AESDM: Accessible E-Governance Site Development Model

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Abstract— *The E-Governance web sites continue to be inaccessible to people with disabilities. Since the tools and guidelines are available to help website designers and managers to make the web sites accessible for disabled people. It is unclear why so many E-Governance web sites continue to be inaccessible. In this article, we present the ''Accessible E-Governance Site Development (AESD) Model,'' which concentrating the multiple points within E-Governance site development where accessibility for disabled can be incorporated. The proposed model's validity and reliability is verified before adopting the final version of the model. For validity and reliability checking a set of questionnaires*
are used and questionnaires were given to three groups of people (E-Governance site Managers, Experts and Academic Specialists) and data were collected from participants. Next we conducted Cronbach's alpha test to verify the reliability of the collected data, one-way anova test and Scheffe post-hoc tests were carried out to verify the difference between   three groups of people opinions about the proposed model. Further the research findings and future directions for research are discussed.
Keywords— *E-Governance, Accessibility, Disabilities, Internet, WWW.*

I. INTRODUCTION

E-Governance is the application of Information and communication technology that uses cloud computing technology or the Internet or the WWW to provide government information and services to their citizens [1], [28]. At this point, E-Governance particularly uses the software as a service (SaaS) model, to enhance the access to and delivery of government information and services to citizens, businesses, government employees, and all other government agencies [4], [18]. The software as a service is type of web application that can be accessed over internet or cloud with specific URLs.

The ability to access the information is a key feature of citizenship and participation in society. Most of the government agencies have their own websites that offer information and services directly to citizens [18], [28].

However, in order to reach the government information and services to all citizens, it must be fully accessible to all citizens, including people with disabilities [18], [28]. To provide better accessibility on websites, the non-profitable organization W3C developed WCAG 1.0 and WCAG 2.0 [22], [25], [26]. The requirement of the guidelines is that all websites should provide their information and services in a fully accessible manner, though such universal accessibility. The failure to achieve acceptable levels of accessibility for E-Governance services threatens not only the E-Governance initiatives, but also the relationship between the government and citizens in general [6].

This paper is organizes as follows: In section 1 we present an introduction of E-Governance and their accessibility importance. In section 2 we discuss the detailed study on literature related to accessibility evaluation of E-Governance websites by E-Governance site manager perspective, Expert perspective and Tools perspective and framed a set requirement. In section 3 we present the research method for this research. In Section 4 we derive a new Accessible E-Governance site development model and discuss the attributes of model. In section 5 we discussed the reliability and validity of the proposed model. In section 6 we discuss the conclusion and direction for future research.

II. LITERATURE REVIEW

2.1 Identifying Accessibility Issues by Manager's perspective

The managers of the E-Governance websites in any E-Governance project play a key role in the success of the project; therefore it is important for any E-Governance project to prepare its website management properly, and to ensure all of the needed elements are present before implementation. This factor is not taken seriously; as it was found that E-Governance management still encounter some problems that need to more attention in order to reach the

success of other website's accessibility. This part of literature review focus on identifying the accessibility problems which are identified by researchers in E-Governance website accessibility evaluation by manager's perspective. Table 1 shows the problems identified by researchers on E-Governance websites accessibility evaluation by manager's perspective.

Table 1. Issues identified by manager's studies

S.No	Issues
1.	The success or Failure of E-Governance websites is depend on Accessibility [1], [4],[13].
2.	Lack of awareness[1],[4],
3.	Lack of Understanding [1], [4], [14], [17].
4.	Lack of manager's attention on users feedback [18],[28],
5.	Lack of Navigation problem [2],[3], [5], [16], [20].
6.	Lack of appearance [2],[3], [5], [16], [20].
7.	Lack of personalization [2],[3], [5], [16], [20].
8.	Lack of search [2],[3], [5], [16], [20].
9.	Lack of trained staff [18],[28].
10.	Lack of budget. [18],[28].
11.	Lack of Management. [1],[2], [18],[28].

2.2 Identifying Accessibility Issues by User's perspective

The success of any E-Governance project is measured by the degree of satisfaction found in its users. Satisfaction of the users plays a key role in determining the success of the project, therefore proper design of websites is of the utmost importance. In addition, preparation of all of the needed elements prior to the implementation of the project is also counted to be of high importance in order to ensure user satisfaction. It is thought that this factor is neglected, as recent research found that the government websites still has a number of problems that need to be addressed in order to improve the accessibility successfully. This part of literature review focus on identifying the accessibility problems which are identified by researchers on E-Governance website accessibility evaluation by end user's perspective. Table 2 shows the problems identified by researchers on E-Governance websites accessibility evaluation by end-user's perspective.

Table 2. Issues identified by End-User studies

S.No	Issues
1.	lack of involvement of end users,[1], [4]
2.	lack of a clear framework of collaboration and coordination, [1], [4],
3.	poor standardization [6]
4.	lack of trust/satisfaction [7]

5.	Lack of Navigation problem [2],[3], [5], [16], [20].
6.	Lack of appearance [2],[3], [5], [16], [20].
7.	Lack of personalization [2],[3], [5], [16], [20].
8.	Lack of search [2],[3], [5], [16], [20].

2.3 Identifying Accessibility Issues by Automatic tool's perspective

The non profitable organizations W3C and web AIM was developed a set of guidelines to develop accessible website for disabled people. The automatic accessibility evaluation tools are developed to verify the accessibility guidelines on websites. This part of literature review focus on identifying the accessibility problems which are identified by researchers on E-Governance website accessibility evaluation by automatic tool's perspective. Table 3 shows the general problems which are identified by researchers on E-Governance websites accessibility evaluation by automatic tool's perspective.

Table 3. Important issues identified by Automatic tools

S.No	Important issues
1.	Lack of different resolution support [8],[9],
2.	Increase the page size [8], [9],
1.	Lack of alt text [24], [25], [26], [27].
2.	Lack of different color support [24], [25], [26],
3.	graphical user interfaces (GUIs) [6], [7].
4.	the non-linear navigation method of the website [12]
5.	visual elements [21]
6.	tables[24], [25], [26], [27].
7.	frames[24], [25], [26], [27].
8.	lack of keyboard support[24], [25], [26], [27].
9.	lack of orientation[24], [25], [26], [27].
10.	non-standard document formats[24], [25], [26], [27].
11.	Abbreviations and acronyms [24], [25], [26], [27].

III.   RESEARCH METHOD

Since the aim of the research is to identify the root cost of accessibility problems on e-governance websites and how to improve their accessibility. For this reason the research review was started with a view to identify the issues on E-Governance websites accessibility. The identified problems in literature are framed in to a set of requirement specifications; table 4 shows the requirement specification of E-Governance websites.

Table 4. Requirement specification

Requirements
1. Validating the CSS, HTML and Scripting problems,
2. Tracing & Rectifying the potential, Known and likely Problems.
3. More Management
4. Expert website designers
5. Promoting and increasing the awareness of accessibility amongst the staff
6. Establishing of Clear guidelines and standards about accessibility
7. Training on accessibility of E-Governance websites
8. Avoid poor standardization
9. Solve the problem lack of testing
10. Pay attention to disabled people
11. Involving disabled people
12. Better attention toward meeting disabled people needs
13. Clear framework of collaboration and coordination among government agencies
14. Increase trust and satisfaction for E-Governance websites
15. Better monitoring
16. Improving the accessibility of E-Governance websites

If the above mentioned requirements are satisfied then the E-Governance website will get better accessibility level. Hence we developed a new model to develop accessible E-Governance websites by satisfying the requirements identified by literature review. Further the validity and reliability of the proposed model was verified by a set of questionnaires. The questionnaires were framed based on the model to develop accessible E-Governance sites. Next the questionnaire was given to three groups of peoples E-Governance site managers, expert website designers and academic specialists. The data were collected form a total of 51 participants and applied Cronbach's alpha test to verify the reliability of the collected data. Finally the one-way anova test and Scheffe post-hoc tests were carried out to verify that any difference between   three   groups of people opinions about the proposed model.

IV.   THE AESD MODEL
The Accessible E-Governance site Development model is an outline or a roadmap that will provide a guide on how to have a accessible E-Governance website. The model has five components: website management and content developer, end-users, accessibility committee (advisory, executive), software evaluation tools, design process .Figure 1 shows the proposed model for developing accessible E-Governance websites. The model when successfully applied, the E-Governance website can be accessible and achieve the main goal of implementing an E-Governance project. The following subsection explains the roles of the components and demonstrates how they contribute to the model.

4.1 Website Manager and Designer
One of the main elements concerning the accessibility of E-Governance websites includes the roles of website management and content developers. These are considered to be one of components included in the model in order to improve the E-Governance website accessibility. There is undoubtedly a relationship between the success of E-Governance website accessibility and the availability of good management and expert designers. However, as mentioned earlier in the literature review first part, management problems and the need for expert website designers are considered to be the major challenges of making a website accessible.

When the manager has enough experience, knowledge and competence, they should be able to focus on the supervision of E-Governance websites, such as regularly checking work progress and quality in order to prove that it performs its job correctly. In addition, the website manager should supervise the designing unit regardless if it is from the government staff or a third party from outside the government to ensure they accomplish their tasks properly. During the construction process, it is required that a website manager and the designers communicate effectively with information concerning building the websites in time.

Following this model is thought to be a positive approach, as it involves the website manager and designer in the website design, which will make accessibility issues easy to understand, which will therefore enhance their involvement.
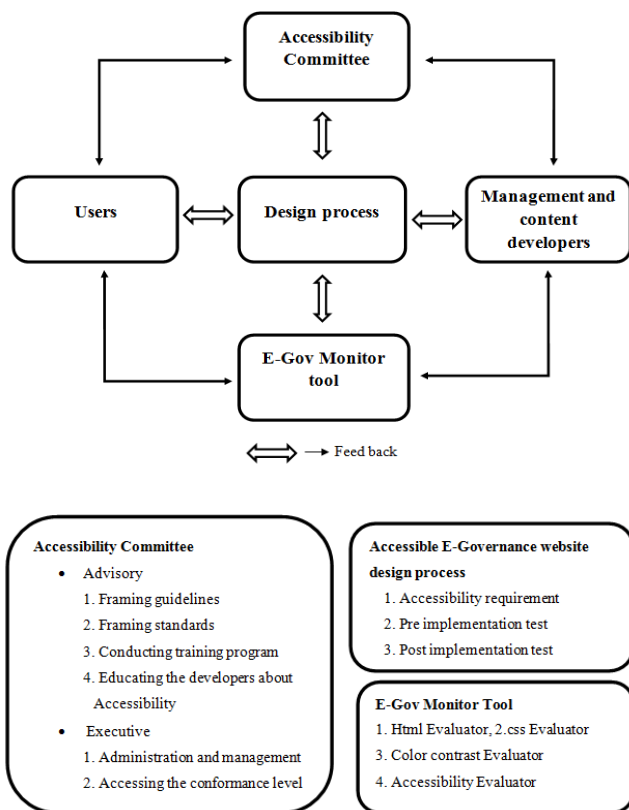
Fig: 1.The proposed AESD model for improving the Accessibility of E-Governance websites

4.2 Users

Errors in the design can be created based on the fact that designers often do not notice flaws in their own work. As a result, it is incredibly important to collect feedback from the prospective end users before a website is launched, as has been previously mentioned. The end user feedback is considered to be one of the main factors in how successful a website is, as it informs the team responsible for the website how people feel about their experience whilst using it. In addition, it can also increase the effectiveness of the website as it solves any complications or frustrations the users experience and it will improve the website in general.

Follow the proposed model and obtain user's feedback is considered as an essential base that can provide an accurate perspective of the way a prospective user sees the E-Governance websites in terms of accessibility, in order to make any improving if necessary. The benefits of following the proposed model regarding obtaining website feedback are unlimited and include:

- ➢ Gaining an understanding of the overall end user perspective on website accessibility.
- ➢ Knowledge of any changing trends and demands of users.
- ➢ Determining the elements that are of the most wealth on the website.

- ➢ Involving any users in building the website show the importance of user's opinions and that give them a feeling of participation
- ➢ Providing new and exciting ideas that will improve the existing websites or aid upcoming websites
- ➢ Developing designer and developer skills as that make them a better in the future
- ➢ Providing a different perspective
- ➢ Being a simple way to ensure quality assurance.

4.3 E-Gov Monitor tool

The known problems, potential problems and likely problems are occurred in the website by wrong designing. These problems can be identified by the software evaluation tools, the WAI defined these are problems which will negatively affect the disabled people [23], [22]. Some of the software evaluation tools are providing automatic error correction on web pages. Further this software evaluation attribute is added in this model to make a website accessible by the way of getting feedback from the managers and end user and update the guidelines also update the evaluation tools based on the requirements. So the developers need not spent each time to verify with users. But getting feedback from users and updating the evaluation tools is very important in developing accessible E-Governance websites.

4.4 Accessibility Committee

It has been determined that the opinion of experts in this area can have a positive impact on the accessibility of an E-Governance website and how successful the website may be. Experts are considered to be people with a high level of competence, skill and experience in accessibility issues and can therefore provide more accurate and effective suggestions and recommendations that will enhance the accessibility of the websites and therefore enhance the overall experience for the user. These opinions should be sought prior to the launch of the website.

The model suggested that there is a need to create a accessibility committee which consists of advisory members and executive members. The advisory is suggested to be controlled by responsible government body such as the Ministry of Information and Communications Technology (MoICT) [8]. As for the executive, it does not matter whether is from government staff or third party (hired from outside) as long as it has expertise and good knowledge in the E-Governance issues in general and in the accessibility issues in particular. The accessibility committee will provide suggestions and recommendations according to accessibility principles and feedback from end

users, with the goal of making websites easier to access, more effective and more pleasant for users.

4.5 Design Process

4.5.1 Accessibility Requirements

Based on the literature review, it has been identified that the key problems facing end users of the E-Governance websites are navigation, search, lack of personalization and appearance. In addition, these requirements that affect a website's accessibility were identified through a literature review [2], [3], [5], [9], [10], [16], [20]. Paying more attention to such requirements helps attract users to the websites more frequently [15]. Therefore, such issues can help increase the accessibility of E-Governance websites.

Therefore, this model focuses on these requirements as well as on the overall satisfaction of the website.

4.5.2 Pre-Implementation Test

The ultimate goal to keep in mind is the creation of an accessible website. By testing a website before its launch one can ensure it is meeting its full potential. If during the testing users can use it without any problems, one has reached the goal. Any design issues that are faced by the user should be outlined via observation and participant responses.

As lack of testing is one of the main problems identified in the conducted studies, the model has taken into account applying a test for website before its launch. In addition, it is without doubt that applying pre-implementation test according to the proposed model will achieve the following benefits:

➢ Any actions of the participants can be observed and recorded.

➢ Data can be analysed and changed made accordingly.

➢ Involve real users in the testing

➢ The user can be provided with real tasks to accomplish.

➢ The overall website accessibility is improved as a result.

V. MODEL VALIDATION

In order to address its validity, the proposed model has been reviewed and assessed by three groups. The first group consisted of E-Governance website managers (16 participants). The second group consisted of expert professionals (computer engineers, people with computer backgrounds, web administrators, designers, technical managers) (20 participants). The third group consisted of academics to reflect a broader view about the model (15 participants). At the end, 51 participants in total were recruited to participate in the assessment.

Before the review and assessment by the mentioned groups, a draft of the questionnaire based on the model was formulated; then it was piloted and refined into the final questionnaire.

In addition to the aim of the research, the introduction section of the questionnaire explained the objectives of the conducted studies and the findings obtained. Moreover, with attached figure of the model, the introduction section explained how the model emerged and the purpose of the questionnaire, which validates the proposed model.

The next section of the questionnaire covered the demographics, years of experience of the participants as well as their familiarity in websites. The last section included questions related to the proposed model in order to validate it. The questionnaire items were measured using a standard five-point Likert scale. The questionnaire was designed in English. On completion of all the participants, the questions and their responses were coded to be analysed using SPSS software.

5.1 Analysis and Outcomes

74.503% of the study participants were male, while 25.49% were female. Regarding the self-declared level of familiarity with websites was 52.94% very good, 41.97% good while fair 5.88%. As for the years of experience, 35.29% of the participants have experience in their fields for 2-5 years, 41.17% for between 5 and 10 years, 13.72% for more than 10 years and 9.803% for less than 2 years. Cronbach Alpha test was conducted for the three groups of people's response in-order to assess the reliability of the obtained data. Table 5 shows the Cronbach alpha value of three groups. Cronbach Alpha was found to be above 0.70 (varying between 0.719-0.912). According to Hair et al (2006) such values are considered acceptable [11]. Table (6) presents the obtained results of the questions.

Table 5 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.719	.752	19
.912	.920	19
.733	.635	19

Table 6 Obtained results of the questions.

s.no	Question	Mean	S.D
1.	Using the proposed model makes it easy for the management of E-	1.67	0.71

	Governance websites		
2.	Using the proposed model is easy to understand accessibility issues of E-Governance websites	1.41	0.54
3.	Using the proposed model we can enhance the designing E-Governance websites for disabled people	1.9	0.92
4.	Using the proposed model promotes and increases the awareness of accessibility among the content developers	1.9	0.93
5.	Using the proposed model takes into consideration the need of skilled website designers	2.31	1.14
6.	Using the proposed model promotes and increases the awareness of accessibility among the staff	1.96	1.02
7.	Using the proposed model supports and keeps using clear guidelines and standards about accessibility	1.88	0.91
8.	Using the proposed model compensates and eases the training related to accessibility of website	2.45	1.1
9.	Using the proposed model helps in avoiding poor standardization in the websites	2.5	1.4
10.	Using the proposed model we can validate the guidelines and standards for accessibility needs	1.88	0.81
11.	Using the proposed model solves the problem of lack of testing	2.49	0.99
12.	Using the proposed model we can validate the source code of websites for accessibility needs	2.08	1.11
13.	Using the proposed model we can validate the source code of websites for accessibility needs	2.2	1.06
14.	Using the proposed model enables users to reflect their experience with the website and send their feedback	2.2	1.02
15.	Using the proposed model gives government agencies the opportunity to follow the same way, therefore improve collaboration and coordination among them	1.49	0.78
16.	Using the proposed model helps in increasing the website accessibility and therefore improves trust and satisfaction for E-Governance websites	1.2	0.49
17	Using the proposed model enables and	1.39	0.6

.	supports better monitoring of E-Governance websites	2	66
18.	Using the proposed model helps in improving the accessibility of E-Governance websites	1.314	0.547
19.	Using the proposed model helps better utilization and successful E-Governance projects	1.2	0.4

Based on the obtained results, it was clear that the assessors believed that the model is useful and applicable in order to accomplish accessible websites. It covers a range of important accessibility issues in relation to E-Governance website.

However, this mean and standard deviation does not grant an accurate assessment. To confirm the good indicator and in order to get better judgment we need another support. For this reason one way ANOVA test and Sceffe Post-Hoc tests were carried out. The one way ANOVA test result of having the sig value (0.985) and the Tukey's and Scheffe's post-hoc test result significance value ranges in between (0.789 to 0.992), these significance values are more than (0.05). So we can conclude that there are no significant differences between the group's opinions in terms of the proposed model. Therefore the proposed model has been accepted as a valid roadmap for improving the accessibility of E-Governance websites.

Table 7 one way ANOVA Result

ANOVA

mean					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.006	2	.003	.015	.985
Within Groups	10.101	48	.210		
Total	10.107	50			

Table 8 Tukey and Scheffe Post-Hoc test result

Multiple Comparisons							
Dependent Variable:mean							
	(I) P.ID	(J) P.ID	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lowe	Uppe

						r Bound	r Bound
Tukey HSD	Managers	Experts	-.064	.115	.843	-.34	.21
		Academic Specialists	-.181	.116	.268	-.46	.09
	Experts	Managers	.064	.115	.843	-.21	.34
		Academic Specialists	-.117	.078	.294	-.30	.07
	Academic Specialists	Managers	.181	.116	.268	-.09	.46
		Experts	.117	.078	.294	-.07	.30
Scheffe	Managers	Experts	-.064	.115	.856	-.35	.22
		Academic Specialists	-.181	.116	.300	-.47	.11
	Experts	Managers	.064	.115	.856	-.22	.35
		Academic Specialists	-.117	.078	.328	-.31	.08
	Academic Specialists	Managers	.181	.116	.300	-.11	.47
		Experts	.117	.078	.328	-.08	.31

VI.   CONCLUSION

Considering the advantages offered by E-Governance websites, there is a need for accessible E-Governance websites. The Accessible E-Governance Site Development model is an outline or a roadmap that will provide a guide on how to have accessible E-Governance websites. The model addressed the main challenges highlighted in the literature to ensure the success of E-Governance websites in terms of accessibility. The model is designed to enable the people who are in charge of E-Governance websites to build accessible and sustainable websites in order to allow all users including people with disabilities to access governmental information and services easily without barriers. Further plan is derive new metrics for measuring the accessibility level and ranking of E-Governance websites based on this proposed model.

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