eInclusion Case Study – Project Enabled

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Enhanced Network Accessibility for the Blind and Visually Impaired (ENABLED)

Project details

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Participants

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BRITISH TELECOMMUNICATIONS PLC	UNITED KINGDOM
FUNDACION LABEIN	SPAIN
VIRTOUCH LTD	ISRAEL
TEKEVER, LDA	PORTUGAL
OMICRON TECHNOLOGY LTD	UNITED KINGDOM
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Summary

Internet has a great impact on people's life. Through the Web, information can be accessed remotely; people can interact with friends and family; services such as online shopping, paying bills and distant learning can be provided to the public. However, people with blindness or other form of disability are not able to take full advantage due to the inaccessibility in the technology itself. Even though the technology should be able to benefit people with disability as much as to the advantaged people. Moreover if the problem of inaccessibility is not solved, the discrepancy will become bigger as the information technology advances.

This project is determined to address this problem with two approaches:

- Developing technologies that create universal accessible contents on the Web, and algorithms that convert existing inaccessible contents to be accessible;

- Developing (ubiquitous) tools that enable easy access to information, and interfaces that are adaptable and interoperable no matter where the user is and what equipment the user is using.

To achieve the objectives of this project, research and development work will be focused on four areas:

- accessible Web content;

- adaptable interfaces;

- wireless networking;

- mobile computing.

Research and development work will be supported by training activities involving local user organizations and SMEs. These training activities will set up a sound foundation for uptake and dissemination of project results.

AWC - Accessible Web contents

Visually impaired people must use largely text-based Assistive Technologies to access the Web. The Web developers must understand how these technologies operate in order to create compatible contents, which must comply with the Web Content Accessibility Guidelines (WCAG) of the W3C/WAI (World Wide Web Consortium/Web Accessibility Initiative).

Some of the Assistive Technologies used are screen readers, magnification software and Braille display. These technologies offer partial alternatives to the graphical representation of information, such as graphs, 3D objects, and images. However, these representations contain a lot of information which cannot be easily interpreted by screen readers. They are commonly used by sighted people to present information or exchange ideas more effectively.

Traditionally, to present graphs and images to blind and visually impaired people, tactile diagrams are used. They can explore the diagrams through the touch sensation of their fingers. Touch or haptic sense is much more effective than speech or audio when exploring a graph. It is an active process in which blind people can have control rather than just being told by the description through speech. However, through extensive testing with blind computer users over several years and in different countries, it is known that presenting graphical images in tactile form to them is still problematic in the absence of informative annotations, though still preferable over speech and audio.

As haptic devices become commercially available, research has been conducted to apply them to the computer-generated graphs. In the previous Framework programme, research projects such as GRAB has investigated the use of haptic interfaces to allow blind people to have access to the 3D computer graphics. Other EU projects such as TIM have tried to present graphs by using Braille display and tactile boards. Other research projects have also investigated the use of multimodal interfaces to present 3D virtual environments to blind people.

Benefits of multimodal representation have been seen from the research findings of those projects. Therefore, the research effort in this project will be put on to the use of multimodal representation to make graphs, 3D objects and images accessible.

The specific objectives in this area include:

- Developing techniques that will convert existing non-accessible Web contents into accessible forms according to the user's need.

- Investigate multimodal representation for different contents, different applications and different user disabilities.

- Producing guidelines for creating multimodal representation and toolkits for developers to create accessible Web contents in general and images in particular.

MAI - Multimodal Adaptive Interfaces

To address accessibility issues, interfaces between the information source and the end user have to be accessible as well. Usually, computer interfaces that blind people use consists of keyboards and screen readers. Some blind people who have learned Braille can use refreshable Braille display. However neither of these devices is suitable to present graphical information on the Web.

Moreover, to use a screen reader software, blind people have to go through a training period in order to be familiar with the command keystrokes and get used to the synthesized voice. Voice control and speech input has been attempted to improve the interaction between the user and the computer.

However, these types of system rely on the length of the training and the accuracy of the speech recognition software. Therefore in order to allow blind people to access information and input commands, interfaces that can provide multimodal interaction will be ideal. Different input and output methods based on speech, non-speech sound and haptic representations will be developed.

Blind people are individuals that have different level of visual impairments. Some of them are born blind, some are blind in the later stages of their life due to illness or old age, whereas some still have residual visions. Therefore there needs to be a range of different ways in which information is presented to them. Interfaces that will be able to recognize the needs of the users and generate appropriate information representation will be developed.

Appropriate intelligence will be required to provide this kind of flexibility based on the user profile, preference and location. Moreover, users may use different types of input and output devices to access information, it is important to ensure the interoperability of data so that users can receive the same information despite the sensory modality or device that is used.

The specific objectives in this area include:

- Developing interfaces that convey information through multiple sensory modalities.
- Building a context-aware system which will present information to users in the appropriate form according to users' profile, location, available resources, etc.
- Developing a scalable and interoperable architecture and mechanism that allows information to be presented on different devices/platforms.

WIN - WIreless Networking

ENABLED project will develop location detection algorithms that are based on Wireless LAN, Bluetooth and GPS.

The algorithms will be able to determine the location of the user whether they are in an indoor or outdoor environment. Information about the area as well as the navigation aids will be provided to the user through the multimodal interface.

Other applications such as a control panel for the household appliances will also be developed in this project.

The specific objectives in this area include:

- Implementing haptic interfaces for the portable devices.
- Developing location detection algorithms based on Bluetooth or other wireless technology (e.g. GPS).
- Developing applications on PDAs, tablet PCs and other portable computers.
- Developing middleware between fixed and wireless networks.

The enhancement of the state of the art in this project is the combination of different modalities integrated into one context-aware system that leads to innovative multimodal User Interfaces for visually impaired people to access information over the Internet.

Workpackage activities:

The primary objective of ENABLED is to realise a coherent interface between web content and any other relevant services that are resident in the fixed network, and the devices that are resident in an end user's Personal Area Network (PAN). The interface between the fixed network and the user's PAN will be wireless. Furthermore, as the services provided to the user's PAN will vary according to the assistive applications used, the interface will need to be configurable in order to provide the required quality of service (QoS) to each application.

Particular innovative aspects of this workpackage include:

The use of layered multicasting techniques to simultaneously transmit web content, which is formatted differently according to the sensory capabilities and disabilities of the end users. While layered multicasting has conventionally been considered as a scalable approach to streaming video and audio services, we believe that this is the first time that it has been applied to this type of application.

The use of policies to auto-configure the connections that have to support the services to the devices on a user's PAN. We believe that this is also the first time that policies have been used to interact with embedded and wearable devices. It is nevertheless a perquisite for the disabled, who will not be able to do this for themselves. This raises a number of interesting challenges including response time and stability/reliability of the configuration policy.

While the interconnection of wearable devices to the Internet is not new, we believe that the approach of using a programmable middleware architecture to facilitate dynamic deployment of services to a WPAN is.

MOC - Mobile Computing

Traditionally people access the Internet on a desktop computer. As the development in wireless technology has matured, access to information on the move has become both feasible and cost effective. Mobile phones, PDAs and portable computers have become popular for mobile users and workers.

By combining these technologies, applications and services is possible to enhance blind people's quality of life. Currently, mobile devices are not really accessible to blind people because of their graphics-dominated displays. Moreover the small display found in most mobile phones can even sometimes be a problem to sighted people. However, the potential of mobile device and wireless communication is enormous.

Multimodal interfaces can be developed for mobile devices which already have audio capability. Haptic interfaces for mobile devices are still uncommon because of the cost and power issues. In this project, low-cost and low power consumption haptic interfaces will be developed to present information in abstract form. Context-awareness and adaptable interfaces are currently being actively studied. One challenge of mobile services today is to exploit the changing environment with a new class of applications that are aware of the context in which they are run.

Such context-aware applications adapt according to the location of use, the nearby people, hosts, and accessible devices and resources, as well as to changes to such things over time, but above all should adapt to the user profile. This last issue combined with the other capabilities will provide disabled people with new opportunities in their daily lives.

A system with these capabilities can examine the environment, react to changes to this environment and inform the disabled person in an adapted way. Emerging mobile services will improve their accessibility by adapting content and interface for disabled people. For blind people, the use of mobile solutions will have one of the most beneficial impacts.

Workpackage activities:

The objective of ENABLED is to design and develop an integrated set of solutions to enable partially sighted people to gain a better understanding of their environment.

This will be achieved by designing multi-modal interfaces that will run on mobile devices (for example PDAs). Of paramount importance will be the integration of wireless technologies (GPS, Bluetooth and 802.11) that provide location based information to the user at any time and place.

Applications will be developed to demonstrate and study the added value of location based and wireless technology to the needs of partially sighted people. The design and development will be focused on: "Developing multi-modal interfaces and applications to enable Mobile computing for partially sighted people".

The development of applications for mobile devices will involve a well devised design to ensure scalability and platform independence. These criteria will be core factors due to the diverse nature of the target devices (PDAs, tablet PCs etc.) as each device will have unique display and performance characteristics.