Voice to Sign Language Translator System

by

Terrence Lawai Wan

Dissertation report submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information System)

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CERTIFICATION OF APPROVAL

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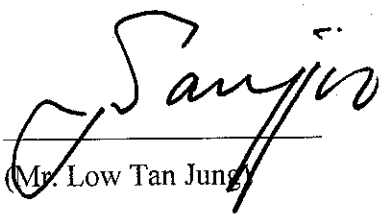
Approved by,

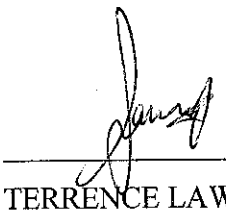


(Mr. Low Tan Jung)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
November 2007

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been taken or done by unspecified sources or persons.



TERRENCE LAWAI WAN

ABSTRACT

The process of learning the sign language may be cumbersome to some, and therefore, this project proposes a solution to this problem by providing a voice (English Language) to sign language translator system solution using Speech and image processing. Speech processing which includes Speech Recognition is the study of recognizing the words being spoken, regardless of whom the speaker is. This project uses template-based recognition as the main approach. In this approach, computer first needs to be trained with speech pattern based on some generic spectral parameter set. These spectral parameter set then will be stored as template inside the database. The system will perform the recognition process through matching the parameter set of the input speech with the stored template. Pattern recognition will be used for this project because it has the advantage of flexibility in terms of storage and matching process. In addition, its implementation is easier as compared to other methods. This paper discusses on the solution to the problem stated above, as well as the methodologies used to develop the system.

ACKNOWLEDGEMENT

With the help and support from many people while working on this project, I would like to take this opportunity to express my gratitude to all who had in one way or another helped me to complete this project.

First of all, I would like to thank Mr. Low Tan Jung, my Supervisor for his kind guidance and infinite encouragement. His advices and suggestions have guided me to complete this project successfully. I thank him for his patience and understanding of all this time.

I am also grateful to all of my friends who have given suggestions and feedbacks on the project. Special thanks go to my roommate, Praveen Manaprath Mathews for his time in discussing about Digital Signal Processing.

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

There are at least 70 million people around the globe who suffer from speech and hearing disabilities, either at birth or by accident. It is somehow difficult for us to interact with them because of the unfamiliar communication means used. Sign language is a common form of communication which is widely used by the speech and hearing impaired. Thus, probably the only way of easier communication/ interaction with them is by learning their language - the sign language. [1] [2]

This project looks into the means of communication between the normal and the hearing (deaf) and/or speech (mute) disabled using the speech recognition technology.

1.2 Problem Statement

We may have friends or family members who have hearing or speech disabilities. Such disabilities may be from birth, or by accident. Surely it is difficult for us to communicate with them if we do not know their language – the Sign Language. It also difficult for them as well to communicate with us since they have such disability.

One may be interested to learn up this language; however it may be costly to attend tuition classes to learn this language. Furthermore, tuition classes exhibits time

constraint, where one does not have the flexibility in time on whether or not to attend the tutorial. He/she may prefer to have a self tutorial, however there is no such inexpensive software that can self teach them. These may contribute to the negligence of the public to learn the Sign Language to better communicate with those with hearing or speech impairment.

There are campaigns of speeches and talks given to the public. However, these talks usually are not able to reach those with hearing disabilities. So far, only the news on RTM 1 uses the Sign Language extensively to present the daily news to them. The cause of the lack of programs using this technique may be the reason for the extra cost incurred in hiring the translator to translate the speech. Furthermore, there are lack of trained personnel in Malaysia who are able to translate these speeches to Sign Language. These had caused those with hearing disabilities to know less on the ongoing news around them.

1.3 Objective of Study

i. To ease the communication between normal people and the hearing/ speech disabled.

ii. To eliminate the need of attending costly Sign Language classes – it can be done at home.

iii. To be able to reach more audience (hearing impaired) during speeches and campaigns.

1.4 Scope of Study

- The translation of natural language to Sign Language.
- The use of Voice (speech) Recognition.
- Applies the Voice Recognition (Speech Recognition) technology to allow one way communication with disabled people (Sign Language).
- The project also focuses on word by word translation (E.g.: System is inputted with the "you", as a result a video of "you" in Sign Language is displayed).

This project's main focal point would be the usage of speech recognition as a translator to allow normal people to communicate with the disabled community (deaf or mute people).

1.5 Sign Language Translator in Malaysia

According to The Star Online on the 20th December 2006, "Radio Television Malaysia (RTM) will be incorporating more Sign Language in their news segments and dramas for the benefits of the hearing-impaired" and on 22nd July 2007, "there is an acute of Sign Language interpreters because at present, there are only 10 qualified ones to cater to 24,000 registered deaf persons nationwide, according to the Malaysian Federation of Deaf".

This means that, media agencies such as RTM are offering opportunities for more Sign Language interpreters to join their company but according to The Star, there is a shortage of people with such qualification in this country.

The development of this system will reduce cost of labor for media agencies for instance RTM. RTM will not need to hire workers as Sign Language interpreters to interpret their news segments and dramas. Hiring extra interpreters for their agency will increase the cost of salary. Thus, this system reduces the burden of compensating employees for media agencies in hiring Sign language interpreters and most importantly it will benefit the hearing-impaired.

Since there is a shortage of Sign Language interpreters in Malaysia, this system can act as a substitute for this case. This means that, the lack of Sign Language interpreters can be replaced by this system. This system is able to replace the old fashion way (a person doing interpretation) of translating Sign Language instead, interpretation is done by using modern technology such as computers, hand phones or PDA as a mediator (translator). Thus, this system solves the shortage problem of Sign Language interpreters in Malaysia.

Refer to appendix (Page 33 and 34).

CHAPTER 2
LITERATURE REVIEWS AND THEORIES

In this section, the literature reviews are divided into parts for better understanding and judgment of the study.

2.1 Voice Recognition

The voice recognition is divided into speaker recognition and speech recognition. Below are briefly of each:

2.1.1 Speaker Recognition

Speaker recognition is the task of recognizing people from their voices. Such systems extract features from speech, model them and use them to recognize the person from his/her voice. Note that there is a difference between speaker recognition (recognizing who is speaking) and speech recognition (recognizing what is being said). These two terms are frequently confused, as is voice recognition. Voice recognition is a synonym for speaker, and thus not speech, recognition. Speaker recognition has a history dating back some four decades, where the output of several analog filters was averaged over time for matching. Speaker recognition uses the acoustic features of speech that have been found to differ between individuals. These acoustic patterns reflect both anatomy (e.g., size and shape of the throat and mouth) and learned behavioral patterns (e.g., voice pitch, speaking style). This incorporation of learned patterns into the voice templates

(the latter called "voiceprints") has earned speaker recognition its classification as a "behavioral biometric." [3]

2.1.2 Speech Recognition

Speech recognition is defined as "The basic task of *Speech Recognition* (SR) to derive a sequence of words from a stream of acoustic information. A more general task is automatic speech understanding, which includes the extraction of meaning (for instance, a query to a database) or producing actions in response to speech. For many applications, interaction between system components devoted to semantics, dialog generation, etc., and the speech recognition subsystem can be critical." [4]

2.2 Digital Signal Processing - Mel-Frequency Cepstral Coefficients (MFCC)

According to Jeih-Weih Hung:

> Feature extraction is critical element in speech recognition since it is the first step of recognition process and generate the parameters on which the recognition is based. It is well known that Mel frequency Cepstral Coefficients are the most widely used features parameters. One of the step of MFCC is Mel-scaled filter bank processing. This step may result in some loss of information from the original signal, but it is widely accepted that such step is helpful in extraction information component from the signals" [5]. The research of JW Hung also showed how MFCC features can be achieved using step by step algorithm.

2.3 Pattern Recognition - Vector Quantization

According to Gray, R:

> A vector quantizer is a system for mapping a sequence of continuous or discrete vectors into a digital sequence suitable for communication over or storage in a digital channel. The goal of such a system is data compression: to reduce the bit rate so as to minimize communication channel capacity or digital storage memory requirements while maintaining the necessary fidelity of the data. The mapping for each vector may or may not have memory in the sense of depending on past actions of the coder, just as in well established scalar techniques such as PCM, which has no memory, and predictive quantization, which does. Even though information theory implies that one can always obtain better performance by coding vectors instead of scalars, scalar quantizes have remained by far the most common data compression system because of their simplicity and good performance when the communication rate is sufficiently large. In addition, relatively few design techniques have existed for vector quantizers. [6]"
>
> Even though there are other technique for pattern matching but Vector quantization is considered as one of the best for its flexibility in training as well as recognizing.

2.4 Sign Language

2.4.1 History

The recorded history of sign language in Western society extends from the 16th century. In 1755, Abbe de l'Epee founded the first public school for deaf childrean in Paris; Laurent Clerc was arguably its most famour graduate. He went to the United States with Thomas Hopkins Gallaude to found the American School for the Deaf [9]. It evolved into Gallaudet University, the only Liberal Arts University for the Deaf in the world.

2.4.2 About

Sign Language is used primarily by Deaf people throughout the world. Sign Language differs from spoken languages in that it is visual rather than auditory, and is composed of precise handshapes and movement. This language has evolved in a completely different medium, using the hands and face rather than the vocal and is perceived by the eye rather than the ear.

Sign Language is not a universal language shared by Deaf people of the world because there are many sign languages that have evolved independently of each other. Just as spoken languages differ in grammatical structure, rules and historical relationships, sign languages also differ along these parameters.

An important property of human language is that the form of words is generally arbitrary, and there are no indigenous sign languages that are simply a transformation of a spoken language to the hands. Sign language is also equipped with the same expressive power that is inherent in spoken languages and it can express complicated, intricate concepts with the same degree of explicitness and eloquence as spoken language. Sign

Language potrays the image, identity and culture of the country that the Deaf Community belongs to. In Malaysia, we have the Malaysian Sign Language (Bahasa Isyarat Malaysia—BIM).

BIM has many dialects, differing from state to state.American Sign Language (ASL) has had a strong influence on BIM, but the two are different enough to be considered separate languages.Other sign languages in use in Malaysia are Penang Sign Language (PSL), Selangor Sign Language (SSL or KLSL), and Kod Tangan Bahasa Malaysia or Manually Coded Malay (KTBM), and Chinese Sign Languages. [9]

CHAPTER 3

METHODOLOGY

3.1 Procedure Identification

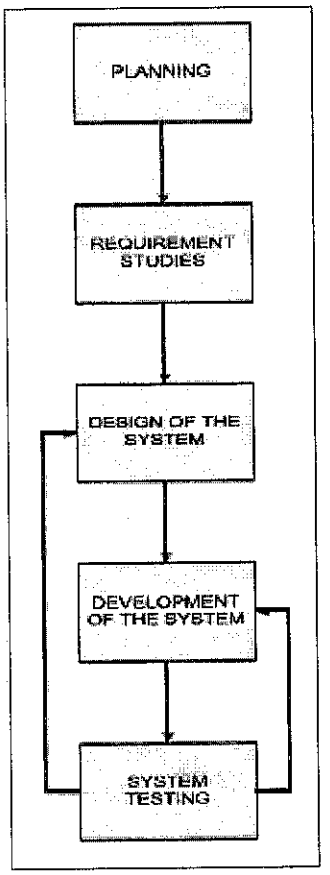


Figure 3.1: System Model

The method used in development of the system is as above. The system model consist of (i) Planning (ii) Analysis, (iii) System Design, (iv) System Development (v) Testing and (vi) Release. The phases involved in the System Model (figure

above) has its own functionality and usage on how it is related with the development of the system. The details of each procedure are as below:-

3.1.1 Planning

During this phase, resources were gathered in ordered to get a start of the planned system. Studies were made from the resources that have been collected to analyze the feasibility of the system. This is also known as feasibility analysis which is to ensure that the project can be logically be developed regarding to its requirements and the resources that have.

Throughout the planning phase for this project, relevant information was gathered from journals, books, magazine and also the Internet.

3.1.2 Requirement Studies

During this stage, the author has conducted a requirement study to identify the needs and wants for the system for instance the tools for developing the project, software required to run the system and the system requirement.

Tools for development and System Requirements

- Pentium Processor of at lease 2.0GHz
- Windows XP
- 512 MB RAM
- 100GB HD space
- 128MB Graphic card
- A recorder Headset for recording the sound
- Matlab software to develop the system

3.1.3 Design of the System

This phase emphasize on how does the outcome of the system will be looking like. Its physical appearance is important to allow user friendly environment for the user to use the system. The system undergoes a design of its framework, which is accurately specified down to each stage to guarantee that they are closely laid down to work coherently. Besides that, the program flow was designed during this phase to understand data are to be manipulated through out the system to generate the desired output.

The data flow of the application is shown below; Programmer's end of the system trains the system with samples of voices for words to be stored in the database. User will only use the recognition interface (voice input) that is responsible to recognize the word said.

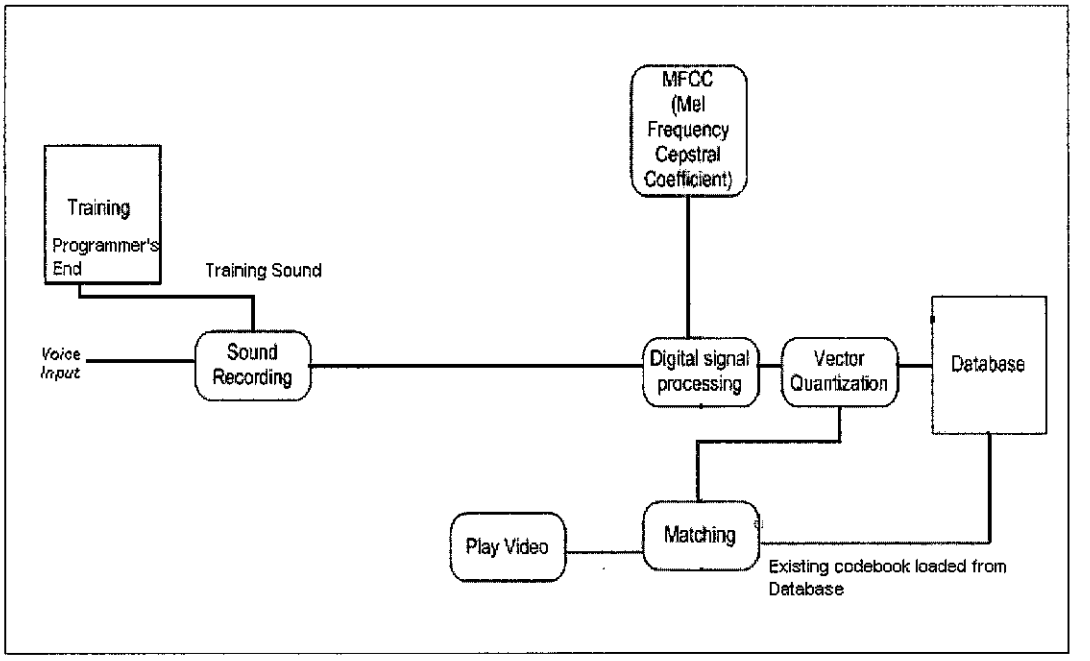


Figure 3.1.3-1: Data Flow Diagram

Following are the main processes and their results which are the output after each process. These results are the practical result of the application in which real data are used to test.

i. Sound Recording

Sound recording process is responsible to capture and record the sound using microphone. Output of this process is the recorded sound as in .wav or .midi format. However the quality of the recorded sound is not as good as the sound recorded by sound recording software in the market; the main reason is noise filter is not implemented yet.

ii. Digital Signal Processing

Above all, this is the most important and difficult process to implement. The main task of this process is to convert sound from time domain to frequency domain and then extract the features (formant) of the sound. MFCC (Mel Frequency Cepstral Coefficients algorithm are used in this process.

iii. Vector Quantization

Vector quantization is one of the most effective pattern matching techniques for speech recognition. The basic concept of Vector quantization is to compress any vector of feature into one scalar vector; by compressing the feature vector, we can save a lot of space for feature storage as well as increase the matching possibility since we just have to compare a new feature with one value instead of many. In vector quantization first we need to train the system, the trained sound will be stored in a codebook. Each trained sound will have its own codebook. During the recognition stage, the new input signal will be used to compare with all the codebooks, and the codebook which has the closest distance will be chosen as the recognized word.

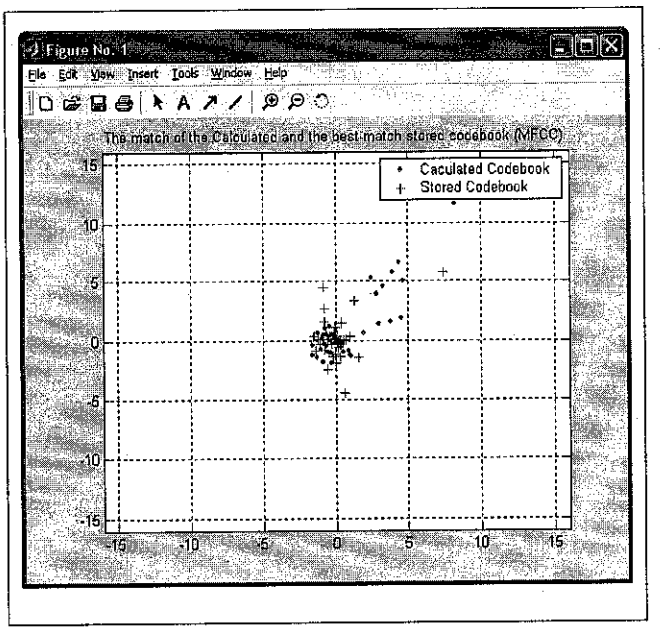


Figure 3.1.3-2: "Me" Codebook with the compared signal

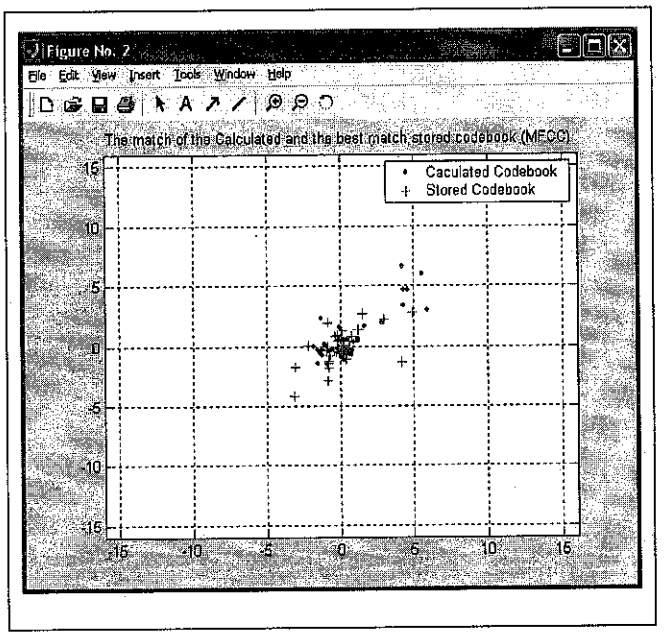


Figure 3.1.3-3: "you" codebook with the compared signal

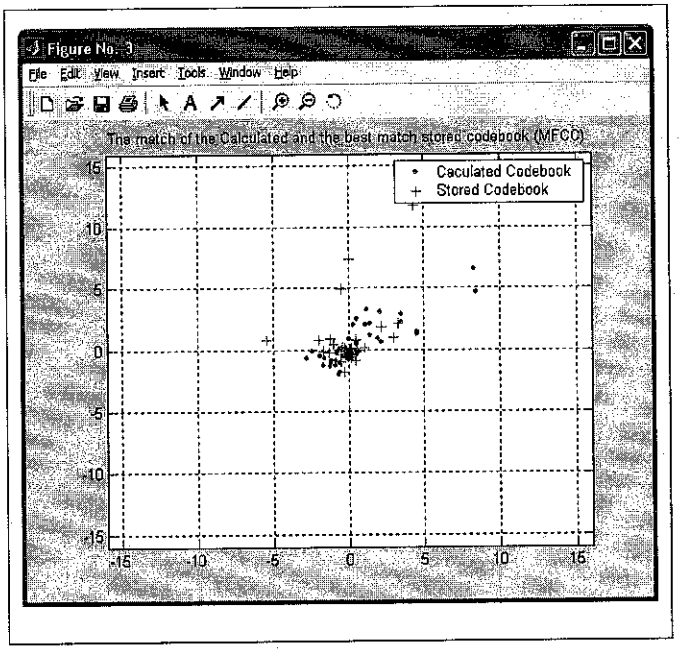


Figure 3.1.3-4: "Us" codebook with the compared signal

iv. Recognition

The system is able to match isolated words at 80-90 % of accuracy; once the word is trained with more utterances then the system can recognize the word almost 100% of accuracy.

v. Video Playback

The input (voice) is compared with the existing codebooks in the database for video retrieval. The value of each codebook and the voice input are represented using matrices. The average value of each codebook is taken as well as the voice input. Then, each codebook will be compared with the voice input value. The confirmation of which video to be played is based on the closest value (voice input) to the codebooks stored in the database.

3.1.4 Development of the System

This stage is where the programming of logics based on the functional specification is done. The coding of what kind of programming language will be used by the programmer was done during the planning stage and now the system is embedded with the specified programming language codes with its logics to meet the requirements. This phase emphasizes more on developing the user interface and integrating it with the system functions

There were errors or bugs during the testing phase thus as a result; this phase was repeated (Development of the System) as a fallback procedure for the purpose of debugging and to ensure the system is error free.

The tools for development are as below:

- Microphone – To allow voice to be captured into the system.
- Matlab software – Matlab 7.0 is installed in the PC and was used as the platform of the system.
- Monitor – To display the output (Sign Language).

3.1.5 System Testing.

System testing phase is where it is opened for a trial period for the users and programmers to try out the system. The purpose of this phase is to ensure that the requirement meets its requirements and it is in a condition where of error-free. Two types of testing were conducted to ensure the reliability of this system which are:-

i. Unit Testing

- Unit testing is basically focuses on the detail part of the system for example testing on the modules (function) to ensure it calls the other modules correctly.
- Besides that, the author had also conducted testing on other buttons such as the Close button which is to ensure that there is a confirmation dialog box when user clicks on the Close button.
- Unit testing also involves the accuracy of the system which ensures that the system calls the desired Sign Language video when a word (voice) is inputted into the system.

ii. System Testing

- System testing focuses mainly on the system as a whole. Meaning that the testing is conducted repetitively until the system is error and bug free.
- A testing to ensure that words that were trained in the system are able to be recognized by multiple users. A sample of 5 have been involved in the testing of the system to ensure that the words trained earlier are recognized.

There were few problems in identifying the correct words that were inputted into the system at first. Thus, a fallback procedure was conducted to modify the existed codes to ensure that the system is more accurate.

3.2 Gantt Chart

TASK	DAYS	FEB	MARCH	APRIL	MAY	JUN	JULY	AUGUST
1. System Planning/Analysis	**58**							
* Collection of information regarding project	38							
* Study of gathered information	10							
* Feasibility Study of the system	10							
2. System Design	**60**							
* Use gathered information to produce the system flow	30							
* Generate System requirements	15							
* Generate System Specifications	15							
3. System Development	**120**							
* Development of System interface	30							
* Development of system logic	30							
* Interaction between the interface and the system logic	60							
4. System Testing	**30**							
* Unit test	15							
* System test	15							
5. Implementation	**2**							
* Final presentation of the project	1							
* Project submission	1							

Figure 3.2: Overall Project Gantt Chart

3.3 Milestone

Suggested Milestone for the First Semester of 2-Semester Final Year Project

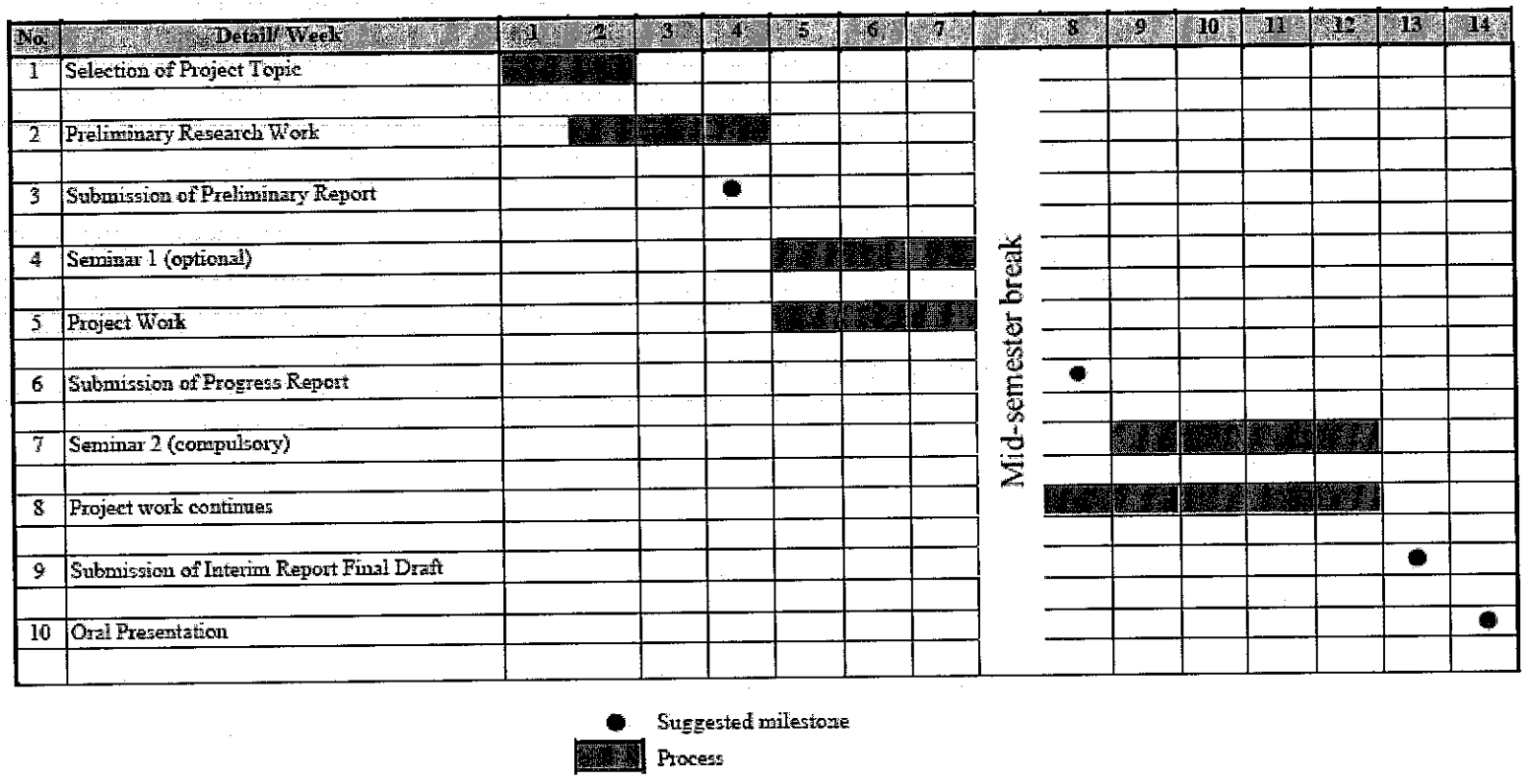


Figure 3.3-1: Suggested Milestone for the First Semester of 2-Semester FYP

Suggested Milestone for the Second Semester of 2-Semester Final Year Project

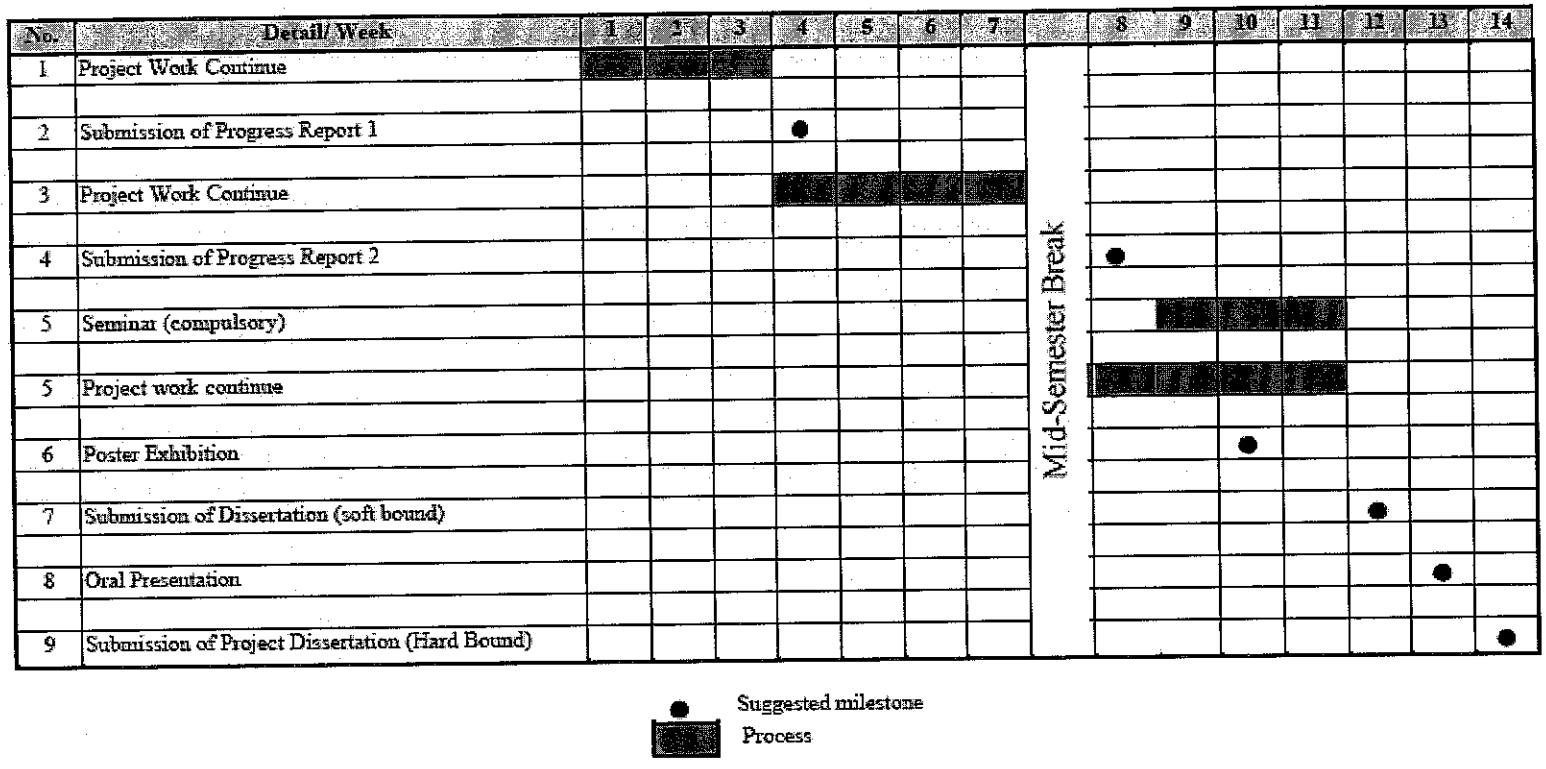


Figure 3.3-2: Suggested Milestone for the Second Semester of 2-Semester FYP

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Prototype Interface

The interface of this project has been created with a single button and a display panel for simplicity purposes. The usage of the "V2S" button is to allow input of raw voice into the system by clicking on it. There is also a display panel which displays the output (Sign Language) video for its translation.

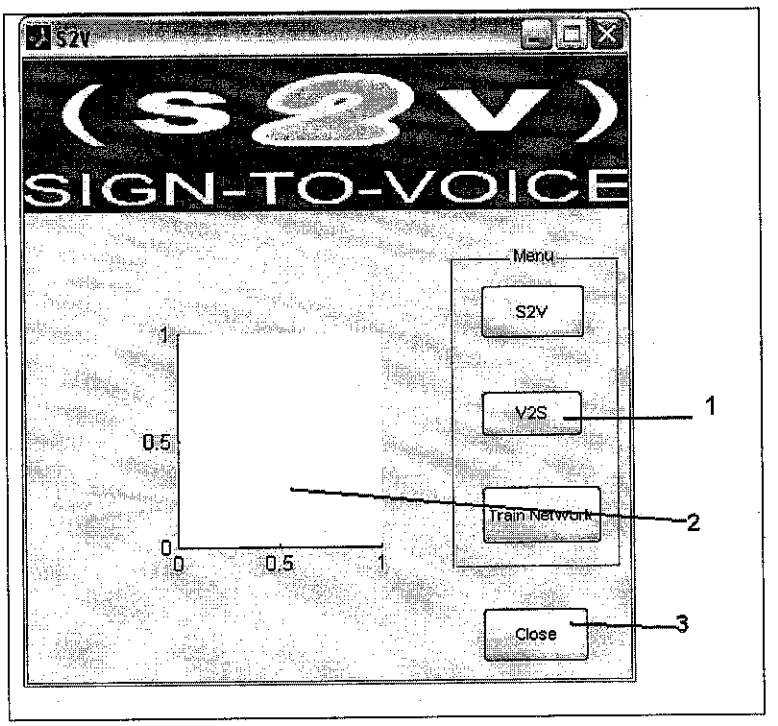


Figure 4.1-1: V2S Main Interface

Figure 4.1-1 depicts the user interface of this system.

1. Input button (V2S)

Once the "V2S" button is clicked, the system will prompt user for voice input. The system will then match the voice to the corresponding video in the database.

2. Display Panel

Once the system finds the match for the voice input, the system will play the video for the voice (word) input. The display of video is displayed in this panel.

3. Close button

The "Close" button ends the system. When user clicks on the button, another window will prompt the user for confirmation to close the system (illustrated in figure 4.2-2 as below).

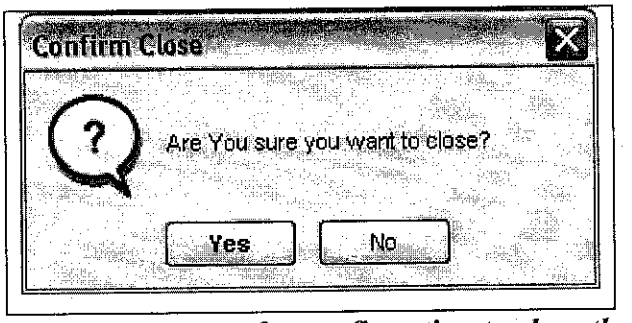
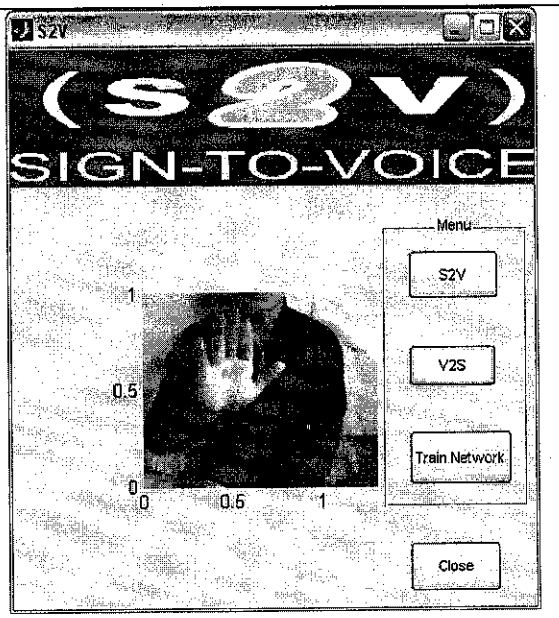
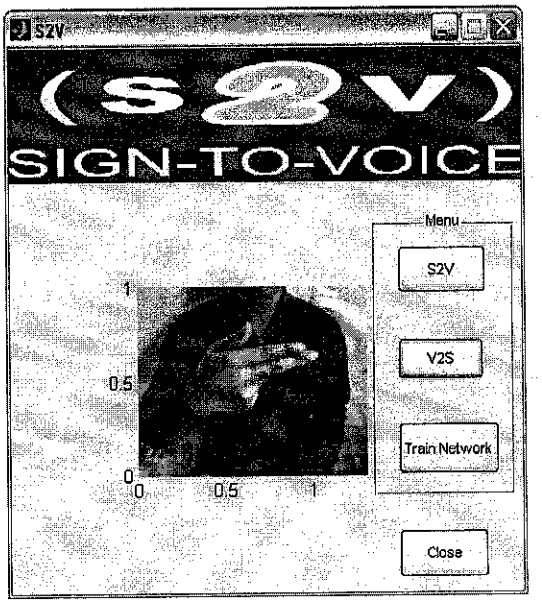
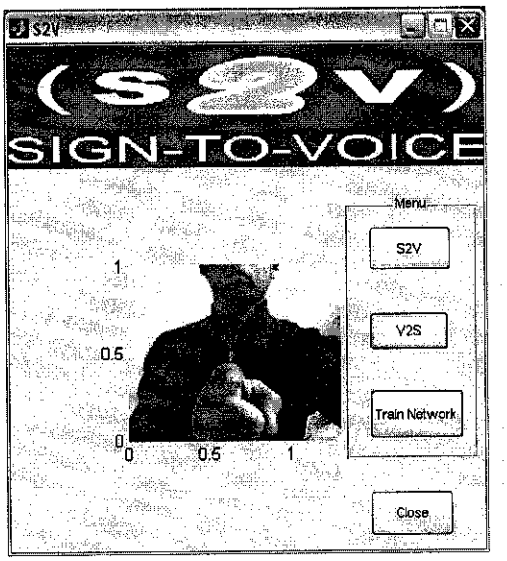
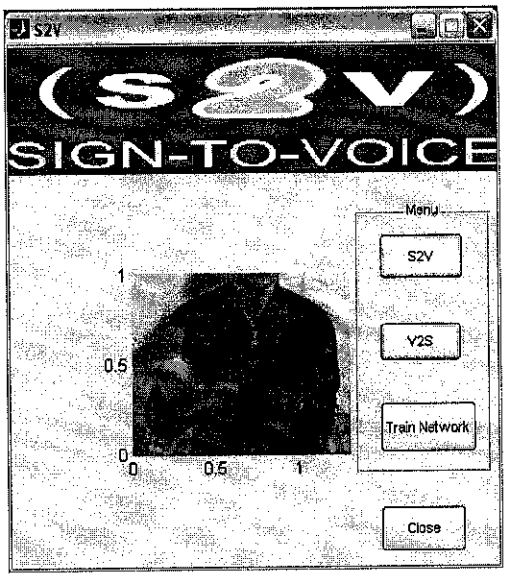


Figure 4.1-2: Prompt user for confirmation to close the system

4.2 Sample Outputs

Input (in word) - Voice	Output – Sign Language
Come Here	 *Figure 4.2-1: Output of Voice to sign language (come here)*
Turn Left	 *Figure 4.2-2: Output of Voice to sign language (turn left)*

You	 ***Figure 4.2-3: Output of Voice to sign language (you)***
Us	 ***Figure 4.2-4: Output of Voice to sign language (us)***

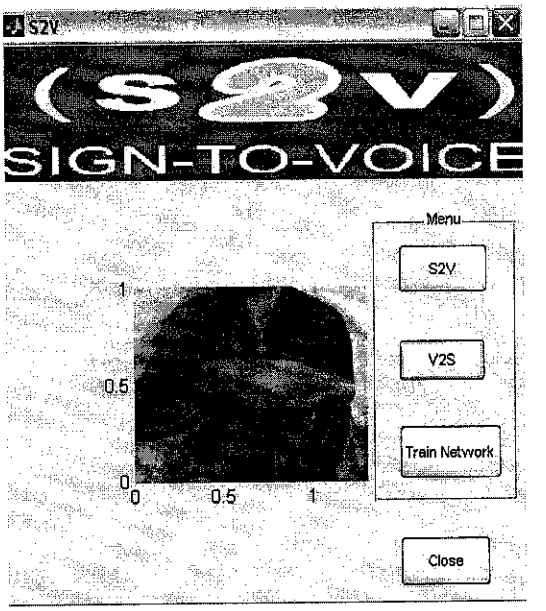
Them	

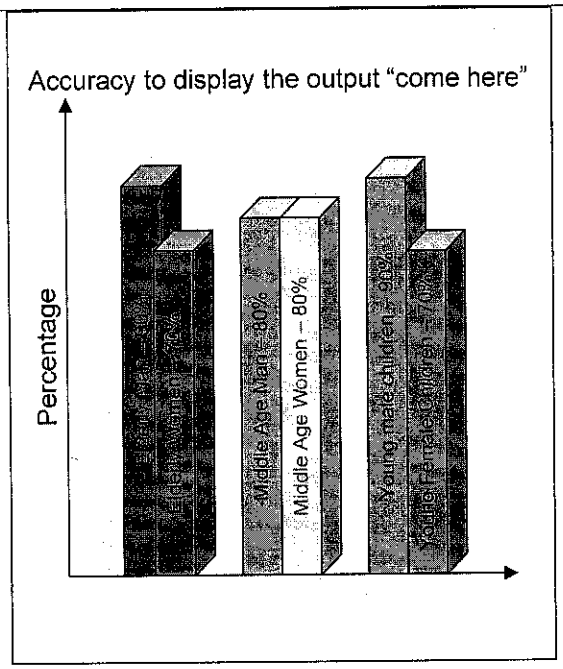
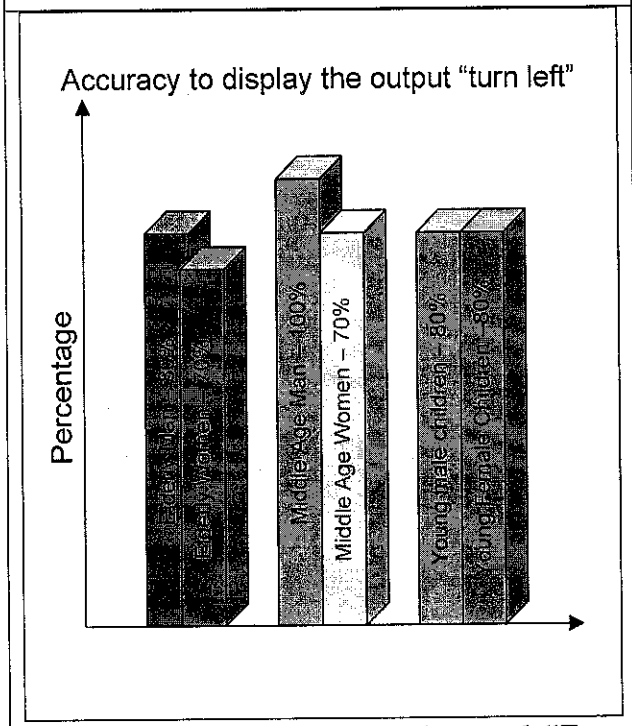
Figure 4.2-5: Output of Voice to sign language (them)

Table 4.2: Sample output

4.3 Accuracy of the System's Response to Multiple Users

This system has not been tested in front of a real audience (mute/ deaf people) because the accuracy of the system was uncertain. Therefore, only testing by normal people was done for this system. The accuracy test was done by taking few samples (user's voice) and input it into the system to test the accuracy of the desired word to be translated into Sign Language.

The author took a sample of 100 people which consist of elderly women and men, young male and female children as well as middle age male and female to test on the accuracy of the system. This test was monitored and done during the PECIPTA 2007 (Expositions of Research and Inventions of International Institution of Higher Learning) and CDC (Career Development Carnival) exhibitions. At least 80 out of the 100 people were able to callback the desired sign language video, which means that system is at least 80% accurate to display the correct sign language video. Here are some of the statistics that show the callback accuracy of each word (trained words):

Graph of Statistic	Summary (based on the graph)
 ***Figure 4.3-1: Accuracy for the word "come here"***	Elderly Man = 90% Elderly Women = 70% Middle Age Man = 80% Middle Age Women = 80% Young Male = 90% Young Female = 70%
 ***Figure 4.3-2: Accuracy for the word "Turn left"***	Elderly Man = 80% Elderly Women = 70% Middle Age Man = 100% Middle Age Women = 70% Young Male = 80% Young Female = 80%

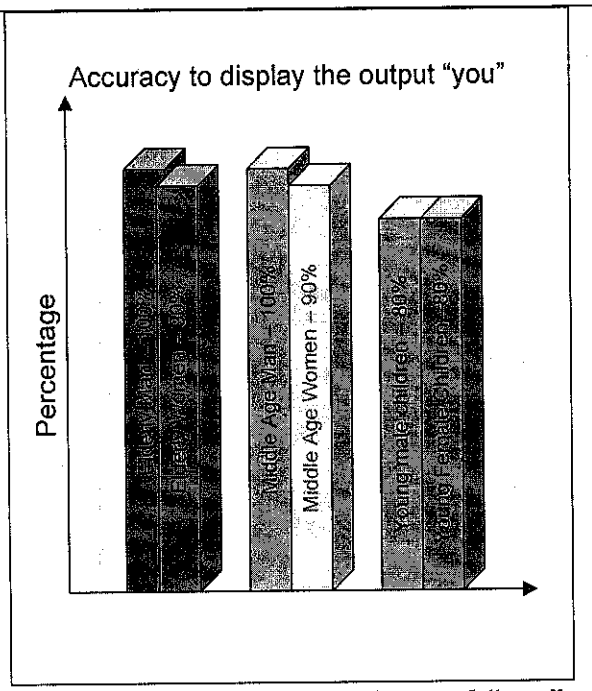


Figure 4.3-3: Accuracy for the word "you"

Elderly Man = 100%

Elderly Women = 90%

Middle Age Man = 100%

Middle Age Women = 90%

Young Male = 80%

Young Female = 80%

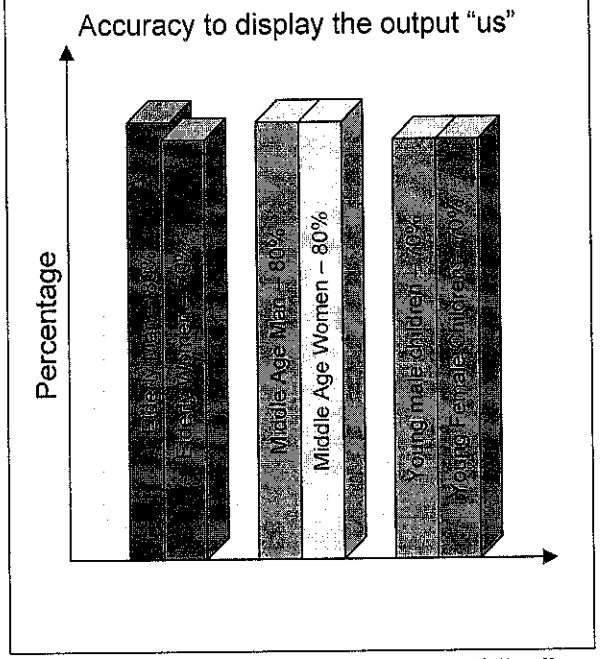


Figure 4.3-4: Accuracy for the word "us"

Elderly Man = 80%

Elderly Women = 70%

Middle Age Man = 80%

Middle Age Women = 8%

Young Male = 70%

Young Female = 70%

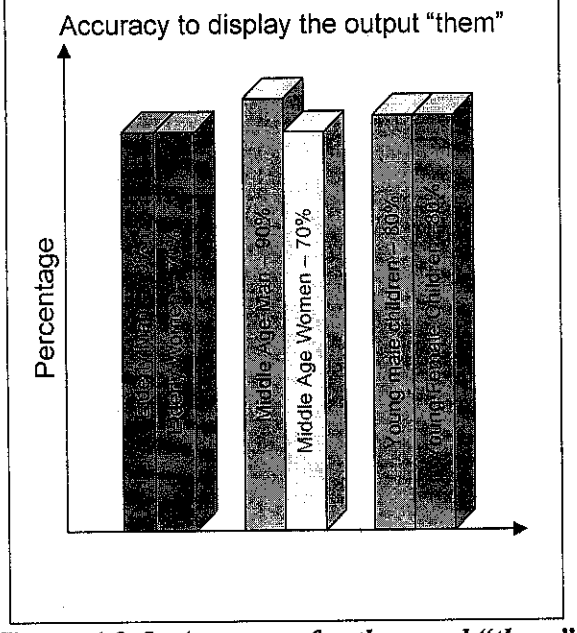


Figure 4.3-5: Accuracy for the word "them"

Elderly Man = 70%

Elderly Women = 70%

Middle Age Man = 90%

Middle Age Women = 70%

Young Male = 80%

Young Female = 80%

Table 4.3: System accuracy statistic

4.3.1 Statistic of Overall Accuracy

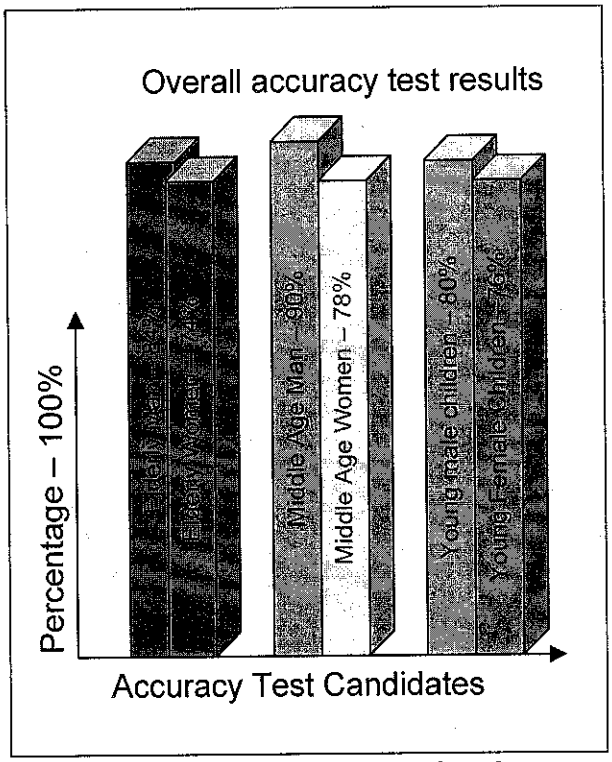


Figure 4.3.1: Overall Accuracy of each category

The graph shows the accuracy of each category by averaging the accuracy percentage of the 5 words. The most accurate of them all is the middle age man. This may be due to the training of the system whereby the system was trained ONLY by a middle age man. Even though the trained words were done by the middle age man, other categories show that more than half the time of the testing shows accurate responses. This means that, the more training the system gets for each word, the more accurate it will be.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Speech recognition technology helps in various ways to ease or solve problems in daily routines of individuals and organizations. Many achievements have been made, and there are a number of commercial however there is not a software that is able to recognize speech and playback Sign Language in a video format.

Natural language to Sign Language translation is the main scope of this research. The fundamental idea of this system is to translate the human voice (input) to Sign Language. The system will match the input (voice captured via the microphone) with the stored Sign Language video in the database and display the appropriate movements (Sign Language). Hence, this system provides an interactive way of communication for the disabled.

This project has created an application that allows translation of English (natural language) to Sign Language. The system's accuracy of displaying the correct Sign Language depends on how much system training was done. Currently, the system has the accuracy of at least 80% accurate. With sufficient training for the system, it will be able to recognize all the trained commands and execute the corresponding actions accurately. With that, this system not only educate new users who wish to learn Sign Language, but also eases those who wish to communicate with the disabled.

5.2 Recommendation

Currently the system has seven different words pre-programmed (trained) in it. Hence, there are also seven different types of videos (Sign Language) stored in the current system's database. Besides that, the current system displays the output (Sign Language-video) in a form of 'frame-by-frame'. This means that the system accepts only a word at a time when the button is clicked. Thus, the user has to click on the input button and input the word-by-word (voice) into the system a few times to create a sentence in Sign Language. Besides that, the pre-programming (training) part of the system is done by the programmer. Meaning that the programmer has to input a few samples of voice (words) into the system and also add on Sign Language (video) before that particular output can be called by the users.

Below are the enhancements that can be done to further expand the system's usability and functionality:

- To allow sentences as input (instead of word-per-frame) and Sign Language in sentences as output.
- To allow flexible training so that other users can train the system, not just the programmer.
- To integrate this system into mobile devices such as PDA (Personal Digital Assistance) for ease of communication with the disabled anytime, anywhere.

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APPENDICES

Appendix 1. RTM to add more Sign Language in their programmes

Wednesday December 20, 2006

Sign language for more programmes

PENANG: Radio Televisyen Malaysia (RTM) will be incorporating more sign language in their news segments and dramas for the benefit of the hearing-impaired.

Information Ministry par- liamentary secretary Noriah Kasnon said yesterday that RTM wanted to reach out to the hearing-impaired so that they could also enjoy its programmes.

She added that sign language was now provided only for RTM's *Berita Perdana* at 8pm.

"RTM has five sign lan- guage interpreters but will in-crease the number if we provide sign language for more programmes.

"We will deliberate on the matter and invite the Women, Family and Com-munity Development Ministry as well as those involved in drama production for their feedback.

"We want the hearing-impaired to enjoy RTM's programmes especially our news and family dramas," she said after opening the National Verbal and Non-Verbal Langu-age Seminar here yester- day.

At the function, Noriah launched a book entitled *Pen-terjemahan Audiovisual Televi-syen* (Television Audiovisual Translation) by Dr Hasuria Che Omar.

Earlier in her speech, Noriah said the term *Orang Kelainan Upaya* (people with different ability) was more appropriate for the disabled.

She also advised under-graduates to upgrade their soft skills.

"The lack of soft skills is attributed to the high unemployment rate among univer-sity graduates.

"Parents should also inculcate the reading habit among their children or encourage them to be at least bilingual," she said.

http://thestar.com.my/news/story.asp?file=/2006/12/20/north/16366613&sec=North

Wanted – Qualified sign language interpreters

Sunday July 22, 2007

By DERRICK VINESH

derrickvinesh@thestar.com.my

KEPALA BATAS: There is an acute shortage of sign language interpreters because at present, there are only 10 qualified ones to cater to 24,000 registered deaf persons nationwide, the Malaysian Federation of the Deaf said.

MFD language trainer Siti Zubaidah Mohd Lani said the Education Ministry had recently allocated RM12.1mil for the training of 300 sign language interpreters.

"Our first batch of 100 students, who started their year-long certificate level course last month, are mainly jobless graduates.

Customer service: Siti Zubaidah communicating in sign language with Mohd Yunus Ismail, who is deaf, during the job carnival in Kepala Batas on Saturday. Looking on are (from second right) Labour Department senior assistant director Dr Kamal Hamid, Perak Labour Department director K. Sritharen and

"We need such qualified sign language interpreters to fill positions especially at the various government departments and agencies that provide customer services," she told *The Star* at the state Labour Department Job Carnival 2007 at Dewan Milenium here yesterday.

As such, she said individuals who were keen on working with the deaf should consider a career as sign language interpreters.

Siti Zubaidah added that students who took up the course at MFD's sign language interpreters' training centre in Puchong, Selangor, were given a monthly allowance of RM600 and provided with free food and lodging.

Upon completing the course, she said, the students could take up an 18-month-long diploma in sign language studies at the International University College of Technology Twintech in Bandar Sri Damansara, Kuala Lumpur.

She said MFD would later help the diploma holders to seek employment at the various government departments.

For details, call the MFD (03-80708930) or the Penang Deaf Association (04-2296421).

Reference:

http://thestar.com.my/news/story.asp?file=/2007/7/22/nation/18374597&sec=nation

Appendix 3. System Brochures

INTRODUCTION

S2V is a system designed to help the deaf, mute, and hearing impaired group of people that need to use sign language for an effective and efficient communications with normal people. S2V can also facilitate people to learn sign language in a shorter period of time.

PROBLEM STATEMENT

It is difficult for a normal person to communicate with people that have hearing or speech problems.

Not easy for people who suffered from sudden diseases or accidents that causes the lost of hearing and speech ability to learn sign-language in a short period of time.

Discrimination against those with hearing and speech disabilities.

Need to attend special courses to learn sign language

PROJECT SCOPE

The main scope is to create a system that is able to capture sign language images and translate them into appropriate voice signal on real-time basis. The system also capable to reverse the process. Translate voice into proper sign language.

OBJECTIVE

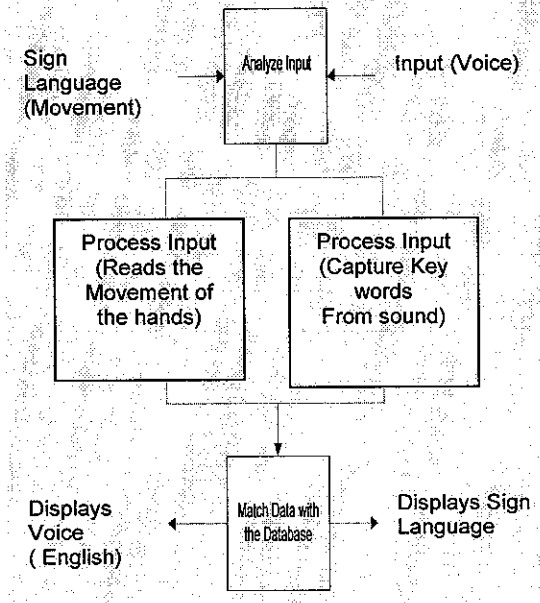
Enrich the life of hearing/speech disabled people.

Allows more effective/efficient interaction and communications between normal and hearing/speech disabled people.

Allows individual to learn Sign Language in a shorter period of time.

Helps to reduce cost in learning Sign Language.

SYSTEM ARCHITECTURE



FEATURES & BENEFITS

Practicality: This product is both functional and practical. The system is able to capture sign language and convert it into appropriate voice speech. It can reverse the process too. That is, capture voice speech from user and translate it into a proper sign language to be displayed on a screen.

Economy Value: This system was designed and developed with a potentially large market in mind. Furthermore, this system can assists normal people to learn the sign language in a short period of time.

APPROACH

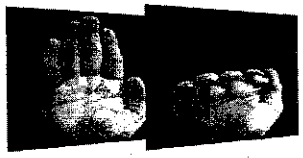
Speech Recognition: Speech recognition is defined as the basic task of deriving a sequence of words from a stream of acoustic information. A more general task is automatic speech understanding, which includes the extraction of meaning (for instance, a query to a database) or producing actions in response to speech.[1]

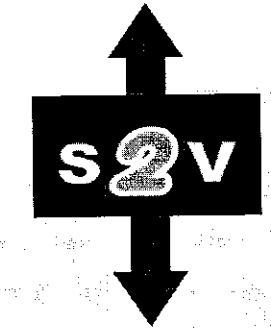
Digital Image Processing: The use of computer algorithm to perform image processing on digital images. It has the same advantages over analog image processing as digital signal processing has over analog signal processing. [2]

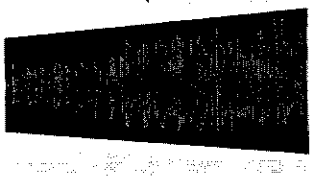
[1] www.agki.tzi.de

[2] en.wikipedia.org

SIGN-TO-VOICE (S2V) SYSTEM







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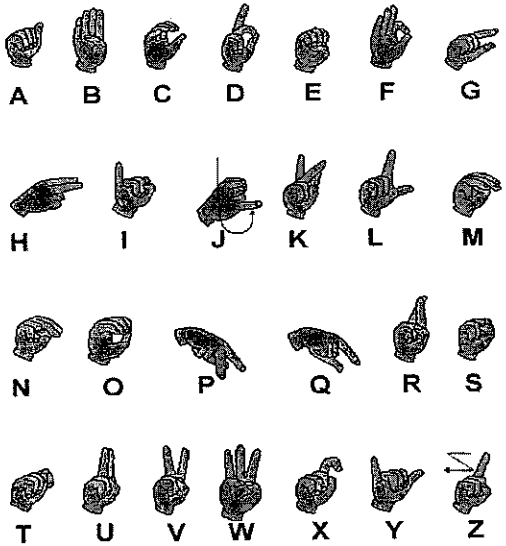
ALPHABETS



NUMBERS