ENABLED – Enhancing Network Access for the Blind and Visually Impaired

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Abstract

ENABLED is an EU funded collaborative project involving 14 organisations from 9 european countries. These organisations include Academic institutions as well as representatives of various industries including the suppliers of technology for the blind and Visually Impaired.

This paper presents the work of the ENABLED project, which aims to improve access to information for blind and partially sighted users by optimizing the appropriate use of interfaces based on the needs and abilities of the visually impaired user in a variety of environments.

The project employed requirements capture techniques involving surveys, telephone, and face-to-face interviews to identify areas in which the lives of blind and partially sighted people could be improved by enhanced network access. The results are being applied in the area of Accessible Web Content, Multi-modal Interfaces, Mobile Computing, and Wireless Networking.

Key words: Blind, partially sighted, visually impaired, mobility, accessibility, network access, haptic

1 Introduction

ENABLED is a 3-year EU funded project which aims to improve access for Visually Impaired people to information on the Web, and in other formats accessed mainly via the Internet. Partners in ENABLED currently include academic and industrial organizations from countries throughout Europe.

The rapid advance of digital network technology contains a paradox for Visually Impaired people. On the one hand, information has never been so readily available with access to newspapers, books and shopping opportunities now increasingly achievable via the internet, while on the other hand, leading edge developments in some areas of web design threaten to make some of the most useful and dynamic web sites inaccessible to them [Hardwick, A. Furner, S. & Rush, J. (1998)].

Using current screen reading technology, blind people can now access a wealth of on-line resources unimaginable before the birth of the web. However it is still the case that information which is to be accessible especially in the case of totally blind people, needs to be capable of conversion into text.

The extent to which any given graphical image poses a problem for a blind reader, depends on its significance in the context of the surrounding material. Where the image is the only repository for the information it contains, then the whole of the web page can be rendered meaningless, whereas if the image is purely decorative, then investing a lot of time and effort in describing it may be a waste of resources.

Some alleviation of the problems caused by graphical images to blind people can be offered by appropriate labeling of images provided via HTML ALT tags etc., which are available to a screen reading package, and which are inserted by the author to describe the graphic. Examples of the use of ALT tags can be seen on the opening page of the ENABLED web site at www.enabledweb.org, where the HTML:
<img src="images/ico_desc.gif" alt="ICON: Current Section" width="12" height="11"> has the effect of making the text "ICON: Current Section" available to a screen reader.

However, ALT tags can usually only provide a description of the image, and very often do not convey its semantic meaning. This problem often occurs in applications such as Computer-based Training packages, where the developer, realizing that they need to cater for the possibility that the user of a screen reader will be accessing their material, has included a description of a graphic, crucial to the meaning of a section of the course. The ALT tag may say something like "Map of London". This description is sufficient unless you need to be able to extract information from the map concerning the whereabouts of streets or buildings.

Web Accessibility Guidelines are laid down by the World Wide Web Consortium – Web Accessibility Initiative http://www.w3.org/WAI/, and are re-enforced by national legislation. However, there are many sites which rely on graphical images, and in addition to these, the position of objects and text on the screen often has semantic significance which is not preserved during processing by a screen reader.

Many sites additionally refer to objects by their position on the screen (e.g. "refer to the menu on the left of your screen"). This positioning is often not retained in the output from current screen reader technology, and is effectively meaningless to the blind reader.

ENABLED aims to address these problems both by developing tools and techniques to facilitate the implementation of accessible web sites. It also aims to develop prototype tools to improve the accessibility of existing web content including graphics.

The ubiquitous nature of the Internet following the advent of wireless technology means that the profusion of data sources is no longer confined to a desktop environment, and adds the possibility of a person now being able to carry his access technology with him. From this it is a natural extension for a user of such access technology to want to access information about locally available sites and services - Visiting an area for the first time, He may wish to know what tourist attractions are available in his immediate vicinity, what bus routes are available to transport him, and what time the next bus will arrive.

ENABLED aims to extend this idea still further and develop a device capable of calculating his position, guiding him to the identified destination, and conducting him around the building he has decided to visit.

2 ENABLED Areas of Activity

The project is divided into 4 R&D work packages supported by further work packages providing

- Training in the tools and techniques developed by the project,
- Evaluation of the effectiveness of the various prototypes under development and
- Dissemination of the findings and results.

2.1 Accessible Web Content (Work Package 1)

Two requirements capture exercises were undertaken as the first steps in Work package 1 of the ENABLED project.

The first of these was directed at web developers to establish the level of knowledge and awareness of accessibility issues. The survey was distributed via the Health On the Net (HON) website (http://www.hon.ch/), and via ENABLED partners. The survey took place in early 2005, and a total of 269 responses were received. Most of the respondents were web developers and/or webmasters, and the results indicated a low level of awareness of accessibility issues in this community. Only 36% of respondents confirmed that they made a special effort to include accessibility when considering requirements for their sites, and 58% were not aware of the WAI accessibility guidelines. This phenomenon may be due to the fact that, as indicated by the results of the survey, a significant proportion of website developers (44% of respondents) did not receive any formal training in web development.

This would appear to indicate the potential benefits of a strategy of providing accessibility training and guidelines in an easily comprehensible form. This is particularly appropriate since the results indicated the willingness of this group to learn about accessibility, particularly with regard to their legal obligations.

A detailed analysis of the results can be found at
http://enabledweb.org/public_results/survey_results/analysis.html

The second survey aimed to establish the level of satisfaction amongst visually impaired users, with the current state of accessibility on the World Wide Web.

A total of 48 interviews were carried out with blind and partially sighted adults, and as a result of these interviews, the following areas for improvement were highlighted:

1. Images
2. Graphs
3. Maps
4. 3-dimensional objects
5. Games

65% of respondents to the ENABLED survey, confirmed their readiness to try new access techniques.

The approach of the ENABLED project in tackling these issues is two-fold.

1. ”Web authoring” tools and techniques will be produced to encourage web developers to generate accessible web sites. This will be achieved partly via the training activity, which will have the effect of spreading good practice amongst the web development community, and partly via a toolset which will aid developers in building accessibility features into the types of web objects listed above. A further area for research is the extent to which meaning can be harvested from images automatically.
2. Plug-ins will be developed to realise the accessibility features incorporated into the accessible images, and present them in the medium best suited to the user.

2.2 Multi-modal Adaptive Interfaces

In this area, ENABLED aims to develop prototype interfaces which will allow Visually Impaired users to optimise their access to the web, using interfaces specially tailored to their needs, and to their environment [Furner S. Schneider-Hufschmidt M. Groh L. Perrin P. Hine N. (2003)].

This approach relies on two underlying strategies, firstly the development of tools and techniques for enhancing accessibility as detailed above, and secondly dynamic adaptation of these interfaces to suit the individual needs of the user.

User needs can be affected by many factors such as the level of any residual vision, additional disabilities including hearing loss, manual dexterity, keyboard skills and technical ability [Furner, S. & Cooper, M. (1995)]. Another important factor is the available equipment. Most blind computer users who do not have additional hearing loss, will have access to speech syntesised output, whereas due partly to the cost of hardware, fewer will use a braille display, and still fewer currently have access to haptic devices. Therefore, the system should be capable of dynamically adjusting its configuration to take advantage of available interfaces.

Prototypes under development demonstrate the conversion of 3 dimensional web images for exploration via a force-feedback haptic device, auditory (see Appendix A) and haptic interfaces to maps and graphs, and the use of 3-D spatial audio to produce a virtual environment in which to take part in games.

2.3 Mobile Computing

Blind and partially sighted people on the move require dynamic access to information about their surroundings. ENABLED aims to develop prototypes demonstrating improved access to information regarding available services (bus/train time-tables), local positioning provided using GPS, local Points Of Interest, and other information which will help them to navigate more effectively. To guide future development in this area, a survey was developed, which was administered either by face-to-face interview, or in some cases by telephone.

Three sub-groups within the population of people with visual impairment were chosen as the subjects for the requirements capture exercise:

1. Partially sighted adults
2. Blind adults
3. Partially sighted elderly

A number of mobility trainers were also interviewed as they are seen as crucial to the acceptance of a device which is envisaged as complementing the use of a cane or a guide-dog. It emerged from the interviews, that mobility trainers have a high degree of scepticism when it comes to electronic navigation aids, as in the past, these have been found to be too expensive relative to the benefits they provide.

The following summary of requirements was extracted from the data produced by this exercise:

1. Navigation – The device should incorporate audio and other guidance to help the user to navigate from place to place.
2. Programmable – It should be possible for users, mobility officers and friends/family to enter new routes into the device.
3. Reroutable – The device should be able to rebuild the route if obstructions render the original unuseable.
4. Take me home – It should be possible for the device to automatically calculate a route to guide the user from their present location to a known ”safe” area such as home.
5. Obstacle Avoidance – The device should be able to warn of obstacles including steps up and down.
6. Traffic Lights – The device should be able to pick up information from local environment such as Go/No-go information from traffic lights.
7. Emergency Communications – The device should include audio communication facilities for sending emergency calls.
8. Timetables – The device should be capable of retrieving details of bus and train times and providing the identification number of an approaching bus.
9. Orientation – The device should provide information to allow the user to orientate him/herself with respect to familiar or significant land marks.
10. Implicit - Some requirements are implied rather than explicit. A number of interviewees said that they would like to have a guide dog, but that for various reasons this wasn't practical. It is difficult, to interpret this in terms of requirements for a new electronic mobility aid, and appears to suggest that there would be scope and demand for an alternative primary mobility aid for those visually impaired people for whom a cane or a dog are not suitable.

At the feasibility evaluation stage, it became apparent that a number of the above requirements were effectively beyond the scope of the ENABLED project, and the following features have been agreed for inclusion in the initial prototyping stage:

1. The prototype will behave in a similar way to an in-car GPS navigation system.
2. This functionality will be enhanced to incorporate a mechanism for identifying the direction in which the user is facing. This will either be achieved by means of a compass, or by visual imaging techniques for the recognition of landmarks.
3. The device will also provide expanded ”Point Of Interest” information allowing the user to request details of local attractions, public buildings, retail opportunities etc. This information will be enhanced by the use of electronic user forums, which can be used to share the experiences of other visitors.
4. In addition to audio output provided via a text-to-speech engine, the device will employ various haptic guidance techniques to reduce the reliance on the auditory channel.

2.4 Wireless Networking

Where GPS is unavailable or inappropriate, e.g. within buildings, this activity aims to specify methods for using in-building wireless access points to aid the navigation of the user.

A typical application of the type of technology under development in ENABLED, is a shopping centre. Using wireless access points, and various types of wireless beacon, the user's position could be established, and information about the environment made available. For instance, a beacon associated with a shop, could inform the user's device of the name of the shop as the user approaches, and then on request, provide a list of available products. The user could then be tracked and guided as he/she progresses through the shop, and alerted when approaching the vicinity of the desired product.

It is predicted that the interior of public and corporate buildings will increasingly be mapped for the purposes of improved building management, and emergency service provision. These maps coupled with location detection technology could provide valuable navigational assistance to blind and partially sighted users.

A prototype has been developed which demonstrates the ability of currently available technology to track a user through a building, and it is hoped that this in-building navigation technology will eventually be merged with the outdoor navigation prototype developed in Work Package 3 described above, to form a unit which can switch seamlessly from GPS outdoor navigation, to in-building functionality.

2.5 User Training, Dissemination and exploitation

A prototype training platform is under development. The aim of this platform is to provide general web accessibility training, and also to centralise the dissemination of training on the various ENABLED prototypes.

3 Conclusion

As the ENABLED project approaches the end of its first 18 months, all R&D work packages have established their requirements, and are now working to develop prototypes.

A global revolution is underway, in which fixed and mobile communications are converging with Information Technology [Schneider-Hufschmidt M. Väänänen-Vainio-Mattila K. von Niman B. Ruuska-Kalliokulju S. (2001)]. In the future, it will increasingly be the case that IP-based wireless and wireline networks will carry this converged traffic. This converged network offers the prospect of ubiquitous information ideally suited to the needs of visually impaired and other disabled users.

Novel forms of information gathering and display, coupled with the drive to ensure the accessibility of existing information, offer the opportunity to greatly enhance the lives of people with visual impairments at home, at work, and on the move.

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Appendix A - Exploration of an auditory map through the city of Brussels