

# Implementation of Sibi And Bisindo Letters Recognition Using Augmented Reality During Pandemic

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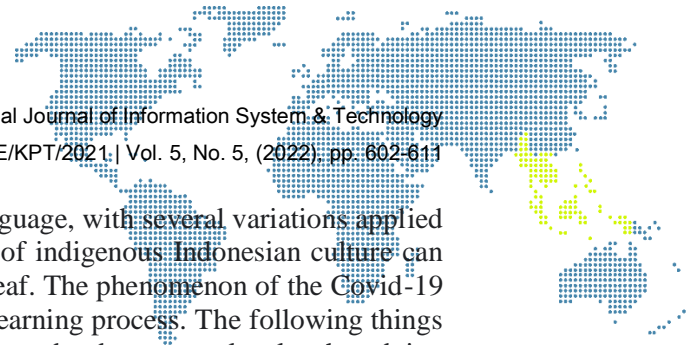
## Abstract

*BISINDO or Indonesian Sign Language, is one of the sign systems used in Indonesia. BISINDO comes from the first language or mother tongue for the deaf. The phenomenon of the Covid 19 pandemic has changed the world of education globally. The results of a survey of people with hearing impairments in Bali, especially in Denpasar, showed that 72 respondents, 62.5%, stated that it was difficult to understand the learning process carried out at home during the pandemic. 37.5% indicated that they had no difficulty understanding the learning process at home during the pandemic. According to respondents, 75.7% of respondents chose BISINDO, which is easy to understand and 24.3% chose SIBI. An augmented reality application was designed to recognize the BISINDO alphabet from this data. This application is expected to provide a solution to make it easier for deaf people to understand BISINDO sign language during a pandemic. SIBI is an adaptation of American Sign Language which is currently applied in special schools (SLB). To provide support in learning SIBI sign language, in advance of technology, the design of Augmented Reality to introduce SIBI letters will help in the learning process. The results of the black box test show that all the features and functions of the application can run well. In observing the response time when scanning markers using the Xiaomi PocoF1 marker on the SIBI letters, the average time is 6.05 seconds. Observation of the scan distance of SIBI letters, the average scan distance of markers that can be scanned at a distance of 5 cm to 50 cm.*

**Keywords:** BISINDO, SIBI, Augmented Reality, Learning

## 1. Introduction

Sign language is communication through hand or finger movements that form a word or sentence. In communicating with the deaf and mute using sign language implemented, there are two sign language models in Indonesia, namely SIBI (Indonesian Sign Language System) and BISINDO (Indonesian Sign Language). SIBI is used as a sign language in schools, not as a medium of daily communication. This is because the vocabulary in SIBI is made only by converting spoken Indonesian into sign language. While BISINDO is a sign language that has been used by an area, group, community for the deaf from the start, it can be said that BISINDO is the mother tongue of the deaf. The problem is not the inability to communicate but the result of developing language skills, namely the inability to understand the symbols and rules of language [1]. The Indonesian Language Research Laboratory (LRBI) of the University of Indonesia, Pheter Angdika said that SIBI was taken from United States sign language and added initial and final affixes. SIBI has an additional feature in the form of sentences consisting of three sign words that will be displayed sequentially. The SIBI learning system can also be used for the general public to learn sign language. To make it easier for the deaf to understand the SIBI sign language, which is the standard of education in every special school, a mobile-based application is used to support the understanding of SIBI.



BISINDO is an adaptation of American Sign Language, with several variations applied in each region. And also, the natural sign language of indigenous Indonesian culture can be easily used in daily interactions of signs for the deaf. The phenomenon of the Covid-19 pandemic has resulted in significant changes in the learning process. The following things need to be considered to support government policies and reduce stress levels when doing social distance. The IASC (Inter-Agency Standing Committee) states that key psychosocial principles, such as hope, security, peaceful social relations, and self-and community-based efficacy, should be embedded in every intervention, including supporting the needs of persons with disabilities during COVID-19 outbreaks. The results of a silent survey of 72 respondents stated that 62.5% had difficulty understanding distance learning at home, and 37.5% indicated that they had no difficulty in the learning process at home. According to respondents, 75.7% chose BISINDO, and 24.3% chose SIBI. To help the speech impaired in the BISINDO learning process.

The Sign Language Augmented Reality Application design as a learning medium is expected to provide a solution in introducing the Indonesian Sign Language System to deaf children with SIBI letter recognition material. Multimedia can convey exciting information and touch various senses: sight, hearing, and touch [2]. The use of graphics, illustrations, text, and sound in education as a medium that can provide effectiveness and efficiency in learning objectives. The presence of visualization can provide different stimuli from each other [3]. Various studies on conventional and modern learning media have been carried out, including [4], [5], [6]. Liu, et al (2018) stated that mobile-based augmented reality applications can help students improve basic listening and speaking skills [7]. Combining educational content with the spatial environment of virtual objects relevant to everyday life can improve learning outcomes, one of which is by utilizing Augmented Reality technology [8]. SIBI and BISINDO sign language applications can display visuals in videos with sign language according to augmented reality technology.

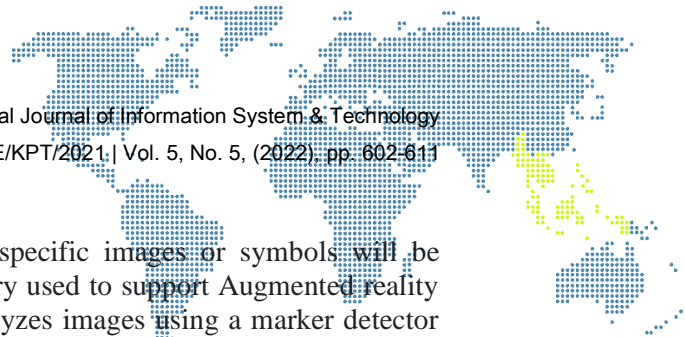
## **2. Research Methodology**

### **2.1. System Description**

This study uses augmented reality technology to visualize the SIBI and BISINDO sign languages. In the current education and learning process, the application of Augmented reality technology plays an important role in conveying information with a visual display supported by audio and video. Two applications are used in implementing Augmented Reality, namely Vuforia and Unity.

### **2.2. Augmented Reality**

Augmented Reality (AR) is an environment that combines 3D virtual objects into a real environment. AR allows users to interact in real-time [9]. Augmented Reality (AR) is a term for an environment that combines the real world and the virtual world created by computers so that the boundary between the two becomes very thin. This system is closer to the real environment (real). This system is more relative to the real environment (real). Therefore, the reality is prioritized in this system [10]. Augmented Reality is a technology that combines 2D or 3D virtual objects into an interactive and real-time real environment [11]. A set of technologies allows users to interact with computers in a simulated environment (either a simulated real-world or an imaginary world [12]. AR Kits assist students in visualization and demonstrate that AR teaching tools enhance student visualization through three dimensions: graphics, representations, and real objects [13]. In the current education and learning process, the application of Augmented reality technology plays an important role in conveying information with a visual display supported by audio and video. Two applications are used in implementing Augmented Reality, namely Vuforia and Unity. The following explains and uses each in the application [15].

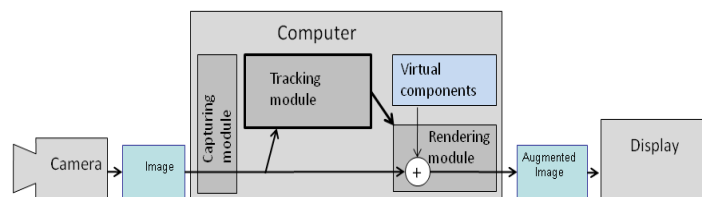


**a) Vuforia**

Simply put, markers prepared in the form of specific images or symbols will be entered into the Vuforia database. Vuforia is a library used to support Augmented reality on Android for the Unity 3D program. Vuforia analyzes images using a marker detector and generates 3D information from markers that have been detected via the API (application programming interface).

**b) Unity**

Unity Engine has a complete framework for professional development. The core system of this engine uses several programming languages, including C#, javascript, and boo. Unity3D editor provides several tools to simplify development, namely Unity Tree and terrain creator to simplify the creation of vegetation and terrain and MonoDevelop for the programming process. The working principle of Augmented Reality and its application can be seen in the image below explaining how AR works. The working process is as follows.



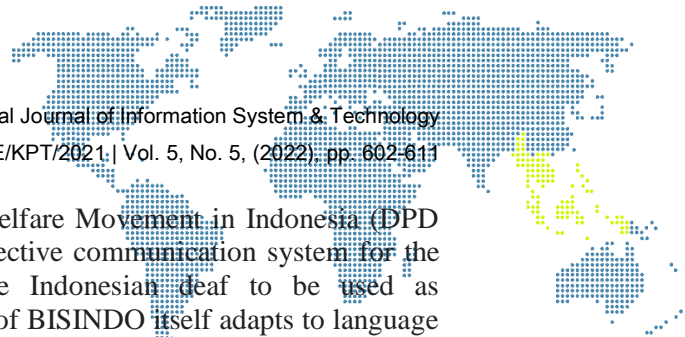
**Figure 1. Augmented Reality Working Principle**  
 Source: Author

**2.3. Indonesian Sign Language System (SIBI)**

Sign language is a form of communication with hand or finger movements that form words or sentences. The standardized Indonesian Sign Language System (SIBI) is one media to assist deaf communication in the broader community. Systematic finger arrangement, various hand movements that symbolize Indonesian vocabulary. People who experience hearing loss or lose the ability to hear due to damage or malfunction of part or all of their hearing aids. They experience disturbances in language development are called deaf [16]. Sign language uses gestures and facial expressions as a symbol of the meaning of spoken language. The deaf are the main group who use this language, to express their thoughts, usually by combining hand shape, orientation, hand gestures, body arms, and facial expressions [17].

**2.4. Indonesian Sign Language (BISINDO)**

Language is a form of communication through hand or finger movements that form a word or sentence. Deaf people are people who experience a lack or loss of hearing ability caused by damage or malfunction of part or all of the hearing apparatus so that they experience obstacles in their language development. The explanation according to Gulo (1996) is a reaction or answer that depends on the stimulus or is the result of the stimulus. Chaiorul Anam (1989) states that language is a language that is done by using body movements and facial expressions as symbols of the meaning of spoken language. The deaf are the main group who use this language, usually by combining hand shape, orientation, and hand movements, arms, and facial expressions to express their thoughts. Language development among the deaf is divided into 2 languages, namely SIBI (Indonesian Sign Language System) and BISINDO (Indonesian Sign Language). A researcher from the Indonesian Language Research Laboratory (LRBI) at the University of Indonesia, Pheter Angdika said, SIBI was taken from the United States language and added with a beginning and a suffix. According to Hakim, Lukman, Samino, et al (2008), namely: "the language system used as a medium that helps communication between deaf people or communication with deaf people in the wider community [18]. BISINDO,



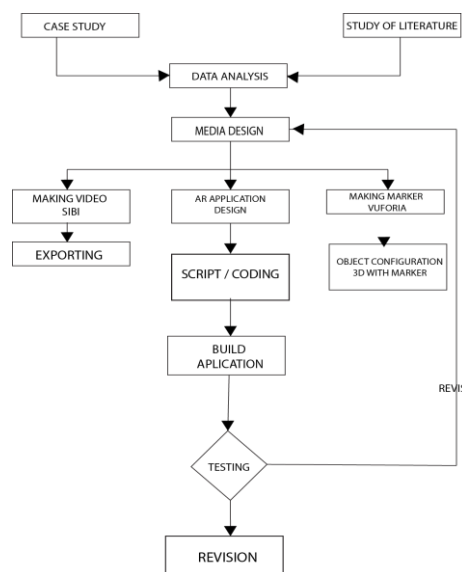
according to the Governing Council of the Deaf Welfare Movement in Indonesia (DPD Gerkatin DKI Jakarta (2010), is a practical and effective communication system for the deaf in Indonesia which was developed by the Indonesian deaf to be used as communication between deaf people, where the use of BISINDO itself adapts to language understanding deaf people from various deaf backgrounds without providing an Indonesian language affix structure [19] In law number 8 of 2016, namely the Disability Law, it is explained that a language is a form of accessibility service. Sign Language used officially in the law is the mother tongue of the deaf community.

### 3. Result and Discussion

In data analysis using existing studies or references in developing augmented reality applications for letter recognition in SIBI and BISINDO Sign Language. The analysis carried out includes the advantages and disadvantages of the application of augmented reality letter recognition in SIBI and BISINDO Sign Language. The application development in this stage describes how a system is built and implemented to design the user interface used for this system and the inputs and outputs of the system. This process converts the previously mentioned requirements into regeneration into the software before coding begins. Testing is carried out with two techniques, the first using the Blackbox method to find out the shortcomings and problems of the application first. Second, by testing the feasibility of using the interactive comic application based on a test after using the application, which consists of four assessment points, including; 1) The display of the interactive comic application, 2) contains learning elements, 3) the material presented is easy to understand, 4) user friendly. The feasibility test was conducted online with a google form conducted by two sign language teachers. Application testing is done by distributing questionnaires to teachers and students. It was testing the questionnaire using a closed type of questionnaire.

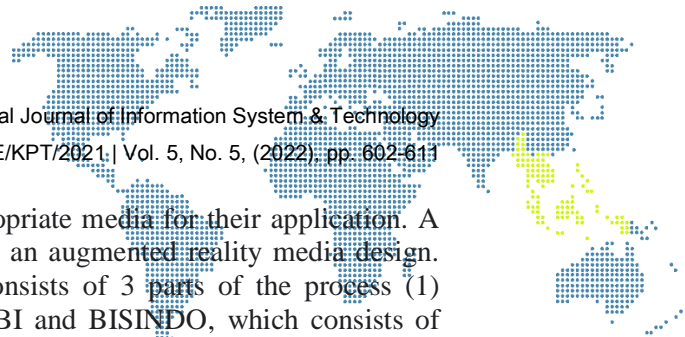
#### 3.1. System Implementation Flow

Utilizing these technological developments creates opportunities for cultural preservation in creative media. The method used for Augmented Reality is R&D (Research and Development), which produces a certain product and tests its effectiveness [20]. This method is also explained with a research flow chart. In detail, the stages of internal work can be seen in Figure 2.



**Figure 2.** Augmented Reality Implementation Process Flow

The system design flow starts from observing the problem and studying the literature to finding the correct basis and data through references. The second stage is to survey to



analyze the need for sign language letters and appropriate media for their application. A collection of needs analyses is carried out to create an augmented reality media design. The structure of the AR application framework consists of 3 parts of the process (1) Making a video of the character recognition of SIBI and BISINDO, which consists of recognizing the letters A to Z, then exported to the unit. (2) AR application design includes SIBI and BISINDO marker and video databases in unity. After that, the app is built into the phone. (3) Making markers consists of configuring 2D objects in posters for recognizing letters of SIBI and BISINDO with Vuforia to store the marker database.

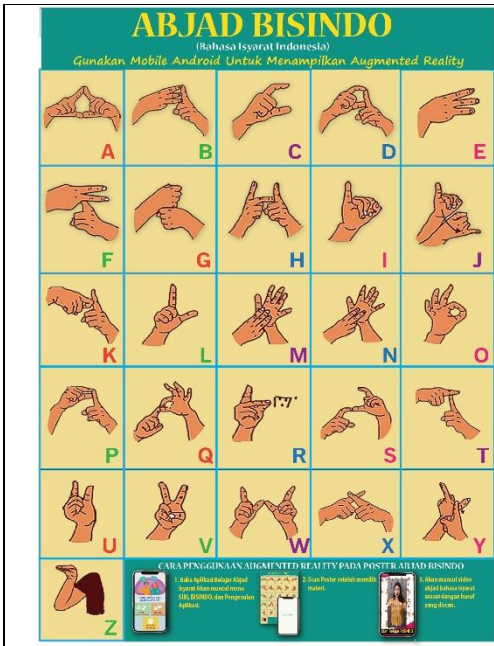
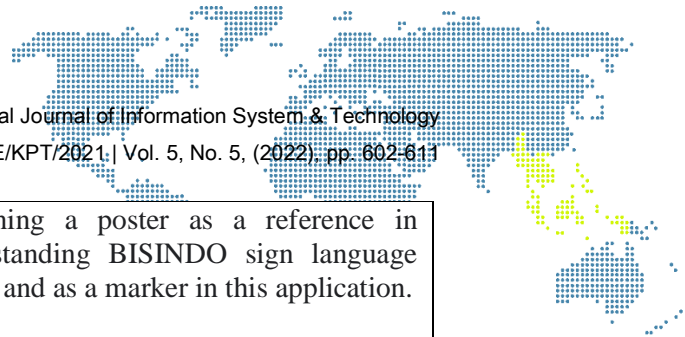
The process can be said to be going well, so testing the augmented reality prototype with the planned data and needs is carried out. Black box testing will be carried out, observing the marker scanning time and the scanning distance. Testing SIBI and BISINDO letter recognition applications are carried out to provide input in application development. The test results will determine the application feasibility step if the test results are good or will be the final result, but the design is revised if the test results are not good.

### 3.2. System Interface

On the system interface, the assets of the application display can be explained in Table 1 as follows:

**Table 1. System Interface and Description**

Assets	Description
	<p>Designing a poster as a reference in understanding SIBI sign language letters and as a marker in this application</p>



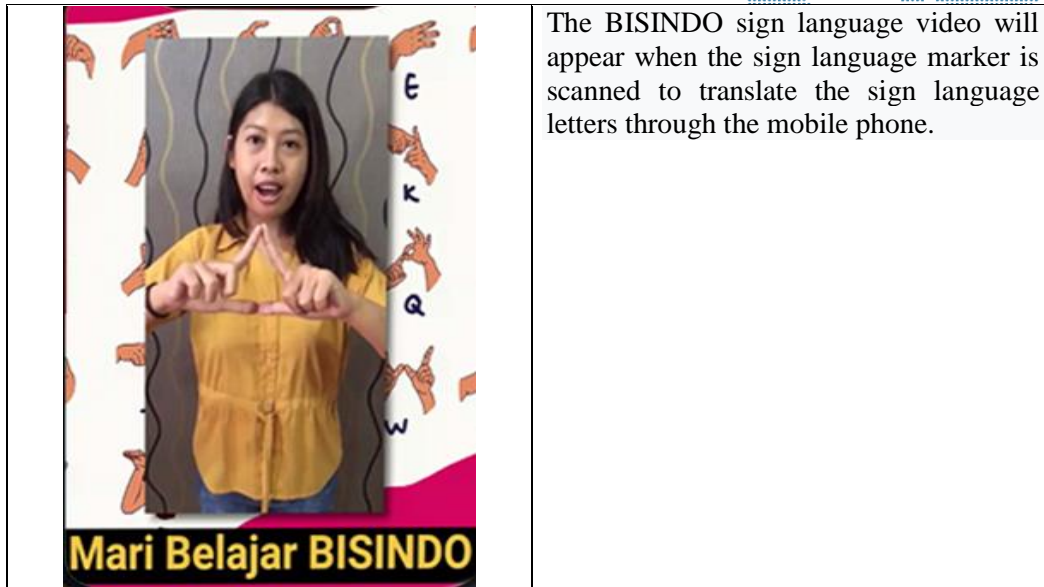
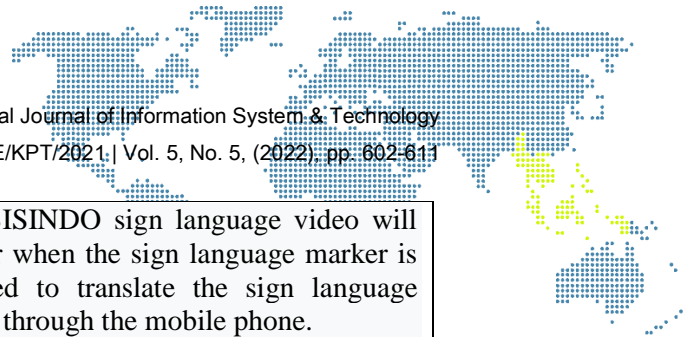
Designing a poster as a reference in understanding BISINDO sign language letters and as a marker in this application.



The SIBI and BISINDO sign language application user interface on the main menu display consists of two buttons: the SIBI, BISINDO button, and the application button.



The SIBI sign language video will appear when the sign language marker is scanned to translate the sign language letters through the mobile phone.



### 3.3. System Testing

The Sign Language Augmented Reality Application design as a learning medium is expected to provide a solution in introducing the Indonesian Sign Language System to deaf children with SIBI letter recognition material. Multimedia can convey interesting information and can touch various senses: sight, hearing, and touch [2]. The use of graphics, illustrations, text, and sound in education as a medium that can provide effectiveness and efficiency in learning objectives. The presence of visualization can provide different stimuli from each other [3]. Various studies on conventional and modern learning media have been carried out, including [4], [5], [6]. Liu, et al (2018) stated that mobile-based augmented reality applications can help students improve basic listening and speaking skills [7]. Combining educational content with the spatial environment of virtual objects relevant to everyday life can improve learning outcomes, one of which is by utilizing Augmented Reality technology [8]. SIBI and BISINDO sign language applications can display visuals in videos with sign language according to augmented reality technology.

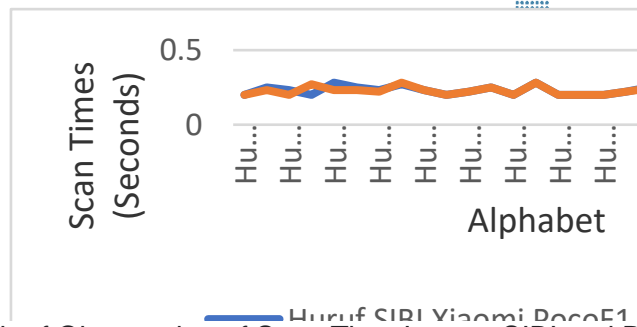
After all the merging processes have been completed, the application test step is carried out before testing the application's feasibility using a black box. In black-box testing, several methods can be used, one of which is alpha testing. Alpha testing aims to identify and eliminate problems before the application reaches the user. The following table 2 shows the results of the tests carried out.

**Tabel 2.** Application Testing Using Blackbox

<i>System Module Testing</i>	<i>Result</i>
<i>App installation</i>	Succeed
<i>Button function on the menu</i>	Succeed
<i>BISINDO Letter marker installation</i>	Succeed
<i>SIBI Letter marker installation</i>	Succeed
<i>Video display and sound</i>	Succeed

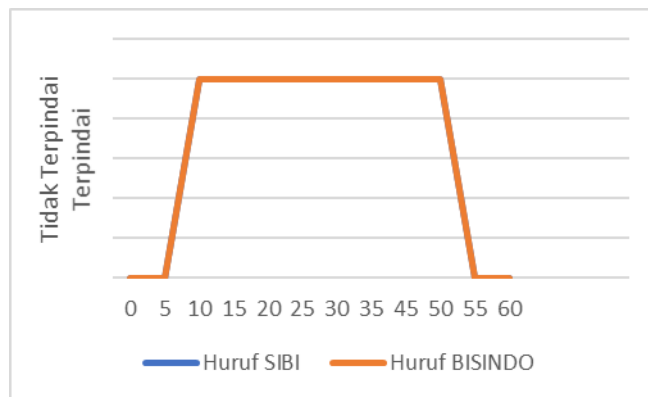
Performance observations are carried out by paying attention to the response time and scanner distance. Scan time observations are carried out to determine how quickly the device can respond when the camera scans the marker to bring up the AR object. This observation was carried out by scanning 52 SIBI and BISINDO sign letter markers in good lighting conditions and a tilt angle of 0° or a straight line opposite the marker as far

as 20 cm. Figure 3 shows the results of observing the average response time with devices with different specifications.



**Figure 3.** Graph of Observation of Scan Time Letters SIBI and BISINDO

This observation was made when scanning markers by the Xiaomi PocoF1 mobile device. In the observation, distance variations are given to determine the minimum and maximum range of the device in scanning markers measuring 5 x 6 cm. Figure 5 below is the result of observing the scan distance in good lighting conditions and a tilt angle of 0° or a straight line opposite the marker.



**Figure 4.** Graph of Scanning Distance Observation Letters SIBI and BISINDO

#### 4. Conclusion

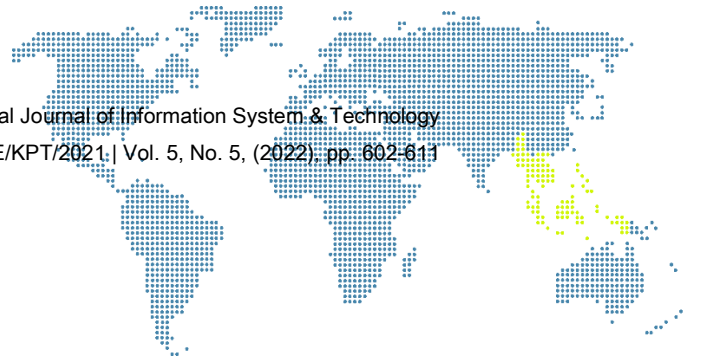
By designing applications using Augmented Reality, it is expected to provide creative solutions in the teaching and learning process, especially in the introduction of SIBI and BISINDO sign letters. Users, especially deaf children, can stimulate their creativity, improve concentration, and improve language recognition skills in the future through a game using an attractive visual display. SIBI and BISINDO Sign Language Augmented Reality Applications as Learning Media have been successfully built. The results of the black box test show that all the features and functions of the application can run well and are supported by Unity 3D and Vuforia software which is very good at developing AR technology. In observing the response time when scanning markers using the Xiaomi PocoF1 marker on the BISINDO letters, the average time is faster than the SIBI letter marker, which is 5.98 seconds for the letters BISINDO and 6.05 seconds for the letters SIBI. Observation of scan distance The letters of SIBI and BISINDO have the same scan distance, which the average marker can be scanned with a length of 5 cm to 50 cm. Marker scanning works best when carried out in bright lighting conditions to minimize the occurrence of errors or scan failures.





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