

WQAP: An Analytical Approach for Website Quality Assessment

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Abstract— Web has become a huge repository of information where millions of people around the world are accessing it. Websites has been playing a vital role in representing such information in an electronic form. In view of this, it became mandatory for the web developer to keep every element of a website as per the user satisfaction and W3C guidelines. This research has identify a major area where every developer must concentrate at the time of website development and do certain assessment tests which evaluates whether the developed website is as per the guidelines and provide a good look and feel environment to the user. This paper has developed and proposed an algorithm called Website Quality Assessment which can be used to implement on a website before making it available to the user in the internet. The research also performed an analysis on 100 websites of Andhra Pradesh government by implementing the algorithm. Finally the research has revealed that only few of the websites are with good quality and others need to optimize. Website errors data has been collected using web based tools from the selected websites and redesigned to improve their performance. Later by implementing T-Test the research has proved that few of the optimized websites are performing better when compared before redesign.

Index Terms— Quality Assurance, Repository, T-Test, Website Development, W3C, Web Based Tools.

I. INTRODUCTION

Now-a-days computers around the world are communicating with each other as a series of networks. The concept of making the computers connect has started in 1991 by Tim Berners Lee named with a most popular service called World Wide Web (WWW). WWW introduced the internet service where people around the globe are communicating together to exchange data.

The most dynamic feature of internet is web where the information is shared among the users around the globe. Around 40% of the world population has an internet connection today. Everyone started using web to provide the data in the form of websites. A website is a collection of related web pages which exhibits the data as web content. A common platform called web browser application software was used as an interface between the user and the internet

service provider. A web browser is capable not only to send the user data to the needy but also retrieves data from web pages. Every web browser comes with built-in applications and some add-ons which help to configure helper applications and additional plug-ins into it.

As websites has become a part of every body it is the primary duty of the website developer to develop the website in such a way that the visitor of the site does not face an accessibility issues in any means. This particular statement made the researchers to think that to how much extend the available websites in the web has user-friendly accessibility. In order to determine the website quality the research has identified certain areas which can impact the quality of the website directly and indirectly. The areas are named as factors which determine the quality of the website in terms of accessibility of behalf of the user. As employed in this journal the factors that identifies the quality of the website are aggregated as

- a. Web content
- b. Website Navigation
- c. Website Design and its structure
- d. Web content accessibility

The content in the website must match with the theme of the site. It means the content placed in the site must be related to the actual purpose what the developer intent to provide. The website must be designed in such a way that the user can easily navigate among the pages to access the web content. The website must be designed good look and feel background and foreground colors and having comfortable navigation. The colors used during the design must be visually comfortable to the user. The screen resolution of the user screen must be compatible with the font size and readable accordingly. The website must have a perfect sitemap so that the user can easily understand the structure how the web pages have been organization and also the depth of the site. In general, a sitemap of a website clearly depicts the number the web pages, links and path of navigation inside the website.

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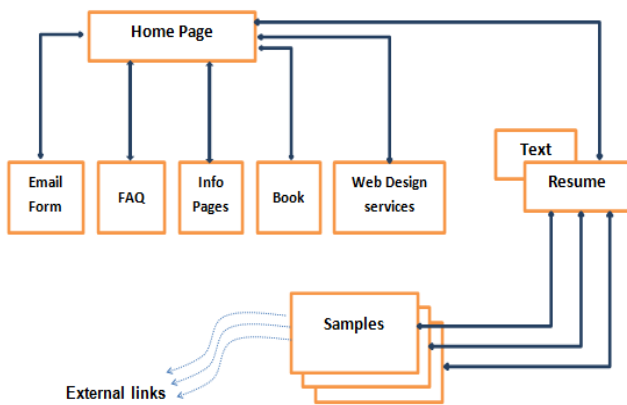


Fig. 1 Sample Representation of a Website Design

II. BACKGROUND STUDY

Web is a collection of websites with some content in which several elements like text, image, and links; graphic, audio and video are incorporated. To determine such organized elements quality W3C has stated some standards to be applied to a website in order to produce a quality with good look and feel. When a website is not able to provide the user needed facilities will becomes an inability. Poor design of the site sometimes lead to be higher download time which makes the user frustrated to leave the site. The research has identified that it is a great challenging task for designers to pay attention on the quality of the website through quality factors and following the standards suggested by W3C. The high quality characteristics of the website suggested are categorized as

- a. Good design
- b. User-friendly accessibility
- c. Optimized SEO
- d. Portable
- e. Efficient and
- f. Reliable

A website is considered as well designed when it is not dumping the elements into the site by rather using the appropriate multimedia elements, clearing the HTML and Script errors and solving web server issues if any. A user friendly website is a one which is easily understandable to the user in terms of accessibility. This will makes the impression and makes many visitors attracted to the website and to spend more time inside the site. The website must also be SEO optimized because if any of the search engines does not able to locate against user query then the sites loose the visitors. Always the designer must be keep track of the changes to the website and optimize the search engine regularly. The research has clearly mentioned all these factors as criteria's. The first criteria of website development depend upon the content to place which determines whether the site is to develop with a single page or multiple pages. A proper research must be done to decide the concept of the proposed website. The developer must have an idea on what basic purpose the website has to be developed and the strategy

behind. They must first identify the target audience and the main content of the website. The second criteria are content creation and it must be organized so that the users are easily accessible and understandable. This is because the website performance depends on how the content has been organized. The third criteria are the design where the developer must concentrate on the visual appearance of the site which causes for good look and feel. The fourth criteria are to make few people involve to test how far the newly developed site is error free and having no issues in its performance. The website testing must be done from the basic functionalities like HTML errors to the extreme assessment of performance in various web browsers and how easy the website is to use. If everything is clear, a task-oriented testing should be done where a series of tasks with various levels of difficulties are given to the user to apply on the website. A clear observation should be done in this regard and note down whether the user has faced any obstacles while accessing the website. If any such issues are identified then they need to be cleared for further launching of the website. Once the site is launched then it need to be uploaded in the web server to make it available to others online. Here a final phase of testing to be done to ensure that the web pages are properly functioning after configuring in the web server.

III. MODEL DEVELOPMENT AND DESIGN OPTIMIZATION

Due to the high demand on web services, the need to assess the website quality has been increased. The research has identified that the determination of site characteristics can make things easy to have a good quality of the website. A little research has been done to consider the number of variety factors associated with successful website development.

According to N.W. Newmann and J.A Landay the website quality can be achieved by modeling a comprehensive methodology to accelerate and improve the process of site design. The website explosion can be determined to measure the need of evaluation related to the quality in terms of usability and accessibility of the website. Hence, it is important for any of the website to have a quality assessment in order to improve the website quality service.

The research has summarized few common quality factors in general a website service offers. The common factors that were used in website quality evaluation is on accuracy, comprehension, value added content, ease to use, availability and reliability of the content, download time, site customization, an effective inside search and good look and feel which will attract the user and makes to spend more time in the website.

The research has followed a process called Website Quality Assessment Algorithm (WQAA) as a methodology to evaluate the website quality with five critical activities such as extraction, link checking, code and script validation and page analysis. During extraction an individual page of the site extracts various web component values like page count, link count, image count, image size count, docs count, CSS size count, multimedia count and website size count. In

link checking module, links which does not have a reference to any other webpage or website is identified so that website performance cannot be degraded. The more number of broken links or dead links reflects the poorer web design quality. Code and script validation module identifies and validates the HTML code and CSS script errors based on the W3C standards. An online tool W3C Markup Validator is used for this purpose. The module multimedia and website size analyzes and identifies the number of multimedia content and the number of images on a page. This is because the more the images and multimedia content the more the website download time.

Most of the web surfers rely on the web only on data extraction which is further leading to increased demand of websites and their good design. To attract more users the website design must be eye catching with useful content and simple navigation through the application. In order to meet the user expectations the developers must make the design process more simple and easy. The research recommended concentrating in developing the website at first and then assuring its quality in terms of content and structure as primary steps. To evaluate the research considered a set of metrics called as major and minor errors which are identified and enumerated based on its data values collected. These error values may directly affect the quality of the website design. The major errors considered in this research are Title Tag Errors (TTE), Frame Tag Errors (FTE), Dead Link Errors (DLE), Document Type Definition Error (DTDE), Connectivity Errors (CE) and Image Loading Errors (ILE). The minor errors are errors occurred from the developers point when they do not follow the standards of W3C. Such errors include Head Tag Error (HTE), Body Tag Error (BTE), Table Tag Error (TTE), Font Tag Error (FTE), Image Tag Error (ITE), Form Tag Error (FrTE), Script Tag Error (STE), Frame Tag Error (FTE) and Link Tag Error (LTE). These tag errors occur when the tags are not properly used, missing image references, scripts are not programmed properly, invalid or no form input.

IV. DATA ANALYSIS

In this research, verifiable 100 Andhra Pradesh government websites are evaluated for qualitative measures. A WQA algorithm has been implemented to extract the major and minor error values by taking the URL of the website as input. Algorithm is enabled with few online web-based tools called Webpage Optimizer which extracts the major error values, Power Mapper and Dead Link Checker which extracts the minor errors. Such recorded major and minor error values are depicted in table 1.

Table 1: Major and Minor Errors of 100 Andhra Pradesh Government Websites

S.No	Organization Name	Website Code	Total Major Errors	Total Minor Errors
1	AP State Election Commission	APSEC	510	66

2	AP State Agro Industries Development Corporation	APSAIDC	84	38
3	AP Finance Department	APFD	10	7
4	AP Seeds Development Corporation	APSDC	193	31
5	Southern Power Distribution Company of AP	APSPDC	214	239
6	Commissionerate of Sericulture	CS	2437	9
7	Directorate of Marketing	DM	273	67
8	Director of State Audit AP	APDSA	384	145
9	AP Director of Insurance	APDI	44	113
10	AP State Civil Supplies Corporation	APSCSC	414	2443
11	AP State Consumer Disputes Redressal Commission	APSCDRC	7	4
12	Commissioner of Civil Supplies	CCS	93	44
13	Public Private Partnerships in India	PPPI	24	43
14	AP Eastern Power Distribution Company	APEPDC	242	42
15	AP Administrative Tribunal	APAT	20	94
16	AP Transco	APT	84	4
17	AP Electricity Regulation Commission	APEREC	4	85
18	Singareni Collieries Company	SCC	1707	53
19	Non-Conventional Energy Development Corp.	NCEDC	603	4
20	AP Forest Academy	APFA	6761	87
21	AP Pollution Control Board	APPCB	333	6
22	Environment Protection Training and Research Institute	EPTRI	469	56
23	AP Judicial Academy	APJC	66	32
24	Director of Insurance Department	DID	44	128
25	AP Press Academy	APPA	715	10
26	AP Crime Branch	APCB	480	169
27	Information and Public Relation Development	IPRD	788	88
28	Anti Corruption Bureau	ACB	133	75
29	AP Human Resource Development	APHRD	1394	72
30	Vigilance and Enforcement	VE	131	25
31	Centre for Good Government	CGG	649	29
32	AP State Aids Control Society	APSACS	3199	114
33	Commissionerate of Family Welfare	CFW	151	58
34	Directorate of Medical Education	DME	8	3
35	Institute of Preventive Medicine	IPM	480	51
36	TTD Seva	TTDS	11	82
37	Director AP Tourism	APT	6	6

38	Director of Government Examinations	DGE	94	19
39	Director of State Council of Educational Research and Training	DSCERT	647	49
40	AP Residential Educational Institutions Society	APREIS	50	9
41	Adilabad DEO	ADEO	297	2
42	Transport Commissioner	TC	984	43
43	APSRTC	APSRTC	681	54
44	AP Police Academy	APPA	35	14
45	AP Vikalangula Co-operative Corporation	APVCC	309	15
46	AP Women's Co-operative Finance Corporation	APWCFC	15	57
47	AP State Disaster Mitigation Society	APSDMS	4	25
48	Director Telugu Academy	DTA	1342	58
49	AP State Council of Higher Education	APSCHE	469	84
50	Board of Intermediate	BI	613	65
51	Directorate of Collegiate Education	DCE	1502	102
52	Commissioner of Intermediate Education	CIE	14	13
53	AP Technology Services	APTS	115	14
54	Institute for E-Governance	IEG	195	15
55	Society for AP Network	SAPN	239	34
56	Engineer in Chief	EIC	51	87
57	AP Instructrial Technical Consultancy Organization	APITCO	390	27
58	Commissioner & Director of Municipal Administration	CDMA	3	4
59	Hyderabad Metropolitan Water Supply	HMWS	766	55
60	Commissioner of Rural Development	CRD	2	8
61	AP Academy of Rural Development	APARD	253	185
62	Commissioner of Commercial Taxes	CCT	30	1
63	Tirumala Tirupathi Devasthanam	TTD	520	537
64	AP Housing Board	APHB	153	77
65	AP Tribal Welfare Department	APTWD	200	11
66	AP Handicrafts Development Corporation	APHDC	516	60
67	AP Industrial Infrastructure Corporation	APIIC	5	1
68	AP Study Circle	APSC	247	18
69	AP Transport Department	APTD	986	44
70	AP State Handloom Weavers Cooperative Society	APSHWCS	542	93
71	AP Infrastructure Corporation	APIC	142	62

72	AP Invest	API	58	55
73	AP Labor Welfare Board	APLWB	582	83
74	AP State Minorities Finance Corporation	APSMFC	52	88
75	AP Municipal Development Projects	APMDP	3	2
76	Greater Hyderabad Municipal Corporation	GHMC	3	329
77	Director of Town and Country Planning	DTCP	2	3
78	Commissioner for Disaster Management	CDM	3	49
79	Commissioner & Inspector General Stamps & Registration	CIGSR	52	48
80	AP Water Sector Improvement Project	APWSIP	104	14
81	AP Physical Education	APPE	105	24
82	AP Ground Water Department	APGWD	111	27
83	AP BC Welfare Society	APBCWS	2	0
84	AP Public Enterprises Department	APPED	1126	0
85	AP State Portal	APSP	1335	0
86	AP State Cooperative Bank	APSCB	1	0
87	Commissioner for Co-operation and Registrar of Co-operative Societies	CCRCS	233	19
88	National Rural Employment Guarantee Scheme	NREGS	2731	67
89	A.P. State Achieves & Research Institute	APSARI	2	19
90	A.P. Govt. Oriental Manuscripts Library and Research Institute	APGOMLR I	952	13
91	Director, Hindi Academy	DHA	272	39
92	A.P Open School Society	APOSS	307	56
93	Director for Govt. Examinations	DGE	95	19
94	A.P.R.E.I. Society	APREIS	50	15
95	AP State Legal Services Authority	APSLSA	56	54
96	IT,E&C Department	ITEC	509	87
97	Commissioner, EDS	CEDS	6	5
98	AP Technology Services (APTS)	APTS	110	54
99	Society for AP Network (SAPNET)	SAPNET	235	30
100	IT,E&C Department (e G.O)	EGO	20	48

According to the error data values analysis it was identified that the large website size is the main reason for poor download time. The sizes of metrics leads to a high website download time. For further analysis of data Regression Analysis was carried to optimize the website size. The analysis was carried as column of numbers representing X as independent variables and Y as dependent variables range. The P-Value < 0.05 concludes that the relative variables as significant and they can be taken as insignificant values. The findings have proved that the reduction in web content size

and improving the speed of download time can improve the performance and quality of a website. For proving this the home pages of 100 Andhra Pradesh government websites were considered for redesign. After the redesign, the download times of the existing and optimized values of websites are calculated in seconds using Webpage analyzer and the resulting values are depicted in table 2.

Table 2: Existing and Optimized 100 websites download time in 56 kbps speed

S.No	Organization Name	Existing Design	Proposed and Optimized Design
1	AP State Election Commission	2.97	0.446
2	AP State Agro Industries Development Corporation	7.05	1.096
3	AP Finance Department	4.44	0.575
4	AP Seeds Development Corporation	6.78	0.389
5	Southern Power Distribution Company of AP	7.9	4.027
6	Commissionerate of Sericulture	60	0.956
7	Directorate of Marketing	20.6	0.22
8	Director of State Audit AP	3.1	0.583
9	AP Director of Insurance	4.1	1.017
10	AP State Civil Supplies Corporation	2.84	2.153
11	AP State Consumer Disputes Redressal Commission	8.28	0.203
12	Commissioner of Civil Supplies	60	0.109
13	Public Private Partnerships in India	3.1	0.929
14	AP Eastern Power Distribution Company	5.4	6.371
15	AP Administrative Tribunal	7.34	0.708
16	AP Transco	5.87	0.084
17	AP Electricity Regulation Commission	3.8	0.697
18	Singareni Collieries Company	4.78	0.424
19	Non-Conventional Energy Development Corp.	1.83	0.115
20	AP Forest Academy	2.26	0.394
21	AP Pollution Control Board	4.25	2.624
22	Environment Protection Training and Research Institute	3.03	1.057
23	AP Judicial Academy	2.06	0.772
24	Director of Insurance Department	3.46	1.017
25	AP Press Academy	1.36	0.113
26	AP Crime Branch	23.17	0.353
27	Information and Public Relation Development	2.74	0.843
28	Anti Corruption Bureau	2.79	1.396
29	AP Human Resource Development	4.51	0.307
30	Vigilance and Enforcement	1.19	0.392

31	Centre for Good Government	4.34	0.113
32	AP State Aids Control Society	1.57	12.293
33	Commissionerate of Family Welfare	1.87	0.544
34	Directorate of Medical Education	2.58	0.109
35	Institute of Preventive Medicine	3.79	0.639
36	TTD Seva	3.14	0.295
37	Director AP Tourism	5.1	0.222
38	Director of Government Examinations	2.38	1.918
39	Director of State Council of Educational Research and Training	1.86	0.303
40	AP Residential Educational Institutions Society	1.98	0.254
41	Adilabad DEO	0.946	1.901
42	Transport Commissioner	2.82	1.037
43	APSRTC	11.59	0.214
44	AP Police Academy	60.75	2.254
45	AP Vikalangula Co-operative Corporation	4.55	0.343
46	AP Women's Co-operative Finance Corporation	1.79	0.362
47	AP State Disaster Mitigation Society	2.44	0.361
48	Director Telugu Academy	7.82	1.723
49	AP State Council of Higher Education	6.95	0.542
50	Board of Intermediate	2.39	0.444
51	Directorate of Collegiate Education	2.06	0.412
52	Commissioner of Intermediate Education	3.19	0.444
53	AP Technology Services	1.88	0.202
54	Institute for E-Governance	2.63	0.62
55	Society for AP Network	4.37	0.595
56	Engineer in Chief	4.92	1.563
57	AP Instructrial Technical Consultancy Organization	2.86	6.184
58	Commissioner & Director of Municipal Administration	0.873	2.385
59	Hyderabad Metropolitan Water Supply	7.71	1.8
60	Commissioner of Rural Development	3.94	2.127
61	AP Academy of Rural Development	9.57	0.094
62	Commissioner of Commercial Taxes	5.56	3.049
63	Tirumala Tirupathi Devasthanam	60.1	3.406
64	AP Housing Board	3.36	0.123
65	AP Tribal Welfare Department	5.21	0.496
66	AP Handicrafts Development Corporation	2.35	0.111
67	AP Industrial Infrastructure Corporation	0.801	1.683
68	AP Study Circle	5.09	0.172

69	AP Transport Department	4.83	1.037
70	AP State Handloom Weavers Cooperative Society	1.36	0.129
71	AP Infrastructure Corporation	0.432	0.104
72	AP Invest	1.57	1.027
73	AP Labor Welfare Board	0.513	0.365
74	AP State Minorities Finance Corporation	4.45	0.975
75	AP Municipal Development Projects	0.68	1.513
76	Greater Hyderabad Municipal Corporation	2.5	0.214
77	Director of Town and Country Planning	2.93	0.102
78	Commissioner for Disaster Management	1.77	0.202
79	Commissioner & Inspector General Stamps & Registration	11.08	0.544
80	AP Water Sector Improvement Project	60	1.745
81	AP Physical Education	2.37	0.083
82	AP Ground Water Department	15.74	0.874
83	AP BC Welfare Society	60	0.095
84	AP Public Enterprises Department	60	0.596
85	AP State Portal	10.95	2.127
86	AP State Cooperative Bank	3.87	0.831
87	Commissioner for Co-operation and Registrar of Co-operative Societies	3.65	0.323
88	National Rural Employment Guarantee Scheme	7.15	4.925
89	A.P. State Archives & Research Institute	1.31	0.056
90	A.P. Govt. Oriental Manuscripts Library and Research Institute	1.83	0.297
91	Director, Hindi Academy	2.13	0.149
92	A.P Open School Society	3.34	0.065
93	Director for Govt. Examinations	3.3	1.918
94	A.P.R.E.I. Society	2.24	0.254
95	AP State Legal Services Authority	2.91	0.455
96	IT,E&C Department	9.41	0.897
97	Commissioner, EDS	4.74	0.192
98	AP Technology Services (APTS)	3.83	0.202
99	Society for AP Network (SAPNET)	3.23	0.595
100	IT,E&C Department (e G.O)	4.03	0.287

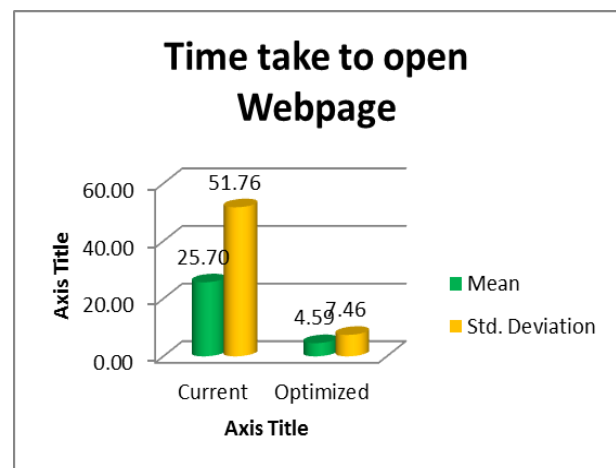


Fig. 2 Existing and Proposed download times of 100 websites

Simultaneously the similar optimization process was carried out by considering 05 web pages of each 100 websites for download time optimization. The results are depicted in fig 3.

Consequently, the research was continued to identify whether the redesigned websites has improved the design quality after reducing the download time. In view of this T-Test was carried to establish a significant difference in the download time of existing and proposed web pages. The complete test results for 500 webpages of 100 websites were depicted in the table 3.

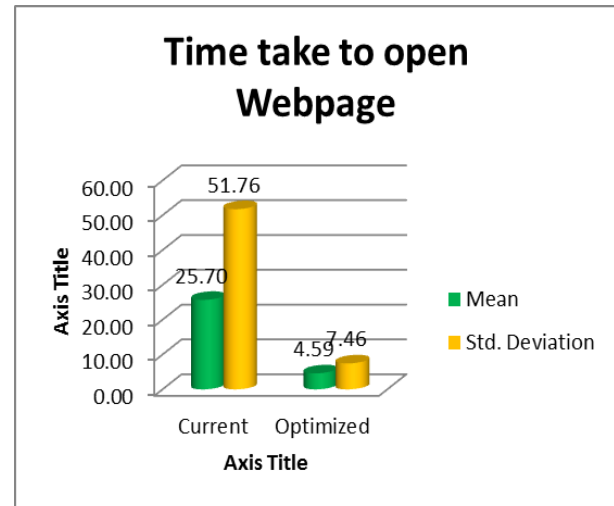


Fig. 3 Consolidated Time for 05 individual web pages of 100 websites

T-Test**Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
	Existing Design (in seconds)	8.26	100	14.75	1.47534
	Proposed and Optimized Design (56kbps speed)	1.05	100	1.63	.16344

Paired Samples Test

		Paired Differences	t	Df	P-Value
		Mean			
	Existing Design (in seconds) - Proposed and Optimized Design (56kbps speed)	7.2139	4.881	99	.000

T-Test**Paired Samples Statistics**

Webpage		Mean	N	Std. Deviation	Std. Error Mean
	Current	25.70	505	51.76	2.30315
	Optimized	4.59	505	7.46	.33183

Paired Samples Test

		Paired Differences	t	Df	P-Values
		Mean			
	Webpage Current - Webpage Optimized	21.11097	9.177	504	.000

T-Test**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
diff1 org	100	7.2139	14.78039	1.47804

T-Test**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
diff2 webpage	505	21.1110	51.69760	2.30051

V. FUTURE ENHANCEMENT

The findings of the research were clearly indicating that further more investigation and site analysis is needed in order to improve the website quality.

VI. CONCLUSION

Based upon the importance of keeping website quality as a primary issue certain factors was identified and analyzed. The results are further used to determine the elements which are impacting the performance of website. The research has made an in-depth analytical study and observed some major variations that only few websites download time has reduced to a greater extend, few to a slight extend and few are observed with increased download time. Finally the research has contributed to a greater extend to improve the website quality in the current scenario.

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