

Accessibility and Usability Issues in Web Based Citizen Services in Pakistan

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Abstract

The Internet has now become an integral aspect of people's lives. Everyone wants to access their required information with ease through the internet. Especially disabled people have the equal right to retrieve all the information that is publicly available. The government also provides information through websites that help their citizens to access it with ease but it affects mostly disabled people if it has accessibility issues. The objective of the paper was to identify accessibility issues in different online services. A framework is developed based on WCAG guidelines. The websites were evaluated on the basis of evaluation framework. The results of the study are useful for developers and policy makers in online service improvements. Accessibility and usability issues in web-based citizen services were identified. Each website was checked for loading time, Performance, Mobile-friendliness, General Errors, Contrast errors, Alerts and ARIA errors by using online testing tools. The findings reveal that the majority of websites are not developed in accordance with the standard which makes information inaccessible for disabled especially low vision persons.

Key words: Web Accessibility, Web Usability, WCAG, Mobile-friendliness

Introduction

The use of the web in the present time is essential for day-to-day life. It has gradually altered the path governments strive to give facility to their customers. The governments provide facilities to their citizens at their convenience using online services which develop the concept of e-government (Bakhsh & Mehmood, 2012). E-government can be defined as the process by which the government can provide their services with ease to their citizens using the internet. Every citizen has an equal right to access all the information available and all the content must be equally accessible (Gambino, Pirrone, & Di Giorgio, 2016). Access to e-government services through Web interfaces has the right of every citizen

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so during the development of projects, especially in a government project. At the stage of development of every project, the government must consider and keep in mind that all their services must be accessible to all citizens (Middleton, 2007). Web accessibility means that persons with any sort of inability also have the equal right to access the available content. As described by World Wide Web Consortium (W3C), accessing all the available data is the right of all people especially those who have any sort of disability so all the information available online must be fully available and accessible for all. Accessibility means the checking of the content available on the website based on different standards and to ensure and identify and highlight all the mistakes which must be needed to correct.

Many factors help us to create an accessible website or to make accessibility high. Making your site accessible to as many people as possible. Traditionally we think of people with disabilities, but it also helps other groups when your sites are accessible and they access it easily. Now a day's most people use smartphones and they prefer to access the available information using their smartphone so your website must also be mobile-friendly. Those who want to access it using their smartphone must also have to access all the available content accurately and when all the content on the website adjusts according to the mobile screen size it means that your website is mobile-friendly. The loading speed of the website must also be fast which means that the content must be loaded faster because those who have any network connectivity problem must also access all the information available on your site so when the website loads fast it will also help those people and they can take benefit from it (Caldwell et al., 2008).

Accessibility means making web content accessible to all especially for people who have some disabilities can also have the right to understand, comprehend, visit and interact with the content available on public websites. Whereas usability focuses on designing such products which are efficient and satisfying if the customer accesses all the information easily then understands how to use the available services which give birth to usability and it satisfies the customers and fulfills their need and usability is also a measure of the extent to which a particular user in a particular context can effectively, efficiently and satisfactorily use the product and developers design such product to achieve a set goal. Usability not only deals with the interface layout, but also with the technical level of the whole system and usability also reflects the human aspect, and it is tested by performing various checkpoints according to the given standard guidelines (Caldwell et al., 2008). Web usage is increasing day-by-day and everyone wants to access their required information with ease and save their time so

they prefer to get all their required information through the use of the web online with a few clicks.

Every individual, as well as especially disabled people, will use the content available on public websites. But problem is that the developer does not follow the standards and develop the system which gives birth to many problems for all people especially for some special case people because they cannot then access the content and are unable to take advantage of such systems, so the evaluation of the system is important to identify the accessibility issues and give suggestions to make the web contact accessible for everyone (Khan, Adnan, & Bakhsh, 2013).

Major issues in the systems are the majority of the government site did not even follow the basic guideline defined by WCAG or W3C. When the developer did not follow the available standard accessibility guidelines then the site has accessibility and usability issues which deprived many groups of the society to access it. Usability means making the product efficient and also making it satisfactory which satisfies the user of your website. Usability also includes general detail that affects everyone and does not disproportionately affect people with disabilities so during the development stage must also keep in mind that the usability of the site must be high. When the developer designs the system, they cannot keep in mind that this website must also be used by disable people so during the projects the developer must consider it, they must consider the standard guideline and make the website according to the standard which means they must have to make the content accessible by adhering to the accessibility guidelines so disable people also get benefit from the system and will access the services and take benefit from it (Bakhsh, Mehmood, & Khattak, 2013).

Literature Review

Many studies have been conducted to determine the accessibility and usability of various websites and to check whether they meet the standard guidelines or not and also to show and point out the problematic area where problems are existing in terms of accessibility which needs further improvements to make the accessibility high and the user will use and access the sites easily. Below are some of the studies which are carried out to measure and identify the usability and accessibility issues in the existing system (Bakhsh & Mehmood, 2012). Accessibility Evaluation of Library Websites in Pakistan for People with Disability are validated using one online tool. If we use 3-4 online tools, then result in inaccuracy will be increased (Idrees & Mudassir, 2015). Evaluation of three famous Arabic e-commerce sites i.e. SOUQ, HARAJ and NAMSHI were made by

using five online automated tools, the sample was limited (Alshamari, 2016). Northern European tourism websites are validated using ten online automated tools and the result show that Norway's tourism website, Sweden, Iceland, the United Kingdom and Germany has a maximum figure of warnings which need further improvement (Domínguez Vila, Alén González, & Darcy, 2019).

Thirty four websites of territorial e-government websites of Indonesia with two accessibility evaluation tools with results that WCAG guidelines were not fully followed (Darmaputra, Wijaya, & Ayu, 2017). Evaluation of state and local government sites of Turkey were made by using online tools with sufficient sample and accessibility, usability and quality were tested (Akgül, 2019). In a similar study Malaysian ministries websites accessibility were evaluated based on two automated tools (Ahmi & Mohamad, 2016). The municipality services websites were evaluated by using three online tools with respect to quality and accessibility (Inal & Ismailova, 2019).

China and Pakistan government sites were evaluated for usability and accessibility problems by using online and off-line testing tools on the basis of a framework (Bakhsh, M. & Mahmood, 2012 and Bilal et al, 2019). Validation of Palestinian universities website using three online tools were made using online testing tools (Hassouna & Sahari, 2014). Randomly selected twenty websites of Bangladesh government were evaluated on the basis of WCAG 2.0 guidelines using ten online tools (Ahmed, Yan, Islam, & Sunny). Commercial banks websites in Pakistan were evaluated for accessibility issues with well-defined framework by using two tools only (Khan et al.). Evaluation of World's Top Twenty Terrestrial Mobile Phone Network Operators websites and Pakistani banks web portals were made using two online accessibility tools (Bakhsh et al., 2013).

The existing literature shows that many studies have been carried out all around the world to assess the accessibility and usability of websites through the use of different online tools to identify the issues which may provide guidelines for improvement according to the standard of accessibility and to make the content accessible to all means everyone especially disable people also have the equal right to access all the available information and take benefit from it.

The results of the studies show that there are still have many problems in the existing systems which need further improvement to fulfill the basic criteria of the standards and make the websites accessibility high which helps everyone to use the sites and access all the information (Bakhsh et al., 2013). As the use of the internet increases, day by day and

Government websites contain public information for all society government prefer to convey their information through electronic media and a large population retrieving that information. But the problem is when the content available on the internet, especially on the government website, does not follow the standard accessibility guide line's which give birth to accessibility issues and a large sector of the population are deprived to retrieve data from government official websites (Bakhsh & Mehmood, 2012).

The objective of this study is to figure out and identify the accessibility and usability issues in citizen services provided by the KP government. All these issues make a barrier for the citizens especially for persons with disabilities to access the online government services. Once all these accessibility issues are resolved according to WCAG guidelines then it will help the developer and organizations to make the content accessible for all, especially for disabled persons.

Framework Development

Web accessibility, based on the World Wide Web Consortium (W3C) principles, relates to anyone, regardless of browsing technology, being able to view the contents of a website. The information gathered should be simple to understand, and the user should be able to engage with the website if necessary. Web accessibility is a crucial part of the content available online for use and many researchers do researches and highlighted the errors and also provide their suggestions on how to improve the accessibility of content and how to make the content according to the standard of wc3 as the framework for web design model to enhance accessibility is shown in the paper of Bakhsh et al. (Bakhsh & Mehmood, 2012). In extended framework performance, interface, content, mobile-friendliness, and HTML and CSS validation are the primary goals of Web accessibility, as indicated in figure 1.

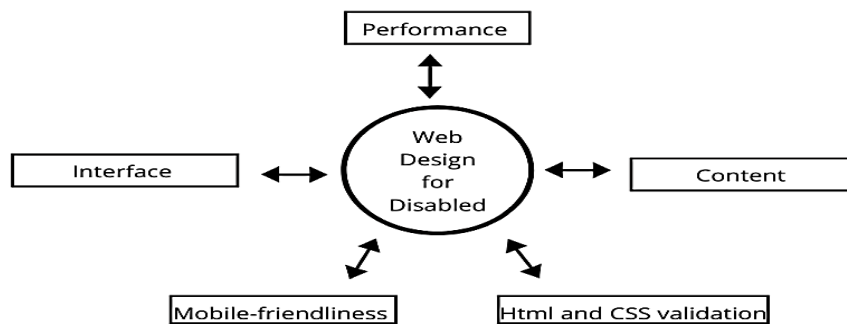


Figure-1: Evaluation framework

Methodology

In this study, online citizen services offered by KP government are evaluated. The population of the study was KP government online service websites. Total 30 websites are selected for evaluation using online evaluation tools. The following four online testing tools were used for accessibility evaluation.

- GT Matrix is used to measure page loading time and page size.
- Mobile-Friendly online tool is used to check the responsiveness of the websites.
- WAVE tool is used to identify the error, contrast error, and alerts.
- AChecker online testing tool will be used to analyze the accessibility performance of all websites.

The results were generated with the above tools and analyzed. Results were generated and recommendations were made on the basis on results. The following are the parameters of evaluation using the online tools.

- Page loading time
- Performance
- Mobile-friendliness
- Errors
- Contrast error
- Alerts
- ARIA errors
- Accessibility checking using (WCAG 2.0) and to identify
- Known Problems
- Likely problems
- Potential problems
- Html validations
- CSS validations

Apart from this manual evaluation will also be done to evaluate the mobile-friendliness of all the websites manually using different screen sizes to check whether the available content adjusts themselves according to the available screen size or not. All the results collected from online tools will be shown in the form of tables and charts to identify and highlight the highest numbers of conformance websites and the lowest number of conformance sites according to the standards and also to identify the site which has the highest number of errors and also the site which has the lowest number of errors etc.

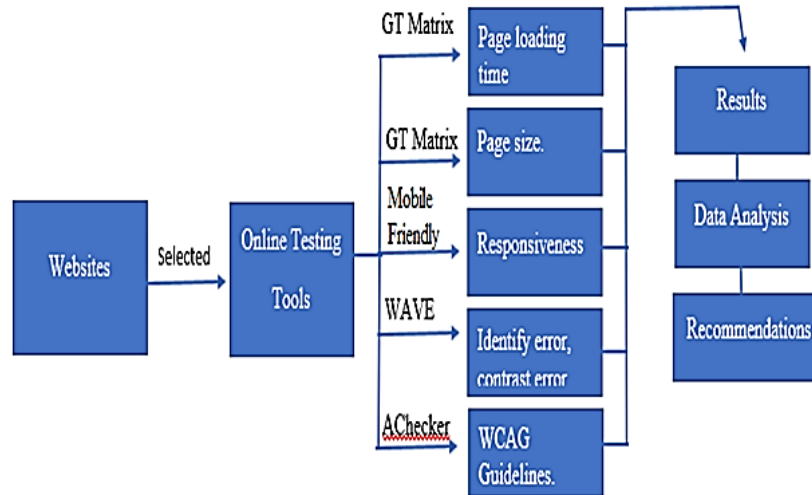


Figure-2: Work flow

Results and Discussion

Thirty online services were evaluated by using automated tools. The results were generated and analyzed on the basis of proposed framework. After analyzing the results are categorized into five groups based on performance, Interface, Content, Mobile-Friendliness, and HTML and CSS Validations.

Performance

First, we analyzed the performance and page loading time using in online tool GTMatrix form the results of figure-3 we observed that most of the website has below the average of 30 % of the performance which needs improvement.

The top website which has the highest score of performance including the following sites Excise & Taxation Department has the highest performance score among all of them and others remaining four department sites are Social Welfare, Population Welfare Department, Revenue and Estate Department, Irrigation Department, and Local Government website whereas Khyber Pakhtunkhwa Employees Social Security Institution score the lowest among all and remaining other sites are ranking below 30 percent which is considered as fail according to Gtmatrix standards which need improvement.

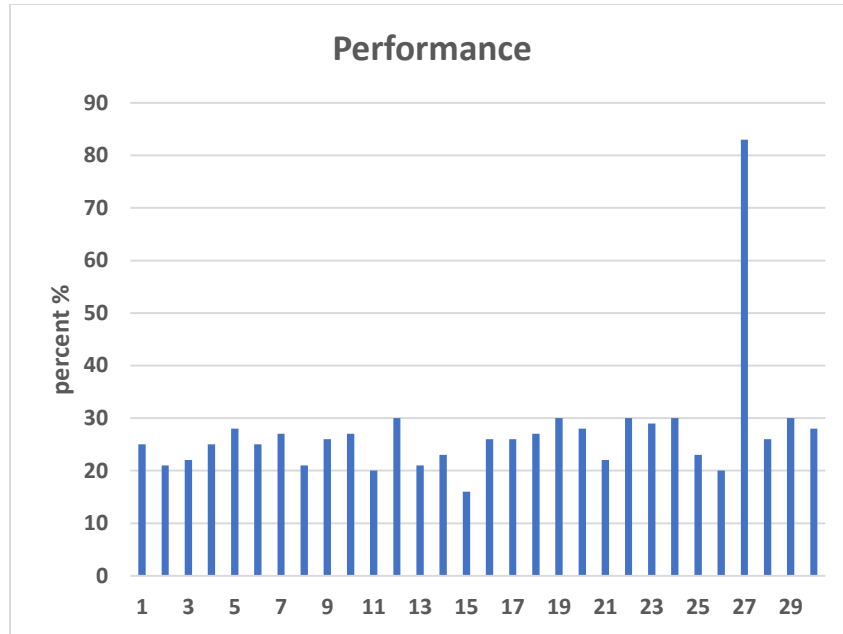


Figure-3: Performance comparison

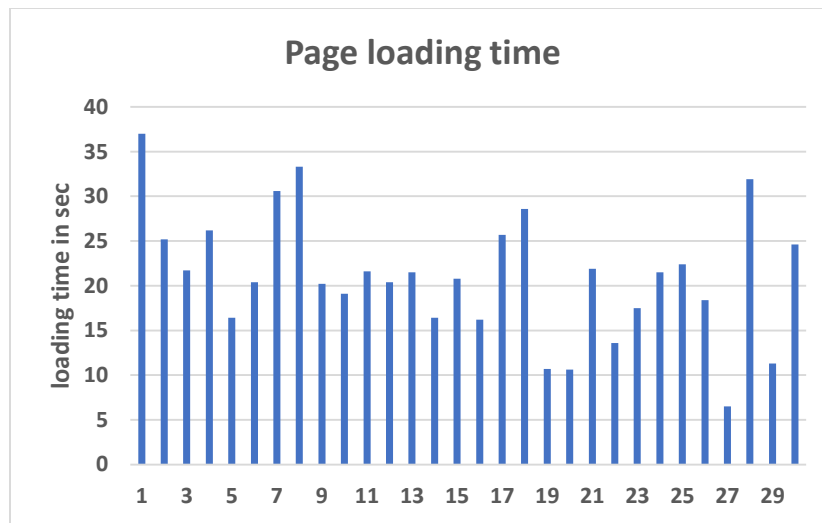


Figure-4: Page loading time comparison

From figure-4, we get the results that average loading time of website in seconds which provide services to KP citizens and the top five fast page loading sites are Excise & Taxation department whose page

loading is timeless among all of the others and the remaining others are Public Health Engineering site, Population Welfare Department, Local Government, and Revenue and Estate Department have the fast page loading time as compare to others whereas the Directorate of Cooperative Societies has the highest page loading time and Forestry, Environment & Wilde Life has the second-highest page loading time to load the homepage and the remaining three are Administration Department, Directorate General of Soil Conservation, and Agriculture department have the highest page loading time.

Interface (Errors)

For interface errors testing we use WAVE online tool to test each of the selected websites one by one and find out the number of errors each single websites have and after that, we show the results in a graphical form which helps us to understand the results more easily and from the data, we highlight the website having the highest number of errors and also that have the lowest number of errors. Interface errors are divided into three main groups general errors, contract errors, and aria errors as shown in the graph



Figure-5: Errors comparison

From figure-5, we get the top five list of websites ranking in the highest number of errors which must need focus for correction and to make it accessible to all the Local Government website rank first in general errors and Agriculture rank second whereas the Directorate of Cooperative Societies, Excise & Taxation, and Forestry, Environment & Wildlife has the top five websites which have the highest number of errors whereas the Elementary & Secondary Education Department Khyber Pakhtunkhwa has the lowest number of error among all of them.

Top five website which ranks high in contrast errors are unfortunate the Directorate of Information Technology rank first in contrast errors among all of them whereas the Directorate of Agriculture Engineering ranks second and the remaining three top site which has the highest number of contrast errors are Directorate of Agriculture Extension, Directorate of Livestock and Dairy Development, and Bureau of Agriculture Information whereas the Agricultural Training Institute, Peshawar and nine other sites has the lowest number of contrast errors.

The Local Government website rank first in aria errors among all of them whereas the Revenue and Estate Department has score second in the highest number of errors and the remaining are Public Health Engineering, and Agriculture whereas the Elementary & Secondary Education Department Khyber Pakhtunkhwa has zero number of aria errors or no errors among all of the tested websites.

Content (Accessibility)

Content accessibility is check using the online tool AChecker 2.0 (level A) which is the primary level of content accessibility conformance according to WCAG standards. The results show the top sites which follow the WCAG standard and also those websites which have the lowest conference and need improvement to achieve the basic level of the conference according to the standards.

Three types of problems are highlighted to check if the content is accessible or not and the problems are named as Known Problems, Likely problems, Potential problems.

Known problems

The following are the sites that have the highest number of problems and need improvement to achieve the basic level of conformance of accessibility according to the standards and make it accessible to all are Population Welfare site score high among all of them and need improvement and the Administration Department has score second in the highest number of known problems and Transport Department has third in the highest number of errors whereas the remaining all has the equal

number of errors whereas the Revenue and Estate Department has the lowest number of errors and Public Health Engineering score second in the lowest number of errors and Local Government, and Excise & Taxation all of these four websites has the lowest number of errors as compared to others.

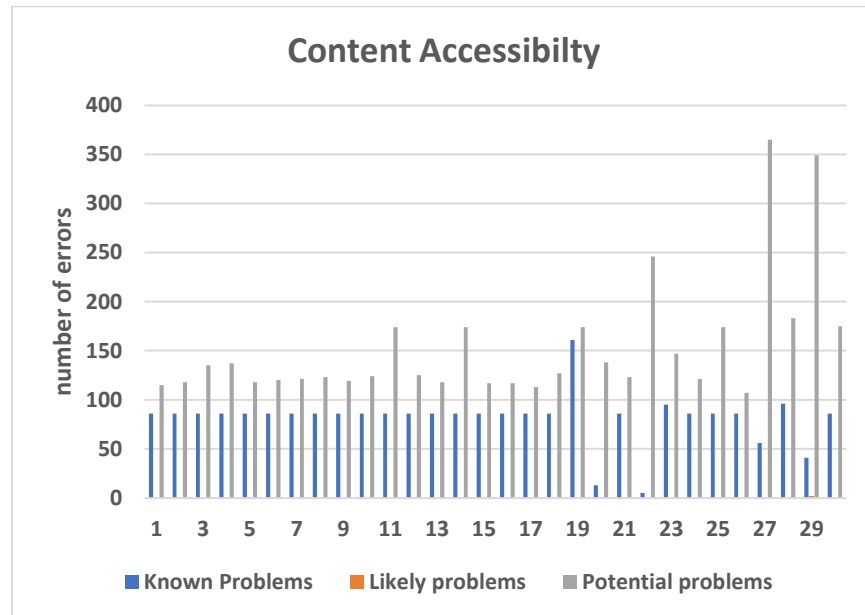


Figure-6: Content accessibility comparison

Likely problems

All the selected sites have no likely problems except Local Government which has only one problem which needs improvement.

Potential problems

The following are the sites we get from the results which have the highest number of problems and also those sites which have the lowest number of potential problems and follow the standards according to WCAG. The top five websites which have the highest number of potential problems are Excise & Taxation department which score the high number of problems among all of them and Local Government website score second and the remaining are Revenue and Estate Department, Administration Department, Elementary & Secondary Education Department Khyber Pakhtunkhwa and the Home & Tribal Affairs,

Directorate of Information Technology, Population Welfare, Food Department Khyber Pakhtunkhwa, and Home & Tribal Affairs are the five websites which have the same number of potential problem and rank in the fifth position among all of them whereas the Industries & Commerce website has the lowest number of potential problems as compare to all of them.

Mobile-Friendliness

Now a day's people prefer to access all their required information using their smartphone because it is easy to get information instead of using their computer so a mobile-friendly test is conducted using online tool mobile-friendly test tool to check their content available is responsive or not and from the results, we know about how many of the websites are mobile-friendly and user can access it easily using both of their smartphone and computer.

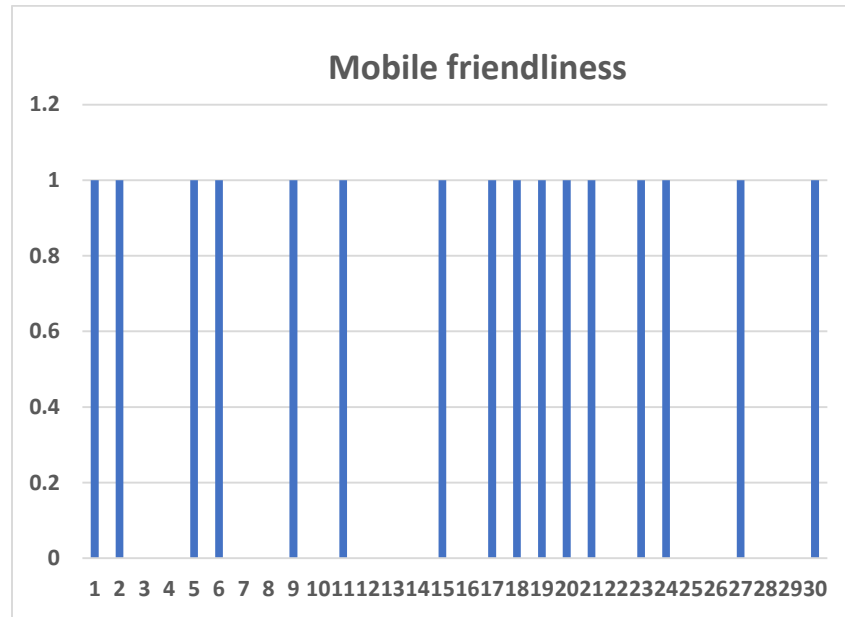


Figure-7: Mobile friendliness comparison

Figure-7 shows the results of mobile friendliness, there are sixteen websites pass the mobile-friendly test and these websites are fully responsive which adjust the content size according to the screen and the remaining fourteen websites fail the test because the content and layout of these sites are not responsive to adjust their screen size according to the

screen and need improvement because everyone has the right to access the content easily.

HTML and CSS Validation

The Validation enhances usability and functionality because users are less likely to encounter issues when a site is properly validated according to the standard so it is an important aspect to check the HTML and CSS validation which helps to improve the site and user can access and use the available content easily.

For HTML and CSS validation online tool AChecker is used to validate the selected sites and find out how many of them are usable and how many of them have validation errors that need improvement.

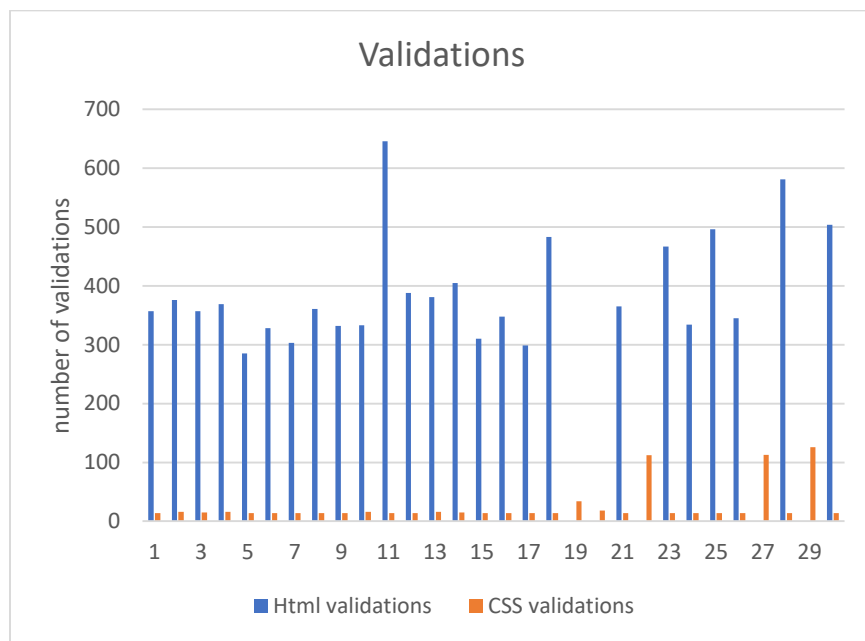


Figure-8: Validation comparison

HTML validations

The following are the top five websites that have the highest number of HTML validation. The Home & Tribal Affairs rank first in the highest number of HTML validation and the Administration Department rank second and the remaining three websites are Elementary & Secondary Education Department Khyber Pakhtunkhwa, Food Department Khyber Pakhtunkhwa, and Agriculture is the top five whereas the Population Welfare, Public Health Engineering, Revenue and Estate Department,

Excise & Taxation and Local Government has no HTML validation as compared to all of them.

CSS validation

From the results summarization and as shown in the figure the following are the top five highest number of CSS validation website of KPK department are Local Government website have the highest number of CSS validation as compare to all and Excise & Taxation department website score the second in the highest number of validation and the remaining three are Revenue and Estate Department, Population Welfare, and Public Health Engineering whereas the remaining score approximately the same number of CSS Validation.

Conclusion

Results show that most of the KP government website which provides citizen services to the people are not designed according to the WCAG standards, for a visually impaired person, it is extremely difficult, or not possible for a disable person to access KP government's website's electronic information. Its discrimination with disabled in online services. According to accessibility and usability standards accessing all the available data is the right of all people especially those who have any sort of disability. All the identified problems and errors may help web developer and expert to make the online contents accessible.

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Appendix

List of evaluated websites (KP government online citizen services)

S.No	Servicing Department	URL
1	Directorate of Cooperative Societies	http://coopsocieties.kp.gov.pk/
2	Directorate of Livestock and Dairy Development	http://livestockext.kp.gov.pk/
3	Directorate of Agriculture Engineering	http://agriengineering.kp.gov.pk/
4	Directorate of OnFarm Water Management	http://ofwm.kp.gov.pk/
5	Agricultural Training Institute, Peshawar	http://ati.kp.gov.pk/
6	PEDO	http://pedo.kp.gov.pk/
7	Directorate General of Soil Conservation	http://soilconservation.kp.gov.pk/
8	Forestry, Environment & Wildlife	http://few.kp.gov.pk/
9	Directorate of Agriculture Research	http://agrires.kp.gov.pk/
10	Directorate of Fisheries	http://fisheries.kp.gov.pk/
11	Home & Tribal Affairs	http://home_tribal_affairs.kp.gov.pk/
12	Social Welfare	http://social_welfare.kp.gov.pk/
13	Directorate of Agriculture Extension	http://agriext.kp.gov.pk/
14	Directorate of Information Technology	http://doit.kp.gov.pk/
15	Directorate of Crop Reporting Services	http://crs.kp.gov.pk/
16	Khyber Pakhtunkhwa Employees Social Security Institution	http://essi.kp.gov.pk/
17	Bureau of Agriculture Information	http://bai.kp.gov.pk/
18	Agriculture	http://agriculture.kp.gov.pk/
19	Population Welfare	http://pwdkp.gov.pk/
20	Public Health Engineering	https://www.phedkp.gov.pk/

21	Minerals Development	http://minerals_developmen.kp.gov.pk/
22	Revenue and Estate Department	https://www.revenue.kp.gov.pk/
23	Transport Department	http://newtransport.kp.gov.pk/
24	Irrigation	http://irrigation.kp.gov.pk/
25	Food Department Pakhtunkhwa	http://food.kp.gov.pk/
26	Industries & Commerce	http://industries.kp.gov.pk/
27	Excise & Taxation	http://www.kpexcise.gov.pk/app/
28	Administration Department	http://administration.kp.gov.pk/
29	Local Government	https://www.lgkp.gov.pk/
30	Elementary & Secondary Education Department Khyber Pakhtunkhwa	https://kpese.gov.pk/
