Android-Based Augmented Reality in Education Activity for Children

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Abstract

Augmented reality technology has been widely developed and implemented in an Android based smartphone application. This technology can be used for entertainment and education. Unfortunately, the use for education is still rare. This paper proposes an android application to introduce the types of land transportation based on augmented reality technology which is visualized in 3-dimensional (3D) form for education as well as entertainment. There are seven land transportation modes that are presented ranged from two wheels to four wheels, i.e. cars, ambulances, buses, motorbikes, taxis, trucks and bicycles. Alpha testing has been carried out and show the results that the application run well following the expected function. This application can be delivered to public, especially for online learning of children in pandemic situation. In addition, it helps parents to introduce several land transportation modes. With a 3D view, the introduction of types of land transportation is more interactive and realistic.

Keywords: android, application, augmented reality, transportation

1. Introduction

In line with the development of technology, facilities and infrastructure have also developed in various fields of work, including the education sector related to the use of technology as a support for learning media. One kind of technology that continues to be developed as a learning medium is augmented reality.

Interactive learning can implement augmented reality, e.g. for a learning on computer devices in one of the learning courses for students (Mustika et al. 2015). Learning media that previously used conventional media such as sheets or books that were only use 2-dimensional objects can be collaborated with 3-dimensional media. Therefore, they can be interestingly presented and interactive.

Another study also developed augmented reality for student in studying the human digestive system; in order the students easily understand the digestive system and how it works easily. This learning method can be implemented in biology subjects (Adami and Budihartanti 2016) (Mauludin, Sukamto, and Muhardi 2017).

Not only about human digestion, even viruses in the human body can be developed using augmented reality technology to help students understand the shape of the virus and how the virus infects the human body (Samsuri, Muqtadir, and Amaluddin 2018). In addition to the topic of the inside of the human body, human movement is also being developed using augmented reality, for example the prayer movement. Applications can assist elementary school students in practicing the prayer movement through mobile-based smartphone media (Ahmadi, Adler, and Ginting 2017). The use of applications can be assisted by parents or teachers in explaining the implementation of the application.

Furthermore, learning for special schools in the vocational section as an educational medium was developed for learning interior and exterior design of buildings in increasing the abstraction skill of students (Muhayat et al. 2017). Another lesson, namely butterfly

metamorphosis that is displayed using augmented reality can help students understand the description of each stage in butterfly metamorphosis (Ningsih, Rusdiana, and Rudini 2019).

Previous studies, related to transportation, research was carried out by utilizing sensor-based augmented reality on mobile public transportation users so that the application can help users to display the nearest transit stop (Kamilakis, Gavalas, and Zaroliagis 2016). Apart from displaying bus stops, it can also monitor trips in real time and display schedule information from user trips related to transportation problems (Królewski and Gawrysiak).

The paper developes augmented reality application on Android-based smartphone. This application is about the introduction of types of land transportation as learning material using augmented reality technology that can visualize object models 3-dimensional (3D) form.

By explanation using augmented reality, we hope teachers and parents in current pandemic situation can make children able to recognize several types of land transportation in Indonesia with guidance or explanation from parents as a means of learning and an explanation of the implementation of the use of the application. The use of this application is not only limited to children but also for children with mental disabilities.

2. Research Method

The research method uses the Multimedia Development Life Cycle (MDLC) software development model, which includes the development process from information or to investigation, analysis, design, and implementation of the project created which is consists of several stages as follows (Binanto 2010).

2.1. Concept

This study used some concept, namely: (1) This study aims to build an application using augmented reality technology regarding land transportation (seven types of land transportation), (2) Users themselves are general, including children. Applications in 3D form and to be used as a learning medium for children, (3) Hardware and software specifications, namely the use of applications on Android-based smartphones, (4) The main material needed is a 3D image and information from land transportation.

2.2. Design

The design consisted of process design and interface design. The process design was used for making the application using the storyboard system modeling. Table 1 shows the storyboard system of the overall use of the application being built.

Table 1. *Storyboard*

Scene	Sequence	Outline	Description	Message / Camera Subject
1	2	3	4	5
1	1	*Splash Screen*	Opening Display on Application	-
2	2	Menu Utama	Displays a menu list which consists of 3 options namely Start, Help, and About.	-
3	3	Memulai AR Kamera	Displays the transportation menu list consisting of cars, ambulances, taxis, buses, trucks, motorbikes and bicycles.	-
4	4	Car	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
5	5	Ambulance	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
6	6	Bus	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
7	7	Motorcycle	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
8	8	becycle	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
9	9	Taxi	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
10	10	Truck	Begins marker reading on image content to display animation	Showing objects in the form of 3D vehicle animation
11	11	Out	Exit Application	-

Scene	*Sequence*	*Outline*	*Description*	*Message / Camera Subject*
1	**2**	**3**	**4**	**5**
12	12	Instructions	An explanation of how to use the application and the functions of the	-
13	13	About	A written explanation of the author's profile.	-

Source: Research Results (2018)

The design process (table 1) shows the parts of the scene, sequence, outline, description, and message/camera subject. Meanwhile, the interface design used image content on the card which also have a function as a marker. The marker used was only 1 marker, but it can cover each of the 7 objects provided. Figure 1 shows the markers for land transportation.

Source: Research Results (2018)

Figure 1. Marker for land transportation

2.3. Building

This stage consists of application building using a 3D blender to create 3-dimensional models, whereas the unity game engine and the Vuforia SDK were used as a library for augmented reality.

2.4. Testing

Testing aims to determine whether there is an error in the application on a smartphone device against the marker made. The test method was alpha testing by observing the use of the application by the user, which is then corrected by the developer for defects in the application (Simarmata 2010).

2.5. Distribution

The application will not be useful if users (children) does not want to use it, does not understand, or does not know that the proposed application exists. For the distributed process, the application will be given a file with the extension so that it can be used by general public users.

3. Result and Discussion

3.1. Result

The application development displays several views such as the splash screen, main menu, and others. In an application, there is a splash screen that opens the application starting as shown in Figure 2.

Source: Research Results (2018)

Figure 2. Application splash screen

After the splash screen appears (Figure 2), the main application menu also appears. On the main menu (Figure 3), there is a menu option to enter each of the other menus, namely the AR Camera menu which displays options for land transportation, the about menu which displays application information, and the help menu for how to use the application.

Source: Research Results (2018)

Figure 3. Application main menu

When the user selects the AR Camera Menu button, there are 7 options represented by each image of land transportation as shown in Figure 4.

Source: Research Results (2018)

Figure 4. Menu of augmented reality for land transportation

If the user selects an object from the 7 objects shown as in figure 4, for example selecting a motorbike or other object and has clicked on the object's image, it will activate the camera on the smartphone and the user points to the designated marker so that the 3D object can shown. There are 7 objects that can be displayed based on the selected object. Figure 5 shows the 3D object view of the transportation types.
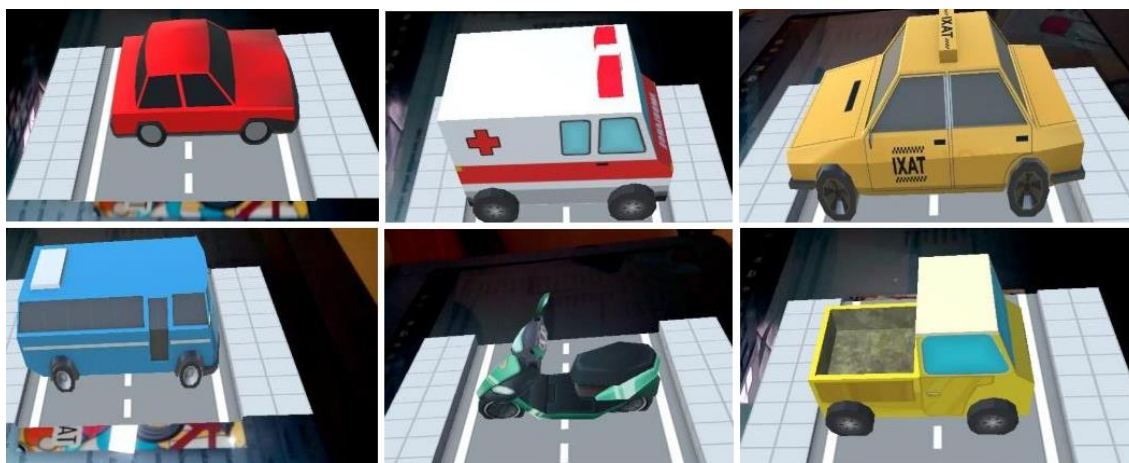
Source: Research Results (2018)

Figure 5. Display of transportation types

3.2. Discussion

After application development, the next process is testing. Tests carried out on applications aims to ensure whether the functional application is running properly and correctly as well as in-line with the needs and goals of application development. Alpha testing was used in this study. This method focuses on the functional requirements of the built software as shown in table 2.

Table 2. Alpha Testing Result

No	Interface	Input	Output	Hasil
1	2	3	4	5
1	Splash screen	-	Displays the splash screen	Ok
2	Main Menu	-	Displays the main menu	Ok
3	Help Menu	Touch the Help menu	Displays instructions for using the application	Ok
4	About Menu	Tap the About menu	Displays a description of the application	Ok
5	AR Camera Menu	Tap the AR Camera menu	Displays a scene of transportation options	Ok
6	Car Menu	Sentuh gambar mobil	Displays the AR Car scene	Ok
7	Scene of AR Mobil	Point the camera at the marker	Displays the AR Car scene	Ok
8	Ambulance Menu	Touch the ambulance image	Displays the Ambulance AR scene	Ok
9	Scene of AR Ambulance	Point the camera at the marker	Displays an animated picture of an ambulance	Ok
10	Bus Menu	Touch the bus image	Displays the AR Bus scene	Ok
11	Scene of AR Bus	Point the camera at the marker	Displays an animated bus image	Ok
12	Motorcycle Menu	Touch the motor image	Displays the AR Motor scene	Ok
13	Scene of AR Motorcycle	Point the camera at the marker	Displays an animated image of the motor	Ok
14	Taxi Menu	Touch the taxi image	Show the AR Taxi scene	Ok
15	Scene of AR Taxi	Point the camera at the marker	Displays an animated taxi image	Ok
16	Truck Menu	Touch the truck image	Shows the AR Truck scene	Ok
17	Scene of AR Truck	Point the camera at the marker	Displays an animated picture of a truck	Ok
18	Menu Sepeda	Touch the bike image	Displays the Bike AR scene	Ok
19	Scene AR Sepeda	Point the camera at the marker	Displays an animated bicycle image	Ok
20	Back	Touch the Back button	Returns to the AR menu	Ok
21	Exit	Touch the Exit button	Exit Application	Ok

Source: Research Results (2018)

Table 2 shows the alpha testing on the application. Based on this test, it appears that the test has appropriate results between the points tested and the application. It can be concluded that the application can run well and provide the correct output based on the given input. The application has run according to the test on Android-based smartphones.

4. Conclusion

Augmented reality technology has been widely used in entertainment. Today, many studies show the ability of this technology to support the online learning. The study has developed an augmented reality application about seven land transportation explanation for children and has been implemented on an Android-based smartphone. Based on alpha testing, the results of the application run according to its function. This 3D application can be used for additional tools of online learning, especially in the current pandemic situation. Parents can use the application as a guidance in study at home. To be more interactive, it can also be developed by providing an audio explanation of the means of transportation in the application regarding the transportation means presented. Other developments that can be done are not only providing the seven land transportation means, it can be added other education materials.

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