Metrics for Assessing Quality of a Web Site

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Abstract: ***Web sites are extensively used in circulation of information. Quality of the web sites is the most important and significant issue when it comes to disseminating most efficient and effective content to the users. More refined and relevant information can be made available to the users by considering every quality aspect of the web site. It is quite important to determine the factors that influence the web sites quality and it is also important that the quality can be assessed and evaluated quantitatively in order to determine the realist state of the web site. Completeness of the web site need to be determined and the same is to be used before considering a web site for surfing the required information.There are more than 42 parameters which can be used for computing the quality. Each parameter has many aspects and dimensions that must be considered for building a model. Quality of a website can be computed based on these parameters. In the following grounds it is primarily focused on the attribute called "Completeness" which is one of the important factor, that need be considered for computing the web sites quality. There is a chance of having disconnected content on the web site such as missing hyperlinks, columns in the tables and forms. The more of the disconnectedness in the content that is available on the web site decreases its quality, as the information available on the web site is incomplete and less readable.***

Index Terms: ***Web site, PODQA, Assessment factors, Completeness, AHP.***

I. INTRODUCTION

Exchange of information through web sites has become a part of every body's life. The content launched on to the web site is in different forms commencing from sound, images, videos, audios, graphics etc. Different formats are used to host different kinds of content. The entire content presents different viewpoints that the user seeks. In present days, many of the web sites are being launched and the quality of these web sites is the real concern. Quality plays a vital role to rely on the information presented in web. Assessment of quality is the most challenging tasks. The quality of a website brings end user satisfaction in pursue of information. There are many factors to consider for attaining the quality of the web sites. Those factors include usability, connectedness, structure, navigation, safety, maintainability, reliability, functionality, privacy, portability etc. There are many methods, models and tools are available for assessing the web sites quality. Some websites that are developed by organizations require logo, colour scheme, animated graphics, mouse-over effects, graphics, art, connectivity with the databases and several other requirements. There are many parameters to determine the quality of the web content, which are either related or un-related.

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Methods used for evaluating the web sites quality are broadly categorised into two types namely subjective methods and statistical methods. Subjective methods are based on individual preferences of the assessor. The quality factors can also be measured using statistical methods which are generally called as objective measurements.

Quality requirements differ from one stakeholder to other. Various actors that include the designers, users, management, developers etc. looks at the quality from different perspectives. Maintainability, Security, Functionality, etc. are considered from the perspective of the programmers, while Usability, Efficiency, Creditability etc. are considered from the perspective of end users. An actor provides the needs of a website and can be accompanied with quality parameters that best represent the needs. The complexity of the web sites is increasing day by day especially considering the web sites in e-commerce, Electronics, Museums and other domains. Selection of suitable quality factors and determining quality evaluation methods to evaluate the factors is increasingly complex due to existence of more factors and the inter-relationships among the parameters. There is need to consider both attributes and characteristics and the relationships between the two of the web sites.

Web sites can be evaluated objectively and also sometimes the subjective approaches are to be considered. There is a need to consider both type of methods considering the parameters that needs those methods for undertaking the evaluation. A set of parameters that are more suitable to the characteristics and attributes of the web site must be selected. Every parameter must be evaluated such that characteristics and attributes are evaluated hierarchically using the sub-criteria and sub-sub criteria. Evaluating models for each of the characteristics, sub-characteristic and sub-sub characteristics must be determine and the same are to be used for computing the quality. There should be a method that combines the quality of the hierarchy of characteristics to determine the overall quality of each attribute or parameters. The overall quality of the web site can be evaluated by considering all the attributes that are selected for a web site quality assessment based on the needs of an end user. In the following grounds web site in quality perspective is presented by considering the parameter "Completeness" and its related sub-criteria and sub-sub Criteria.

II. LITERATURE SURVEY

Miss Kausar Fiaz Khawaja et al., [1] considered various factors that include security, usability, adequacy, and appearance for measuring the quality of the web sites. A web site can be set to be usable provided if it is easy to use and one can learn using the web site. One can assess that the quality of the website on its

usage. The more the web site is used resembles more quality. The experience of the user could be considered as rich and valuable when the users learn from quality web sites. The way the look and feel is designed for a web site can be attributed to the factor "Appearance". The look and feel includes appealing, organisation of colours and objects, meaningful arrangement of information etc. Quality of a website can also be assessed based on the observations of the users while the web site is in use.

Several other factors such as flexibility, safety and usability have been provided by Vijay Kumar Mantri et al., [2] for computing the completeness of a web site with respect to quality. The effective, satisfactory and efficient uses of the web site are considered with respect to the factor "Usability". The connection of user should never be revealed which can be assessed through a factor called "Safety". The ability to develop a web site that allows changes to be made while the web site in use is related the factor "Flexibility". A tool named PoDQA (Portal Data Quality Assessment Tool) has been developed to assess the quality of a web site.

Many other factors such as navigation, content, structure, multimedia, appearance and uniqueness are proposed by Vassilis S. Moustakis et al., [3] to assess the quality of a web site. These factors are related to the information available on the web site and conveyed to the end user through an user interface. The quality factor "content" expresses the extent of generalisation and specialisation, completeness, connectedness, coverage of a domain. Supported documents and user guide, designed and provided to the user helps moving around the site is called as navigation. The quality of navigation is dependent on the effort required to move around the site, availability of the connected links and simple structure. The quality factor "Structure" deals with speed, organisation of content, quick access to the contents etc. The look and feel of the web site can be related to the appearance and use of different kinds of multi-media and graphics objects. web sites can be designed in several ways and styles. A web site is said to be "Unique" provides it stands out among similar web site. A unique web site has to be of high quality and such sites are used quite often by the users. A method named AHP (Analytical Hierarchical Process) has been presented using which quality of the web site is assessed.

Many other interesting parameters exit which also needs to be considered for determining the quality of the web site. According to Andrina Graniü et al., [4] the issue of "portability" is used for assessing the flexibility to move content from one site to the other without making any changes at either end.

An assessment system has been presented by Tanya Singh et al. [5] considering different kinds of factors that include appearance, adequacy, security and privacy. They presented literal meaning of these factors. The flexibility in using a web site and the extent that one can learn in using that web site are computed by representing the quality of the same in terms of the factor called "usability". The experience of the users in terms the way the web site can be used is represented through the factor "usability". Some information that can be displayed through web site could be private to a user concerned. Web sites must be programmed such that information is rendered to those who can have access to it. The quality related to the factor "privacy" is the exactness with which the privacy is enforced. The access to the content must be restricted to authorised and authenticated users. The information exchanged between the users and web site must be secured that no damage is caused in the transit. The quality of the web site can be assessed using the factor called "security", which need to be enforced during exchange of information. They also considered another factor for computing quality of a web site which is "Adequacy" that deals with completeness and exactness of the content hosted on the web site.

Similar attributes have been considered by Anusha et al., [6] for assessing the quality of the embedded system. Among the parameters considered by them, the most important attribute considered by them is the attribute "Portability". The ability to move the code and content from one machine without making any change and still make them ready for the target machine to other is called portability.

Yet anothr important thing about the web sites is the reliability of the content displayed to the users every time a hyper link is clicked or an URL is initiated. A web site should redirect to the same content every time a user clicks on the same link unless the information on the web site is dynamically changed. The reliability of a web site can also be termed in terms of probability that the requested link is not available. Design and development of a web site need to be maintained such that the quality of the web site depends on the easiness with which the web site can be maintained. Various issues that include changeability, testability, analysability etc. must be considered when it comes to assessing the quality factor "maintainability". Another important issue that must be considered when it comes to maintainability is the ability to make changes to the web site while it is running.

One other important factor that needs to be considered from the point of quality of web site is "Analysability". The analysability of a web site includes the ability to read the content, relate the content and interpret the same and also find and determine the navigational paths that exists within the web site. A web site can be said to be stable one, if no loose ends exists, user interface not changed or the layout of the display is not disorderly presented. Stable web site does not undergo frequent changes.

A web site must be deigned such that it can be tested while the it is in use. Most of the web sites being used these days do not support this feature.

Filippo Ricca et al., [7] considered many other quality factors including the design of the web sites, organisation, user friendliness and the organisation setup of the web site. The Organisation of the web site includes the web pages, and links of the web pages. The way the web pages are linked will reveal the web pages are accessed with easiness. The design of the web pages must be suitable to the content and is rendered as per the preferences of the surfing users.

According to Saleh Alwahaishi et al., [8] levels to which the content is rendered and the playfulness with which the content can be accessed are the most important factors that must be considered to evaluate the quality of the web sites. They have

presented the framework but not the computational methods required to compute the quality of the web sites.

It has been considered that general criteria is required so as to calculate the quality of any web site that renders any kind of content and the kind of service rendered. They have explained that many dimensions need to be considered for assessing the quality of the web sites. Layla Hasan and Emad Abuelrub [9] commented these dimensions must be considered in conjunction with quality indicators and checklists by the web designers and developers.

The information presented through the web sites are alarmingly increasing. There has been fast growth in web applications and web sites. The quality of the web sites should be high such that same are extensively used for accessing information needed for different purposes. Kavindra Kumar Singh et al., [10] developed a model called WebQEM (Web Quality Evaluation Method) for computing the quality of web sites based on the objective assessment. However it is has been observed that evaluation of quality of web sites is achieved through subjective assessment. They have presented quality of the website based on object evaluation. The method proposed by them covers the attributes, characterise and sub-characteristics.

Many of the users worldwide are interacting with each other through web sites, especially through social sites. The quality of such social web site has become the most important criteria so as to facilitate proper interactions among the users. Long-Sheng Chen et al., [11] provided certain factors that can be used for evaluating the quality of social sites. They have used feature selection techniques to compute the quality of social sites.

Metrics are required for measuring the quality of the web sites. Naw Lay Wah et al., [12] proposed sixteen metrics using which usability of a web site can be computed. They include total pages, word count percentage of body text, text to link count, total size of the site in bytes etc. They have used support vectors for predicting the web sites quality.

Sastry JKR et al., [13][14][15][16][17] have presented the way the quality can be assessed by considering the attributes that include content, structure, navigation, multimedia and usability. They have shown the way the sub-characteristics and sub-sub-characteristics can be considered and the way the quality can be assessed considering all characteristics related to an attribute which should be measured both evaluation and assessment methods are presented.

III. INVESTIGATIONS AND FINDINGS

Completeness of Information hosted on a web site is important so that users can see the meaning of the content hosted. Many aspects must be considered relating to content completeness available on the web sites. Missed URL/Web pages, missing self-reference hyper links in the same page, Missing tabular columns in the tables, missing data items in input-output forms, Missing menus as per the context, are some of the characteristics of the attribute "Completeness" that must be considered and quality assessed to get the overall quality of the web sites.

Missed URL/Web Pages

An URL is said to be missing if the hyperlink is present and the corresponding web page has not been located as per the URL represented directory hierarchy. The quality in relation to these characteristics can be measured based on the 'number of missing hyperlinks'. Missing hyperlinks can be identified through all the pages developed for implementing entire web site.

Let n = Number of pages

Total Missing hrefs = $\sum_1^n mherefs(i)$

Table 1 show the way quality of this sub-characteristic can be computed. This table can be refined as per the experience gained considering the perception of the user.

Table 1 Assessment of quality of Missing hyperlinks (Qhrefs)

Missing hrefs	1	2	3	4	> 5
Quality factor **(Qhrefs)**	1.00	0.70	0.50	0.25	0

Missing self-referential hyper links

In an html page navigation can be implemented using hyperlinks especially when the size of the page is too high. The Navigation within the same page is implemented through self hyperlinks. Generally it is the case that self hyperlinks are coded by the navigation.

Missing self hyperlinks can be identified through all the pages developed for implementing entire web site.

Let n = Number of pages

Total self-missing hyperlinks **Qshrefs** = $\sum_1^n msherefs(i)$

Table 2 Assessment of quality of missing self hyperlinks (Qshrefs)

Missing hrefs	1	2	3	4	>5
Quality factor (**Qshrefs)**	1.00	0.70	0.50	0.25	0

Missing Tabular columns

As a part of content hosting table based presentation is used one of the ways presenting the data. Generally the data taken using the tables or displayed in terms of the tables have to be in line with the data repository. Comparing the html based tables with the existing data repository will help to find whether the tables have been coded properly within the HTML. While comparing the tables, missing columns in the table if any can be found. The details of the comparison tabulated in the Table 3.

Table 3 Missing Column details in the Tables Incorporated into HTML pages

Serial No	HTML Page	Number of Tables referred	Number of missing Columns

1	Kluniversity.in/cse /reser	2	2
2	Kluniversity.in/cse /programs	2	0
3	Kluniversity.in/cse /publications	4	0
4	…		
Total		8	2

The quality of the Tables inserted into the HTML Tables can be computed as per the table 4.

Table 4 Quality assessment based on the Missing Columns

Missing Columns	0	1	2	3	>4
Quality Factor (**Qmiscols**)	1.0	0.7	0.5	0.2	0.0

Missing columns in forms

Content may be presented sometimes based on use forms. The attributes reflected as part of forms may be incomplete due to missing of some of the relevant fields designed into displayed forms. The more the fields missing the less the web site quality.

Generally the data can be inputted through the forms have to be in line with the corresponding data repository. Comparing the html based tables with the existing data repository will help to find whether the tables have been coded properly within the HTML. While comparing the tables, missing attributes in the forms if any can be found. The details of the comparison can be tabulated in Table 5.

Table 5 Missing field details in the forms

Incorporated into HTML pages

Serial No	HTML Page	Number of forms referred	Number of missing fields
1	Kluniversity.in/cse/ research	1	0
2	Kluniversity.in/cse/ programs	1	0
3	Kluniversity.in/cse/ publications	2	1
4	…		
Total		4	1

The quality of the forms inserted into the HTML pages can be computed as per the table 6.

Table 6 Quality assessment based on the Missing fields

Missing fields	0	1	2	3	>4
Quality Factor (**Qmisfields**)	1.0	0.7	0.5	0.2	0.0

Total quality considering the factor "completeness" = **(Qhrefs + Qshrefs + Qmiscols+ Qmisfields)/4**

IV. EXPERIMENTATION AND RESULTS

The above, mentioned methods are applied on to a live web site. **Table 7** shows the experimental results. Using the given results the web site can be improved further.

Table 7 Quality assessment of the parameter "Completeness"

Quality Factor	Quality Value
Qhrefs	0.70
Qshrefs	0.70
Qmiscols	1.00
Qmisfields	1.00
Total	3.40
Average	0.85

V. CONCLUSIONS

To serve a purpose, the web sites should be designed and developed such that the quality needs to be high. There are 42 factors and each factor can be recognised using many characteristics and each characteristic represented through many attributes. There should be an evaluation and assessment model using which each factor quality can be evaluated. Completeness is very important without which the web site shall be disconnected. Users generally don't have interest in such kind of web sites. The models proposed in this paper for evaluating the website's quality are simple, extendable and easily implementable.

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