E-GOVERNANCE WEBSITE ACCESSIBILITY EVALUATION BY END USER’S PERSPECTIVE

Gohin.B*1, Viji Vinod†2

*Department of Computer Applications, DR.M.G.R.Educational and Research Institute University
Maduravoyal, Chennai, Tamil Nadu India.
gohin.b@gmail.com

†Prof and Head, Department of Computer Applications, DR.M.G.R.Educational and Research Institute University
Maduravoyal, Chennai, Tamil Nadu India.
vijivino@gmail.com

Abstract:
E-Governance is the application of information and communication technology for providing government services efficiently to their users in the form of a two-way-communication. However, the success and the failure of these E-Governance websites are heavily dependent on some important aspects, mainly website accessibility and usability. The research in this paper focuses on the accessibility (digital divide between E-Governance websites and disabled people) of E-Governance websites in India. Since the tools and guidelines are available to help website designers and managers to make the web sites accessible for disabled people. It is unclear why so many E-Governance websites continue to be inaccessible. Moreover, the literature has been used to elucidate that there are limited studies conducted in the field of E-Governance’s website accessibility in India and most specifically the studies were conducted by automatic tools and web masters perspectives. Hence this article focuses on accessibility study by end-user’s (disabled people) perspective to identify the root cause accessibility problems and requirements of end-users. The study revealed number of issues that the Indian E-Governance websites should satisfy the disabled people. Further the research findings and future directions for research are discussed.

Keywords: E-Governance, Accessibility, Disabilities, Internet, ICT.

1. Introduction

E-Governance is the application of information and communication technology that uses cloud computing technology or the Internet or the WWW to provide government information and services to its citizens. At this point, E-Governance particularly uses the software as a service (SaaS) model, to enhance the access and delivery of government information and services to all of its citizens, businesses, government agencies and other agencies at all levels of government [14].

The ability to access the information is a key feature of citizenship and participation in society. Most of the Indian government departments have individual websites that offer information and services directly to citizens, including information for research, government forms and services, public policy information, employment and business opportunities, voting information, tax filing, license registration or renewal, payment of fines, and submission of comments to government officials [13].

According to Mukherjee & Sahoo [11]; many individuals believe increased access to government information online will help them become more active participants in the democratic process. However, in order to reach the government information and services to all citizens, it must be fully accessible to all citizens, including people with disabilities [4]. To provide better accessibility of Indian E-Governance websites the Department of Information Technology, Government of India had developed a set guideline in 2009. These Guidelines are based on International Standards including ISO 23026, W3C’s Web Content Accessibility Guidelines and Disability Act of India as well as Information Technology Act of India [12].

Further, the longstanding experience of the employers in design, development and management of government websites as well as their knowledge of the ground realities and challenges faced by the Government Departments in developing and managing their websites have helped significantly in drafting these Guidelines. The requirement of the guidelines is that all Indian E-Governance websites should provide their information and services in a fully accessible manner [12].
The failure to achieve acceptable levels of accessibility for E-Governance services threatens not only the E-Governance initiatives, but also the relationship between the government and citizens in general [11].

The objects of the website are considered as one of the most important aspects of accessibility, because it is the medium for interaction and communication between the system and the users. Good accessibility of any system should be the main goal of website designers, and the website must be satisfactory for those users with disabilities [10]. So, without having good accessibility in E-Governance websites, E-Governance will continue to find problems when interacting with users.

This article started with the introduction of this paper, then the methodology, it is followed by outcomes of the study, finally discussion of findings and ends with conclusion.

2. Methodology

Since the objective of this study is to investigate the accessibility of the existing E-Governance websites in India from the perspective of end-users, the approach was based on user testing. The end-user experience is considered one of the most important factors affecting the success or failure of E-Governance websites accessibility [15]. Hence, in investigating the status of accessibility of the existing E-Governance websites in India, this study focused on the end-user perspective and assessed WCAG 2.0 principles and overall satisfaction of the selected websites.

The participants were asked to carry out a number of pre-selected tasks on a given website and a questionnaire was administered accordingly to gather their experience regarding the operable, perceivable, understandable, robust and overall satisfaction.

The questionnaire was organized into two parts: pre-test questionnaire, which covered the demographics and background information of the participants in addition to their experience with the technology usage (9 questions); and post-test questionnaire, investigating Operable Principle (8 questions), Perceivable (10 questions), Understandable (5 questions), Robust (5 questions) and overall satisfaction (6 questions). The questionnaire items have been measured using a standard five-point Likert scale.

The pre-test questionnaire was completed at the beginning of the session by the participants, then (without time limitations) they navigated through nine Indian E-Governance websites after they were given specific tasks. Table 1 shows the websites and the selected tasks for the testing.

<table>
<thead>
<tr>
<th>Departments With Their Web Address</th>
<th>Participants Task in corresponding websites</th>
</tr>
</thead>
</table>
| Union Public Service Commission (www.upsc.gov.in) | • Checking the documents for obtaining exemption of age relaxation for central Government Exams  
• Finding procedures for registration |
| Tamil Nadu Public Service Commission (www.tnpsc.gov.in) | • Checking the documents for obtaining exemption of age relaxation state Government Exams  
• Finding procedures for one time registration |
| India Banking Details (www.bank-india.com) | • Accessing contact address and the telephone number for SBI,Chennai branch  
• Finding information about account opening |
| Bharat Sanchar Nigam Limited (www.bsnl.co.in) | • Access the nearest BSNL branch office details  
• Get the document for getting connection |
| Indian Railways (www.indianrailways.gov.in) | • Access the train detail from Chennai to Delhi  
• Find any train details |
| Income Tax Department (www.incometaxindia.gov.in) | • Access the registration details  
• Find the tax details |
This study involved 22 participants for each website; therefore, 198 participants in total were recruited to participate in testing the nine websites. The selected websites were: Union Public Service Commission (UPSC) website, Tamil Nadu Public Service Commission (TNPSC) website, Indian banking Details (IBD) website, Bharat Sanchar Nigam Limited (BSNL) website, Indian Railways (IR) website, Income Tax Department (ITD) website, Tamil Nadu Electricity Board (TNEB) website, Tamil Nadu Government website (TNGW) and Anna University Website.

3. Analysis and Outcomes
3.1 Demographic and Background Information

As shown in figure 1, 63 percent of the study participants were male, while 37 percent were female. The highest percentage age group was 18-30 years old, with a percentage of 36 percent, followed by the age group (31-40) years old, with a percentage of 27 percent. The age group (51-65) years old and the age group (41-50) years old had percentages of 14 percent and 18 percent respectively. Finally the age group over 65 years old had percentage of 5 percent.

As for the position level of the participants, 27 percent of the sample was employees in the public sector same as 27 percent employees in private sector. Studying or in training came second with a percentage of 23 percent followed by self-employed with 14 percent and at the final place, retired users came up with a percentage of 9 percent. 45 percent of the participants had bachelor’s degrees followed by diploma, postgraduate and higher secondary options with percentages of 27 percent, 14 percent, 14 percent respectively.
3.2 Technology usage

As for the technology usage frequency figure 2 shows, using the Internet daily is 27 percent, weekly 32 percent, monthly and rarely 32 percent and 9 percent respectively. In addition, the self-declared level of the Internet expertise was 32 percent excellent, 36 percent good while fair and poor experience comprised 27 percent and 5 percent respectively. Regarding the level of using E-Governance websites, the results indicated that, often 27 percent, sometimes 55 percent, rarely 18 percent. As the users feeling were gathered when using the E-Governance websites, none of them responded excellent on comfortable to use E-Governance websites, 14 percent were responded good, 50 percent were fair and 36 percent were poor respectively.
3.3 Reliability Analysis

The level of consistency between multiple variables is data reliability [8],[9]. High reliability is determined if variables in the same measuring group are correlated within others. The commonest test for data reliability is Cronbach Alpha which determines how closely each variable is related to the remaining variable’s sum, using a multi-point scale for measuring consistency among individual items.

In this study, Cronbach Alpha Test was used to assess the data reliability. As shown in figure 3, the Cronbach Alpha value for perceivable principles was 0.82; operable was 0.76; understandable was 0.85; robust was 0.72 and for overall satisfaction 0.83. These alpha values are found to be above 0.70 and 0.80; such values are considered as acceptable and good according to Hair et al. [8].

![Reliability Analysis](image)

**Reliability Analysis**

<table>
<thead>
<tr>
<th>Alpha Value</th>
<th>Perceivable</th>
<th>Operable</th>
<th>Understandable</th>
<th>Robust</th>
<th>Overall Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha Value</td>
<td>0.82</td>
<td>0.76</td>
<td>0.85</td>
<td>0.72</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Figure 3 Reliability Analysis of WCAG 2.0 principles on user study

![Operable Features](image)

**Operable Features**

<table>
<thead>
<tr>
<th>Feature Description</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is easy to navigate from one page to another</td>
<td>3.82</td>
<td>0.997</td>
</tr>
<tr>
<td>It is easy to find the information which related to the task</td>
<td>3.67</td>
<td>1.072</td>
</tr>
<tr>
<td>Sometimes I fell confused about where I am, where I have been and where I want to go</td>
<td>3.46</td>
<td>1.036</td>
</tr>
<tr>
<td>Navigation menus is simple and straightforward</td>
<td>3.81</td>
<td>1.095</td>
</tr>
<tr>
<td>The links are easy to find (e.g. underlined text to indicate links)</td>
<td>3.33</td>
<td>1.088</td>
</tr>
<tr>
<td>Headings on the website clearly identify their target pages</td>
<td>3.49</td>
<td>0.963</td>
</tr>
<tr>
<td>There is a clear link back on each page lead to the homepage</td>
<td>3.39</td>
<td>1.002</td>
</tr>
<tr>
<td>Information about the often used services is easy to find</td>
<td>3.33</td>
<td>1.002</td>
</tr>
</tbody>
</table>
3.4 The Outcomes

Operable

The operable principle provides the guidelines about user’s ability to move through the website and find their way easily in order to get services and information with the ability of users to identify their location at any moment of the navigation.

As shown in figure 4, all the questions for operable features on Indian E-Governance websites scored above 3 mean (varying in between 3.33 to 3.82). These values are greater than the mean scale in five scale likert questionnaires form (1=strongly agree, 2= agree, 3=neutral, 4=disagree, 5=strongly disagree). Hence we can conclude the Indian E-Governance websites should improve the operable principle on websites.

Perceivable

Perceivable principle provides guidelines about information and user interface components of websites must be presentable to users in any ways they can perceive.

Figure 5 shows the mean and standard deviation score for the perceivable feature related questions, all the questions for perceivable features on Indian E-Governance websites scored above 3 mean (varying in between 3.14 to 3.96). As stated earlier in operable features, the values are greater than the mean scale in five scale likert questionnaires. This shows the presentation of Indian E-Governance websites should be improved to facilitate the disabled people to access them and the need for all people’s participation in E-Governance growth.

Understandable

Understandable provides guidelines about the information and the operation of user interface on websites must be understandable to all types of peoples including people with disabilities.
Figure 6 shows the mean and standard deviation score for the understandable features related questions, all the questions for understandable features on Indian E-Governance websites scored above 3 mean (varying in between 3.23 to 3.75). As stated earlier in operable features and perceivable features, the values are greater than the mean scale in five scale likert questionnaires. This shows the lack of user friendly design on Indian E-Governance websites for disabled people access.

Figure 6 Understandable Feature Questions and Their Scores

<table>
<thead>
<tr>
<th>Understandable Features</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site is free of unannounced pop-up windows</td>
<td>3.75</td>
<td>0.968</td>
</tr>
<tr>
<td>Separate Submit or Go buttons/links are provided to initiate page changes</td>
<td>3.48</td>
<td>1.061</td>
</tr>
<tr>
<td>Accuracy of internal search results was good</td>
<td>3.16</td>
<td>1.178</td>
</tr>
<tr>
<td>Navigation and labels are consistent across a website or application</td>
<td>3.53</td>
<td>1.128</td>
</tr>
<tr>
<td>Mechanisms are available to detect errors and provided clear instructions to users on fixing errors</td>
<td>3.23</td>
<td>1.143</td>
</tr>
</tbody>
</table>

Figure 6 Understandable Feature Questions and Their Scores

<table>
<thead>
<tr>
<th>Robust Features</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The website supported thin client access</td>
<td>3.78</td>
<td>1.172</td>
</tr>
<tr>
<td>The website functionality is good when accessing thin clients</td>
<td>3.32</td>
<td>1.168</td>
</tr>
<tr>
<td>The website supported screen reader access</td>
<td>3.21</td>
<td>1.128</td>
</tr>
<tr>
<td>The website supported to navigate through voice commands</td>
<td>3.24</td>
<td>1.109</td>
</tr>
<tr>
<td>The website supported by more than one language</td>
<td>3.29</td>
<td>1.169</td>
</tr>
</tbody>
</table>

Figure 7 Robust Feature Questions and Their Scores
Robust

Robust principle provides guidelines about the website compatibility to meet the direct needs and allow users to access the website with different user agents without losing any contents and flexibility of the website or in simple way the websites should support current and incoming technology based access.

Figure 7 shows the mean and standard deviation score for the robust features related questions, all the questions for robust features on Indian E-Governance websites scored above 3 mean (varying in between 3.21 to 3.73). As discussed on previous sections, the values are greater than the mean scale in five scale likert questionnaires. This shows that the lack of robust principle on Indian E-Governance websites for disabled people access. Because in India most of the people are using different thin clients to access the websites, thin clients is the affordable one in Indian economic environment. The thin clients don’t have features to customize server based application that is websites; so the E-Governance websites should be designed to customize the websites based on user’s requirements.

Overall Satisfaction

This section of questions are relating to the disabled peoples satisfaction about the selected E-Governance websites after completing the operable, perceivable, understandable and robust features questions. This includes how much the user like or dislikes using the website? (was it good or bad experience) does user recommend these websites to others? The aim is to find out what people think and feel about using a website.

Figure 8 shows the mean and standard deviation score for the overall satisfaction questions, all the questions for overall satisfaction about selected Indian E-Governance websites scored above 3 mean (varying in between 3.3 to 3.56). As discussed on previous sections, the values are greater than the mean scale in five scale likert questionnaires. This shows the participants of this study are not satisfied with the current designing of selected Indian E-Governance websites.

Overall Satisfaction

![Overall Satisfaction Graph](image_url)

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The website is easy to use (user-friendly)</td>
<td>3.31</td>
<td>1.022</td>
</tr>
<tr>
<td>I would like to use this website frequently</td>
<td>3.41</td>
<td>1.066</td>
</tr>
<tr>
<td>I will recommend this website to others</td>
<td>3.56</td>
<td>1.003</td>
</tr>
<tr>
<td>I felt comfortable using the website</td>
<td>3.51</td>
<td>0.996</td>
</tr>
<tr>
<td>It is easier to use the website rather than contacting other people for help</td>
<td>3.49</td>
<td>1.081</td>
</tr>
<tr>
<td>The overall impression of the website is good</td>
<td>3.3</td>
<td>0.917</td>
</tr>
</tbody>
</table>

Figure 8 Overall Satisfaction Questions and Their Scores

Selected Website’s Accessibility Principle Scores

As presented in figure 9, the TNPSC (Tamil Nadu Public Service Commission) website’s accessibility score is 3.284 and it is in the first place of accessibility mean score compared with other selected E-Governance
websites based on the end-users responses about the accessibility level. The AU (Anna University) website’s accessibility mean score is 3.82 and it is in the last place in accessibility level.

The UPSC website’s accessibility mean score is 3.446, IBD (Indian banking Details website’s accessibility mean score is 3.43, BSNL (Bharat Sanchar Nigam Limited) website’s accessibility mean score is 3.6, IR (Indian Railways) Website’s accessibility mean score is 3.4, ITD (Income Tax Department) website’s accessibility mean score is 3.6, TNEB (Tamil Nadu Electricity Board) websites accessibility mean score is 3.598, and TNGW (Tamil Nadu Government Website) website’s accessibility score is 3.522 respectively.

![Comparison of Mean](image)

**Comparison of Mean**

<table>
<thead>
<tr>
<th>Websites</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPSC</td>
<td>3.446</td>
</tr>
<tr>
<td>TNPSC</td>
<td>3.284</td>
</tr>
<tr>
<td>IBD</td>
<td>3.43</td>
</tr>
<tr>
<td>BSNL</td>
<td>3.6</td>
</tr>
<tr>
<td>IR</td>
<td>3.4</td>
</tr>
<tr>
<td>ITD</td>
<td>3.6</td>
</tr>
<tr>
<td>TNEB</td>
<td>3.598</td>
</tr>
<tr>
<td>TNGW</td>
<td>3.522</td>
</tr>
<tr>
<td>AU</td>
<td>3.82</td>
</tr>
</tbody>
</table>

Figure 9 Accessibility score of E-Governance websites from User’s perspective

4. Discussion

With reference to website’s accessibility for disable people access, it seems that a lack of awareness on web page developers and lack of clear accessibility guidelines for E-Governance websites has negatively affected the accessibility of E-Governance Government websites. Based on some signs from the outcomes, some examples in different websites have been identified.

- Regarding the perceivable principle on the tested websites, the research revealed that headings of some tested websites in India do not clearly identify their target pages (around the half of the participants at ITD and TNGW website), although the WCAG 2.0 stated that the information contained in any category should be reflected by descriptive and meaningful headings, that will help the disable people to quickly understand the concept, perform their work easily and saves the time of users by not diverting them to pointless destinations.

- In addition for better perusal of web interfaces the non text contents should have alternate text contents. Unfortunately almost all of the tested websites have images without alt text contents in all pages.

- In terms of the Operable principle, moving around the website, it was noticed that there is a need to improve the navigation system in order to let the users know where their locations are throughout the websites. The need comes as most of the participants felt confused about their location during the navigation. This was more obvious with the AU website, due to the navigation bar not appearing on some pages. It is worth mentioning that using the breadcrumb trail is one of the recommended techniques that help users keep track of where they are.

- Moreover the link back to the homepage, BSNL, AU, UPSC websites have option to go to the home page directly but all other websites (TNEB, IB, IR,TNPSC, TNGW and ITD) do not have the option to go to the home page. The AU website provided Navigation menu to go to the home page but in BSNL and UPSC website provided link to go to the home page.
Appropriate use of fonts gives the website more advantages and builds a positive impression. However, it was noticed that the fonts used in websites (TNEB, AU, IB, ITD, TNGW and IR) varied between 8.5 - 10 points. This does not meet W3C’s [6] recommendations for the default font size, which is at least 10-point (and 12-point if the website is used by elderly people), nor W3C’s [7] recommendation of at least 12-point on all web pages (and 14-point if the website is used by elderly users, to avoid eye strain and fatigue). This may be one of the reasons why users prefer to customize their individual preferences and needs. The TNPSC, BSNL and UPSC websites used the font size of 10-point and greater point values for texts, links and menus.

On the other hand, despite Maues Rodrigo de & Simone Diniz Junqueira Barbosa [5] pointed out that the characteristics of websites users must initially be identified and analyzed in order to meet their needs and expectations. However, it seems that one of the problems of Government websites in India is a failure to lack of meet user’s needs and expectations [3], [4]. Based on the outcomes, some signs have been revealed, such as:

- E-Governance websites in India should provide the users with the ability to customize some services without needing to ask for them. By giving this ability, users will meet their direct needs and preferences and facilitate their visiting to the websites in order to reach what they want as fast as they can. Although the IB websites have color contrast option, IR website have option for changing the text font size and TNGW website have both color contrast option and text font size option. But all other tested websites UPSC, TNEB, AU, ITD, BSNL and TNPSC, do not have a single option to customize the pages based on user needs. However, the majority who participated in the study pointed out that the websites should allow users to customize individual preferences and needs such as color, font, layout and background. This will helpful for improving the scannability and readability of E-Governance websites in order to accommodate every person (including people with special visual requirements).

- Next the different language support; the IR and UPSC websites have the option to change the contents in Hindi language, when choosing Hindi language half of the contents are displaying in English balance half of the contents are getting changed. The TNPSC website have the option to change the language as Tamil other tested websites do not have the option to change the language based on user needs.

- In addition, the Indian E-Governance websites having the problem of unannounced pop-up windows appearing when accessing the websites. Undoubtedly this will affect the disabled people access on Indian E-Governance websites.

- Moreover the research reveals that the need for help contents for better accessibility, if the help contents is available as a means so that the disabled people can easily access the information services.

- Furthermore, despite the fact that advanced search helps users to find what they are looking for quickly and saves time and effort, none of the Government websites offered an advanced search facility on their websites, although some websites pointed out that the accuracy of the internal search results was not good enough.

- Additionally, it can be identified that the accessibility of E-Governance websites in India has problems related to lack of testing and monitoring. This can be seen for example from the lack of accuracy of internal search results, as the study results revealed that the search accuracy in some websites was not good enough (and advanced search was unavailable). In addition, it can be seen that the non-availability of the navigation bar in some pages at BSNL and TNGW websites is due to lack of monitoring.

- Another main important principle is compatibility of websites, and unfortunately none of the websites was supported for different thin client access. But in PCs and Laptops this tested websites are giving little flexibility based on the interfacing applications used.

Another problem can be identified that there is a lack of involvement of end-users. Besides involving end-users from the inception of establishing websites, they can be effectively developed by getting and considering feedback from end-users (visitors of the websites) from functioning websites. Unfortunately, the entire tested website do not
offered the opportunity for users to leave feedback. This is another example of ignoring end-users even after the websites were established.

Interfaces play an important role in generating a positive reaction from the user [1]. However, some of the users who participated in the study did not like much the interfaces of the websites. It seems that the interfaces and layout in Indian E-Governance websites have been affected by poor standardization. The failure of India’s E-Governance project to achieve this could be due to the lack of a clear framework of collaboration and coordination between governmental agencies. This is confirmed by each of the tested websites having a different interface and layout.

Accessibility and usability has a significant effect on the degree of trust and satisfaction directly [2], [1]. A lack of trust/satisfaction might be involved in Indian E-Governance websites. This was noticed as there is a bit of hesitation among users to use the websites frequently, as well as to recommend the websites to others.

The E-Governance project management in India should focus on website’s accessibility and usability in order to improve user’s trust and satisfaction, because if websites fail to achieve that, the situation of E-Governance will be threatened with failure. The low quality and not meeting user’s needs in the websites play an important role in widening the gap in terms of trust and satisfaction between government websites and its users mainly disabled people in India.

Finally, because of the awareness and experience of the Internet, Indian E-Governance websites are considered unsatisfactory to people with disabilities who participated in the study. It was noticed that the level of using Internet among the participants is good. This leads to the assumption that users have visited lots of websites; therefore, E-Governance management in India should pay more attention to designing its websites in the accessible form for the whole citizens.

Conclusion

The importance of the accessibility of E-Governance websites has been raised increasingly over recent years. This paper presents the existing situation of the accessibility of E-Governance websites in India from some aspects related to the design of website interfaces. The study has concluded that lack of experience in developing accessible E-Governance websites in India reflects limited knowledge about user interfaces and lack of clear understanding about accessibility guidelines within the team responsible for the E-Governance project. This undoubtedly has a negative impact on the accessibility of Indian E-Governance websites.

The findings indicate that there are some barriers to the improvement of the accessibility of E-Governance websites in India such as lack of testing and monitoring, lack of involvement of end-users, lack of a clear framework of collaboration and coordination, poor standardization, lack of trust and lack of satisfaction. It is very important that E-Governance should pay more attention to those points to be addressed in order to ensure the provision of accessible E-Governance websites in India.

This study adds to the existing body of knowledge by identifying some main points that could help in improving the accessibility of E-Governance websites in India for future websites as well as it is useful not only from the perspective of improving Indian E-Governance services, but also to those of other developing countries which may share the same culture and situation.

References


