Feature Extraction Analysis of the Significant Pattern Sign Language toward to the Finger Movement

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ABSTRACT

In this study, feature extraction technique is used to analyze the significant pattern of sign language toward to the finger movement. This technique is used to observe the difference value of voltage and resistance between five (5) fingers in 2 condition; all extract and retract as a control measurement. This measurement is used to recognize the sign language based on the hand gesture specifically finger movement. Flex sensor bending measurements may provide the relationship of respective finger movement to the difference force that produces the angle. There are significant different of the hand gesture due to sign language based on force and angle of the finger movement. Result from the control measurement is a bench mark for the sign language to other alphabet These results shows that the amount of voltage that is required to bend the flex sensor may be resulting on the difference alphabet during hand gesture.

Keywords: Feature extraction, sign language, flex sensor

1. INTRODUCTION

Sign language is a type of communicative gestures that highly influenced by hand gesture recognition for hearing impaired express their feelings, contribute to a conversation, learn, and overall live their lives as normal as possible. Gestures and sign language recognition includes the whole process of tracking and identifying the signs performed and converting into semantically meaningful words. Not many of the people with the disability understand the Sign Language even though Sign Language is the only common language and medium that is used to communicate with others [1]. The combination of the manual gestures and the communication consists of movement and orientation of hand that conveys symbolic meanings cause the sign language to be complicated to understand [2].

sign language can also show the deaf community that they are not being forgotten, and they have the same access to communication with the rest of the world as anyone else, and that their voices should never be muted or disregarded. In Malaysia the number of people who understand the Sign Language is considered small.

Approximately of 40,000 has stated that deaf populations registered with Social Welfare Department of Malaysia [3], therefore an initiative techniques may give the people with disabilities opportunities to live as normal citizen of Malaysia. Those who suffer from being deaf and have impaired hearing should not be sheltered from communicating with the rest of their peers. They must live in an environment and world that they feel can hear them and what they are trying to say at all times, and to all walks of life

Gestures in sign languages can be placed along a similar scale, from fully closed (the closed fist hand shape) to fully open (the open palm hand shape), with flat, bent, and curved hands hapes in between [4]. In spoken languages, there are phonotactics (phonological rules) that regulate the sequence of open and closed sounds; similarly, in ASL, phonotactics regulate the alternations between open and closed handshapes [18].

The most common sign languages recognition researches are based on American Sign Language (ASL), Arabic Sign Language (ArSL) and Indian Sign Language (ISL) and Several other sign languages Tamil sign language (TSL), Dutch sign language (DSL), Korean sign language (KSL), Malaysian sign language (MSL), Persian sign language (PSL), English sign language (ESL), New Zealand sign language (NZSL), Chinese sign language (CSL), Japanese sign language (JPL), Vietnamese sign language (VSL), Brazilian sign language (Libras), Bangla sign language and Indonesian sign language [5-8].

Feature extraction method has been used widely in recent gesture [9]. Selection of a feature extraction method is probably the most important factor in achieving identification performance in character [10]. It should contain relevant information from the hand gestures input and represented in characteristic sign and gesture pattern to be classified apart from other gestures [11]. The features extracted from data glove measurement include flexion of fingers, position, angles and motion

2. METHODOLOGY

This section discusses the techniques used in sensor-based gesture characterisation analysis. Flex sensor approaches on the use of sensors which are physically attached to users to measure the movement and resistance of fingers and hand data. A sensor-based approach often requires users to wear a glove with flex sensors attached to the fingers of users. It were attached to the each fingers is because each gesture has different finger

placement which the flex sensor will be identifying the changes in resistance and voltage which eventually produce data for identifying the alphabets.

Flex sensors are present in some data gloves measurement. Flex sensors are mostly based on reading of resistance. Resistance values and voltage are obtained while bending the fingers. Feature extraction method formula as shown in (1) has been used to get a data glove measurement for each of the finger to calculate the amount of finger bending. And the processor should be equal or more than 32-bit, (32X32=1024) as well as to embed the coding into Arduino software.

$$s(n) = (5.0\ X\ s(n) X\ 100)/1024 \quad (1)$$

where; $s(n)$ = number of finger 1,2,3,4,5,

which 1 is pinky
2 is ring finger
3 is middle finer
4 index finger
5 is thumb finger

Different movement or bending of finger is requiring in order producing an alphabet. With a different movement of finger also give a result from different forces that produce the angle. Therefore will be effect the amount of voltage that is required to bend the flex sensor. For every sign language, there is different finger movement that will be resultant on different resistance value. Arduino is not capable to reach the value of resistance so the value of voltage will digitalized into the coding for data that each flex sensors will resultant with many data of different movement. Figure 1 shows the sign language for alphabet A, B and C respectively.

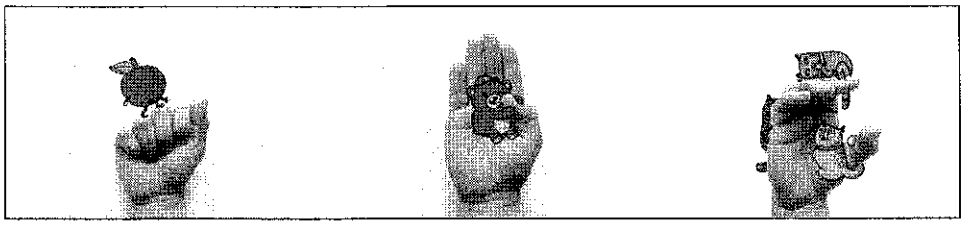

Fig. 1 Sign language of the alphabet A, B and C

3. RESULTSAND DISCUSSIONS

In this section, measurement data analysis is focused on the resistance value characteristics and the pattern of the letter A, B and C. This resistance threshold is set up in the coding in order for the processor to differentiate the letter gesture. Each letter have difference threshold for each finger (thumb, index, middle, ring and pinky). The increase of the resistance or any changes of resistance from the extract and retract of the finger will produce certain amount of data. Table 1 shows that letter B sign language only the thumb is bent more than 40Ω while others are less than50Ω. For alphabet C, all the fingers threshold are more than 40Ω which are similar values for all the fingers and alphabet A oppositely with alphabet B which is less than 40Ω at the thumb and others are more than 50Ω.

Table 1

The threshold resistance control value

	Finger				
Resistance Control Value	**Thumb**	**Index**	**Middle**	**Ring**	**Pinky**
Letter A	<370	>420	>420	>420	>420
Letter B	>420	<370	<370	<370	<370
Letter C	>420	>420	>420	>420	>420

Letter A data are obtained when the flex sensor is bent over their resistance threshold that had been set in the programming. From the feature extraction analysis there are significant pattern for letter A. Based on the finger movement for the sign language for letter A, All the finger were bend (retract) except thumb finger is extract. Figure 2 shows difference resistance between each finger especially for the thumb finger.

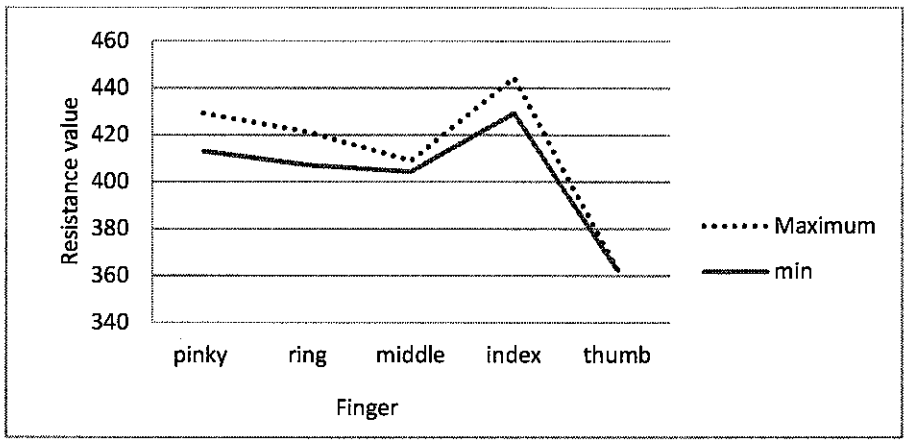

Fig. 2 Significant pattern of letter A

Letter B data are obtained when the flex sensor is bent over their resistance threshold that had been set in the programming. The resistance threshold set for letter B are thumb is >40Ω and the other are <50Ω. The data were captured from the serial monitor of Arduino software when the sign language for letter B is gesture. The figure 3 reveal that, there are significant pattern for sign language for letter B, which the maximum and minimum values of the resistance are similar for pinky, ring, middle and index except thumb finger.

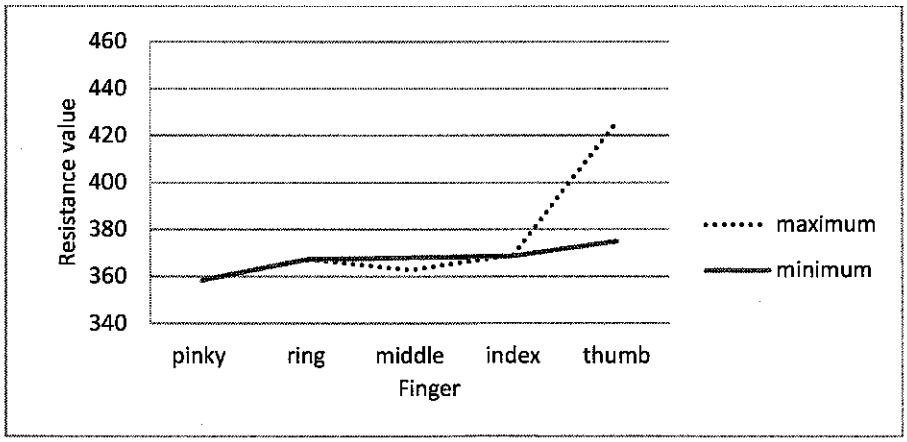

Fig. 3 Significant pattern of letter B

Letter C data are obtained when the flex sensor is bent over their resistance threshold that had been set in the programming. The resistance threshold set for letter C are similar for all the fingers as present in figure 4, the data were captured from the serial monitor of Arduino software when the sign language for letter C is gesture. There

are significant pattern between maximum and minimum value for alphabet C toward the finger movement..

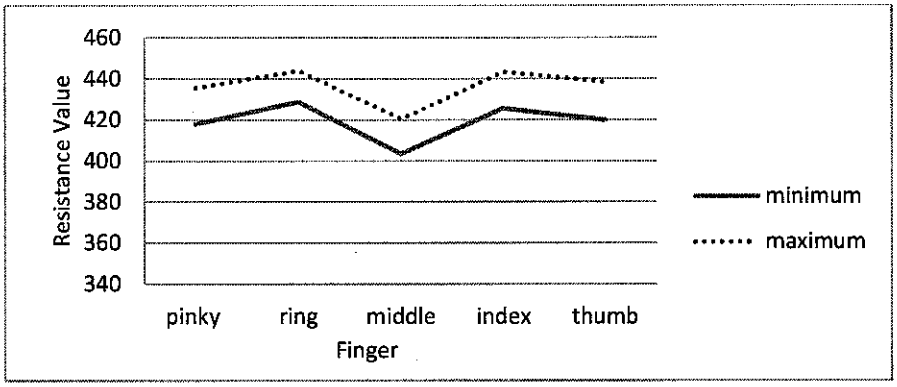

Fig. 4 Significant pattern of alphabet C

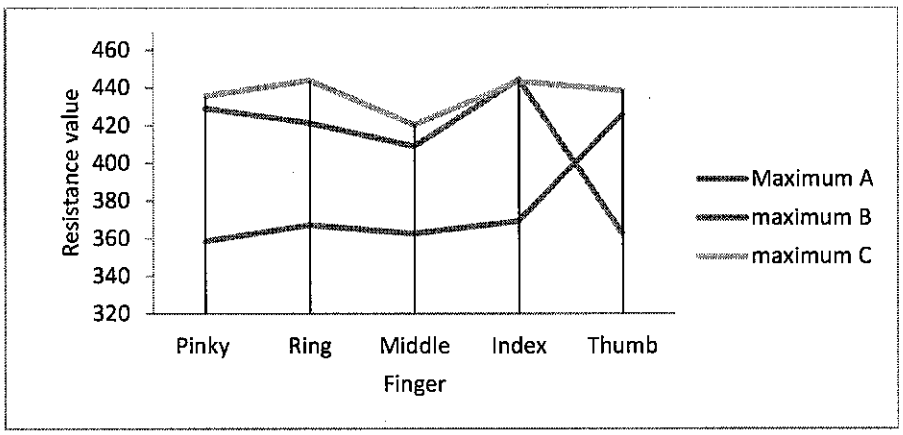

Fig. 5. Difference pattern for letter A, B and C

Figure 5 summarized the significant pattern for maximum value toward the finger movement for letter A, B and C respectively. Letter A sign language only thumb finger is extract, and oppositely with Letter B sign language only the thumb is bent or retract. While for letter C, all the fingers are movement. There are significant pattern for all letter toward finger movement.

4. CONCLUSIONS

Feature extraction analysis technique, works as well as for recognizing the hand gesture and there significant pattern for gesture and sign language in different resistance value and angle based on finger movement for every hand gesture. Pattern identification

for gesture has been on-going research driven for future which potentially for applications such as sign language recognition, remote control robots and human–computer interaction in virtual reality

This project is of Bahasa Isyarat Malaysia (BIM) with the aid of flex sensors that were attached to the fingers. It were attached to the each fingers is because each gesture has different finger placement which the flex sensor will be identifying the changes in resistance and voltage which eventually produce data for identifying the alphabets. Currently, this product only be able to identify three alphabets which are B, C and A.

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