
**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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PROJECT REPORT

FINAL YEAR PROJECT 2

# SIGN LANGUAGE RECOGNITION SYSTEM FOR DEAF AND DUMB PEOPLE

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"I hereby declare that I have read through this report entitle "Sign Language Recognition System for Deaf and Dumb People" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronic Engineering."

Signature : ……

Supervisor's name : ……

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# SIGN LANGUAGE RECOGNITION SYSTEM FOR DEAF AND DUMB PEOPLE

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**A report submitted in partial fulfillment of the requirements for the degree of**

**Bachelor of Mechatronics Engineering**

**Faculty of Electrical Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2015**

I declare that this report entitle “Sign Language Recognition System for Deaf and Dumb People” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……

Name : ……

Date : ……

To my beloved mother and father

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Bissmillahirrahmanirrahim.

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## ABSTRACT

Every normal human being sees, listens, and reacts to surrounding. There are some unlucky individuals who does not have this important blessing. Such individuals, mainly deaf and dumb, they depend on communication via sign language to interact with others. However, communication with ordinary individuals is a major impairment for them since not every typical people comprehend their sign language. Furthermore, this will cause a problem for the deaf and dumb communities to interact with others, particularly when they attempting to involve into educational, social and work environments. In this project, the objectives are to develop a sign language translation system in order to assist the hearing or speech impaired people to communicate with normal people, and also to test the accuracy of the system in interpreting the sign language. For the methodology, several researches have been done with a specific end goal to choose the best method in gesture recognition, and the data glove approach may be the champion. The configuration of the data glove includes 10 tilt sensor to capture the finger flexion, an accelerometer for recognizing the orientation of the hand, Arduino Leonardo function as microcontroller and Bluetooth module is use to establish connection between Arduino and mobile phone. The first experiment is to test the performance of the tilt sensor. While second experiment is to test the accuracy of the data glove in translating several alphabets, numbers and words from Malaysian Sign Language. The result for the first experiment shows that tilt sensor need to be tilted more than 85 degree to detect the tilt. The result for the second experiment shows that total average accuracy for translating alphabets is 95%, numbers is 93.33% and gestures is 78.33%. For the average accuracy of data glove for translating all type of gestures is 89%.

# ABSTRAK

Setiap manusia biasa melihat, mendengar dan bertindak balas terhadap persekitaran. Terdapat beberapa individu malang yang tidak mempunyai kebolehan yang penting ini. Individu itu, terutamanya pekak dan bisu, mereka bergantung kepada komunikasi melalui bahasa isyarat untuk berinteraksi dengan orang lain. Walau bagaimanapun, komunikasi dengan individu biasa adalah masalah besar bagi mereka kerana tidak semua orang memahami bahasa isyarat mereka. Ini akan menyebabkan kekangan untuk orang pekak dan bisu untuk berinteraksi dengan orang lain, terutamanya apabila mereka cuba untuk melibatkan diri dalam persekitaran pendidikan, sosial dan bekerja. Dalam projek ini, objektifnya adalah untuk membangunkan satu sistem penterjemahan bahasa isyarat untuk membantu individu yang mempunyai masalah pendengaran atau pertuturan untuk berkomunikasi dengan orang normal, dan juga untuk menguji ketepatan sistem dalam mentafsir bahasa isyarat. Untuk kaedah ini, beberapa kajian telah dilakukan bagi memilih kaedah terbaik untuk mentafsir isyarat, dan pendekatan sarung tangan data telah menjadi pilihan. Konfigurasi sarung tangan data termasuk 10 sensor kecondongan untuk menangkap gerakan jari, pecutan untuk mentafsir orientasi tangan, Arduino Leonardo berfungsi sebagai pengawal mikro dan modul Bluetooth digunakan untuk mewujudkan komunikasi antara Arduino dan telefon mudah alih. Eksperimen pertama adalah untuk menguji prestasi sensor kecondongan. Eksperimen kedua adalah untuk menguji ketepatan sarung tangan data dalam menterjemahkan beberapa huruf, nombor dan perkataan daripada Bahasa Isyarat Malaysia. Keputusan untuk eksperimen pertama menunjukkan bahawa sensor kecondongan perlu condong lebih daripada 85 darjah untuk mengesan kecondongan. Keputusan untuk eksperimen kedua menunjukkan bahawa jumlah ketepatan purata untuk menterjemahkan huruf ialah 95%, nombor adalah 93.33% dan perkataan adalah 78.33%. Untuk ketepatan purata sarung tangan data untuk menterjemahkan semua jenis gerak isyarat adalah 89%.

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| | | |
|---|---|---|
| AC | - | Alternating current |
| ARM | - | Advanced RISC Machines |
| AVR | - | Automatic Voltage Regulation |
| DC | - | Direct current |
| IR | - | Infrared |
| kg | - | Kilogram |
| LCD | - | Liquid Crystal Display |
| MSL | - | Malaysian Sign Language |
| RGB | - | Red-Green-Blue |
| s | | second |
| USB | - | Universal Serial Bus |

# LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.1 Project Background

Each individual utilize language to communicate with others. The listening to disabled individuals likewise utilize language to communicate among themselves. Sign language is basically utilized by hearing impaired people to communicate with each other, developed by deaf communities. Communication through signing is a very organized non-verbal language using both non-manual and manual correspondence. Non manual signals are essentially outward appearance, head movement, stance and orientation of the body. While manual signals incorporate movement and orientation of hand that passes on typical significance [1].

On the other hand, communication with typical individuals is a major impediment for them since not every ordinary people comprehend their gesture based communication. To beat this issue, sign language recognition system is expected to assist the deaf and mute people to communicate with normal people. In Malaysia, Malaysian Sign Language (MSL) is the communication via gestures that is generally utilized by the deaf community. Hence, the design of the sign language recognition system will be based on the MSL, in order to suit the local people environment.

In this project, the technologies for hand gesture recognition is by using data-glove approach which use special glove-based device to extract hand posture. The glove will utilize Arduino microcontroller as the processor, and tilt sensors and accelerometer as the sensors to identify hand pose that represent an alphabet, number and several words from Malaysian Sign Language. The translation of the gesture will be displayed on mobile phone.

## 1.2 Motivation

Each ordinary individual sees, tunes in, and responds to encompassing. Notwithstanding, there are some less blessed individuals who are denied of this important blessing. Such individuals, mainly deaf and dumb, they depend on sign language to communicate with others. Statistic shows that about 9 billion people in this world are deaf and dumb [2]. In Malaysia, there are about 2.8 million people who have disabilities [3]. Interactions between deaf-dumb people and normal people have always been a troublesome assignment. Generally, not every ordinary people comprehend the communication through sign language utilized by the weakened. . This makes an almost no space for them as communication is one of the necessity of life. Furthermore, this will cause a problem for the deaf and dumb communities to interact with others, particularly when they attempting to coordinate into instructive, social and workplaces. To conquer this issue, a sign language recognition system must be developed with a specific end goal to kill the imperative between the ordinary and debilitated individual.

The main goal of this project is to develop sign language translation system that can translate the sign language into text. Since not every typical people being educate with communication through signing, this system will help them to comprehend the language of deaf and dumb people so that will give points of interest to them in conducting their daily tasks ahead. The Figure 1.1 shows the ratio of Malaysian citizen from the normal to the person with disability. The disability includes deaf, dumb, blind and physical handicap.

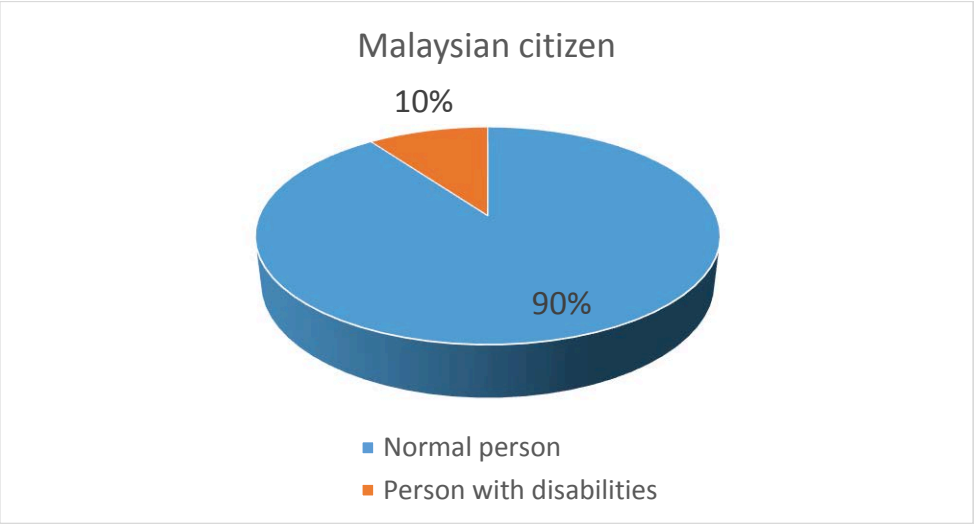


Figure 1.1: Ratio of total Malaysian citizen [3].

## 1.3 Problem statement

Despite the fact that the deaf and dumb people can impart without issues amongst themselves, there is serious challenge for the hearing impaired person trying to communicate with normal people. This is because not every single typical people can comprehend their gesture based communication. The greater part of ordinary individuals has not been taught about the sign language. As communication is imperative, this issues inevitably makes a limitation for the impaired individuals to correspond with the normal. Therefore, a sign language translator must be developed to tackle those issues. At present, there are numerous techniques for capturing and recognizing the hand gestures. However, every technique has their own favourable circumstances and inconveniences. In order to develop a gesture recognizing device, the best method for capturing the hand posture need to be contemplated and chose.

## 1.4 Objective

The main objective of this project is to design a system that can assists the impaired people to communicate with normal people. This project also aims to meet the following objectives:

i. To develop gesture recognizing system that can recognize sign gesture of Malaysian Sign Language and translate it into text.
ii. To test the accuracy of the system.

## 1.5 Project scope

The scope for this project are as followed:

i. Sign language recognition system for deaf and mute people.
ii. The sign language used is Malaysian Sign Language.
iii. This project implement a data glove that use a tilt sensor and accelerometer.

# CHAPTER 2

# LITERATURE REVIEW

This section reviews the research on the important elements in developing the sign language recognition device. The first research study focuses on gesture recognition method for detecting the movements of the hand. The second research study discusses the hardware that will be used in this project.

## 2.1 Gesture recognition method

Nowadays, automatic sign language translation systems generally use two approaches, which are data-glove and visual-based approaches [1]. However, new hand gesture recognition method has been introduced, called virtual button [4]. This section will clarify the detail about all methods of gesture recognizing and the comparison between these methods.

### 2.1.1 Data-glove approach

The data-glove approach utilize a unique assembled electronic glove, which has in-fabricated sensors that utilized to distinguish the hand stance. Most commercial sign language translation systems use the data-glove method, as it simple to acquire data on the bending of finger and 3D orientation of the hand using gloves [1]. The framework require less computational force, and continuous interpretation is much simpler to accomplish. The data glove is outlined with ten flex sensors, two on every finger [5]. The flex sensors work as variable resistance sensor that change resistance as indicated by the sensor's flexing [6]. These sensors can recognize the bending point of every joint of the fingers and send the information to microcontroller. It is mounted in the outer layer of the data glove, from the association joints of fingers and palm to fingertips.

Furthermore, to expand the exactness in recognizing the hand pose, a 3-axis accelerometer is utilized to identify the change of acceleration of hand's movement in distinctive bearings [7]. The accelerometer is attached on the back of the data glove. The data glove is exceptionally suitable in perceiving both fingerspelling and sign motions, which include static and movement signs. However, these data glove can be expensive. While it is conceivable to create less expensive data glove, they are much more vulnerable to noise. If the amount of the sensors used is reduced, it will bring about loss of essential data about the hand stance. This will results in the loss of exactness in sign interpretation [1]. The data glove also can be less comfortable to be worn by the signer.

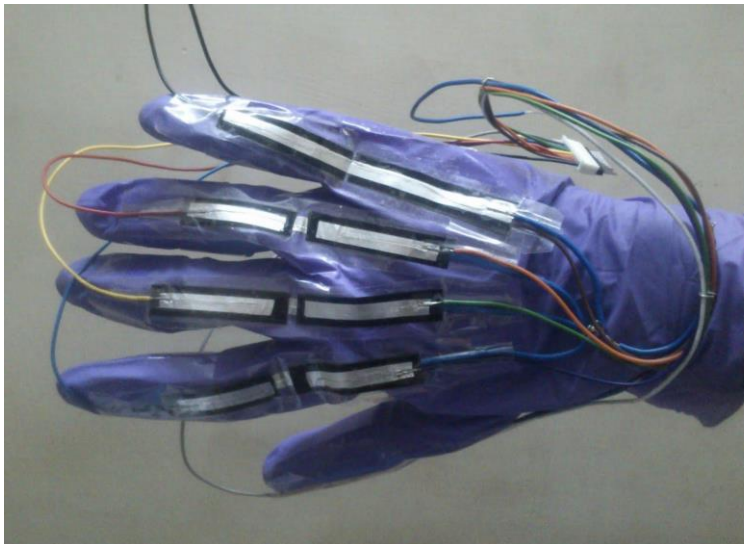

Figure 2.1: Data glove with flex sensors [2].

### 2.1.2 Visual-based approach

With late progression in PC and data innovation, there has been an expanded regard for visual-based methodology. Images of the signer is captured by a camera and video processing is done to perform acknowledgment of the sign language. Contrasted with data glove approach, the fundamental advantage of visual-based methodology is the adaptability of the framework. The recognition of facial expression and head movements additionally can be incorporated to the framework and perform lip-perusing. This system can be separated into two strategy, which are utilization hand crafted shading gloves and in light of skin-colour recognition.

For the specially crafted glove, the signer is furnished with colour-coded gloves. The colour will give the extraction of information from the images of the signer through colour segmentation. These gloves are essentially normal pair of glove with particular shading on every fingertip and palm. Some way or another, these gloves are less expensive contrasted with electronic data gloves. This system is use insignificant equipment by utilizing just essential webcam and basic glove. Webcam is used to acquire images from the signer in type of still images and video streams in RGB (red-green-blue) shading.

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Figure 2.2: Colour-coded gloves [1].

For the recognition based on skin-colour, the framework require just a camera to catch the pictures of the signer for the normal collaboration in the middle of human and computer and no additional gadgets are needed. It is turn out to be more common and helpful for constant applications. This system utilize an uncovered hand to concentrate information required for recognition, and it is simple, and the user directly communicate with the system [2]. In order to track the position of hand, the skin colour region will be fragmented utilizing colour threshold technique, then the region of interest can be determined. The image acquisition runs constantly until the signer demonstrates a stop sign [8]. After the threshold, the segmented images are then analysed to obtain the unique features of each sign.

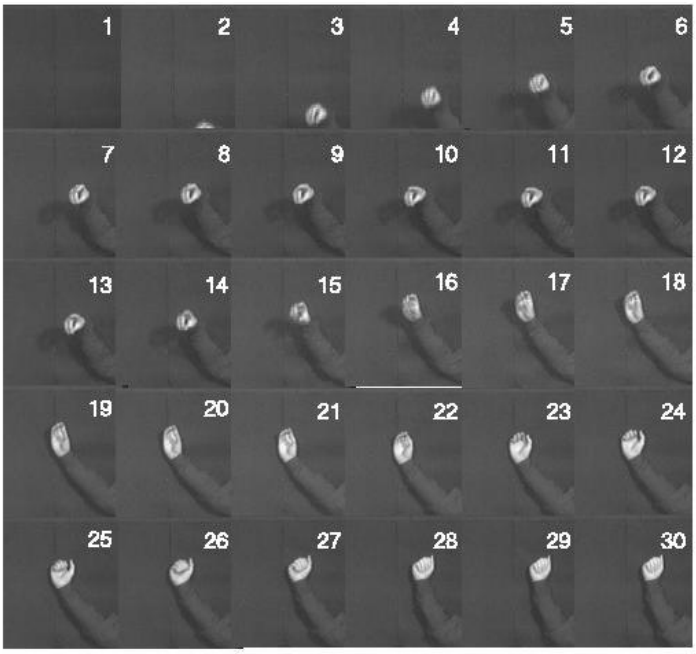


Figure 2.3: Image acquisition [8].

These visual-based approaches are fundamentally minimizing the equipment necessities and cost. However, these systems are just suitable and viable for deciphering alphabets and numbers, as opposed to perceiving sign gestures. Signs with comparable stance to another sign can be confused, along these lines diminishing the precision of the system [8]. Moreover, the image acquisition process is subjected to numerous ecological concerns, for example, position of the camera, background condition and lighting affectability. The diverse tallness of the signer likewise must consider. Adequate lighting additionally required to have enough brightness to be seen and analysed [1].