A Tool for Evaluating Thai Web Accessibility for Disabled and Elderly People

Kewalin Angkananon[1], Piyabud Plodaksorn[2], Mike Wald[3]

Abstract

There are rapidly increasing numbers of websites and online services in Thailand which leads to more web content being created daily. Developers should consider the importance of Web accessibility when creating their content. At present, Thai developers have not had much knowledge and experience in developing web accessibility and there is a lack of guidelines and tools available in Thailand. Therefore, the majority of web content which are created by Thai developers are not accessible to those with disabilities. The solution to this problem is to create the Thai Evaluation Criteria which is applicable to Thai Websites as well as creating a tool which will allow developers to evaluate their created web contents. The Thai Evaluation Criteria were created through a series of steps which involved the use of expert reviews and validation, focus groups, and experiments to check the usability of the Thai Evaluation Criteria. This paper explains the WebThai2Access website which allows the users to evaluate websites based on the Thai Evaluation Criteria and which is based on the Web2Access website.

Keywords: Website; Accessibility Checker; Disabled; Elderly; Thailand

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เครื่องมือในการประเมินการเข้าถึงเว็บไซต์ไทยสำหรับคนพิการ และผู้สูงอายุ

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บทคัดย่อ

เว็บไซต์และบริการออนไลน์มีจำนวนเพิ่มขึ้นอย่างรวดเร็วส่งผลให้เนื้อหาต่างๆ เกิดขึ้นบนเว็บไซต์เพิ่มขึ้นทุกวัน ดังนั้น นักพัฒนาซอฟต์แวร์ควรจะตระหนักถึงการสร้างเนื้อหาที่ให้บริการบนเว็บไซต์ ในปัจจุบันนักพัฒนาเว็บไซต์ไทยยังไม่มีความรู้ ความชำนาญด้านการพัฒนาเว็บไซต์ที่ทุกคนเข้าถึงได้เท่าที่ควร และยังขาดแนวทาง และเครื่องมือในการประเมินการเข้าถึงเนื้อหาบนเว็บไซต์ไทย ดังนั้น ปัญหาหลัก คือ ผู้พิการและผู้สูงอายุไม่สามารถเข้าถึงเนื้อหาบนเว็บไซต์ส่วนใหญ่ที่สร้างโดยนักพัฒนาเว็บไซต์ไทยได้ การแก้ปัญหานี้ทำได้โดยการสร้างเกณฑ์การประเมินการเข้าถึงเนื้อหาภาษาไทยที่สามารถใช้กับเว็บไซต์ไทย รวมถึงการสร้างเครื่องมือที่จะช่วยให้นักพัฒนาเว็บไซต์สามารถประเมินเนื้อหาบนเว็บไซต์ที่สร้างขึ้นได้ เกณฑ์การเข้าถึงเนื้อหาบนเว็บไซต์ไทยได้ถูกสร้างขึ้น โดยผู้มีเชี่ยวชาญเป็นผู้ตรวจสอบความถูกต้องของเกณฑ์การประเมิน มีการประชุมกลุ่มย่อย เพื่อพัฒนาเกณฑ์การประเมินให้มีประสิทธิภาพมากขึ้น และทดลองกับผู้ใช้งานกลุ่มผู้พิการ และผู้สูงอายุ เพื่อตรวจสอบความสามารถในการใช้เกณฑ์การประเมินการเข้าถึงเว็บไซต์ไทย บทความฉบับนี้อธิบายเกี่ยวกับเว็บไซต์ ในการประเมินเว็บไซต์ไทยที่เข้าถึงได้ (WebThai2Access) ที่ช่วยให้ผู้ใช้สามารถประเมินการเข้าถึงเว็บไซต์ไทย โดยมีการพัฒนาเกณฑ์การประเมินในการเข้าถึงเว็บไซต์มาจากเว็บไซต์ Web2Access

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1. Introduction

Accessible Web design allows those with disability equal access to information and guidelines and standards help developers create accessible content (Henry, 2006). The World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI) aims to make the web accessible to everyone (W3C, 2016a) through the Web Content Accessibility Guidelines (WCAG) 2.0 published in December 2008 (W3C, 2008) which has improved on WCAG 1.0 and has become an international standard (Caldwell et al., 2008). There are many translations of WCAG 2.0, such as Arabic, French, and Russian but there are no Thai translations of the guidelines officially authorised by W3C. There are no clear web accessibility guidelines in Thailand, which causes many Thai web developers to neglect the importance of web accessibility when developing websites. Websites and online services are a rapidly increasing business in Thailand and web technology is a crucial tool for many business enterprises and government sectors to display their services and provide information to the public, however, many Thai websites do not account for those with visual, auditory, physical, speech, cognitive disabilities, or the elderly, and there has not been any analysis of accessible websites in Thailand.

The Thai Department of Empowerment of Persons with Disabilities (2016) stated that there were approximately 1,597,775 disabled people (2.43% of the population), and approximately 170,362 people were visually impaired, (10.74% of all disabled people) and 287,178 people had an auditory disability (18.10% of all disabled). The National Statistical Office (2014) stated that there were approximately 10,014,699 elderly people (14.9% of the total population). Therefore, there are a lot of disabled and elderly people in Thailand who need websites to be designed to be accessible for them.

Reasons why Thai websites are not accessible are: Web developers do not have a good understanding of web accessibility (Mitsamarn et al., 2007); there is only a misleading literal Thai translation of the of the web content accessibility guidelines not supported by the W3C (W3C, 2014a). The WCAG 2.0 were developed in English and do not account for cultural issues, such as the different font size, and type in Thai websites. There are no free evaluation tools that support Thai websites, only a commercial tool that does not indicate what criteria are being evaluated (Thai Web Accessibility, 2013). Automated Web accessibly evaluation tools cannot find barriers requiring human checks (W3C, 2005b).

This paper aims to address the gap in Thai website accessibility by explaining the Thai web accessibility guidelines and evaluation tool, based on Web2Access (Wald et al., 2012) which is easy to use with criteria and scoring corresponding to WCAG 2.0 conformance levels.

2. Literature Review

Web Accessibility

Carter and Markel (2001) found that only 1% of web developers pay attention to the accessibility of websites, because most web developers believe a lot of time and money would be required. According to the WAI (W3C, 2005a), “Web Accessibility” means that “people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web”. Obstacles using a website can include (W3C, 2012): for auditory disabilities - audio and video without any transcripts or customizable captions or sign language; for visual disabilities lack of text alternatives for images and audio description for video content, keyboard support, foreground and background contrast; for elderly people - hearing and vision disabilities due to aging.

The WAI is a part of W3C which aims to make the web accessible to everyone (W3C, 2016a). The standards which are developed by WAI are open to public review whereas those such as the International Standard Organisation (ISO) or the British Standards Institute, develop standards behind closed doors (Lewthwaite, 2014). The WAI has developed “strategies, guidelines, and resources to make the web accessible to people with disabilities” (W3C, 2016b). The main guidelines which are developed by WAI and considered as essential components of web accessibility (W3C, 2015) are: Authoring Tool Accessibility Guidelines (ATAG) for content creation; User Agent Accessibility Guidelines (UAAG) for displaying content; Web Content Accessibility Guidelines (WCAG) explaining how to make information within the web page or application accessible to those with disabilities (W3C, 2008).

WCAG 2.0 is the leading accessibility guidelines as even though there are other guidelines such as Section 508 in the USA, most of these accessibility standards have all been derived from WCAG (Lewthwaite, 2014). In WCAG 2.0, there are 4 main principles, which are perceivable, operable, understandable, and robust. These 4 principles are made up of 12 guidelines for each principle. Each guideline is composed of a testable success criterion classified into 3 conformance levels: A, AA, and AAA (Caldwell et al., 2008).

Thai Web Accessibility Guidelines

The Ministry of Information and Communication Technology have declared to use a Policy Framework, Thailand Information and Communication Technology Policy Framework (2011 - 2020) (Thailand Ministry of Information and Communication Technology, 2010) where it is stated in Strategy number 6, that one of the foci is for "ICT to enhance social equality" to lower the disparities in society and also to promote equality when it comes to accessing resources in these strategic actions and 6.4 states that electronic access should be accessible to everyone, and that it should coincide

with the needs of daily lives of the people. For Thailand, since 2007, the Ministry of Information and Communication Technology have seen the problems with accessing websites for the disabled. Therefore, they have produced the "Thai Web Content Accessibility Guidelines (TWCAG) 2010" (Ministry of Information and Communication Technology, 2010) to combat this problem. In addition to this, they have also encouraged different parties to improve their websites such that it accommodates, the disabled and elderly, such that they can access websites easily. They have used the WCAG 2.0 as a starting point and modified it to suit a circumstance in Thailand (Ministry of Information and Communication Technology, 2010).

However, TWCAG 2010 is just a translation copy of the WCAG 2.0 done by the government, since Thai guidelines are not officially recognized by the W3C (W3C, 2014b). TWCAG 2010 does not provide techniques to achieve the success criteria of guidelines as seen in WCAG 2.0. (W3C (2016c), Announced from Ministry of Industry titled Defining Industry Standard of Web Content Accessibility Guideline (2012)). According to the Electronic Government Agency Public Organisation (2012) for those in Thailand, the Government have shown a considerable attention in Web accessibility, by creating a Government Website Standard to be used as a standard for all government websites produced by the Electronic Government Agency Public Organisation (2012).

The standard includes Government Website Contents, which are the contents which are shown within the website which are divided into 3 main areas, basic information, connections with the users, and e-services. The development of websites should meet the standards which are developed from the Web Accessibility Initiative and should follow the WCAG guidelines 2.0 and meet the success criteria level 'A'. Although there are Government Website Standards, Thailand Information and Communication Technology Policy Framework or the Convention on the Rights of Persons with Disabilities, which all have enforcement relating to government websites, there are still no parties who follow up and check on these standards (Announced from Ministry of Industry titled Defining Industry Standard of Web Content Accessibility Guideline 2012).

However, the private company “Thai web accessibility” did a research study on 19 ministry websites, and the office of the prime minister’s website, where they checked the first page of the websites (Thai web accessibility, 2013). All the websites “failed” checks on the following criteria; document type, encoding, content structure, mark-up validation by using the mark- up validation service offered by the W3C to check on the mark-up validity of web documents in HTML, XHTML, SMIL, and MathML. Thailand lacks of the tools to evaluate Thai websites freely as although there are evaluation tools available, they are all for commercial purposes, such as the ones from “Thai web accessibility” (Thai web accessibility, 2013).

Evaluation of Web Accessibility

Evaluating accessibility is important for web content (Abou-Zahra, 2008): to make sure that the web developer is developing web applications which meet a certain required standard for accessibility; To allow web designers to be aware of the accessibility related issues regarding the visual design so they can be improved; To see if the website of an organisation will meet or fail the accessibility standards. The Web accessibility content guidelines can be implemented in an evaluation tool in order to evaluate the accessibility of the web application automatically to reduce the amount of time needed when performing the evaluation especially when the web application contains large amounts of web pages.

Evaluation tools are categorised into 2 groups (Abou-Zahra, 2008). Firstly, general automated testing; the aim of this group of tools is to evaluate the majority of the guidelines, and an example of this tool would be the Functional Accessibility Evaluator 2.0 (FAE). Secondly, Special automated testing; the aim of this group of tools is to focus on specific topics in the web accessibility guidelines, and examples of this would be the Colour Contrast Analyser and W3C HTML Validator. However, evaluation through the use of automated tools is not enough.

Evaluation of the web accessibility guidelines also require human judgements (W3C, 2005b). Furthermore, testing the website will benefit from those with disability doing the evaluations in order to help improve on the accessibility of the website (Gunderson et al., 2006). According to Centeno et al., 2006; Molinero et al., 2006, Web accessibility evaluation tools may have a weakness when testing the same criteria and evaluating accessibility for the same web page, as this will yield a different result when using different evaluation tools. This would mean that the evaluation tools (e.g. Bobby, Taw or WebXACT) which are used are not reliable.

Web2Access

Web2Access is an interactive website, which users can use to test any Web 2.0 site or software application on their own through the directed guidance of the system. It is developed by The Access Technologies Team at the University of Southampton School of Electronics and Computer Science (ECS). Other functions of Web2Access is to allow users to find any “Web 2.0” interactive and collaborative e-learning tools which are considered to be accessible and usable by the system. Web2Access provides tools and checklists which can be used to complete manual evaluations.

Web2Access, has 15 criteria which are based on the WCAG 2.0: 1) Login, Signup and Other Forms Accessible; 2) Image ALT Attributes; 3) Link Target Definitions; 4) Frame Titles and Layout; 5) Removal of Stylesheet; 6) Audio/Video Features; 7) Video/animations - audio descriptions; 8) Appropriate use of Tables; 9) Tab Orderings Correct and Logical; 10) Page Functionality with

Keyboard; 11) Accessibility of Text Editors; 12) Appropriate Feedback with Forms; 13) Contrast and Colour Check; 14) Page Integrity when Zooming; 15) Text size, style, blinking elements and Readability. Web2Access also provides the necessary tools to complete the manual evaluations including, Web developer toolbar, WAVE toolbar, WebbIE, Thunder/NVDA screen reader, AIS Accessibility toolbar, FAE functionality checks, Colour filter website and Colour Contrast Analyser. The scoring on web2access corresponds to the WCAG 2.0 conformance levels, where 0% would be fail condition, 33% would be equivalent to an A, 67% would be equivalent to an AA, and 100% would be equivalent to AAA.

3. Development of WebThai2Access

WebThai2Access was developed from Web2Access (Wald et al., 2012) with Thai Evaluation Criteria for the Thai guidelines and Evaluation tools to be used to evaluate Thai websites for those with disabilities. The English Web2Access Criteria were translated to Thai and modified by adding more explanations, and testing techniques after testing it with Thai websites. The contents for criteria number 15, Text size, style, blinking elements and readability, has been changed in the Thai version as instead of the usual sans-serif fonts, the font family which should be used for the Thai language is serif (Kamollimsakul et al., 2014) and 14 - 16 px instead of 10 - 12 px stated by Web2Access. The developing of WebThai2Access consists of 2 steps: developing the evaluating criteria and online tool.

3.1 WebThai2Access Evaluation Criteria

There are 15 criteria to evaluation of Thai websites as follows.

1) Login, Signup, and other Forms Accessible, such as Contact us, Feedback form and Help form: to check the process for the signup form, if the member will have access to the website or not, check how accessible the forms are, and if they can be accessed through the use of a keyboard and screen reader (NVDA, JAWS, and Voiceover) and check if the labelling has a meaningful name which can be understood by the users.

2) Image ALT Attribute: when there are images being used in a website, those images need to be accompanied with the “alt-tag” which allows the users to hear explanations about the image through the use of a screen reader, although some screen readers will only read the file name or just read “image” if there is no “alt-tag”.

3) Link Target Definitions: where links are used for menus and navigation to send users to external or internal websites, the text for all links must be easy to understand and functional. Sitemaps

and search functions of websites are beneficial for exploring the website.

4) Frame Title and Layout: the layout of a webpage can be set into frames (an iframe), which help the layout of information within a single page. If frames do not have a title then the screen reader user will not know where they are currently at in the webpage, will not be able to know where the screen reader is reading, or will not know which content to read next. As a result, it is more popular to use Cascading Style Sheets (CSS) than frames.

5) Removal of Stylesheet: using CSS provides layout of websites by allowing content to be presented easily without the use of tables and frames. If CSS is used within the website, then the website must have a good structure which allows the user to change: size, colour, font, background colour, and allows the content to be read in the correct order.

6) Audio / Video Features: for those whom are deaf/hard of hearing or those with cognitive learning disability, alternatives need to be provided for audio files and videos with audio. For example, text transcripts, captioning, and sign language.

7) Video / animations - audio descriptions: for users who have visual impairments, text and audio descriptions are needed in any animations, or videos where there are long scenes with no descriptive dialogue.

8) Appropriate use of Tables: contents within the web pages can be set in tables, however it may cause errors for the screen reader as it typically reads from left to right. In the case of having a basic table, the screen reader will only read the table heading once, and read the following information in the next row without repeating the table heading, which will force the users to remember what these information is about. Therefore, it is important to create a simple table, and the order of content, the use of row and column headers is an important factor.

9) Tab Orderings Correct and Logical: when the user is unable to use a mouse to navigate through the website, the tab key can be used to navigate to the menu and other links within the website, however the user will not be able to access the content through the use of tab key. To be able to access the content the user will need to use shortcut keys of NVDA, and some websites offer skip navigation in order to skip the menu into the main content. If there is no style sheet, frame or table, the content order must remain in the same order.

10) Page Functionality with Keyboard: functionality within the website such as action button (e.g. submit/ send/ ok) must be accessible through the use of a keyboard and a screen reader.

11) Accessibility of Text Editors: there are many websites which allow the users to edit text, images or other multimedia content. Text Editors allow users to change the content and format as they would in a Microsoft Word application, however the problem is that there are a limited amount of editors that can be used with a keyboard and a screen reader program; TinyMCE is the best

editor at present.

12) Appropriate Feedback with Forms: when the user sends a message or answer to a question through forms, the system should send feedback to the user such that it is easy to understand. There should be an error message for the user once an error has occurred, and the user can return to the page to correct an error. Check if there is any feedback in the website, and if there is a form to complete within the website. There should be no time limit and forms must be accessible through the use of screen readers.

13) Contrast and Colour Check: checking colour contrast is an important aspect in order for users to enjoy reading web sites. Text colour and background colour must contrast each other appropriately. Symbols, such as logos should not include certain colours as colour blindness may be affected. Text should be comfortable to read.

14) Page Integrity when Zooming: most browsers have the function to enlarge text and images through the use of the zoom feature. This is very useful because web developers usually reduce the size of fonts, which in return has a negative effect on the elderly, or those who are partially sighted. Zooming allows the content to be read easily, however it may have an effect on the layout of the websites.

15) Text Size, Style, Blinking Elements, and Readability: flashing and blinking can cause seizures when accessing information, therefore it is best to avoid this, in order for the users to be able to concentrate on the content. Small text, and using the “sans serif” font will cause problems for the elderly. The language used within the website needs to be understandable by all, including those who are deaf since birth, and those who are not Thai native speakers.

3.2 Developing WebThai2Access Website

The development of WebThai2Access website is shown in Figure 1 to 9. There are five menus: homepage, all products page, list of all disability groups page, tests associated for those with visual disabilities, lists of criteria’s.

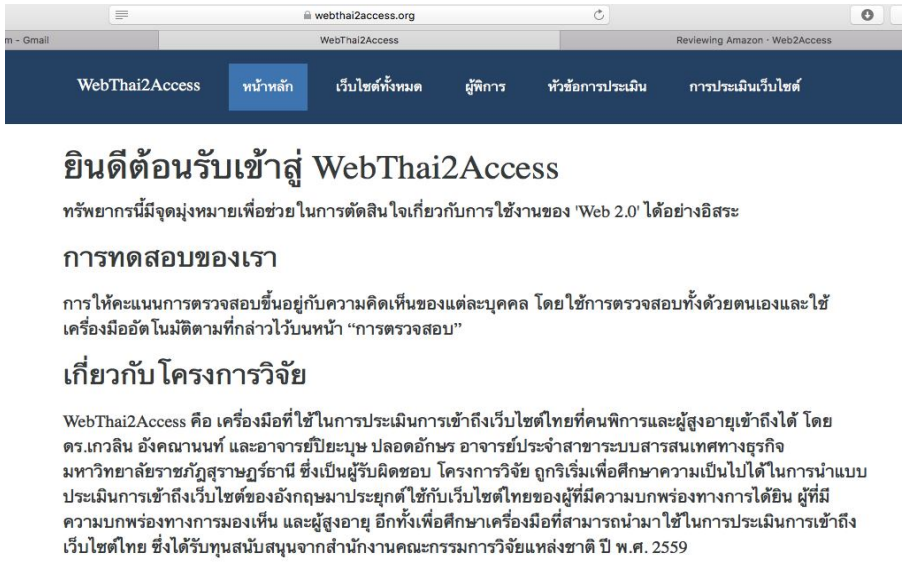
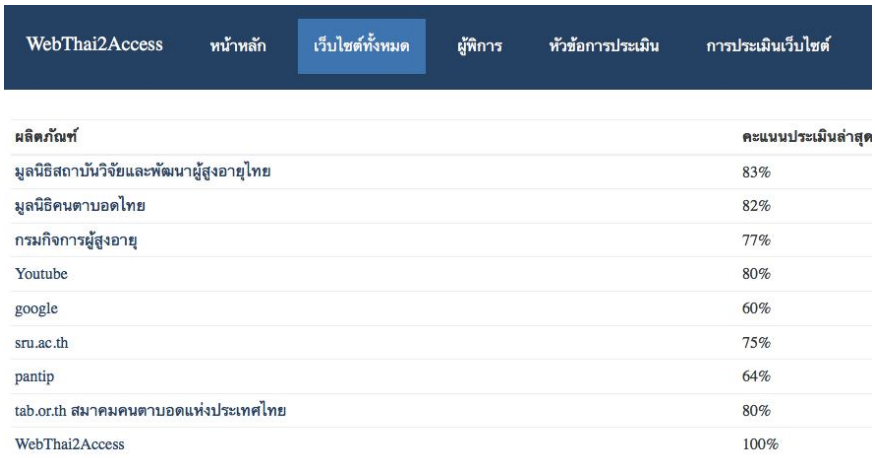


Figure 1: WebThai2Access Home page

Figure 1 is the Home page of WebThai2Access, with IP address "https://webthai2access.org".



ผลิตภัณฑ์	คะแนนประเมินล่าสุด
มูลนิธิสถาบันวิจัยและพัฒนาผู้สูงอายุไทย	83%
มูลนิธิคนตาบอดไทย	82%
กรมกิจการผู้สูงอายุ	77%
Youtube	80%
google	60%
sru.ac.th	75%
pantip	64%
tab.or.th สมาคมคนตาบอดแห่งประเทศไทย	80%
WebThai2Access	100%

Figure 2: List of all products page

The second tab in the navigation bar will lead the users to the page containing all the websites which have been reviewed and approved by the system administrator as seen in Figure 2.

Figure 3: List of all disability groups page

The third tab in the navigation bar will lead the users to a list and description of all the disabilities. The users can click on the link tests in order to see what tests are associated with the disability as seen in Figure 3.

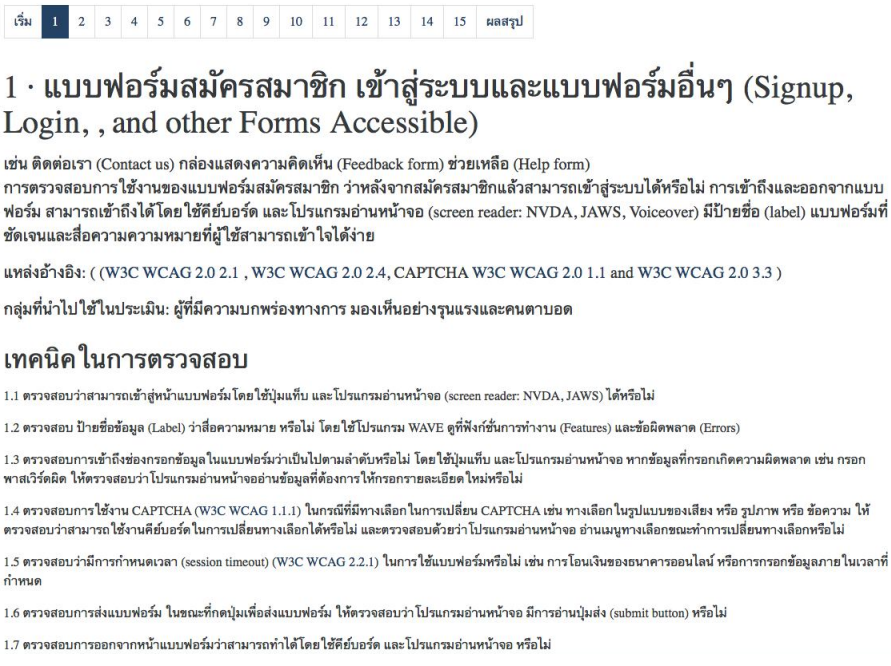


Figure 4: Detail of evaluation criteria 1 and techniques

Figure 4 is an example of the evaluation criteria 1 and techniques. The first paragraph describes the importance of the criteria in the top paragraph and is followed by references of the criteria that users can click links to when they need to, and the disabled group that is relevant to this criterion. The second paragraph describes the techniques which should be answered in the evaluation process. The third paragraph is the outcomes which the user will need to decide based on the techniques section. Lastly, the user is required to enter a summary of this criteria based on the techniques question.

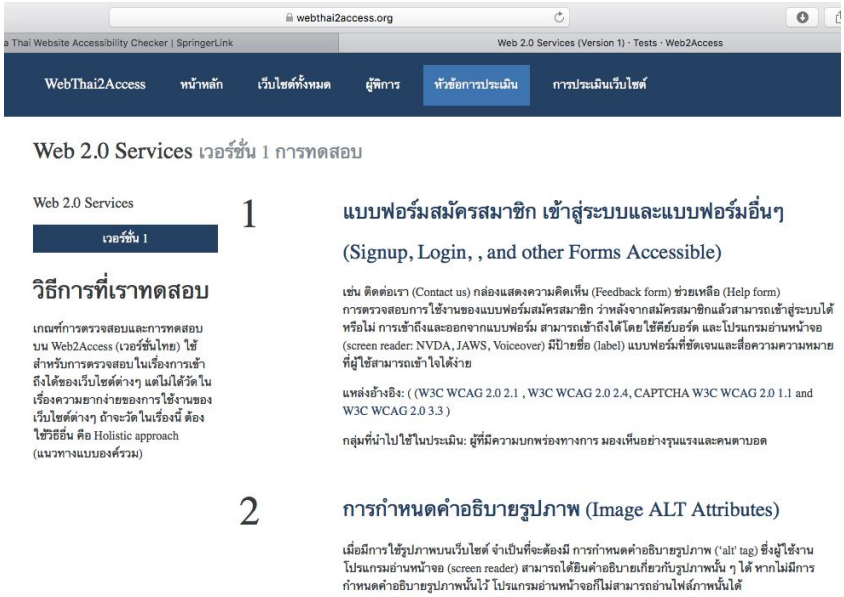


Figure 5: Lists of Criteria

The fourth tab in the navigation bar will lead the users to a list of the 15 criteria which are used for the evaluation process. A short description of what the criteria is about is provided. The users can click on the link to see more detail of the criteria as seen in Figure 5.

Figure 6: Example of output of criteria 1

Figure 6 is an example of the signup, login, and other forms accessible criteria. In this page the radio buttons are the outcome which are the possible choices of the evaluation that the user should select from.

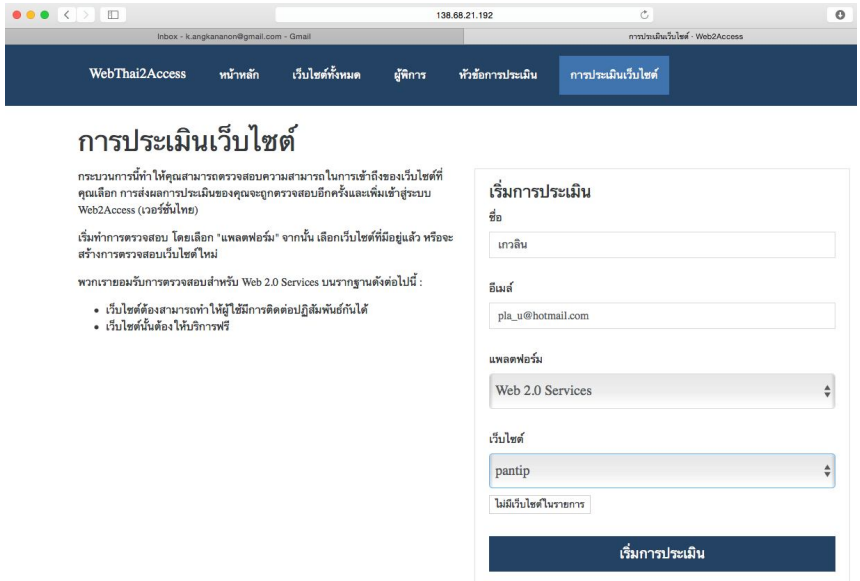


Figure 7: Evaluating websites

The final tab in the navigation bar is the evaluating. The users will be required to enter the following information as seen in Figure 7: name, email address, select a platform, select a website. If the website that they want to evaluate is not listed, then they will be required to add the following website details: name, url, and a short description.

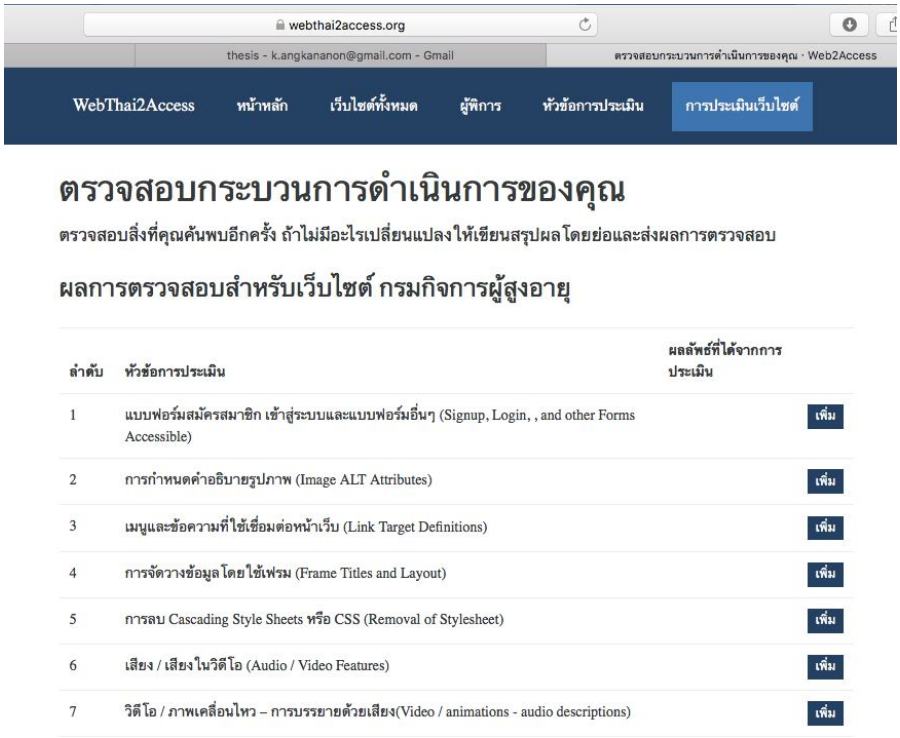


Figure 8: Summary of evaluating website

Figure 8 shows the page providing a summary of all the outcomes which the user has selected for each of the criteria. The user will have an opportunity to edit the outcome at this stage. The user will be required to enter a general overview summary of the evaluated website.

4. Evaluating WebThai2Access Tool

4.1 Comparing Evaluating scores between WebThai2Access and WCAG

The scoring on WebThai2Access uses similar criteria to Web2Access and this corresponds to the WCAG 2.0 conformance levels, where 0% would be fail condition, 33% would be equivalent to an A, 67% would be equivalent to an AA, and 100% would be equivalent to AAA as shown in Table 1.

Table 1 Comparing evaluating criteria in web accessibility between WCAG 2.0 and WebThai2Access

WCAG 2.0	Web2Access
	0%: It would be fail condition.
Level A: the Web page satisfies all the Level A Success Criteria, or a conforming alternate version is provided.	33% : It would be equivalent to an A.
Level AA: the Web page satisfies all the Level A and Level AA Success Criteria, or a Level AA conforming alternate version is provided.	67% : It would be equivalent to an AA.
Level AAA: the Web page satisfies all the Level A, Level AA and Level AAA Success Criteria , or a Level AAA conforming alternate version is provided.	100%: It would be equivalent to AAA.

The differences between WCAG 2.0 and WebThai2Access is the techniques in checking the web accessibility. WebThai2Access has been designed to be easier to use and score than the WCAG 2.0 guidelines which have more than 60 tests. Most of them can only be carried out manually by somebody with expert knowledge and experience (Hay, 2016) as only a few of the tests can be carried out by automatic checkers (W3C, 2014b). WebThai2Access and Web2access have summarised and compressed the guidelines and tests into 15 criteria that can be undertaken by developers. Therefore, using WebThai2Access will take less time in evaluating a website because it has summarised the criteria with techniques how to check and score. For example, checking CAPTCHA using WCAG guideline:

"CAPTCHA: If the purpose of non-text content is to confirm that content is being accessed by a person rather than a computer, then text alternatives that identify and describe the purpose of the non-text content are provided, and alternative forms of CAPTCHA using output modes for different types of sensory perception are provided to accommodate different disabilities."

Checking CAPTCHA using WebThai2Access guideline:

Check CAPTCHA (W3C WCAG 1.1.1) if there is an option to change the captcha i.e. the option to change from text to sound or from image to sound or text. Check if these are able to be changed through the use of keyboard or not and also check if the screen reader is able to read the changes.

Outcome:

0% unable to access to CAPTCHA

33% hard to access to CAPTCHA

67% can access to CAPTCHA but some errors

100% can access easily to CAPTCHA

From the example above shows that WCAG guideline doesn't not include how to check CAPTCHA and doesn't lead to how to score about CAPTCHA. WCAG needs experts in web accessibility to evaluate websites whereas novice web accessibility developers can use the WebThai2Access to check web accessibility.

4.2 Comparing Results from experts, developers, disabled and elderly people

The 30 Thai web developers evaluated 3 websites (www.pantip.com, www.youtube.com, http://tabgroup.tab.or.th) and the results were compared with the average scores of 3 experts using the same 3 websites. The results of mean scores of experts and web developers in rating 3 websites as shown in Table 2.

Table 2 Comparison the mean scores between experts' rating and developers' rating

Criteria	www.pantip.com			www.tab.or.th			www.youtube.com		
	expert	developer		expert	developer		expert	developer	
	mode	mean	mode	mode	mean	mode	mode	mean	mode
1	0.33	0.87	1.00	1.00	1.00	1.00	1.00	0.83	1.00
2	0.00	0.58	0.67	0.67	0.70	0.67	0.33	0.50	0.00
3	1.00	0.88	1.00	1.00	0.98	1.00	1.00	0.91	1.00
4	1.00	0.57	1.00	1.00	0.48	0.33	1.00	0.53	0.67
5	1.00	0.82	1.00	1.00	0.98	1.00	1.00	0.81	1.00
6	0.67	0.65	0.67	1.00	0.99	1.00	0.67	0.86	1.00
7	1.00	0.73	1.00	1.00	1.00	1.00	1.00	0.88	1.00
8	1.00	0.76	1.00	1.00	0.96	1.00	1.00	0.67	1.00
9	1.00	0.91	1.00	0.33	0.46	0.33	1.00	0.91	1.00
10	0.67	0.83	1.00	1.00	1.00	1.00	1.00	0.87	1.00
11	0.67	0.79	1.00	1.00	1.00	1.00	1.00	0.74	1.00
12	0.33	0.77	1.00	0.33	1.00	1.00	1.00	0.78	1.00

Table 2 Comparison the mean scores between experts' rating and developers' rating (Continued)

Criteria	www.pantip.com			www.tab.or.th			www.youtube.com		
	expert	developer		expert	developer		expert	developer	
	mode	mean	mode	mode	mean	mode	mode	mean	mode
13	0.67	0.60	0.67	0.67	0.73	0.67	1.00	0.77	1.00
14	1.00	0.91	1.00	1.00	1.00	1.00	1.00	0.87	1.00
15	0.67	0.87	1.00	0.67	0.70	0.67	0.67	0.91	1.00
Average	0.73	0.77	0.93	0.84	0.86	0.84	0.91	0.79	0.91

This comparison was used to determine how well evaluations using WebThai2Access predicts the accessibility of websites for visually impaired, hearing impaired and elderly users. From Table 1 comparisons, the average scores of the developers and experts were similar in both pantip and tabgroup websites whereas it was slightly different for YouTube website but the experts' score and average of developer's mode score were exactly the same (0.91). The mode ratings were the same for the developers and experts for 9 criteria on websites pantip, 13 on tabgroup, and 11 criteria on YouTube and for all websites for criteria 3, 5, 7, 8, 13, and 14. It is showed that WebThai2Access is reliability. The detail of the results are published in Angkananon et el (2017).

5. Discussion and future work

The contribution of this work is the Thai Evaluation Criteria and WebThai2Access website that can be used to evaluate the accessibility of Thai websites, as there are currently no Thai Web Content Accessibility Guidelines and accessibility checker, which is publicly available and free to use. It was confirmed by comparing the scores from evaluating 3 websites and by experts that the tool is reliable and useful to evaluating Thai websites to be accessible. WebThai2Access has been designed to be easier to use and score than the WCAG 2.0 guidelines which have many more tests. The WebThai2Access techniques to check web accessibility makes it easier to provide the evaluation scores.

Further work on the Thai Evaluation Criteria can also be done to keep up to date with WCAG 2.0 if there are any significant changes as well as to keep the criteria as up to date as possible with the current technologies. In the future, an automatic version of some of the checks of

WebThai2Access could be implemented as a quick alternative to the manual evaluation.

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