SIBI Blue: Developing Indonesian Sign Language Recognition System Based On The Mobile Communication Platform

by Tri Listyorini

Submission date: 06-Nov-2020 05:30PM (UTC+0700)
Submission ID: 1437906695
File name: JURNAL_INTERNASIONAL_TAMBAHAN_02.pdf (1.29M)
Word count: 2204
Character count: 11909

International Journal of Information Technology, Computer Science and Open Source
Vol.1, No.1, 2017

SIBI Blue: Developing Indonesian Sign Language Recognition System Based On The Mobile Communication Platform

Mohammad Iqbal
Electrical Engineering
Muria Kudus University
Central Java, Indonesia
mohammad.iqbal@umk.ac.id

Endang Supriyati
Informatics
Muria Kudus University,
Central Java,Indonesia
endang.supriyati@umk.ac.id

Tri Listyorini
Informatics
Muria Kudus University,
Central Java, Indonesia
tri.listyorini@umk.ac.id

***Abstract*— Sign language as a kind of gestures is one of the most natural ways of communication for most people in deaf community. The researches and developments in the field of automatic speech recognition of accuracy said is still a research challenge. This problem is due to the lack of services that facilitate sign language for hearing people into sign language for persons with hearing impairment. We present in this paper a new approach based on android operating system to build a mobile translation system from sign language into text and voice. Wireles gloves developed by using flex sensor, acceleometer and gyroscope. Before implement in mobile device, this application was recognition in Discrete Time Warping (DTW). The main feature is that it can be used to learn sign language and to provide sign language translation of written text for people with hearing impairment. The system can be implemented in ordinary mobile equipment. Low cost and popularity of sign language recognition device can be realized**

Keywords — android, mobile, Discrete Time Warping, embedded speech recognition

I. INTRODUCTION

To make a communication bridge, a highly accurate, cost effective and an independent glove was designed for deaf-mute people to enable them to communicate. Sign language as a kind of gestures is one of the most natural ways of communication for most people in deaf. Different approaches of sign languange are discused, design of hand glove for gesture recognition into speech have done in our research before [1]. In this paper we develop mobile sign language Indonesian.

Automatic speech recognition (ASR) is a natural, and increasingly popular, alternative to typing on mobile sevices . A number of practical limitations have been encountered that often sets obstacles in the widespread deployment of application and services provided by ASR systems.[2-4].

There are few mobile applications for deaf and dumb like Deaf and Dumb through 3G applications[5]. The mobile application which proposed in helps to make recognition of sign language. Mobile-based Deaf and Mute Interaction System project in proposed mobile application that enables the needs of 'deaf and dumb developing a voice-activated mobile which would convert their sign language into messages that may be read by other users, this message can also converted to a voice.[6-7].

In this paper we develop SIBI Blue: Indonesian Sign Language based on android. Indonesian Sign Language known as SIBI (Sistem Isyarat Bahasa Indonesia). The reminder of this paper is organized as follows. Section 1 Introduction. Section 2 Experimental Procedures. Section 3 Experiment Result. Finally, section 4 Result and Discussion concludes this paper.

II. EXPERIMENTAL PROCEDURES

Figure 1 presents our approach to SIBI Blue on smartphone android. First we develop cyberglove use 5 flex sensor for each finger, and a.

Figure 1. SIBI Blue experimental approach

A. Hardware of system

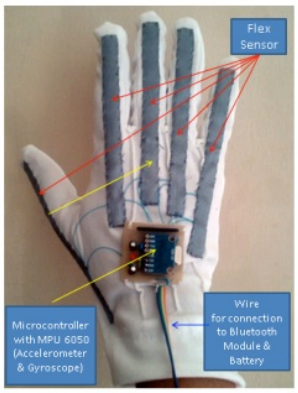
A right-hand Cyberglove is used to retrieve the finger joint angle values for gesture features. The glove has 5 sensors that measure the bending angles at various form. The sensors used in this research are flex sensors[9], MPU-6050[10] and HC-05[11] as shown at Figure 2. Flex sensor is a type of sensor that changes its resistance when it is bent. The MPU-6050 is a small little piece of motion processing, by combining a MEMS 3-axis gyroscope and a 3-axis accelerometer on the same silicon die together with an onboard Digital Motion Processor™ (DMP™) capable of processing complex 9-axis. The HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for wireless serial connection setup.

(a). Flex (b). MPU-6050 (c). HC-05

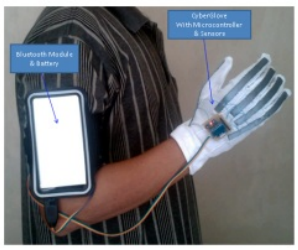
Figure 2. CyberGlove sensors and interface

B. Dataset

The system is implemented and tested using a data set of 1000 samples of 50 Indonesian word sign language, 20 samples for each sign. Among these 500 data were used as the training data, and the remaining 500 data were used as the testing data. As shown in Figure 3, flex sensors mounted using a support ribbon sewn on top. Sensor accelerometer gyroscope MPU-6050 is installed right at the back of the palm of the hand. MPU-6050 sensors are used to determine the inclination or orientation of the palm of the hand.



(a) CyberGlove



(b) CyberGlove being used

Figure 3. CyberGlove Implementation

C. Feature Extraction

Feature extraction is done to obtain quantities which indicate the specificity of the data processed. Feature extraction is one of the most important parts and affect the accuracy of recognition. For extraction of testing data and template data to get the same characteristic vectors. Feature vector consist of the processed data flex and accelerometer data that form series of numbers (values). In this research, we use some method to get feature extraction. Figure 4 explain steps of feature extraction.

a. Mean and Deviation Standard

Statistical approach is often used as a measure in the analysis of the data, the average value (mean) and deviation standard values.

b. Quantization

Quantization used in this study is a non-linear quantization, which is done only for the acceleration-gryroscope pals data. The use of quantization for acceleration of research done on J Liu [12]. This process is done for determining the palm orientation or the plam tilt.

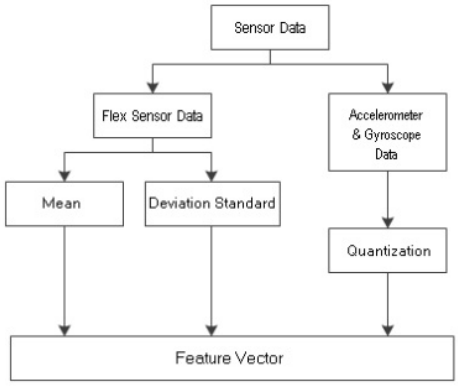


Figure 4. Feature extraction steps

c. Feature Vector

Feature vector is the result of feature extraction process. Feature vector obtained by lined the values of feature extraction which includes features for the fingers bending and the palm orientation. Data length for the feature vector for each dependent feature extraction feature extraction is used.

Feature extraction results to the data signaled the word 'kami' that is depicted in the form of a graph shown in Figure 5. The length of feature vector data is 61.

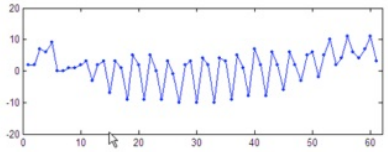


Figure 5 Feature extraction of word 'kami'

D. Dinamic Time Warping (DTW) for Sign Languange

DTW is a method which measures the distance between each input frame and each reference frame using the

dynamic programming algorithm to find the finest warping of the pattern, and decides the best match by minimizing the distance between the input frame and the reference frame. Hand gestures are well-known to suffer from inherent temporal variations. They differ from person to person and even the same person cannot perfectly replicate the same gesture.

DTW algorithm focuses at aligning two data series of feature vectors by warping the time axis cyclically until an optimal match between the two series is found. Continuity plays a less role in DTW than in other pattern matching methods. DTW is an algorithm that is predominantly suitable to matching data series with missing information, provided there are long enough segments for matching to occur [14,15]. Figure 6 shows a block diagram of Indonesia sign language recognition system using DTW.

Figure 6. Diagram Block of Indonesia sign language recognition system using DTW

III. Experiment Results

The application was implemented on mobile device with android operating system such as smartphones and tablet computers. This operating system is providing access to a wide range of useful libraries and tools that can be used to build rich applications [8]. Figure 7, shows sign language recognition Indonesia were implemented on android smartphones.

Figure 7. SIBI Blue were implemented on android smartphone.

Smartphone must be connected first with the gloves, to be used as a translator between deaf people and normal people. Figure 8, shows connection smartphone and cyber glove.

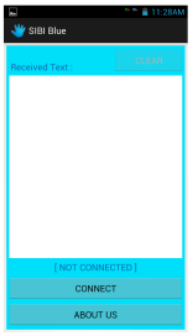
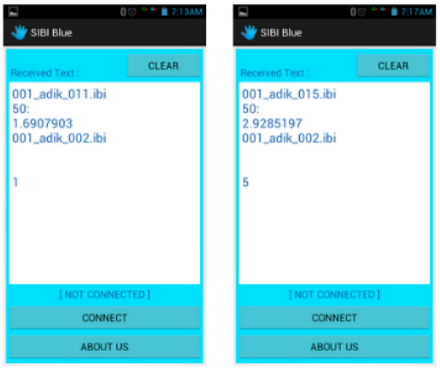


Figure 8 Connection smartphone and gloves.

Testing process is done by offline, using the data that has been recorded in the form of files. This offline data taken in previous studies. Recognition method used is DTW (Dynamic Time Warping).

In the figure 9 shows the results of the recognition of the word ‘adik’ ('brother'). In the figure 9 (a), file 001_adik_011.ibi correctly recognized by the system as the word ‘adik’ ('brother') that is in accordance with the DTW smallest value = 1.6907903 against 001_adik_002.ibi file is used as one of the templates. While figure 9 (b), file 001_adik_015.ibi recognized properly by the system as the word 'brother' that is in accordance with the DTW smallest value = 2.9285197 against 001_adik_002.ibi file is used as one of the templates.

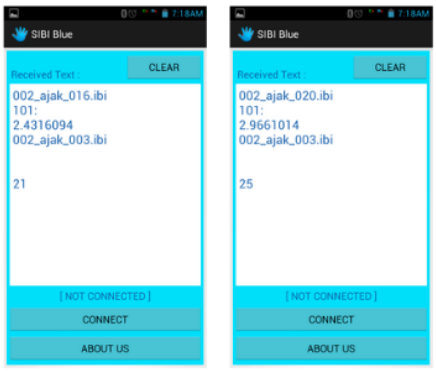


(a) (b)

Figure 9. The recognition result of the word ‘adik’ ('brother')

In the figure 10 shows the results of the recognition of the word ‘ajak’ ('invite'). In figure 10(a), file 002_ajak_016.ibi recognized properly by the system as the word ‘ajak’ ('invite') that is in accordance with the DTW smallest value = 2.4316094 against 002_ajak_003.ibi file is

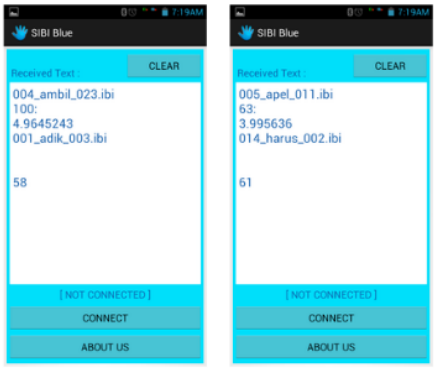
used as one of the templates. While figure 10(b), file 002_ajak_020.ibi correctly recognized by the system as the word 'invite' that is in accordance with the DTW smallest value = 2.9661014 against 002_ajak_003.ibi file is used as one of the templates.



(a) (b)

Figure 10. The recognition result of the word 'ajak' (invite)

Figure 11 shows the result of the recognition of the word 'take' and the word 'apel' ('apple') as an example of the incorrect recognition by the system. In figure 11(a), the wrong file 004_ambil_023.ibi recognized by the system as the word 'brother' that is in accordance with the DTW smallest value = 4.9645243 against 001_adik_003.ibi file is used as one of the templates. While figure 11(b), any file 005_apel_011.ibi recognized by the system as the word 'harus' ('must') is in accordance with the DTW smallest value = 3.995636 against 014_harus_002.ibi file is used as one of the templates.



(a) (b)

Figure 11. The recognition result of the word 'ambil' ('take') dan 'apel' ('apple')

IV. Result and Discussion

To perform the offline test, the data taken consists of 50 gesture classes; each word has 20 data samples, so there are a total of 1000 datasets. From the 1000 sample data, 500 data are taken for each class as a testing data and 500 remained as learning data. The word is a word taken move. Words do not only require finger gestures but also requires moving the hands or other parts of the hand. Using DTW method, accuracy reach 95%.

This research need further experiment for larger dataset dan for more effective recognition method so speed and higher accuracy recognition can be achieved. Another challenge for this research is improving recognition system for continous word sign languange, without any separation between the words detected by sensor.

Acknowledgement

This research received funding from the Directorate General of Higher Education RISTEKDIKTI through HIBER (Hibah Bersaing) Research Program 2014-2015. We would like to say thanks to RISTEKDIKTI, Kopertis Region VI Central Java, and Muria Kudus University.

REFERENCES

[1] Endang Supriyati, Mohammad Iqbal "Recognition System of Indonesia Sign Language based on Sensor and Artificial Neural Network " , Makara Seri Teknologi, 2013, 17(1): 25-31J.

[2] Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] Taabish Gulzar , Anand Singh , Dinesh Kumar Rajoriya, and Najma Farooq "A Systematic Analysis of Automatic Speech Recognition: An Overview", International Journal of Current Engineering and Technology , E-ISSN 2277 – 4106, P-ISSN 2347 – 5161.

[4] Xin Lei , Andrew Senior, Alexander Gruenstein, Jeffrey Sorensen, "Accurate and Compact Large Vocabulary Speech Recognition on Mobile Devices", INTERSPEECH 2013, ISCA.

[5] N. Jaitly, P. Nguyen, A. W. Senior, and V. Vanhoucke, "Application of pretrained deep neural networks to large vocabulary speech recognition," in Proc. Interspeech, 2012.

[6] http://deshgujarat.com/2011/08/20/deaf-and-dumb-people-talk-through-mobile-phone-in-gujarat/.

[7] Dalia Nashat, Abber Shoker, et all, "An Android Application to Aid /uneducated Deaf-Dumb People", International Journal of Computer Science and Mobile Applications, Vol.2 Issue. 9, September- 2014, pg. 1-8 , ISSN: 2321-8363.

[8] S. Zhao, M. Wang, Z. Wei, , "A New Type of Deaf-Mute Sign Language Recognition System Based on the Mobile Communication Platform and Terminal Equipment" Advanced Materials Research (Volumes 734 - 737) 2880-2886

[9] "Android Overview" Open Handset Alliance. Retrieved 2012-02-15

[10] Spectrasymbol, Flex Sensor, http://spectrasymbol.com, 2012

[11] https://www.sparkfun.com/products/10937

[12] http://www.rhydolabz.com/index.php?main_page=product_info&products_id=1169

[13] J. Liu et al., uWave: Accelerometer-based personalized gesture recognition and its applications, Pervasive and Mobile Computing 5, pp. 657-675,2009.

[14] Eamonn Keogh , "Exact indexing of dynamic time warping". Proceedings of the 28th VLDB Conference, Hong Kong, China,(2002)

[15] Ahmad Akl, Shahrokh Valaee, "Accelerometer-Based Gesture Recognition Via Dynamic-Time Warping, Affinity Propagation & Compressive Sensing" 978-1-4244-4296-6/10/2010/IEEE, ICASSP 2010

SIBI Blue: Developing Indonesian Sign Language Recognition System Based On The Mobile Communication Platform

ORIGINALITY REPORT

11%	10%	8%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Bulus P. Bala, Laminu Aminu Song. "Android App for Improvising Sign Language Communication in English and Hausa", International Journal of Advances in Scientific Research and Engineering, 2020 Publication	4%
2	mafiadoc.com Internet Source	4%
3	electronics.semaf.at Internet Source	3%

Exclude quotes	On	Exclude matches	< 3%
Exclude bibliography	On		

SIBI Blue: Developing Indonesian Sign Language Recognition System Based On The Mobile Communication Platform

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5