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 et al., 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 et al., 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 et al., 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 et al., 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 et al., 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, 2011].

The paper develops 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.

| Scene | Sequence | Outline | Description | Message / Camera Subject |
|-------|----------|---------|-------------|--------------------------|
| 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        | bicycle | 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 | -                        |
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.
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.

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.

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.
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  | 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.

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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.

References

Adami FZ, Budihartanti C. 2016. Penerapan Teknologi Augmented Reality Pada Media Pembelajaran Sistem Pencernaan Berbasis Android. Jurnal Teknik Komputer AMIK BSI 2(1): 122-131.

Ahmadi RA, Adler J, Ginting SL. 2017. Teknologi Augmented Reality Sebagai Media Pembelajaran Gerakan Shalat. Seminar Nasional Komputer dan Informatika (SENASKI). Bandung, Indonesia. 20 Juli 2017.

Binanto I. 2010. Multimedia Digital – Dasar Teori + Pengembangannya. Yogyakarta: CV. Andi Offset.

Kamilakis M, Gavalas D, Zaroliagis CD. 2016. Mobile User Experience in Augmented Reality vs. Maps Interfaces: A Case Study in Public Transportation. Dalam: Part of the Lecture Notes in Computer Science book series. Cham: Springer.

Królewski J, Gawrysiak P. 2011. Public Transport Navigation System with Augmented Reality Interface. Dalam: Communications in Computer and Information Science. Berlin: Springer.

Mauludin R, Sukamto AS, Muhardi H. 2017. Penerapan Augmented Reality Sebagai Media Pembelajaran Sistem Pencernaan pada Manusia dalam Mata Pelajaran Biologi. Jurnal Edukasi dan Penelitian Informatika (JEPIN) 3(2): 42-48.

Muhayat U, Wahyudi W, Wibawanto H, Hardyanto W. 2017. Pengembangan Media Edukatif Berbasis Augmented Reality untuk Desain Interior dan Eksterior. Innovative Journal of Curriculum and Educational Technology (IJCET) 6(2): 98-107.

Mustika, Rampengan CG, Sanjaya R, Sofyan. 2015. Implementasi Augmented Reality Sebagai Media Pembelajaran Interaktif. Citec Journal 2(4) : 277-291.

Ningsih F, Rusdiana L, Rudini. 2019. Analisis Dan Desain Aplikasi Pembelajaran Metamorfosis Kupu-Kupu Berbasis Augmented Reality. SINTECH Journal 2(2) : 118-123.

Samsuri M, Muqtadir A, Amaludin F. 2018. Penerapan Teknologi Augmented Reality Sebagai Media Pembelajaran Virus Pada Manusia Berbasis Android. Tuban, Prosiding Seminar Nasional Hasil Penelitian dan Pengabdian kepada Masyarakat III. 29 September 2018.

Simarmata J. 2010. Rekayasa Perangkat Lunak. Yogyakarta: Andi.