

Empowering Persons with Disabilities through Information and Communications Technology

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ABSTRACT

The Internet provides unparalleled opportunities for people around the globe to gain knowledge and learn new skills. Technology opens up great opportunities to improve the quality of life of disabled people. Today, people with disabilities are carrying out electronic banking, online shopping, e-mailing etc. ICT has been playing a vital role in helping those in India who are visually impaired. The IT Industry can employ visually impaired persons in various functional responsibilities involving administration, front office, telephone operators, legal, e-servicing as well as client servicing. With appropriate training, those who are visually impaired can be employed at senior levels. This paper analysis how ICT can meet the requirements of physically challenged and disabled persons. It also explores ways in which ICT especially multimedia can help them perform day-to-day activities.

KEYWORDS

ICT, information and communication technology, visual impairment, physical disability, physically challenged, disabled, less privileged, illiteracy, handicapped, multimedia, universal design, Inclusive Design, Accessible Design, Accessibility

INTRODUCTION

As technology goes about making gigantic leaps and bounds it is necessary to harness this progress to address the needs of a diverged group of users that is still generally overlooked. There are users who sometimes cannot see what is being displayed on a monitor screen, cannot type on keyboard or move a mouse. There are also people with partial blindness such as color blindness, night blindness, etc. This large chunk of society is unable to gain from the mammoth information explosion that has revolutionized our way of living - all because of lack of availability of technology and appropriate adaptation to their special needs. About 8.4 per cent and 6.1 per cent of the total estimated households in rural and urban India, respectively reported to have at least one disabled person, as per the survey by Ministry of Social justice and empowerment, Government of India conducted in 2002. Statistics shows that approximately 1 in 136 or 0.74% of the total population in any of the Asian countries are affected by the Glaucoma, which can lead to vision loss and the possibility of blindness. At the same time statistics show that India is the second largest populated country with 10 million blind people, which is a quarter of entire world's figures.

Traditionally for the visually impaired there have been two alternatives to deal with this problem – Braille and/or talking books. Materials in both these media have to be specially prepared. Thus, the materials available in these media are extremely limited and, in

the less developed countries of the world, virtually non-existent. The advent and use of ICT, however, as a medium for creation, dissemination and accessing information brought about a revolution. ICT and its tools are highly flexible and provide great scope for usage by persons with vision impairment. Information available to the seeing world is now available in its entirety to the persons with vision impairment. ICT can provide a rich medium of learning for physically challenged persons, as it will make information available to them anytime, anywhere as well as in a format fitting into their requirements. Disabled persons can use computers meaningfully for their basic education. Also, the skills they develop in using computers often permit them to take on responsibilities just like normal persons. In the developed world, special facilities are extended to help the disabled move around, work in buildings without having to heavily rely on the support from persons around.

Enabling technologies such as voice text and Braille readers will allow disabled people access while the potential of the internet for creating online communities will allow people to develop social contact and networking groups, enabling a greater voice and potential for social inclusion. Information and communications technology (ICT) can support people with physical disabilities by enabling them to access the information alongside their peers. In the office setting via electronic document processing, visually impaired and blind employees have access to vital information equal in some cases to their sighted colleagues. Similarly, telecommunication services have enabled hearing impaired persons to communicate in their preferred linguistic mode. The speech recognition systems have afforded greater freedom of communication to those with severe arms restrictions.

TYPES OF DISABILITIES

1. **Cognitive:** Cognitive impairment refers to people with dyslexia and learning difficulties. Dyslexia is a condition where people have difficulties with reading, writing or spelling. Learning problems can range from someone who has a serious mental impairment, or may be due to more common factors as poor literacy, a low level of skill using a computer, having to use the web in a second language, or problems understanding information. Eg. Learning disabilities, distractibility, inability to remember or focus on large amounts of information

2. **Dexterity:** Reduced function of arms and hands makes activities related to moving, turning, or pressing objects difficult or impossible. This disability does not influence speech communication itself, but makes it hard to make a telephone call or use a range of other telecommunication equipments.
3. **Hearing:** This includes people who are completely deaf or have partial hearing in one or both ears and require the use of a hearing aid. Eg. Deafness.
4. **Mobility:** People who have reduced function of legs and feet depend on a wheelchair or other aid for mobility. In addition to people who are born with a disability, this group includes a very large number of people whose condition is caused by age or accidents including illnesses caused by polio.
5. **Motor:** This refers to a wide range of people with varying types of physical disabilities. With regards to the web it refers largely to people with upper limb mobility, manual dexterity and co-ordination problems. This can be caused though a disability that an individual is born with or one that develops due to illness such as Multiple Sclerosis (MS) or a stroke. People with a broken bone would also temporarily fall into the category. Eg. Inability to use a mouse, slow response time, limited fine motor control
6. **Speech and Language:** Speech impairment may influence speech in a general way or only certain aspects of it, such as fluency or voice volume. Language impairment may be associated with an intellectual impairment.
7. **Visual:** This includes people with no vision, or some functional vision. For example, screen readers are used by the blind to read web pages, and someone with poor vision may use screen magnification or adjust their browser settings to make reading more comfortable. This group also includes people with colour blindness and those with eyesight problems related to ageing. Eg. Blindness, low vision, color-blindness.

The Internet and the World Wide Web introduce additional barriers for disabled people unless the structure and the content of Web sites are designed in conformity with the principles of universal design or the Web design guidelines of the World Wide Web Consortium (W3C). For example, the screen readers used by blind computer users cannot understand images that are not appropriately labeled. Deaf users cannot understand the sound tracks of multimedia files unless transcripts are provided. Users with dexterity or mobility disabilities may not be able to use a mouse or keyboard to access a site

THE UNIVERSAL DESIGN

The Universal Design (also called *Inclusive Design*, *Accessible Design* or just *Accessibility*) refers to facility designs that accommodate the widest range of potential users, including people

with mobility and visual impairments (disabilities) and other special needs.

Although Universal Design standards address the needs of people with disabilities, it is a comprehensive concept that can benefit all users. For example, people who are unusually short or tall, carrying packages or pushing a cart are not disabled, but their needs should be considered in facility design. Universal design should be comprehensive, meaning that it results in seamless mobility options from origin to destination for the greatest possible range of potential users. This can greatly assist access to Web content for people with disabilities. Examples include:

1. **Speech recognition software** which can be useful for those who have difficulty using a mouse or a keyboard
2. **Screen magnification software** which enlarges what is displayed on the computer monitor, making it easier to read for vision impaired users.
3. **Keyboard overlays** which can make typing easier and more accurate for those who have motor control difficulties.
4. **Screen reader software** which can read out, using synthesised speech, either selected elements of what is being displayed on the monitor (helpful for users with reading or learning difficulties), or which can read out everything that is happening on the PC (used by blind and vision impaired users).
5. **Translation software** to allow reading of websites in foreign languages especially for those who had been diagnosed to have a learning disability

SEVEN PRINCIPLES OF UNIVERSAL DESIGN

1. **Equitable Use:** The design is useful and marketable to any group of users.
2. **Flexibility in Use:** The design accommodates a wide range of individual preferences and abilities.
3. **Simple and Intuitive Use:** Use of the design is easy to understand.
4. **Perceptible Information:** The design communicates necessary information effectively to the user.
5. **Tolerance for Error:** The design minimizes hazards and the adverse consequences of accidental or unintentional actions.
6. **Low Physical Effort:** The design can be used efficiently and comfortably.

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7. **Size and Space for Approach and Use:** Appropriate size and space is provided for approach and use

the MAGic software magnifies the computer screen (Freedom Scientific, 2003b).

SOFTWARES FOR DISABLED PEOPLE

1. **BATS:** The blind and severely visually impaired can access geographic maps using the map-navigation software Blind Audio Tactile Mapping System (BATS). It takes digital map information and provides non-visual feedback as the user moves a cursor across the map.
2. **Digital Accessible Information System (DAISY) Consortium:** The Digital Accessible Information System (DAISY) Consortium was formed in May, 1996 by Talking book libraries to lead the worldwide transition from analog to Digital Talking Books. DAISY denotes the Digital Accessible Information System. Members of the Consortium actively promote the DAISY standard for Digital Talking Books because it promises to revolutionize the reading experience for people who have reading disabilities. Specifically, the Consortium's vision is that all published information is available to people with print disabilities, at the same time and at no greater cost, in an accessible, feature-rich, navigable format. The DAISY Consortium has established a mission and goals in order to make this vision a reality.
3. **IBM Home Page Reader:** IBM Home Page Reader (HPR) bring spoken access to the Internet for the blind or visually impaired user and also converts Web information text in columns, tables, date input fields, and graphic description to speech. Support for low vision users permits customization of font size, background, color, and other display elements (Technology Round-Up, 2002).
4. **JAWS:** Job Access with Speech (JAWS) for Windows uses an integrated voice synthesizer and the computer's sound card to output the content of a computer screen to speakers. Users can adjust voice rate, pitch, and amount of punctuation spoken. Because Braille is by far the most common tactile system used by the blind or visually impaired, JAWS helps them by providing line-by-line Braille on a specialized keyboard that changes or refreshes according to the text on the screen (Freedom Scientific, 2003c).
5. **Realspeak :** One example of screen-reading voice software is RealSpeak software (ScanSoft, 2003)¹⁰. This program can read the text on a computer screen aloud. Because many professors use Web sites to provide class updates, the blind or visually impaired can now use RealSpeak to access these updates.
6. **OpenBook and WYNN Wizard:** For printed information that is physically present, OpenBook and WYNN Wizard (Freedom Scientific, 2003a) convert written text to speech for the blind or visually impaired. For the low vision user,

SOME INITIATIVES AT NATIONAL LEVEL

There is now a wide range of software and peripherals available as alternatives to using the traditional keyboard and mouse, which can suit learners with varying physical disabilities such as head pointers, predictive word-processors, touch pads, joysticks, speech recognition systems etc. Person can select the technology based on their requirements and their ability to work with the technology. Technological innovations in computer hardware and software have given us a number of aids for the disabled, making it possible for a large number of persons affected by blindness, deafness or motor disabilities to use computers in meaningful ways to overcome their disabilities.

1. Department of Information Technology

The Department of Information Technology started computer center for blind in 2004. The center was equipped with 4 computers, 4 Braille printers and one Juliet pro. The department had taken up projects that would make life easier for the handicapped. The department is maintaining a computerized Braille system at the blind school of Namchi. To encourage physically challenged individuals and help them join the mainstream, the department of Information Technology has been imparting special training programmes for the disabled.

They are also working on conversion of Standard VI to XII CBSE Books into Braille. Along with Braille, IT Department is also working on conversion of these CBSE Books into Talking Books for the blind. The Department of Information Technology has established a recording studio in the multimedia center of the department. The studio was completed in March 2006. It is equipped with a Computer, 8 track mixers, electronic keyboard and sound systems. With regards to this, three members of the department under CRTI were sent for 7 days training on Daisy Book.

2. Dr. Ambedkar Institute for Physically Handicapped, Kanpur

This institute, established by the government of Uttar Pradesh, is located in Kanpur, in Northern India. It has links with major organizations in the region, including the Indian Institute of Technology, Kanpur.

3. J.S.S. Polytechnic for Physically Handicapped, Mysore

The J.S.S. Mahavidyapeetha, a non-governmental education society that supports 220 educational institutions in India, established this Polytechnic institute. With financial aid from the government of

Karnataka, the Polytechnic institution is linked to a network of institutions, one of which is the Science and Technology Entrepreneurs Park located on the same campus. Through this organization, students with physical disabilities will be assisted to start small businesses. Other established organizations in the city of Mysore that work with the rehabilitation of persons with disabilities include.

4. **NAB Delhi**

NAB Delhi⁸ are working to develop a special e-text library where books of various topic such as literature, novels, text of universities and schools, material for competitive exams etc will be kept for People with Disabilities[PWDs]. It would be first of this kind in India and will have more than 1500 titles to start with. The material kept will be in such a format that anyone can read the text with the help of a screen reader or can directly emboss the text in Braille.

They are also working on a screen reader named screen access for all SAFA⁹ which is an open source initiative to develop a screen reading software for the vision impaired persons to read and write in their language of choice. The software is an alternative to the already available commercial screen readers which are very expensive, proprietary and serve only to users of English and other Western European languages. This software will be multi lingual software targeting Indian and other Asian languages.

5. **Shruti Drishti:**

It is a web page browser developed for visually impaired users is considered to provide user-friendly environment, sharing and strengthening of global knowledge by removing barriers and providing equitable access to information for all by the use of Assistive Technologies. Shruti Drishti has an option of presenting the displayed information in a verbal mode using a speech synthesizer or in the Braille format.

The verbal mode of information representation provides descriptive information on all events of a web page, including links, buttons, check box, text etc. It is keyboard event driven and provides 'keyboard only' accessibility using a minimal set of keys. It also provides a large text window for partially sighted users and a standard web page browser to enable users to work together with sighted workers. Shruti Drishti is a combination of Text to Speech [TTS] & Text to Braille [TTB] application - to provide high-value integrated Web Browsing through listening anytime, anyplace

6. **Simputer Project**

In an effort to bring the Internet to the masses in India and other developing countries in line with Design-for-all several academics and engineers have used their spare time to design an inexpensive handheld Internet appliance. The Simputer makes the Internet accessible to illiterate populations. This was design by the Indian Institute of

Science (IISc.) Bangalore and Encore Software Bangalore based Design Company.

ISSUES AND CHALLENGES IN USING ICT FOR DISABLED PEOPLE

Information and Communication Technology present both opportunities and challenges for the economic and social inclusion of disabled people. The major advances in ICT usage as well as the major new barriers imposed by ICT on disabled people are predicted on the issue of accessibility. People with physical challenge either temporary or of permanent nature put limitations in learning process of an individual as it can limit accessibility, it can hamper understanding or it may result in slow learning thus making it difficult for such persons to be at par with their peer group. People with sensory disorders, especially partially sighted and blind people, are unable to access wide areas of this medium and are thus excluded from it.

There is a necessity to focus for the use of technology with the communication and educational needs of young people with physical and communication difficulties. ICT can provide a rich medium of learning for physically challenged persons, as it will make contents available to them anytime, anywhere as well as in a format fitting into their requirements. Enabling technologies such as voice text and Braille readers will allow disabled people access while the potential of the internet for creating online communities will allow people to develop social contact and networking groups, enabling a greater voice and potential for social inclusion.

The situation in India is different since technology is not affordable by majority of the citizens specifically those who live in rural areas. Also knowledge of English, which is required for learning the technologies, is not something one can expect from this population. Over the years, volunteer organizations and Government bodies have worked together to provide Assistive devices but the progress has been slow. Major challenge in using ICT for educating physically challenged person's lies in creating contents for their learning requirements, pace and efficiency of learning. Multimedia components can provide rich learning contents for such persons and help in creating multi-modal websites for accessibility of all.

CONCLUSION

Information Technology holds a lot of promise for helping the underprivileged and the disabled in their education. Skills are also required for training them in the use of Computers. Inclusive education in schools is desirable from the point of view of basic education where Assistive Technologies could be deployed effectively to help the disabled gain basic skills to complete their school or college education.

All persons should be developed to their fullest potential because of their greater potential for making contributions to

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society. The needs of disabled who are blind or visually impaired should not be overlooked and can be uniquely met by the use of electronic technology in order to help them develop into strong, independent, individuals by providing these students with the ability to compete as equals with their peers. Organisations that provide information, help and advice to older and disabled people about how to use information and communication technology.

ICT is revolutionary technology for persons with blindness. To harness the potential of this technology, training is essential. It is necessary to have specialized training centers for the initiation process whilst advanced computer training is best in a non-specialized training environment.

APPENDIX –I USEFUL ORGANIZATIONS

AbilityNet

www.abilitynet.co.uk

Tel. 0800 269 545

This charity provides impartial advice about computer technology for those with disabilities. They can also provide assessments.

Action for Blind People

www.afbp.org

Tel. 020 7635 4900

Action for Blind People is a UK charity which aims to enable blind and partially sighted people to enjoy equal opportunities in every aspect of their lives.

American Council for the Blind

www.acb.org

The Council strives to improve the well being of all blind and visually impaired people by promoting greater understanding of blindness and the capabilities of blind people. Their Web site includes technology and information resources.

American Foundation for the Blind

www.afb.org

This organization is a leading resource in the US for people who are blind or visually impaired, the organizations that serve them and the general public. They have a comprehensive Web site that holds news, information and other resources, including two online journals.

British Computer Association for the Blind

www.bcab.org.uk

BCAB was formed to cover all aspects of computing and visual impairment. They produce a regular newsletter, have an electronic mailing list, run training courses and introductory workshops.

Disability Net

www.disabilitynet.co.uk

Disability Net is one of the world's leading Internet based disability information and news service.

Electronic Aids for the Blind

www.eabnet.org.uk

Tel. 020 8295 3636

This charity has a remit to enhance the independence of blind and visually impaired people through the provision of specialist or suitably adapted electronic equipment. They will raise funds for the purchase of equipment. Target groups are wide including, for example, pupils in mainstream education who have equipment provided by the LEA for use at school but require similar equipment at home for homework and effective study.

APPENDIX –II JOURNALS

Access World: Technology for Consumers with a Visual Impairment

www.afb.org

This online journal is written by the American Foundation for the Blind and contains interviews, information and reviews concerning technology and software for the visually impaired.

British Journal of Special Education (BJSE)

The BJSE aims to cover the whole range of learning difficulties and disabilities, both in special and mainstream schools. There is a regular computer page. Blackwells Publishers, 108 Cowley Rd, Oxford, OX4 1JS Tel. 01865 791100

www.blackwells.co.uk

British Journal of Visual Impairment (BJVI)

This periodical covers all aspects of visual impairment. It is written for professionals who are concerned with pupils and adults who have a visual impairment. It is a national forum for all views on related subjects.

NASEN, Tel. 01827 311500

Centre Software

This quarterly RCEVH journal concentrates on visual impairment and computing with special emphasis on additional needs and technology. Research Centre for the Education of the Visually Handicapped (RCEVH), University of Birmingham, School of Education, Edgbaston, Birmingham B15 2TT Tel. 0121 414 6733

www.bham.ac.uk/RCEVH/welcome.htm

Educational Computing and Technology

This journal specializes in computing for schools. It includes news, reviews and information on most aspects of educational computing. Published six times per year. Hobsons Publishing, Bateman Street, Cambridge CB12 1LZ Tel. 01223 354551

Eye Contact

This journal focuses on the needs of pupils with impaired vision who have additional learning difficulties. It has news and other information for parents and professionals. It has

technology features and is published termly. RNIB Education Information Service, 224 Great Portland St, London, W1N 6AA Tel. 020 7388 1266

Journal of Visual Impairment and Blindness

www.afb.org.uk

This is an interdisciplinary journal for practitioners and researchers professionally concerned with blind and visually impaired persons. It provides a forum for wide ranging views and draws on many different disciplines in order to further work for visually impaired people. Published six times a year. The American Foundation for the Blind, 11 Penn Plaza, Suite 300, New York, NY 10001

New Beacon

A monthly magazine for people with a visual impairment and their families. It is also aimed at volunteers and professionals. It has news and views and articles on various subjects, including advances in technology. Customer Services, RNIB, PO Box 173, Peterborough PE2 6WS Tel. 0845 702 3153

Special Children

This independent magazine focuses on pupils with special needs. It carries news, views and information with occasional special features on technology. 27 Fredrick St, Hockley, Birmingham B1 3HH Tel. 0121 212 0919

Visability

Visability is for parents and professionals working with pupils and young people who attend a local school or college. RNIB Education Information Service, 224 Great Portland St, London W1N 6AA Tel. 020 7388 1266

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