Web Navigation Tool for Visually Impaired People

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ABSTRACT

Internet access has become a necessity for all sectors in communities. Conventional web navigation means hinder access to the visually impaired. Presented is a low cost tactile web navigator device aimed at enabling blind people to have efficient and economic internet accessibility. Presented in this paper centers around a microcontroller that communicates with a proxy transcoder browser server that runs on a PC to acquire the text from a target web page. An array of solenoid coils is used to output the text in tactile form to the end user. The device has the ability to output the text in Braille language format mode or in plain English character format using the usual dot-matrix representations mode. The navigator can also be configured to output the text in other languages using the Pattern-Generator tool. Many navigation functions like loading a webpage address, clicking on links and entering data (E-mails, passwords, etc) have been provided. The navigator was tested by blind volunteer with excellent results. The cost of the implementation is an impressive ~12% of the price of commercial Braille displays.

Keywords: Braille, Microcontroller, Pattern Generator, Tactile, Web Navigator

INTRODUCTION

The internet has become a mass communication media that links the whole world together; it does provide knowledge, experience, news, social networks, E-commerce and jobs offers. Blind and visually impaired people need internet access means in their daily life in order to enroll into jobs and extend their knowledge sources. Most of the access means available to visually impaired people are expensive and not dedicated to the internet navigation (e.g., Sriskanthan et al., 1990). The major issue among these tools is their high cost (Freedom Scientific, 2012a, 2012b; King et al., 2004). These means vary greatly in the level of user convenience they provide. They include screen readers (Freedom Scientific, 201b2), screen magnifiers (for those who are not totally blind) (Pearson, 2002), Braille printers and Braille tactile displays. Each method has its advantages and limitations as will be illustrated. Screen magnifiers are not suitable for totally blind individuals. Blind people who are using hardcopy Braille printout or synthesized voice (Josifovski, 1997) output from the computer face limitations of
interaction speed and accuracy. They do not have the flexibility of ‘reading’ the screen and making the necessary changes interactively or instantaneously. To receive and process the voice output, the person using the computer must be quite alert in listening. Also, the vocabulary of the synthesized voice is limited. Words with slightly different spelling but having similar phonetics may be pronounced in the same manner, leading to incorrect interpretation. Character by character sound output is very slow for interactive use of computers. A soft Braille display device, on the other hand, allows the users to ‘read’ the characters at their own pace and make on-line changes instantaneously (Sriskanthan et al., 1990).

Braille Display Terminal (BDT) that recognizes the text on the screen and displays it in the Braille display has been reported in (Sriskanthan, 1990). This is a cell-based unit which displays 40 characters at a time. This BDT is implemented as an expansion card that fits into the PC expansion slot. Braille dots were implemented using thermo-plastic pins that expand on heating and contract on cooling. Another display device that reads data from a file has been reported (Huang et al., 2010). This e-reader converts both the Chinese and English characters into the corresponding Braille code and allows data entry from the keyboard. A similar prototype, termed the Tactobook (Velazquez, 2008) consists of a computer-based system that translates fast and automatically any eBook into Braille. Devices converting images into a tactile display have been investigated and used. Bliss et al. (1970) used a 24×6 array of pins driven by piezoelectric bimorphs to produce a tactile representation of an optical image. Another device used an 8×8 arrangement of tactile pins actuated by shape memory alloys (Velazquez, 2006). Another 3D prototype was reported by Shinohara et al. (1998). This consisted of a 64×64 array of pins aligned in a hexagonal structure. Each pin can be raised in discrete steps giving the overall 3D tactile sense.

Rotard (2005) presented a tactile web navigator that uses a transformation schema to render web pages on a tactile graphics display. This web browser supports voice output to read text paragraphs and to provide feedback on interactions to the users.

The commercially available navigators serving the sector of society who are blind or visually impaired are relatively expensive, costing many thousands of dollars on average (Sriskanthan et al., 1990). These are normally unaffordable for a vast percentage of blind and visually impaired people, while the affordability in developing countries is greatly reduced. The high cost is attributed to the level of sophistication and complexity of the solutions provided for such displays. It is recognized that a simpler tactile web navigation devices providing interactive linear access to the text content of web pages could be sufficient for most blind internet users; this is surely the case for blind users in developing countries.

The objective of this paper is to present a low cost tactile internet navigation device. The rest of the paper lists the requirements of the tactile web navigator system, followed by a description of the detailed solution designed during this research work. The paper also lists the limitations and possible suggestions for enhancements in future models. A conceptual view of the tactile web navigator system is shown in Figure 1. The system design comprises software and hardware design as will be described in the rest of this paper. It is estimated that about 80% of blindness is curable. This is particularly the case in third-world countries. This research work aims towards improving the quality of life of this sector of the society, providing the means to access the wealth of data and information available on the Internet (Curable Blindness, http://www.curableblindness.org).

SYSTEM REQUIREMENTS

Considering the limitations listed above for the different access mechanisms available for blind or visually impaired users, our system is intended to provide the following set of functions:
Enhancing the Quality of Educational Website Design through Assessment for Learning Strategies
Wing Shui Ng (2016). *Design Solutions for Improving Website Quality and Effectiveness* (pp. 24-51).
[www.igi-global.com/chapter/enhancing-the-quality-of-educational-website-design-through-assessment-for-learning-strategies/143367?camid=4v1a](www.igi-global.com/chapter/enhancing-the-quality-of-educational-website-design-through-assessment-for-learning-strategies/143367?camid=4v1a)

Cases for the Web in Your Pocket (WiPo): Surviving Offline with Online Data
[www.igi-global.com/article/cases-for-the-web-in-your-pocket-wipo/123183?camid=4v1a](www.igi-global.com/article/cases-for-the-web-in-your-pocket-wipo/123183?camid=4v1a)