International Journal of Engineering Trends and Technology
ISSN: 2231 – 5381 /doi:10.14445/22315381/IJETT-V68I10P216

Volume 68 Issue 10, 93-99, October 2020

Mobile-based Virtual Reality Application for Freshwater Fish Education

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Abstract *– Virtual Reality (VR) is the latest technology utilized in various sectors, such as market penetration in education, entertainment, and industry. VR uses various technologies to create a realistic world. This research was conducted to develop a Mobile-based Virtual Reality Application for Freshwater Fish Education that operates using an android platform. This mobile application was developed by applying the elements of multimedia to attract students and improve their knowledge. The methodology used in this application was Addie methodology. ADDIE methodology consists of 5 phases, which are Analysis, Design, Development, Implementation, and Evaluation. This virtual reality application has an amazing potential to be used as an alternative teaching and learning way.*

Keywords — *ADDIE, Education, Mobile-Based, Virtual Reality.*

I. INTRODUCTION

The implementation of Virtual Reality (VR) has been growing over the past two years [1]. VR is a combination of video and audio that fills the field of a single person's sensation, which works with their perceptual process to give the illusion of being created in a machine. It can give credence to the real environment [2]. This is due in part to its usefulness in many sectors and the news media attention to it. This trend is expected to expand with technological advances in fields such as digital graphics, computer vision, controls, image processing, and other technological-affiliated components in the future. The implementation of Virtual Reality (VR) has been growing over the past two years [1]. VR is a combination of video and audio that fills the field of a single person's sensation, which works with their perceptual process to give the illusion of being created in a machine. It can give credence to the real environment [2].

The research paper is supported by Universiti Sultan Zainal Abidin (UniSZA) using SRGS Research Grant Fund, project number: UniSZA/2017/SRGS/06. Special Thanks to the Center for Research Excellence and Incubation Management (CREIM), Universiti Sultan Zainal Abidin (UniSZA), for providing financial support for the research.

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Additionally, students use technologies to exchange information or acquire experience from one another. It is not a surprise that children are also introduced to the use of technologies in their lives in this generation of Z. Some parents take the opportunity to show their kids how to work using new technologies. Additionally, these children may be more interested in how to use technology than books.

This developed application can create real aquarium VR in the mobile device. This application is an interactive mobile application that us new era technologies to help students learn and know about freshwater fish. By diving into the water, a person can discover a new environment and have an exciting experience to see different types of Fish. Scuba Diving experience would be perfect for the Aquarium VR as students can learn the Fish's names and look at them closely while using this application. Besides, this application focuses on nine types of Fish that can be learned by users. Users need to connect the application with mobile-based headgear to feel the real experience in the water.

II. RELATED WORK

Several products will be produced in relation to the topic of the project. Aquarium Videos VR [3], users can view HD 3D Stereo video with VR Glass. The videos are recorded with a 3D camera, and there are in Side by Side format. Users can watch these videos with a 3D TV or video goggles and observe a real 3D movie.

Rice Fish VR [4] is a VR app that provides the experience of viewing rice fishes from inside the tank. This application also has an AR mode and where the users can put the fish tank on any surface recognized. The users can also move the fish tank by pushing its bottom. Additionally, they can choose their language preference, whether in English or Japanese. This application focuses on the entertainment category.

In Aquarium VR [5], users can take a deep breath and escapes into the relaxing Aquarium VR world. Interact with a large range of exotic fish, including the common clownfish. Experience incredible aquatic design in Virtual Reality (VR) as you communicate with the Fish and watch them interact with each other. This application best fits all Google Cardboard devices.

By EON Reality [6], Aquarium VR can take users on a journey under the sea to discover what lies beneath the virtual aquarium. This application is an interesting aquarium app with information about the Fish and creatures inside it. Users can move their device around to view the reef and listen to the narration describing what they see. This application focuses on entertainment and education.

III. METHODOLOGY

To develop a successful application, the ADDIE model is the most suitable methodology for developing mobile VR applications. The ADDIE model is an iterative instructional design process, where the results of the formative evaluation of each phase may lead the instructional designer back to any previous phase [7].

In this phase, the analysis was done to identify what is needed to develop the mobile VR application. This application's target audience was analyzed as children aged four (4) to fifty-five (55). As for these features, the target audience guided the determination of the content and design of this application.

This project was built on hardware powered by Windows and a simulator running Android Phone. The major software used to develop this application was Unity3D and Autodesk Maya. Unity3D was the main software utilized to develop this application. This included building 3D models (Fig. 1) using Autodesk Maya, developing a VR environment application (Fig. 2) using Unity3D, and create UI/UX (Fig. 3) using Unity3D.

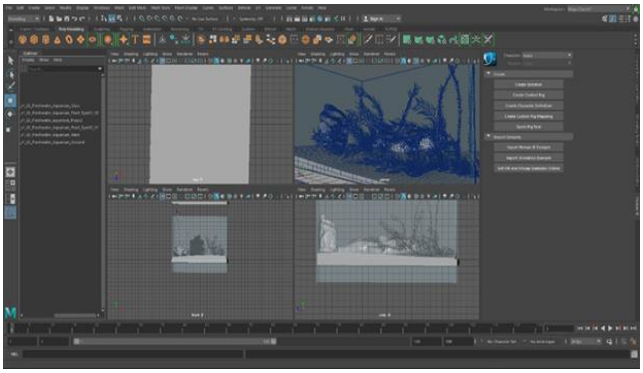

Fig. 1 Building 3D models using Autodesk Maya

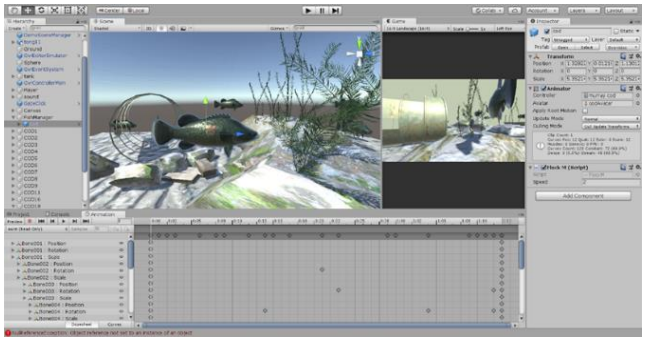

Fig. 2 Developing VR environment using Unity3D

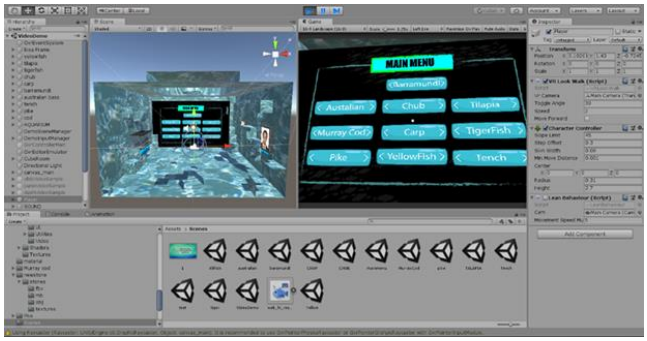

Fig. 3 Create UI/UX application using Unity3D

Gaze input interaction [8] technique is suitable to develop this application. Gaze input interaction does not use a controller to play the application. Traditional controller-less interactive compare to gaze input interaction in the virtual reality environment. Users interact with a virtual reality environment by wearing the mobile-based virtual reality headgear and use the pointer to interact with the application. The framework of this application used to overview of flows of the project is as shown in Fig. 4. The framework contained three modules including user, google cardboard and application.

The framework shows that users must apply google cardboard when using this application. To connect with the application. To develop this application, Autodesk Maya 3D and unity were utilized. Following this, the application transmits a VR view to google cardboard, which gives immersive view to users. This framework suitable used for mobile-based virtual reality [12] application or mobile-based augmented reality application [9,10].

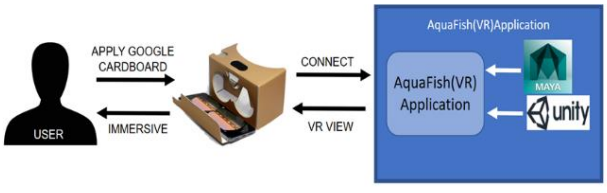

Fig. 4 Framework of application

IV. RESULT AND DISCUSSION

Aqua Fish virtual reality was transposed into a real prototype and end-user application. The implementation testing was carried out to assess the features for the whole application. This section focuses on the implementation, deployment and application results.

A. Deployment

Figures Aqua Fish application was developed and deployed as an android application using the Unity 3D to create the overall project. This application was built in hardware terms using an Asus laptop with Intel ® core i7-7200U 2.5GHz CPU, 8 GB RAM, 240 GB hard disc SSD, and Windows 10.

B. Interfaces

The outputs of the application can be seen in the interface.

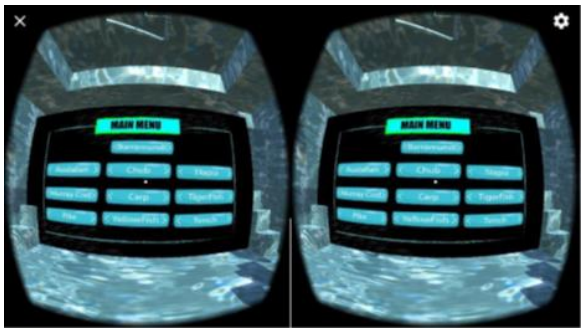

Fig. 5 Main Menu application

Figure 5 shows the menu that has on the homepage of the application. It is the first view when users open this application. In this homepage provides sound instruction about how to play this application and sound background. In this menu, 10 buttons are displayed from which the users can choose. If users gaze barramundi button, go to barramundi scene.

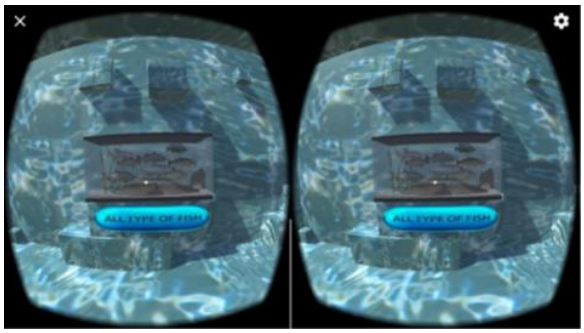

Fig. 6 Menu all type of Fish

Figure 6 shown the button for all type of Fish also has in homepage application. When users gaze this button, its go-to Scene all type of Fish, inside this Scene has 10 types of Fish that users can learn.

Fig. 7 Button Barramundi

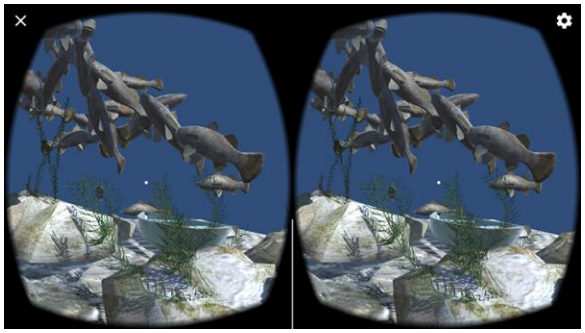

Fig.8 Barramundi scene environment

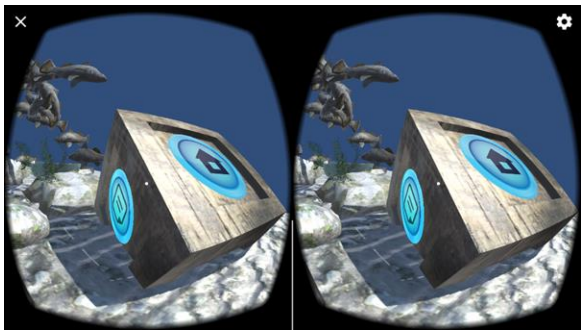

Fig. 9 Note and Home button

Fig.10 Fish information

Figure 7 until Figure 10 present the environment button that provides the Scene of Barramundi. In this Scene, instrumented water sound and description information about this Fish. When users gaze Barramundi button (Figure 7), will go to Scene of Barramundi (Figure 8). Figure 9 shows

the home and note buttons. When user gazes home button, it will go back to the homepage and while the note button will show pop-up text like in Figure 10.

Fig. 11 Button all type of fish

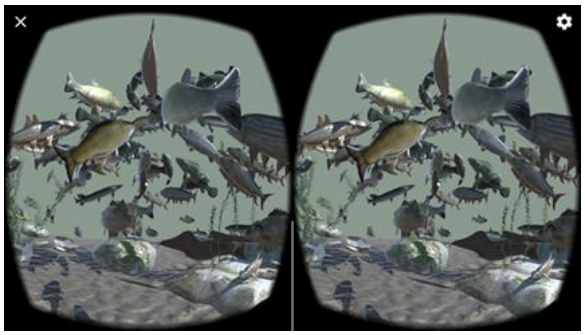

Fig. 12 All fish scene environment

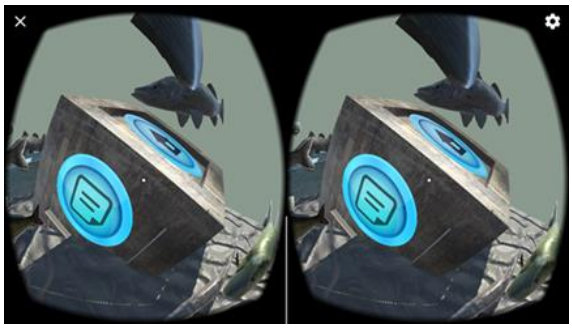

Fig. 13 Note and Home button

Fig. 14 All type of fish information

Figure 11 until Figure 14 shown all environment and buttons that provide the Scene for all types of Fish. In this Scene instrumented water sound and description of Fish. In this Scene contains 10 types of Fish, namely Barramundi, Australian Bass, Chub, Carp, Tilapia, Yellow Fish, Tiger Fish, Pike, Trench, and Murray Cod. When users gaze the button shown in Figure 11, go to Figure 12. In Figure 13, the 3D object environment in the river and all type of fish are shown. Figure 14 displays the buttons for home and note. When users gaze the home button, it will return to the homepage and while the note button shows pop-up text.

C. Testing

Testing is needed to ensure that the system is fully functioning and free error [11]. Module testing was used to test each feature of the application in giving the input and expected output of the application [11]. This application was checked using black-box testing techniques that included architecture, interfaces, basic features and functional button.

Table 1: Test Case for Home Page

Test Case 1 Test Case Name: Home Page Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer on "Barramundi" button	Go to Scene Barramundi	Success
2	Gaze pointer on "Australian" button	Go to Scene Australian	Success
3	Gaze pointer on "Chub" button	Go to Scene Chub	Success
4	Gaze pointer on "Tilapia" button	Go to Scene Tilapia	Success
5	Gaze pointer on "Murray Cod" button	Go to Scene Murray Cod	Success
6	Gaze pointer on "Carp" button	Go to Scene Carp	Success
7	Gaze pointer on "Tiger Fish" button	Go to Scene Tiger Fish	Success
8	Gaze pointer on "Pike" button	Go to Scene Pike	Success
9	Gaze pointer on "Yellow Fish" button	Go to Scene Yellow Fish	Success
10	Gaze pointer on "Tench" button	Go to Scene Tench	Success
11	Gaze pointer on "All Fish" button	Go to Scene All Fish	Success
12	Gaze pointer on "Developer" button	Display Developer Information	Success
13	Gaze pointer on "Supervisor" button	Display Supervisor Information	Success

Based on Table 1, users were allowed access to the application and choose a button to play and learn.

Table 2: Test Case for Scene Barramundi

Test Case 2 Test Case Name: Scene Barramundi Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 2, users were allowed to play Scene Barramundi.

Table 3: Test Case for Scene Australian

Test Case 3 Test Case Name: Scene Australian Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 3, users were allowed to play Scene Australian and based on Table 4; users were allowed to play Scene Chub.

Table 4: Test Case for Scene Chub

Test Case 4 Test Case Name: Scene Chub Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Table 5: Test Case for Scene Tilapia

Test Case 5 Test Case Name: Scene Tilapia Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 5, users were allowed to access Scene Tilapia.

Table 6: Test Case for Scene Murray Cod

Test Case 6 Test Case Name: Scene Murray Cod Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 6, users were allowed to play Scene Murray Cod.

Table 7: Test Case for Scene Carp

Test Case 7 Test Case Name: Scene Carp Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 7, users were allowed to play Scene Carp.

Table 8: Test Case for Scene Tiger Fish

Test Case 8 Test Case Name: Scene Tiger Fish Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 8, users were allowed to play Scene Tiger Fish.

Table 9: Test Case for Scene Pike

Test Case 9 Test Case Name: Scene Pike Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 9, users were allowed to play Scene Pike.

Table 10: Test Case for Scene Yellow Fish

Test Case 10 Test Case Name: Scene Yellow Fish Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 10, users were allowed to play Scene Yellow Fish.

Table 11: Test Case for Scene All Fish

Test Case 12 Test Case Name: Scene All Fish Application: Aqua Fish VR			
Step	Procedures	Expected Result	Result
1	Gaze pointer "Note" button	Display Information about Fish	Success
2	Gaze pointer "end" button	Close note	Success
3	Gaze pointer "Exit" button	Go to Home Scene	Success

Based on Table 11, users were allowed to play Scene All Fish. Of all the checks that were carried out on this application, all were completed.

V. CONCLUSIONS

In conclusion, the objective of this study to build a Mobile-based Virtual Reality Application for Freshwater Fish Education have been successfully achieved. This system is helpful to the user who wants to learn about freshwater Fish interactively. Then, the gaze interaction techniques have been used in this application to add more interactivity and user-friendly for users. ADDIE model has been used during the development of the application. The framework and the interface design included in this report can also act as a guideline to users in using this application. Future works are recommended to design a different environment. Also, more topic or content needs to be added to the application. Last but not least, it is hoped that this application can benefit the community at large.

ACKNOWLEDGMENT

Special Thanks to the Center for Research Excellence and Incubation Management (CREIM), Universiti Sultan Zainal Abidin (UniSZA) for providing financial support for the research.

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