HAND SIGN LANGUAGE TRANSLATOR BY USING MOTION SENSOR

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Special thanks dedicated to my project supervisor, my family, UTeM lecturers, and my friends

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ABSTRACT

Hearing impairment and speech impairment are a form disabilities faced by a minor group of the society. Having those disabilities will not causes them have to face obstacles to communicate with the rest of the society, but also makes them more difficult to convey their message. Connected World - the theme of the project. There are two meanings in the term: the first one is to break the communication barrier between deaf or mute community and the rest of the society by translating hand sign language into readable text and speech, thus, connecting both world. The second meaning of the project is for global accessibility, the implementation platform of this project will allow anyone to access the algorithm anywhere, connecting the world. In order to achieve the goal, an American Sign Language (ASL) Translator was developed to translate ASL hand sign to readable text and speech. The LEAP motion technology was implemented in this to capture ASL fingerspelling hand sign gesture displayed by the user. The captured data is then further processed, recognized, and classified into English letters. The translated letters will be concatenated into words and then pronounce verbally

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ABSTRAK

Kecacatan pendengaran dan ucapan adalah halangan yang dihadapi oleh sebahagia minoriti masyarakat. Dengan kecacatan tersebut, orang kurang upaya (oku) bukan sahaja menghadapi masalah untuk berkoumunikasi dengan masyarakat, tetapi juga menyebablan mereka sukar untuk menyampaikan mesej mereka. Connected World - tema projek ini mengandungi dua makna: yang pertama adalah untuk memecahkan halangan komunikasi antara pekak atau masyarakat bisu dan seluruh masyarakat dengan menterjemahkan tangan bahasa isyarat ke dalam teks yang boleh dibaca and juga suara, dengan itu, menghubungkan kedua-dua dunia. Makna kedua projek ini adalah untuk menjayakan komunikasi globalisasi, platform pelaksanaan projek ini akan membolehkan sesiapa sahaja untuk mengakses algoritma ASL Translator di semua lokasi yang mempunyai internet. Untuk mencapai matlamat tersebut, Penterjemaah American Sign Lanuage(ASL) telah dihasilkan untuk menterjemahkan tanda tangan ASL kepada teks yang boleh dibaca dan suara. Teknologu LEAP motion telah digunakan dalam projek ini untuk menangkap ASL Fingerspelling tangan tanda isyarat ASL Fingerspelling dipaparkan oleh pengguna. Data yang telah dirakam akan diproses, dan dikelaskan kepada huruf bahasa Inggeris. Huruf diterjemahkan akan dirangkaikan kepada perkataan-perkataan dan kemudian disebutkan secara lisan..

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CHAPTER 1

INTRODUCTION

This chapter introduces the background of the project. The selected project is named as **Hand Sign Language Translator using Motion Sensor.** Basically, in this part, the concept of the projects as well as the objectives need to be achieved be discussed and stated clearly. Besides, limitations and constraints were also imposed on the project in order to manage the scope of project. Last but not least, the purposes of having this project and the impacts the project can bring to the society upon implantation will also be discussed thoroughly.

1. 1 Background Study

Hearing impairment and speech impairment are a form disabilities faced by a minor group of the society. Having those disabilities will not causes them have to face obstacles to communicate with the rest of the society, but also makes them more difficult to convey their message.

This project was proposed to break the communication barrier between the disabled group and the rest of the society by converting the sign language (American Sign Language) into readable English text. This project proposed the use LEAP motion technology to recognize the hand gestures and movement of a person who is conveying his/her message using sign language.

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Though the sign language recognition can also be done using the cameras which is using the image processing technology, the LEAP motion technology will have a better advantage since LEAP motion does not depends on the outdoor light intensity. Normal cameras will have difficulties in capturing images if the surrounding light intensity is under a certain values, the LEAP motion is however, using the infrared sensing, can avoid this problem.

1. 2 Problem statement

Hearing impairment people are often facing difficulties to communicate effectively with the fortunate people as most of them do not know how to interpret sign language. This will not only form a barrier between them and the rest of the society in terms socialization but also affecting their working chances. Thus, a system that capable of translating sign language into written text is essential to smoothen the communication between those who are fortunate and those who are not.

1. 3 Objective

The objectives were set as main goal for the project to be achieved:

I. To analyze hand gestures and movement involved in sign language used by hearing impairment group

II. To implement LEAP motion technology in both hand gesture tracking and movement recognition

III. To design an algorithm that can translate hand gestures into readable text and speech.

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1. 4 Scope of Project

The scope of the project was set to set limitation and coverage range for the research work and the project itself. The scope of project is as followed:

- American Sign Language (ASL) was chosen as the target sign language.
- Spoken English are the target language to be translated into.
- The target group of this project is the hearing impairment group and speech impairment group.
- Only Basic English alphabets and simple salutation sentence will be included into the library.

1. 5 Project Significance

The fundamental concept of this project is to convert the commonly used hand sign language, which is the American Sign Language into readable English text. By using motion sensing technology such as LEAP Motion Controller, the pattern recognition of hand gesture becomes more achievable and portable.

The hearing impairment community is constant having difficult when they try to communicate with the rest of the society, as normal people are not hand sign language literate. Thus, by converting the hand sign language, natural language of dear people to readable English text, a world-wide spoken language, is capable to reducing the obstacle faced by the deaf people in communication. Therefore, upon commercialization, this project is believed to have a significant positive impact on the society, especially for the hearing impairment community.

One of the benefit of this project including the breaking of the invisible barrier of communication as it allows fortunate people to understand the hand sign language expressed the deaf people, while the deaf shall no longer have difficulties to convey their message to the normal people. This can indirectly increases the employment

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chances as many of the deaf people cannot present themselves to the employer well as the employer cannot understand their thoughts through communication.

Besides, this project upon successful implementation will also eases the learning of the sign language. There are a significant portion of hearing impairment community is not born with hearing defectiveness, some of them had lost their hearing ability in an event of illness or accidents, thus, they need to learn the hand sign language as well. Thus, by having this project, the education of hand sign language will become much easier, as even self-learning of the hand sign language becoming more reliable.

1. 6 Report Structure

This report consist a total of five main chapters, which include: Chapter One: Introduction, Chapter Two: Literature Review, Chapter 3: Methodology, Chapter 4: Result and Discussion, and Chapter Five: Conclusion and Recommendation.

The introduction of the project will be discussed in Chapter One, whereby the background of the project are analyzed. Problem statement will be derived from the problematic situation and the objectives are stated as the proposed solution to the problem stated. Besides, the project scope will be stated in order to limit of field of study for the project. In last part of this chapter, the project significance will also be discussed.

The Chapter Two covers all the related previous research works which were used in the project. The previous research work will provide sufficient pre-requisite knowledge and would act as a reference point for the project development. Summarization of the related previous research work will be also be done on this chapter.

The Chapter Three is regarding the project methodology. Development process flow of the project will be introduced in this chapter. This chapter will provide and explain all the necessary steps and procedure required to be followed in order to achieve all the

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project objectives which include: pre-requisite software installation, hand feature extraction, hand feature recognition and classification, letters concatenation, and also GUI development process.

The collected results throughout the project will be illustrated and tabulated in Chapter Four. Observation will be made, and analysis will be done on the collected result. Furthermore, rational deduction will also be made to explain the problem encountered in the project. This chapter was designed to compare to the achieved result with the stated objectives.

Chapter 5 would be the last chapter of the project where the project conclusion are made. On the other hand, recommendations will also be suggested as future improvement to solve the limitation faced during the development project.

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CHAPTER 2

LITERATURE REVIEW

This chapter include all the research work done to develop the project. Previous research works including American Sign Language basics, hand feature recognition, hand gesture classification methods are used as pre-requisite knowledge for the development of the project. Similar previous research was taken as a reference for the comparison of the data and result achievement of the project. Credits are all solely belong the respective authors.

2. 1 American Sign Language

A language is defined as rules-governed communication system, while the studies discovering and researching those rules are known as linguistics. Basically, then hand sign language is also of the natural language of human community, and as other communication system, it allows the user to manipulate the composed symbols to express their thought, and at the same time, understand others [1].

American Sign Language (ASL) is a language or tool for social communication within the hearing impairment society. The ASL itself have its own grammars and signs for the language system, which means, will have an expression, which is mostly used for communication between the deaf people [1]. Basically, the ASL consist of roughly 6000 gestures of common words with finger spelling [5].

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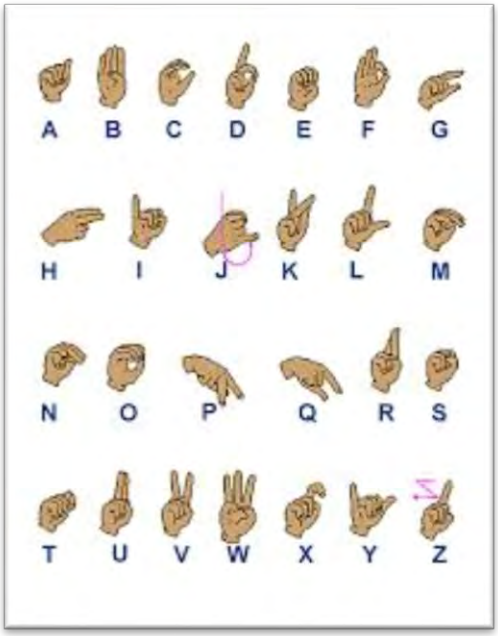

Figure 2.1: The hand sign gestures for American Sign Language alphabets

On the other hand, when the deaf people communicate with the hearing people, fingerspelling from ASL is commonly used, to spelling out English words by using hand signs to represent the alphabets. In the fingerspelling, the ASL is a single-handed sign language, compare to English Sign Language which is consist of two-hand signs. This is one of the reason of selecting the ASL as the target language in hand sign conversion as it has significant advantage in a limited space [2]. Figure 2.1 shows the signs used to represent English alphabets.

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2. 2 Hand Gesture Tracking and Feature Extraction

Hand gesture tracking is process whereby a system traces the hand of the user, and able to recognize its gesture and movement. The hand gesture detection process often requires precise hand features. One of the research has successful developed an approach of hand gesture recognition based on precise multiple feature point of motion features [6]. Figure 2.2.1 shows the structure of multiple feature point recognition system.

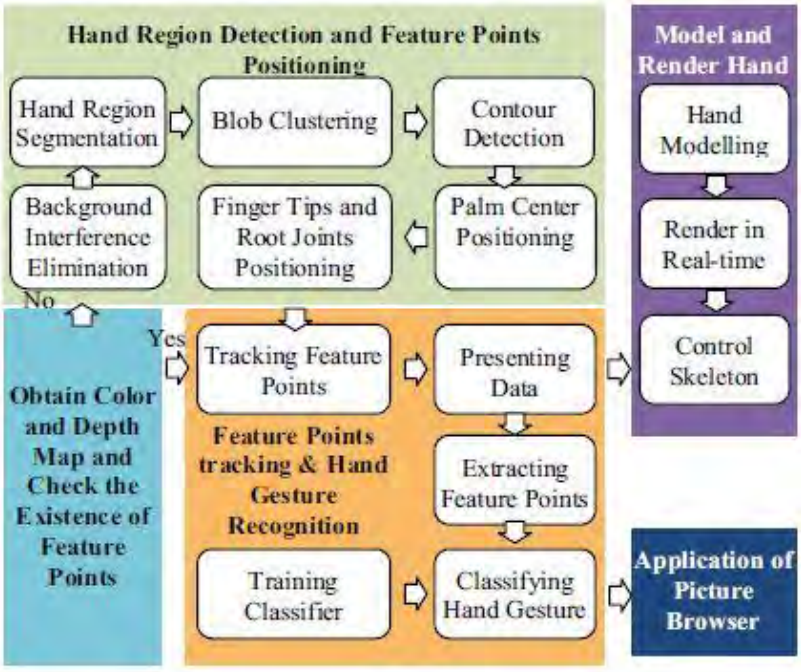

Figure 2.2.1a a multiple feature point's hand gesture recognition system

The above system utilizes cameras to capture the hand gesture image, and recognize the captured hand gesture using the proposed approach. Some of the feature points used in recognition include: fingertip locations, hand palm location, and also the hand palm movement speed.

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