

Bahasa Melayu (BM) Screen Reader for Visually Impaired Internet Users

By

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16334

Dissertation submitted in partial fulfillment of
the requirements for the
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(Business Information System)

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CERTIFICATION OF APPROVAL

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(BUSINESS INFORMATION SYSTEM)

Approved by,

(Dr Suziah Binti Sulaiman)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

May 2015

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 undertaken or done by unspecified sources or persons.

NUR FADHILAH BINTI MOHD NOH

ABSTRACT

Currently, the Internet usage is rising at a frenzied rate as knowledge and information sharing becomes easy and is time-saving. Regrettably, the visually impaired do not enjoy this liberty and they are facing difficulties in using computer and the Internet to seize any shared and available information. This difficulty is faced especially among the visually impaired Malay language medium Internet user. Specifically, existing screen reader cannot fully cater for users who need to browse the Malay language web pages. The inability of screen reader narration to enunciate Malay words correctly has become a restriction for the visually impaired to acquire any information in the Malay language. Narration of the words are done by non-Malay speakers and the enunciation of those words confuses and at times, do not help users. Thus, this project addresses this issue by investigating the difficulties for visually impaired Internet user to understand what is spoken when using screen readers without a native Malay narrator or speaker. This project aims to reduce the time needed for the visually impaired to understand the information in the Malay language read by the narrator of the screen reader. This project also strives to develop a screen reader prototype, which is able to read in Bahasa Melayu (BM) using local accent. To achieve all the objectives, preliminary interviews and testing session were conducted to collect data to test the hypothesis made. The findings are then will be used as main source of data to develop a prototype of the screen reader. From the built prototype, user testing will be conducted with a sample group of visually impaired to test the functionalities and evaluate the effectiveness of the software. The results and recommendations will be shared by the end of the project as a key milestone for future enhancement.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

In this era, the Internet is widely used in transferring information across the world. All Internet users including the visually impaired are able to obtain any type of information with just a single click on their devices. Unlike normal users, the visually impaired need to rely on added technology that enables them to browse the Internet and get the latest information from around the world.

One of the technologies developed for them is assistive technology. Assistive technology is technology that helps the visually impaired to use the Internet. It has made an impact in their searches for current information and knowledge and they are able to enjoy the Internet just like other users. The best example for assistive technology in giving aid to the disabled is the screen reader. Briefly, a screen reader is a software that will translate anything on the computer screen into synthesized speech (Hackett, et. al, 2004). The narrator that has been programmed will read out aloud each item that appears on the computer screen. There are many types of screen readers with varieties of features developed by programmers. Not only that, there are many languages narrators offered to suit the language of preference of the users too. These features make Internet-browsing easy and provide pleasant experiences for the visually impaired when using their preferred screen reader.

The effectiveness of screen readers can be determined by how fast the information and understanding of the content is captured by the visually impaired. Language plays a major role in the transferring of knowledge. A person will be able to communicate with another effectively if they use the same language when communicating. The same approach is being applied in the usage of screen readers. The visually impaired will have difficulties in understanding what they browse if their preferred language of narration is unavailable. Thus, this situation will consume more time for the visually impaired to understand what have been read by the

narrator of a screen reader which does not speak their language of choice. According to the analysis done on screen readers available in the market, there is no Malay language narration offered by any kind of screen readers. Thus, this becomes a problem for Malay language-preferred Internet users.

Therefore, a screen reader that offers Malay language narration should be available in the market. Hence, a Malay language screen reader for visually impaired Internet users needs to be developed to ease in the reading and understanding of Malay language web pages.

1.2 Problem statement

According to the World Health Organization (WHO) site in August, 2014, there were about 285 million people who are visually impaired around the globe. Other than that, 39 million are blind and 246 million have low vision. To be more specific, 90% of the 285 million estimated people are living in the low-income settings. Eighty two percent of the blind are aged 50 and above. The Malaysia Ministry of Health Portal states that visual impairment can occur at any age and ranges from low vision to total blindness. Based on the National Eye Survey of 1996, the prevalence of blindness for all ages is 0.2% and low vision is 2.44% (Ministry of Health, 2015) and the blindness among children 7 to 15 years is 0.1% (based on Refractive Error Study in Children, 2003).

In this era, the usage of the Internet is important and necessary to all people around the globe including the disabled. Previously, the visually impaired can only access the information physically by using Braille. They need to be updated with current world and local news and other information. As technology evolves, now it is possible for them to use the computer and browse the Internet. Assistive technology helps the visually impaired in gaining knowledge through the use of computers. One of the most helpful creations of assistive technology is the screen reader software. The software will act as a narrator and read aloud any words on the screen or gives output as Braille pins for them to touch. Thus, it acts as a medium of transferring

information to the visually impaired user. However, there is no screen reader that offers Malay language narration using local accent. Screen readers available in the current market can read any Malay language article or web pages, but the pronunciation of the narrator complicates the user. It takes time for the visually impaired to really understand and capture the information read by the narrator.

To conclude, The absence of a screen reader with local Bahasa Melayu accent pose as an obstacle for the visually impaired to read and understand any Bahasa Melayu articles or web pages. This obstacle is also time consuming.

1.3 Objectives

The objectives of this project are:

1. To investigate the difficulties visually impaired Internet user encounter to understand what is being read aloud when using existing screen readers.
2. To develop a screen reader prototype that can read aloud in Bahasa Melayu using local accent for visually impaired Internet users.
3. To test the effectiveness of the newly developed Malay version screen reader prototype.

1.4 Scope of study

The scope of this project is mainly to focus on the visually impaired who use the Internet or computer as a medium of seeking information. It is aimed on creating a screen reader prototype, which is a software used by the visually impaired Internet user that can offer a narration in Malay language. The target user will be the visually impaired Malay language medium Internet user. To be specific, the visually impaired Internet users are from the Malaysian Association for The Blind (MAB) in Ipoh. They will be the targeted user who will be involved in the testing phase. This project only aims to reduce the duration taken for the visually impaired to really understand

what has been spoken by the narrator without having accent of any other languages. Simple and user-friendly interface will also be developed to give ease to the user. At the end of this project, the prototype will be tested on them to prove the effectiveness of the developed prototype.

1.5 Relevancy and feasibility of the project

This project is relevant since it will provide a solution to the visually impaired Internet user who used Malay language as their prime language in seeking knowledge or as a medium of communication. The language used may influence the duration taken in capturing the information browsed. Because of that, a Malay language screen reader needs to be created. This project will help the disabled to understand the information in short time.

This project is feasible as there are many references available in ensuring the Malay version of screen reader prototype is successfully developed. The screen reader prototype can be developed by enhancing the open-source script that may available on the Internet. An audio element of a Malay narrator can be added in the ‘dictionary’ of the software.

Next, with the allocation of about eight months of duration to complete this project, it is believed that this project can be completed within the time given. If the time allocated seems insufficient, only proof of concept without existing real Malay version of screen reader will be presented. A few constraints and difficulties may occur along the process of the development, as the time given to complete this project was short.

CHAPTER 2

LITERATURE REVIEW

2.1 Current technology used by visually impaired Internet user

The usage of the Internet is essential to people from all walks of life including the visually impaired. Through the Internet, various types of information can be accessed with just by a single click. Normal Internet users do not have many problems when browsing the Internet. They are capable to cope with the range of technologies that are available. Unlike the disabled or visually impaired Internet users, they need to use other alternatives to access information on the Internet. Currently, a number of technologies exist to cater for the visually impaired. The most common is assistive technology. The phrase assistive technologies is used to ‘describe devices or systems allowing an individual to perform a task that they would otherwise be unable to do, or increasing the ease and safety with which the task can be performed’ (Cowan and Turner-Smith, 1999). It is rapidly becoming preferred to alternatives such as aids and appliances, partly because it better reflects the range of technological advances that have taken place in recent years and partly because it gives a greater sense of how independence can be enhanced (Audit Commission, 2004).

Assistive technology devices are accessible for individuals who are visually impaired. Some are viewed as “low tech” but are reasonably functional while others are all the “high tech” with more functions and therefore, more costly. They are accessible in an assortment of classifications to address practical capacities and to suit the degree and type of vision impairment. This technology opens a door for the visually impaired to the exciting world of knowledge and information sharing on the World Wide Web. It demonstrates that accessibility of information and knowledge should not be discriminatory, it is for everyone despite of disabilities particularly for the visually impaired. Below are the brief descriptions in aid of the visually impaired for efficient Internet browsing:

1. Screen reader

A screen reader is the interface between the computer's operating system, its application, and the user. It is a software program that permits visually impaired users to read the content that is shown on the computer screen with a speech synthesizer or Braille outputs. Commands can be sent by pressing a diverse combination of keys on the keyboard or Braille device to train the speech synthesizer what to articulate, for instance if any pop-up information or notification appears on the computer screen. A command can instruct the synthesizer to read or spell a word, read a line or a full screen of content and articulate the labels or items touched by the cursor.

2. Speech recognition software

Speech recognition software is used with a microphone to interpret spoken words to create text-style documents. It is actually utilized to carry out computer commands. Basically, it substitutes voice entrance for the keyboard section. This software can be a significant instrument in a number of applications, and it is particularly convenient for school students, employees, interpreters, transcribers, and those with special needs.

3. Text-to-speech (TTS) software

Text-to-speech software converts written text such as, text files, web pages, PDFs and emails into audio files that can play on a wide range of devices, such as computers, MP3 players, iPods and CD players. The software will get user input as content keys and integrates data on the screen into a voice program. Visually impaired users can utilize text-to-speech software to hear what they are typing on their computer.

4. Screen magnification software

Screen magnification software is a type of assistive innovation that allows visually impaired user to peruse large web page contents that interfaces with computer's graphical output. Screen magnification software can enlarge the contents showed on a PC screen and users can choose the magnification level that best suit their individual needs and comfort. The software is accessible

on desktop variants for establishment home PC, USB drive versions for transfer between computers and dedicated versions for cell telephones, and PDAs. (GovHK, 2014)

5. Color contrast enhancement

This software can show website page content in high contrast or in monochrome, which permits high contrast for individuals who have inconveniences telling colors apart.

6. Braille display devices

This braille display device is used together with screen reader. It retrieves screen content and interprets them into series of pins. The output will be the series of pins that portray words, letters, or numbers in the web pages. Braille readers can then decipher the content by touching the pins with their fingers.

2.2 Screen reader as a main tool to help the visually impaired Internet users

A screen reader is a product application that empowers individuals with extreme visual impairment to utilize a computer. According to *Urban Dictionary*, it works by translating the content that shows up on the screen and changing it into a voice that can be heard using earphones or speaker. Screen reader works compatibly with the computer's Operating System (OS) to interpret symbols, menus, dialog boxes, folders and files. A screen reader gives access to the whole OS that meets reasonable expectations, including numerous general applications.

There are two ways that input can be provided to the user when using screen reader. It is either speech or Braille that will be the input. To achieve the numerous assignments as a fit performing computer, a visually impaired user will utilize a mix of screen reader orders and operating system commands (Watson, 2005). Screen reader often has one or more edit modes that allow users to interact with different types of form elements (Borodin, et. al, 2010). All current operating systems have

their own individual keyboard shortcuts, which are accessible to everyone and not only screen reader users.

Screen readers are equipped for supporting the scope of applications that are most common to their local platform. Watson (2005) implied that for a possible programmers or developers to enhance the scripts of the software and to add or change any features available. Programmers can customize the software with open sources of scripts.

Meanwhile, on its medium of communication, the language of the screen reader will correspond with exactly the language of the operating system. Usually, screen readers support popular languages such as English, French, German and Italian. It largely depends on the screen reader developers. Screen readers will offer different package of languages.

The structure of the web page is the main criteria that need to be considered when working with screen readers. How well designed the structure of the web page is built will determine the easiness of the screen reads to interact with it. A well-structured web page should have sub-structures (Watson, 2005). Well-structured web pages ought to incorporate headings, records, passages and citations where suitable, and additionally tables that incorporate important data about their contents, pictures that convey an option content descriptions and connections that have clear connection text. These items are coded using computer language that the web page is composed in. This language element needs to be built clearly to allow screen readers to decipher codes and create certain key commands. Just like the languages, screen readers have different types of key commands depends on the developers.

According to Jaijongrak, et. al (2011) speech command is good in increasing the accuracy towards the target. The context-based audio signal can be perceived faster than the speech but requires more training in order to understand. Most people will have a tendency to pick only one screen reader, which they have chosen and will stick to that particular one. This is attributed to screen readers that have individual characteristic commands, which can be entirely different from each other. This differences provide the visually impaired with choices to pick the ones which suits them the most.

The following page contains an analysis of the various types of screen reader available in the market. Although not an exhaustive list, this forms the basis of the researches investigation.

2.3 Comparative studies of screen reader

Below is the list of screen readers that available in the current market. Certain criteria has been observed in this comparative studies in order to make sure that there is no screen reader that offer Malay language of narrator yet.

No.	Screen Reader	Developer	Platform	Feature(s)	Limitation(s)	Language(s) Offered	License	Source
1.	Project metalmouth	Alistair Garrison	Chrome OS, or via Chrome Browser , Linux, Mac, Windows	<ul style="list-style-type: none"> • Chrome based text-to-speech • Allow user to interact with it via voice commands or input from the keyboard 	<ul style="list-style-type: none"> • Still in enhancement phase. Not fully developed. 	English	Free Open source (Apache 2.0)	https://code.google.com/p/metalmouth/
2.	Emacspeak	T. V. Raman	Linux	<ul style="list-style-type: none"> • Rich aural representation of electronic • Capable of being heard interface of the diverse parts of the Internet • Gives a solid, stable discourse friendly arrangement that opens up the Web to outwardly debilitated clients across the world. 	<ul style="list-style-type: none"> • Blocking it from being the "first screen reader for Unix usable by everyone" • Lack of multi language support. • Lack of documentation • Braille display functions are not supported 	English only	Free	http://emacspeak.sourceforge.net/
3.	ORCA	GNOME	Linux	<ul style="list-style-type: none"> • Works with the GNOME desktop, Mozilla Firefox/Thunderbird, OpenOffice/LibreOffice and GTK+, KDE/Qt and Java Swing/SWT 	<ul style="list-style-type: none"> • Does not have a screen review mode 	Brazilian Portuguese, Czech, Danish, French, Galician, Greek,, Hungarian,	Free	https://wiki.gnome.org/action/show/Projects/

				<p>applications</p> <ul style="list-style-type: none"> • Flexible, extensible, and powerful assistive technology • Can produce speech, Braille and magnification of computer screen 		<p>Indonesian, Italian, Lithuanian, Nepali, Norwegian Bokmål, Polish, Serbian, Serbian Latin, Slovenian, Spanish, Ukrainian, German, Chinese (Hong Kong), Chinese (Taiwan), Russian, Catalan (Valencian), Catalan, Slovak, Aragonese, Basque, Belarusian, Latvian, Chinese (China), Portuguese, British English, Hindi, Tamil, Uighur,</p>	<p>Orca?action=show&redirect=Orca</p>
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						Finnish, Bulgarian, Telugu, Swedish, Asturian, Macedonian, Vietnamese, Dutch, Romanian, Punjabi, Turkish, Malayalam, Japanese, Bengali, Thai, Arabic, Tajik, Norwegian Nynorsk, Hebrew, Esperanto, Dzongkha, Maithili, Korean, Oriya, Gujarati, Welsh, Albanian, Occitan, Estonian, Kannada, Marathi, Canadian English, Bengali		
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						(India), Sinhala, Irish, Kinyarwanda		
4.	Edbrowse	Karl Dahlke	Linux	<ul style="list-style-type: none"> • Can tap into databases through odbc • Combination editor, browser, and mail client that is 100% text based 	<ul style="list-style-type: none"> • Does not support dynamic document objects, digest authentication, or imap • Limit to certain language only 	English, French, Brazilian Portuguese, Polish	Free Open source	http://the-brannons.com/edbrowse/
5.	BRLTTY	The BRLTTY Team	Linux and Windows console	<ul style="list-style-type: none"> • Intelligent cursor routing that allow cursor to be fetched easily without moving ones hands from the braille display • A cut & paste function which is useful for copying long file names, copying text between virtual terminals, entering complicated commands • Table driven, in-line, contracted braille • Support for multiple braille codes. • Able to identify an unknown character and to inspect character 	<ul style="list-style-type: none"> • Did not have a capacity to stop the speech synthesis midstream 	English	Free Open source	http://mielke.cc/brlty/

				highlighting <ul style="list-style-type: none"> • Braille gets displayed soon after the OS starts up 				
6.	Fire Vox	Charles L. Chen	Linux, Unix, Windows, OS X	<ul style="list-style-type: none"> • Talking browser extension for the Firefox web browser • Close integration with Firefox • Support for Live Regions marked up with WAI-ARIA • Support for the CSS 3 Speech Module 	<ul style="list-style-type: none"> • Only for Firefox browser 	Auto-detect language; Fire Vox will try to detect the language the page is using and choose an appropriate voice for it. Note that this will only work if an appropriate voice installed.	Free Open source	http://firevox.clcworld.net/
7.	TextAloud	TextAloud	Linux, Windows, Mac OS X, iPhone, iPad, iPods, Windows, Android	<ul style="list-style-type: none"> • Able to save text to MP3 for portable audio players • Proofread your own writing • Create messages for answering machine • Listen to information while you work on something else • Turn your iPod into a tax write-off • Listen to an eBook 	<ul style="list-style-type: none"> • Trial version is only valid for 15 days • Need to purchase for full features 	US English, UK English, Indian Accent English, Scottish Accent English, French, Canadian French, Latin American Spanish, Castilian (European),	Free Commercial	http://www.nextup.com/TextAloud/

				<ul style="list-style-type: none"> during your commute • Listen to text read in other languages • Can create audio files for computer games 		Spanish, Mexican Spanish, Brazilian, Portuguese, European Portuguese, Russian, Mandarin Chinese, Cantonese Chinese, Korean, Japanese, German, Greek, Italian, Dutch, Belgian Dutch, Danish, Swedish, Norwegian, Polish, Arabic, Czech, Faroese, Icelandic, Finnish, Turkish		
8.	Proloquo	Assistive Ware	Mac OS X	<ul style="list-style-type: none"> • Includes natural-sounding InfovoxVox voices for language of choice • Provides large icons and resizable toolbars 	<ul style="list-style-type: none"> • Trial version for only 15 days • Need to be purchased 	American English, British English, American Spanish,	Commercial	http://www.kallysta.com/index.php?k

				<ul style="list-style-type: none"> Universal Binary optimized for PowerPC and Intel processors 		Czech, Canadian French, French, German, Italian, Dutch, Flemish, Icelandic, Spanish, Polish, Portuguese, Brazilian Portuguese, Danish, Norwegian, Finnish, Swedish and Turkish		all=53 &PHP SESSI D=57b 5b9a1 c54ab 8ee05e d9797 dd0ab 8f8
9.	Apple VoiceOver	Apple Inc.	Mac OS X, iPhone, iPad, iPods, and Apple TV	<ul style="list-style-type: none"> Can be controlled using same gestures used on iOS Provide plug-and-play support for refreshable braille displays Includes an onscreen braille panel and can displays both braille and a plain-text version of the descriptions spoken by VoiceOver Support more than one braille display at a time 	<ul style="list-style-type: none"> Does not have scripting capabilities, so customizing applications that might not be accessible does not exist in this environment 	English (U.S.), English (UK), English (Australia), English (Ireland), English (Scotland), English (South Africa), English (India), Spanish (Mexico),	Free Commercial	https://www.apple.com/my/accessibility/osx/voiceover/

				<ul style="list-style-type: none"> • Not a stand-alone screen reader. It's deeply integrated in OS X • Available with over 30 languages 		Spanish (Spain), Spanish (Colombia), Spanish (Argentina), French (France), French (Canada), German, Hebrew, Italian, Japanese, Korean, Mandarin (Mainland China), Mandarin (Taiwan), Cantonese (Hong Kong), Arabic, Czech, Danish, Dutch, Finnish, Flemish (Belgium), Greek, Hindi, Hungarian, Indonesian, Norwegian, Polish,		
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						Portuguese, Portuguese (Brazil), Romanian, Russian, Slovak, Swedish, Thai, and Turkish.		
10.	Talks	Nuance Communications	Symbian OS Series 60 or 80	<ul style="list-style-type: none"> Converts the displayed text on the mobile handset into highly intelligible speech Easy navigation of Apps and virtual keypads Supports a variety of phones from the classic number keypad over full QWERTY 	<ul style="list-style-type: none"> Costly 	Danish, Dutch, English, Finnish, French, Greek, German, Italian, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish, Turkish	Commercial	http://www.nuance.com/for-individuals/mobile-applications/talks-zooms/index.htm
11.	ReadSpeaker	ReadSpeaker Holding B.V.	Web-based	<ul style="list-style-type: none"> Available in 35 languages and 90 voices. Device-independent and no downloads required by end-user. Synchronized highlighting of the text being read Enables online content 	<ul style="list-style-type: none"> Not an alternative to coding web pages with accessibility in mind using standards-based web development practices 	Arabic, Basque, Catalan, Chinese(Cantonese), Chinese(Mandarin), Czech, Danish, Dutch, English(American),	Free	http://www.readspeaker.com/

				<p>owners to provide their end users with a highly accessible</p> <ul style="list-style-type: none"> • Plugin-free document viewer that can display all types of documents • Assists language acquisition for non-native speakers of English 		<p>English(Australian), English(British), English(Indian), English(Scottish), English(South African), Faroese, Finnish, Flemish, French, French(Belgian), French(Canadian), Frisian, Galician, German, Greek, Hindi, Italian, Japanese, Korean, Norwegian(Bokmal), Norwegian(Nynorsk), Polish, Portuguese, Portuguese(Brazilian), Romanian,</p>		
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						Russian, Spanish, Spanish(American), Spanish(Mexican), Swedish, Swedish(Finland), Turkish, Valencian, Welsh		
12.	NonVisual Desktop Access (NVDA)	NonVisual Desktop Access project	Windows	<ul style="list-style-type: none"> • Can be utilized specifically from a USB stick • Work on Mozilla Firefox, Microsoft Internet Explorer, Word, Excel and Outlook Express, and Mozilla Thunderbird • Customized and scriptable in Python. 	<ul style="list-style-type: none"> • Access to only certain school computers • May not work straight out of the box for some applications that choose not to follow accessibility guidelines or use standard controls. 	Afrikaans, Albanian, Amharic, Arabic, Aragonese, Brazilian Portuguese, Bulgarian, Catalan, Colombian Spanish, Croatian, Czech, Danish, Dutch, Farsi, Finnish, French, Galician, Greek, Georgian, German, Hebrew, Hindi,	Free Open source	http://www.nvaccess.org/

						Hungarian, Icelandic, Irish, Italian, Japanese, Korean, Nepali, Norwegian, Polish, Portuguese, Punjabi, Romanian, Russian, Serbian, Slovak, Slovenian, Spanish, Swedish, Tamil, Thai, Traditional and Simplified Chinese, Turkish, Ukrainian and Vietnamese.		
13.	Supernova	Dolphin Computer Access	Windows	<ul style="list-style-type: none"> Friendly user interface What we typed will be read aloud so that we can check what we write Document, email or web page can be read by single key only 	<ul style="list-style-type: none"> Lacks only the dedicated compatibility for electronic books 	UK English, US English, Arabic, Australian English, Belgian Dutch, Belgian French,	Commercial	http://www.yourdolphin.com/productdetail.asp?id=5

				<ul style="list-style-type: none"> • Fast and accurate multilingual Braille output for text at fingertips • Access complex websites with ease by choosing to list links, headings or frames • Full support PDF documents, form filling, PowerPoint, Word & Email • Customize the speed and volume of the voice and control the level of detail and punctuation that is spoken or sent to Braille. • Supports a large number of various Braille output tools 		Chinese (Cantonese), Croatian, Czech, Danish, Dutch, Finnish, French, German, Greek, Hindi, Hong Kong Cantonese, Icelandic, Italian, Lithuanian, Norwegian, Polish, Portuguese, Russian, Slovak, South African English, Spanish, Spanish (Catalan), Spanish (Latin America), Swedish, Welsh		
14.	Serotek System Access	Serotek	Windows	<ul style="list-style-type: none"> • Can be used even not for browser • Supports Microsoft Internet Explorer 	<ul style="list-style-type: none"> • Java is not supported yet 	English	Commercial	http://www.serotek.com/s

				(including DHTML/Ajax and Flash), Outlook Express, Outlook, Word, Excel, PowerPoint, Skype, and Adobe Reader				system access
15.	Microsoft Narrator	Microsoft	Windows	<ul style="list-style-type: none"> Text is read on the screen and events like error messages is described too Can customize the narrator setting; <ul style="list-style-type: none"> Hear what's on the screen Voice Sounds you hear Cursor and keys 	<ul style="list-style-type: none"> Not available for all languages Is not designed to read content in all apps 	English, Mandarin Chinese	Commercial	http://windows.microsoft.com/en-us/windows/hear-text-read-aloud-narrator#1TC=windows-8
16.	ZoomText	Ai Squared	Windows	<ul style="list-style-type: none"> Available in two versions that enable user to choose either ZoomText Magnifier which can enlarge and enhance everything on the computer screen or ZoomText Magnifier/Reader, 	<ul style="list-style-type: none"> Currently not supporting Windows 64 bit 	English (American & U.K.), Finnish, French (Standard and Canadian), German, Italian, Portuguese,	Commercial	http://www.aisquared.com/zoomtext

				<p>which will enlarge and also have an additional features by reading aloud what is on the computer screen.</p> <ul style="list-style-type: none"> • Support Windows OS, Microsoft Office 2013, Internet Explorer 10 and all types of games. • Have feature of color enhancement transition effects. • Have smooth mouse pointers 		Spanish (Standard and Mexican)		
17.	Simply Talker	EcoNet International	Windows	<ul style="list-style-type: none"> • Software available in international version • Talking Web Browser for Windows 95, 98, ME, NT4, and Windows 2000 	<ul style="list-style-type: none"> • Need to purchase for full features 	Supports every foreign language in which Windows 98 has been released	Commercial	http://simplytalker-2000.sourceforge.info
18.	Thunder ScreenReader	Sensory Software	Windows	<ul style="list-style-type: none"> • Support Windows XP and Vista, Windows 7, and partly works with Windows 8 • Compatible with Outlook Express, Microsoft Word, WordPad, Notepad, MS Calculator, MS Excel, 	<ul style="list-style-type: none"> • The limitation is Web browsing. The only way to navigate the Web is by using WebbIE 	Arabic, Bulgarian, Czech, Estonian, French, Greek, German, Italian, Polish, Slovakian, Spanish, Turkish	Freeware	http://webbie.org.uk/thunder/index.htm

				Nod32 AntiVirus, Listen Again radio, and MS Sound Recorder <ul style="list-style-type: none"> • Its commands rely on the number pad 				
19.	Claro ScreenRuler Suite	Claro Software	Windows	<ul style="list-style-type: none"> • Dynamic software package to assist with reading on the PC • Users can focus and track around a computer screen easily • Provides a strip or ruler across the screen 	<ul style="list-style-type: none"> • Costly 	American English, Arabic, Argentinian Spanish, Australian English, Basque, Belgian Dutch, Brazilian Portuguese, British English, Canadian French, Catalan, Chinese Mandarin, Colombian Spanish, Czech, Danish, Dutch, Finnish, French, Galician, German, Greek,	Commercial	http://www.clarosoftware.com/

						Hebrew, Hindi, Hong Kong Cantonese, Hungarian, Indian English, Indonesian, Irish English, Italian, Korean, Mexican Spanish, Norwegian, Polish, Portuguese, Romanian, Russian, English, Slovak, South African English, Spanish, Swedish, Mandarin, Thai, Turkish, Valencian, American English, American Spanish, Arabic, Arabic		
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						(British), Australian English, Belgian Dutch, Brazilian Portuguese, British English, Canadian French, Catalan, Czech, Danish, Dutch, Finland Swedish, Finnish, French, German, Gothenburg Swedish, Greek, Indian English, Italian, Italian, Japanese, Korean, Mandarin Chinese, Norwegian, Polish, Portuguese, Russian, Scanian, Scottish		
--	--	--	--	--	--	--	--	--

						English, Spanish, Swedish, Turkish		
20.	COBRA	BAUM Retec	Window s	<ul style="list-style-type: none"> • Support for Braille • Support JAVA applications • Can navigate from cell to cell in tables 	<ul style="list-style-type: none"> • Need to purchase the license 	English, Norwegian, Italian, French, Arabic, Russian, Belgian, Swedish, Dutch	Commer cial	http:// www. baum. de/cms /en/co bra10/
21.	LookOUT	Choice Technolo gy	Window s	<ul style="list-style-type: none"> • No extra speech synthesizer is required • Visual Basic scripting for complex situations 	<ul style="list-style-type: none"> • Costly 	English	Commer cial	http:// www. barryb ennett. co.uk/ compo nent/c ontent/ article/ 5- softwa re/379 -the- lookou t- screen reader. html
22.	95Reader	SSCT	Window s	<ul style="list-style-type: none"> • Japanese screen reader 	<ul style="list-style-type: none"> • Not maintain by the developer 	Japanese	Commer cial	http:// www.

					<ul style="list-style-type: none"> Not enough resources to analyze this screen reader 			nise.go.jp/research/kogaku/twat/anab/Onsei/95Reader/95REn.html
23.	HAL	Dolphin Computer Access	Windows	<ul style="list-style-type: none"> Fully integrated speech and Braille Supports all display resolutions and color-depths of your video card driver. Requires no macro files or complex configurations 	<ul style="list-style-type: none"> Costly Not available for many languages Trial version for 30 days only 	English (UK and USA), Cantonese, Catalan, Danish, Dutch, Finnish, French, German, Greek, Italian, Mandarin, Norwegian, Polish, Portuguese, Spanish (Latin and Castilian) and Swedish	Commercial	http://www.synapseadaptive.com/dolphin/hal.htm
24.	PC-Talker	Kochi System Development	Windows	<ul style="list-style-type: none"> Japanese screen reader 	<ul style="list-style-type: none"> Only available in Japanese language 	Japanese	Commercial	http://www.pctalker.net/

25.	JAWS (Job Access With Speech)	Freedom Scientific	Windows and DOS	<ul style="list-style-type: none"> • Information from the screen is read aloud • Access a wide numbers of information, education and job related applications. • Can give refreshable braille displays as output • Compatible with the most frequently-used workplace and classroom applications 	<ul style="list-style-type: none"> • Costly for Windows user 	English, Spanish, German, French Canadian, Brazilian Portuguese	Commercial for Windows; freeware for DOS	http://www.freedomscientific.com/Products/Blindness/JAWS
26.	ClickHear	gh LLC	Windows and Mac	<ul style="list-style-type: none"> • Text is read aloud for the user • Have variable text and highlighting color options • Configuration settings saved per user • Set volume and speech rate to user needs 	<ul style="list-style-type: none"> • Have a trial version and after that need to be purchased • Costly 	Spanish, French and German	Commercial	https://www.gh-accessibility.com/software/clickhear
27.	Spoken Web	Eyal Shalom	Windows, Linux, Mac OS X, iPhone, iPad, iPods, Windows,	<ul style="list-style-type: none"> • Web based page • Dealing with variety of online information escalated substance like news overhauls, climate, travel and business articles • Gives straightforward, simple to-utilize 	<ul style="list-style-type: none"> • Limited functionality 	Bulgarian, French, Polish, Portuguese, Simple English, Chinese	Free	http://spoken-web.com/

			Android	<ul style="list-style-type: none"> • interface • No installation requirements • No hardware requirements • No advertisements • The speaking is clear and seamless • Can be operated from any computer, smartphones or any tablet 				
28.	TeleTender	TeleTender.org	Windows, Linux, Windows, Mac OS X, iPhone, iPad, iPods, Android	<ul style="list-style-type: none"> • Embedded with cloud based screen reader • Any web pages on the internet can be interacted by issuing voice commands over the phone • Can use either voice commands, or phone pad to perform all the tasks 	<ul style="list-style-type: none"> • Can't download the documents on web page contains links to word document, PDF files • Sound from the browser cannot be played 	English	Free	http://tele tender.org /

Table 1 : List of screen reader available in the market

2.4 Analysis of existing screen readers in the market

Several analyses have been made on available screen readers in the market based on the comparative studies of screen reader above. For the comparative studies above, various aspects like limitations, features, languages offered, license and source has been observed. As shown in Table 1, there are many types of screen reader that offer different features to be served to the users. Other than that, users also can choose whether to use free screen reader or purchase any screen reader that suits their preferences.

Based on the objectives of this project, the most important criteria that need to be analyzed is the language offered by available screen reader in the market. It is found that there is no Malay narrator of screen reader with local accent offered to the users. There are hundreds of languages offered such as French, Germany, English, Portuguese and many other languages. This means that people around the world can browse any language of web pages without having any difficulties as they can choose screen readers that offer the respective language. Unfortunately, there is one language that is still not available to be offered yet, which is Malay language. The Malay language medium Internet users have difficulties in understanding information read by the screen reader.

Individuals often pay attention on such structural components of language, for example, pronunciation, and vocabulary, as they are such clear linguistic differences. Those extra attentions can cause information understanding greater than when language is not viewed as an issue (Schomaker and Zaheer, 2013). Based on the statement given earlier, languages do become an issue in information transfer.

According to Schomaker and Zaheer (2013), differing representations of the information being exchanged from source to recipient can be resulted by the absence of structural semantic resource overlap between most widely used language and the unit language that may influence the encoding and decoding of the message. Both the encoding and decoding techniques are influenced by the level overlap of the lingua franca and unit languages. The narrator of screen reader is able to read in Malay language of web pages, but the pronunciation of the words or the sentences creates

problem to the users. It is cannot be understood and also confuses the users. Narration of the words are done by non-Malay speakers and the enunciation of those words confuses and at times, do not help users. Due to this difficulty, users have to listen repeatedly to what has been read by the screen reader. Thus, longer time is needed for them to understand the information browsed. Not only that, there might be misinterpretation of information if users misunderstood what have been read by the narrator of the screen reader. As such, purpose of knowledge transfer from browsed web pages cannot be achieved, as the accurate information cannot be shared correctly to the user. Due to the above, this project is deemed important and needs to be conducted.

CHAPTER 3

METHODOLOGY

3.1 Research methodology

There are several methods that have been carried out during the research methodology phase. This is to ensure the prototype is developed correctly according to the demands from the society. Data gathering phases and interview session are the most suitable methods to be implemented in this project. By doing that, the main problem that encountered will actually help in developing and enhancing the prototype. Below are the illustrations of research methodology that have been conducted;

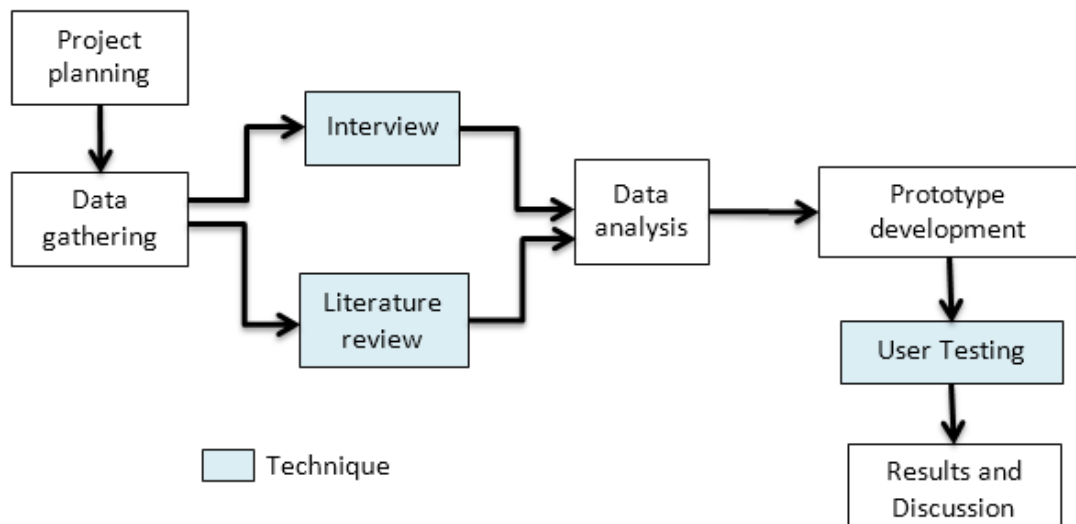


Figure 1 : Research methodology

3.1.1 Project planning

There are several activities done in the project planning phase. One of the activities is selecting the project topic. After the supervisor approves the selected project, brainstorming session is conducted between the supervisor and the author. Along with the several brainstorming session, the author also did some research on the selected topic by reading all the collected articles, research paper and many other materials. All the information obtained was gathered in one folder for the referencing purposes. After that, the problems

will be identified. In this phase also, the objectives of this project is defined. And then, the author also did the study on the background of the project.

3.1.2 Interview and data gathering

Interview session is done at MAB, Ipoh. Selected participants were interviewed by the tester to collect their background data either they are already familiar with JAWS or not. Then, they need to go through the testing session that has been designed in order to determine the difficulties in using JAWS as a screen reader. The tester needs to follow all the procedure in the experimental design that has been prepared earlier. The purpose of the testing session using existing screen reader is to measure the duration taken by the visually impaired internet user to capture the information spoke by the screen reader as the existing screen reader in the market does not have any Malay narrator yet. The results obtained from the testing session will be the reason why this screen reader prototype needs to be developed.

3.1.3 Literature review

After completing the project planning phase, literature review is developed. The literature review is developed based on the study of several research papers during the project planning phase. The selected research paper comprises on variety aspects of the selected topic. In literature review also, the author did some comparative studies on existing screen readers that are currently available in the market. Then, the author come out with one conclusion which is to use Job Access With Speech (JAWS) software for testing purpose as JAWS is commonly used by the visually impaired Internet user at MAB, Ipoh.

3.1.4 Data analysis

In data analysis phase, there will be the discussion on findings. From the results, the suitable methodology will be selected in order to develop the BM screen reader prototype. Basic software architecture also is designed at this phase. And then, the main component of the prototype will be determined. This is to ensure that the right component is chosen to develop the prototype successfully and can fulfill the requirements of the prototype. This is to make

sure that the objectives will be achieved in completing this project. After the analysis is done, the result and discussion will be projected in the report.

3.1.5 Prototype development

Based on the data available, the working prototype will be developed. This phase will be conducted during FYP2. During this phase, the author needs to decide what language of programming that will be used and also design the suitable user interface to make sure this prototype will be user friendly. The development of the prototype will be based on the requirements gathered at the early stage of project development.

3.1.6 User testing

After completing the development of prototype, user testing needs to be done. This is to make sure that the developed prototype follows all the requirements and also to make sure the functionalities of the prototype is developed correctly. User testing also will be conducted during FYP2.

3.1.7 Results and discussion

All the results obtained will be documented into the report. And lastly the report will be submitted to the supervisor and examiner to be evaluated.

3.2 Development methodology

In this section, the author will discuss on the suitable development methodology that will be used in this project. It is important to choose the right methodology as different type of methodology will cater different types of development based on the needs of the project. There are certain criteria that need to be considered in choosing the most suitable development methodology to be implemented during the development. Example of the criteria is; size of the project, time allocated for the project to be completed, and requirements gathered at early stage of development.

For this project, the author has decided to choose Rapid Application Development (RAD) model as the approach in developing the prototype. RAD is an iterative framework that mainly focuses on short period of time in development cycle time. It is different from the traditional methodology like waterfall model of development. By using RAD model, the components in the development are developed in parallel as prototypes to make the delivery of completed product become faster. Not only that, small changes of requirement during development of software can be done easily using RAD model. This is because in RAD model, we will face one cycle phase of development before the software is being deployed to the real environment. That phase is what we called as Prototyping Cycles phase. All phases in RAD model will be discussed below.

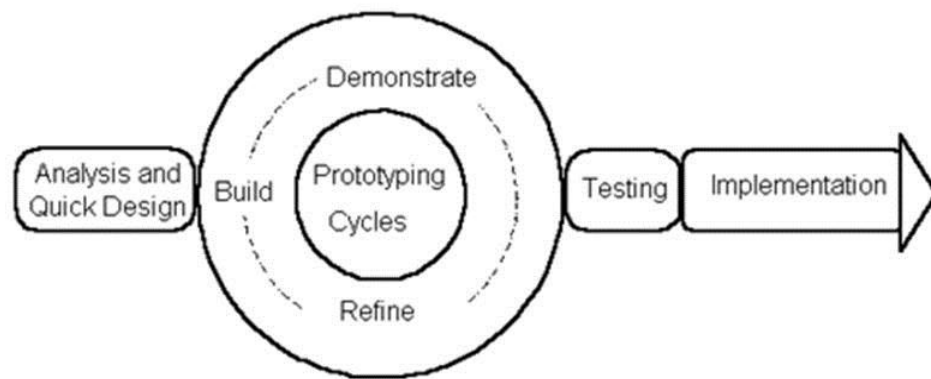


Figure 2: RAD model

Phases in RAD model;

- Analysis and Quick Design

In this phase, the author needs to gather the necessary requirement that will involve in the development of the prototype. Brainstorming session is done at the beginning of the project life. Through the brainstorming session, the author will identify the objectives, the problem involved, and the constraints that may occur during the development of the prototype. At this stage, all details and requirements can be developed based on the proposed functionalities as per discussed. After the analysis phase, the details of

requirements will be presented at Quick Design Phase. At this phase, the flow and working of the prototype is important to be projected by using the available of development tools.

- Prototyping Cycles

This phase is also known as Construction phase. This is a phase whereby the prototype is developed in iterative cycles of development, testing, requirements refining and development again until the development is completed. It is important to deliver each iteration within the time that has been allocated. Once the prototype is completed, the developer will test it using the test scripts that have been prepared earlier. If the testing result is not following the requirements that have been set, the developer needs to make some changes on the prototype. The refining requirements usually happen many times at this phase. This is to make sure the core and secondary requirements is performed for all iterations. After that, the documentation of the development will be updated and necessary steps will be defined for implementation purposes.

- Testing

During this phase, the testing will focus on the final prototype of software that has been build. The purpose going through this phase is to validate and verify the developed prototype. User testing also will be done at this phase by the author and the actual user. All the functionalities of the prototype of the software will be tested.

- Implementation

Implementation is the final phase in RAD model. At this phase, the author will present the final working prototype and send a complete report to the supervisor to be evaluated. Troubleshooting will be performed in this phase to make sure the prototype works properly.

3.3 Gantt chart and key milestone

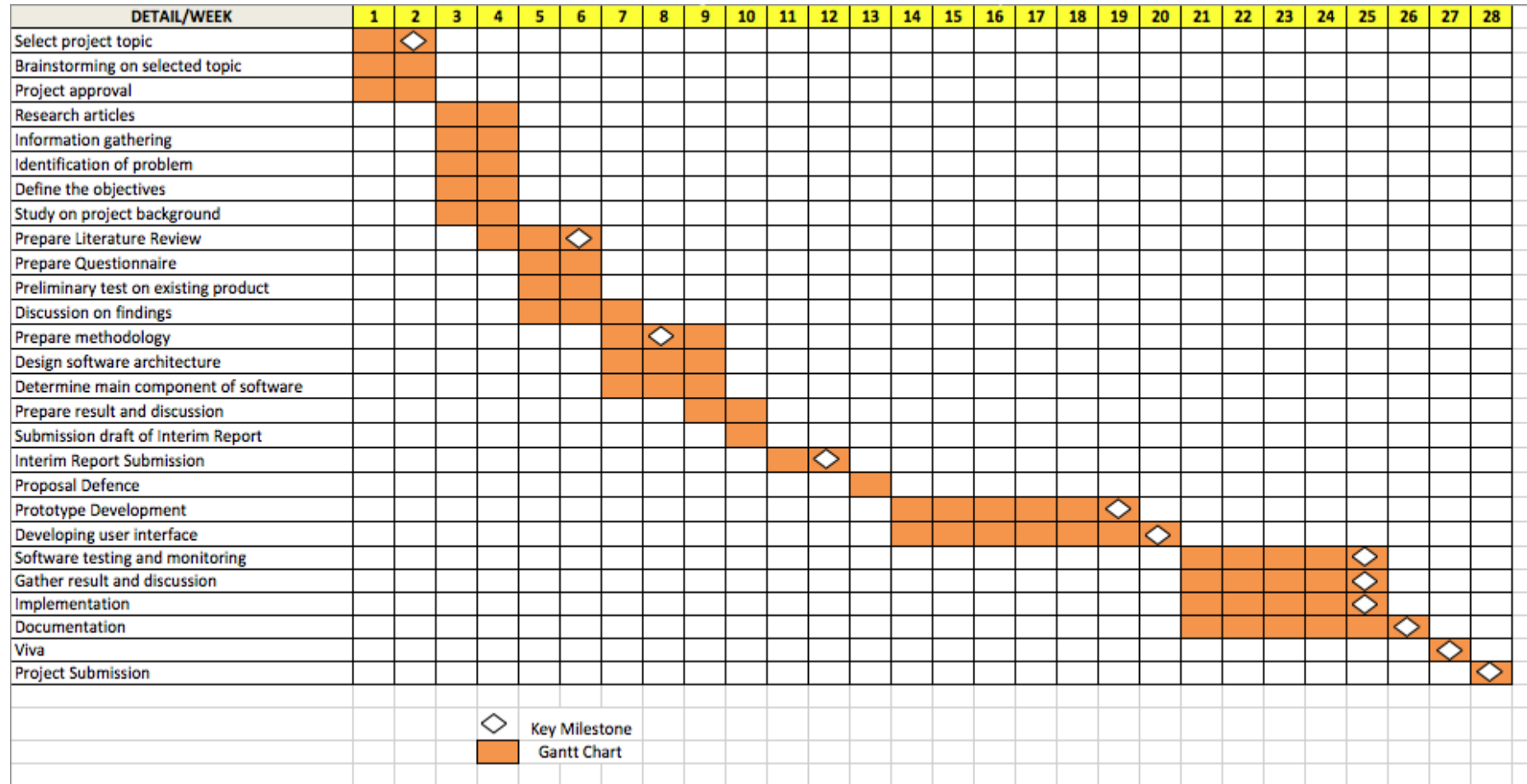


Figure 3: Gantt chart and key milestone

3.4 Development tools

The tools that have been used in this project are:

1. Software

- a. Job Access With Speech (JAWS)

JAWS is a screen reader program that can run on Microsoft Windows which will assist the visually impaired users to access information on the computer screen. JAWS can facilitate the visually impaired users through text-to-speech output or by a Refreshable Braille display. Not only that, users can use JAWS to access the Internet too. In this project, jaws will be used to serves audio feedback in the prototyping and testing on the subject.

- b. Microsoft Visual Studio 2008

This software enable user to develop console, Graphical User Interface (GUI), Windows Form, web sites and other web services for all platforms supported by Microsoft Windows. Microsoft Visual Studio 2008 will be used to develop a program that enable user to give input and synchronize the audio output from the devices, user interface design, and web site rendering automation.

- c. Web Interface: Notepad++ 6.4.2

Notepad++ is a source code editor that supports many types of programming languages. This software will be used to program, and to edit the website interface as it will be easy to do debugging of codes.

- d. Microsoft Access 2010

It is a database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. In this project, Microsoft Access 2010 is used to store the path of the audio to produce the output using the system.

- e. Audacity

Audacity is the name of a popular open source multilingual audio editor and recorder software that is used to record and edit sounds. It is free and works on Windows, Mac OS X, GNU/Linux and other operating systems. In this project, Audacity is used to edit and create the audio for the words.

- 2. Hardware

- a. Desktop/Laptop

Used as a medium to run the software.

CHAPTER 4

RESULTS AND DISCUSSION

In this section, results from the preliminary interview and testing session with student from Malaysian Association For The Blind (MAB) Ipoh will be discussed. The results obtained will be the evidence to support the main objectives of having this project. It will be supported with the discussion and analysis of the results.

4.1 Preliminary interview and testing session with student from Malaysian Association For The Blind (MAB) Ipoh

Students from MAB, Ipoh has been chosen to be the participants of the interview and testing session for this project. There are eight participants and they have been selected randomly based on their availability during the session was conducted. Each of them has different background and different level of visual impairment. The results of preliminary interview and testing session will be discussed further in the next section.

4.1.1 Objectives

The main objectives of conducting this preliminary interview and testing session is:

1. To find out the relevancy of proposed project to the visually impaired Internet user.
2. To investigate the difficulties visually impaired Internet user encounter to understand what is being read aloud when using screen readers that do not provide Malay language narration.

4.1.2 Technique

As mentioned earlier, eight participants have been chosen to undergo this session. There are two techniques involved in collecting the data.

1. For the first part, the participant will be interviewed by the tester according to the questions that have been prepared at early stage of the project. The background details of the participants were obtained through the interview session. Below is the sample questions that have been asked in the interview session:

1. Have you use any screen reader that offer Malay language?
2. How long you have been using the screen reader?
3. How long it takes you to get familiar on the usage of screen reader?
4. How frequent you use the Internet in a week?
5. Do you prefer to browse web pages in Malay language or any other language?
6. Have you ever worked before?



Figure 4: Testing session

2. For the second part, the participant needs to go through the testing session that has been designed for them. Tester needs to follow all the created procedure in the Experimental Design. Screen reader – JAWS is selected as existing software in the testing session. Below is the procedure involved:
 1. Tester launches JAWS.
 2. Let the screen reader read the first article.
 3. Ask questions prepared based on the selected article.
 4. Record number of correct answer in the result table.
 5. If there is wrong answer, repeat step 1 to step 4 until exceed the maximum trials (3 trials), if not, proceed with the next steps.
 6. Let the screen reader read the second article.
 7. Ask questions prepared based on the selected article.
 8. Record number of correct answer in the result table.
 9. If there is wrong answer, repeat step 6 to step 9 until exceed the maximum trials (3 trials).

4.1.3 Result: Interview session

Analysis has been made according to the collected data from the interview session. Based on the interview between the tester and participants:

- All participants never use any types of screen reader that can offer them narrators of Malay language. Based on the author's observation, there is no screen reader that offer narrator of Malay language yet in the market.
- All participants have only used the screen reader less than a year ago. This will make the testing result become more accurate as the participants still in the learning process to get familiar with the accent of the narrator when reading any Malay language web pages. From

this observation, author can determine the level of difficulties for the visually impaired to understand what have been read by the screen reader.

- Based on the interview with the participants, all of them said that it might takes less than six months to get familiar with the usage of the screen reader. Different people have different abilities on how fast they can capture the information read by the screen reader.
- Majority of them stated that they rarely use the Internet in a week. This is due to the lack of interest as they are having difficulties to browse the Malay language web pages. Once in a while they still use the Internet, but they need to spend for quite long time to really understand information read by the screen reader. Because of that, they more prefer to only read materials that available in braille only.
- Most of the participants prefer to browse web pages in Malay language. This is because Malay language is the main language used as medium of communication. Other than that, Malay is the official language in Malaysia. So, there is need in providing a screen reader that can offer narrator who can read Malay web pages correctly without the English accent.
- Some of the participants have worked before. There is also a participant who stills a student. This information is important for the author as the result from the testing session will be varies because each of the participants have different experience in dealing with technology. There is one participant who worked as a clerk before. Because of that, he is having less difficulty in dealing with the usage of computer. There is also a participant who finished his school until standard five only. So, he has difficulties to capture the information read by the screen reader and to deal with the technology.

From the interview session, the author has made the decision that it is necessary to develop a prototype of screen reader that can offer Malay language narration. There is high demand from the visually impaired Internet

user especially for those who have difficulties to understand English. After interview session done, tester have to proceed with the testing session.

4.1.4 Result: Testing session

The testing session involved eight participants. The tester has followed all the procedures accordingly. Below is the results obtained from the testing session:

No.	Participant	No of correct answer						Avg no of correct answer
		First Article			Second Article			
		Trial			Trial			
		1	2	3	1	2	3	
1.	Participant 1	2	3	5	0	5	5	3.3
2.	Participant 2	1	4	5	2	4	5	3.5
3.	Participant 3	1	3	3	0	2	3	2
4.	Participant 4	2	4	5	1	4	5	3.5
5.	Participant 5	1	4	4	2	3	4	3
6.	Participant 6	2	4	5	4	5	5	4.2
7.	Participant 7	4	5	5	3	5	5	4.5
8.	Participant 8	2	2	5	1	4	5	3.2

Table 2 : Results from testing session

Based on the result above, it is shown that the participants need to listen repeatedly to the articles that read by the narrator of the screen reader. They need more trials to answer questions given correctly. From Table 2, there are participants who still cannot answer all questions correctly eventhough three trials have been given to them. This is because they had difficulties to understand and capture the information read by the software. After several trials, then only they can answer the questions given correctly.

The result obtained actually influenced by the participants' background details also. For example, for Participant 6 and Participant 7, they had an experience of working before they lose their sight. Participant 6 worked as an army before and Participant 7 is a clerk. Because of that, they

are familiar with English language although the accent from the narrator is a bit difficult to be understood. Different from Participant 3 and Participant 5, they felt very difficult to understand what the narrator of the screen reader read for them. So, they can't answer the questions given correctly.

Despite coming from different background, all of them still need the article to be repeatedly read by the narrator of the screen reader. By only listen the article once, they cannot answer the questions given. Thus, this can be a proof that users of screen reader needs more time to understand the information read by the narrator of the screen reader if they browse Malay language web pages. They are having difficulties to capture the information from the web pages. Thus, this project is relevant enough to be developed in order to fulfill the needs of the visually impaired.

4.2 Basic system architecture

Below is the basic system architecture that have been designed. Basic system architecture is the conceptual model that defines the structure, behavior and flow of the system. The main focus of this project is to provide a narrator that can read Malay language web pages correctly.

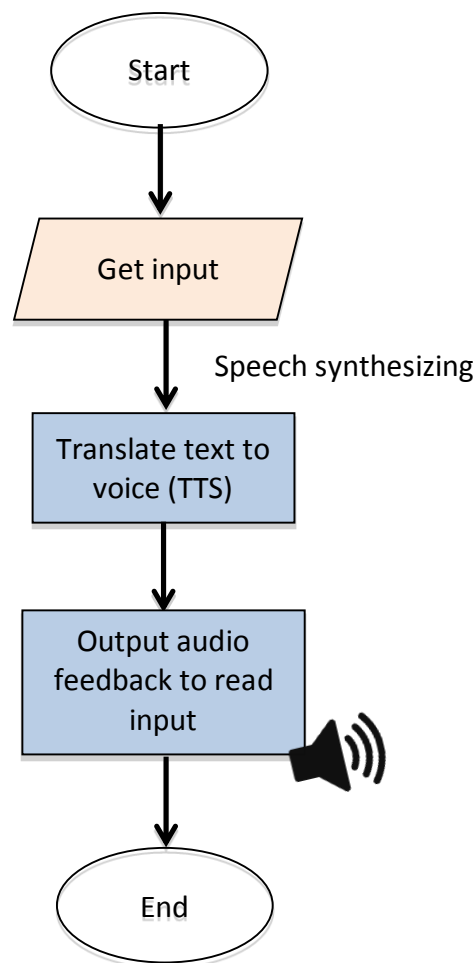


Figure 5: Basic system architecture

Basically, the user will give input of intended websites into the system. Then the system will process the content of the web pages by translating the text to voice. Speech synthesizer will convert available text to speech. Then, the narrator of the screen reader will read out the recognized words. That is how the output will be

projected out to the user. User will get the information browsed by listening the auditory output of the content of web pages.

4.3 Prototype design

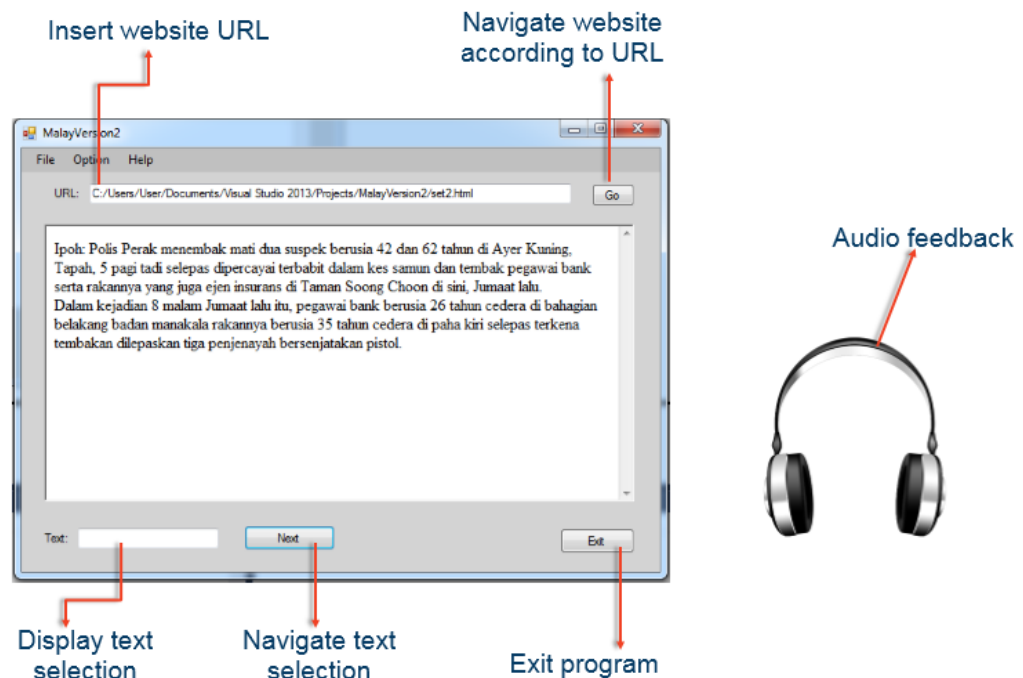


Figure 6 : Prototype

The prototype consists of two integrated components; the Malay version of screen reader system, and the speaker. The speaker is plugged to the computer as external devices. As the prototype is developed specially to assist the visually impaired users in high degree of impairment group, it is designed with a simple graphical user interface (GUI) that minimized user's efforts to navigate throughout the system. This is to promote the ease of use and provides system flexibility for the visually impaired users. The prototype design criteria are summarized as follows:

Keyboard Shortcuts

- Standardize keyboard shortcuts are used to navigate the system.
- The keyboard shortcuts for the system are designed according to "Microsoft Windows Guidelines for Designing Keyboard User Interface". This is to ensure efficiency in usage, so that visually impaired user does not have to learn new keyboard shortcuts.

- The following are the proposed keyboard shortcuts for the system:

Keyboard Shortcut	Function
ALT+F4	Close the active item, or quit the active application.
SPACE	To start the program.
CTRL+C	Copy selected items.
CTRL+X	Cut selected items.
CTRL+V	Paste, cut or copied items.
DELETE	Delete selected items. (To delete URL)
F1	Display Application Help.

Table 3 : Keyboard Shortcut

4.4 Lists of Functions

The following functions are listed in the main program. These functions are written in C#.

Function	Description
GetTextRange ()	To determine the text range in html file.
FindTextMode ()	To identify types of text attributes.
GetTextRange ()	To identify word by word.
MoveRange ()	To navigate from one word to another.
NumberToWords ()	To convert any number into word.
ReadWord ()	To produce audio as the output.

Table 4 : Function

4.5 Snapshot of Important Codes

i. Determining text range.

```
string GetTextRange()
{
    if (webBrowser1.Document != null)
    {
        IHTMLDocument2 document =
webBrowser1.Document.DomDocument as IHTMLDocument2;
        if (document != null)
        {
            IHTMLBodyElement bodyElement = document.body as
IHTMLBodyElement;
            if (bodyElement != null)
            {
                IHTMLTxtRange range =
bodyElement.createTextRange();
                if (range != null)
                {
                    return range.text;
                }
            }
        }
    }
    return null;
}

string text = GetTextRange();
string[] textlines = new string[1000];
string[] textlinesdraft = text.Split(new string[] {
Environment.NewLine }, StringSplitOptions.None);
int j = 0;
for (int h = 0; h < textlinesdraft.Length; h++)
{
    if (!textlinesdraft[h].Equals(""))
    {
        textlines[j] = textlinesdraft[h].ToString();
        j += 1;
    }
}
```

ii. Producing the audio as an output.

```
void ReadWord()
{
    if (txtSelection.Text != "")    //if text area is not empty
    {
        //set up the connection string
        string ConnectionString =
@"Provider=Microsoft.ACE.OLEDB.12.0;Data
Source=C:\Users\User\Documents\Visual Studio
2013\Projects\MalayVersion2\MalayDict.accdb";
        //set up the select statement
        string SelectCommand = "SELECT path FROM Word where word
= '" + lblNo2.Text + "'";
        //set up the connection object&nbsp;using the conn string
        OleDbConnection Connection = new
OleDbConnection(ConnectionString);
        //set up the data adapter using the select statement and
the connection object
        OleDbDataAdapter Adapter = new
OleDbDataAdapter(SelectCommand, Connection);    //a new empty
dataset

        DataSet ds = new DataSet();

        //fill the dataset with a new datatable of all the
results
        Adapter.Fill(ds, "Word");//string is the DataTable name,
can be anything
        //now, let "Table" point to the datatable with our
results
        DataTable Table = ds.Tables["Word"];

        if (Table != null && Table.Rows.Count > 0) //check if the
word is in db or not
        {
            //get the path into string
            String strPath = "";
            strPath = ds.Tables[0].Rows[0]["path"].ToString();

            if (strPath != "") //check path col
            {
                player.SoundLocation = strPath;
                player.LoadAsync();
                player.Play();
            }
            else
            {
                MessageBox.Show("Audio for Word: '" +
txtSelection.Text + "' is not in the database!");
            }
        }
        else
        {
            MessageBox.Show("Word: '" + txtSelection.Text + "' is
not in the database!");
        }
    }
}
```

4.6 Sample Websites

For testing purpose, two sample websites are used. Each of this sample website contains numbers of Malay words. The websites are then simplified for testing purpose. The objective of testing multiple sample websites to the system is to vary the Malay words that will be enunciated using the system.

i) First article

Tembak mati suspek samun

Share 216 Like 8k Tweet 3 Pinterest 0 Google + 0

Oleh Mohd Hafizee Mohd Arop
hafizee@hmetro.com.my

Ipoh: Polis Perak menembak mati dua suspek berusia 42 dan 62 tahun di Ayer Kuning, Tapah, 5 pagi tadi selepas dipercayai terbabit dalam kes samun dan tembak pegawai bank serta rakannya yang juga ejen insurans di Taman Soong Choon di sini, Jumaat lalu.

Dalam kejadian 8.20 malam Jumaat lalu itu, pegawai bank berusia 26 tahun cedera di bahagian belakang badan manakala rakannya berusia 35 tahun cedera di paha kiri selepas terkena tembakan dilepaskan tiga penjenayah bersenjatakan pistol.

Ketua Polis Perak, Datuk Osman Salleh berkata, kedua-dua suspek itu berjaya dikesan berdasarkan maklumat diperoleh daripada dua suspek yang ditahan sebelum ini selepas turut dipercayai terbabit dalam kes itu.

Menurutnya, kedua-dua suspek yang menaiki kereta itu melepaskan beberapa das tembakan ke arah kenderaan polis menyebabkan polis terpaksa membalas tembakan itu sebelum mereka berjaya ditumpaskan.

"Pemeriksaan ke atas suspek menemui sepucuk pistol dan berdasarkan semakan mendapat kenderaan digunakan suspek dilaporkan hilang pada 29 September tahun lalu di Pulau Pinang.

"Kedua-dua suspek juga mempunyai rekod jenayah lampau di mana seorang daripada suspek dikehendaki dalam

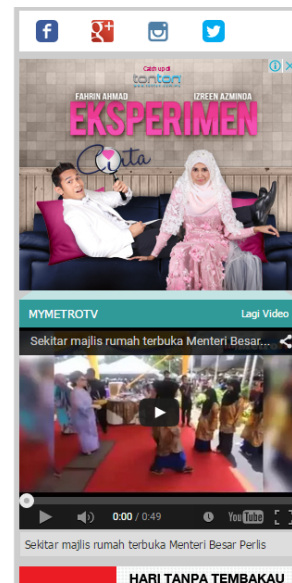


Figure 7 : First article

```
<html>
<H1>Tembak mati suspek samun </H1>
Oleh Mohd Hafizee Mohd Arop <BR>
hafizee@hmetro.com.my <BR><BR>
Ipoh: Polis Perak menembak mati dua suspek berusia empat puluh dua dan
enam puluh dua tahun di Ayer Kuning, Tapah, 5 pagi tadi selepas dipercayai
terbabit dalam kes samun dan tembak pegawai bank serta rakannya yang juga
ejen insurans di Taman Soong Choon di sini, Jumaat lalu. <BR>
Dalam kejadian lapah dua puluh malam Jumaat lalu itu, pegawai bank berusia
dua puluh enam tahun cedera di bahagian belakang badan manakala rakannya
berusia tiga puluh lima tahun cedera di paha kiri selepas terkena tembakan
dilepaskan tiga penjenayah bersenjatakan pistol. <BR>
Ketua Polis Perak, Datuk Osman Salleh berkata, kedua-dua suspek itu berjaya
dikesan berdasarkan maklumat diperoleh daripada dua suspek yang ditahan
sebelum ini selepas turut dipercayai terbabit dalam kes itu.
Menurutnya, kedua-dua suspek yang menaiki kereta itu melepaskan beberapa
das tembakan ke arah kenderaan polis menyebabkan polis terpaksa membalas
tembakan itu sebelum mereka berjaya ditumpaskan. <BR>
</html>
```

ii) Second article

Semangat tak luntur

Share 0 Like 0 Tweet 0 Pinterest 0 Google+ 0

Oleh Aida Adilah Mat

aida_adilah@hmetro.com.my

Kuala Lumpur: Pengalaman ditimba di Kejohanan Dunia memberi pengalaman berharga buat pelumba pecut negara Fatehah Mustapa biarpun tewas pusingan kedua acara keirin wanita, sekali gus menyaksikan hasrat mara ke perlumbaan akhir tidak kesampaian.

Acara berlangsung di Velodrom Saint-Quentin-en-Yvelines, Perancis itu menyaksikan Fatehah sekadar mampu menduduki tempat kelima dalam perlumbaan membabitkan seteru utama dari Hong Kong Lee Wai Sze yang berada di tangga keempat.

Dalam saingan kategori wanita elit pada Kejohanan Berbasikal Trek Dunia UCI 2015 itu, tiga pelumba teratas yang mara ke final menjadi milik Lin Junhong (China), Monique (Kanada) dan Shanne Braspenninx (Belanda).

Tiga lagi pelumba dari satu lagi kumpulan membabitkan Anna Meares dan Stephanie Morten (Australia) serta Lisandra Guerra Rodriguez melengkapkan enam peserta berlumba di final.

Kegagalan itu tidak mematahkan semangat Fatehah, pemenang pingat perak acara keirin Siri Piala Dunia Klasik Ketiga tahun lalu, biarpun hasrat untuk mengulangi kejayaan rakan senegara, Azizulhasni Awang yang merangkul gangsa acara keirin lelaki, tidak kesampaian.



Figure 8 : Second article

```
<html>
<H1>Semangat tak luntur </H1>
Oleh Aida Adilah Mat <BR>
aida_adilah@hmetro.com.my <BR><BR>
Kuala Lumpur: Pengalaman ditimba di Kejohanan Dunia memberi pengalaman
berharga buat pelumba pecut negara Fatehah Mustapa biarpun tewas pusingan
kedua acara keirin wanita, sekali gus menyaksikan hasrat mara ke perlumbaan
akhir tidak kesampaian. <BR>
Acara berlangsung di Velodrom Saint-Quentin-en-Yvelines, Perancis itu
menyaksikan Fatehah sekadar mampu menduduki tempat kelima dalam
perlumbaan membabitkan seteru utama dari Hong Kong Lee Wai Sze yang
berada di tangga keempat.
Dalam saingan kategori wanita elit pada Kejohanan Berbasikal Trek Dunia UCI
dua ribu lima belas itu, tiga pelumba teratas yang mara ke final menjadi milik Lin
Junhong (China), Monique (Kanada) dan Shanne Braspenninx (Belanda). <BR>
Tiga lagi pelumba dari satu lagi kumpulan membabitkan Anna Meares dan
Stephanie Morten (Australia) serta Lisandra Guerra Rodriguez melengkapkan
enam peserta berlumba di final. <BR>
</html>
```

4.7 Experiment

In order to test the effectiveness and usability of the Malay version of the screen reader prototype, a series of experiments are conducted. The experiments are divided into two parts; experiment with the sighted users (pilot testing) and experiment with the visually impaired users (user testing).

4.8 Pilot Testing with the Sighted Users

A pilot testing is conducted to test the effectiveness and overall usability of the Malay version of the screen reader prototype by observing the number of correct words they can get. The pilot testing is also done to test the experimental framework design, so that it can be improved and adjusted later in the user testing with the actual population - the visually impaired users.

Ten participants from Universiti Teknologi PETRONAS aged 22 years are recruited to participate in the pilot testing. It is acknowledged that they have no prior experience using screen reader or any other assistive technology for the visually impaired. The visually impaired are not being used in the pilot testing in order to apply a controlled condition whereby the degree of visual impairment is constant (Stevens et. al, 1996). In addition, according to Ramstein et. al (1996) and Yu W., et al (2001), there are no significant differences in performance between visually impaired users and blindfolded sighted users to complete the tasks. However, this may not be the case in all scenarios.

The participants are blindfolded for all tasks to assimilate the visually impaired users. For the pilot testing purposes, only 21 words are used as a sample of Malay web page. This decision has been made in order to reduce the burden of the cognitive load of test participants. Not only that, the decision is made to reduce the time for each session of the pilot testing with the participants too.

**Refer APPENDIX 1-5 for pilot testing experimental framework.

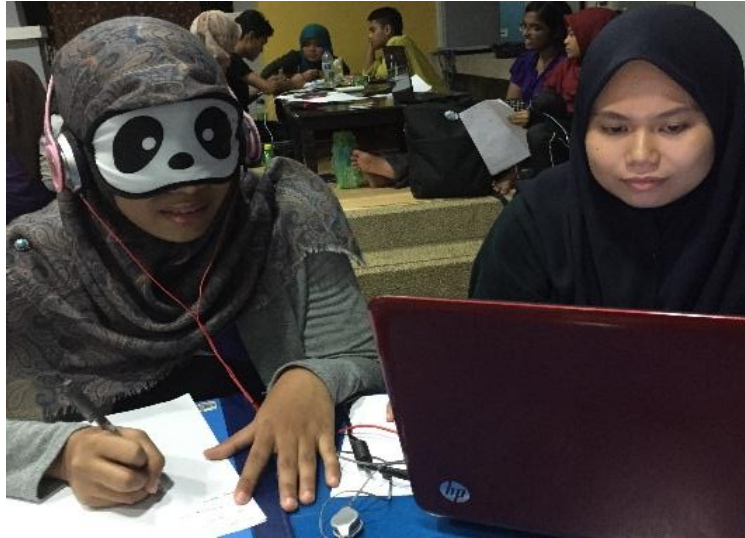


Figure 9 : Pilot testing

4.8.1 Result of the Pilot Testing

Participants	System			
	English Version		Malay Version	
	No. of correct words	% of correct words	No. of correct words	% of correct words
Participant 1	0/21	0	21/21	100
Participant 2	4/21	19.05	20/21	95.24
Participant 3	1/21	4.76	21/21	100
Participant 4	0/21	0	21/21	100
Participant 5	1/21	4.76	21/21	100
Participant 6	0/21	0	20/21	95.24
Participant 7	1/21	4.76	21/21	100
Participant 8	6/21	28.57	20/21	95.24
Participant 9	0/21	0	21/21	100
Participant 10	1/21	4.76	21/21	100

Table 5: Result of pilot testing

The result of pilot testing in table 5 above shows the number of correct words and percentage of correct words that the participants get to capture in completing the tasks. The result shows that the number of correct words wrote by the participant when using Malay version of screen reader prototype is higher than English version of screen reader prototype. From the observation, the participant took shorter time to recognize the word pronounced by the narrator of the screen reader when using Malay version of screen reader prototype instead of the English version of screen reader

prototype. They only need to take about two to three seconds to write down the word that they listened. This reflects the effectiveness of the new proposed system in conveying correct information to its users. The participants are able identify the words accurately using the Malay version of screen reader prototype.

Other concern to be discussed in this section is the sample of the web page. The participants said that 21 words for testing purposes were too many for them as they felt that they have to focus for a long duration to complete the tasks. This is because they need to go through with two sets of experiment which were with the Malay version of screen reader prototype and also the English version of screen reader prototype. The experiment requires them to listen, focus and at the same time write down the words enunciated by the narrator of the screen reader. It has become a burden to them. To solve this problem, other sample of web page that contain lesser words will be used for the user testing purposes in the future.

4.9 User Testing with the Visually Impaired Users

User testing was conducted with the visually impaired from Malaysian Association for the Blind (MAB) Gunung Rapat, Ipoh. The purpose of the experiment is to investigate, test the effectiveness and overall usability of the Malay version of the screen reader prototype compared to English version of screen reader prototype. This testing is carried out in order to verify for its strength, weaknesses and for future enhancements. The experiment focuses on one area which is to identify the effectiveness of the Malay version of the screen reader prototype. The participants were required to complete the tasks that have been designed for them.

Six participants from Malaysian Association for the Blind Ipoh aged between 25 and 30, male and female are recruited to do the user testing. It is aware that the number of participants is small. However, considering the difficulties in recruiting visually impaired users and shortage of manpower, the size is reasonably acceptable

(Takagi et. al, 2007). The participants are from partial blind. This is because the tasks that need to be completed can only be done by the partial blind people. Most of them are not initially blind, and only became visually impaired due to diseases and surgical complications. Therefore, they have past experience on using computer, and also writing like a normal people. All of the participants are experienced screen reader users range as beginner. The participants are also had computer training for visually impaired from the past and are regular Internet users.



Figure 10 : User testing

* Refer APPENDIX 1-6 for user testing experimental framework.

4.9.1 The Effectiveness of Malay Version of Screen Reader Prototype

To investigate the effectiveness of Malay version of screen reader system compared to English version of screen reader, the percentage of correct words wrote by the participants are calculated. The result was then compared between the two testing.

4.9.2 Result of the User Testing

Participants	System			
	English Version		Malay Version	
	No. of correct words	% of correct words	No. of correct words	% of correct words
Participant 1	2/17	12	16/17	94
Participant 2	1/17	6	14/17	82
Participant 3	2/17	12	17/17	100
Participant 4	3/17	18	16/17	94
Participant 5	0/17	0	10/17	59
Participant 6	0/17	0	16/17	94

Table 6: Result of user testing

The result of user testing in table 6 the number of correct words and percentage of correct words that the participants get to capture in completing the tasks. The result indicates that the number of correct words captured by the participant when using Malay version of screen reader prototype is higher than English version of screen reader prototype. From the observation, the participant takes shorter time to try to recognize the word pronounced by the narrator of the screen reader when using Malay version of screen reader prototype instead of the English version of screen reader prototype. They only need to take about two to three seconds to write down the word that they listened. Most of the participants have difficulties to recognize the first word read by the narrator of Malay version screen reader prototype. This scenario happened probably because that is the first experience for them listening to the Malay version of screen reader prototype narrator. After listened to the several words pronounced by the narrator, the participants became more familiar with the output from the prototype. This result reflects the effectiveness of the new proposed system in conveying correct information to its users. The participants are able identify the words accurately using the Malay version of screen reader prototype.

Based on the pilot testing that was carried out earlier, the participants complaint that 21 words for testing purposes were too many for them as they felt that they have to focus for a long duration to complete the tasks. This is

because they need to go through with two sets of experiment which were with the Malay version of screen reader prototype and also the English version of screen reader prototype. The experiment requires them to listen, focus and at the same time write down the words enunciated by the narrator of the screen reader. It has become a burden to them. To overcome this problem, other sample of web page that contain lesser words has been used in the user testing. Only 17 words were used in the user testing. All participants involved in the user testing stated that they were enjoyed during the user testing as they can have the experience using the Malay version screen reader prototype. They also hope that the actual Bahasa Melayu screen reader can be developed in the future.

4.10 The Need of Malay Version of Screen Reader

From pilot testing and user testing that have been carried out, it is clearly shown that there is a need to develop actual Malay version of screen reader. The developed prototype in this project is just to portray the concept of screen reader that will be used by the visually impaired in the future. From the both testing we can see that it is more effective to use Malay version screen reader prototype to browse Malay language webpages especially for the visually impaired Malay language medium Internet user. The information browsed can be transferred clearly to the user. There will be no more misunderstanding of information whenever they are browsing the Malay language webpages as they can clearly listen to each word enunciate by the narrator of the Malay version of screen reader. Other than that, the duration needed for the visually impaired Internet user to understand the information spoke by the narrator of the screen reader can be reduced too by using Malay version of screen reader. Observation has been made during the user testing to verify the statement. The participant only took about two to three seconds to recognize the word pronounced by the narrator of the screen reader when using Malay version of screen reader system instead of English version of screen reader system. The existing of Malay version of screen reader in the future will make the visually impaired

Malay language medium Internet user browsing experience on Malay language webpages become easier.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This chapter will be a section whereby overall objectives of the project will be concluded. Future works that can be done to expand this project also will be suggested in this section.

5.1 Relevancy of the objectives

Based on the previous discussion, the ultimate objectives of the project is:

1. To investigate the difficulties visually impaired Internet user encounter to understand what is being read aloud when using screen readers that do not provide Malay language narration.
2. To develop a screen reader prototype that can read aloud in the Malay language for visually impaired Internet users.
3. To test the effectiveness of the developed Malay language screen reader prototype.

The project serves the determined objective at the early phase of development. Preliminary interview and testing has been done regarding the use of screen reader that does not offer any Malay language of narrator. This was done to prove the necessity of this project to be developed. Along the study of this project, a comparative study on the existing screen reader also has been made. As a result, it is confirmed that there is no other screen reader that offer Malay language of narrator.

Based on the preliminary interview and testing session conducted, it is proven that the visually impaired having difficulties in understanding the information read by the screen reader that which does not offer Malay narrator. This project is seen to be relevant to reduce the difficulties for the visually impaired. From the study, it can be concluded that there is a need in providing narrator that can read Malay language

properly without the English accent. This is to ensure the visually impaired Internet user can browse Malay language of web pages easily without taking too long time to understand what is spoke by the narrator. It is essential to provide equal access and opportunity to the visually impaired.

The second objective have been met along the completion of this project. A prototype of Malay version of screen reader system that can properly pronounce the Malay words have been developed. The concept of the prototype was developed based on the hypotheses and theories studied in the literature review. Rapid Application Development (RAD) model was adopted as a development methodology to develop the system. The system is able to read the Malay language webpages and can pronounce the Malay words properly.

The third objective is to test the effectiveness of the newly developed Malay version of screen reader prototype. This is done through user testing with the visually impaired from Malaysian Association for the Blind (MAB) Gunung Rapat, Ipoh. Prior to the user testing, a pilot testing was conducted with the sighted users blindfolded to assimilate the blind people to study the effectiveness of the experimental framework before testing the system with the actual potential users; the visually impaired. The findings from both experiments show significance improvement in web browsing experience using Malay version of screen reader as compared to the English version of screen reader system.

To conclude everything, there is a need to develop an actual Malay version of screen reader. This project have clearly shows the impact of having a narrator of screen reader that can properly pronounce the Malay words correctly on Malay webpages. By having Malay version of screen reader, the browsing experience of the visually impaired Malay language medium Internet user will be more effective. Lesser time is needed for them to capture the Malay language information and chances of misunderstanding of information from happen will become lesser too. This is to ensure that people with disabilities especially the visually impaired users that prefer Malay webpages can have better browsing experience as it is essential to provide equal access and opportunity to disabled users.

5.2 Suggested future work for expansion and continuation

For future work and expansion, it is suggested that, the developed prototype can be improvised by having many version of Malay language of narrator. For example, by having a male narrator or vice versa. In addition, it is also suggested to automate the system in order to reduce user's effort. Currently, users have to press a hotkey in order to read the content of the webpage. With the system automation, the system will give the users option, whether to control the speed of reading through hotkeys or to automate the reading to default speed. For the time being, one screen reader can only properly pronounce words from one language. It is suggested that in the future there will be a screen reader that can properly pronounce two languages with only one screen reader used. For example, the narrator of the screen reader can properly enunciate English and Malay language correctly in one sentence. The next researcher who wants to continue this project can consider the suggestion as mentioned earlier.

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APPENDICES

APPENDIX 1-1: BACKGROUND SURVEY

Participant:

1. Pernahkah anda menggunakan ‘screen reader’ yang ‘narrator’nya fasih berbahasa Melayu?
(YA) (TAK)
2. Sudah berapa lamakah anda menggunakan ‘screen reader’?
(< setahun) (setahun – 3 tahun) (> 3 tahun)
3. Berapa lamakah masa yang diambil untuk mahir atau pandai menggunakan ‘screen reader’? (faham apa yang dibacakan oleh screen reader)
(< 6 bulan) (6bulan – setahun) (> setahun)
4. Seberapa kerapkah anda melayari Internet dalam masa seminggu?
(< 5 kali | jarang) (5 – 10 kali) (> 10 kali | kerap)
5. Lebih suka melayari laman web berbahasa Melayu atau Inggeris atau bahasa lain?
(MELAYU) (INGGERIS) (LAIN-LAIN)
6. Pernahkan anda bekerja sebelum ini? Jika ya, nyatakan.
(TIDAK) (YA:)

Testing result:

Article	Trial	Answer					Result of correct answer	Avg no of correct answer
		1	2	3	4	5		
First	1							
	2							
	3							
Second	1							
	2							
	3							

APPENDIX 1-2:

EXPERIMENTAL DESIGN FOR PRELIMINARY TESTING SESSION

TITLE: To determine duration needed for the visually impaired Internet user to understand article read by screen reader – JAWS.

HYPOTHESIS: The average number of correct answer depends on the time needed for the visually impaired to understand information read by the narrator of the screen reader.

INDEPENDENT VARIABLE: Participants

DEPENDENT VARIABLE: Average number of correct answer

CONSTANT VARIABLE:

1. Type of screen reader -JAWS
2. Set of article
3. Speed of the narrator

PROCEDURE:

1. Tester launches JAWS.
2. Let the screen reader read the first article.
3. Ask questions prepared based on the selected article.
4. Record number of correct answer in the result table.
5. If there is wrong answer, repeat step 1 to step 4 until exceed the maximum trials (3 trials), if not, proceed with the next steps.
6. Let the screen reader read the second article.
7. Ask questions prepared based on the selected article.
8. Record number of correct answer in the result table.
9. If there is wrong answer, repeat step 6 to step 9 until exceed the maximum trials (3 trials).

RESULTS:

No.	Participant	No of correct answer						Avg no of correct answer
		First Article			Second Article			
		Trial			Trial			
		1	2	3	1	2	3	
1.	Participant 1							
2.	Participant 2							
3.	Participant 3							
4.	Participant 4							
5.	Participant 5							
6.	Participant 6							
7.	Participant 7							
8.	Participant 8							

CONCLUSION:

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APPENDIX 1-3: SURVEY FORM

Background Survey

Participant: XXXXXXXXXX

1. Pernah guna 'screen reader' yang 'narrator' dia fasih berbahasa Melayu?
(YA) (TAK)
2. Dah berapa lama menggunakan 'screen reader'?
(< setahun) (setahun – 3 tahun) (> 3 tahun)
3. Berapa lama ambil masa untuk mahir atau pandai menggunakan 'screen reader'? (faham apa yang dibacakan oleh screen reader)
(< 6 bulan) (6 bulan – setahun) (> setahun)
4. Berapa kerap melayari Internet dalam masa seminggu?
(< 5 kali | jarang) (5 – 10 kali) (> 10 kali | kerap)
5. Lebih suka melayari laman web berbahasa Melayu atau Inggeris atau bahasa lain?
(MELAYU) (INGGERIS) (LAIN-LAIN)
6. Pernah bekerja sebelum ini? Jika ya, nyatakan.
(TIDAK) (YA:)

Standard

Testing result:

Article	Trial	Answer					Result of correct answer	Avg no of correct answer
		1	2	3	4	5		
First	1			/			1	3.3
	2	/	/	/	/		4	
	3	/	/	/	/	/	5	
Second	1	/	/				2	3.7
	2	/	/	/	/		4	
	3	/	/	/	/	/	5	

Background Survey

Participant: XXXXXXXXXX

1. Pernah guna 'screen reader' yang 'narrator' dia fasih berbahasa Melayu?
(YA) (TAK)
2. Dah berapa lama menggunakan 'screen reader'?
(< setahun) (setahun – 3 tahun) (> 3 tahun)
3. Berapa lama ambil masa untuk mahir atau pandai menggunakan 'screen reader'? (faham apa yang dibacakan oleh screen reader)
(< 6 bulan) (6 bulan – setahun) (> setahun)
4. Berapa kerap melayari Internet dalam masa seminggu?
(< 5 kali | jarang) (5 – 10 kali) (> 10 kali | kerap)
5. Lebih suka melayari laman web berbahasa Melayu atau Inggeris atau bahasa lain?
(MELAYU) (INGGERIS) (LAIN-LAIN)
6. Pernah bekerja sebelum ini? Jika ya, nyatakan.
(TIDAK) (YA: Pembantu kedai)

Testing result:

Article	Trial	Answer					Result of correct answer	Avg no of correct answer
		1	2	3	4	5		
First	1	A	B	D	B	C	2	3.3
	2	A	B	B	C	C	4	
	3	B	B	B	B	B	5	
Second	1	C	B	B	A	A	4	4.7
	2	C	C	B	A	B	5	
	3	C	B	B	D	B	5	

APPENDIX 1-4: VISIT MAB, IPOH



APPENDIX 1-5:

Pilot Testing Experiment: The Effectiveness of Bahasa Melayu (BM) Screen Reader Prototype for the Visually Impaired Internet Users

1.0 Purpose of the Experiment

The purpose of this experiment is to test the experimental design and to investigate the effectiveness of the newly developed Malay version of screen reader prototype for visually impaired Internet users, by using two different approaches:

- i) English version of screen reader prototype (English narrator).
- ii) Malay version of screen reader prototype (Malay narrator).

2.0 Scope

The study focuses on one area:

- i) The effectiveness of Malay version of screen reader prototype compared to English version of screen reader prototype.

3.0 Hypothesis

Malay version screen reader prototype is more effective to be used by visually impaired Malay language medium Internet users to narrate any words that appear on the screen. This would help them to gain better understanding of the web content and reduce the time needed to understand the narrated words.

4.0 Variables

Constant Variables	The web pages content structure of articles. Similar set of articles are used in both experiments.
Manipulated Variables	Version of the screen reader prototype; (1) Malay version (2)English version
Responding Variables	The effectiveness of Malay version of screen reader prototype. It is measured by observing and counting the correct words wrote by the participant on the paper.

5.0 Tools and Materials:

- 1) CPU Unit (Window 7)
- 2) Malay version of screen reader prototype
- 3) English version of screen reader prototype
- 4) Stop watch
- 5) Camera
- 6) Pen
- 7) Paper
- 8) A list of Bahasa Melayu words (taken from article 1 during preliminary testing session)

6.0 Procedure

- 1) Explanation on the experiment to the participant.
- 2) The participant is blindfolded to assimilate the visually impaired users.
- 3) Tester launches the English narrator version of the screen reader prototype.
- 4) Tester will input the first link of web page and click 'Go' button.
- 5) The participant listens to the word enunciated by the narrator of the screen reader and at the same time writes down the word listened.
- 6) Step 5 is repeated until the last word from the listing.
- 7) Step 3 until 6 are repeated with the local Bahasa Melayu accent narrator version of the prototype.
- 8) Data for both experiments are recorded.

7.0 Result

The number of correct words and percentage of correct words are calculated and recorded.

Participants	System			
	English Version		Malay Version	
	No. of correct words	% of correct words	No. of correct words	% of correct words
Participant 1				
Participant 2				
Participant 3				
Participant 4				
Participant 5				
Participant 6				
Participant 7				
Participant 8				
Participant 9				
Participant 10				

8.0 Conclusion

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APPENDIX 1-6:

User Testing Experiment: The Effectiveness of Bahasa Melayu (BM) Screen Reader Prototype for the Visually Impaired Internet Users

1.0 Purpose of the Experiment

The purpose of this experiment is to investigate the effectiveness of the newly developed Malay version of screen reader prototype for visually impaired Internet users, by using two different approaches:

- i) English version of screen reader prototype (English narrator).
- ii) Malay version of screen reader prototype (Malay narrator).

2.0 Scope

The study focuses on one area:

- i) The effectiveness of Malay version of screen reader prototype compared to English version of screen reader.

3.0 Hypothesis

Malay version screen reader prototype is more effective to be used by visually impaired Malay language medium Internet users to narrate any words that appear on the screen. This would help them to gain better understanding of the web content and reduce the time needed to understand the narrated words.

4.0 Variables

Constant Variables	The web pages content structure of articles. Similar set of articles are used in both experiments.
Manipulated Variables	Version of the screen reader prototype; (1) Malay version (2)English version
Responding Variables	The effectiveness of Malay version of screen reader prototype. It is measured by observing and counting the correct words wrote by the participant on the paper.

5.0 Tools and Materials:

- 1) CPU Unit (Window 7)
- 2) Malay version of screen reader prototype
- 3) English version of screen reader prototype
- 4) Stop watch
- 5) Camera
- 6) Pen
- 7) Paper
- 8) A list of BM words (taken from article 1 during preliminary testing session)

6.0 Procedure

- 1) Explanation on the experiment to the participant.
- 2) Tester launches the English narrator version of the screen reader prototype.
- 3) Tester will input the first link of web page and click 'Go' button.
- 4) The participant listens to the word enunciated by the narrator of the screen reader and at the same time writes down the word listened.
- 5) Step 5 is repeated until the last word from the listing.
- 6) Step 3 until 6 are repeated with the local Bahasa Melayu accent narrator version of the prototype.
- 7) Data for both experiments are recorded.

7.0 Result

The number of correct words and percentage of correct words are calculated and recorded.

Participants	System			
	English Version		Malay Version	
	No. of correct words	% of correct words	No. of correct words	% of correct words
Participant 1				
Participant 2				
Participant 3				
Participant 4				
Participant 5				
Participant 6				

8.0 Conclusion

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