UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HANDROID – SIGN LANGUAGE TRANSLATOR

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours.

by

DEN ROKO BIN KASDI

B071610708

950131-10-5689

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

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Jalan Gombak Batu 6, 53100 Kuala Lumpur.

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This report is submitted to the Faculty of Electrical Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours. The member of the supervisory is as follow:

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DEDICATION

To my beloved parents.

ABSTRACT

Deaf-mute term is used globally to describe the people who are unable to speak orally and those who need to use sign languages with their hand gestures to deliver information to others. The problem arises when most people do not really familiar with sign languages, thus limiting the communications in daily life. There are some factors contributing to this, mainly that the society do not really recognized the mute-deaf and handicapped people to be part of them. There are not enough exposures as well in the education systems regarding these matters. So this project brings new encouragements and awareness towards realizing their needs to counter these issues. Thus, the project will be able to convert the sign language gestured by mute people to sounds and voices that can easily be understood by everyone. Arduino microcontroller is used to process all the inputs from sensors and convert them to readable data. This project also comes with an Android application to monitor all the parameters involved throughout the process. From the results as well, the data obtained have been analysed from calibration of sensors such as reaction of timing of hand gestures and the positioning of hand. These elements are crucial to get the best outcome and provide better users experience. The outcomes have been analysed and recorded for further researches for the future as well. From the project also, it has been found that most people are actually did not familiar with the sign language from the start. As the conclusion, this project is actually one of the approaches to put the recognition for the mute-deaf society to be acknowledged better in the future.

ABSTRAK

"Bisu dan pekak" ialah terma yang digunakan di seantero dunia untuk orang-orang kelainan upaya yang tidak mampu bertutur secara lisan dan perlu menggunakan bahasa isyarat untuk berkomunikasi dalam kehidupan seharian. Masalah-masalah timbul apabila ramai dalam kalangan masyarakat tidak biasa menggunakan bahasa isyarat dan memahaminya secara terus. Dalam kajian projek ini, galakan untuk meningkatkan kesedaran terhadap golongan minoriti ini telah didedahkan untuk menyelesaikan masalah-masalah tersebut. Projek ini akan menterjemah bahasa isyarat daripada pergerakan tangan kepada teks dan bunyi supaya ianya boleh difahami oleh semua orang. Arduino digunakan untuk membaca input daripada semua sensor dan memproses nilai-nilai tersebut kepada teks yang boleh dibaca. Disamping itu, sebuah aplikasi Android juga telah dibina bagi membantu proses tersebut. Daripada hasil kajian, data yang diperoleh telah dikaji daripada kalibrasi kesemua sensor seperti masa yang diambil untuk data diperoleh dan kedudukan pergerakan tangan. Data-data seperti ini sangat penting untuk memberikan keselesaan kepada pengguna. Ianya juga telah dianalisa dan direkod untuk kajian pada masa hadapan. Daripada kajian projek juga, masyarakat pada zaman kini juga didapati tidak biasa dengan bahasa isyarat secara langsung. Banyak faktor yang menyumbang kepada isu ini, antaranya ialah mereka tidak mengiktiraf dan menghargai kewujudan komuniti orang kelainan upaya (OKU) sebagai sebahagian daripada masyarakat. Terdapat juga kekurangan yang jelas dalam sistem pendidikan yang tidak memberi pendedahan yang jelas terhadap bahasa isyarat ini. Sebagai konklusinya, kajian projek ini sebenarnya menjadi salah satu usaha dalam menangani masalah ini.

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LIST OF ABBREVIATIONS

ASL	American Sign Language
PSE	Pidgin Signed English
SEE	Signed Exact English
US	United States
DMP	Digital Motion Processing
IIC	Inter-Integrated Circuit
SPI	Serial Peripheral Interface
ADC	Analog-Digital Converter
IMU	Inertial Measurement Unit
ARM	Advance RISC Machine
RISC	Reduced Instruction Set Computing
ATMEL	Advanced Technology for Memory and Logic
LCD	Liquid Crystal Display
HMI	Human Machine Interface
ISL	Indian Sign Language
OS	Operating System
USB	Universal Serial Bus
DOF	Degree of Freedom
IC	Integrated Circuit

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain in detail about the background of the project, problem statement, objective, work scope and outline of the project.

1.2 Project Background

For almost a century, sign languages have been used globally by deaf and mute community to communicate in their daily lives. The languages are expressed as hand gestures and face expressions to make others understand the message the users want to deliver. As time passing by, the understanding of these sign languages is still not recognizable and familiarized by most of the public, making it hard for deaf and mute community to put themselves among the society and become more expressive.

Lately, there are some efforts to encounter these problems by scientists and educators. There are a lot of courses in universities that offer the sign languages as one of the subjects to be learned in campus too. Mainly, the sign languages are not standardized throughout the globe. For example, Americans used American Sign Language (ASL). This is not the same sign language used by others in other parts of the world. The problem becomes worse when these sign languages users even meet, they still cannot understand each other. It is unclear that how many sign languages currently exist worldwide. Each state, country and continent have their own perspective and native sign language, in which make them perfectly specific and hard to be categorized.

Figure 1.1: Sign Language Users

The National Centre for Health Statistics estimates that 28 million Americans (about 10% of the population) have some degree of hearing loss. About 2 million of these 28 million people are classified as deaf (they can't hear every day sounds or speech even with a hearing aid). Only about 10% of these 2 million people were born deaf. The other 90% became deaf later in life. This is based on research by Colin Mathers (2000).

The speakers of ASL need to face the reality and all the challenges waiting for them ahead. Not to forget, that these deaf and mute community includes the people who are deaf and mute and who are connected to them in the surroundings. Today, it is estimated that the number of users of American Sign Language falls between 250,000 and 500,000 Americans according to the research on Hearing Loss Prevalence (Frank R. Lin, 2011). On a large scale, a truly international sign language does not exist, however, ASL is one of the most popular sign languages in the world.

Figure 1.2: Sign Language is Used Globally

The other effort made was to invent a device that can directly translate the sign languages into understandable elements such as words and voices. This device has been developed from the 19th century until now. The problem is, there are no genuine approach and effort to commercialized these ideas. For that, the case study for this project is focusing on how to develop and invent the sign language translator as well as encouraging and increase the awareness towards appreciating the deaf and mute community.

1.3 Problem Statements

Sign language is not for everyone to understand. It is used widely across the globe but only for deaf & mute people only. The problem arises when most individuals do not familiar with sign language thus resulting in lack of awareness and miscommunications during the exchange of information. Therefore, this Sign Language Translator is developed to overcome those problems.

1.4 Objectives

There are several objectives to be achieved from this project:

i) To develop an Android application to be integrated with Arduino microcontroller as a system.

ii) To develop a glove that can translate sign language from hand gestures into text and voices.

iii)To help deaf and mute community acquiring better daily communication approaches.

1.5 Project Scope

Before implementing the idea of the project in the term of hardware and applications, there are some guidelines issued by the project to be offered. This is to ensure that the objectives will be accomplished eventually. This project will cover these scopes as well as achieving its objectives.

This project covers on the translation of basic sign language of American (ASL). The basic terms are those sign that are used frequently in daily life such as greetings, directions and name of places and animals. An Android application also has been developed to functions as the display through any Android smartphones that runs the operating systems from Android 2.0 and above. The application is developed with a free source website, App Inventor 2 that allows the interaction of the application and microcontroller.

The project also focuses to built one glove instead of pairs because of costing, quality control and other purposes. This is mainly can give advantage to other aspects of the project that should be done before coming up with fully built device.

On the other hand, an Arduino microcontroller is used as the brain of the system implemented. The microcontroller functions as the comparator between the values of sensors such as gyro meters and flex sensors and changes them into strings or texts. These data are being sent away from the transmitter and receiver port through Bluetooth connection.

1.6 Thesis Outline

This project consists of five main chapter:

1) Chapter 1: **Introduction**.

Discussing about the background of the project and the problems it wants to solve. Basically, chapter 1 brings the overall ideas of the project. It consists of project background, objectives, problem statements, scopes and project outline.

2) Chapter 2: **Literature review.**

In this chapter, the preview of the previous researches and project regarding this issue are documented.

3) Chapter 3: **Methodology.**

This chapter represents all the methods or ways on how the project is being implemented. The chapter holds most of the project's blueprint and information of its development.

4) Chapter 4: **Result.**

Representation of data and result are documented in this chapter. The results are necessary for further researches in the future.

5) Chapter 5: **Conclusion**

This chapter consists of the recommendation and conclusions which states whether the objectives are achieved or not.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will compile all about the researches made from theoretical and basic principles regarding the project. With the guide of the project scopes, the data and information needed have been collected from various types of sources. This covers from books, journals, articles, organizations and websites. The literature review is compulsory to compare the current project with the previous ones that tried to solve the same problem.

As the results, much improvements can be made thus giving better outcomes and recommendations for future researches. The method of literature review will further support the comparison of ideas, whether they are practical or theoretical in every way. It will cover on the previous projects that have went for similar objectives, to translate sign languages from hand gestures to readable texts and sounds.

2.2 ASL Against Different Types of Sign Languages

There are 3 types of sign languages in the US. Which is American Sign (ASL), Pidgin Signed English (PSE), and Signed Exact English (SEE). Each of them is unique and special in their own ways to represent words and expressions between the users.

ASL is used by most of the deaf community in the US because it's the most popular type of sign language. It is a visual language, which means the speech-reading and listening skills are not needed to be fluent in ASL. Furthermore, it has been used widely across the nations within a century. ASL is a free-flowing language, because the language completes itself when the users expand their expression as time passing by. It's rarely written or spoken, but mainly it's still easier to be translated compared to the other type of sign languages.

Another reason that brings ASL on top of the list is that many education systems have already recognizing it as the official language to be taught in deaf school. Morgan (2002) in his journal stated that other type of sign languages finds their difficulty to grow and expand is because of their complexity. In addition, they are not really fit into the education systems of deaf and mute community around the world.

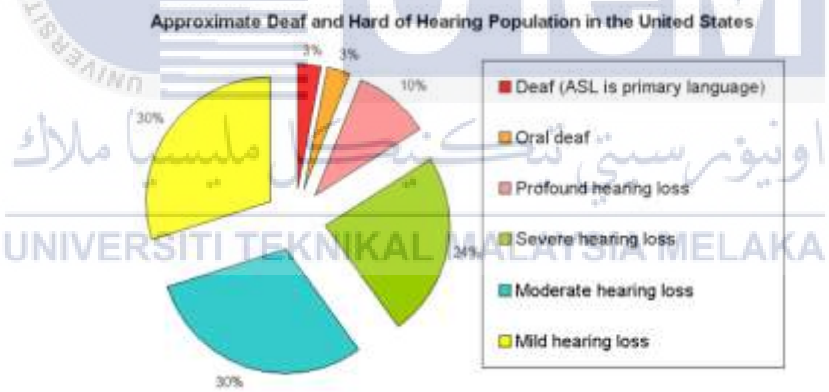

Figure 2.1: Deaf-Mute Population in the US

On top of that, ASL is suitable for most of the deaf, knowing that the types of deaf are exist in many varieties. From the article from Hearing Loss Association of Carolina titled Deaf and Hard of Hearing (2017), many deaf people do not consider themselves as deaf, whose refuse to learn the sign languages. But later ASL give them opportunity to communicate with the others when necessary.