MALAYSIAN SIGN LANGUAGE TRANSLATOR FOR COMMUNICATION USING 3-D VIRTUAL HUMAN CHARACTER (ALTERLANGUAGE)

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ABSTRACT

Communication is very important to human being. Deaf community use sign language to communicate among them. Sign language is a language of hand shapes, facial expressions and movement used as a form of communication. However, current sign language learning method in sketch and illustration format is not interesting to learn and difficult to understand the sign language. Therefore, Alterity Technology takes this opportunity to develop Alterlanguage, innovative software that will help the deaf to learn Malaysian Sign Language. Augmented transition network parser, pattern-matching technique and pattern-matching search technique are used in translator to change text into a set of command. Furthermore, kinematics technique is used in developing the graphic to control the hand movement. This software can receive input in text and generate output in term of three dimension animation. It is also suitable for those who want to learn and communicate using sign language.

ABSTRAK

Komunikasi adalah sangat penting dalam kehidupan seharian manusia. Orang pekak menggunakan bahasa isyarat untuk berkomunikasi antara satu sama lain. Bahasa isyarat adalah satu sistem komunikasi yang berorientasikan visual dan pergerakan tangan. Walaubagaimanapun, kaedah pembelajaran bahasa isyarat dalam bentuk lakaran dan ilustrasi yang digunakan agak membosankan dan tidak dapat menarik minat mereka untuk belajar serta memahaminya. Oleh itu, Alterity Technology telah mengambil inisiatif untuk membangunkan satu perisian yang inovatif serta berdaya saing supaya dapat membantu orang pekak untuk mempelajari bahasa isyarat. Penghurai Rangkaian Transisi Penambahan, teknik padanan-corak dan teknik carian padanan-corak digunakan untuk menukarkan teks kepada set arahan. Teknik Kinematik pula digunakan dalam menjana grafik untuk mengawal pergerakan tangan. Perisian ini dapat menerima input dalam bentuk teks dan menjanakan output dalam bentuk animasi tiga dimensi. Ia juga sesuai untuk mereka yang ingin belajar dan berkomunikasi menggunakan bahasa isyarat.

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LIST OF ABBREVIATIONS

3-D	-	Three Dimensional
ALT	-	Advanced Learning Technology
ASL	-	American Sign Language
ASR	-	Automatic Speech Recognition
ATN	-	Augmented Transition Network
BIM	-	Bahasa Isyarat Malaysia (Malaysian Sign Language)
BSL	-	British Sign Language
CD	-	Compact Disk
CIC	-	Council Information Centers
DBP	-	Dewan Bahasa Dan Pustaka
DOF	-	Degrees of Freedom
KTBM	-	Kod Tangan Bahasa Melayu
MARA	-	Majlis Amanah Rakyat
MFD	-	Malaysian Foundation Of Deaf
MOE	-	Ministry of Education
MYF	-	Majudiri Y Foundation For The Deaf
MySL	-	Malaysian Sign Language
NGO	-	Non-Governmental Organization
NLP	-	Natural Language Processing
OKU	-	Orang Kurang Upaya (Disabilities Person)
RTM	-	Radio Televisyen Malaysia
RUP	-	Rational Unified Process
SADeaf	-	Singapore Association for the Deaf
TESSA	-	Text and Sign Support Assistant
TTS	-	Text-To-Speech
UK	-	United Kingdom
UN	-	United Nation

UNESCO	-	United Nations Educational, Scientific and Cultural Organization
UTM	-	Universiti Teknologi Malaysia
VANESSA	-	Voice Activated Network Enabled Speech to Sign Assistant

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

Alterlanguage *- Malaysian Sign Language Translator for Communication using 3-D Virtual Human Character.*

Communication is a process that allows organisms to exchange information by several methods. Communication requires that all parties understand a common language that is exchanged. There are auditory means, such as speaking, singing and sometimes tone of voice, and nonverbal, physical means, such as body language, sign language, paralanguage, touch, eye contact, or the use of writing.

Communication happens at many levels (even for one single action), in many different ways, and for most beings, as well as certain machines. Several, if not all, fields of study dedicate a portion of attention to communication, so when speaking about communication it is very important to be sure about what aspects of communication one is speaking about. Definitions of communication range widely, some recognizing that animals can communicate with each other as well as human beings, and some are narrower, only including human beings within the parameters of human symbolic interaction.

Nonetheless, communication is usually described along a few major dimensions:

a. Content (*what type of things are communicated*);
b. Source (*by whom*);
c. Form (*in which form*);
d. Channel (*through which medium*);
e. Destination/Receiver (*to whom*);
f. Purpose/Pragmatic aspect (*with what kind of results*).

Between parties, communication includes acts that confer knowledge and experiences, give advice and commands, and ask questions. These acts may take many forms, in one of the various manners of communication. The form depends on the abilities of the group communicating. Together, communication content and form make messages that are sent towards a destination. The target can be oneself, another person or being, another entity (such as a corporation or group of beings).

Depending on the focus (who, what, in which form, to whom, to which effect), there exist various classifications. Some of those systematical questions are elaborated in Communication theory.

A sign language (also signed language) is a language which uses manual communication, body language and lip patterns instead of sound to convey meaning—simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express fluidly a speaker's thoughts. Sign languages commonly develop in deaf communities, which can include interpreters and friends and families of deaf people as well as people who are deaf or hard of hearing themselves.

As is the case in spoken language, sign language differs from one region to another. However, when people using different signed languages meet, communication is significantly easier than when people of different spoken languages meet. Sign language, in this respect, gives access to an international deaf community. Sign language is however not universal, and many different sign languages exist that are mostly mutually unintelligible.

Wherever communities of deaf people exist sign languages develop, in fact their complex spatial grammars are markedly different than spoken language. In many cases, various signed "modes" of spoken languages have been developed, such as Signed English and Warlpiri Sign Language. Hundreds of sign languages are in use around the world and are at the core of local Deaf cultures. Some sign languages have obtained some form of legal recognition, while others have no status at all.

Exemplary for the mature status of sign languages is the growing body of sign language poetry, and other stage performances. The poetic mechanisms available to signing poets are not all available to a speaking poet. This offers new, exciting ways for poems to reach and move the audience.

In Malaysia, deaf community uses Malaysian Sign Language (MySL) to communicate among themselves. MySL is a 'natural' sign language which constitute by deaf person on the factors as daily communication and culture of deaf person.

Since foundation of Sekolah Kanak-kanak Pekak Persekutuan Pulau Pinang, MySL is being used as communication language widely by the deaf community in the country. MySL symbolizes real identity and culture to Malaysian deaf community.

Combining computer technology and linguistics research to bridge the communication gap between the deaf and hearing worlds, Alterity Technology working towards the realization of a digital Malay Language-to-MySL translator for communication. An automatic Malay Language to MySL translator would give deaf people greater access to the hearing world.

Malaysian Sign Language (MySL) is a dynamic set of hand configuration, hand positions, body positions, body movement, and facial expressions that, when used in combination, support communication among deaf people of Malaysia. Certain signs represent complete words or phrases. A manual alphabet is used to "finger-spell" to introduce the Proper Noun before creating specific signs for these nouns. It is also used for concepts which do not have a specific, single sign before it can introduce a "synonym" sign for the concept.

Currently, human MySL translators are frequently necessary to facilitate communication between deaf and hearing presenters and their audiences. Good MySL translators are in high demand and are not always available. That means that communication among hearing and deaf people may be impaired or nonexistent, to the detriment of both groups.

Development of an automated synthesizer for MySL will make much more information accessible to deaf people on a more economical basis. It will allow the deaf to participate in and more fully understand the exchanges among a hearing audience in classrooms, meetings, and other venues. The synthesizer will also provide deaf people with a better tool than Malay Language documents or notes for understanding content.

Given that MySL is the fourth most-used language in the Malaysia, the project team feels that a very large group of people will benefit.

1.2 Background of Problem

Hearing is the basis to human ability communicates. Human capability form speech and language from producing their ability to hear, understand his insight and further utter what she heard.

Researcher discovered that deaf students were not making the connection between what they signed in sign language, Malay language and what was written in Malay. They did not recognize everyday words such as “school” and “class”.

Sign Language differs from spoken language in that it is visual rather than auditory and is composed of precise hand shapes, facial expressions and movements. The book on Bahasa Isyarat Malaysia is in a clearly defined format for deaf children and their families.

> *"This handy and user-friendly book is to encourage children, even from a very young age, to communicate meaningful with their parents and siblings"*
>
> (Malaysian Federation of the Deaf, 2000)

The book has over 1000 common signs or words ideal for children of all ages and divided into following topic: Sports, foods, pronouns, conjunctions, auxiliary verb, adjective, transportation, clothing, animals, colors and education. It also includes Malaysian Sign Language number signs and Malaysian Sign Language manual alphabet for handy reference.

The state of the art of the computer and technological tools that can be considered as the most representative systems of the communication in sign language through the whole world, in different environments. Three main approaches exist in the literature: the first is based on writing or drawing symbols, the second approach is based on video; however the third is based on 3-D and animation of a virtual person according to a standard. Another approach is constituted by systems that are oriented dynamic Web.

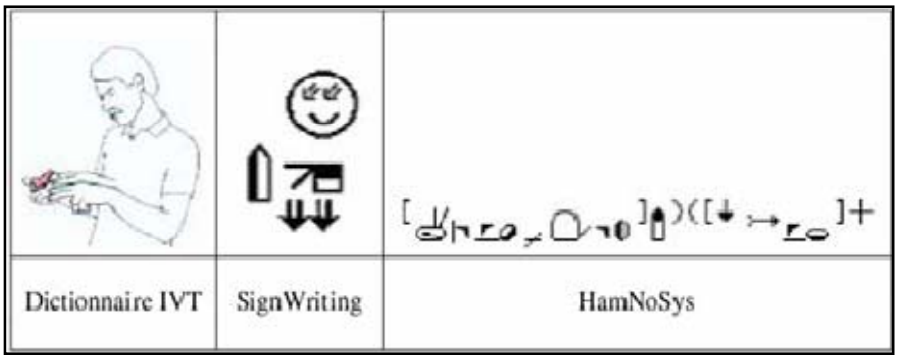

Figure 1.1: Transcriptions of Word in French Sign Language

In this new technological context, the modeling of a virtual character can be achieved either according to a segmented model, gotten by a hierarchical graph of the anatomical segments 3-D, or according to a model seamless. In both cases, the surfaces are represented either with the help of polygonal stitch, either by a mathematical analyzing, and either again according to implicit functions to skeleton. The creation of the virtual character is achieved either from a modeler of geometric primitives, or with the help of a scanner 3-D.

The problem with Sign Language classes is that you have to stick to it. Attending regularly – especially after hours – quickly become a real chore. Alterlanguage solves the problem. You can learn

a. As much as you want;
b. When you want to;
c. At your own pace;
d. In your own home.

Sign language is not written language but rather a set of visual descriptors. Therefore, when using sign language think in pictures instead of words. When using sign language there are various ways to express you by hand forms, arm movements, head movements, facial expressions and also body language (Wikipedia, 2008).

The system database act as resource centre would not only benefit the deaf community but also the public as those interested in learning more about communicating in sign language. It would also help the deaf and hard-of-hearing become more gainfully employed and self-reliant in future.

From newspaper article (Appendix B), shows that deaf is a hidden disability and might cause unattractive attention of the community over with other disabled group of people. Deaf people are an unnoticed group as they do not can hear and societies do not know their need because there was no communication among them.

From newspaper article (Appendix C), shows that sign language teacher might be used as translators for the deaf community in court and police station.

1.3 Statement of Problem

From newspaper article as shown in Appendix D, shows that latest statistics issued by Ministry of Health estimates 440,000 or two percent from 22 million Malaysians face hearing problem including deaf. With that high figure, needs and facilities for this community should be taken seriously.

Besides that, hearing-aid-device is also one of the important matters in facilitate the deaf person to communicate and interact with community.

Unfortunately, awareness on the importance such as communication is not enough to be proud over compared to those developed countries.

We only have sign language interpreter on television for Radio Televisyem Malaysia (RTM) channel one during eight o'clock news. That means, deaf person only have chance to understand television broadcast for one hour only.

1.4 Opportunity

> *"... Menyedari terdapat kekurangan Jurubahasa Isyarat yang terlatih untuk membantu golongan kurang upaya pendengaran dan pertuturan berkomunikasi, program khusus akan diadakan untuk melatih ramai jurubahasa isyarat..."*
>
> (Budget 2007, YAB Dato' Abdullah Hj Ahmad Badawi)

Currently, there are many foreign sign language products such as American Sign Language: Personal Communicator, Hyper Sign Kids. However, Malaysian Sign Language is rarely found in the market.

Malaysian Sign Language from Malaysia Foundation of Deaf is an official language use by the Deaf school. However, teaching process at special schools still

using the same material to educate normal student for their special student, which is seen as an opportunity to develop Alterlanguage to be utilized. They really need special learning aid to enable the student to understand what they learn.

Moreover, deaf people also have interest, comparable desire and ambition with individual normal. That is why OKU must get education opportunity comparable with normal person.

Appendix E is one of the articles from news paper shows that nowadays Special Education is very important for Ministry of Education.

1.5 Project Objectives

Clear objectives can help to ensure that Alterlanguage will carry out with success. Alterlanguage planned to meet following objectives:

a. To compose 3-D motion captured database of the standard Malaysian Sign Language;
b. To develop an automated translator for converting alphabet, digit and standard Malay word into virtual Malaysian sign language.

1.6 Project Scope

Scopes to implement Alterlanguage are as follows:

a. Inputs are character, digit and simple single word conversation that might be use in daily conversations;
b. Output - Malaysian Sign Language 3-D virtual human character animation;
c. Movement shown is limited to hand movement only.

1.7 Importance of Project

Like any other language, a sign language will have a large number of signs which are nearly synonyms, i.e., have similar meanings. The slight distinctions in the meanings are part of the richness of the language, permitting sign languages to be very precise and make fine distinctions, just as in spoken language. The structure of fluent sign languages is very efficient. Hand-shape, location, motion, orientation, and the broad category of non-manuals and facials-occur simultaneously are all integrated and represent meanings in the ways easiest for the hands, the eyes and the mind. Each sign is not isolated, but uses parts common to many other signs. The principle of verb directionality will save much time and effort in signing. Some verbs in sign language can move in different directions to show who the actor is and who the receiver is. Other verbs or adjectives or nouns can be signed at different locations to show which person or thing is referred to.

This is one of the most important ways in which sign language is efficient with time and efforts, since what is happening and who or what is acting or acted upon can be signed at the same time, rather than separated by long pauses. The principle of simultaneous grammar on the face is most important. For negation, the form using a small headshake is the most common and important. Repeating a movement or not, using a larger or smaller movement, and changing the speed or rhythm of movement in various ways can be performed very rapidly on the hands, and corresponds in some spoken language to a longer phrase often using many extra words. Even the difference between a verb and a noun related in meaning is sometimes shown this way. To create a new sign, it can be done by changing the formation of a sign defined earlier. Such changes are according to the rule used in defining new spoken words.

As far as what is known to us, most of sign language translator application deal with only video data, word translation, etc. None, however, exploits the semantic content into their products. Thus, this circumstance has boosted our motivation further beyond expectation to archive our goal and objectives. Being a

meaning-based application by itself, the project gains much benefit under the knowledge management specifications.

We summarize the commercialization aspects of the research proposal as follows:

a. Natural human-machine interaction;
b. Facilitate accessibility service for the disable;
c. Sign language animator for education application and television.

1.8 Chapter Summary

As we draw the bridge ever closer for human-machine interaction (i.e.: automatic speech recognition - ASR), the gap between the disabled and us would stretched even further apart. Despite such technological discrimination, there will always be a way to tip the scales. For example, an ASR system coupled with text-to-speech (TTS) functionality can aid a blind man getting through his mundane chores. Thus in this project, we address a system to compensate some of the challenges faced by the speech/hearing impaired. The text to sign language translation system can be beneficial in various implementations such as television news caption, e-learning scheme, information kiosk, and electronic board announcer. Ultimately this could lead to substantial reduction on cost and time of using a human expert as a sign language interpreter. By using 3-D animation, we can tune the system to balance between realism and real-time computation. Both methods that had been use which play major role in user comprehension and acceptance.

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