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An Analytical Approach to Accessibility and Usability Evaluation of Nigerian Airlines Websites

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Abstract

In the present globalized world, online access to information and service irrespective of location and time have become the order of the day. A major gateway to online information and services in any corporate or government organization is the website. Thus, websites accessibility and usability across different organizations is gaining interest among researchers and practitioners. This study focuses on evaluating the level of accessibility and usability of websites of major airlines in the civil aviation industry in Nigeria for the purpose of ascertaining their level of compliance with Web Content Accessibility Guidelines (WCAG) 2.0. In achieving the aim of the study, different automated tools such as the A-Checker tool, European Internet Inclusion Initiative (EIII) e-accessibility tool, WAVE web accessibility evaluation tool (WAVE), Functional Accessibility Evaluation Tool and Mobile Friendly Test were used in the study. In addition, heuristic method was used for the usability testing. Based on the various tests conducted, majority of the websites show known problems (KP) and high failure in terms of xhtml conformance with the stipulated guidelines. Findings from the coding and design tests reveal an average performance while the websites' implementation tests and mobile friendly tests were not satisfactory. The usability evaluation reveals that most of the websites do not have functional and required usability tools expected from commercial airlines. In practical terms, this study provides pointer to stakeholders in the civil aviation industry in Nigeria on the importance of ensuring that websites deployed facilitate seamless interaction with customers and enable service delivery without constraints.

Keywords: Airline websites; Website accessibility; Website usability; Functionality; Flights; Nigerian airlines; Nigeria

Introduction

The rapidness in the advancement of information technology necessitated the needs for proper assessment of software products qualities. In particular, for organizations engaging the services of software developers; it is important to ensure that stipulated standard are adhered to in order to ensure that customers of such organizations are well catered for and for ensuring continuous patronage of their services. Every organization that goes online does it *via* a website and the primary aim is to ensure reachability without bound [1]. Therefore, websites provide the first point of contact to organizations in today's digital world, and as such the accessibility and usability of website becomes imperative. The aviation industry is not an exception to this. Therefore, an accessible and usable website for the aviation sector becomes very paramount [2,3].

Usability and accessibility are key factors in website development [4,5]. A website must be usable and accessible at all times to users of the site. This leads to increase in customer satisfaction, hence increase in market sales. Airline operations cannot be carried out nowadays without a website, as such there is need to have a website that is accessible and usable. The World Wide Web Consortium [6] defines accessibility on the Web as "an attribute by which people with disabilities can perceive, understand, navigate, and interact with the web, and they can contribute to the web." It is evident from the definition that accessibility is aimed at abolishing any limitations encountered by people with any type of disability, including visual, auditory, physical, speech, cognitive, and neurological disabilities so as to make the content on the Web accessible to anyone. Consequently, some studies on different genre of websites have been carried out [1-9]

With good websites' accessibility in place, airlines will have the opportunity to connect to all people including those with special needs which form a significant market segment. Transforming business and adapting technology to the needs of people with disabilities promote business and prove to be a significant investment of time, money and resources. A general definition of usability is given by the International Standards organization's ISO9241 standard [10], which states that "Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness,

efficiency, and satisfaction in a specified context of use". Website usability is a prerequisite for a firm's success because a website cannot attract users unless they can navigate the site easily [11].

The application of websites as an information gateway is pivotal to the strategic positioning of airlines business goals. Airline websites (which have become a universal system for linking stakeholders in any business platform) allows passengers that include foreign business investors, Nigerians abroad, local top-class business men and top government functionaries and the citizens generally, the opportunity to access airline services any time the need arise. Services such as flight schedule, flight route, flight destination, flight booking, weather report and operations related to general information can be implemented and viewed on airline websites.

In this paper, evaluation of airline websites in terms of accessibility and usability is investigated since online flight services is gaining prominence in the aviation industry. The evaluation focused on ten sample websites of the airlines considered to be among the top ten popular commercial airlines in Nigeria.

Related Work

Considering the growing importance of accessibility and usability evaluation of websites, several research have been conducted and are still going with focuses on different genre of websites [12-15]. The work of [7] which focussed on airline websites comparison in Turkey in 2012 and 2014 revealed that efforts were made by the owners of the selected airline websites to improve the functionalities (accessibility and usability issues) of their websites. It was discovered however, that changes observed had not greatly impacted the usability of the websites. A customer-oriented airline site evaluation framework (ASEF) was developed by Apostolou which focussed on airline websites [16]. The research serves as a guide towards improving airline websites' services by considering several quality criteria. The framework developed was used to evaluate thirty major airlines websites worldwide and identified some weaknesses in technical and navigational aspects of the sites.

The quality of Asia airline websites operating in Malaysia was evaluated by [17,18]. Online web diagnostic tools in conjunction with Multi Criteria Decision Making (MCDA) approaches were used to determine and evaluating the best airlines website based on many criteria of website quality. Elkhani proposed an integrated model to evaluate the effectiveness of an AirAsia airline websites in Malaysia from customers' point of view [19].

Wan investigated the accessibility and usability of electronic government websites in Malaysia noting that proliferation of such websites may result in falling standards in the development of the websites [8]. The assessment factors used by the authors includes speed, page size and existence of broken links. More so, tools testing against compliance with WCAG version 1.0 such as Axandra, Websiteoptimization, EvalAccess 2.0 were used. The results obtained were compared based on Federal and State Government websites and it was discovered that State Government websites have more usability and accessibility issues than Federal Government websites.

Hasan presents an approach which involves three Usability Evaluation Methods (UEMs) to conduct a multi-faceted usability evaluation of three Jordanian e-commerce websites [20]. The three usability evaluation methods are user testing, heuristic evaluation and web analytics (WA) software [21]. It was pointed out that e-commerce websites in Jordan, is faced with more challenges compared to their counterparts in the western nations in making their sites acceptable, usable and profitable in the absence of legislation and regulations.

Methodology

The methods engaged in this study starts with sampling of airline websites from the registered airlines in Nigeria, to the use of different evaluation tools. These approaches are further described below.

Sampling

Ten airline websites are purposefully sampled for this study out of the very many registered airlines in Nigeria, as sourced from the Nigerian Civil Aviation Agency (NCAA). The sampling was carried out between August and October of the year 2017. It is important to mention that though there are so many airlines that have registered with NCAA, either in the past or recently; not all of these airline operators are in active operation as at the time of conducting this study. Airports operation was relied upon to sample of those airlines that currently engages in daily commercial operations. The list of the ten frequently patronized airlines which make up our sample is presented below in **Table 1**.

Table 1: List of Airlines' Websites

	Airlines	Websites
1	Arik Air Limited	www.arikair.com
2	Airpeace Limited	www.flyairpeace.com
3	Dana Airlines	www.flydanaair.com
4	Aero Contractor Limited	www.flyaero.com
5	First Nation	www.flyfirstnation.com
6	Med-View Limited	www.medviewairline.com
7	Max Air Limited	www.maxair-inc.com
8	Azman Air	www.airazman.com
9	Discovery Airways	www.discoveryair.com
10	Overland Airways	www.overlandairways.com

Accessibility evaluation approaches

The evaluation approaches employed in this study are guided by the Web Content Accessibility Guidelines (WCAG) 2.0. The Web Content Accessibility Guidelines 2.0 has a Checklist that is grouped into four guidelines. The first guideline is concerned

with making sure that a website is perceivable. A website is perceivable according to WCAG standard if provision is made for text alternatives for all non-text contents; provide synchronized alternatives for multimedia, ensuring that information and structure can be separated from presentation, making it easy to distinguish foreground information from its background.

An operable website is the concern of the second guideline that focuses on making sure that all functionality are operable *via* a keyboard interface, allow users to control time limits on their reading or interaction, allow users to avoid content that could cause seizures due to photosensitivity, provide mechanisms to help users find content, orient themselves within it, and navigate through it, and help users avoid mistakes and make it easy to correct mistakes that do occur.

Third on the guideline is that it should be understandable with respect to making text content readable and understandable, making the placement and functionality of content predictable. Finally, websites should be developed in a way that will support compatibility with current and future user agents and assistive technologies, ensuring that content is accessible or provide an accessible alternative. Based on the aforementioned guidelines, a website can be said to be accessible when it conforms with the WCAG 2.0.

To establish the level of accessibility of the sampled websites, five popular automated tools which are: A-Checker, European Internet Inclusion Initiative (EIII) Tool, Wave Tool, Functional Accessibility Evaluation (FAE) Tool, and Google Mobile-Friendly Test (MFT) were used for the assessment. These tools have been widely used in previous studies, therefore assessing conformity with WCAG 2.0 using these tools would reveal the true level of accessibility of the websites under consideration. Also, usability evaluation was conducted through online heuristic/manual checks of the ten sampled websites to see in what ways they can be used to deliver satisfactory customer services.

Usability testing

In their work on usability (U) guidelines which range from U1 to U13, [22] emphasized in U2 that there should be a match between system and the real world: to use the user's language and to follow real-world conventions. This informed the need to heuristically check the availability of certain services peculiar to airline industry on the ten websites under evaluation.

The services are ability to check Flight Schedules (FS)-it is important for users to be able to access information regarding when airplanes are to take-off by visiting airline websites for effective time management. Flight Routes (FR)-it is equally necessary to find information on air traffic route as it may be influential on a potential passengers decision to fly. Most passenger may not be interested in flying over a war zone. In addition, Flight Destinations (FD)-tells the website user, how close to an actual place of visit is the airport an airline intends to fly into. Flight Booking (FB)-the user should also be able to find out the cost of tickets and make payment to book a seat using an airline website by clicking on the Flight Booking functional feature or icon on a webpage.

Weather Report (WR)-this user feature on an airline website reports the weather condition of a desired place of destination as well as the place of departure. A bad weather conditon usually leads to the cancellation of flight schedules, as stormy weathers conditions during rainy seasons and poor visiblity condition during harmattan does not favour safe airline traffics. WR can also inform a potential passenger's decision on the choice of attires, luggages and timing of travel.

Accomodation Services (AS)-accomodation services that are provided close to the destination airport should be on display for users who visit an airline website. Airline passengers should be able to view information on trusted hotels around an airport for safety precautions, in the event of arriving on late hours of the day. Other Users Services (OS), are general information that are necessary for customer satisfaction. These include relevant news and updates with respect to changes in flight schedules, flight destinations, feedbacks, email addresses and physical contact addresses that are pivotal to the high rating of an airline website. Functional icons present on a website is recorded as yes (Y) and no (N) for those that are not implemented.

Results

A-checker tool

One of the tools used in the evaluation of selected Nigerian Airline websites is the use of A-Checker tool to conduct accessibility tests with respect to the WCAG 2.0 Level AA guidelines to see the level of compliance with standard web development. A-Checker tool has very detailed analysis of line by line violation of the WCAG guidelines. In addition, the tool has a web based online platform for evaluating websites. The results of its evaluation are categorized as Known Problems (KP), Likely Problems (LP), and Potential Problems (PP). Known Problem is the most important of all the problems and so it used as a basis for judging the extent of complying with WCAG 2.0. Of all the ten (10) websites that were successfully tested, only two have as few as less than ten (10) known problems, four (4) of the ten (10) Nigerian airlines' websites have between 20 and 50 known problems, one of the website has 95 known problem and the remaining three (3) had more than one hundred (100) known problems according to the tool. The summary of results from the A-Checker tool is shown in **Table 2**.

Table 2: A-Checker Tool Output

Airlines	KP	LP	PP
Website 1	241	8	519
Website 2	44	2	291
Website 3	177	0	250
Website 4	36	2	448
Website 5	20	1	273
Website 6	277	0	254
Website 7	2	0	25
Website 8	28	0	236

Website 9	8	0	161
Website 10	95	0	506

EIII e-accessibility tool

The European Internet Inclusion Initiative owns the EII web page checking platform [11]. It tests for the number of xhtml elements that pass and fail WCAG 2.0 guidelines and give the results for accessibility of a website over hundred percent (100%). Based on the output given by tool, all the airlines' websites evaluated in this study were reachable and most of the websites either failed some tests or most tests as shown in **Table 3**. Thirty percent (30%) of the websites were found to have failed some tests, while the rest failed most tests. Thus, none of the websites was able to achieve a green light pass of over 95%.

Table 3: Scores from EIII Tool

Airlines	Fail	Pass	Scores
Website 1	98	527	53.46
Website 2	22	425	79.5
Website 3	79	337	70.87
Website 4	47	482	87.2
Website 5	22	280	92.52
Website 6	41	313	71.94
Website 7	12	122	71.1
Website 8	20	176	85.15
Website 9	8	303	80.13
Website 10	59	600	83.67

WAVE web accessibility evaluation tool

Another accessibility tool used in this study is the Wave web accessibility evaluation tool. The tool checks for all coding and design errors in a website by highlighting all codes that are implemented in violation to the WCAG 2.0 guidelines. It serves the purpose of debugging more by counting errors, alerts, and contrast errors, to help the developer correct mistakes than evaluation. So, the tool does not give information about the number of code elements that conforms to WCAG 2.0 guidelines. Test values of the ten airlines' websites from Wave web accessibility evaluation tool are recorded in **Table 4**.

From the results shown in **Table 4**, though the significance of errors differs; six (6) websites recorded less than thirty (30) errors, while the remaining four websites recorded between thirty (30) and fifty-one (51) errors. However, all the websites were successfully tested on the Wave web accessibility evaluation tool.

Table 4: Results of Wave Evaluation Tool

Airlines Errors	Errors	Alerts	Contrast
Website 1	51	32	30
Website 2	7	22	19
Website 3	30	30	0
Website 4	29	47	62
Website 5	11	17	11
Website 6	34	10	13
Website 7	9	1	8
Website 8	10	28	4
Website 9	3	6	13
Website 10	19	22	97

Functional accessibility evaluation tool

Testing using Functional Accessibility Evaluation platforms reveals the following information about the level of compliance on the website of the first ten popular airlines in Nigeria is shown in **Table 5**. Violations of guidelines are judged as failure while compliance is judged as pass. The number of failures and passes and the overall rating of the implementation score for the websites are rated over 100. As shown in **Table 5**, the test result of FAE tool reveals that out of the ten airline websites tested, two (2) could not be accessed on the platform; while the remaining eight (8) that were successfully accessed and tested to be having a lot of violation problems as most of them score less than forty (40) on a scale of 100 score. This helps to easily evaluate and understand the websites' degree of compliance. This implies than on the average, they commit more implementations errors than complying with the WCAG 2.0 guidelines. Website 3 and Website 7 which are websites that could not be assessed as mentioned above implies error reports. The most common reason for a report with an error is the use of problematic java scripts on the initial page returned by the requested URL.

Table 5: Results of FAE tools

Airlines Websites	Fail	Pass	Score (100)
Website 1	14	7	21
Website 2	16	25	41
Website 3	0	0	0
Website 4	16	10	24
Website 5	7	18	36
Website 6	13	22	38
Website 7	0	0	0
Website 8	14	18	36
Website 9	10	14	27
Website 10	11	11	26

Mobile Friendly Test (MFT)

The advancement in mobile phone technology has encouraged their widespread use for accessing websites for

World Wide Web (www) based information and business transactions. Thus, it becomes important to test the ease with which an airline website can effectively and fully load on a smart mobile phone. To achieve this aim, this stud used the Google's Mobile-Friendly Tool to check the selected Nigerian airlines websites' efficiency on mobile computing devices. Very friendly websites are those that fully load on a smart mobile phone, while those that load with few issues are those regarded as just being friendly and those that load with many issues are described as not friendly. Others are out rightly not reachable.

The results of our analysis as shown in **Table 6** depict that only one (1) of the websites loads without any issue, and three (3) loads fully with some issues. Two (2) of the websites were not friendly as link objects superimposed on each other, their contents being wider than screen, text being too small to read, viewport not being se and clickable elements being too close together. The remaining three (3) were out rightly not reachable, this could be because the pages were unavailable or blocked by robots.txt.

Table 6: Results from MFT Tool

Airlines	MFT Tool Remarks
Website 1	Very Friendly
Website 2	Friendly
Website 3	Not reachable
Website 4	Not reachable
Website 5	Very Friendly
Website 6	Friendly
Website 7	Friendly
Website 8	Not reachable
Website 9	Not Friendly
Website 10	Not Friendly

Usability Evaluation

The evaluation of usability was conducted by visiting the websites one after the other and taking note of the various ways in which each of the websites has been put to use. As presented in **Table 7** below, only one (1) out of the ten (10) websites do not have Flight Schedule (FS) and Flight Destination (FD) shown on its website. Flight Route (FR) icon was found to be in use in only three (3) out of the ten (10) websites while Flight Booking (FB) icon is active in seven (7) out of the ten (10). Only two (2) of the websites in this study provide information about Accommodation Services (AS) while one (1) of the airline websites did not provide Other Services (OS) as general information for potential passengers. Furthermore, all the airlines websites visited do not have Weather Report (WR) on their websites.

Table 7: Airlines Usability Check

Airlines	FS	FD	FR	FB	AS	OS	WR
Website 1	Y	Y	Y	Y	N	Y	N
Website 2	Y	Y	Y	Y	Y	Y	N
Website 3	Y	Y	N	N	N	Y	N
Website 4	Y	Y	Y	Y	N	Y	N
Website 5	Y	Y	N	Y	N	Y	N
Website 6	Y	Y	N	Y	Y	Y	N
Website 7	Y	Y	N	N	N	N	N
Website 8	Y	Y	N	Y	N	Y	N
Website 9	N	N	N	N	N	Y	N
Website 10	Y	Y	N	Y	N	Y	N

Summary of the accessibility and usability findings

Based on the various testing conducted, majority of the websites show known problems (KP) that are greater than 50 while their xhtml conformance test range between 53% to 92%. In terms of coding and design error, a fairly good result was found as most websites have values ranging between 3% and 34%. Most of the websites score less than 40% in terms of complying with implementation guidelines, while just about 40% of the websites were found to be mobile friendly. The usability evaluation reveals that most of the websites do not have functional and reliable usability tools such as flight schedule, flight route, accommodation services and weather report as expected from commercial airlines.

Conclusion

This article attempts to evaluate websites in the civil aviation industry in Nigeria. While knowledge about the functionalities of airlines websites from other countries abound in literature, our knowledge about airline websites in Nigeria is very limited. Though only automated tools were employed in the work; the findings of this work have contributed to our understanding of the functionality level of airlines websites in Nigeria. The work can serve as guide for future works which aims at combining expert evaluation with automated tool for comprehensive analysis.

As discovered under the accessibility evaluation tools, none of the websites is devoid of one problem or the other. Although the performances of the websites under study differ, the result shows that none of these websites has been able to satisfy the accessibility guidelines as stipulated by WCGA 2.0. Consequently, none of the websites can be said to be completely accessible. Website developers often focus attention on winning potential projects and may underplay the importance of giving details of accessibility and usability issues to their customers (website owners); and thus, the consideration for these factors are hardly given the right of place.

As online transactions gradually become the norm in Nigeria, airlines operators must go beyond just making websites available, but must also ensure that the websites satisfy the minimum standard required in other to give customers satisfactory services. Because of the limited knowledge of most

management of these airlines operator in the nitty-gritty of websites, it is recommended that the in-house IT unit staff of these airline services providers be provided with adequate training to be able to test the conformity of the sites against stipulated standards or engage the services of a third party to attest the adequateness of their websites accessibility and usability after developing a new website or whenever upgrades are carried out on the websites.

In addition, there is the need for adequate awareness on accessibility standards among the developers and designers of website for easy site development, update and maintenance. To ensure that all airline online services users either those with disability or not are cater for; the designers, airline service providers as well as government should take both accessibility and usability measures important for equal access to websites.

In conclusion, this study has shown that most of the Nigerian airline websites need to be thoroughly improved upon to make accessibility and usability easy for all.

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