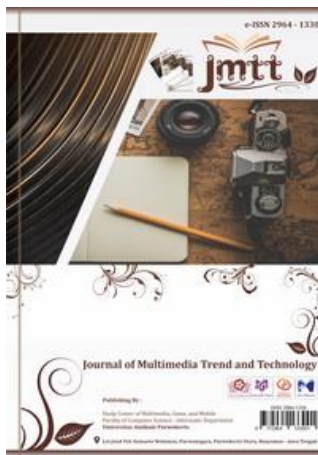


Gesture to Text and Text to Speech Models for Assistance with Speech Impaired People

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ABSTRACT

Special Schools in Indonesia are special educational institutions for disabilities. Persons with disabilities, especially the speech impaired, are also in the spotlight in the education sector and need attention. Education for disabilities requires special skills in presenting learning to students with disabilities. The problems that arise in learning for people with disabilities are quite complex. There are not many teachers who are able to provide learning to the speech impaired. They have difficulty with the style of Sign Language used by the speech impaired. This paper will discuss how learning models and techniques for the speech impaired are packaged, the aim is none other than to help teachers present learning for the speech impaired. Standards on teaching materials such as sign language also seem to really need to be done, therefore we first prepared the concept of sign language which will be used as data processing in information for speech impaired persons. We use in solving this problem using waterfall development, and to complement the data we use literature studies and interviews. The results obtained are in the form of a platform that teachers use as a learning medium for speech-impaired people.

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INTRODUCTION

Learning is certainly something that everyone must do. Because in essence education is a form of learning patterns in someone during his life. Education knows no age or boundaries[1][2]. From birth to death humans will certainly continue to learn. What is in the spotlight in the eyes of the general public is what if someone has a disability? Can they learn optimally? Specifically, this paper will discuss learning for speech-impaired or mute disabilities[3].

The deaf and mute are the main groups who use this language. Sign languages are unique in their kind in each country. In Indonesia, two types of sign languages are used, namely the Indonesian Sign Language System, in Indonesian is "Sistem Isyarat Bahasa Indonesia (SIBI)" and "Bahasa Isyarat Indonesia (BISINDO)" it mean Indonesian Sign Language[4]. However, in Indonesia itself, the system commonly used today is the Indonesian Signing System[5]. The Indonesian Language Sign System is one of the media to help communicate among deaf or mute people in the wider community.

In education in Indonesia for services to people with disabilities there are several problems faced, including that of a number of teachers in special schools there are only at least 1-4 teachers who understand sign language while the others do not understand sign language[6]. However, currently all teachers in SLB use sign language without prior planning to convey information or communicate with students because they find it difficult to convey information or communicate using the general sign language provided by the government called SIBI [4][7]. Apart from the teacher, students also experience difficulties when communicating directly with people who do not understand sign language[8]. So there will be miscommunication between students and teachers or the community because teachers or the community sometimes do not understand what information they get from the students[9].

The information conveyed by teachers is sometimes different from what students receive because of differences in teacher delivery and students' understanding of communication. This difference arises because the teacher conveys information using sign language without prior planning. The use of sign language without prior planning results in the lack of standardization of sign language as provided by the government[10].

With the participation of information technology, everything is possible, such as learning. Currently there are many information technology innovations designed for education and learning. We can see examples of this, namely the smart classroom model, or the smart campus[6]. Many technologies such as AI, Cloud and IoT have played a role in the development of educational information technology. One that will be discussed in this paper is media technology such as computer vision. Where computer vision is considered capable of handling learning problems for this disability[11][3].

Computer Vision is an automatic system for analyzing images and videos by a computer with the aim of obtaining information and understanding of an object [10]. In general, the aim of developing Computer Vision is to duplicate the capabilities of the human eye in terms of image capture/recording, image analysis or image understanding for application in a machine or computer[10][12]. In other words, computer vision is the ability of a machine or computer to see and understand an image that is equal to or even exceeds the ability of real human vision[11].

Gesture can refer to any non-verbal communication intended to communicate a specific message. Gesture can be defined as any physical movement, large or small, that can be interpreted by a motion sensor[9][13]. This may include anything from an index finger to a roundhouse kick or a nod of the head to a pinch or wave of the hand. Movements can be wide and sweeping or small and contained. In some cases, the definition of "gesture" may also include voice or verbal commands[11].

Based on the problems and obstacles that have been described, the author will build an application that can help teachers and students learn SIBI sign language as well as students with speech impairments can convey information or communicate with the general public using gesture to text to convert sign language into text form. to speech to convert the text conversion results to voice[3][7].

METHOD

In our method, we use 3 method steps, namely, data collection, research methods, and model development. The explanation is as follows:

1. Data collection.

Based on books, journals, e-books, websites, research related to data collection is carried out by studying, researching and examining various literature from books, scientific journals, internet sites and other reading related to the application to be built.

2. Research methods.

Research and data processing are carried out by studying, researching and examining various literature from books, scientific journals, internet sites and other readings related to the application to be built. Then we conducted a direct survey of teachers and students with speech impairments to observe the characteristics, habits and processes that occur in the classroom which can later become input and reference for making application media.

3. Model Development.

The software development method used is the waterfall method. The Waterfall method is a systematic method and its development is carried out sequentially. The stages that are passed must wait for the previous stage and run sequentially. The following is the flow of the waterfall method.

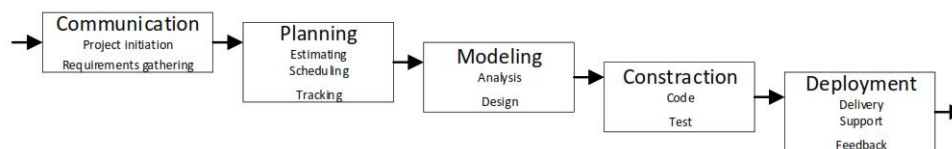


Figure 1, Media development using the waterfall model
(Pressman, R. 2010. Software Engineering A: Practitioner's Approach 7th Edition ed)[14].

- System / Information Engineering and Modeling, At this stage is to look for the needs of the entire system that will be applied in the form of software.
- Software Requirements Analysis, The needs search phase is intensified and focused on software. To find out the nature of the program to be made, for example the functions needed, the user interface, and so on.
- Design, At this stage, the system and software that will be built will be designed in accordance with the needs that have been analyzed at the needs analysis stage.
- Coding, At this stage, the design results must be transformed into a form that can be understood by machines, namely into a programming language through a coding process. This stage is the implementation of the design stage.
- Testing, This stage is the stage of testing the software and its functions so that the software is free from errors, and the results must be truly in accordance with the requirements that have been previously defined.
- Maintenance, The maintenance stage is the stage of operating the software in its environment and carrying out maintenance, such as adjustments or changes due to adaptation to the actual situation.

RESULT & DISCUSSION

System analysis is defined as a stage that aims to identify and evaluate problems and determine needs so that improvements can be made. The system analysis stage discusses several analyses, namely problem analysis, analysis of ongoing procedures, analysis of similar applications, system architecture analysis, non-functional requirements analysis, and functional requirements analysis.

Analysis of ongoing procedures aims to study and evaluate the current system and formulate goals to be achieved with the new system, as well as formulating a system development plan. Based on the results of observations that have been made and interviews with related parties, it was found that ongoing communication procedures can be seen in Figure 2 below:

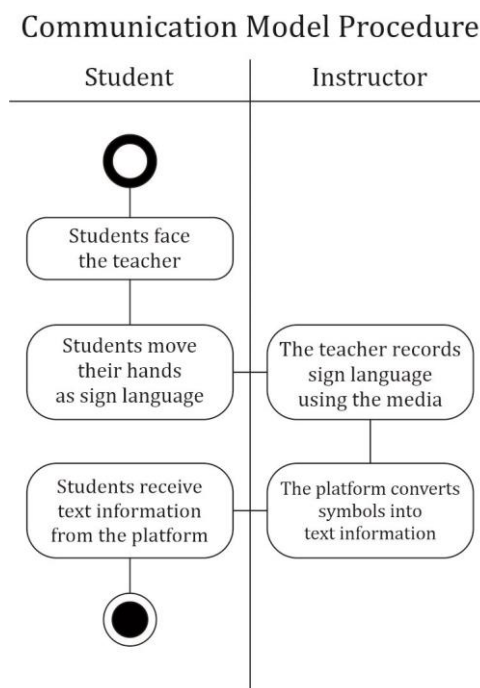


Figure 2, Model of the proposed learning procedure.

Analysis Distance is the distance when communicating. The following is an analysis of the distance when communicating which can be seen in Table 1.

Table 1, Communication distance analysis.

Zone	Distance	Description
Intimate	0 – 45,5 cm	Communicate with family and people closest to you.
Personal	45,5 cm – 124 cm	Communicating with friends.
Social	124 cm – 378 cm	Communicate with people you don't really know.
Public	378 cm – N/A	Communicate in front of many people.

In the next analysis is the analysis of the level of light sensitivity. Light Analysis is the light conditions required for the system to detect sign language gestures[15]. This light will also affect the level of accuracy of the resulting output gesture detection. Light analysis can be seen in Table 2.

Table 2, Analysis of light conditions to detect gestures.

Light Condition	LUX	Description
Dark	0	Dark place or no light
Dim	20 – 50	In a room with low light
Normal	50 – 80	In a room with normal light

Next is the arrangement of gesture data which will be read as a database for visual processing detection. SIBI Gestures is a sign language used by people with speech impairments. The letter and number gestures used in this application can be seen in Table 3.

Table 3, SIBI Gesture Dataset for letters.

Letter	Symbol	Letter	Symbol	Letter	Symbol	Letter	Symbol
A		I		O		U	
B		J		P		V	
C		K		Q		W	
D		L		R		X	
E		M		S		Y	
F		N		T		Z	
G							
H							

Analysis of the Gesture To Text method to describe how the system that will be created can detect sign language gestures. Gesture To Text is done by recognizing the shape of the sign language gesture, then after recognizing the form of the sign language gesture it will be processed using Template Matching to match the form of the entered sign language gesture with the gesture template.

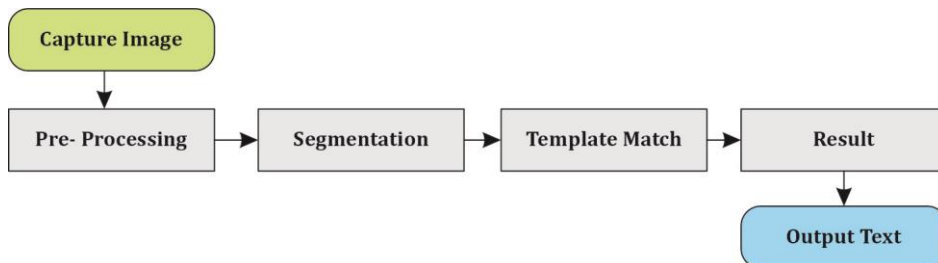


Figure 3, Template data matching process.

Using the Google Text To Speech API allows developers to convert text into voice. This service can be processed offline and online. In offline processing, the languages supported are limited to the languages found on each device/smartphone[16]. In contrast to online processing which allows complete language support. However, to use it, users are required to have an internet connection to be able to access the database on the Google server online. The flow of using the Google Text To Speech API to convert text into voice (speech).

SIBI (Indonesian Sign Language System) is one of the SIBI sign language recognition applications on Google Playstore. Made by LGA Indie Dev. This application helps people with speech impairments to make it easier to recognize SIBI sign language. This application also has material for introducing alphabets, numbers and game material. The game material contains alphabetical or numerical order. This application is an alternative learning media for Android smartphone users.

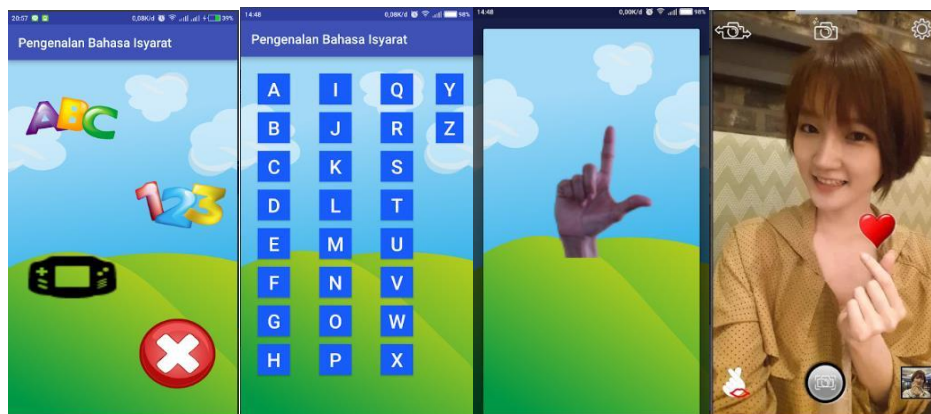


Figure 4, Platform model on smartphone.

VR Gesture Player is a video player application that uses VR (Virtual Reality) and uses hand gestures. Created by MACRON. This application can play videos with VR and change videos by moving the hand which is recorded by the smartphone's rear camera, apart from that, hand gestures can also control the application. The appearance of the VR Gesture Player application can be seen in Figure 5 below.

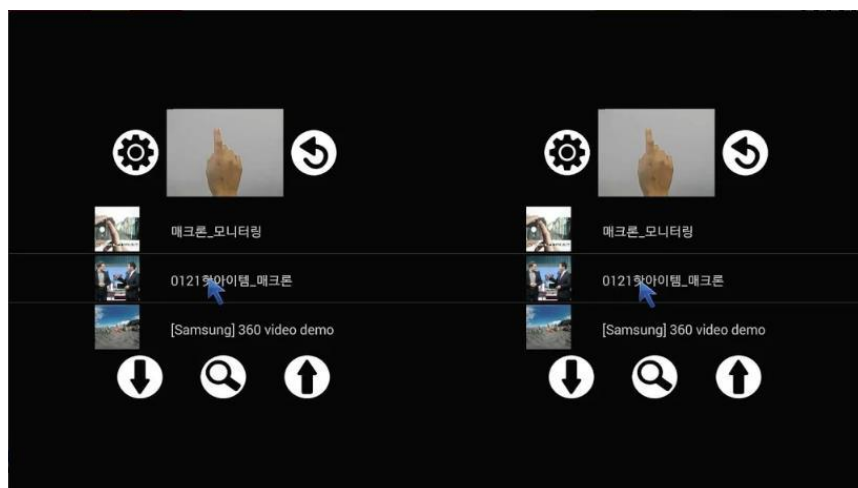


Figure 5, View of the VR Gesture Player Application.

Based on the beta testing results in Table 4.10. From the interview results, it can be concluded that the Gesture To Text and Text To Speech applications are quite helpful for communicating with speech-impaired students and understanding SIBI, but are not yet optimal.

CONCLUTIONS

Based on the results of research on the Development of Gesture To Text and Text To Speech Applications for Speech Impaired Sufferers, it can be concluded that the application built is not optimal in recognizing and obtaining information on gestures for SIBI sign language letters, as well as the need for close distances and normal light conditions. However, the application is quite helpful in communicating and understanding SIBI sign language.

The applications that are built still need to be developed further in the future, so that the applications that have been built can work even better. The author proposes several suggestions that can be taken into consideration, including, Improving a better method for recognizing gestures and can be used in various conditions, then being able to recognize gestures in sign language words, so that it is more optimal in communicating.

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