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Augmented Reality Application Of Sign Language Learning For Deaf People Based On Android

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Keywords

Application, Augmented Reality, Deaf, Learning, Sign Language.

Abstract. Communication is the process of delivering messages from one person to another, which is done verbally or verbally and can be understood by each other. However, some people experience communication difficulties, one of which is deaf people. Deaf people are people with special needs who experience hearing and communication difficulties. This research aims to develop sign language learning resources using BISINDO and SIBI that can be helpful and interesting in learning activities. This research also aims to overcome these obstacles by designing and implementing an augmented reality application that aims to facilitate language learning interactively and educationally. In this research, augmented reality is used to visualize sign language codes through videos projected on a smartphone. This application consists of 3 menus, namely SIBI, BISINDO, and markers. The test results using Blackbox show successful results, meaning the application is as expected. The use of augmented reality in sign language learning for the deaf can increase knowledge about sign language learning.

1. INTRODUCTION

Communication is a process of conveying messages or ideas from one person to another that is verbal and can be understood together. However, some people have difficulty in communication [1], like people who have special needs, for example, deaf people who have difficulty listening to understand communication in everyday life. Although having special needs must still be able to communicate to achieve good communication, it is necessary to understand sign language from both parties [2]. Deafness is a condition of a person experiencing partial or complete hearing loss or experiencing deficiencies or weaknesses, which results in part or all of the hearing aid not functioning so that deaf people cannot use the hearing aid in everyday life, thus greatly affecting language skills as an essential means of communication [3]. There are several ways deaf people interact or communicate, including lip reading and facial expressions. In addition to direct communication with deaf people, sign language can also be applied in other ways, namely by using the field of technology and communication, namely in learning. The application of technology using augmented reality is expected to help deaf people benefit from a good education [4].

Therefore, this research uses augmented reality technology as additional media for learning deaf sign language codes that support sign language learning for deaf people. The use of this technology by utilizing smartphones to be able to facilitate sign language learning [5]. Sign language learning using augmented reality technology or methods is used to visualize videos in the form of words that can be displayed when the user scans the image on the marker directly, and then displays a video explanation of the sign language code. This sign language learning is an additional source of education to create a learning environment that can be used by deaf people or people with no special needs to learn sign language.

Language is a tool to communicate or interact which is very important in daily life [6]. One of the languages used by deaf people is sign language [7]. This sign language plays an important role in the life of deaf people to communicate [8]. In Indonesia, there are two sign languages used by deaf people, namely BISINDO (Bahasa Isyarat Indonesia) and SIBI (Sistem Isyarat Bahasa Indonesia) [9]. BISINDO uses two hand gestures while SIBI only uses one hand to communicate [10]. This language is easily understood by deaf people and people who do not have hearing loss because it is the national language for deaf people in Indonesia [11]. To strengthen communication between deaf people and normal people by using hand gestures and facial expressions that can be understood or understood by both, as an additional medium so that both parties can communicate well.

Previously, there has been research conducted by researchers regarding the use of augmented reality in sign language for people with deafness. This research was conducted by Muhammad Alfi Falan, Ahmad Tri Hanuranto, Retno Hendriyanti with the title of pengenalan bentuk dan warna pada anak penderita tunarungu menggunakan bahasa inggris . This research also applies the gamification method and uses full-word syntax in its approach [12]. In the study, the goal was to help deaf children and normal children learn English through the use of American Sign Language (ASL). In research conducted by Ade Yuliana and Nia Kurnia Asih with the title "Pengenalan Kode Bahasa Isyarat Abjad Tuna Rungu Dengan Memanfaatkan Augmented Reality 3D" with the method Multimedia Development Life Cycle (MDLC) [13].

This study aims to improve the learning of alphabetic sign language codes through android mobile applications. In research conducted by Arvita Agus Kurniasari, Trismayanti Dwi Puspita, Leli Kurniasari discusses the development of educational games with the theme of pengembangan permainan edukasi bertema pertanian cerdas sebagai upaya untuk mendorong minat berwirausaha dikalangan penyandang disabilitas tuna rungu. This research aims to motivate deaf students in SLB Negeri Jember [14].

This research aims to create or create an augmented reality-based application that is used as a learning medium for deaf people in sign language. In developing this augmented reality sign language application, several problems need to be overcome. One of them is how to design an application that can recognize and translate sign language using markers in the form of videos using augmented reality. It is also important is how to measure the level of user satisfaction with the performance of the sign language application [1].

2. METHOD

This stage contains the research used which can be seen in Figure 1.

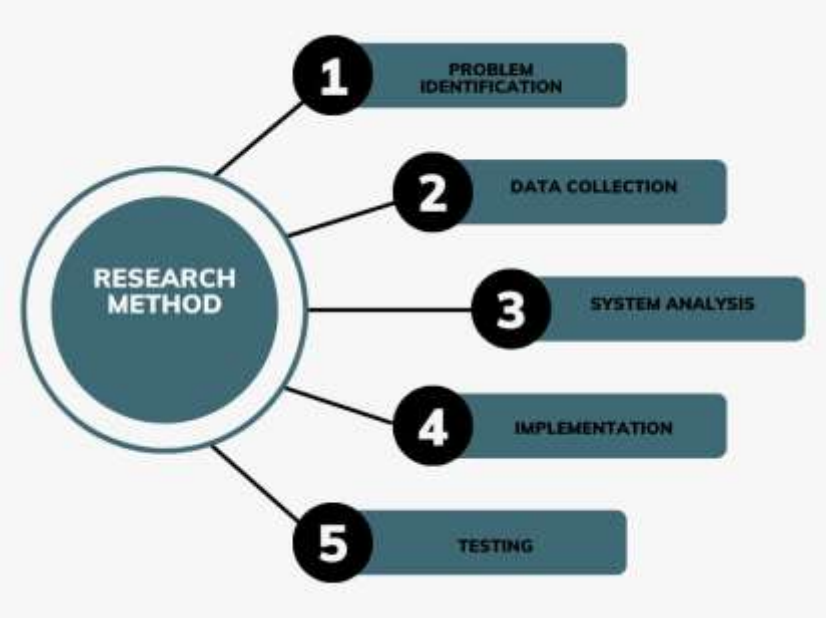

Figure 1. Research Method

Problem Identification

At this stage, it is used to find problems that arise [14]. After that, the formulation of the problem of how the results of the application of augmented reality applications can improve the recognition of Indonesian sign language using market-based methods. The design of the Indonesian Sign Language Learning application with Augmented Reality is deemed necessary to allow people who do not have special needs and people with special needs to interact with video objects. This makes it easy to learn sign language wherever and whenever according to the wishes of the application user.

Data Collection

Data collection is taken from various journal sources entitled Augmented Reality Language Learning for deaf people and the implementation of the application using augmented reality.

System Analysis

The analysis of the current system is still done as shown in Figure 2 which shows the process of learning about sign language in the past.

Figure 2. Analysis of the Past Running System

The following is a definition from Figure 2 of the sign language learning process that goes first.

1. Normal people and deaf people (users)
   Users are people who use the system or interact with the system.
2. School, Library, Youtube, Bookstore
   Tools for learning sign language

The analysis and design of the new system is a proposal from me regarding sign language learning described in Figure 3.

Figure 3. New System Analysis

The following is a definition from Figure 3 of the current sign language learning process.

a. Normal people and deaf people (users)
   Users are people who use the system or interact with the system.
b. Sign language learning app
   This app is used for basic sign language learning.
c. Scan marker
   This marker is used to display a video for basic sign language learning.
d. Sign language video
   This video is about learning sign language

Implementation

Implementation is a stage that has been made into the form of a programming language. Creating a Sign Language AR application using the Unity 3D software engine and creating a user interface with Canva and C#. While making markers or storing markers using the Vuforia application.

Testing

There are two methods used in testing the application, namely the black box method and the user acceptance test (UAT) method. The purpose of black testing is to find out whether all application features have run properly. The purpose of testing on UAT is to find out whether the application is by its features and benefits.

3. RESULTS AND DISCUSSION

This stage describes the implementation and testing results of the augmented reality sign language learning application for the deaf.

Application Implementation

Application implementation is a step to realize the design that has been made to find out the results of the application design.

Main Page Implementation

The prefix page in this application is the initial or main menu. On this main page, there is a start button the start button is used to enter the menu page. The practice page can be shown in Figure 4.

Figure 4. Main Page

Menu Page Implementation

This menu page has SIBI, BISINDO, and marker buttons. This SIB button pressed will enter the SIBI page. The BISINDO button is used to enter the BISINDO page. This marker button is used to download the marker. The menu page can be shown in Figure 5.

Figure 5. Menu page

SIBI Page Implementation

This SIBI page has letters, numbers, family names, about, and exits. The letters, numbers, and family names button pressed will enter the scan ar page. The About button is used to enter the about

page which explains the application. This exit button is used to return to the previous page. The Sibi page can be shown in Figure 6.

Figure 6. SIBI Page

BISINDO Page Implementation

This BISINDO page has letters, numbers, family members, daily words, quizzes, about, and exits. This letter, number, family member, and daily word button is pressed to enter the scan ar page. The about button is used to enter the About page which explains about the application. The quiz button is used to return to the quiz page. The *exit* button is used to return to the previous page. The BISINDO page can be shown in Figure 7.

Figure 7. BISINDO page

Implementation of AR Scene Page

The scene page arises after the user presses the button. The video is displayed according to the marker pointed at by the camera on the smartphone. The exit button is used to return to the previous page. The AR scene page can be shown in Figure 8.

Figure 8. AR Scene Page

Quiz Page Implementation

This quiz page has select answer and exit buttons. The select answer button is for selecting an answer. The exit button is to return to the previous page. The quiz page can be shown in Figure 9.

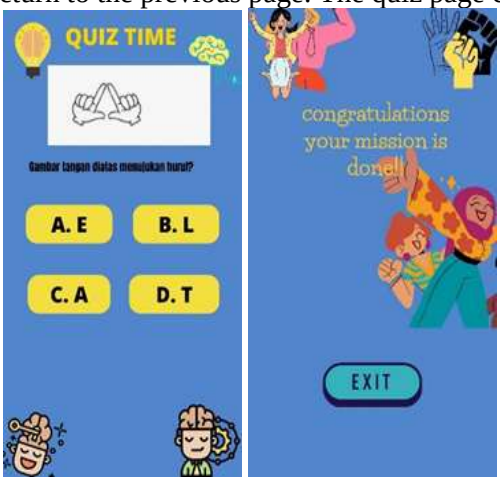

Figure 9. Quiz Page

Application Testing

Blackbox testing is used to test this application, which aims to test whether the application functions as expected [15]. Each test case is entered to see the results of the application. The results given by the application are in accordance or not with the expectations of application development. This test is also for error checking so that if an error is found in the test it can be corrected immediately. The results of Black Box testing are shown in Table 1.

Table 1. Testing

No.	Menu	Test Care	Expected results	Test results
1	start	Click the start button	Enter the menu page	Successful
2	SIBI	Click the SIBI button	Enter the SIBI page	Successful
3	BISINDO	Click the BISINDO button	Enter the BISINDO page	Successful
4	Marker	Click the marker button	Enter the page to download the marker	Successful
5	exit	Click the exit button	Go to the previous page	Successful
6	Quiz	Click the quiz button	Quiz page appears	Successful
7	Numbers, letters,	Click the Numbers, letters,	The ar page appears and	Successful

No.	Menu	Test Care	Expected results	Test results
	question words, family names, everyday words	Ask Words, Family Names, and Colloquial Words buttons and point the camera at the target image.	the video appears and when the target image disappears the video automatically turns off.	
8	About	Click the about button	The About page appears	Successful

The black box test results show that all menus created are valid or successful as expected by the application developer.

4. CONCLUSIONS

This research resulted in the successful development of augmented reality applications in the form of sign language learning systems for Android-based deaf people: Detecting markers in the form of QR codes made to display basic sign language learning videos, implemented in this research using Vuforia and Unity software. Based on the implementation steps above, the Android-based Sign Language Learning Augmented Reality Application for Deaf People was successfully designed and tested. All application functions have been successfully implemented based on the results of functionality tests on several different types of smartphones.

REFERENCES

[1] M. Dewi, T. Wahyuningrum, and N. A. Prasetyo, "Pengenalan Kata Bahasa Isyarat Indonesia (BISINDO) Menggunakan Augmented Reality (AR)," *INISTA J. Informatics, Inf. Syst. Softw. Eng. Appl.*, vol. 3, no. 2, pp. 53–60, 2021, [Online]. Available: https://journal.ittelkom-pwt.ac.id/index.php/inista/article/view/256

[2] A. Annisa, N. Hiron, and M. A. Khairul Anshary, "Rancang Bangun Aplikasi Konversi Bahasa Isyarat Ke Abjad dan Angka Berbasis Augmented Reality dengan Teknik 3D Object Tracking," *J. Online Inform.*, vol. 2, no. 1, p. 25, 2017, doi: 10.15575/join.v2i1.82.

[3] S. Panjirai and B. Robiin, "Augmented Reality Sebagai Media Pembelajaran Penggambaran Ekosistem Hewan Darat Untuk Anak Tunarungu," *JSTIE (Jurnal Sarj. Tek. Inform.*, vol. 9, no. 2, p. 55, 2021, doi: 10.12928/jstie.v9i2.19466.

[4] D. Nincarean, M. B. Alia, N. D. A. Halim, and M. H. A. Rahman, "Mobile Augmented Reality: The Potential for Education," *Procedia - Soc. Behav. Sci.*, vol. 103, pp. 657–664, 2013, doi: 10.1016/j.sbspro.2013.10.385.

[5] R. A. Mursita, "Respon Tunarungu Terhadap Penggunaan Sistem Bahasa Isyarat Indonesa (Sibi) Dan," *Inklusi*, vol. 2, no. 2, pp. 221–232, 2015.

[6] J. K. Hikmalansya, "Aplikasi Pembelajaran Bahasa Isyarat Berbasis Android," *Inf. J. Ilm. Bid. Teknol. Inf. dan Komun.*, vol. 1, no. 2, pp. 118–124, 2016, doi: 10.25139/inform.v1i2.849.

[7] R. Sinukun and Y. Darise, "Aplikasi Bahasa Isyarat Sederhana Berbasis Android," *J. Teknol. Inf. Indones.*, vol. 2, no. 1, pp. 20–26, 2019, doi: 10.30869/jtii.v2i1.305.

[8] N. Hikmatia and M. I. Zul, "Aplikasi Penerjemah Bahasa Isyarat Indonesia menjadiSuara berbasis Android menggunakan Tensorflow," *J. Komput. Terap.*, vol. 7, no. 1, pp. 74–83, 2021, [Online]. Available: https://jurnal.pcr.ac.id/index.php/jkt/

[9] A. Irdandi, H. Nasution, and A. S. Sukamto, "Perancangan Aplikasi Multimedia untuk Pengenalan Bahasa Isyarat bagi Anak Tunarungu Berbasis Android," *JUSTIN (Jurnal Sist. dan Teknol. Informasi)*, vol. 5, no. 4, pp. 241–246, 2017, [Online]. Available: https://jurnal.untan.ac.id/index.php/justin/article/view/21757

[10] R. Fatmawati, R. Asmara, Y. R. Prayogi, and R. Y. Hakkun, "Voice-Based Indonesian

Sign Language System (SIBI) Learning Application Using Open SIBI," *Technomedia J. (TMJ*, vol. 7, no. 1, pp. 22–39, 2022.

[11] A. Yuliana and N. K. Asih, "Pengenalan Kode Bahasa Isyarat Abjad Tunarungu Dengan Memanfaatkan Augmented Reality 3D," *Tedc*, vol. 13, no. 3, pp. 219–227, 2019.

[12] A. A. Kurniasari, T. Dwi Puspitasari, L. Kurniasari, and P. N. Jember, "ARIOT: Permainan Edukasi Pertanian Cerdas Sebagai Upaya Menumbuhkan Agro-Entrepreneurship Pada Siswa Penyandang Disabilitas Tuna Rungu," *J. Sains Komput. Inform. (J-SAKTI*, vol. 6, no. 2, pp. 1087–1101, 2022.

[13] Y. I. Kurniawan and A. F. S. Kusuma, "Aplikasi Augmented Reality untuk Pembelajaran Salat bagi Siswa Sekolah Dasar," *J. Teknol. Inf. dan Ilmu Komput.*, vol. 8, no. 1, p. 7, 2021, doi: 10.25126/jtiik.2020712182.

[14] J. Amanullah and L. Santoso, "Perancangan Media Pembelajaran Interaktif Bahasa Isyarat," *J. Ilm. Elektron. dan Komupter*, vol. 15, no. 2, pp. 242–249, 2022, [Online]. Available: http://journal.stekom.ac.id/index.php/elkom□page242

[15] A. Falan, "Aplikasi Pengenalan Bentuk Dan Warna Menggunakan Bahasa Inggris Pada Anak Penderita Tunarungu Berbasis Augmented Reality," *e-Proceeding Eng.*, vol. 8, no. 6, pp. 2845–2852, 2022.