

Virtual Reality of Historical Places in North Sulawesi

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Abstrak

Sulawesi Utara adalah salah satu provinsi di Indonesia yang memiliki banyak tempat menarik untuk dikunjungi, seperti wisata alam, kuliner dan tempat-tempat bersejarah. Presentasi informasi yang mudah dan menarik sangat penting untuk atraksi wisata di Sulawesi Utara. Penyajian informasi yang menarik dapat menarik minat wisatawan mancanegara maupun lokal untuk berkunjung di Sulawesi Utara. Virtual Reality menjadi salah satu teknologi yang dapat memberikan pengalaman baru dalam melakukan eksplorasi suatu tempat secara digital dengan sangat atraktif. Oleh karena itu, tujuan dari penelitian ini adalah mengembangkan sebuah aplikasi yang dapat memberikan informasi tentang tujuh tempat bersejarah di Sulawesi Utara dengan menggunakan teknologi virtual reality, terutama teknik fotografi yang merupakan teknik untuk menampilkan gambar dengan sudut pandang 360 derajat. Aplikasi ini dirancang menggunakan metode Prototyping sebagai model proses. Unity 3D digunakan dalam penelitian ini untuk membangun aplikasi dan antarmuka dan memungkinkan untuk dapat di jalankan di berbagai operating system. Aplikasi ini dibuat menggunakan bahasa pemrograman C #. Dalam penelitian ini dibahas mulai dari proses desain, pengambilan gambar dengan teknik Immersive, hingga menghasilkan aplikasi yang siap digunakan.

Kata Kunci : Tempat Bersejarah, Virtual Reality, Immersive Photography.

Abstract

North Sulawesi is one of the provinces in Indonesia that has many interesting places to visit, such as natural attractions, culinary and historic places. Easy and interesting information presentation is very important for tourist attractions in North Sulawesi. The presentation of interesting information can attract foreign and local tourists to visit in North Sulawesi. Virtual Reality becomes one of the technologies that can provide a new experience in exploring a place digitally with very attractive. Therefore, the purpose of this research is to develop an application that can provide information about seven historical places in North Sulawesi using virtual reality technology, especially photography technique which is a technique to display images with 360 degree viewing angle. This app is designed using the Prototyping method as a process model. Unity 3D is used in this research to build applications and interfaces and allows it to run on various operating systems. This app is created using C # programming language. In this research discussed starting from the design process, shooting with Immersive technique, to produce applications that are ready to use.

Keywords : Historical Places, Virtual Reality, Immersive Photography

1. INTRODUCTION

North Sulawesi is one of Indonesian provinces which is located at the northern part of Sulawesi and the capital is Manado [1]. There are lots of interesting places to visit in North Sulawesi, such as nature tourism, culinary, and historical places. This research is more focused on historical places in North Sulawesi. According to the observation done by the researchers, the researchers found that the information provided about the historical places in North Sulawesi took the form of social media or a website which is considered less attractive.

In accordance with the current technology, an easy and interesting information presentation is necessary for tourism attraction especially the historical place in North Sulawesi. Therefore, the researchers are developing an application that can provide information about historical place in North Sulawesi by using Virtual Reality technology.

Virtual reality is a development technology in field of Computer Graphics (CG) which is user can interact with virtual world[2][3]. The advantages of virtual reality is to make user to feel the virtual world as real as they can by using the fivesense such as eyes and ears. Now google and any other developers already launch the tools to utilizing the virtual reality, such as Google Cardboard, and VRBox as shown in Fig 1.



Fig. 1. Head Mounted Display (HMD)

In Virtual Reality Photography, there is a technique known as immersive photography. Immersive Photography is a technique to display the borderless image, so user can look around with image 360 degrees angle [4] as shown in Fig 2.



Fig. 2. Result image 360 degrees angle

Virtual Reality (VR) is a technology that is created to support the interaction between user and the three dimensional environment that is simulated by a computer to make a real object or imagination, so that the user can pretend to be involved at the virtual world [5]. There

are four elements in VR such as virtual world, sensory feedback, interactivity, and immersion [6]. In immersion element, there are another types of immersion [7], such as Non-Immersive VR (Desktop Virtual Reality). This type of immersion can be implemented by using personal computer or laptop. The second type of immersion is Semi-Immersive wide screen projection system, a technique that use wide screen monitor to experience the virtual reality. The last type is Fully Immersive Head-Mounted Display System.

In this research, we use the advantages of virtual reality technique especially immersive photography to be used as a promotion media about the historical places in North Sulawesi to be used as a promotion media for historical places in North Sulawesi. The advantages of using immersive photography is that the user can see the picture of an object in all 360 degrees' angle. The object is created using panorama 360 software, where the pictures are obtained from combining pictures of historical place. This research is implemented by using fully immersive head-mounted system technique which is a technique to benefit the sensation of Virtual Reality world.

2. RESEARCH METHODOLOGY

2.1. Framework

In this section, we present our framework of application that explains how to create the interaction of the user with the application.

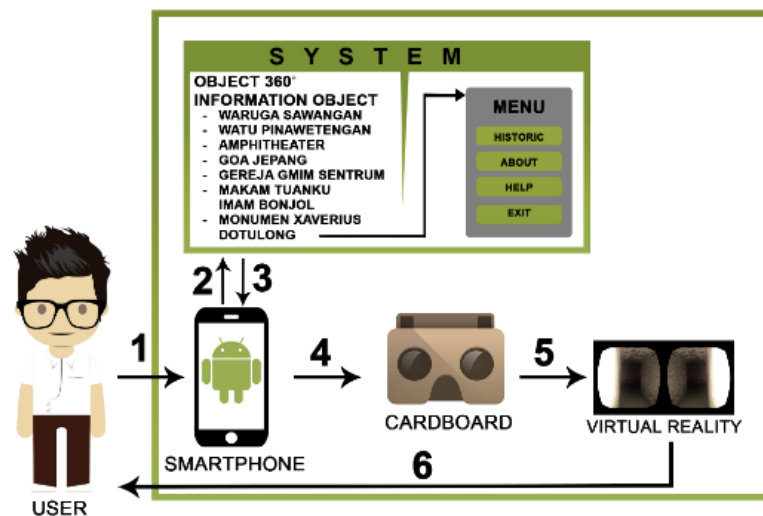


Figure 3. Application Framework

Figure 3 explains how this application works. The first step is user use an Android smartphone to open the application. Afterward user can see the listed menu such as Historic Place, About, Help and Exit. Each menu has their own functionality. Historic Place menu, user can see the listed menu of historic places in North Sulawesi, in this menu user can choose one historic place to see the information. We researchers, already listed seven choices of historic places such as Watu Pinawetengan, Goa Jepang, Gereja GMIM Sentrum, Makam Tuanku Imam Bonjol, Amphitheater Woloan, Waruga Sawangan, and Monumen Xaverius Dotulong and for the information of each historical place will be delivered with image 360 degrees angle, text, and sound information.

Still in Historic Place menu, this application also provided change position features for each historical places, so in each historical places user can see more than 1 point of view. About menu to show the information of application developers, and for Help menu will explain how to use application. After that, the third step is the system will return the interface of the main menu application, and lastly to use this application is needed to wear head mounted display, in this case use Google Cardboard. This method will make optimal the virtual world experience.

2.2. Analysis and Application Design

We analyzed and designed our application framework into two diagrams i.e., Use Case Diagram and Class Diagram. They will be explained below.

Use Case Diagram is a picture of interaction between application and the actor to define the functions of application.



Figure 4. Use Case Diagram

Fig. 4 shows the use case diagram in this research. The explanation of the six Use Case Diagram as follows:

1. Historic Place

User can see the listed seven menu of historic place and choose the button to see the information of the historical place. Application shows the information of each historical places with image 360 degrees angle, text, and sound.

2. Get list of Historic Place

User can get the information of the selected historic place.

3. Get info

User can see the information of the selected historic place with image 360 degrees angle, text, and sound.

4. Image Info 360 degrees angle

Application shows the information of historical place with borderless image or image 360 degrees angle.

5. Text Info

Application shows the information of historical place with text information.

6. Sound info

The information of selected historical place is delivered by sound.

7. About

Application shows the information of the application.

8. Help

Application shows the user guide about the application.

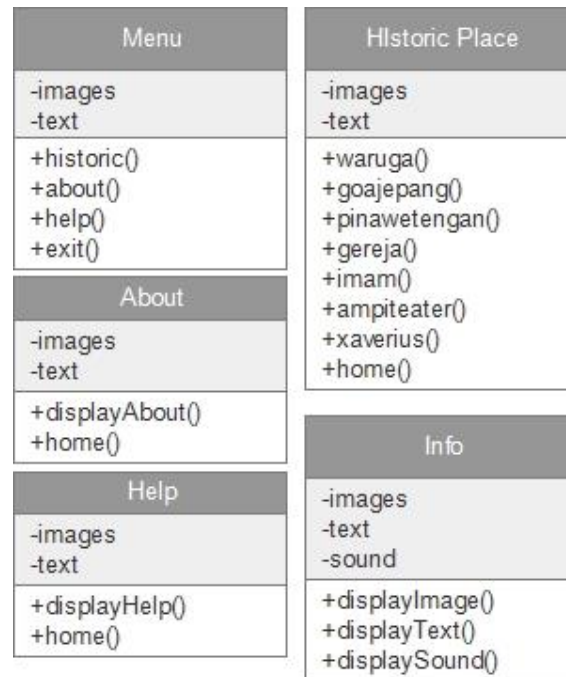


Figure 5. Class Diagram

Figure 5 shows the class diagram in this research. The explanation of the five classes are as follows:

1. Menu Class

This class is a class to display the main menu-HistoricPlace, About and Help.

2. HistoricPlace Class

This class is a class that will be listed the seven historical places and to show the information of the selected HistoricPlace.

3. About Class

This class is a class to display information about the application.

4. Help Class

This class is a class to show the user guide of the application.

5. Info Class

This class contains the informations of the Historic Place such as text, image 360 degrees angle, and sound information.

2.3. User Interface Design

These are the images of how this application look like. In short the user interface of application.

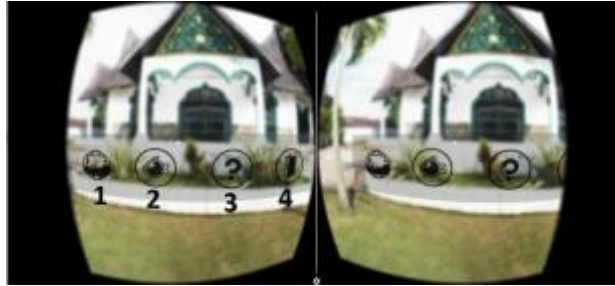


Figure 6. Main Menu Display

Figure 6 shows the main menu view of the application. Here are the explanation of the numbers:

1. The menu to open the list of historic places
2. About menu that shows the information about the application developers.
3. Help menu that explains how to use the application
4. Exit menu to exit the application.



Figure 7. List of Historical Places

Figure 7 listed the 7-historical place. Here are the explanation of the numbers in Figure 6:

1. To open Waruga Sawangan
2. To open Watu Pinawetengan
3. To open Amphitheater Woloan
4. To open Goa Jepang
5. To open Gereja GMIM Sentrum
6. To Open Makam Tuanku Imam Bonjol
7. To Open Monumen Xaverius Dotulong.



Fig. 8. Display the information of Makam Tuanku Imam Bonjol

Figure 8 shows the information of a historic place called Makam Tuanku Imam Bojol. Beside the 360o image and sound information features, this application also provide two type of trigger, such as the White Trigger that can change the position of user to another position, and Yellow Trigger that can show a text information about Makam Tuanku Imam Bonjol.

3. RESULTS AND DISCUSSION









We were using Game Engine Unity3D as the tool to build and compile our program. It came out as an APK (Android Application Package) to install it on our smartphone[7]. The result we've done our testing that focused on Main Menu and Historic Place Menu testing. Here's the explanation as follows.







TABLE 1 MAIN MENU TESTING

| No. | Description | Test Procedure | Input | The expected output | The results obtained | Conclusion |
|-----|--|--|--|---|---|------------|
| 1. | Testing on the main menu | Select an existing menu on the main menu | Click any existing menu in the main menu | The next menu will open according to the selected menu | The next menu is opened after selecting the menu on the main menu | OK |
| 2. | Testing on list of <i>historic place</i> | Choose one of the <i>historical place</i> to show the information. | Click the the <i>historic place's icon</i> | Display the image 360 degrees angle, sound information and trigger (<i>white trigger</i> and <i>yellow trigger</i>) of the selected historic place. | The infomration is successfully is opened. The trigger is opened after view the <i>historic place</i> | OK |
| 3. | Testing on <i>white Trigger</i> | Choose the <i>White Trigger</i> | Move the view to the <i>White Trigger</i> | Change to the next position but still at the selected historic place. | Change position is successfully opened. | OK |

| No. | Description | Test Procedure | Input | The expected output | The results obtained | Conclusion |
|-----|----------------------------------|----------------------------------|--|--|--|------------|
| 4. | Testing on <i>yellow trigger</i> | Choose the <i>yellow trigger</i> | Move the view to the <i>Yellow Trigger</i> | Display text information of the selected historical place. | Successfully showed the information of the selected historical place | OK |

TABLE 2
HISTORIC PLACE MENU TESTING

| Testing | Event | (a) | (b) |
|---------|--|---|--|
| 1 | <p>a). Click the button Makam Tuanku Imam Bonjol from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up.</p> |  |  |
| 2 | <p>a). Click the button Waruga Sawangan from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up.</p> |  |  |
| 3 | <p>a). Click the button Goa Jepang from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up.</p> |  |  |
| 4 | <p>a). Click the button Amphitheater Woloan from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up.</p> |  |  |

| | | | |
|--|--|--|---|
| | <p>a). Click the button Gereja GMIM Sentrum from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up</p> |  |  |
| | <p>a). Click the button Watu Pinawetengan from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up</p> |  |  |
| | <p>a). Click the button Monumen Xaverius Dotulong from the previous menu-Historic Place</p> <p>b). Move the trigger to <i>Yellow Trigger</i>, then the information will be popped up</p> |  |  |

4. CONCLUSION

Based on this research there are three points of conclusion. The first point is this application can run on Android devices that have gyroscope and accelerometer sensor with Android 4.4 (Kitkat) as the minimum requirement for Android version. We also concluded that this application is successfully obtained its main work which is to provide the information of seven historical places in North Sulawesi by using the advantage of virtual reality, particularly the immersive photography technique. So in other words, this application can show the information with image 360 degrees angle, text and sound. And for the last point, to gained the best result we should using head mounted display (HMD). We've tried to use VRBox, and the display of the information came out was good, we can control the application by touching the button that already been provided in VRBox.

5. SUGESTIONS

This application is only made for Android user, therefore it would be great if this application can be built in cross platform compatibility so that this application can run on Personal Computer, iOS and Android smartphone. Secondly, more historical places in North Sulawesi or even other Indonesia historical places can be added to the applications. Lastly, this applications needs a high requirements in hardware, especially for the storage. Its better if the data storage of 360 pictures stores in cloud database, so the application can be smaller and only if the user wants to explore the other places then the user may download the other 360 pictures using the applications.

ACKNOWLEDGMENT

This work was supported by the Computer Science Faculty in Universitas Klabat.

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