Augmented Reality Technology for Increasing the Understanding of Traffic Signs

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Submission date: 09-Jul-2022 10:57PM (UTC-0400)
Submission ID: 1868502307
File name: 29-Article_Text-60-1-10-20191225.pdf (1.22M)
Word count: 2429
Character count: 13029

Edutec
Journal of Education And Technology
2597-9221 (Online)

Augmented Reality Technology for Increasing the Understanding of Traffic Signs

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ABSTRACT

The problem in urban areas which has always been the topic of discussion is the discipline of city residents regarding traffic regulations that still need to be improved. Some commonly used methods to increase understanding of traffic signs have been carried out by related parties including counseling at school and as a condition for obtaining a SIM. But the method used has a less interactive and attractive appearance, and is not practical to carry anywhere. This study provides a solution to these problems by utilizing smartphones and augmented reality (AR) technology. Smartphone has now become one of the needs that can not be separated from human life, where almost everyone and even children can operate it. In addition, AR technology has also been widely used as a learning medium, one of which is as a medium for the introduction of traffic signs. Through the ability of AR in combining the real world and the virtual world at one time, the application of AR produced by this study was able to increase people's understanding of traffic signs by being more interactive, interesting and practical.

Keywords: Augmented Reality, Traffic Signs, Smartphone

INTRODUCTION

The problem in urban areas that has always been the topic of discussion is the discipline of city residents of traffic rules that still need to be improved. Education and counseling regarding traffic signs are still routinely organized by related parties, such as police and school.

Some familiar recognition methods, among others, make the level of understanding traffic signs as a condition for obtaining a driving license, introduction of traffic signs in activities at school, as well as an introduction to using book media. But in its application, methods that is used has several drawbacks, namely that knowledge of past signs people are vulnerable to being forgotten by the community when leaving the location, for example schools; display of the media used are less interesting and interactive because most are delivered in one direction only; Other problems are less practical when taken away.

Utilizing a smartphone can be one solution to reduce the obstacles that occur in previous method. This is because the nature of the smartphone is practical and easy to carry where and at any time, and is operated by almost the majority of Indonesian people, including children and parents. In addition, there are many applications that can run on smartphones, wrong one of them is augmented reality technology. This study aims to build an introduction to traffic signs that have high mobility, a more attractive and interactive display, as well as being practically carried wherever and whenever will be used. Applications built utilizing augmented reality (AR) technology implemented on smartphones.

LITERATURE REVIEW

Augmented Reality is an attempt to merge the real world with the virtual world created through a computer so the boundary between the two is very thin (Perdana, Fitrisia, & Putra, 2012). This situation is described inward a scheme created by Milgram and his colleagues in 1994. The scheme can be seen in Figure 1. The creation of the virtual world is done to arouse the user's perception (user) to understand information from recognized objects (Setiawan, Ferdiana, & Hartanto, 2014).

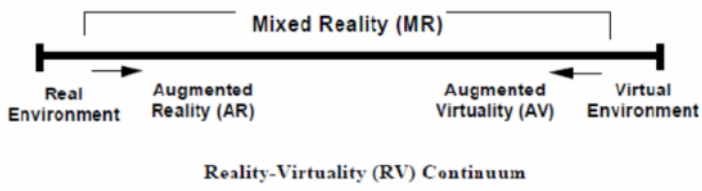

Figure 1 Augmented Reality Illustration Diagram (Milgram & Kishino, 1994)

The introduction of markers on AR plays an important role in recognizing objects which then the AR application will provide additional information on these objects. The object recognition method / AR marker has an influence in the process of recognizing a marker. There are two methods of marker recognition in AR, namely: marker and markerless. Markers are special markers that are made like a barcode or black frame, while markerless is a marker that is associated with objects directly (Setiawan et al., 2014). Markerless AR analyzes the structure of the environment seen from the camera to estimate the position and orientation of the camera to the surrounding environment (Saputra, Utami, & Sunyoto, 2015).

To be able to recognize markers or markerless software is needed that functions as a library. In this study, the software is Vuforia which has been widely used to design AR

applications (Wahyudi, 2014). Vuforia is an AR that uses markers and unlike previous AR technology, Vuforia makes it possible to make colorful markers because Vuforia only detects edges and contrasts as the main feature points (Santoso & Gook, 2012). Vuforia provides this service free of charge with a maximum quota of 1000 users and 1000 application accesses per day (Wibowo, Indriasari, & Anindito, 2015). Through Vuforia, the pattern can be recognized well. The pattern that will be recognized and formed in this discussion is the traffic sign pattern.

In this study, the application was created using Unity 3D. Unity 3D is a tool integrated to create three-dimensional object shapes in video games or for interactive contexts others such as Architectural Visualization or real-time 3D animation. The environment of developing Unity 3D runs on Microsoft Windows and Mac Os X. Applications made by Unity 3D can It runs on Windows, Mac, Xbox 360, Playstation3, Wii, iPad, iPhone and doesn't lag on Android platform (Sudyatmika, Crisnapati, Darmawiguna, & Kesiman, 2014).

Android is an operating system for Linux-based mobile devices that includes a system operations, middleware and applications. Android also provides a very open platform useful for developers to be able to create their applications here (Safaat, 2011). Android has several advantages that are very supportive for the development of AR-based applications such as a user friendly display, has notifications, is open source, and most importantly is that Android can run on smartphone media. A smartphone is a mobile device that is ideal for AR applications. The device has been equipped with a build-in camera that really allows the capture of objects, GPS, accelerometer and processor that can do high computational (Safaat, 2011).

SDK is required to be able to run AR applications on Android. SDK is an API tool (Application Programming Interface) needed to develop applications on the platform Android uses the Java programming language (Wahyudi, 2014). This is because the SDK is able to change devices such as mobile phones or PCs are performing like Android. One type of SDK used in this research is Vuforia SDK.

In this research, the method used is Multimedia Development Life Cycle (MDLC) or the multimedia development life cycle. MDLC method consists of six stages, namely concept, design, material collecting, assembly, testing, and distribution (Indrawaty, Rosmala, & Ramdhanial, 2013). The six stages of this MDLC It does not have to be done sequentially, but for the concept stage it must remain in order first. Figure 2 below is a scheme of the MDLC stages.

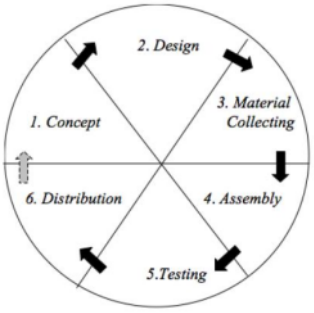

Figure 2 Stages of Multimedia Development Life Cycle (MDLC) (Sutopo, 2003)

DISCUSSION

The application of the MDLC method in this study can be seen in the following discussion:

Concept

At this stage, the process of determining the purpose of making the application is to build Traffic signs recognition application that has high mobility, more attractive appearance and interactive, and practically carried wherever and whenever. Then identify the user (user) application, where in this study are people of all ages. Sign recognition application this traffic is named ARTRAS (Augmented Reality Traffic Sign).

Design

In the design phase, application design is made. In this study, system design made using UML (Unified Modeling Language) which consists of use case diagrams and activity diagram. These two diagrams can be seen in Figures 3 and 4 below.

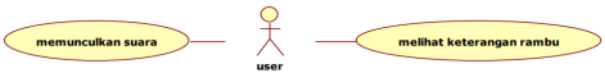

Figure 3 Use Case Diagram of the ARTRAS application (Noviyana, Akhriza, & Farida, 2017)

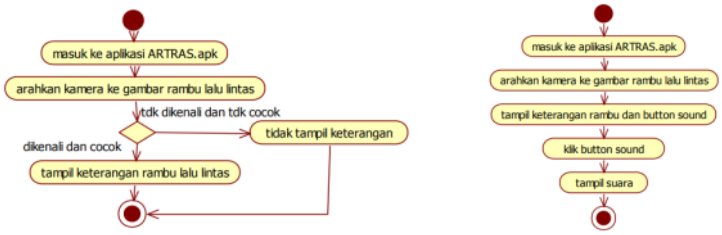

Figure 4 Activity Diagram of the ARTRAS application (Noviyana et al., 2017)

From Figure 3 it is known that the user can do two things, which are seeing the sign information and listen to the sound from the button sound. From Figure 4 it can be seen 2 processes of activity which can be done by the ARTRAS application. The first picture is a describing activity the process for displaying sign information that starts from pointing the camera to the last image cross, then checks occur, if recognized, information will appear and if the marker does not recognized, then AR does not display any information on the screen. Whereas the second picture is activity to bring up sound that starts from the user clicking or touching the sound button when the sign information appears on the screen of your smartphone or PC screen.

Material Collecting

Material collecting stage is the stage of collecting things related to research. The material needed in this study is a laptop with 2 GB RAM specifications and Dual Core Processor, the operating system used is Windows 7, and is equipped with a camera a minimum of 8 MP and Auto Focus. For smartphone specifications that will be used namely RAM a minimum of 1 GB, a minimum of Quad Core processor, as well as a main camera of at least 8 MP and Auto Focus, The Operating System (OS) used on smartphones is a minimum Android version of Ice Cream Sandwich 4.0.

1. Assembly

Is the stage of making an application using the material that has been collected. In the assembly stage is also carried out the process of installing the software needed, such as Unity 3D, Blender, Adobe Photoshop, and other supporting software. For this research, the process begins by making markers done on Adobe Photoshop CS3 and Corel Draw X4, audio manipulation of Audacity software version 2.0, and package creation in Vuforia.

Testing or testing is the stage where applications that have been made are tested with the needs of users who operate it. Also carried out testing whether the application has been made answer the formulation of problems that occur.

2. Distribution

At this stage there is no need to distribute the application to users. On this research, this process still cannot be done.

Marker Design and Application Making

Markers used in this application are images of traffic signs, both signs warning (yellow), prohibition (red circle) or suggestion (blue). There are more than 100 image signs commonly known to the public, but in this study only 9 signs were used for trials. Markers

that have been made are then printed with a printer can produce good quality images, while sign image files are uploaded on Vuforia to be stored as a package marker.
The process of designing an AR application introducing traffic signs uses Unity software 5.1.1. Markers that have been created are saved into Vuforia to be downloaded so that The marker is in one vuforia package file. This package file is then imported into Unity. Display markers that have been packaged can be seen in Figure 5 below.

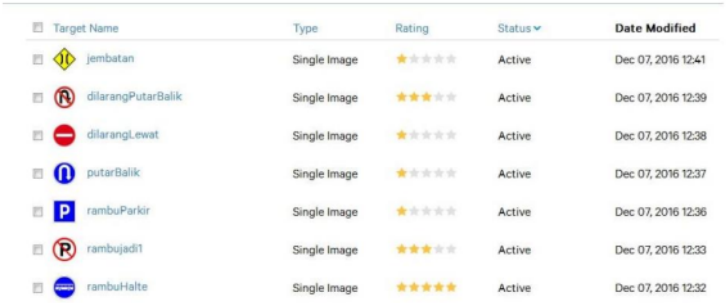

Figure 5 Traffic signs for markerless

The process of making additional information from the object to be displayed can be done on some software according to the type of information you want to display. In this research, Additional information will be displayed in the form of text explaining the meaning of the last sign traffic and button sound that functions to run audio files about the meaning of traffic signs previously processed in Audacity software.
So that this application can be implemented on an android smartphone, then after the process making an application, the Build and Run process needs to be done. This is done so that the application has been This built can run on a format that suits a smartphone.

Application Testing

The testing process in this study was carried out using functional testing from the camera and the sound button contained in the application when the information is successfully displayed. Test results can be seen in Table 1 below.

Table 1 Testing Results

No.	Item tested	Expected results	Results
1.	Function marker	When drawing marker signs traffic succeeded captured on camera and matches the marker on system, then description the sign will	Successful

		appear.	
2.	Function marker	When drawing marker signs traffic does not match with markers on the system, then it does not appear any description.	Successful
3.	Function button sound	When information signs appear, button sound too appears and when touched, a sound appears about information signs	Successful

CONCLUSION

From the results of research that has been done, it produces an application to recognize traffic signs which is named ARTRAS which is more interesting because the meaning of the traffic signs can be displayed in the form of audio and text that can directly appear on the smartphone / PC screen. ARTRAS application also more interactive. This can be seen from the sound button that allows users to interact by touching/clicking the button to listen to the sound. The last one is ARTRAS application is more practical and dynamic because it can be operated on smartphones.

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