

# Investigating the Quality of local E-Government Websites Using Mixed Techniques: Web Diagnostic Tools and Manual Investigation

A. Basit Darem<sup>1</sup>, Suresha<sup>2</sup>

*DoS in Computer Science University of Mysore, India*

**Abstract**— Most people today cannot stand without the internet. It provides access to many things like news, email, shopping, and entertainment, at anytime and anywhere. Governments around the world have adopted internet as a channel to introduce their information and services to citizens, businesses and other government sectors. The government websites work as an interface between the government and people. It helps in introducing the concerned government agency/ department to citizens. This interface should have enough content elements, design elements, and reasonable speed to fulfil the citizens' demands. It also has to support the assistive technology to be accessible for people with disabilities. This paper investigates the status of current local government website at the district level in India. It tries to find out whether these websites comply with the guidelines for websites, and have the right elements. Mixed techniques of web diagnostic tools and manual investigation have been used in this study. The results show that local the government website at the district level in India does not have many important elements and components required for government website. It needs to be improved to serve the citizens better and allow them to have the best out of the best.

**Keywords**— : e-government, content elements, design elements, accessibility, online evaluation tools.

## I. INTRODUCTION

Desktop applications have limited users, so it can be an easy job to win the acceptance of these users. On the other hand, websites and web applications have different users that makes it difficult to win their acceptance. A web application can have more users than non-web application. Internet users make up their minds about the quality of a website in the blink of an eye. As e-government websites spread to connect government with citizens, it is important to have the right number of content elements, design elements, and reasonable speed to become usable and accessible by all citizens. Moreover, governments should design a website that will work with all categories of people with different backgrounds and abilities.

'Electronic Government' (or in short 'e-Government') is defined as 'The employment of the Internet and the world-wide-web for delivering government information and services to the citizens[26]. "E-Government" essentially refers to the utilization of Information Technology (IT), Information and Communication Technologies (ICTs), and other web-based telecommunication technologies to improve and/or enhance on the efficiency and effectiveness of service delivery in the

public sector [27]. In particular, e-government provides an effective means for all citizens to interact with large governmental sectors. According to Gauld et al. [8] governments around the world are motivated to promote public interaction because of the accessibility and affordability of ICTs. E-government development not only implements a new IT system but also aims to improve public service delivery, improve access to information and services, and increase government transparency and accountability [5][11]. The success of e-government depends upon the public desire to adopt this innovation [4][7]. Many governments still face the problem of a low-level of adoption of e-government services by their citizens[9][3]. On the other side, an e-government website that provides web access and support often does not offer the "potential to reach many users including those who live in remote areas, are homebound, have low literacy levels, exist on below poverty line incomes." [28]. Moreover, government websites should have many important sections and elements to introduce the information and services. It should be arranged in a proper way to prevent complexity and disorientation for the users. The identity of the organization in the website should be clear enough to gain the trust of the users. Regular updates, information about the agency, "contact us", sitemap, and many other website's sections must be included in the government websites.

Every webpage design has its own characteristics and these characteristics have drawbacks as well as benefits [25]. Without maintaining the balance between the webpage elements, this will lead to many problems like large size of webpage or using wrong components. Such problems will affect the download speed that represents an important factor for website success. It can also create an unwanted complexity for navigation and understandability. For that, it is an important part of an evaluation process to evaluate the number and type of website elements or components.

Research conducted by Andy King [31] can be used as a standard for performance measurement of quality. The download time, Number of component per page, and Webpage size in byte are Standards for the performance that can be used as a reference to categorize the tested webpage.

Table 1. Standard of the website performance

Factor	Quality Standard
Number of component per page	< 20 objects
Webpage loading time	< 20 second
Webpage size in byte	< 100K

Universal access in the information society means having an accessible webpage whose information is accessible to anyone [23]. Access to information on the web has been recognized as a human right by the UN Convention on the Rights of Persons with Disabilities (UNCPRD) [14]. As the World Wide Web has assumed an increasingly important role in providing government information and services, the need to extend these resources to the portion of the population with disabilities has become readily apparent[18]. Among the potential users of these resources are many disabled individuals. Widespread discrimination against them and their exclusion from mainstream society lead to extensive economic hardship and loss of their creative capabilities[17]. It is estimated that between 15% and 30% of the total general people (i.e. 750 million) in the world have functional disability to use technology tools [32]. This figure will increase due to some factors e.g. as we are growing older, most people experience a decrease in vision, hearing, physical abilities, and cognitive abilities [33].

The internet is one of the best things that ever happened to people with disabilities. It helps them to communicate with the world using different assistive technology that was built to help them in using internet. They can listen to any thing available on the internet using screen reader or read in the font size they can be able to see using screen magnifier. These technologies help people with disabilities not to rely on other people to read to them. Despite the web's great potential for people with disabilities, this potential is still largely unrealized by private and public sector. Some sites do not support the assistive technology like screen reader and screen magnifiers that can be used to help people with disabilities. The major categories of disability types are[2]:

- Hearing (e.g. deafness)
- Visual (e.g. Blindness, low vision, colour-blindness)
- Motor (e.g. inability to use a mouse, slow response time, limited fine motor control)
- Cognitive (e.g. learning disabilities, distractibility, inability to remember or focus on large amounts of information)

Each of the major categories of disabilities requires certain types of adaptations in the design of the web content. Most of the time, these adaptations benefit nearly everyone, not just people with disabilities. Almost everyone benefits from helpful illustrations, properly-organized content and clear navigation. Similarly, while captions are a necessity for deaf users, they can be helpful to others too including those who view a video without audio.

Making websites accessible to all users, regardless of ability or disability, is essential for businesses, and government agencies. Unfortunately, most website designers do not

include common accessibility features in their sites which would dramatically improve the user experience for customers using screen readers and other assistive technologies, mobile phone browsers, personal digital assistants, and even low-bandwidth connections[1]. Common problems include a lack of:

- Using image menus rather than text-based menus.
- Fluid layouts that easily adapt to different form factors.
- Well-organized tables with summaries that can be indexed by search engines.
- Tab order and "Skip navigation" links for clear navigation.
- Larger font sizes with relative values for low vision and older users.

To solve the usability and accessibility problems, innovative designs are being required for web developers to make their website more usable and accessible by everyone including people with disabilities [29]. The reasons for low accessibility level may be both technical and administrative. Technically, the means for achieving accessibility is not obvious to Web administrators and developers who are inexperienced in this area[18]. Administrative reasons for low accessibility could be due to the government agencies being not aware of accessibility or they do not bother about people with disabilities.

Developed countries take advantage from e-government services, but there is still much space for improvement[12]. The immediacy of the Web creates an immediate expectation of quality and rapid application delivery, but the technical complexities of a website and variances in the browser make testing and quality control more difficult, and in some ways, more subtle[25]. A number of e-government researches focuses on the supply side (e.g. government infrastructures and policies), and not on the demand side (the citizen's perspective). Some researchers[10][13] have indicated that the e-government literature ignores the fact that human beings have to use these systems.

This paper presents the results of an evaluation of the level of usability and accessibility of local government Websites in Karnataka state. This study investigates the sample websites to find out if these websites have the important sections and elements required for any government website. The study also measured the extent to which these sites were usable to all people and accessible to persons with disabilities, as defined by established Web accessibility standards. Therefore, it investigates whether the government websites conform to international accessibility guidelines W3C WCAG 1.0 [5] or not, and if not, what are the reasons behind that.

**The Web Accessibility Initiative Guidelines (WCAG)**

The Web Accessibility Initiative (WAI) was formed by the World Wide Web Consortium (W3C) in order to bring accessibility considerations into the technology development of the Web Consortium and to determine guidelines for accessible technology including web authoring and user agents (browsers). As Tim Berners-Lee, the inventor of the

Web, and the Director of the W3C conform that "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."

The first version of the authoring guidelines, the Web Content Accessibility Guidelines 1.0, became a W3C Recommendation on May 5, 1999. WAI checkpoints are prioritized with respect to severity, Priority 1 accessibility problems being the most significant and Priority 3 the least [19]. It consists of three priorities:

- Priority 1: issues *must* be fixed to provide the most basic level of accessibility. Web developers **must** satisfy these requirements; otherwise, it will be impossible for one or more groups to access the Web content. Conformance to this level is described as A.
- Priority 2: issues *should* be fixed to provide the minimum level of accessibility recommended by the EU. Web developers **should** satisfy these requirements, otherwise some groups will find it difficult to access the Web content. Conformance to this level is described as AA or *Double-A*.

	Greatest	Least	
	← Significance →		
W3C WAI Priority	1	2	3
	Must be satisfied	Should be satisfied	May be satisfied
Example	<i>Provide alternative text for images</i>	<i>Do not use tables for layout</i>	<i>Provide logical sequence for tab navigation</i>
Conformance Level	A Priority 1 satisfied	AA Priorities 1 & 2 satisfied	AAA Priorities 1, 2 & 3 satisfied

Figure 1. Accessibility priorities and corresponding site conformance levels.

- Priority 3: issues *may* be fixed to maximise accessibility. Web developers **may** satisfy these requirements, in order to make it easier for some groups to access the Web content. Conformance to this level is described as AAA or *Triple-A*.

Figure 1 illustrates the accessibility priorities and corresponding site conformance levels that were adopted from [18].

## II. SIGNIFICANCE OF STUDY

The challenge in delivering E-Government services is to design the websites in order to make it easier for citizens to find the desired information. However, current efforts on government website design mainly concentrate on website content, but few of them answer why some Websites are better than the other websites. Thus, this study will provide basis to the local governments in India to use the data and tools tested in this paper to improve their websites. Perhaps, the results of the study should be considered as benchmarks to improve weaknesses. Government agencies can also be benefited from the study, as they can know the extent of websites implementation and compliance with the guidelines. this investigation can add to the body of literature on the subject and provide a baseline for evaluation in subsequent studies.

## III. RESEARCH DESIGN

In this section, the procedure, sample, techniques and tools used in this research will be presented. The evaluation method used in this study consisted of an initial evaluation conducted manually and involving human judgment, and a second evaluation using automated software tools.

Twenty-six local government websites in Karnataka were selected for the purpose of this research because Karnataka was considered the leader in computer and IT. The evaluation was repeated three times during January 2010, January 2011 and January 2012 to find if there were any further improvements or changes. Unfortunately, there were no significant changes in the results during these three years. For this analysis, the results of 2012 evaluation were used.

### Procedure

Thus, this study has three phases. The first phase starts with the investigation of the sample websites to find out if these websites have the important sections and elements required for any government website. The second phase starts with the evaluation of website usability. This phase investigate the elements of the home page of each website using the available web diagnostic tools online ([www.websiteoptimization.com](http://www.websiteoptimization.com)). In the third Phase, the accessibility of these websites was evaluated with reference to the WCAG 1.0 using quantitative measures and automatic evaluation tools. Among the well-known guidelines for accessibility and usability is the Web Content Accessibility Guidelines 1.0 (WCAG 1.0) [30].

### Tools

It is a website performance tool and webpage speed analyzer online service. It provides a list of performance measured and reported by this service including total size, total objects and number of objects (HTML, images, CSS, scripts), and download times on a 56kbps and 128Kbs connections. The text information was presented in HTML file form. The non-text information content in the websites were categorized into four content groups: image, multimedia, applet/script, and CSS. The metrics used to rate the stages is shown in Table 2[31].

Table 2. Standard components of the website performance

Objects	Total Number of Objects			Total Size of Objects		
	good	caution	warning	good	caution	warning
All objects	1-11 objects	12-20 objects	>20 objects	1 - 100 K	>100 - 200 k	> 200 k
Images	1-10 image	11-20 image	>20 image	1- 50 k	> 50- 100 k	> 100k
CSS	1- 2 files	3- 5 files	> 6 files	0 - 8 k	> 8 - 20 k	> 20 k
HTML	1- 4 files	5- 5 files	> 6 files	1- 50 k	> 50- 100 k	> 100k
Multimedia	1- 2 files	3- 5 files	> 6 files	0 - 10 k	> 10 - 30 k	> 30 k
Script	1- 2 files	3- 5 files	> 6 files	0 - 8 k	> 8 - 20 k	> 20 k

*Accessibility Tools*

WCAG 1.0 is an internationally accepted standard consisting of 14 guidelines (www.w3.org/TR/WAI-WEBCONTENT) that provide specifications on how to develop an accessible webpage[20]. Web accessibility evaluation tools are software programs or online services that are used to check the website's accessibility level under web accessibility guidelines[17]. Automated software tools (e.g. AChecker, TAW) are available to help find accessibility flaws in websites before the websites are publicly posted. These tools work by crawling through the websites and identifying various coding violation, such as Hypertext Markup Language (HTML) or the absence of tags essential to assistive technologies. Information on webpages may be accessed directly or with the use of various assistive technologies. A website that is sufficiently flexible to be used by all of these assistive technologies is called an accessible website [22]. Assistive technologies are hardware or software or combination of both used by persons with disabilities to increase, maintain, and improve the functional capabilities in spite of their physical or mental impairments[17]. As WCAG 1.0 became the norm for web accessibility evaluation, various software tools have been developed to automatically evaluate websites based on WCAG 1.0[20]. The WCAG 1.0 web accessibility standards are focussed primarily on HTML accessibility. The authors used the TAW accessibility validation tool to analyze the homepage of each selected site. AChecker tool also used to find if there any significant difference in the results.

*A. TAW (Web Accessibility Test)*

TAW [15] was developed by the Spanish Fundación CTIC. This tool can be used as an online accessibility tool to check pages or as an offline stand-alone java application suitable for multiple platforms (i.e. Microsoft Windows, Mac OSX, Linux and Solaris). This tool analyses websites according to W3C Web Accessibility guidelines (WCAG 1.0 and WCAG 2.0) by providing fixes and recommendations. TAW results are presented with different representation of violations (problems, warnings, and not reviewed).

*B. AChecker*

AChecker[16] is an open source web accessibility evaluation tool developed by the Adaptive Technology Resource Centre

at the University of Toronto. It uses variety of international accessibility guidelines. The accessibility guidelines supported by AChecker are:

- 1- WCAG 1.0(International) Levels A, AA and AAA.
- 2- WCAG 2.0(International) Levels A, AA and AAA.
- 3- BITV 1.0 (Germany).
- 4- Section 508 (U.S.).
- 5- Stanca Act (Italy)

IV. RESULTS AND DISCUSSIONS

*Website sections*

The results of the websites inspection in Table 3 show that 15% of district websites in Karnataka ignore to present the identity of the district. Sixty-two percent did not put the logo in their homepage. Unfortunately, none of these websites has search facility, feedback section or introduces any kind of help to navigate the website. In addition, they did not have any type of connectivity with social networks and none of these websites provide user registration feature to have good interaction channel with the citizens. Six websites (23%) introduce themselves to citizens through “About us” section. One website has “FAQ” section and other one has “sitemap”. Two websites only introduce their websites’ interface in two languages, English and Kannada (Karnataka state language). Most of the websites did not update the information regularly or mentioned the last date of update except five websites (19%). Fifteen websites (58%) provided contact information with district officials and 23 websites provided an email or phone number to contact the webmaster. All websites ignored tracing the visitors or type of activities they are doing in the website. Only Elven websites provide vaster counter feature.

*Page elements*

The results in Table 4 have significant difference compared to the standards in Table 2. All the websites used only HTML files and images to present the information. They did not take the advantage of CSS to have the good style and format for the webpage except a few websites. The use of multimedia files (audio and video) are very less. In addition, only 4 websites maintain to keep the size of the homepage below than 100kb but unfortunately, two of them don’t have any content but only few links and menus. The developers of these websites did not balance the elements of the page to avoid the low download speed and navigation complexity.

Table 3 important sections in government websites

Website sections	Logo	Identity	Registration	About us	Social Connectivity	Feedback	Help	FAQ	Multi-Languages	Search	Sitemap	Statistic and Tracking information	Contact the Officials	Contact Webmaster	Last update
Count	10	22	0	6	0	0	0	1	2	0	1	11	15	23	5
Average	38%	85%	0%	23%	0%	0%	0%	4%	8%	0%	4%	42%	58%	88%	19%

Table 4 number of webpages' elements or components and size

No	URL	HTML		Images		JavaScript		CSS		Multimedia		Total Number of Objects( HTTP Requests)	Total Size of Objects in Kbs
		No of HTML files	HTML Size(Kb)	No of Images	Images Size(Kb)	No of Java Script Files	Java Script Size(Kb)	No of CSS Files	CSS Size(Kb)	No of Multimedia Files	Multimedia Size(Kb)		
1	www.bagalkot.nic.in/welcome.html	1	19.6	3	936.6	2	8.5					6	964.7
2	www.bangalorerural.nic.in	1	9.4	14	117.6	1	4.4			1	5.8	17	147.0
3	bangaloreurban.nic.in/	1	11.3	11	104.2							12	115.5
4	www.belgaum.nic.in	1	10.7	6	84.5							7	95.2
5	www.bellary.nic.in	1	11.7	17	345.8	1	1.6	3	7.0			22	366.1
6	www.bidar.nic.in	1	4.5	6	75.6	1	4.9	1	3.7			9	88.7
7	www.bijapur.nic.in	1	11.8	13	442.9			1	0.1			15	454.8
8	chamrajnagar.nic.in	1	50.1	2	223.0	2	7.4					5	280.6
9	www.chikballapur.nic.in	1	16.2	21	122.1			1	10.5			23	148.8
10	www.chickmagalur.nic.in	1	19.3	5	1211.3	5	23.1	3	1.5	1	782.4	15	2037.6
11	www.chitradurga.nic.in	1	12.2	11	144.8	2	1.9	1	8.5			15	167.4
12	www.dk.nic.in	4	34.1	23	0.0							27	34.1
13	www.dharwad.nic.in	1	15.7	8	89.5	3	16.8	1	0.8	2	1425.	15	1547.8
14	gadag.nic.in/gdnewsite/home.html	1	16.2	3	222.7					19	909.9	23	1148.8
15	www.gulbarga.nic.in	1	8.3	21	29.0	6	128.7	3	5.3			31	171.3
16	www.hassan.nic.in	1	22.8	8	115.3	1	1.0					10	139.1
17	haveri.nic.in	1	27.0	14	414.8			1	4.5			16	446.4
18	www.kodagu.nic.in	1	6.9	22	56.1	3	27.5	1	2.5			27	93.0
19	kolar.nic.in	1	7.1	6	100.3							7	107.4
20	www.koppal.nic.in	1	8.7	6	47.7			3	4.6	5	175.0	15	235.7
21	www.mandya.nic.in	1	10.9	18	109.5							19	120.4
22	www.mysore.nic.in	1	36.5	11	2059.4							12	2095.9
23	www.raichur.nic.in	1	9.8	4	204.8							5	214.6
24	www.shimoga.nic.in	1	21.5	3	14.4					4	139.5	8	175.4
25	uttarakannada.nic.in/	1	19.7	17	81.5	2	6.1	1	3.0			21	110.3
26	udupi.nic.in	1	2.7	6	9.8			1	09	2	20.6	10	34.0

Accessibility

Table 5 shows the number and percentage of sites achieving each approval level. As indicated, none of the evaluated websites rated Conformance Level A, B or C. There was no significant difference between the results using TAW online tool or AChecker online tool. More importantly, the most common accessibility errors can be easily fixed. As noted earlier, the most common error was the lack of text descriptions for graphic images. Consequently, the adoption

of accessibility standards by the local government tends to introduce new efficiencies for public and private sectors.

Table 5 results of accessibility test using TAW online tool

WCAG 1.0 Priorities	Priority 1	Priority 2	Priority 3
Average accessibility errors	9.35	91.8	5.4
SD	11.7	84.2	4.2
Max accessibility errors	60	349	17
Min accessibility errors	1	4	1
<b>Total website passed</b>	<b>0</b>	<b>0</b>	<b>0</b>

Mark-up validation and CSS Validation

No website passed the Mark-up validation test. Moreover, only nine websites used CSS, and 6 of them passed CSS validation test. The results are shown in Table 6.

Table 6 results of Mark-up and CSS validation using W3C validation tool

Validation	Mark-up Validation	CSS Validation
Total websites Passed the test	0	6
Average websites Passed the test	0	23%

Speed

Computer in 1968 in which it the minimum of ten seconds, is about the limit time for keeping user’s attention focused on navigating the site [24].

Table 7 results of size and download speed

No	URL	Home Page size in Kbs	Speed in 56K/s	ISDN 128K/s
1	www.bagalkot.nic.in/welcome.html	964.7	198.08 s	61.49 s
2	www.bangalorerural.nic.in	147.0	33.40 s	12.59 s
3	www.bangaloreurban.nic.in/	115.5	25.97 s	9.62 s
4	www.belgaum.nic.in	95.2	20.83 s	7.35 s
5	www.bellary.nic.in	366.1	79.12	27.28
6	www.bidar.nic.in	88.7	19.91 s	7.35 s
7	www.bijapur.nic.in	454.8	95.81 s	31.42 s
8	chamrajnagar.nic.in	280.6	58.26 s	18.53 s
9	www.chikballapur.nic.in	148.8	34.97 s	13.90 s
10	www.chickmagalur.nic.in	2037.6	418.84 s	130.35 s
11	www.chitradurga.nic.in	167.4	37.17 s	13.47 s
12	www.dk.nic.in	34.1	12.36 s	7.53 s
13	www.dharwad.nic.in	1547.8	318.87 s	99.73 s
14	gadag.nic.in/gdgnewsite/home.html	1148.8	239.05 s	76.33 s
15	www.gulbarga.nic.in	171.3	41.16 s	16.91 s
16	www.hassan.nic.in	139.1	30.59 s	10.90 s
17	haveri.nic.in	446.4	94.29 s	31.10 s
18	www.kodagu.nic.in	93.0	24.39 s	11.22 s
19	kolar.nic.in	107.4	23.33 s	8.11 s
20	www.koppal.nic.in	235.7	51.91 s	18.53 s
21	www.mandya.nic.in	120.4	28.37 s	11.32 s
22	www.mysore.nic.in	2095.9	430.13 s	133.39 s
23	www.raichur.nic.in	214.6	44.80 s	14.41 s
24	www.shimoga.nic.in	214.6	37.4	12.56
25	uttarakannada.nic.in/	175.4	26.7	11.09
26	bidupi.nic.in	110.3	8.94	4.13
<b>Total websites Passed the test</b>		<b>4</b>	<b>3</b>	<b>3</b>
<b>Average websites Passed the test</b>		<b>15%</b>	<b>11.5%</b>	<b>11.5%</b>

With the awareness of connection slowdown the users can wait up to 20 seconds to get frustrated. Table 7 shows the results of size and download speed. Only three websites manage to keep the download speed within the standard of in 56kbs.

V. CONCLUSIONS

In this research, the quality of Local governments’ websites was evaluated. It provides a clear picture about the status of

the local government websites in Karnataka. The results showed that the governments are neglecting the usability and accessibility criteria in the context of website design. It seems that they are not aware or do not bother to introduce their services to people with disabilities. Government websites should be more accessible and easier to use to ensure they meet all the current standards of accessibility and can be used effectively and efficiently by more satisfied users. There is a need to raise the level of awareness among the web designers and government administrators towards increasing the number of accesses and usable participation of all Indian citizens. Where appropriate, this study makes recommendations for improved site accessibility.

REFERENCES

- [1] Website Accessibility Analysis Service Ensures Compliance with Federal Law and WCAG Guidelines, 2010, available at <http://www.websiteoptimization.com/services/web-development/accessibility/>. Last access 13-06-2013.
- [2] Introduction to Web Accessibility, available at <http://webaim.org/intro/>. Last access 13-06-2013.
- [3] 4. F. Bélanger and L. Carter. Trust and Risk in E-government Adoption. *Journal of Strategic Information Systems* 17(2): 165-176, 2008.
- [4] 7. L. Carter and F. Bélanger. The Utilization of E-Government Services: Citizen Trust, Innovation and Acceptance Factors. *Information Systems Journal* 15(1), pp. 5-25, 2005.
- [5] 12. C. Ciborra and D. Navarra. Good Governance, Development Theory, and Aid Policy: Risks and Challenges of E-Government in Jordan. *Information Technology for Development* 11(2), pp. 141-159, 2005.
- [6] 16. Z.A. Ebrahim. The Adoption of E-Government in the Kingdom of Bahrain. *School of Information Systems, Computing and Mathematics: Brunel University*, 2005.
- [8] 20. R. Gauld, S. Goldfinch, S. and S. Horsburgh. Do They Want It? Do They Use It? The ‘Demand-Side’ of E-government in Australia and New Zealand’. *Government Information Quarterly* 27(2), pp. 177-186, 2010.
- [9] 23. B. Gupta, S. Dasgupta and A. Gupta. Adoption of ICT in a Government Organization in a Developing Country: An Empirical Study. *Journal of Strategic Information Systems* 17(2), pp. 140-154, 2008.
- [10] 26. R. Heeks and S. Bailur. Analyzing E-government Research: Perspectives, Philosophies, Theories, Methods, And Practice. *Government Information Quarterly* 24(2), pp. 243-265, 2007.
- [11] 53. L. Tung and O. Rieck. Adoption of Electronic Government Services among Business rganizations in Singapore. *Journal of Strategic Information Systems* 14(4), pp. 417-440, 2005.
- [12] 54. UN, 2010. United Nation E-Government Survey. Retrieved by <<http://unpan1.un.org/intradoc/groups/public/documents/UN-DPADM/UNPAN038853.pdf>>, [Accessed 15.01.2011].
- [13] 60. P. Verdegem and G. Verleye. User-centered E-Government in Practice: A comprehensive Model for Measuring User Satisfaction. *Government Information Quarterly* 26(3), pp. 487-497, 2009.
- [14] UN, “Convention & Optional Protocol Signatories & Ratification.” [Online]. Available: <http://www.un.org/disabilities/countries.asp?navid=17&pid=166>.
- [15] <http://www.tawdis.net/>
- [16] <http://achecker.ca>
- [17] Baowaly, Mrinal Kanti, and Moniruzzaman Bhuiyan. "Accessibility analysis and evaluation of Bangladesh government websites." *Informatics, Electronics & Vision (ICIEV), 2012 International Conference on.* IEEE, 2012.
- [18] Potter, Andrew. "Accessibility of Alabama government websites." *Journal of Government Information* 29.5 (2002): 303-317.
- [19] World Wide Web Consortium. (1999). Web content accessibility guidelines 1.0. Available at: <http://www.w3.org/TR/WAI-WEBCONTENT/>. Retrieved June 04, 20013.

- [20] Hong, Soongoo, Pairin Katerattanakul, and Dae-hyung Lee. "Evaluating government website accessibility: Software tool vs human experts." *Management Research News* 31.1 (2007): 27-40.
- [21] Abou-Zahra, S. (2006), "Managing and monitoring website accessibility", *Lecture Notes in Computer Science*, Vol. 4061, pp. 192-8.
- [22] Slatin, J. and Rush, S. (2003), *Maximum Accessibility: Making Your Website More Usable for Everyone*, Addison Wesley, Boston, MA.
- [23] Stephanidis, C. and Savidis, A. (2001), "Universal access in the information society: methods, tools, and interaction technologies", *International Journal of Universal Access in Information Society*, Vol. 1 No. 1, pp. 40-55.
- [24] Isa, Wan ARW Mohd, et al. "Assessing the usability and accessibility of Malaysia e-government website." *American Journal of Economics and Business Administration* 3.1 (2011): 40-46.
- [25] Jati, Handaru, and D. Durai Dominic. "Quality Evaluation of E-government Website Using Web Diagnostic Tools: Asian Case." *Information Management and Engineering, 2009. ICIME'09. International Conference on*. IEEE, 2009.
- [26] United Nations Department of Economic and Social Affairs. "United Nations E-Government Survey 2012". UN. Retrieved 2010-04-30.
- [27] Jeong Chun Hai @Ibrahim. (2007). *Fundamental of Development Administration*. Selangor: Scholar Press. ISBN 978-967-5-04508-0
- [28] Becker, Shirley A. PhD. "Bridging Literacy, Language, and Cultural Divides to Promote Universal Usability of E-Government Websites". Northern Arizona University. Retrieved 2009-03-03.
- [29] Lee, S., B.G. Kim and J.G. Kim, 2007. Accessibility Evaluation of Korean E-Government. In: *Universal Access in HCI, Part III*, C. Tephaniadis (Ed.). HCII 2007, LNCS 4556, Springer-Verlag Berlin Heidelberg, pp: 73-78. DOI: 10.1007/978-3-54073283-9\_9.
- [30] Robbins, J.N., 2006. *Web Design in a Nutshell*. 3<sup>rd</sup> Edn., O'Reilly Media, Inc, ISBN: 10: 0-59600987-9, pp:796.
- [31] King, Andrew B. *Speed up your site: website optimization*. New Riders Pub, 2003.
- [32] Chartbook on Disability in the U.S (1996), [Online], Available: [http://www.infouse.com/disabilitydata/disability/1\\_1.php](http://www.infouse.com/disabilitydata/disability/1_1.php).
- [33] Disability as a Function of Age (2001), July, [Online], Available: <http://trace.wisc.edu/docs/function-aging/>.