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Augmented Reality in Learning the Introduction to the Toba-Simalungun Batak Language Using the Marker-Based Tracking Method

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Abstract

Regional languages are invaluable cultural treasures and are inseparable from socio-cultural values that reflect the principles of regional behavior and identity. In the areas where tribes are spread in North Sumatra Province, there are several languages such as Batak Toba and Simalungun which are used in several areas in North Sumatra. Global developments have made the use of Batak Toba and Simalungun languages decrease and the intention to learn from children to adults is decreasing and the lack of learning facilities to understand Batak Toba and Simalungun languages. This study will aim to combine Batak Toba and Simalungun languages with augmented reality (AR) technology in order to obtain more efficient, interesting and interactive learning facilities for children to adults in learning Batak Toba and Simalungun languages. The application development method uses Marker Based Tracking as an augmented reality (AR) reference in the development of the Android-based Batak Toba-Simalungun Language Introduction Learning Application Marker Based Tracking Method. The Marker-Based Tracking method for the Toba-Simalungun Batak language, produced in this application, is a 3-dimensional (3D) image of the language. When the user points the camera at an object or 3D image, the application displays a 3-dimensional (3D) image of the Toba-Simalungun Batak language pattern captured by the user's camera.

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1. Introduction

In this era of globalization, the development of information technology and visual communication design has experienced rapid progress in recent years due to the discovery of new technologies in digital media, both in hardware and software. As a country with a diverse cultural heritage, Indonesia

boasts numerous regional languages, both spoken and written. Among the indigenous languages of the archipelago are the Toba and Simalungun Batak languages, which are part of the North Sumatran language family. As one of the archipelago languages, this cultural heritage of the Toba and Simalungun Batak people needs to be preserved because it is threatened with extinction, and many people, especially those who have migrated to other cities, do not know the languages. The reasons for their extinction are limited references and the fact that they are passed down from one generation to the next only orally, without any written form.

The limited use of the Toba and Simalungun Batak languages has resulted in fewer and fewer people recognizing the script, even among the local people themselves, and they are now increasingly being abandoned. To reintroduce and preserve the Toba and Simalungun Batak languages, it is necessary to create interactive Augmented Reality (AR) media for introduction and learning, allowing future generations to learn about their ancestral culture, particularly the Toba and Simalungun Batak languages.

This application in learning Batak Toba and Simalugun languages uses the gamification learning method. Based on the results of interviews by linguist Dr. Samsuddin Lubis, S.E. MM and elder Zul Hasan, there are several languages asked, such as the meaning of "Sayang" in Batak Toba becomes "hasian" and likewise in Simalungun the meaning of "Kamu" becomes "ham". As for gamefication is the application of game elements and animation into applications to increase motivation to learn Batak Toba and Simalungun languages in using technology. The research aims to create an android application based on Augmented Reality (AR) as an interesting and fun learning tool for the generation who want to learn Batak Toba and Simalungun languages. With the Augmented Reality (AR) application, it is hoped that the generation who wants to learn Batak Toba and Simalungun languages will be more interested in learning or expanding their knowledge of Batak Toba and Simalungun languages well which are used in everyday life, especially to improve the ability of Batak Toba and Simalungun languages that are flexible and good. AR allows students to see and interact with virtual objects in real environments, thus providing a more in-depth learning experience. With this technology, students can visualize the meaning of a word directly in the form of a three-dimensional (3D) image and hear the pronunciation of the word (Hasan Basri, et al; 2024).

Augmented Reality is a term used to describe a technology that combines the real world and the virtual world directly or in real-time (Ainiyah Hidayanti Yusup, et al.; 2023). This research will also use the Marker Based Tracking method, which is a two-dimensional object marker that has a pattern that is read through a webcam or camera connected to a computer (Ayuna Kintani, et al.; 2021). With Augmented Reality technology, users can witness virtual objects projected onto the real world in an attractive 3-dimensional form so that the Toba and Simalungun Batak languages can be preserved again.

Through this Augmented Reality education system, users can learn about the vocabulary of the Batak Toba - Simalungun language in a more interesting and interactive way. Augmented Reality technology is currently hot and has great potential to be used in regional language learning for young people, especially children, because it will attract more attention with a different learning method compared to the current conventional method. By utilizing the Android operating system that can support the development of interactive learning media and can represent material with Augmented Reality technology that can also be added with 3D features and sound or text to preserve regional languages by creating a technology to learn regional languages and to get information directly through applications that can be downloaded on Google Drive that can be installed on Android (Listia Rizky, et al; 2025).

2. Research Methodolgy

This research will use reference studies and journals as data collection methods. The explanation is as follows:

a. Library Method

Data collection comes from books, journals, reports, and other written sources of information related to the problem being studied, research related to "The Application of Augmented Reality Technology in Learning the Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method."

b. Interview Method

An interview is a purposeful conversation. The conversation is conducted by two parties: the interviewer who asks questions and the interviewee who provides answers. The main characteristic of an interview is direct, face-to-face contact between the information seeker and the information source, Dr. Samsuddin Lubis, S.E., MM, and the elder, Mr. Zul Hasan. My first question concerns the Toba Batak language.

Author: What is the Batak word for "water," Sir?
Interviewee: "Air" means "aek"
Author: What is the Toba Batak word for "big," Sir?
Interviewee: "Big" means "balga" in Toba Batak.
Author: What is the Toba Batak word for "cry," Sir?
Interviewee: "Crying" means "crying."
Author: What is the Toba Batak word for "eat," Sir?
Interviewee: Muruk
Author: Lastly, what is the Javanese Batak word for "mandi," Sir?
Interviewee: "Maintaining" is "maridi" in Batak.
Next, I would like to ask about the Simalungun Batak word.
Author: What is the Simalungun Batak word for "beautiful," Sir?
Interviewee: "Beautiful," Jeges
Author: What is the Simalungun Batak word for "mother," Sir?
Interviewee: "Mother" usually means "host."
Author: What does the word "jongjong" mean in the Batak Simalungun language, sir?
Interviewee: "Jongjong" means "standing."
Author: Lastly, sir. What is the Batak Simalungun word for "jalan"?
Interviewee: "Jalan" is usually "mardalan."
Author: Okay, thank you, sir. That concludes my interview.
Good afternoon.
Interviewee: Afternoon.

System development using a fishbone diagram can be explained as follows:

1. Requirements Analysis
   This stage involves the process. Building an application requires an understanding of interrelated variables. At this stage, researchers collect theoretical data related to the research.
2. Process
   This stage demonstrates the program's accuracy under actual usage conditions. This process runs scenarios based on data and environments that represent the real world using a test machine. Program testing is a method used to ensure the correctness of a program. Program testing implements input symbolization to ensure assurance of all data used as input.
3. Tools
   Software requirements are documents containing a complete statement of what the software can do.
4. Method
   At this stage, the researcher chose a full coding-based approach in accordance with data collection in the Application of Augmented Reality Technology in Learning the Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method.
5. Program Testing

After the designed system has been implemented into an application, the next stage is the testing phase, encompassing specifications, design, and coding. In this study, system testing was conducted through black-box testing of all application functions. Black-box testing is a type of application or software testing that focuses on the functional requirements of the software.

6. People

At this stage, the researcher and the users are the users of the designed system. Users will then check the system to determine if (insert first paragraph here) errors remain that may not have been previously discovered, or if new features have been added that were not yet available in the system.

3. Results and Discussion

In Indonesia is a country that has an archipelago and has a diversity of racial cultures, ethnicities, beliefs, religions and languages and many more. Many Indonesian cultures have experienced changes, one of which is the Batak Toba and Simalungun. The Batak Toba and Simalungun tribes are one of the tribes that exist from various tribes throughout Indonesia. Unfortunately, children or people in the Batak Toba and Simalungun regions, especially those who migrate, do not understand how to use the Batak Toba language properly and correctly. Therefore, this research is designed to create an application based on Augmented Reality (AR), Augmented Reality (AR) is a technology that is able to combine two-dimensional or three-dimensional virtual objects into a real environment and then display them in real time and will display 3D image objects. The AR application for learning the Batak Toba and Simalungun languages to improve the Batak Toba and Simalungun language for children and the community is made using Unity 3D software which is an application used to develop multi-platform games designed to be easy to use by the creator. This application in learning the Toba Batak language uses a gamification learning method with quizzes.

1. Making Markers

Marker creation is done by designing an image of a medical device object in an image processing application, then the image will be used for image tracking. The edited image will be uploaded to the Vuforia Developer website. The uploaded file will be assessed for quality by the system. All markers uploaded through Vuforia will generate source code (the resulting image after Vuforia generation) in the form of an XML file. This XML file is the configuration file for Vuforia for the uploaded markers. To create this marker, an image file with the extension *.JPG/JPEG is required, which will then be uploaded to Vuforia. The uploaded marker will be assessed for quality by the system, as shown in Figure 1 below:

Figure 1. Marker Detection

B. Vuforia Marker Database Creation Process

To create a marker in Vuforia, we must first register the object to be used as the marker on the Vuforia website. This is because there is no tool for creating custom markers in the Unity Engine. The steps for registering a marker are as follows:

1. Log in to the Vuforia developer site at http://www.developer.vuforia.com.
2. Click the target manager menu, as shown in Figure III.4 below.

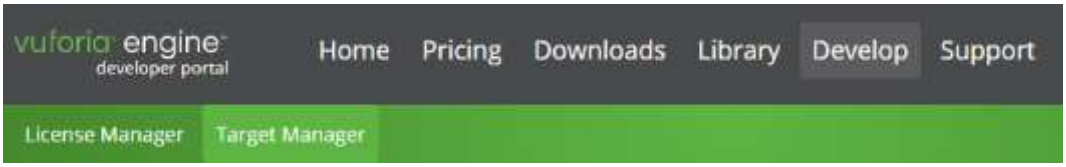

Figure 2. Vuforia Target Manager Menu

3. Click on the previously created database to add the target image.

Figure 3. Vuforia Target Manager Database

4. Click the Add Target button to add a marker to the Vuforia database.

Figure 4. Adding a Vuforia Target Manager

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. Fill in each field on the Add New Target form according to the specified requirements.

Figure 5. Vuforia's Add New Target Field

6. Click the Add button.
7. Target image registration is complete. The form for successfully registered objects will appear as shown in Figure 6 below:

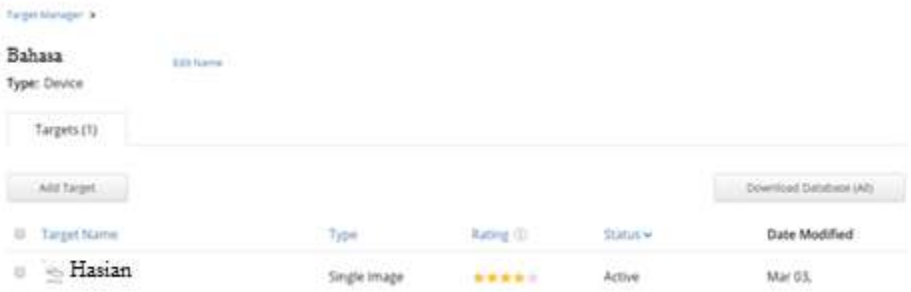

Figure 6. *Form Image Target Vuforia*

The following explains the results of the Android-based Land Transportation Recognition application:

1. Main Menu Scene Display

The system's display of the Main Menu is shown in Figure 7.

Figure 7. Main Menu Scene

The main menu scene in Figure IV.1 is the scene displayed when the user first opens the Toba and Simalungun Batak language recognition augmented reality application. The main menu scene contains five buttons: the "Start" button, which displays the Augmented Reality marker scan scene; the "Quiz" button, which displays the quiz; the "Material" button, which displays the material; the "Download Marker" button, which displays the marker you wish to download; the "About" button, which displays information from the application developer; and the "Exit" button, which exits the application.

2. Initial Scan Display
The display presented by the system to display the initial scan is shown in Figure 8 as follows:

Figure 8 Initial Scan Display

The initial scan display will appear when the user clicks the AR Camera button. This allows the user to more easily scan using the provided form.

3. Scene Scan Marker Display
The system displays the Scene Scan Marker as follows:
a) Toba AR Marker
1. Chicken

Figure 9. Chicken Marker Scan Scene

a) Simalungun AR Marker

1. Large

Figure 10. Large Marker Scan Scene

The AR Scan Marker Scene is used to perform the Augmented Reality process of recognizing the Toba Batak language. The initial step is for the user to scan the previously created marker, and then the 3D object will be displayed on the Android smartphone screen. In this scene, there are three buttons available for the user to use. The back button returns to the main menu, the sound button generates a description in the form of sound, and the info button displays the description panel containing overall information about the 3D object.

4. Displaying the Quiz Scene

The system display for displaying the quiz scene can be seen in Figure 11, as follows:

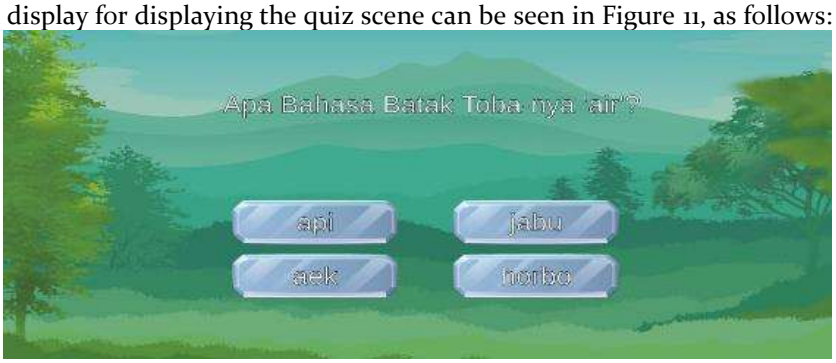

Figure 11. Quiz Scene

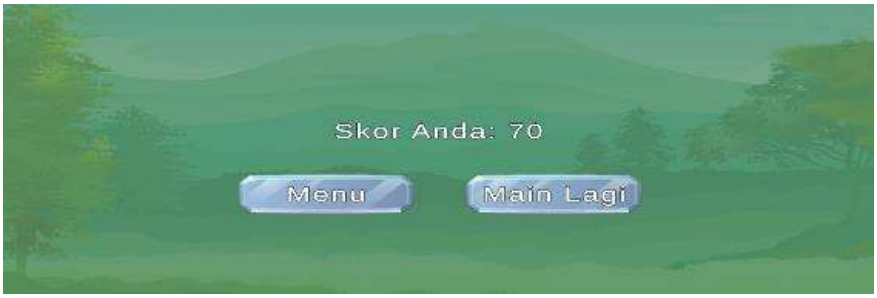

Figure 12. Score Scene

The quiz scene will appear when the user clicks the quiz button in the main menu. This scene displays the quiz questions and scores.

5. Displaying the Material Scene
The system's display of the Material Scene can be seen in Figure 13, as follows:

Figure 13. Material Scene

The material scene will be displayed when the user clicks the material button in the main menu. This scene displays a short learning material on the introduction to the Toba and Simalungun Batak languages.

6. Scene Download Marker Display
The system display for the Scene Download Marker can be seen in Figure 14 as follows:

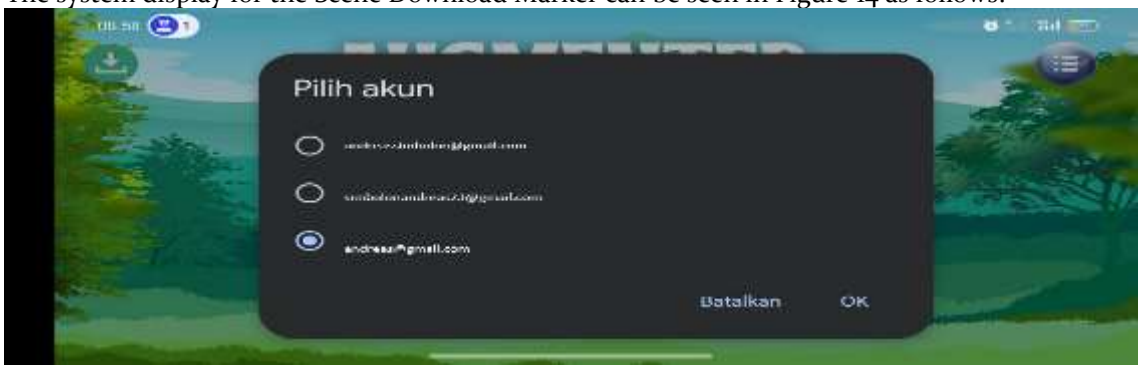

Figure 14. Marker Download Scene

The marker download scene appears when the user clicks the material button in the main menu. This scene displays a short learning material on the introduction to the Toba and Simalungun Batak languages.

4. Conclusion

Based on the research results, design analysis, and application of Augmented Reality Technology in Learning Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method, as described in the previous chapter, the following conclusions can be drawn from the application developed The application of Augmented Reality Technology in Learning Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method uses Blender software to design 3D objects in the Toba-Simalungun Batak Language, the Unity game engine software is used to combine 3D objects from Blender, Photoshop software to design marker images, and the Vuforia SDK to create images into marker targets. To display 3D objects in the Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method, the first step is to detect/scan marker images specifically designed for the Application of Augmented Reality Technology in Learning Toba-Simalungun Batak Language Introduction Using the Android-Based Marker-Based Tracking Method. The detected marker image will display a 3D Batak Toba-Simalungun object according to its respective marker image.The application of Augmented Reality Technology in the Introduction to the Toba-Simalungun Batak Language using the Android-based Marker-Based Tracking Method utilizes Augmented Reality technology in the form of virtual 3D visuals packaged in the form of modules as a creative, innovative learning medium or teaching aid, capable of increasing user enthusiasm in learning various types of Toba-Simalungun Batak language learning. The implementation of Augmented Reality Technology in the Introduction to the Toba-Simalungun Batak Language using the Android-based Marker-Based Tracking Method works well on Android smartphones, utilizing the smartphone camera as a marker image capture device.

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