

# Website Readability, Accessibility and Site Security: A survey of University Websites in Punjab

Vishal Gupta<sup>1</sup> and Hardeep Singh<sup>2</sup>

<sup>1</sup> Guru Nanak Dev University, Amritsar Punjab 143001, INDIA

<sup>2</sup> Guru Nanak Dev University, Amritsar Punjab 143001, INDIA

## Abstract:

Websites have become a primary source of information for most universities. Users can share their relevant data, addresses, contact numbers, and even online fee transactions. Making the websites and web resources error-free for all users (abled/disabled), requires various actions on different parameters such as readability, accessibility, and security. The real target of this examination is to explore the readability, accessibility, and website security of 27 University Websites in Punjab (India). Flesch Reading Ease analyzed the contents of websites for readability. Accessibility analysis was carried out by the WAVE tool. The website security was measured for SSL secured by a website grader tool. Readability results suggested that only 3% of sites are easy to understand, 100% of websites were found with accessibility errors, and an SSL certificate did not secure 33% of websites. Based on these results, this study provides a clear view for website developers to improve the readability of contents, follow accessibility guidelines and provide proper security to users. So that the users feel safe while entering and accessing their valuable information on University Websites.

Keywords: Websites; Accessibility; Readability; Security; WCAG.

## 1. Introduction

The website plays a significant role in e-commerce, health, tutorials, entertainment, education, industries, and other aspects of life that use various internet technologies and e-apps as an effective channel to the target receiver. Websites are becoming the most critical communication channels where users expect to fulfill their requirements quickly and comfortably. University sites assume a significant job and go about as an interface between the college and the assorted scope of clients as they empower the dispersal of data to general society. The primary role of scholarly sites is to empower forthcoming understudies to find out about the foundation, courses offered, schedule of each course, prerequisites for affirmation, inquire about gatherings, and productions, profession guiding administrations, handicap administrations, library administrations, money related guides, work openings, arrangements, news refreshes [1]. With the rundown of administrations offered by these sites, the subject of its security and ease of use is significant [2]. The fantasy behind the web is to give a typical data space to correspondence and sharing assets regardless of handicap or some other limitations. As the requirement for data dispersal and the journey to stay focused and comprehensively noticeable builds, most universities and colleges around the globe currently have dynamic sites [3]. In [4], it was proposed to assemble the components influencing the nature of sites into six significant classes: (1) security and privacy; (2) usability; (3) content; (4) services; (5) citizen participation; and (6) features [5]. Web usability examination looks at the framework to be tried for ease of use issues in its structure and defines the seriousness of the ease of use issues and the general ease of use of a whole plan [6]. Another essential criterion for a university website is accessibility. As per the World Wide Web Consortium (W3C), web availability involves individuals with incapacities who can see, understand, explore and cooperate with the web. During inspection for accessibility, the layout, choice of colours, and browser compatibility are tested. Tests are led by principles for the plan of available Web content—the Web Content Accessibility Guidelines 2.0 (WCAG 2.0) as created by the W3C. Readability is likewise a significant part of assessing the accessibility of a webpage. The readability will be estimated utilizing different measurements.

Security is an essential point in university websites. To build up another trust model, the institutional framework must support integrity, authentication, and confidentiality to build up another trust model. Effective management of information security in university websites is an essential key factor of trust to various users like employees, businesses, citizens, and students while submitting their sensitive data (contact numbers, personal info, addresses. Your site also needs an SSL declaration certificate if you request any detailed personal information. Web crawlers are getting severe about saw 'non-secure' sites. In university sites, the consequences of such attacks can be tragic.

The primary target of this examination is to assess the accessibility, readability, and web security of 27 University Websites of Punjab using online evaluation tools to answer the following research questions. First, what is the readability score of 27 University Websites of Punjab? Second, what do university websites violate the immediate accessibility standards to find common problems? Third, do University Websites provide information security to their users and provide solutions to these problems?

## 2. Literature Review

So many surveys on university sites were organized to inspect accessibility and usability. However, significantly fewer outcomes are presently available for website readability and security. Akoglu et al. proposed a tool for retrieving the usability of the architectural department website at the University of Istanbul. The tool contains two parts; in level one, consumers can be accessed where they visit and answer the questionnaire about the site. Level two was constructed for the administrator usage, where the admin can manage the contents to evaluate the usability. Two environments are used for evaluation: traditional laboratory and internet environments [10]. S.N. Junaini reviewed whether the sites satisfy the accessibility and usability guidelines provided by WCAG. Various government and public universities were associated with various evaluation tools; lift and bobby. The study also thought about websites in terms of navigation design. The evaluation results showed that Malaysian universities were still very weak in usability, accessibility, and navigation [11]. Chiew et al. Focuses on developing web tool WEB USE consist of 24 questionnaires for usability evaluation. This tool shows how the better tool performs with usability. WEB-USE tool was suitable for all types of domains and websites. WEBUSE tool can assist web developers in improving the website response given by the visitors of the intended website [12]. Scowen G et al. evaluated e-learning sites against the checklist guidelines WCAG1.0. Five ranking evaluation tools were analyzed. The results define ALEXA and Google PageRank used for correlations with usability and found website popularity strongly compliance with usability. Google PageRank is used to achieve a higher page ranking. In general, ranking system results in positive correlations with each other and the usability of websites [13]. Suleiman H. Mustafa. evaluates the sites of Jordan's various universities from a usability perception. Automated tools are used for internal attributes like downloaded time error, HTML code, and HTML size error. Twenty-three questionnaires were designed and developed grounded on usability criteria; further distinguished into five sub-categories. Results show weakness in design and some aspects of performance [14]. Nasser M. Amaitik analysis the usability and evaluate the website I.T. faculty portal of the University of Benghazi. Online automated tools and questionnaire-based evaluation methods were used. In the first method, external attributes were used, and in the second method, internal attributes were used. The result shows that some aspects have been acceptable at the performance level. For others, suggestions are proposed for the quality of website usability [15]. S. A. Adepoju repositions various universities in Nigeria to validate both WCAG 1.0 and WCAG 2.0 using automated tools. Various websites evaluated using online evaluation tools show errors inherent in them according to accessibility guidelines [16]. Rita Ismailova 2015 investigates the accessibility, security, and usability parts of government locales in the Kyrgyz Republic. The analysis covered 55 websites of state data assets of the country and 5 government websites. Various automated evaluation tools do an evaluation. Evaluation metrics include no images, upload page size, page size, scripts, broken links, and response time duration. As a result, usability is a low priority, with 94.24 % and 44.23 % of websites having broken links [17]. S Kaur et al. define website quality assurance depends upon various automated tools that increase efficiency and decrease an individual website's cost. The performance and speed of a website are critical factors to its success. Evaluation through two usability automated testing tools, performance is measured based on speed, load time, no of requests, security, and overall page size of universities of Punjab [18]. Fortune B. Deedam et al. evaluate accessibility and usability. Various Automated tools are used to assess the conformance of 10 haphazardly chosen sites of state-possessed colleges in Nigeria. Results demonstrate that the destinations don't comply with the execution of (WCAG) 2.0 models [19]. B. Brucee in 1981[28], (Lange in 1982) [29], Connatser et al. (Connatser, 1999) [30], Misra (Misra et al., 2013) [31]. Ahmi & Mohamad in 2015, another investigation on websites accessibility examination on 20 universities of Malaysia was executed by using A checker, WAVE tool [32]. A few assessment strategies and techniques are utilized on Alabama public websites to refine their availability to a particular level [33]. S. Raj et al. investigated a large group of wellbeing (health) data sites in India. This investigation discovered 32 wellbeing data sites from 50 sites assessed as quality standards. Outcome found that only 03 sites have maximum LIDA points and just 05 sites have suggested 6th-grade category meaningfulness point [39].

## 3. Methodology

In our study, private, public, central, and deemed university websites were analyzed in India's Punjab state. "Web Addresses" of University webpages were gathered from the "University Grant Commission" website. Due to the best universities in the state, these 27 universities were selected for evaluation. Their homepages were examined for accessibility, readability, and security with various online evaluation tools. Table 1 shows the university type. The count shows the number of universities with 27 universities in Punjab (India), with 27 Universities in Punjab URLs under the U.G.C. website [8].

| University Type    | Name of Website  | URL   |
|--------------------|--|---|
| State Universities | Guru Nanak Dev University                              | <a href="http://online.gndu.ac.in/">http://online.gndu.ac.in/</a> |
|                    | Baba Farid University of Health Sciences               | <a href="http://www.bfuhs.ac.in/">http://www.bfuhs.ac.in/</a>     |
|                    | Guru Angad Dev Veterinary & Animal Sciences University | <a href="http://www.gadvasu.in/">http://www.gadvasu.in/</a>       |
|                    | Guru Ravidas Ayurved University                        | <a href="http://graupunjab.org/">http://graupunjab.org/</a>       |

|  |   |   |
|--|---|---|
|  | Maharaja Ranjit Singh Punjab Technical University             | <a href="http://www.mrsptu.ac.in/">http://www.mrsptu.ac.in/</a>                             |
|  | Punjab Agriculture University                                 | <a href="https://www.pau.edu/">https://www.pau.edu/</a>                                     |
|  | Punjab Technical University                                   | <a href="https://www.ptu.ac.in/">https://www.ptu.ac.in/</a>                                 |
|  | Punjabi University  | <a href="http://www.punjabiuniversity.ac.in/">http://www.punjabiuniversity.ac.in/</a>       |
|  | The Rajiv Gandhi National University of Law                   | <a href="http://www.rgnul.ac.in/">http://www.rgnul.ac.in/</a>                               |
| Central Universities                           | Central University of Punjab                                  | <a href="http://www.cpu.edu.in/">http://www.cpu.edu.in/</a>                                 |
| Private Universities                           | Adesh University  | <a href="http://adeshuniversity.ac.in/">http://adeshuniversity.ac.in/</a>                   |
|  | Akal University   | <a href="http://www.auts.ac.in/">www.auts.ac.in/</a>  |
|  | Chandigarh University   | <a href="http://www.cuchd.in/">http://www.cuchd.in/</a>                                     |
|  | Chitkara University   | <a href="http://www.chitkara.edu.in/">http://www.chitkara.edu.in/</a>                       |
|  | C.T. University   | <a href="http://www.ctuniversity.in/">http://www.ctuniversity.in/</a>                       |
|  | D.A.V University  | <a href="http://www.davuniversity.org">http://www.davuniversity.org</a>                     |
|  | Desh Bhagat University  | <a href="http://www.deshbhagatuniversity.in/">http://www.deshbhagatuniversity.in/</a>       |
|  | GNA University  | <a href="http://www.gnauniversity.edu.in/">http://www.gnauniversity.edu.in/</a>             |
|  | Guru Kashi University   | <a href="http://www.gurukashiuniversity.in/">http://www.gurukashiuniversity.in/</a>         |
|  | Lovely Professional University                                | <a href="http://www.lpu.in/">http://www.lpu.in/</a>   |
|  | Rayat Bahra University  | <a href="http://www.rayatbahrauniversity.edu.in">http://www.rayatbahrauniversity.edu.in</a> |
|  | RIMT University   | <a href="http://www.rimt.ac.in/">http://www.rimt.ac.in/</a>                                 |
|  | Sant Baba Bhag Singh University                               | <a href="http://www.sbbsuniversity.ac.in/">http://www.sbbsuniversity.ac.in/</a>             |
|  | Sri Guru Granth Sahib World University                        | <a href="http://sggswu.edu.in/">http://sggswu.edu.in/</a>                                   |
| Sri Guru Ram Das University of Health Sciences | <a href="https://www.sgrduhs.in/">https://www.sgrduhs.in/</a> |   |
| Deemed Universities                            | Sant Longowal Institute of Engineering & Technology           | <a href="http://www.sliet.ac.in/">http://www.sliet.ac.in/</a>                               |
|  | Thapar University   | <a href="http://thapar.edu.in/">http://thapar.edu.in/</a>                                   |

#### 4. Readability Analysis and Test tools

Different apparatuses are accessible for the assessment process for readability analysis of the website. In our study, we use this readability tool (<https://www.webfx.com/tools/read-able/>) which is accessible online, to examine the content readability of site pages in three distinct ways, 1) test with the help of a web address, 2) test using Direct Inputting and 3) test using Referrer. In this testing, we use the test by web address method for 27 state university sites of Punjab to examine the estimation score for readability using various intelligibility lists strategies. The following steps are involved while using the tool: 1. Pass URL in the given textbox and then start calculating readability. 2. Testing is based on several metrics: Number of words, Number of sentences, Number of complex words, the percentage of difficult words, an average of words in a particular sentence, and the average of syllables in an individual word. 3. On behalf of these metrics' readability, the Flesch-Kincaid Reading Ease score is calculated. The readability scores for 27 websites are shown in Table 2. The test result shows the readability score determined by Flesch Reading Ease on 27 University Websites of Punjab in Table3. The results indicate the understanding levels of text status, only 1 out of 27(3%) sites are very much easy to understand, 6 out of 27(22.22%) sites are pretty tricky, 18 out of 27(66.66%) sites are challenging to understand, 2 out of 27(7.4%) websites are very confused (typical) to understand. Table 2 represents various levels of text understanding levels according to their readability score.

| Sr. No. | Name of Website  | Flesch Reading Ease |
|---------|--|---------------------|
| 1       | Guru Nanak Dev University                              | 45.3                |
| 2       | Baba Farid University of Health Sciences               | 40.5                |
| 3       | Guru Angad Dev Veterinary & Animal Sciences University | 32.1                |
| 4       | Guru Ravidas Ayurved University                        | 43.3                |
| 5       | Maharaja Ranjit Singh Punjab Technical University      | 38.9                |
| 6       | Punjab Agriculture University                          | 47.9                |
| 7       | Punjab Technical University                            | 38.9                |
| 8       | Punjabi University                                     | 59                  |
| 9       | The Rajiv Gandhi National University of Law            | 35.4                |
| 10      | Central University of Punjab                           | 45.1                |
| 11      | Adesh University                                       | 43                  |
| 12      | Akal University  | 58.6                |
| 13      | Chandigarh University                                  | 52                  |
| 14      | Chitkara University                                    | 29.3                |
| 15      | CT University  | 36.2                |
| 16      | D.A.V University                                       | 52.4                |
| 17      | Desh Bhagat University                                 | 40.1                |
| 18      | GNA University   | 32.2                |
| 19      | Guru Kashi University                                  | 52.3                |
| 20      | Lovely Professional University                         | 45                  |
| 21      | Rayat Bahra University                                 | 42.6                |
| 22      | RIMT University  | 26.7                |
| 23      | Sant Baba Bhag Singh University                        | 121.2               |
| 24      | Sri Guru Granth Sahib World University                 | 49.1                |
| 25      | Sri Guru Ram Das University of Health Sciences         | 51.7                |
| 26      | Sant Longowal Institute of Engineering & Technology    | 40.2                |
| 27      | Thapar University                                      | 31.6                |

## 5. Accessibility Test Analysis & Tool

The web Accessibility Evaluation Tool is “WAVE”, created by WebAIM (Web Accessibility in Mind) and initially propelled in 2001. WAVE device identifies the accompanying highlights of a specific site in numbers to be specific Error, Feature, Structural Element, HTML5 and ARIA, Alerts, and Contrast-Error [55]. The following are errors that were found to be present in Table 3.

| Sr. No | Error Type  |
|--------|---|
| 1      | No alternate for image: Images without (alt) attribute            |
| 2      | No alt tag for image map: Images with blank "alt" attribute       |
| 3      | Invalid “longdesc”: Images that need a long description text      |
| 4      | Forms missing with labels: Form controls without associated label |
| 5      | Missing “title” attribute in frame                                |
| 6      | Reading the text on the move                                      |
| 7      | Blinking/ moving contents   |
| 8      | Different destination links with duplicate names                  |
| 9      | Document language missing   |
| 10     | The table header contains no text.                                |

The total number of errors present in 27 websites is categorized into 4 groups depending on the number of accessibility errors present, as given in Table 4.

| No. of Errors | University Websites | Percentage of Errors |
|---------------|---------------------|----------------------|
| 0             | 0                   | 100%                 |
| 1-100         | 02                  | 7.4%                 |
| 101-500       | 16                  | 59.2%                |
| More than 500 | 09                  | 33.3%                |

The accessibility assessment showed that 100% of University websites have accessibility errors and do not conform to WCAG 2.0. As it can be seen, 2 out of 27(7.4%) websites have errors less than 100, 16 out of 27(59.2%) have less than 500 errors and 09 out of 27(33.3%) have more than 500 errors in a website. Wave report for a total number of errors of 27 universities in Punjab is given in Table 5.

| WCAG 2.0     | Errors | Alerts | Features | Structural Elements | HTML5 & ARIA | Contrast Errors |
|--------------|--------|--------|----------|---------------------|--------------|-----------------|
| Total Errors | 1358   | 2849   | 1141     | 3692                | 2457         | 1435            |

## 6. Security Analysis and Test Tool

SSL is the establishment of our sheltered Internet. It verifies your sensitive information as it crosses the world's P.C. frameworks. Any P.C. between you and any server can see your card number, password, card CVV number, and even your username and other unstable information if your details, card numbers, and personal details are not encoded with a Secure Socket Layer certificate [56]. SSL certificates protect websites from attacks and give visitors confidence that your site is authentic and trustworthy. In addition, we use the website grader tool for security analysis of university websites [57], which is available online to check whether the website is secured. The website grader tool is a free online tool. This tool grades your website against key metrics like performance, mobile readiness, search engine optimization (SEO) and security. Under the security metrics, this tool checks for an SSL certificate for the website. For security testing, a test by web address method is used for 27 state university sites of Punjab to check the security of the websites. The result shows that 09 out of 27(33.3%) websites were not secured, and 18 out of 27(66.6%) websites were secured by an SSL certificate. Figure 3 represents the websites with SSL certificated and Non-SSL certified websites, which gives intruders an open invitation to access our sensitive data quickly. Moreover, non-SSL certified websites lower users' trust and willingness to use university websites.

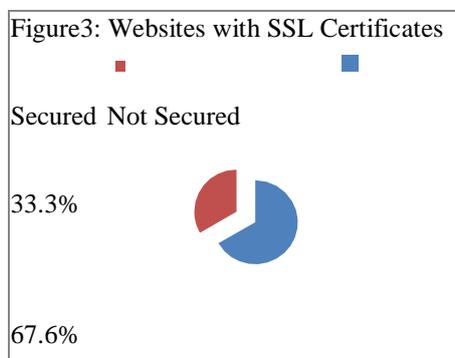


Fig. 3 Websites with SSL Certificates

## 7. Comparative Analysis

Examination of site accessibility and readability were the main fields of research. The investigations have been directed throughout the number of years to evaluate the accessibility and readability of website contents to an individual with incapacities. Inside this segment, the very close investigation is executed with two previous essential examinations: An investigation led to

gauge the availability of 344(302 states, 42 Central) Indian Universities [26]. An examination led to gauge accessibility inspection of twenty Malaysian Universities [32]. These two investigations are picked for examination; the main goal is an arrangement with the examination exhibited in our survey. Comparison analysis is represented in Table 6, which shows the comparison results of surveys using fourteen distinct metrics. The Indian Universities' homepages accessibility survey database examines state 302 and central 42 universities [26]. Malaysian university analysis invoked 20 universities [32].

WCAG standards have been adopted in all three studies. Wave tool was an important tool utilized by numerous accessibility surveys. Furthermore, the accessibility mistakes in the Universities of Punjab homepages show a comparatively massive number of mistakes. Regarding quantities of accessibility mistakes (errors), the Universities of Punjab's home pages have indicated enormous mistakes. This fills as an essential pointer for taking fundamental actions immediately to make these pages progressively comprehensive. At that time, in the study of Malaysian Universities [32], two university sites were watched with zero errors. But now, in this current investigation, we were engaged to find any website with zero mistakes. Making a site reach this target will be set as a needed task for creating the web pages free from errors for the individuals who have inabilities. We added the security measures in the readability and accessibility assessment process in this examination. We were not able to find any security investigation in different examinations. In our investigation, SSL certification for university webpages was seen as 33.3% of websites were not secured. A measure needs to be taken to increase the security of the websites so that users will feel safe about entering personal data, such as their email addresses, credit card numbers, contact numbers, and their home address.

| Study Metrics             | Ahmi & Mohamad         | Abid Ismail                   | Our Study  |
|---------------------------|------------------------|-------------------------------|--|
| Data Set                  | Malaysian Universities | Indian Universities           | Punjab Universities                                  |
| Sites Count               | 20                     | 344 (State: 302; Central: 42) | 27 (State: 09; Central: 01; Private: 15; Deemed: 02) |
| Accessibility Standards   | WCAG2.0                | WCAG2.0                       | WCAG2.0  |
| Tools for Evaluation      | AChecker, Wave         | AChecker, Wave                | Wave, Grader   |
| Errors                    | 282                    | 498                           | 1358   |
| Alerts                    | 1592                   | 1340                          | 2847   |
| Features                  | 1120                   | 659                           | 1141   |
| Structural Elements       | 1355                   | 660                           | 3692   |
| HTML5 & ARIA              | 445                    | 167                           | 2457   |
| Contrast Errors           | 751                    | 708                           | 1435   |
| Total Errors              | 5545                   | 4032                          | 12930  |
| University without errors | 02                     | 0                             | 0  |
| Readability Test          | No                     | Gunning Fog                   | Flesch Reading Ease & F.K. Grade Level Test          |
| Security Test             | No                     | No                            | SSL security with Grader Tool                        |

## 8. Discussion

In this work, University sites have been assessed using demonstrative web apparatuses. Examinations were led in 3 measurements Readability, security, and accessibility. Particular online tests estimated individual measurement. In section 4, we utilized readability equations to compute the clarity score of 27 University websites in Punjab. The results indicate that 3% of sites are straightforward, 22.22% of sites are pretty tricky, 66.66% of sites are complex, and 7.4% of sites are very-confused (typical) to understand. The average score was 45, indicating that websites are challenging to understand. A (65 or more) score is considered for better understanding. In general readability score of these sites was too low, which means these websites were difficult to understand. To accomplish better outcomes regarding readability, the websites need to be appropriately improved. In segment 5, we utilized a website accessibility assessment apparatus to examine the accessibility points (score), particularly for these sites regarding WCAG rules. The accessibility assessment showed that 100% of University websites have accessibility errors and do not conform to W3C (WCAG 2.0). Errors observed during the analysis: no alternate for image, no alt tag for image map, images that require a long description, form missing with the label, missing "title" attribute in frames, reading texts on the move, multiple destination links with the same name. Thus, during development, improvement has to be made to make University websites

usable, more accessible and convenient to use by their users. To get better results, website engineers and programmers should concentrate on the primarily targeted points to accomplish website accessibility in a superior manner. Furthermore, the assessment devices progressively progress to beat the present issues we face during the examination of information. In section 6, the main security concern about University websites is that 33.3% of websites were not secured. In comparison, 66.6% of websites were secured by SSL certificates. University sites are often the target of hackers. If an attacker takes advantage of these weaknesses, it could simplify the attack. Therefore, website developers should ensure that passwords are encrypted over HTTP. There is proper input validation to safeguard websites against different types of attacks. Websites must be SSL secured for securing the information of a particular student, employee and further transactions on the websites.

## 9. Conclusion and Future Directions

This survey has introduced an investigation of 27 University sites in Punjab, with measurements, for example, readability, accessibility, and security. The general target is to measure the website readability, accessibility and web security with various online tools. This work shows a need to refine the readability, accessibility, and security of University websites. It saves all kinds of users (average users and disabled users). It was seen that the readability measures of these sites were not in an acceptable range. There is a strong need to manage the contents of the websites so that the websites are easily readable by any user. Concerning accessibility, evaluation with the WAVE tool, it was seen that the accessibility rank of these websites should be improved further with the goal that all clients will get the contents. The third measurement and a central point in empowering the site to arrive at a vast gathering of clients and to make surety of safety while entering their information on their website, it was observed that the security of these University websites is given a low priority. There is a need to improve the security of these websites at the development level. Hence, our valuable data remains secure at every end. The overall conclusion derived from this study is: In today's time, there are vast amounts of resources available nowadays if a website didn't found secure, accessible and readable, that website becomes invisible and cannot be accessed by a large number of abled and disabled users. All three dimensions of readability, accessibility and security should be given legitimate need in making web assets Globally Reachable. Great effort is needed for University websites residing in Punjab to improve readability, accessibility and website security.

## Acknowledgements

No funding has been received for this work

## Conflict of interest

The authors declare that there is no conflict of interest in this paper.

## References

- [1] Bernier, M. Barchein, A., Canas, C. GomezValenzuela and Merelo, J. J.(2002). The Services a University website should offer. *Journal of Information Society and Education: Monitoring a Revolution*, (9):1746- 1750
- [2] Shivashankar, M.M.S and Choudhary M. A. 2014 Study of usability of Indian Websites. *An International Journal of Engineering Research and Technology* 3(4)
- [3] Sukhpal K (2012) An Automated tool for website evaluation, *International Journal of Computer Science and Information Technology*. 3 (3):4310- 4312.
- [4] Henriksson, A., Yi, Y., Frost, B., Middleton, M.: Evaluation instrument for e-government websites. *Electron. Gov. Int. J.* 4(2), 204–226 (2007)
- [5] Nielsen, J.: Usability inspection methods. In: *Conference Companion on Human Factors in Computing Systems*, pp. 413–414. A.C.M. (1994, April)
- [6] Nielson, J.: *Designing Web Usability*, 1st edn, p. 419. New Riders Publishing, ISBN-13: 978-1562058104 (2000)
- [7] <https://www.namecheap.com/security/do-i-need-ssl-certificate>.
- [8] <https://www.ugc.ac.in/>
- [9] Idler, S. (2012). URL: <http://blog.usabilla.com/8-guidelines-for-better-readability-on-the-web/>.
- [10] Akoglu: Usability Evaluation: A Method for A Specific Field, Yildiz Technical University, Istanbul, Turkey.
- [11] S. N. Junaini: Second National Conference on Cognitive Science C.S.C., Kuching, Sarawak, Malaysia, pp.181-18, 2002.
- [12] CHIEW, Thiam Kian; SALIM, Siti Salwa. WEB USE: Website Usability Evaluation Tool. *Malaysian Journal of Computer Science*, [S.l.], v. 16, n. 1, p. 47-57, June 2003. ISSN 0127-9084
- [13] G. Scowen: Increased Website Popularity through Compliance with Usability Guidelines.
- [14] Mustafa S. H, and Al-Zou'bi. L.F, "Usability of the Academic Websites of Jordan's Universities An Evaluation Study". In

Proceedings of the 9th International Arab Conference for Information Technology, pp.31-40., December 2008.

- [15] M. A. Nasser and M. J. El-Sahli: An evaluation of the usability of its faculty educational portal at University of Benghazi, World Academy of Science, Engineering and Technology, Volume 7, 2013.
- [16] Adepoju and Shehu: Usability evaluation of academic websites using automated tools. In User Science and Engineering. 3rd International Conference on (pp. 36-191). <https://doi.org/10.1109/IUSER.2014.7002700>.
- [17] Rita Ismailova: <https://link.springer.com/article/10.1007/s10209-015-0446-8>, <https://doi.org/10.1007/s10209-015-0446-8>.
- [18] S. Kaur: An Empirical Performance Evaluation of Universities Website. <https://doi.org/10.5120/ijca2016910922>.
- [19] Fortune B. Deedam, Enefa-a Thomas and Onate E. Taylor: <http://www.ijettjournal.org/2018/volume-56/number-1/IJETT-V56P206.pdf>.
- [20] Zaphiris, P., Ellis, R.D., 2001. Website usability and content accessibility of the top U.S.A. universities. In: WebNet, pp. 1380–1385.
- [21] E. N. Asiimwe and N. Lim, “Usability of Government Websites in Uganda,” *Electron. J. e-Government*, vol. 8, no. 1, pp. 1–12, 2010
- [22] C. Study, “Usability of E-government Portals in China.”
- [23] Y. B. Kim, “Accessibility and usability of user-centric web interaction with a unified-ubiquitous name-based directory service,” *World Wide Web*, vol. 13, no. 1–2, pp. 105–120, 2010.
- [24] M. Katre, Dinesh and Gupta, “Expert usability evaluation of 28 state government web portals of India,” *Int. J. Public Inf. Syst.*, vol. 7, no. 3, 2011
- [25] A. Abanumy, A. Al-badi, and P. Mayhew, “eGovernment Website Accessibility: In-Depth Evaluation of Saudi Arabia and Oman,” *Electron. J. e-Government*, vol. 3, no. 3, pp. 99–106, 2005.
- [26] Ismail, A., & Kuppusamy, K. S. (2016). Accessibility of indian universities homepages: An exploratory study. *Journal of King Saud University-Computer and Information Sciences*.
- [27] Manzo, A. V. (1970). Readability: A postscript. *Elementary English*, 47, 962–965.
- [28] Bruce, B., Rubin, A., & Starr, K. (1981). Why readability formulas fail(readingeducationreportno.28).urbana: Universityofillinois at urbana-cham-paign. Center for the Study of Reading
- [29] Lange, B. (1982). *Eric/rcs: Readability formulas: Second looks, second thoughts. The reading teacher*, 35, 858–861.
- [30] Connatser, B. R. (1999). Last rites for readability formulas in technical communication. *Journal of technical writing and communication*, 29, 271–287.
- [31] Misra, P., Agarwal, N., Kasabwala, K., Hansberry, D. R., Setzen, M., & Eloy, J. A. (2013). Readability analysis of healthcare- oriented education resources from the american academy of facial plastic and reconstructive surgery. *The Laryngoscope*, 123, 90–96
- [32] Ahmi, A., & Mohamad, R. (2015). Webaccessibilityofthemalaysian public university websites. In *Proceedings of International Conference on E-Commerce* (pp. 171–177).
- [33] Potter, A., 2002. Accessibility of alabama government web sites. J.
- [34] Bohman, P., 2003. University web accessibility policies: a bridge not quite far enough, Retrieved April 19, 2006.
- [35] Hackett, S., Parmanto, B., Zeng, X., 2004. Accessibility of internet websites through time. In: *ACM SIGACCESS Accessibility Com-puting*, 77–78. A.C.M., pp. 32–39.
- [36] Hanson, V.L., Richards, J.T., 2013. Progress on website accessibility? A.C.M. *Trans. Web (TWEB)* 7, 2.
- [37] West, D., 2008. State and federal electronic government in the united states, 2008.
- [38] Tahani, A., Steve, D., 2016. An evaluation of the accessibility of top-ranking university websites:accessibility rates from 2005 to 2015. In: *Proceedings of the DEANZ2016 Conference DEANZ2016*, pp. 224–233.
- [39] Raj, S., Sharma, V., Singh, A., & Goel, S. (2016). Evaluation of quality and readability of health information websites identified through indias major search engines. *Advances in preventive medicine*, 2016
- [40] Eika, E. (2016). Universally designed text on the web: Towards readability criteria based on anti-patterns. *Studies in health technology and informatics*, 229, 461
- [41] Sinha, M., & Basu, A. (2014). A study of readability of texts in bangla through machine learning approaches. *Education and Information Technologies*, (pp. 1–24).
- [42] A. Kaur and D. Dani, “Banking websites in India: an accessibility evaluation,” *C.S.I. Trans. I.C.T.*, vol. 2, no. 1, pp. 23–34, 2014.
- [43] V. Moen and A. N. Klingsheim, “Vulnerabilities in e-governments Kent Inge Fagerland Simonsen and,” *security*, vol. 1, no. 1,

pp. 89–100, 2007.

- [44] Choudrie, J., Ghinea, G., Weerakkody, V.: Evaluating global e-government sites: a view using web diagnostics tools. In: Academic Conferences International (2004).
- [45] Moen, V., Klingsheim, A.N., Simonsen, K.I.F., Hole, K.J.: Vulnerabilities in e-governments. *Int. J. Electron. Secur. Digit. Forensics* 1(1), 89–100 (2007)
- [46] J. Ouoba, D. Ahmat, B. Cedric, M. Bikienga, A. Sere, and O. Si, “Vulnerabilities of Government Websites in a Developing Country – The Case of Burkina Faso e To cite this version :,” no. *Africomm* 2015, pp. 11–14.
- [47] <https://www.webfx.com/tools/read-able/flesch-kincaid.html>
- [48] <https://readable.com/readability/#goodscore>.
- [49] Hargrave DR, Hargrave UA, Bouffet E. Quality of health information on the Internet in pediatric neuro-oncology. *Neuro Oncol* 2006;8:175–82.
- [50] <https://www.webfx.com/tools/read-able/>accessed August 22, 2019.
- [51] <https://ugc.ac.in/stateuniversitylist.aspx?id=28&Unitype=2>
- [52] <https://ugc.ac.in/centraluniversitylist.aspx?id=28&Unitype=1>
- [53] <https://ugc.ac.in/privateuniversitylist.aspx?id=28&Unitype=3>.
- [54] <https://www.ugc.ac.in/deemeduniversitylist.aspx?id=28&Unitype=4>
- [55] <http://wave.webaim.org/> accessed September 10, 2019.
- [56] <https://www.sslshopper.com/why-ssl-the-purpose-of-using-ssl-certificates.html>.
- [57] <https://website.grader.com/>