AN EFFECTIVE EDUCATIONAL PORTAL FOR VISUALLY IMPAIRED PERSONS IN INDIA

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Abstract: Education for Visually Impaired Persons (VIP) is a serious problem and they face worst situations while accessing information. Basically, VIP relies on the applications which transform the information become visible in screen and textual documents to various formats which are easier to access. The design of education portal for VIP needs extra requirements to provide naturalness and intelligibility. E-learning is one the important way to educate disabled people efficiently. Large number of researchers is carried out in this field to design and develop an efficient e-learning platform for VIP. In this paper, an education portal is developed for VIP in India which includes the information and sources. It allows the VIP to easily access several educational packages with information of various content and different time durations. The education portal for Indian VIP designed in this paper uses PHP for coding and MySQL for the database. JAWS is employed as screen reading software. HTML5 and CSS3 are used to code HTML pages in such a way that it is compatible with JAWS. The proposed educational portal is found to be highly useful for VIP and it is very interactive. The inclusion of JAWS screen reading software also improves the VIP experience with the educational portal. As a result, it is recommended to employ the proposed portal to provide all or partial educational content in different formats to VIP in India.

Keywords: E-learning, Education portal, PHP, JAWS, Visually Impaired Persons

1. Introduction

The world's largest number of blind people lives in India and the count is increasing 30,000 every year. Cataract is the primary cause of blindness in India. Every year approximately three million people develop cataract in India but the worst part is that almost half of these cases are curable, which when left unattended translates to complete or partial blindness [1]. Visual impairment refers to a person with sight which cannot be completely cured by glasses or contact lenses. Blindness indicates a person has the following conditions: VA < 3/60-1/60, <1/60-PL and NPL. In India, people with VA < 6/60 is legally blind and the person with low vision indicates a person with impairment of vision of less than 6/18 to 6/60 with better correction and the people with 20/20 is considered normal vision [2].

The VIP should be trained with some techniques associated to meet their personal requirements in day to day life. The necessary areas of learning begin from easier things like eating, arranging the bed, and improving to peel off the fruit, ironing, shoe polishing, cleaning, shaving, cooking and so on. Additionally, training in modeling, Braille writing and abacus is very essential for VIP. Education is the fundamental factor which makes the child become a responsible adult. Visually impaired students should access the complete education to obtain knowledge, employment and interaction with the society. In the real world, VIP faces difficulties to get appropriate employment. It results to low salary and also affects the quality of living. It is reported that 63% of VIP in Australia at working age are unemployed. A report reveals that the normal people obtain better education and employment comparatively to blind people. As vision is the basic way to achieve better knowledge and development, visually impaired students are not able to access to information [3]. Visually impaired students suffer in various ways in the educational environment. There is a need that the visually impaired students have to access text information and also visual information. These students are facing several problems in learning and the importance of educating normal people is not given to blind people. In some situations, they are not comfortable to study with normal people as their requirements are completely different. The advanced technologies leads to the development of various educational tools for blind people to access information using web pages, specialized audio books, video magnifiers, Braille, materials, etc. Various researches have been carried out linked to educate VIP. [4] investigated the social behaviors of VIP and identified the areas of requirement and gap during their education. [5] observed the issues faced by VIP faced in e-learning and also noted that various educational
environments cannot be used by VIP. The e-learning environment has been designed to overcome this problem and has been operated in agreement with the VIP. It is also found to be useful regarding learning. [6] suggested the way of educating VIP through web and websites are developed using some technologies like Jaws, Supernova. [7] developed a system with the consideration of all visual acuity levels as the person's visual acuity is not exactly determined. The JAWS screen reader, magnifier and Braille keyboard are employed to navigate in the web. [8] developed a system that enables the VIP to grasp the profits of library in the university by the help of speech synthesizer. [9] developed a system for sighted and VIP to attend exam in the same environment. [10] created the audio books of numerous books in the university library and provides the audio books to VIP to educate them. In the recent days, e-learning environments are utilized not only for vocational or training courses, it is also used to provide a platform exactly same feel as actual classroom and bear all activities. This resulted in the learning and teaching activity more effective. This can be helpful for VIP and normally sighted people also. In this paper, an educational portal for VIP is prepared by considering their requirements. The contribution of the paper is listed below.

- An education portal is developed for VIP in India to access information.
- PHP is used for coding purposes and MyMySQL is employed for the database.
- JAWS is employed as the screen reading software.
- HTML5 and CSS3 are used to code HTML pages in such a way that it is compatible with JAWS.

The remainder of the paper is formulated as follows. Section 2 reviews the existing e-learning techniques in detail. Section 3 explains the proposed educational portal design and methodology. The performance of the education portal is analyzed in Section 4. The paper is concluded in Section 5.

2. Related Work

Several e-learning techniques developed for VIP are reviewed in this section. VIP needs some assistance in the initial step because of the limitations in writing and reading math formulas [11]. Braille is the more comfortable way to access to access the text documents but math documents using Braille is very tedious and is not recommendable [12]. To overcome the demerits of existing math tools for VIP, [13] developed an automatic reading aided tool, math learning and teaching tool for visually impaired students and teachers. It incorporates a screen reader which produces output as a voice in a computer. It has the ability to read math documents aloud. i-Math has four modules in the designing process; XML Conversion module, MathEx [14] Structure Analysis module, Math–Thai Mapping module and Speech Synthesis module. It improves the comfortness and independency of blind users to practice their mathematics. [15] proposed a framework with an aim of providing access to online math content and solving algebraic problems for visually impaired students in middle school. This proposed method not only provides direct or indirect answers, it also enables VIP to learn algebra and solving math problems with no guidance and results given from the system. In addition, history of all calculation steps done are also kept which helps the students to go back and review it. The implementation depends on the representation of expressions in MathML [16] (or MSOffice OOXML format) and the workspaces are implemented as a web tool which provides a virtual notebook with the depicted features. A new e-learning platform for visually impaired students is designed to solve the lack of accessibility for the blind people [17]. The proposed method decomposes the classical mathematical exercise into a series of basic sub-exercises. This allows the blind person to interactively solve the math problems and validating in each step. In this method, three groups of math formulae with an alternate description are designed and are listed here: Simple formulae with basic math operators, +, -, *, /, >, <, %, numbers, variables, functions and brackets; Complex math formulas (fractions, roots, powers) and Advanced formulae (differentiations, integrals, limits, progressions). Currently, the presented platform is only available for students from Silesian University of Technology. [18] proposed a new study with an aim to analyze the visually impaired students distance education (DE) and the relationships between attitudes and participants’ personal characteristics. The elder people are having more positive attitudes towards DE than younger people. In addition, the positive attitude towards DE increases as the level of education increases. The report also indicated that VIP has slightly positive attitudes towards DE. [19] is designed to eliminate the three challenges present in the integration of Text to Speech (TTS) technology [20] into screen readers. A new architecture with advanced features is designed to integrate TTS system to screen reading software as a supporting tool for VIP.
problems like greeklish are solved effectively using statistically driven transliteration technology to translate from greeklish to Greek. At present, it has been used by the National Association for Blind in Greece. [21] has developed a robust and accurate method to identify and convert greeklish words and phrases into proper Greek. It integrates an intermediate stage of language recognition using Bayesian acoustic model for Greek words. [22] discussed an e-learning application for VIP and also an e-learning application for the teaching English language to deaf and hearing impaired people. This paper also provides a study which discusses the relationship of the deaf and hearing impaired with technological advancements in Greece. The main aim of this study is to support the distance and lifelong education, to ensure their equivalent access to information, knowledge, education and employment and also to reduce the gap in the usage of assistive technologies and e-learning platforms. [23] proposed an e-learning environment designed for VIP and teachers. This platform integrates various technologies which covers the communicative needs and challenges of the VIP. In addition, it presents an opportunity to people for using alternate sensory routes like hearing and touch for simpler navigation. It also gives access web content which intimates them initially and in long term it assures their equal access to information, knowledge, education and employment. It fulfils both specific personal and communicative requirements of the VIP [24]. [25] The main goal of this work is to analyze the difficulties of visually impaired learners (VIL) while accessing information and communication technologies (ICT) skills and to recommend clarifications for these problems. The actions of VIL are noted by the screen capture software and evaluated with regard to the skills. The obtained result implies that there is a greater need to develop the ICT skills among VIP. [26] analyzed the experiences of visually impaired students in India in the view of e-learning. The aim of this study is to discover the learning experiences of 10 visually impaired online students to analyze their views on e-learning concept. The basic idea is "not to conclude a study but to develop ideas for further study". The Voice Activated E learning System [27] eliminates the problem of visually impaired students. It helps to assist visually impaired students to learn in an easier way using voice commands. It has 2 key components; Speaker Verification and Speech Recognition subsystem. Generally, this voice activated system is designed with 2 subsystems namely the user verification subsystem and isolated word recognition subsystem. The user verification subsystem can be utilized to authorize the user, and the word recognition subsystem is implemented for command identification. The e-learning system consists of a user enrollment, user authentication and numerous word recognition processing. For testing purposes, 20 users were registered and were asked to use the system. A verification system is developed to verify a user by their voice input and his identity claim. The system tests the input sample by: 1) Matching with the given user's Identity and 2) NOT matching with the given user's Identity.

[28] performed a study to examine the attitude of 10 VIP while performing copy typing task. The visually impaired adults suffer from ineffective working skills like poor touch-typing, lack of frequent shortcut keys usage, absence of adjusting equipment, furniture and copy material. [29] identified extra barriers as technical accessibility problems for VIP which needs to be resolved. [30] also performed a study about the usage of web accessibility by the consideration of 6 visually impaired persons (2 male and 4 female). They performed 6 think-aloud assessments for comparison with default web display. The main intention of this study is to enhance the design by identifying the usability issues. The validated result proves that the tested persons are more satisfied with the modified web site. [31] also performed a study to provide web accessibility of visually impaired students advised web-site designers to be sensitive to the requirements of visually impaired persons in the preparation of their information sites.

3. Education Portal And Accessibility Criteria

Recent advancement in the field of wireless and communication technology leads to the development of education platforms to address the needs of disabled individuals. Particularly, the advanced technologies like speech synthesizers or Braille visions are used to read the characters on the screen [32]. But, the contents of the website like videos, images, text documents are not easily accessible by VIP. To address these issues, the developers design the websites by considering the accessibility standards. Another way is the VIP should navigate using particular tools while navigating among the sites. Kurzweil Education System is a tool for VIP which consists of 300 software. It speaks aloud the printed text by the use of speech synthesizer and an electronic scanner [33]. ZoomText and Lunar tools are designed for partially-sighted people which allow partial or full selection and zooming of the screen. JAWS is a screen-reading software which enables the user to select text on the screen and it produces audio output. The VIP can
communicate via both hardware and software. For instance, Braille input output hardware. Braille is a dedicated system for VIP which makes the text accessible. Generally, it can be used via keyboard; it is also possible to use an embedded monitor. Several tools based on Braille were developed in [34] (Debowskaa et al, 2013). Though these tools investigate the websites, they follow some rules. Additionally, it needs detailed operations rather than navigating in websites like education portal. Therefore, the tools, utilized by VIP experienced several problems as navigating in websites. Because of the reason, some requirements should be satisfied when it is used by VIP or partially sighted people among the site users. In this paper, we made an attempt to create those requirements and they have been tested in an Education platform by a pilot study. The main aim of this measure is to enable the VIP to quickly access the contents in a more precise manner. The software requirements were decided at the level of software requirement analysis, and the system requirement document and interface requirements document were arranged. Software requirement analysis consisted of two levels. In the initial level, the requirements are determined and developed. The next requirement management process level manages the requirements would be managed in the whole software lifecycle. The entire requirement analysis methodology is finalized by the consultancy of the visually impaired computer operator. This is obtained by the combined process of distance learning portal software developers. Some of the headings are listed below.

- The unchanging click (access) point can be defined by the images and animated object's grammatology.
- Modified combo boxes can be accessible.
- The work of reader programs should be simpler. The effortless readability can be achieved by the use of shortcut keys of screen reader programs rather than special shortcut keys on the website.

### Table 1: Web contents’ accessibility standards [35]

<table>
<thead>
<tr>
<th>Principle</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The menu structure should be as far hierarchy level.</td>
<td>For showing of Hierarchy.</td>
</tr>
<tr>
<td>2. All objects in the interface should have the same meaning.</td>
<td>Quality and Quickness.</td>
</tr>
<tr>
<td>3. The terms should come after the input and information is all kind of forms.</td>
<td>Consistency.</td>
</tr>
<tr>
<td>4. One should avoid using the unnecessary words.</td>
<td>Consistency.</td>
</tr>
<tr>
<td>5. The names should be enriched in the page taking the suitable elements.</td>
<td>Consistency.</td>
</tr>
<tr>
<td>6. All pages should have navigation menus and they should be consistent.</td>
<td>Consistency.</td>
</tr>
<tr>
<td>7. There should be a general navigation menus and the links at the end of page in order to provide the continuity.</td>
<td>Consistency.</td>
</tr>
<tr>
<td>8. The naming field to be placed on the page should be easily accessible to all pages.</td>
<td>Quality and Quickness.</td>
</tr>
<tr>
<td>9. All links, located the page arrangement, should be removed and they should be presented through CSS without using visuals.</td>
<td>Quality and Quickness.</td>
</tr>
</tbody>
</table>

- The accessibility and usability are enhanced by the use of structures like Anchor in the site.
- Simpler availability in the pages needs to be given. The unwanted information should be deleted and redundancy to be avoided.
- The structures like flash should be employed in the appropriate places.
- The toolbars should be avoided. It may result in confusion like unwanted columns in the reader programs.
- Letter size adjustment is needed for the partially-sighted persons. script languages like JavaScript for zooming the main texts.
- The headers are needed to be in proper place.
- The designs and scanners are to be compatible with each other.
- The page continuity should be given.

Using the survey of VIP and literature work, the requirements are computed and they are combined and tabulated in Table 1. The system design is comprised of 4 fundamental blocks which include hardware structure, communication infrastructure, security structure, application structure. These basic blocks represent the general structure of the system and all structural features of that educational environment were given. The database with 13 tables, created in MySQL database for the Database Design. In the database, the Foreign Key relations between them were pointed out. The designed portal interface draft undergoes testing and verified by the consultant of VIP. The functional process related to every level is was cyclically planned. The students can access and listen to the course documents online; they can save the documents in computers to access it anytime. The website interface was tagged and prioritized steady with the screen reading program which is integrated with the Web Site Interface Design. The importance is given to all requirements in all pages. HTML samples are summarized from the Education Portal.
4. Performance Analysis

4.1. Procedure

The education portal designed for VIP consists of the following steps:

- Register to the education portal at free cost
- Project the existing education tops, course registration and a request for new course is sent upon required
- Registered users listen and save the course content.
- Registered users attend the pilot tests of the course
- A communication is established among administrator, teacher and students registered in the portal using the forum.
- Virtual live lessons are attended based on the registered course related to the course which s/he is registered.
- The announcements should be followed.

4.2. Education Portal Tests

3 scenarios were generated to test the usability of education portal by VIP and it is carried out by 32 VIP and normal sighted persons. The scenarios were tested individually and based on the time employed in the test procedures. The scenarios are listed in Table 2. The scenario procedures are priory explained in a simpler way and introduced to the participant. The computer using degrees of volunteered subjects are at least at the medium level.

Table 2: Education Portal Test procedure scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: Registering to the Website</td>
<td>Use login to the website.</td>
</tr>
<tr>
<td>Scenario 2: Downloading the Course</td>
<td>Use login to the site.</td>
</tr>
<tr>
<td>Scenario 3 Test</td>
<td>User enters the site. (Assured that s/he is registered and downloaded and read the course documents)</td>
</tr>
</tbody>
</table>

The observed average times of the scenarios are tabulated in Table 3. The correlation between the VIP and normally sighted persons are nearer to “+1” value. It indicates that there is no negative progression in the scenario processes for VIP. Figs. 1, 2 and 3 depict the time used by VIP and normally sighted people. It is also showed that the test results are noted commonly from the test results that the normal sighted persons recognize the scenarios faster than VIP.

Table 3: Observed average times of the scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Scenario processing times according to the impairment situation</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP</td>
<td>Normal sighted persons</td>
<td></td>
</tr>
<tr>
<td>1 Registering to the site</td>
<td>96.21</td>
<td>78.31</td>
</tr>
<tr>
<td>2 Course Downloading</td>
<td>145.9</td>
<td>130.39</td>
</tr>
<tr>
<td>3 Test</td>
<td>590.31</td>
<td>468.21</td>
</tr>
</tbody>
</table>

Figure 4 shows the significant results from the poles performed for the feedbacks from the visually impaired volunteered subjects. The pole consists of open-ended questions and allows evaluating the content of education portal.
They stated that they have the expectations related to the social importance, art society, religion, psychology, international relationships and other verbal courses. The VIP has difficulty in the quantitative subjects, and especially they are not successful in math. In the pole, the participants selected more than one field and did not prioritize any selection.

5. Conclusion

In this paper, an education portal is developed for VIP in India which includes the information and sources. It allows the VIP to easily access several educational packages with information of various content and different time durations. The education portal for Indian VIP designed in this paper uses PHP for coding and MySQL for the database. JAWS is employed as the screen reading software. HTML5 and CSS3 are used to code HTML pages in such a way that it is compatible with JAWS. The proposed educational portal is found to be highly useful for VIP and it is very interactive. The inclusion of JAWS screen reading software also improves the VIP experience with the educational portal. The reviews from the VIP related to the portal are satisfactory. As a result, it is recommended to employ the proposed portal to provide all or partial educational content in different formats to VIP in India. The course contents should be prepared by the experts and should be organized constantly with the auxiliary tools which the VIP uses.

References


[26] Kalpana Kharade & Hema Peese , Learning by E-Learning for Visually Impaired Students: opportunities or again marginalisation?, E-Learning and Digital Media Volume 9 Number 4 2012


