and virtual tourism. At this phase, 5 functional requirements and 1 non-functional requirement obtained. The non-functional requirement is the system usability.

Application design is done by making use cases and use case scenarios. Then an activity diagram is made based on the use case scenario that has been made. Followed by making a class diagram to describe what components are used. In the design phase, a virtual reality sequence is also created as an interface design in VR.

After that, the implementation phase is done based on the design results. It's been done with React 360 framework using the JavaScript programming language. The results of functional testing using black box are 100% valid. Usability testing is done with the System Usability Scale (SUS) questionnaire in which respondents are given a questionnaire with 10 questions and answers using Likert scale and the results will be

calculated to determine the usability system. In this research, the system has a usability value of 83.75 (Acceptable).

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