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Measuring Effectiveness of Library Websites with User Traffic Analytics: A Review

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Abstract

The purpose of this review is to examine the process of measuring and analyzing user traffic on academic websites including library websites. It helps improve the user experience and overall performance of library websites. User traffic analysis is also used in the internet world to analyze visitor types, user demographics, popular content, and to evaluate service strategies and campaigns. There are different tools, methods, and protocols available to analyze and handle user traffic on library websites. Types of website data analysis are discussed in this review. This review is based on relevant literature and scholarly articles on web analytics, web traffic, measuring website effectiveness, and user traffic analysis on different websites of educational institutions including library websites. Despite practical information found in usage log files, data also suffers from limitations, because certain types of visitors' data are not loaded, such as the visitor details and incomplete information about the system used.

Measuring website effectiveness is an important technique that is used nowadays for the purpose of increasing website effectiveness. It is also useful to increase the number of visitors and to improve the performance of library websites. This technique includes the analysis of web traffic, website speed, webpage load time, first view on different devices, average time that visitors spend on the website, and the visitors' behavior. It has achieved widespread acceptance and become one of the most significant tools for the up-gradation of website and facilitation of its users. It has quickly emerged as one of the best services for the collection and analysis of the most complicated website data. With the ever-increasing amount of data sources, user traffic analysis will play a more important role in the future.

Keywords: Library Websites, Network traffic, Google analytics, Interest analysis, Clickstream analysis, Conversion analysis, Webometrics.

Introduction and Background

Website analytics is a measure of the activities and behavior on a Website. By the collection of numerous website analytics metrics, including the number of page visits and its duration, we can establish a Key Performance Indicators (KPIs) - a flexible analytics version (Booth, 2009).
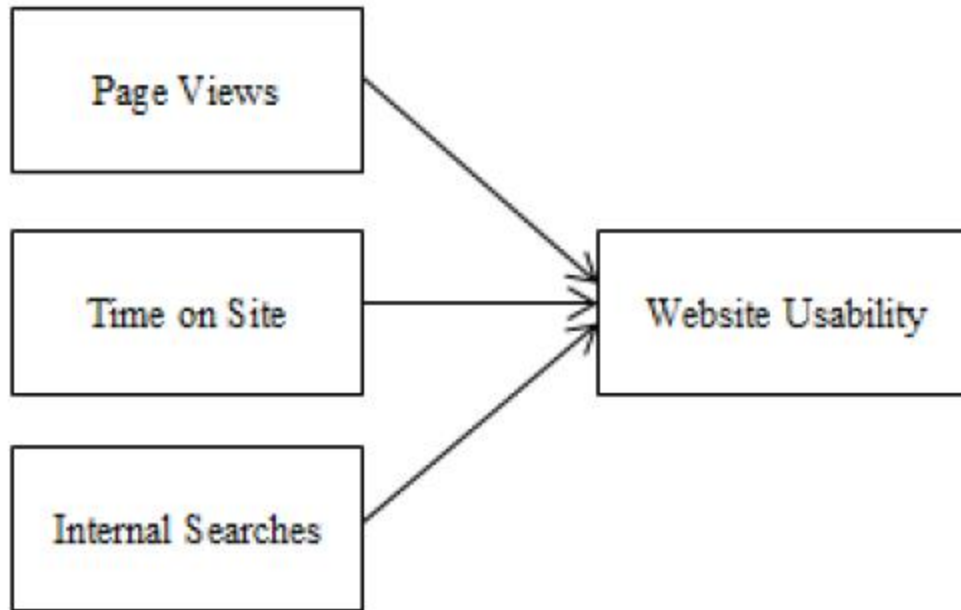

Figure 1. Website usability analytics (adopted from Beri & Permindar, 2013, p. 34)

User traffic analysis is a monitoring process that usually follows an ongoing reporting process, which helps to improve the user experience and overall performance of a website. User traffic analysis is also used in internet marketing to analyze visitor types, user demographics, and popular content. It is also used to evaluate marketing strategies, campaigns and its usage. The first step for studying a website and website traffic is to apprehend and examine service targets then using that information for the selection of metrics.

In 1993, Moses used Log records to understand the web demands of the website users for the development of the World Wide Web. In 1995, Stephen Turner made Analog, a free programming system, with the expectation of complimentary document analysis. Norguet (2004) explained website analytics as the science of determining and analyzing the Internet audience. It deals with website consultation, web usage collection, compilation, and presentation of metrics; and results in exploitation to improve the satisfaction of website goals. Burby and Brown (2007) explored that

website analysis is the knowledge and method of gathering, gaging, examining; and reporting webs and details of using web applications.

Table 1. Eight Common Metrics of Website Analysis (adopted from Booth, 2009, p. 154)

Metric	Description	Category
Visitor type	Who is accessing the website (returning, unique, etc)	Site usage
Visit length	The total amount of time a visitor spends on the website	Site usage
Demographics and system statistics	The physical location and information of the system used to access the website	Site usage
Internal search information	Information on keywords and results pages viewed using a search engine embedded in the website	Site usage
Visitor path	The route a visitor uses to navigate through the website	Site content analysis
Top pages	The pages that receive the most traffic	Site content analysis
Referring URL and keyword analysis	Which sites have directed traffic to the website and which keywords visitors are using to find the website	Referrers
Errors	Any errors that occurred while attempting to retrieve the page	Quality assurance

Qutab and Mahmood (2009) observed that advantages of website analysis to help understand the strengths and weaknesses of a website, to find out how to improve website navigation, to compile web contents, to diagnose problems with customer service, to improve customer satisfaction, reliability and to maintain the website by providing good information for web users. Kaushik (2010) evaluated that identifying personally identifiable information about how to improve a website to communicate with a customer. Interaction is a significant idea for web sites because user-friendly web sites permit students to study efficiently and in an appealing way. According to TagMan (2012), an essential reason for website analysis is the assortment and analytics of web usage information. Today, web analytics are utilized in numerous businesses for multiple purposes, for example, user traffic checking, web-based business, promoting/publicizing, web improvement, data creation, etc. Websites have unique users such as prospective students, parents, active faculty and staff members, donors and alumni (Caglar & Mentes, 2012).

Zheng and Peltsverger (2015) revealed that one of the developers of weblog analytics was WebTrends, a Portland Oregon-based organization, which examined the web utilizing information gathered from the weblog. Around the same time, WebTrends was considered as the main programming for user traffic analysis of a website. Shaya (2015) narrated website analysis as the

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dimension, assortment, analytic, and reporting of Internet information for purposes of considering and enhancing the use of the Web. Adi and Joshi (2015) informed that website traffic analysis and forecasting are an effective way to ensure secure, reliable, and relevant network communications. Various strategies are proposed and tested to analyze network traffic including neural-based techniques. Similarly, various Linear and Nonlinear models are proposed for the prediction of network traffic. Several interesting combinations of network analysis and forecasting techniques are used to achieve appropriate and efficient results. It is a method of computing the level and type of activities of clients on the web, understanding the capacities, and implementing the results.

Khan, Idrees, and Mudassir (2015) examined that the website is a fundamental source of information for People with Disabilities (PWDs). This is a basic human right perceived in the UN Convention on the Rights of PWDs, clearly assign to the Internet and other Information and Communication Technologies (ICT) as an access code for them. Various researches showed that the internet and ICT are three times more interactive and accessible for normal people than disabled persons. Tella and Oladapo (2016) explained that website analysis is the practice of evaluating and analyzing website performance in terms of SEO (Search Engine Optimization), speed, competition, and traffic. Website analysis is a series of tests and test points to see if a website works properly. Sun, Fong, Law, and Shan (2017) suggest that websites have become a standard platform for data search, and website testing has attracted the interest of professionals and many investigators.

Significance of User Traffic Analytics

User traffic analysis is a study of data gathering and analysis of a website. It has achieved widespread acceptance and become one of the most significant tools for the up-gradation of a website and facilitation of its users. It has quickly emerged as one of the best services for the collection and analysis of the most complicated website data. With the ever-increasing amount of data sources, user traffic analysis will play a more important role in the future. However, it is a less researched area in the field of Library and Information Science. This study examines and compares that user traffic analysis is essential for faster performance and better conversions, which leads to improving traffic on a website. It can provide website visitors' information so you can grow your content according to users' interests. By user traffic analytics, you can check where your website traffic comes from, what kinds of blog posts, issues and pages attract the most traffic, what day of the week it is most traffic-tracking and what people typed in search engines to get to

your website. You can also look at where your traffic changes in sales, and where those leads are coming from (Kaushik, 2010; Norguet, 2004).

According to Qutab and Mahmood (2009), TagMan (2012), Tella and Oladapo (2016), the following points show the significance of the study:

1. Proper evaluation and analysis of user traffic on a website can be helpful to find out issues in your website, its ratification, up-gradation, and its performance enhancement. Once you have solved them, the resource becomes more effective.
2. User traffic analytic tell us about the number and percentage of the audience or traffic that visit a website, the duration of the visit session, the most effective traffic source, and the number of pages visited each session.
3. It helps in analyzing the traffic of a website with the help of Google Analytics and Search Console.
4. It helps in the comparison of the current result with the previous one within a similar period.
5. Different tools such as Serpstat, AcerWeb, and Aherfs are used for checking, measuring and analyzing data on websites.
6. User traffic analysis helps in fixing errors on the website.
7. It helps to increase the speed and performance of a website.
8. It improves the reputation and effectiveness of a website.
9. It ensures website safety, security, and efficiency.
10. It is useful for the improvement of service standards and user interest in a website.

Data for User Traffic Analytics

The basic function of measuring website analytics is to gather and examine the website traffic data and its usage designs. Hu and Cercone (2004) suggested that the most famous practice to read this information is to use a dimensional model. There are two main kinds of information i.e. factual and dimensional information, which describes facts from various aspects and levels in this model. Factual information is about the calculation of usage and time. The most fundamental measure is a page view that is a single web page application. The number of client activities e.g. a mouse click can be used as a measure. The details of the size are very complicated. The main types of metrics are time, content, location, user customer details, and operator or time.

Types of User Traffic Analytics

Zheng and Peltsverger (2015) examined that the best and commonly used metrics in website analysis are visit counts: page views, casual user, travel duration, page duration, site duration, link rate, and opt-out rate. There are many quantitative methods of data analysis. Some of these are discussed below:

Trend analysis

It looks at the information such as time range and shows the chronological change of the chosen metrics. For instance, information about the increase in mobile app download and its usage statistics in the past and also in future (Zheng & Peltsverger, 2015).

Figure 2. Mobile app download and usage statistics (adopted from Blair, 2020, p. 3)

Distribution analysis

It is a few reductions within the value of the metric. Values are usually measured as a percentage of the worth of ONE or more dimensions. It often analyzes profiles of guests and clients. For instance, the odds of browser types within the last month provide information about customer variations. The foremost widely use of this sort of study is that traffic source (e.g., posting source analysis) that reveals campaign performance, location, technical data including browser, OS,

device, screen resolution color depth and customer support, and so on (Zheng & Peltsverger, 2015).
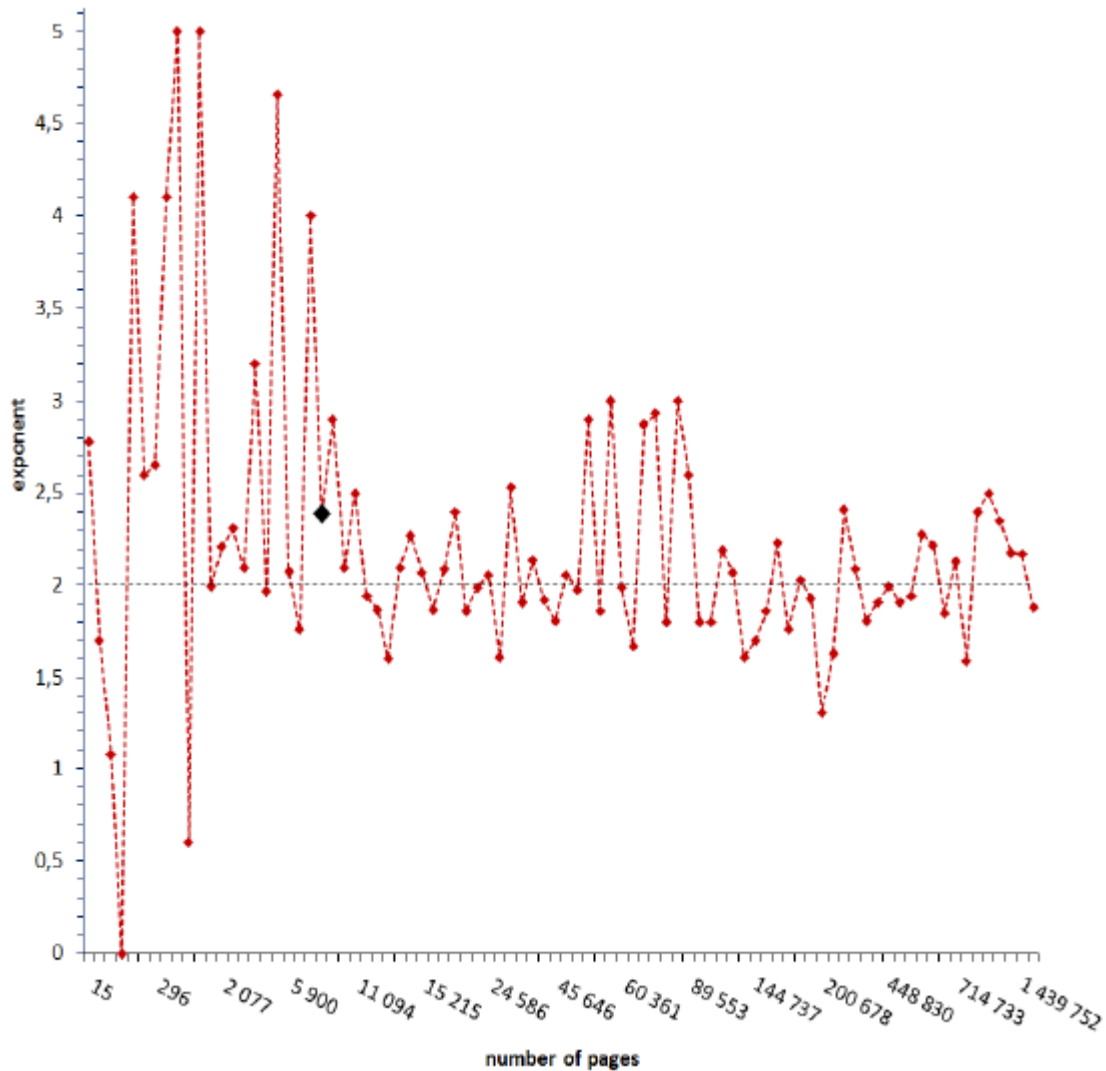

Figure 3. Distribution analysis of a website (adopted from Blekanov, Maksimov, Moskalets & Sergeev, 2017, p.2)

The analysis based on studies showed that the pages were distributed in terms of the power-law via the count of incoming links. Blekanov, Maksimov, Moskalets, and Sergeev (2017) presented an idea that university websites have somehow unique features. The preliminary analysis discovered that the adjustments of the components of the distribution law in our formulas will have a significant influence at the webpages of a website and hyperlinks count estimation error.

User activity or behavior analysis

User behavior analysis is an essential feature to promote client-friendly products; promotional offers can be made based on those recommendations and provide useful records to promote services by using data analytics (Roman, Velasquez, Palade, & Jain, 2013). It analyzes how users interact with websites. Common examples are engagement analysis, click-through processing, and page analysis (Zheng & Peltsverger, 2015).
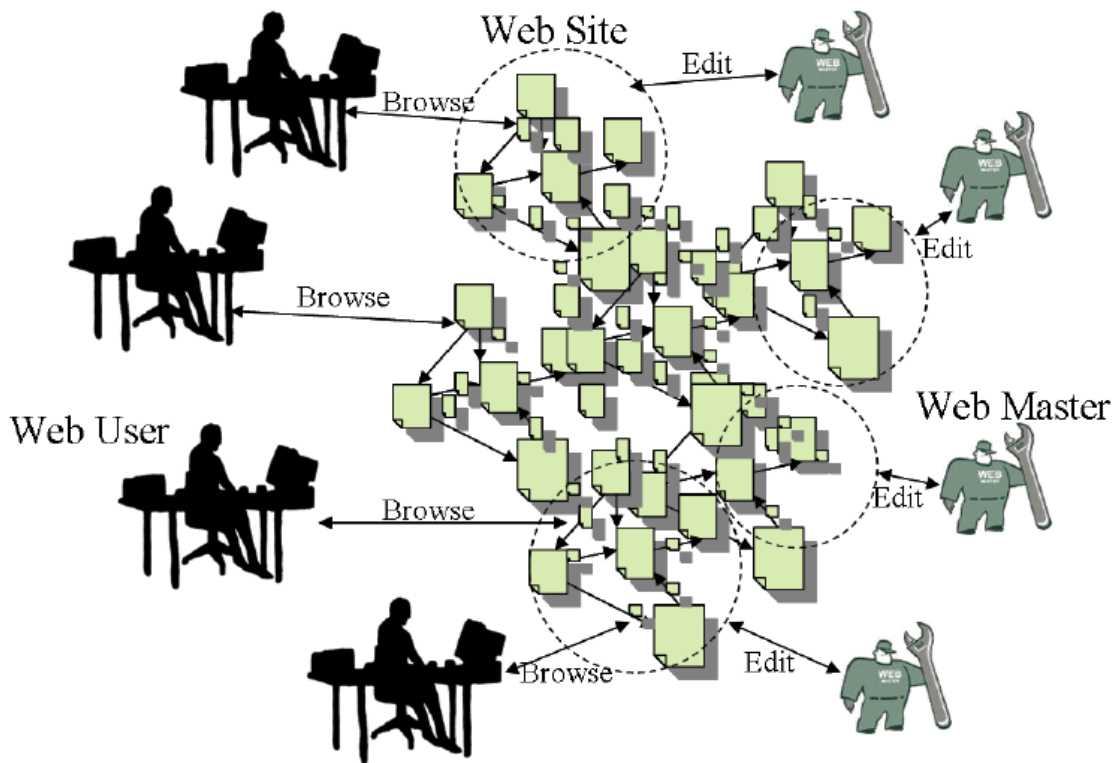

Figure 4. First level description of the web user/site system (adopted from Roman et al., 2013, p. 3)

User behavior analysis has been carried within different fields, including psychology, sociology, economics, linguistics, commerce, and library and information sciences. Therefore, a broader theoretical framework is available with an extraordinary capacity for its use in different fields, especially in the analysis of web browsing behavior. The aforementioned fields use studies and experimental samples to check and quantify their theoretical models. Regarding the browsing behavior of web traffic, the main source of information is weblogs, which save all visitor's activities on the site. Such files can contain hundreds of thousands of registers, relying on web

traffic, and represent the main supply of statistics on user behavior. Roman, Velasquez, Palade, and Jain (2013) worked on new tendencies in analyzing user behavior on a website and discussed novel approaches, including those, which are based totally on the neurophysiological idea of decision-making, by describing what web user, want in a website.

Engagement analysis

According to Peterson and Carrabis (2008), it is one of the foremost widely used analytics within the web industry. The subsequent items are measured as follows:

1. How many pages were visited per session?
2. What is the duration of a visit?
3. How often new visitors become returning visitors?
4. How often visitors return to the location (loyalty)?

Figure 5. Engagement analysis of a website (adopted from EAi Engagement Analyzer, 2020, p.1)

The purpose of this type of analysis is to seek out why the majority of the activities done on the web site are endless. There are numerous attempts to get engagement codes that differentiate from the visit of the user. For instance, a user came by searching website in search engine and visited two webpages and downloaded a few documents and other came from an outsized website and visited 20 pages in 35 minutes, downloaded a few articles (Zheng & Peltsverger, 2015).

Clickstream analysis

As Figure 6 shows (Guanasanbandan & Poonkuzhali, 2018, p. 893), a clickstream is a record of customer behavior on the browser that may include every website and every webpage that the user visits, the duration of visit, in what structure the site was inspected and the email addresses that user sends or receives. Both internet service providers and websites should have the capability to discover a user's clickstream. This type of data is becoming very valuable to internet marketers and advertisers.
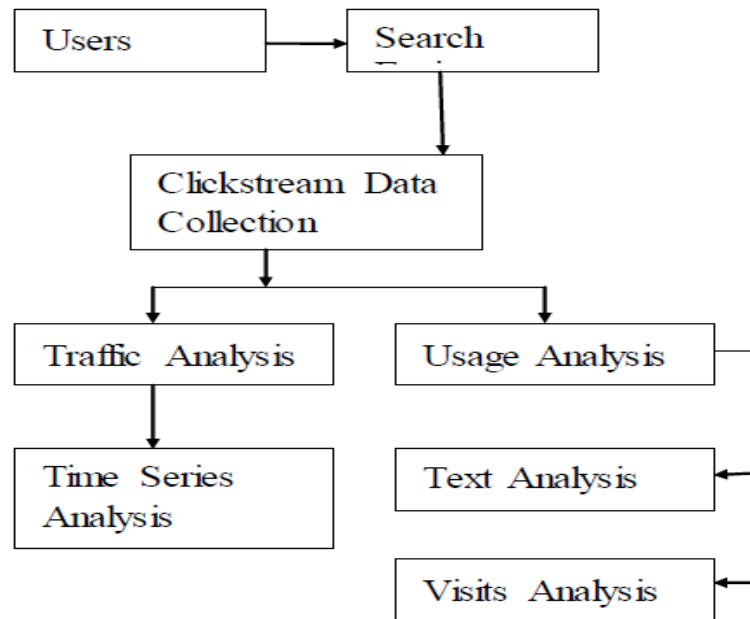

Figure 6. Clickstream architecture

It also refers to click paths and analyzes the traffic on an internet site. Clickstream may be a list of all the pages viewed by a visitor, that is displayed within the watch order and is described as a 'mouse click sequence' performed by each visitor. Clickstream analysis helps improve the planning and construction of internet sites (Zheng & Peltsverger, 2015).

Figure 7. Clickstream data analysis (adopted from Buckley, 2018, p. 1).

Interest/travel analysis

It is also called page analysis. It analyzes users' understanding of an internet page. It uses client text to trace clicks and movements of the user's mouse and shows results on a heat map. It can also show how far clients are following the webpage. Analytics of link preferences and areas of attention helps to develop content placement strategies. For instance, it helps to choose which objects should be placed at the highest of the page or finding the simplest spots for ads (Zheng & Peltsverger, 2015).

Figure 8. User interest analysis: The user-driven approach (adopted from Hotjar, 2020, p.1)

Conversion analysis

A conversion is a complete specific, desirable action taken by a user on a website. Target action can be a certain quantity of site visitors to an internet page, to buy a product, online shopping, to

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fill out a registration form (Beri & Parminder, 2013). It is one of the crucial analytics in the field of e-commerce and other sectors. The conversion rate is measured by dividing the quantity of targeted activities completed by the sum of unique visitors who visited the location. All website analysis providers try to enhance conversion tracing. For instance, Google Analytics provides conversion reports for multi-channel funnels that show which campaigns, sources, or channels have influenced the conversion of many visitors (Zheng & Peltsverger, 2015).

Today, web users use many unique websites often in their daily lives. Website utilization and its conversion rate reflect the level of satisfaction of website users. The higher the usability and conversion of a website, the better the website works. Web analytics consists of a chain of meta-techniques and techniques used by webmasters to the degree of their performance and the price of conversion of their website. Beri and Parminder (2013) pursue to explore the contribution of website analysis to increase the website's overall performance and conversion rates. This may be utilized by organizations to enhance their services and SEO ranking of their websites.

Figure 9. Website conversion analysis (adopted from Outsourcesem, 2020, p. 2)

Performance analysis

It helps to reveal website performance issues (such as load time) or linking errors. For instance, after an internet site restarts, indirect traffic volume must be viewed. If there is a touch of indirect traffic, some links from other sites and/or bookmarks may break down after re-provisioning

(Zheng & Peltsverger, 2015). Website performance can be a critical factor in its success. It depends upon the speed of the system. When a website speeds up, its performance goes up automatically. Performance can be evaluated by using tools that provide information on the resources and features on that website. There is a wide diversity of automated website testing tools available for this purpose nowadays (S. Kaur, K. Kaur, P. Kaur, 2016).

Figure 10. Quality and performance analysis (adopted from Dareboost, 2020, p. 1).

The automated testing tools are used to determine the performance, speed, several requests, load time, page size, SEO (Search Engine Optimization), mobile and security of a website. The performance analysis of a website is done by using automated usability testing tools like Pingdom, GTMetrix, Website Grader, and Site Speed Checker Tool; and results are analyzed based on the above said parameters. (Dareboost, 2020)

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Limitations of User Traffic Analysis

According to Ferrini and Mohr (2008), following are some limitations in measuring the effectiveness of a website with user traffic analytics.

- Weblog file limitations often appear because certain types of visitors' data are not loaded, such as the visitor details and incomplete information about the system used for visiting the site.

- Web visit counting can also be incorrect, as most web analytics programs define a visit as a sequence of page requests for different visitors over a period of time, i.e. 30 minutes. Therefore, if a website provides more information, or a visitor searches for more than 30 minutes of information on a website, a second visit is counted.

- If the original log data is up or down, the secondary report will not lead to accurate and consistent service decisions.

- Some websites hava no ability to accurately identify certain users.

- However, due to the diversity of internet technologies, IP addresses are not always associated with the visitor in a single person relationship.

Conclusion

User traffic analytics is a study of data gathering and analysis of a website. It has achieved widespread acceptance and became one of the most significant tools for the up-gradation of website and facilitation of its users. It has quickly emerged as one of the best services for the collection and analysis of the most complicated website data. With the ever-increasing amount of data sources, user traffic analysis will play a more important role in the future. The literature review showed that websites are a good source of information about users' behavior and current trends, but it should not be outdated and out fashioned.

The users of the websites should be well conversant with ICT, the virtual world; and should be familiar with big data emerging tools. Proper measurement, evaluation, and analysis of user traffic on a website can be helpful to find out issues in your website for its ratification, up-gradation, performance enhancement and improvement for effectiveness. Once you have solved them, the resources become more effective and useable. Despite practical information found in log files, data also suffers from limitations, which creates challenges for users. Weblog file limitations often appear because certain types of visitors' data are not loaded, such as the visitor details and incomplete information about the system used for visiting the site.

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