CHAPTER 1
INTRODUCTION

Websites are one of the leading communication channels to attract massive audience for their social needs. Measuring the effectiveness of delivery of information and services through website contents has become a key issue. Information effectiveness is driven from website and defined by success of its information architecture which is the true reflection of its quality. Superior design, information and contents of the website definitely attract larger audience and lead to make it more popular and effective. This effectiveness further helps to increase the popularity of the website among the audience. Through the current study, evaluation of the website is carried out through the analysis of few shortlisted metrics to depict the dynamic online web learning environment.

1.1 Web Learning : Dynamic Scenario

Web learning environment is a framework by which behavior of a website and its audience can be traced by the third party application. In this scenario, the third party program is helpful in tracking the information related to the static and dynamic components of the website and capturing the real time information relating to these components. This information is correlated with the users of the website, their behavior and the website response to those users. Web learning environment contains Web Server, Website, Users, Site Administrator and Tracking Application as components [1]. A User is the visitor of the website to access information and service.

Dynamic environment of a website means the changing properties of the attributes of the website, when it is being used by the visitor and processing is going on in the background. Continuous change in values of the properties reflects the working behavior of the dynamic environment. This change can be observed from both, website end and from user end. Web learning strategies are therefore helpful to serve two main dimensions. Firstly, they help business organizations to make strategic promotional and operational plans and secondly they provide Search Engine Optimization (SEO) [2]. In the current study, few attributes relating to the website are analyzed with respect to user behavior through web analytics.
1.2 Web Analytics

Web Analytics are the reporting of analyzed internet data which is measured and collected for the purpose of understanding and optimizing the web usage. They have countless benefits such as data collection, behavioral analysis, keyword success rate, page views and session limits [3]. These benefits can be taken into consideration for the effective analysis of web analytics for their future optimization. These benefits not only help in the decision-making process but are also useful in optimizing the success rate of web sites. Data patterns captured through tracking is the backbone for utilization of these advantages of web analytics. There are several benefits, which vary according to the domain in which the website falls. The key benefits include the following:

- **Visitor monitoring system**, which monitors the number of visitors on the website. It takes into account, the duration of the usage of the website data, identification of those visitors and the reasons for which they access the website as well as their preferences.

- **Website optimization**, utilizes the key benefit of web analytics as knowledge that is gathered and can further be utilized to optimize the website. Optimization deals with the effective service delivery, high performance processes and efficient result generation which, in turn, contribute to better quality.

- **Better formulation of scales and e-marketing plan**, assist the owner to make better plans for the effective and efficient distribution of services and utilization of resources. Highly viewed items build the owner confidence to formulate new scales for these items in terms of demand and supply. Increasing view values is the reflection of customer demands.

- **Tracking web traffic**, retrieves analytics which are helpful for the knowledge acquisition to track the traffic on the website on per page basis. Moreover, keywords can also be analyzed to make the selected keywords more result oriented towards searching. Tracking keeps the monitoring record of the website and also acts as a watchdog which works round the clock.
• **Identification of exit pages**, provides comprehensive study which is helpful for the owner of the website in identifying those pages from which most visitors exit the website. Such pages are referred to as exit pages or exits which in turn can be restrained for problem solving.

• **Categorization of the visitors**, analyzes data patterns that are helpful to categorize the visitors of the website based on their behavior. For instance, a visitor can be classified according to the number of visits made to the particular website for its easy accessibility to the web site and affordability. The number of sessions and its duration identifies interested visitors. Frequent visitors depict that the website is user friendly. For example, in financial websites easy accessibility of transaction rights leads to more usage of online banking services. It also shows that visitors can easily afford to do online transactions.

• **Identification of profitable markets and visitors**, are helpful to deliver the information that is critical from financial perspective. Reporting provides full knowledge about potential target markets like cities, visitors and applications. Time related attributes such as login, logout time, session duration and conversations attributes such as mode and methods are also kept as a record.

• **Guidance for visitor**, provides useful guidance mechanism through user behavior. Visitor ability to approach the website using click streams is viewed. Moreover, visitor disability regarding hitting the web page can also be viewed and analyzed. This knowledge helps the owner to guide the visitor for proper and effective search of web pages and ultimately targets the suitable and relevant websites.

Web environments are designed according to the static components like site design and implementation of dynamic components like user behavior and acquisition. Both of these components contribute in the quality evaluation of any website. Moreover, there are numerous reasons, which depreciate the quality of website [4]. The major reasons which influence the quality evaluation parameters of a website are inaccurate website design, incorrect implementation of website and varying user behavior. Implementation of website and its design is managed by the designers and the
developers. In case of first two reasons of incorrect implementation and poor website design, designers can be contacted for revision. The focus of the present study is on the third aspect of dynamic component of web environment, that is, “user behavior”.

1.3 Quality Analytics

Despite website proliferation, assessment of website quality remains a challenging area of research [5]. Quality relates to the contentment of the customer and also with the level of accomplishment of user expectation when interfacing with a website. The benchmarked standards 14598-3 and 9126 of International Standards Organization (ISO) incorporate models, which focus on these issues with respect to software external characteristics, which must be accomplished when the software is in practice [6]. The quality of a website makes a website user friendly, easily accessible and profitable. It also offers useful and reliable information with appealing visual appearance to meet the user needs and expectations [7].

Web analytics are helpful to focus on the effective and cognitive capabilities of a website. The qualitative and subjective assessment of a website can be judged by the behavior analysis of user community which depends on website for information retrieval and online services. The main focus of quality analytics is user satisfaction assessment. It also contributes to the emergence of website quality as an aggregate composite that brings together formal metrics and perceptual user traits. Analysis of quality through analytics supports many measurement activities which further contribute to website ultimate success.

Imperative scientific literature identifies several quality criteria, which are often aggregated into five dimensions such as navigation information, design and structure, contents, appearance and uniqueness [8]. Quality of a website is also evaluated through various metrics referred to as Key Performance Indicators (KPI). Quality analytics highlight those values in which variation is required. Some of the indicators are static and are generated with respect to design time changes whereas some are dynamic, related to the changes which can be done at run-time. Since the focus of the research work is on dynamic indicators and metrics, hence emphasis has been made on dynamic metrics of reliability of contents, means of navigation, hyperlinks,
navigation tool, search engines compatibility, loading speed and real time information.

User behavior is a prime concern through which dynamic behavior of the user is evaluated. The approach must be efficient to keep track of such information. To track the navigation dimension, it is important to keep track of users who are using the website and the track information that can be captured through web analytic tool. In the present context, Google Analytics, a web analytic tool has been used to gather user inputs of the website at run time. Its customizable user interface, excellent technical and analytical features have led the selection of this tool. Google Analytics is a hosted solution by Google. According to Google Analytics Terms of Service Article 2 (Google, 2010e) [9], with the permission of Google, a user can perform 5 million page views, per month, per account.

For the purpose of research, after due permission, analytics are captured in two primary formats, Metric and Dimension, which are as follows:

- Metric is a numeric summary of behavior of users of website.
- Dimension is a data key or field value generally in the form of strings to describe the metric.

Web analytics report internet which is measured and analyzed after proper collection to understand and optimize the usage of web. To share the services through internet, the interrelation of three tier architecture of website and analytic tool is depicted in Figure 1.1.

![Figure 1.1: Relationship between Three Tier Architecture of Website and Web Analytic Tool](image-url)

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Data gathered by analytic tool is further analyzed and methods are proposed to improve the statistical results to reflect better quality and performance of the tested application. Users can interact with the analytical tool, as well as, with the reported data stored in the database as depicted in Figure 1.1. It acts as a third party service provider to gather and validate the present research.

There are many quality models which prescribe different metrics to be evaluated in order to quantify them. A quality model is available as a baseline in benchmarked ISO quality model. Researchers have been working since long time to make use of this base model by customizing it according to their requirement and specifications. In this context, web analytic tool provides support for such type of customizations along with providing generalized organic and inorganic data to be used accordingly.

1.4 Statement of the Problem

“Anyone, Anytime andAnywhere” approach of web based applications makes them popular for societal needs. As people are dependent on websites for accessing best information and services, so, just-in-time delivery of quality information and service to the audience is the major concern to be addressed. Development of quality analytics for real time data analysis is therefore the need of the hour. Reporting of analyzed internet data which is measured and collected for the purpose of understanding and optimizing the web usage has always been found advantageous to evaluate the quality of web application. Quality analytics for critical quality factors such as services, accessibility, contents, visitor satisfaction, navigation and proper linking of websites, help to gain significant and sustainable performance in quality. These analytics enable the developers and the users to get optimized results. Hence, it is necessary to identify the analytics which are capable of highlighting web quality characteristics so as to associate them with an approach which can refine these characteristics for optimization.

Presently, analytics are used to keep track of website data for predictive analysis by business organizations. There is no formal way by which analytical data can be studied for optimization of the website. Therefore, in view of these parameters, the present research study measures the quality of websites in quantitative terms and provides design methodology for its evaluation. Quality analytics process involves
continuous monitoring of various critical key factors contributing in maintaining the quality of website environment for fixed time duration. The captured results are analyzed and those quantities which generate poor results are reviewed. These analyzed results are then taken as input to the present research work to optimize the website for future use. The optimized website is re-analyzed to formulate the improvements for selected metrics. The comparative results are validated against better quality and performance.

The aim of this study is to draw attention towards those metrics which are poorly affecting the quality of a website in dynamic run time environment. As a summation, the goal is to hand over a mechanism in the form of plugin, which can be incorporated within any website for optimizing the searching based on keywords and hence improving the overall performance through selected metrics.

1.5 Objectives of the Study

The primary objective of this research work is to develop and implement quality analytics to evaluate, assure and enhance the usage of dynamic web learning environment. To achieve this primary objective, various sub-objectives have been formulated as follows:

1. Study of current web environment frameworks to identify critical quality factors and mapping of these factors to the current working model
2. Comparative analysis to select the best suitable analytic tool for continuous monitoring of various quality parameters
3. Analysis and ranking of the quality factors according to the need and domain of the application for need analysis
4. Formulating a new research approach for website evaluation based on metrics supporting dynamic environment
5. Developing metrics oriented quality analytics to evaluate dynamic web environment
6. Conformance with existing benchmarked ISO standards 14598-3 and 9126 for quality maintenance and assurance
7. Designing customizable automated quality evaluation tool and plugin to integrate it into various web applications
1.6 **Significance of the Study**

The first web service in electronic form was introduced in the mid nineties of the last century. Today web services have extended across the world in various dimensions changing the face of several key business sectors. The new e-revolution is not only driving global economics, but, is also transforming societies into knowledge-based economies all over the world. Usage of Internet service has shown a vertical rise in commercial traffic volume. The operation of recent information and communication technologies has enabled firms to provide higher quality services at lower prices along with increased profit margins.

To study this phenomenon web analytics are helpful in collection of highly detailed information about visitors such as hits, search details, locations, and page views including details about the time spent on the site by the visitor. Analytics approach collects data on per second basis during given time span. The major challenge lies in drawing inputs out of this recorded information. According to Phippen [10], over time, businesses have begun to find the use of basic metrics such as hits, page views to be sadly inadequate for accessing the success of a website; due to the fact that their simplistic and ambiguous framework can induce misleading conclusions.

In many cases, frequent views and success hit ratio lead to unbalanced search engine optimization due to the fact that, analytics show highest hit ratio on certain pages but do not have relevant contents for its visitors. Analytics are purely click stream based, so, the decisions for optimization can be taken accordingly. Average behaviors of all the visitors can sometimes be deceptive [11].

Sometimes, complete web analytics efforts offer too broad and non strategic information. Hence, the adoption of key metrics can contribute in web site performance by reducing time and cost of finding relevant information. So, interpretation of web metrics may be oversimplified when the effect of intervening variable is not considered [12]. Dynamic web metrics should not be examined separately, but in conjunction with other metrics. Therefore, web analytic framework has been intensively studied to face these issues and challenges in an appropriate way. Metrics have been shortlisted from all the dimensions by examining all its static and dynamic components. The key performance indicators are identified to simplify the
interpretation of analytics. To achieve these goals the need is to develop those quality analytics that are capable of automatically evaluating the quality of web learning environment through the website.

The research scope is identified to address these key issues. Usually, owners of websites are not developers and they belong to non technical backgrounds and hence, cannot adopt analytical strategies and search engine optimization techniques because of outsourcing of the website. These, automated procedures will help those website communities for easy performance, tuning for best web search results as they can integrate this proposed facility into their website through plugin just like an add-on tool used in case of software updates.

1.7 Outline of Thesis

The research work has been organized into seven chapters. The structure of the thesis with these seven chapters is as follows:

Chapter 1 is an introductory chapter that covers the fundamental concerns of research. It includes introduction to web learning environment, which focus on dynamic scenario, evaluation through quality analytics, objectives of the study, problem statement and major issues and challenges in this context.

Chapter 2 presents the deep review of relevant literature. In this chapter, the literature study is divided into three logical sections of web analytics, quality evaluation models and search engine optimization. The research gaps are identified and discussed in detail.

Chapter 3 describes the overall methodology. It presents phase wise approach for research work, research settings, investigation of pilot study with proposed analytical model and discussion on research findings.

Chapter 4 discusses the metrics selection criterion, data acquisition methods as well as design and structure of proposed technique. Strategic process modeling with all supporting modules is also incorporated with input dataset.
Chapter 5 presents implementation of the proposed methodology. It covers setup of web learning environment and code customization. The implementation includes module-wise implementation and proposed plugin development.

Chapter 6 evaluates analysis and results through tracking data interpretation. It focuses on sample set selection techniques and verification methods. This chapter also includes comparative study of existing and proposed techniques results on various sample sets. The results are also verified using statistical techniques of Wilcoxon Signed-Rank Test and one way ANOVA.

Chapter 7 discusses conclusion of research, research contributions and future scope of this research work for future extension.