Faculty of Computer Science & Information Technology

ASSISTIVE FORM FILLING TECHNIQUE FOR THE BLIND

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ASSISTIVE FORM FILLING TECHNIQUE FOR THE BLIND

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Declaration

No portion of the work referred to in this report has been submitted in support of an application for another degree or qualification of this or any other university or institution of higher learning.

…………………………………

CHEUNG KIAN KOK

17th FEB 2014
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Abstract

There are many assistive technologies for blind users in web accessibility. Currently, screen reader is the most popular assistive technology used by blind users. The screen reader is a computer software that can interact with the user and read text aloud. It is ideal for blind users who wish to read news and email. However, there are several difficulties that blind users encounter when using screen reader to fill online forms.

Most of the time, blind users seek help from the sighted to assist them in form filling. Although there are assistive technologies available for blind users, but they are not adequate enough. Poorly designed web forms only make things worse for blind users. Moreover, screen readers are not built to detect errors of any kind during process of data input.

Therefore, the assistive VIOF technique for the blind, which is known as Verify Instead Of Filling is proposed to enable a faster, more reliable and friendlier form filling process. VIOF helps blind users to extract, fill and verify web forms. Furthermore, VIOF provides better assistance and accessibility to blind users in form filling. Comparative testing of VIOF and screen reader performance has been conducted. The result shows that VIOF is helpful and well accepted by blind users.
Abstrak

Terdapat banyak teknologi bantuan untuk pengguna buta penglihatan dalam capaian web. Pada masa ini, pembaca skrin merupakan teknologi bantuan paling popular yang digunakan oleh pengguna yang buta penglihatan. Pembaca skrin merupakan perisian komputer yang menyediakan interaksi dan membaca maklumat laman web. Ia adalah ideal bagi pengguna buta penglihatan untuk membaca berita, melayari maklumat and emel. Tetapi, ia sukar untuk pengguna buta penglihatan dalam mengisi borang atas talian.

Kebiasaannya, pengguna buta penglihatan meminta bantuan daripada pengguna biasa dalam mengisi borang. Walaupun teknologi bantuan disediakan, tetapi ia masih tidak mencukupi. Reka bentuk web yang kurang baik lebih memburukkan keadaan dalam proses pengisian borang. Tambahan pula, pembaca skrin hanya membaca maklumat yang sedia ada kepada pengguna buta penglihatan, ia tidak akan mengesan sebarang kesilapan dalam mengisi borang.

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<th>Description</th>
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<tbody>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>AT</td>
<td>Assistive Technology</td>
</tr>
<tr>
<td>BFF</td>
<td>Blind Form Filling</td>
</tr>
<tr>
<td>HTML</td>
<td>HyperText Markup Language</td>
</tr>
<tr>
<td>IVR</td>
<td>Interactive Voice Response</td>
</tr>
<tr>
<td>JDK</td>
<td>Java Development Kit</td>
</tr>
<tr>
<td>OCR</td>
<td>Optical Character Recognition</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>USE</td>
<td>Usability, Ease of Use, Ease of Learning and Satisfaction</td>
</tr>
<tr>
<td>VIOF</td>
<td>Verify Instead Of Filling</td>
</tr>
<tr>
<td>W3C</td>
<td>World Wide Web Consortium</td>
</tr>
<tr>
<td>WWW</td>
<td>World Wide Web</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
<tr>
<td>XHTML</td>
<td>Extensible HyperText Markup Language</td>
</tr>
</tbody>
</table>
Chapter 1  INTRODUCTION

1.1  Introduction

Daily life has improved significantly through the usage of the Internet and World Wide Web (WWW). Many people have benefited from filling forms online in term of convenience, time and cost. Statistics on world internet usage recorded 566.4% of growth from 2000 to 2012 (Internet World Stats Usage and Population Statistics, 2013), which indicated people use the web more frequently in their daily life. However, web inaccessibility is one of the factors hindering people with disability from using it. Study of Murphy et al., (2008) found that there were about 81% of websites do not meet basic accessibility criteria. According to (Okeke & Izuogu, 2012), there are still large number of websites do not meet requirement of web accessibility. Hence, large number of people with disability, especially blind user is unable to access to the Internet and web.

Total world population of visually impaired people is more than 285 million. There are 3 categories of visual impairments; moderate impairment, severe impairment and blindness (Visual Impairment and Blindness, 2011). The prevalence rate of the blind users in Malaysia is less than 0.3% of its population, which is equivalent to 86,000 people (Prerevalence of Blindness, 2011). Thus, a large group of Internet users are still unable to benefit from the internet if the website is inaccessible to them. Information inaccessibility is one of the factors that obstruct blind users from the world. Blind users acquire information through help from sighted people. Blind users use assistive technology (AT) to access information as well. Examples of assistive technologies are Braille, OCR (Optical Character Recognition) and speech software.
ATs often involve steep learning curve and high cost. Braille display is expensive, which costs up to $15000; and OCR is around $4800 to $5500 (Technology Resources for People with Vision Loss, 2011). Braille technology is designed for blind users. However, it is not widely used for web interaction in Malaysia. The screen reader is a type of speech based software that speaks aloud the text displayed on the screen. While some of the screen readers are free of charge, good products can cost up to $1100 (Technology Resources for People with Vision Loss, 2011). Blind users are required to memorize large number of commands when using screen reader. However, screen readers are still the most popular AT used by blind users (Pitt & Edwards, 1996).

Form is defined as a document that provides a structural layout of a list of questions or inquiries for information acquisition purpose. Most of the information acquisition tasks use forms (Toda et al., 2010). Forms are available in electronic and paper based medium. Paper based (hard copy) forms are widely used by people. However, paper forms require manual form validation checks take up a lot of human resource, time and cost. As technologies continue to develop, electronic form is developed to overcome limitations of paper based form. Information is processed and stored digitally. People can avoid long queues and travels for form submission as electronic form submission can be done with a few clicks. The usages of electronic forms for official purposes have also increased. Nowadays, many companies, organizations, government agencies, and websites use electronic forms. For example, in Malaysia income tax forms can be filled online (e-Filling). Most websites require users to provide information before gaining access to subscribed services. Thus, websites always require users to fill up similar type of information repeatedly.
Some common web form controls include text box, radio button, check box, submit button, drop down list, and combo box.

Blind users normally request sighted person to help them with form filling. Since the invention of screen reader, most of the blind users have started to fill forms by themselves. First, blind users need to learn how to use the keyboard. The QWERTY keyboards are widely used by blind users in computer interaction. Afterwards, blind users need to familiarise themselves with the screen reader and how it works in browsers and other software. In form filling, blind users have to change the screen reader mode to Form mode for form filling. This is due to the fact that every input from user is treated as a command in Cursor mode.

1.2 Problem Statement

Blind users meet the challenges of form filling in most of the web activities (Lazar et al., 2007). Then, blind users access information from the web easily via effective page navigation and good screen reader. However, when comes to provide information on the web, page navigation and screen readers are insufficient to serve the purpose effectively. This section will focus on blind users’ problems with form filling, which are uncertainty and time consuming form filling process that cause by poor web form design, high learning curve of screen reader’s commands and web technologies.

The main obstacle in form filling for blind users is low level of confidence. Based on observation in the Social Networking Workshop (further explained in Chapter 3), blind users are unsure
where to key in the information and lack of confirmation on what they have keyed in. As a result, blind users would always have to seek help from a sighted person for confirmation. In Web 2.0, conventional static text website is transformed to web application (Hailpern et al., 2009). This transformation increases complexity in web navigation for blind users. Blind users are good at navigating in a static page. However, blind users find it difficult to interpret the layout and structure of web applications (Akhter et al., 2009), (Takagi et al., 2009). Moreover, modular layout is one of the most popular design approaches for sighted audience, while the same cannot be said for blind users who use screen readers (Francisco-Revilla & Crow, 2009). Furthermore, there is no description on how web forms are organized and structured.

Fast evolving technologies make form filling even more difficult for blind users. As static web changes to web 2.0, ATs need to be updated accordingly. Blind users need to update the version of screen readers frequently in order to have better accessibility. One example would be JAWS (Job Access with Speech) screen reader software from Freedom Scientific, which is updated at least one version every year since 2001 (except 2004). As a result, blind users are required to learn new updates for the screen readers every year. Furthermore, screen readers have a large number of commands and settings to be learned by blind user. These increase the burdens of blind users who not only need to know well a web page before navigating it but they also have to think on how to operate or interact with screen reader software to achieve their target (Theofanos & Redish, 2011).

Most screen readers apply visual Cursor mode for web navigation and Form mode for form editing. The Cursor mode is used for navigation where the user is allowed to enter command
only. Blind users need to switch to Form mode in order to input information into forms. Bigham et al., (2007) pointed out that some of the blind users need to switch over between Form mode and Cursor mode during form filling as blind users are unable to instruct any command to screen readers in Form mode.

Blind users are 2.5 times slower than sighted people in web browsing (Ivory et al., 2004). Most of the blind users require an extremely long time to complete their web forms. Furthermore, blind users face session time out problems in form filling, especially when booking airline tickets. This is because commercial websites apply session expiration to reduce their server processing resource, as well as for security and business purposes. As a result, blind users do not have equal ease of access as compared with the sighted, in term of time given for form filling.

Furthermore, blind users face problems in correcting errors occurred during form filling. The amount of error that occur in form filling will further delay form submission. If errors are inaccessible, blind users will feel too frustrated to continue filling the same forms over and over. Conventional web form is validated once the form is submitted. Then, blind users will have to track the error and correct it based on the error message description. Locating the error will take a long time. Moreover, certain websites like eBay require users to re-fill form once errors are detected in different fields upon submission. For example, the user needs to re-type the password field just because the entry in the email address field is not valid.
Lastly, some of the error message is designed for visual display resulting in blind users being unable to access the message. For example, Figure 1.1 shows error message: “You can’t leave this empty” which appears only after the blind user navigates to next field. Thus, screen reader users will not be aware appearance of the error message. Table 1.1 listed difficulties faced by blind users during form filling.

Table 1.1: Difficulties faced by blind users during form filling

<table>
<thead>
<tr>
<th>No.</th>
<th>Difficulties faced by blind users during form filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Low confidence level in form filling</td>
</tr>
<tr>
<td>2.</td>
<td>Complex design of web form lead to longer time of navigation</td>
</tr>
<tr>
<td>3.</td>
<td>High learning curve on screen reader command</td>
</tr>
<tr>
<td>4.</td>
<td>Web form designed in visual way.</td>
</tr>
</tbody>
</table>
1.3 Objectives

The objectives of this research is to propose an assistive form filling architecture, which will help blind users filling up web forms more consistently, easily and faster. For instance, blind users will be informed where, what and when to fill the form. Hence, blind users will be able to fill in forms independently with minimal assistance from the sighted. The web form technology is enhanced to be more effective through XML technology. Introduction of the VIOF (Verify instead of Filling) technique enables a fast and effortless form filling task without requiring much typing. As a result, VIOF will significantly shorten the form filling time with less effort. The objectives of this research are as listed:

1. To propose an assistive and blind friendly form filling architecture-BFF (Blind Form Filling) architecture. This architecture aims to ease the form filling process and eventually helps blind users to gain higher confidence level with fewer errors in form filling. The confident level of bind user will be measured based on number of helps requested in form filling. The higher number of help requested the lower confident level of blind users, and vice versa. The number of helps requested against level of confident (high, medium, low) is subjected to task difficulty level.

2. To propose the use of XML to enhance web form filling experience via VIOF data transformation. This is to enhance the time performance of a blind user in form filling. The time performance is measured by task completion time between VIOF and screen reader.
1.4 Significance of Research

This research identified the difficulties that blind users struggled with when filling forms. Thus, a blind friendly form filling technique is proposed, which allows blind users to independently complete forms with higher level of confidence. Blind users are higher level of confidence if they able to complete the same form filling task with lower number of helps.

1.5 Scope

This research studies the problems of the current web and form filling technology where target users are people with vision disabilities. This research will address the problem faced by a blind user particularly on form filling task in the web. The proposed solution for this research is by integration of web technologies, XML and VIOF technique. The form field mapping algorithm is beyond this research scope. A prototype of the proposed solution will be developed and tested with blind users. The targeted form and speech language for this proposed solution is English.

1.6 Research Methodology

This research aims to improve blind users’ form filling experience. Blind users have limited accessibility to the web. First, background study of interaction between blind users and the web will be reviewed. A detailed review on strengths and limitations of current web technology, web