IMPLEMENTATION OF LEAP MOTION TECHNOLOGY TO HELP INDONESIAN SIGN LANGUAGE AT SLB ABC MUHAMMADIYAH SUMEDANG

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ABSTRAK

SLB ABC Muhammadiyah Sumedang is an extraordinary school that was established on July 15, 1991. Sign language is a language that prioritizes manual communication, namely body language and lip movement in communication. The learning media applied in the Muhammadiyah ABC SLB in Sumedang in particular. Hand sign language learning material is a material that must be taught especially for waiting students for elementary school classes. At the time of teaching and learning activities using the method of discussion, where it will require a longer time so that the material to be delivered by the teachers is not delivered. Sign language learning applications using tutorial models and animation models in delivering learning materials and the use of leap motion technology as a learning media support tool in the material of hand sign language movements. In this application there are 4 main menus namely material, simulation, and evaluation. Testing was carried out by testing Alpha (blackbox) and Beta (interviews and questionnaires). Based on the results of the research and testing carried out in the form of learning media applications for hand signal language using leap motion technology can show interesting learning and equipped with images and material in the form of sign language videos

Keywords: Sign Language, Learning Media, Leap Motion

1. INTRODUCTION

Sign language is a language that prioritizes manual communication, namely body language and lip movement in communication. There are at least three forms of sign language, namely: body cues, hand signals, facial cues. In Indonesia itself consists of 2 sign languages for tunarunggu sufferers, namely Indonesian Sign Language (BISINDO) and Indonesian Sign Language System (SIBI) [1].

Based on case studies and also direct interviews with teachers N.Rini, S.Pd and Aldi Nur Fauzi students assisted by the companion Dinar Arisandra in an interview at ABC Muhammadiyah SLB. Hand sign language learning material is a material that must be taught especially for waiting students for elementary school classes. At the time of teaching and learning activities using the method of discussion, where it will require a longer time so that the material to be delivered by the teachers is not delivered. While the results of interviews with students learning alphabet letters, numbers, vowel letters, is the initial material in which students have difficulty learning because of the lack of teacher capacity and the number of students in one class reaches 15 to 20 people which results in learning the material is hampered and not presented with good. Therefore, an innovation is needed to make it easier for students to learn hand sign language material, by interacting directly and using an animated image in it

Based on the explanation, a solution is needed that can facilitate students to understand the material of hand sign language using leap motion technology as sign language learning media in ABC Muhammadiyah Sumedang SLB

1.1 Purpose and Objectives

The purpose of this study is to make sign language learning media applications using Leap Motion technology, so that teaching and learning activities in sign language can be carried out properly and students can quickly understand how to understand sign language hand gesture material

The objectives to be achieved are as follows :

1. Facilitate students in understanding the material of hand sign language
2. Introducing the alphabet, number, and vowel letters material

1.2 Research Methodology

The research methodology used is a qualitative method. Qualitative method is a research method that is used to examine the condition of natural objects, and this research utilizes data, theories as explanatory material.

1. Data Collection Phase
   Data collection methods carried out in this study came from observations, literature studies and interviews
2. Software Development Methods
   System software development methodology refers to Luther-Sutoppo's Version

Multimedai Development Method which was presented by Ariesto Hadi Sutopo (2003)

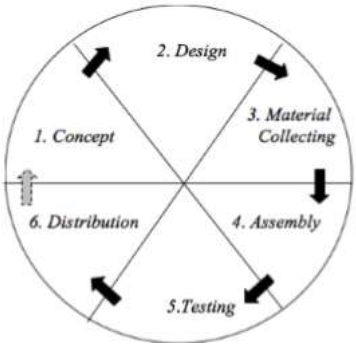


Figure 1 Multimedia Application Development Method (Sutopo**)**

The following is an explanation of Figure 1:

a. *Concept*
   At the concept stage is to determine the purpose of the application, which is to help students to easily understand the material of hand sign language using technology tools such as Leap Motion
b. *Design*
   Making specifications regarding application architecture and material / material requirements to support application development
c. *Material Colecting*
   Collection of material that will be needed when making applications such as dictionaries, pictures, learning materials
d. *Assembly*
   All project applications are developed together at this stage. Making this application according to the design stage.
e. *Testing*
   Testing is done after the manufacturing phase is complete and all required data has been entered. Besides the application can be used properly by users, users can feel the ease and benefits of the application and can be used personally.
f. *Distribution*
   The distribution stage is carried out if the application will be stored in a storage medium. If the storage media is not enough to accommodate the application, compression of the application will be carried out. This stage can also be called the evaluation phase for developing ready-made products to make it better.

1.3 Leap Motion

Leap Motion is a term for recording hand movements that are used as digital models and are additional devices that can be connected to a computer and can then be used to replace mouse and keyboard functions. Leap motion is a technological leap that benefits computer systems and operating systems [2]. Based on Rusmono Yulianto and David Holz's theory, it can be concluded that leap motion is a small-sized device that allows us to control a PC.

Leap Motion Cotroller is a device that is useful for detecting hand gestures that cannot be represented by a mouse and keyboard. The motion of the hand signals raised by this is then mapped in various forms. One example is to rotate, move freely an object, or add certain effects in an application. The Leap Motion Controller is able to detect fingers from a distance of 25 millimeters to 600 millimeters. This device has two monochromatic cameras and three infrared LEDs with accuracy of up to 1/100 millimeter

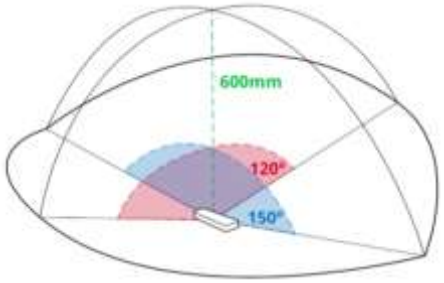


Figure 2 Leap Motion Controller Coverage Area

2. CONTENT OF RESEARCH.

2.1 System Concept Analysis

System concept analysis is an analysis that uses to find out how the flow of the system that will be applied to ABC Muhammadiyah Sumedang SLB. The stages include about sign language learning by using Leap Motion technology as a tool for the sign language learning process as a communication requirement for students with teachers, parents and friends in their environment. The following is a picture of the concept analysis of sign language learning media using Leap Motion technology.

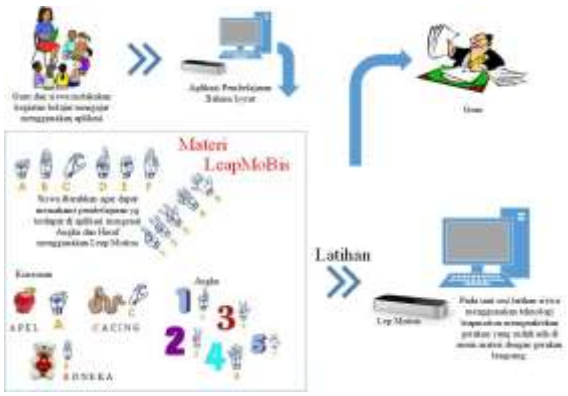


Figure 3. System Concept Analyss

2.2 Analysis of Built Application

Sign language interactive learning application is an application that is built based on desktop with

the aim to help students in ABC Muhammadiyah Sumedang SLB to better understand and be able to communicate well and in accordance with the applicable curriculum, and make better presentation of material so that students' understanding of sign language especially in communication increases and is more accepted and more attractive

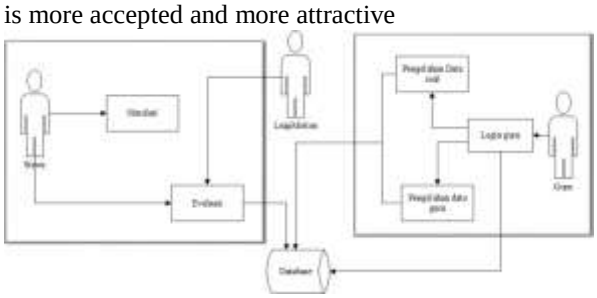


Figure 4. Analisis Aplikasi Yang Dibangun

2.3 Materi Analysis

Material analysis is needed so that the use of learning media has a clear picture. The material source used as a guide is the SIBI Dictionary and also the student book material for the 2013 Curriculum.

Table 1 Table Materi Analysis

No	Compentence	Indicator
1	Phonon pronunciation	
	a. Vocal Consonant	1. Vocal Home 2. Vocal Mid 3. Vocal Behind
	b. Consonant Pronunciation	1. Cons Pronunciation /b/ 2. Cons Pronunciation /p/ 3. ConsPronunciation /m/ 4. Cons Pronunciation /f/ 5. Cons Pronunciation /v/
2	Numb Pronunciation	1. Numb Proun 0-9

2.3. Leap Motion Process Analysis



Figure 5 Leap Motion Process Analysis

The following is an explanation of Figure 5 about the Leap Motion Process Analysis :

1. Gambar

The image is used to be a reference for the data on how the formation of the gesture of the sign language is taken from the Indonesian Sign Language System (SIBI) dictionary

2. Leap Motion

After knowing the form of sign language movements. In the LeapMotion process there are several processes carried out, first coding using C # language which is also assisted by the API that has been prepared by the LeapMotion device. After this process is complete the application can run on the desktop

2.4. Analysis of Learning Methods

The learning method used can affect the success of the learning process, of course it needs to be supported using the right media so that the objectives of learning can be achieved. The sign language learning application uses 3 models, namely tutorial, simulation, and drill and practice

1. *Tutorial*

The tutorial learning model presents sign language learning materials using the SIBI method. Learning material learned according to the syllabus used by the teacher. The material that will be presented in each chapter is the ring or the main part

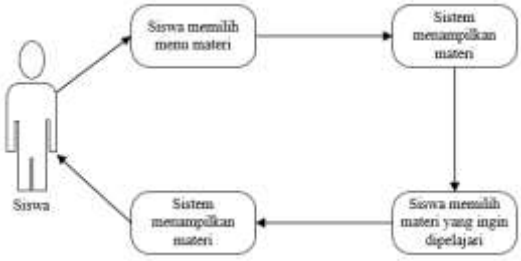


Figure 6. Flow of Material Submission

2. *Simulation*

In the simulation concept, displays simulations or demonstrations that are adapted to the material.

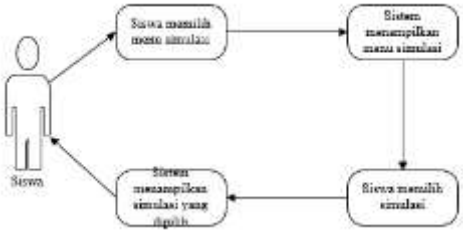


Figure 7 Simulation Submission Flow

3. *Drill & Practice*

The drill and practice concept that will be used in this application is in the form of training or evaluation. After the user is a student reading, paying attention to the material, then the student can do the movement to train as deep as students understand the movement in the material, the display system for students



Gambar 8 Flow of Evaluation Submisssion

2.5. Analysis Of System Architecture

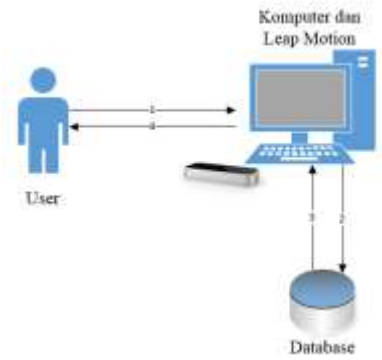


Figure 9 Analysis of System Architecture

Based on the system architecture picture and the flow, it can be chosen that the user can use the system with a companion or teacher to use the system, after that the PC that has been connected with the leap motion sends a request to the database, after that the database gives a response to the PC , then the PC displays the response that has been made previously to the user.

2.6. Non Functional Analysis

Non-functional analysis serves to explain the system requirements needed to support the running of the system to be built. These needs are divided into 3, namely: hardware requirements, software requirements, and system users.

A. Hardware Requirements Analysis

Hardware requirements analysis is needed to find out what hardware is needed in application development.

Teble 2 Hardware Requirments Analysis

No	Hardware	Spesification
1	Processor	Intel Core i3 2.4 GHz
2	Memory	Free Space 500 MB
3	Graphic Card	VGA 1 GB
4	Hardisk	2 GB

B. Software Requirements Analysis

Software analysis is important in supporting system development. Analysis of software requirements is divided into 2 (two), which are the requirements of the developer and user needs.

a. Requirments Developer Software

Tabel 3 Develpoer Software

No	Software	Spesification
1	Sistem Operasi	Microsoft Windows 7
2	*Tools* Pembangun	Visual Studio 2015, Leap Motion 4.0

b. Requirments User Software

Tabel 4 Kebutuhan Perangkat Lunak Pengguna

No	Software	Spesification
1	Sistem Operas	Microsoft Windows 7

C. Users Analysis

User analysis is an analysis carried out to users or users who will use this built application. Basically the user must have several criteria needed. The user criteria needed in using this learning application are as follows.

Table 5 Requirment User Analysis

Users	elementary school students tunarungu Teacher SLB ABC Muhammadiyah
Access Rights	Student : Using Application Teacher : add questions, edit questions, find questions, add values, delete values, edit values, find students, add students, find student grades
User Ability	Teacher: master the material, can use a computer
User's Physical	Normal
Mastered language	Indonesian Language and Sign Language

2.7. Functional Analysis

The specification of functional software requirements is the software requirement as a result of the analysis process carried out in the development of software. Analysis of this software requirement specification is needed to make use case descriptions.

A. *Use Case* Diagram

Usecase diagrams are diagrams that show the functionality of the system, giving an overview of how things that are outside the system such as users, interact with the system

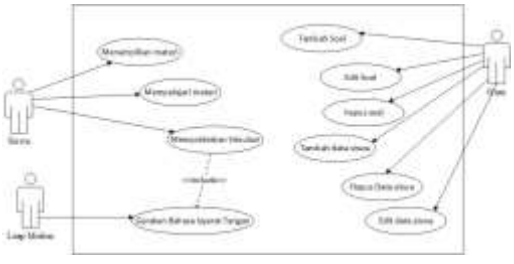


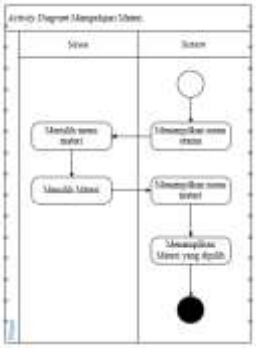
Figure 10 *Use Case* Diagram

B. *Activityi* Diagram

Activity Diagram is an activity diagram that describes the activities that occur in the system between applications and users who use the system

1. *Activity* Diagram Study material

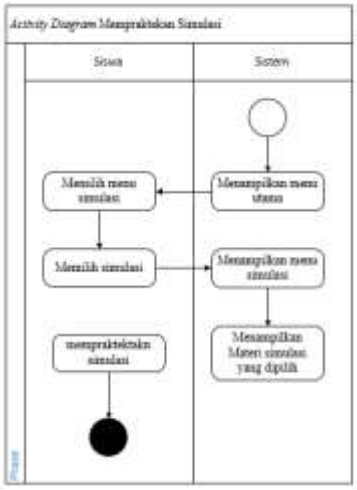
Activity diagrams study material explaining the workflow of students when they will enter the learning menu material page



Gambar 11 *Activity* Diagram Studi material

2. *Activity* Diagram Practicing Simulations

Activity Diagram The practice simulation describes the workflow of students when entering the simulation menu page



Gambar 11 *Activity* Diagram Practicing Sumlations

3. *Activity* Diagram Evaluation

Activity Diagrams working on evaluations explain the workflow of students when they will enter the menu page working on Evaluation

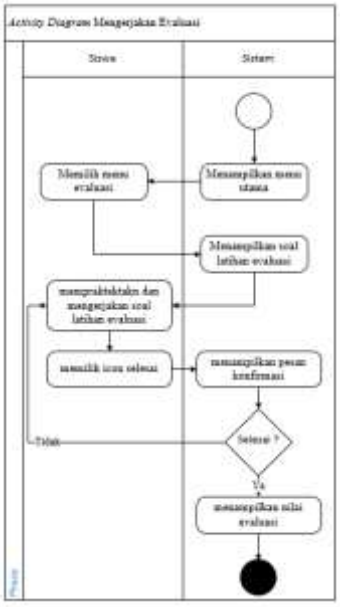


Figure 12 *Activity* Diagram Evaluation

2.8. System Planing

System design is a process that describes how a system is built to meet every need in the analysis stage

A. Menu Structure Design

In the design of an application, a menu structure containing menus and submenus is needed to facilitate users in using the system

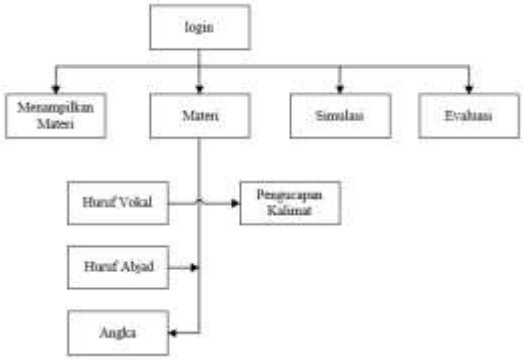


Figure 13 Student Menu Structure Design

The following is the menu structure of the teacher

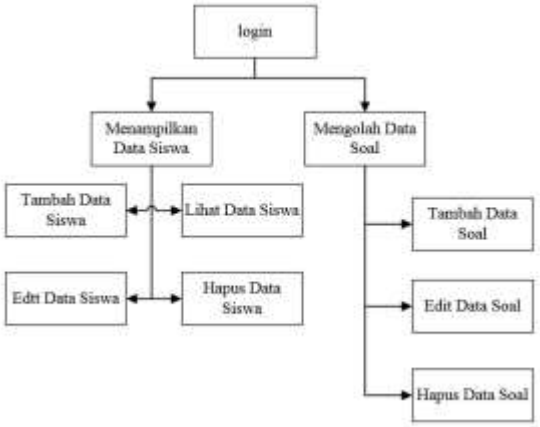


Figure 14 Teacher Menu Design Structure

2.9. Interdace Implementation

Implemetasi interface is the application of the interface of the following interface design is a list of anatomical implementations of Sign Language Learning Application in ABC Muhammadiyah Sumedang SLB.

2.9.1. Implementation Main Page Interface

Can be seen in figure 15



Gambar 15 Implementation Main Page Interface

2.9.2. Impelemntaion Main Menu Interface

Can be seen in figure 16



Gambar 16 main Menu Interface Implementation

2.9.3. Implementation Main Interfac material Vocal

Can be see in Figure 17



Gambar 17 Impelemntaion Main Interface material

2.9.4. Impelemntaion Main Interface material

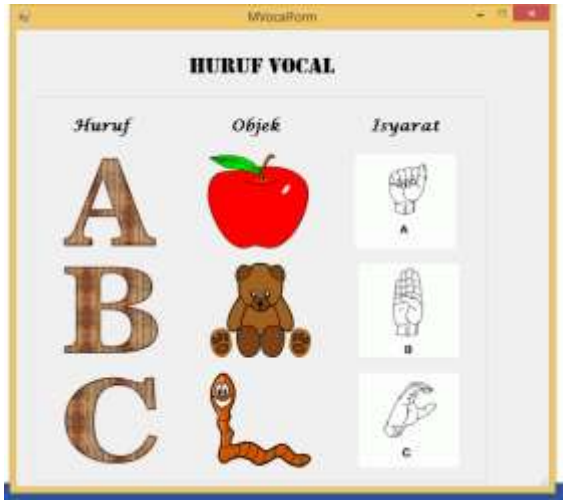
Can be see in figure 18



Gambar 18 impelemntation Main interface amterial

2.9.5. Implementation Main Interface Number

Can be see in figure 19



Gambar 19 Implementation Main Interface Material Number

2.10. System Testing

Testing the sign language learning application system is a way to find errors or shortcomings in the software being tested. Tests are carried out to find out which software has been developed whether it meets the requirements for the purpose of designing the software. In this study, the tests conducted on the system are testing with the blackbox method.

2.10.1. Testing Plan

The test plan is a test of the functionality found in the system. This test plan aims to find out

whether the functionality is as expected or not. The following is a test planning table of the system built.

Table 6 Testing Plan

Menu	Butir Menu	Jenis Pengujian
Initial Menu	elect the enter button	*Black-box*
Main Menu	Select the material button	*Black-box*
	Select the simulation button	*Black-box*
	Select the evaluation button	*Black-box*
Material Menu	Selects the Vocal Letter button	*Black-box*
	Select a number button	*Black-box*
Evaluation	The process displays evaluation questions	*Black-box*
Teacher login	Validate username & password	*Black-box*
Student Data	Add Student Data	*Black-box*
	Edit Student Data	*Black-box*
	Delete Student Data	*Black-box*
Question Data	Add Question Data	*Black-box*
	Edit Question Data	*Black-box*
	Delete Question Data	*Black-box*

2.10.2. Blackbox Test Cases and Result

Based on the testing plan, it can be done testing blackboxes on a system that is not as useful as the following:

Table 7 Test Cases And Result

Test Cases And Result			
Action	**Hoped**	**Observation**	**Conclusion**
Press the start button	Display the main menu	Display the main menu	Succeed

2.10.3. Testing Conclusions

Based on the results of the test and the test sample case that has been carried out, it can be concluded that the system is functionally able to work and produce the expected output. But it is not possible to make mistakes when the system is implemented, so that it requires a maintenance process to keep the system running as expected

2.10.4. Testing Of Users

Testing of users is done in the ABC Muhammadiyah Sumedang SLB school environment, this testing is direct to teachers and students. The method carried out in this test was interview and questionnaire, interviews were conducted with students and students with assistance from the facilitator as application users, while questionnaires were conducted with the teacher. From the results of the interviews and questionnaires, conclusions were drawn, whether the applications that were built were in accordance with the objectives or not

2.10.5. Scenarion Respondets

The scenario of the respondent is by giving the questionnaire to the respondent in this case the teacher. The method of questioning and the calculation uses the Likert scale method. For the score of the Likert scale category in this case can be seen in the table 8

Tble 8 Likert Scale Category Score

Valuei	Information
5	Strongly agree
4	Agree
3	Doubtful
2	Disagree
1	Strongly Disagree

he following is a calculation of the Likert scale of the answers given:

1. Determine Score
   The score determined is a minimum, maximum, median, quartile 1 and quartile 3 score

   a. Determine maximum total score
      = (Maximal Score) * (number of respondents)
      = 25 * 10
      = 250
   b. Determine Minimum total score
      = (minimum score) * (number of respondents)
      = 5 * 10
      = 50
   c. Determine Median
      = (Maximum total score + minimum total score)/2
      = (250 +50)/2
      = 150
   d. Determine value kuartil 1
      = (minimum total score + median value)/2
      =(50 + 150)/2
      = 100
   e. Determine value kuartil 3
      =(maksimum total score + median value)/2
      =(250 + 150)/2
      =200

2. Make a scale of the score scale obtainedt
   Here is the minimum total score scale up to the maxima total scorel



3. Make score limit
   The following is the score limit that can determine the attitude category of respondents from the Likert scale:
   a. Very Positive category, which is an area limited by quartile 3 and maximum score (Quartile 3 ≤ x ≤ maximum score)
   b. Positive attitude category, which is the area bounded by the median and quartile 3 (median ≤ x <quartile 3)
   c. Negative Attitude Categorical, which is an area limited by quartile 1 and median (quartile 1 ≤ x <median)

Very Negative brush categories, which are restricted areas by minimum scores and quartiles 1 (minimum score ≤ x <quartile 1)
The score limit can be seen in the following table 9

Tble 9 Score

Kategori	Skor
Sangat Positif	200 ≤ x ≤ 250
Positif	150 ≤ x ≤ 200
Negatif	100 ≤ x ≤ 150
Sangat Negaitf	50 ≤ x ≤ 100

3. CLOSING

3.1. Conclusion

Based on the results of questionnaires and interviews that have been conducted, the conclusions and final assignments entitled Application of Leap Motion Technology to Assist Signs of Abundant Learning in ABC Muhammadiyah Sumedang SLB are as follows:

1. Facilitate students in understanding the material described in this applicationi
2. Make it easy for students to understand the material of consonant, vocal, and numeral handwriting language

3.2. Suggestion

Application Development The learning of the hand sign language movement by using Leap Motion technology in the SLB ABC of Muhamadiyah in Sumedang has a lot of shortcomings, so it requires some further development to make this application better. The suggestions for developing the application for the future are as follows:

1. Animation made 3D from the hand using the Leap Motion
2. ntroduction of prefix and suffix sentences using Leap Motion
3. The display is made more attractive so that students can follow learning more seriously

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