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Review of Search Engine Optimization

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Abstract

The internet is one of the most potent weapons presents. If made fair use of what it has to offer, the results are compelling and efficient. Search engines, which are the most used software system on the internet, helps the users in obtaining the web pages as results based on their requirements. Every website owner aspires for his/her page to be on the top with the highest ranking and hence be displayed first to the users. This is achieved by a process called Search Engine Optimization. This will help improve the business by diverting the traffic towards their web page and thereby gives an upper hand over the competitors. Some various techniques and methods are utilized to perform this optimization. It is crucial to analyze the different ranking algorithms too, which are used by different Web Search Engines to rank the web pages while displaying the results to the users. Since it is observed that a user hardly opens the web pages that are on page 2 or above in the results page, it is imperative to understand how this ranking is calculated. This paper reviews different papers that assess search engines' optimization and describe different types and methods in the process.

Keywords - *SERP, Query Dependent (QD), PR (Page Rank), Query Log, Meta Tag, Priority Encoder*

I. INTRODUCTION

In day to day life, people surf many things on the internet. Furthermore, to benefit people, there are many sites where the content is available. Furthermore, its people who decide which site to visit and which do not. People mostly desire to visit only those sites which usually appear in the starting. The search engine and its algorithms do this job for users [1]. The various search engines in the market and are Google, Bing, Internet Explorer, Yahoo. [3][4]. When they search for anything, they will come across many pages. There will be billions of pages are there for a particular keyword. People will have many keywords in their search queries to have many website pages with this information. Moreover, the pages with higher ranking and popularity come on top searches [6]. Usually, people visit only the first page of the result; they will not even go to the next page. Furthermore, on the first page and the ten websites that will come, most people only visit the top three sites. Imagine just how much these websites have to compete to come on top [10][12].

According to data, there are around 1.13 billion websites and nearly 3.5 billion internet users worldwide. Furthermore, in a second, there are around 58351 google searches [2]. The websites need to come to the top and perform well in the competitive world. A search engine is a system that is structured to get the data from the computer system where it is stored. The search results are returned in the form of lists of data [5][7]. The search engines have the User Interface that allows the user to search whatever they needed with keywords or phrases. Users can mention the criteria about the required item, and the engine matches the request with the items that are available and get back with the result [11]. This criterion that is specified is called a ". search query.". Search queries can be either plain text or hypertext, that is, URLs. When we surf anything, the search engine works by following a few methods, and they are crawling, indexing, calculating relevancy, and retrieving search results [8].

A search engine is that kind of program where people or users just search something by typing some keywords of the application [9]. Furthermore, the result of their search is based on the relevance to the topic that was searched for. The search results of the search engine are called Search Engine Result Pages (SERPs). The result of web search is not only linked to various sites but also images, videos, articles, research papers, and other kinds of files [12]. Each search engine has its databases where all the information is stored, and based on the user's search keywords, the search engines apply various algorithms on the web crawler and display the real-time information to the users. It is essential to increase and improve the user experience when surfing the website and also the usability of the website. Users usually believe the search engines, and whichever the sites that come in the starting based on the keywords of their search, they will usually go for that. In this case, search engine optimization plays a very vital role in the ordering of sites [14].

When the user searches by using keywords, it will be vital for websites to come on top. That is why website designers apply various techniques to get their website on top [13][15]. The one technique which they use is the optimization of search engines. This method is used to optimize and hence increase the ranking of it so that the page comes at the top. So that more people visit the site and they will get free traffic to the website.

Moreover, according to website designers, it is crucial to design a website that must have higher ranks. The website content plays an essential role in getting the ranking for it in software search engine optimization. Moreover, various other factors are also important, like both On-page and Off-page SEO parameters. Using either

a Black hat, white hat, or grey hat SEO technology to get traffic.

II. LITERATURE SURVEY

Fan et al. [1] discussed the search engines' architecture and how they are changing the architecture based on the current trends and technologies. The Internet of Things (IoT) is a new trend in the market. People are started using IoT in various sectors like smart city, healthcare, industry, and others. Furthermore, IoT devices require a fast and efficient search engine for their work. The Google File System is the database that is used by Google to retrieve any search results. The MapReduce technology does the process of how to increase the retrieval speed and get specific data from the extensive database. The BigTable helps in storing the data in a structured format. There are two workflows for the search engines they are before the query and after the query. The motivation to design the IoT search engines include Data sharing, Resource Integration, Artificial Intelligence. The components and architectures are the two fundamental things for IoT search engines. IoT resources, IoT data, Search Space, IoT query, Edge Computing Nodes, Middleware. The architecture of the system should provide the quality of service (QoS); it should have the proper module for the customer interactions like User Interface, API. There are various search techniques for the IoT search engines, and they are Location-based search, Content-based search, and Heterogeneous search. There are various problems for this system, and they the CPS and IoT problems, the problem space, the opportunities problem like data retrieval, comprehensive data analysis, system automation, Artificial Intelligence. And the challenges in the field of a dynamic environment, search techniques, performance, and security. The future of this field may include Co-design with other techniques, various system interactions, optimize the performance, security and privacy are also very important in the data and networking field.

Prashant et al. [2] discussed in the paper that when we surf anything, then the search engine works by following a few methods they are crawling, indexing, calculating relevancy, and retrieving search results. There are various Search engine optimization techniques that people are using in their websites to optimize it. White Hat SEO is an ethical method that follows specific guidelines for its websites and displays quality content, and makes sure that the content is available for all. Black Hat SEO or spamdexing is the unethical ways of getting traffic to the site by using the keyword stuffing method or getting many spam links. Gray Hat SEO is an irrelevant technique used to optimize the site. Here paid rankings are obtained. Search engine results page (SERP) are those resultant pages that we will get when we search. The various SEO tools used by Google are Google Webmaster, which analyses how Google behaves with its websites and improves crawling and indexing. Google Analytics tool is used to monitor the amount of traffic that the site is getting. Google Ad Words helps in the advertising part. Google Trends gives details of the number of keywords that are searched. Google Recommendations gives some strategies to increase ranking. The search engine working varies from desktop to mobile phones. The parameters in which the mobile Search Engine Optimization varies from desktop Search Engine Optimization are Search behavior as the mobile search context is different, and their search intent and context also is different. Engagement is more when we are doing a mobile search. Different ranking algorithms are used on mobile a desktop. By considering all these factors, we can apply them to the website and try to optimize it so that the free traffic will come to the site.

Samedin et al. [3] discussed the vital search engine that is used by most of the people are Google, Bing, Internet Explorer. When users search anything on the net, they always visit only the top sites that the engine gives. People mostly depend on these search engines, only the information. According to the data, there are around 1.13 billion websites, and nearly 3.5 billion internet users are there. Moreover, in a second, there are around 58351 google searches. When we increase the website's visibility, we will get more traffic, profit will increase, the number of people who use the website also increases, and they will get more promotions. More money is getting invested in marketing. When we search anything online, a series of results according to our search criteria will appear on the site, and based on the site's ranking; these pages will appear. To study the various SEO techniques and their result, the authors considered a website called studying-in-Germany for study.

Moreover, studied how organic search methods bring visitors to the site. Keyword analysis plays an essential role in getting a higher rank, and it is essential to use proper keywords. On-page SEO considers keyword for the ranking. We can use Graph objects for Google SEO techniques. The website needs to have quality efficiency. The backlinks and social signals are the two off-page SEO techniques that help in the optimization. Moreover, they concluded that the Organic link building helps to gain more optimized websites.

Mayank et al. [4] discussed how White Hat SEO techniques help in the optimization. Search engine follows a few steps when we search in the net they are crawling, indexing, processing, ordering, and getting the results. They use web Crawlers for this purpose. Google uses Google bot for this purpose. The algorithms used by Google, which classifies spam results from the actual and displays exact content, are Panda, Penguin, Hummingbird, and Pigeon. There are three kinds of search results, and they are Organic results use ranking algorithms, and they are natural results. Paid ads are the paid results that usually come on top when we search. Blended results include videos, images, maps, locations, news, movies, local business. The various techniques used for the ranking purpose are White Hat Search Engine Optimization, which follows proper rules, guidelines for the optimization, and these methods will not do anything wrong for websites. Black Hat Search Engine Optimization uses those not ethical methods; it takes little time to compare to White Hat. Grey Hat is the in-

between technique implemented for optimization. To improve the optimization, we can use SEO techniques are On-page and Off-page. The On-page SEO considers various factors like Content, Page structure, Keyword Research, Alt tags, Meta Tags, Robots meta tags,, Internal links, and sitemaps. Off-page, Search Engine Optimization takes into consideration of few facts they are backlinks, social site, local search, and webmaster tools. Furthermore, it discusses various applications that include how SEO helps in business. This paper discusses all these factors and how we can implement them on the website.

Amrutha et al. [5] discussed from the initial search engine how the working of a search engine has changed since then, and the optimization techniques also—explained how the crawler methodology works from searching for the index to get the website and apply various algorithms and get top results and displays it. The web crawlers are the one which helps in the link building. The META search engine gives multiple search results at the moment. A vertical search engine considers specific search fields. Around 76percent of people use Google for searching. 84percent of the people usually stick to the 1st page and will not go for the next pages when they search for anything. The percent of people who visit these paid ads is around 65percent. Website optimization can be achieved through images, videos, articles. Moreover, it discusses how we can apply various SEO tools and study the pattern and try to implement that in the website and get good rankings.

When we use the organic search method, then the ranking of the site will be higher. It is also essential to change the content and theme of the website according to user needs. It is crucial to analyze the user mindset, what they are looking for, and the keywords they are using. White hat, Gray hat, and Black hat SEO's are the three flavors of SEO technique. The various SEO types are On-page SEO, and few essential parameters of it are meta tag, Title tag, internal linking, keywords density, sitemap, and others. Off-page SEO considers backlinks. There are also various benefits from the search engine optimization technique; they are popular, increase visibility, targeted traffic, high ROI, online marketing, and promotion.

Wang et al. [6] discussed how everyone has smartphones and has access to the internet on their phones. The students can use the mobile either for a useful purpose or can misuse it. These websites can provide all the information like university examinations, university clubs, university study materials, and all these details are up to date also. The search engine working principle has 3 processes, which includes initially it will find and gather web content from the net and also organize the index library. Then the crawlers find webpages based on user keywords and finally display the result. The various factors which play a significant role in the rankings of a website include servers, links, keywords, web content, meta tags, visual plugins, and various other factors. In various ways, one can optimize the website. We can optimize the website design and try to gather more visitors. Website design includes its themes, structures, style, and various other factors too. We can use various CSS style sheets and JavaScript to improve website structure. The keywords which are used in the website play a significant role in the optimization. It is crucial to understand the exact keywords that the user is looking for and use those proper keywords. Furthermore, it is also crucial to use these keywords in the proper locations like in the title, description, image description, hyperlinks, texts, and other locations. We can optimize the web page by giving the proper title and naming for it.

Moreover, it can use proper keywords for the description, in the subtitle, and content writing. It is essential to do a link optimization, which includes import link and export link. Moreover, various optimization techniques consist of space, domain name, site maps, and various other factors. When the university considers all these facts and designs the website like that, it will get a good ranking.

El-Gayar et al. [7] discuss a challenge that gives more precise results for an unclear query at a lower period. For the retrieval of information, the usage of the tags to linking the websites are playing a crucial role in search engines. This paper proposes a comprehensive search engine framework that is based on a keyword and ontology system by using fuzzy logic and mathematical models to explore a relationship between keywords that are used to search on web pages. Also, developing an algorithm helps to get better ranking results of web pages. Algorithms like crawling, pre-processing, a score of a rank are also discussed. This paper mainly considered four distinct stages, which include retrieval of semantic web frame is proposed to improve input which is unclear but give results with high precision. An algorithm is proposed for keyword retrieval that is pre-processing of keywords. Moreover, a ranking algorithm for calculating the semantic score is developed. Enhancement of query search engine using ontology analyzer to increase the input of keywords. There are two phases: Crawling of web pages, indexing and ranking are in the background phase, and browsing or retrieving found in front phase in which the users can use it efficiently. The logical architecture diagram of the proposed framework is explained in this paper. The crawling algorithm, pre-processing algorithm, and the comparison of ranking methods are explained. The information is retrieved with the help of an ontology system from the data which has been recorded.

Dezhang kong et al. [8] discussed how search engines influence social networks. They designed a model to establish a connection in social networks using search engines. They improved this system by taking the influence of search engines optimally. An algorithm based on search engines' influence is used to identify the number of people enhancing website traffic. The message passing in a social network is very crucial, so the new model is proposed to get to know the connection network with the help of search engines. With probabilities, the new model for the social network's impact due to search engines can be identified correctly. The influence of the users in the social network is essential and to be calculated. In this paper, they explained about PSP Algorithm. The random generation of networks and real-world networks are

compared and shown how effectively it is influencing the social networks. Performance of CI-TM algorithm is less efficient, and PSP algorithm works more efficiently. The calculation of subcritical paths is also necessary for social networks, influenced by the user's queries. The usage of the PSP algorithm in applications, the transmission of the virus in networks is explained.

Oleh Lehkky et al. [9] mainly focus on competitors' semantic score parsing and disclosing approximate calculations of spent on resources. Using softwares and algorithms manually, the keyword processing will be much more effective. To provide information security to a modern enterprise and protect information resources and telecommunication infrastructure, and human potential, it is necessary to carry out continuous and consistent information and analytical activities by competitive intelligence. The main aim of competitive intelligence is to get strategically important information for the enterprise. Search engine optimization is a comprehensive methodology and tools to increase website traffic and place your webpage in high ranking. The higher the place in search results, the more users will access those web pages first. The semantic core of the site is the base of search words that accurately characterize the type of activity, goods, or services offered by the site. External optimization is the management of the referential mass of the site to bring it in line with the requirements of search engines. The internal optimization is a criterion for comparing sites. The traffic for the website mainly depends on keyword analysis. The main attributes of search terms are frequency and length. Approaches to semantic core building and semantic core parsing and correcting are discussed.

Tsai et al. [10] discuss that priority encoder is essential in search engines to select matching priority and patterns. In this paper, they propose a system that uses three phases to search a query, which helps remove priority encoders in search engines. This query uses information like length, repetition of the keywords. To ensure the flow of many packets in a machine, the usage of Ternary content addressable memory search engine is evolved. In this firewall, router architecture is explained. This type of search engine has various applications in biometrics, vehicle plate recognition, sensor networks, and many others. Symmetric and asymmetric TCAM cell structures are discussed. Energy efficiency in nonvolatile is more than TCAM search engine. PDM uses three phases in which the pattern which must search from the data collected in the first phase and then in that most extended pattern should be searched later the most prolonged pattern which is matching to the query should be searched. With the help of these enhancements, energy consumption will be less.

Jine Tang et al. [11] presented the internet of things supports many applications. In industrial and academic fields, the searching of data sources is highly in context with search engines. In this paper PKR-tree mechanism to search and architecture of SMPKR is explained. Usage of three-tier architecture to publish information and to facilitate the searching of user queries. The implementation of searching the Iot objects with gathered information when a user inputs a query. The calculation of costs for queries and wireless communications is discussed. For the matching of keywords and to achieve high accuracy, the lossy compression method is inculcated for better searching. Algorithms like range and knn query are explained. The properties which affect the execution of SMPKR is taken into consideration along with the query algorithms. Also, the terms like pre-processing, performance of the search query with various parameters affect the analysis of the SMPKR search engines.

Shantha Sheela et al. [12] discuss search engine is very useful to search for any kind of information from the internet. In this paper, the syntactic and semantic search engines are compared with the help of different input queries. The information obtained is related to the website when searched using a syntactic type of search engine. The retrieval of information is obtained when html to XML conversion occurs, and enhancement in the retrieval of information is seen. The usage of mappers is helpful for mapping purposes. The repetition of keywords can be obtained with the help of analysis. After the analysis, it is divided into raw and order vectors. The syntactic search engine uses html and XML to create metadata, whereas the semantic search engine uses RDF and OWL to create metadata. The syntactic search engine is structural characters with a symbolic expression of language or phrases of the language. In semantics, it is a complete contextual expression of language and things of objects. The syntactic search engine does not use any methodology; it just matches the exact keyword available on the website through a ranking algorithm. However, in sematic search engines, ontology helps to identify the relation.

Joyce Yoseph Lemos et al. [13]. Analyze how Search Engine Optimization helps in improving the ranks of the results of the searches and hence increasing the page views. SEO will direct the user towards the popular pages with higher ranks and provide better and optimized ranks to the user. The ranks will also help increase the competitive edge of the websites since everyone wants their website to have a higher ranking and hence have the most page views. Here, the author describes the process of carrying out Search Engine Optimization and compares different SEO techniques. The authors make multiple observations. • PR Algorithm seems to consider only the outgoing links, whereas the Weighted PR Algorithm will take into consideration the links that are incoming as well as outgoing. Hence it was observed that the ratio of ranking provided by the PR algorithm is less when compared to the Weighted PR algorithm. 1. According to the PR algorithm, the pages that have been existing for quite some time will have higher ranks than those added freshly even though the content of the new page is more pertinent. Nevertheless, according to the Weighted PR algorithm, the pages with a higher number of links (incoming and outgoing) will be given a higher rank. 2. HITS algorithm overcomes the problem of PR algorithm where it does not consider the same repeated data and

performs an iterative process. However, instead, a different model is created with precise similarity parameter. 3. In query dependent algorithm, the outcome depends on the query provided by the user whereas, in HITS algorithm, the outcome is obtained during the process of indexing. 4. A matrix is used to contain the similarity index in the HITS algorithm once the analysis of the web contents is done. The similarity index in the QD algorithm is based on the count of the usage of the same query by the users. 5. HITS algorithm is seen to consider only that data which is pertinent ignoring the unnecessary information and hence takes significantly less time, and the outcome is precise unlike the Weighted PR algorithm. 6. PR algorithm is based on the outgoing links. Weighted PR is based on the links that are outgoing and incoming. Query Dependent algorithm is based on the count of views by the user.

Ankita Tiwari et al. [14]. Discuss the two types of Search engine optimizations that are carried out. One of them is Semantic Search Engine Optimization. In this type, the obtained results are seen to be relevant even if they do not contain the exact key phrases as the user's query. The other is Syntactic Search Engine Optimization. In this type, the web pages shown in the results page contain the words or phrases that exactly match that of the query of the user. Most of the search engines make use of the syntactic type of SEO. Here the authors propose a model and algorithm in which a log of pas queries of the user is used. Clusters are formed using the same types of queries, using a match of key phrases or the links that are clicked. The pertinent content is organized in the form of clusters. If a user is spending more time on pages after querying, then ranks are assigned. New ranks are assigned based on the pattern and considering the previous ranks using various rank improvement architectures.

N Nithya [15] discusses how the usage of Search Engine Optimization can benefit digital marketing. The competition in this world is massive. Day by day, the competition in digital marketing is increasing at a rapid rate. Hence it is essential to make use of social media and all that the technology has to offer to the market the business. It has almost become mandatory to have a presence on social media in this digital era. This paper discusses different methods of digital marketing and how SEO will be of use in it. It is vital to notice and monitor every step taken by the customers in order to help design and market the products that they know or do not know that they need. It becomes crucial to use the advertising platform efficiently in order to increase sales. Search Engine Optimization becomes a great tool to market the products digitally and make the brand seen. SEO helps in bringing in the traffic to the web page and hence promote the products. SEM (Search Engine Marketing) is one of the subbranches of Search Engine Optimization that deals with efficient use of all the techniques and tactics of Search Engine Optimization to obtain higher visibility and higher position in Search Engine Results. Page. Utilizing different platforms for digital marketing is seen to have better outcomes. Investment in Search Engine Optimization never goes waste. By making sure the web page has a higher rank, the traffic is ensured. Hence to obtain a competitive edge in the products' digital marketing, optimization of a search engine is a very vital step.

III. CONCLUSION

Search engine optimization is a smart way of increasing visibility in the online world, saving time and cost of marketing. With the implementation of the right tactics and methodologies, the business will expand, and the profit in business will be much higher. Achieving a high ranking on search engines helps in growth in the site traffic and high return on investment. Search engine optimization helps to expand customer and target audience with a more competitive edge. Good quality web pages and optimized content web pages are playing a very crucial role in digital marketing. On the page, off-page search engine optimization methods, black hat, white hat search engine tactics are beneficial to increase the traffic to a site. Search engine optimization increases brand credibility, and it is affordable. The great challenge is that there is no guarantee in the results as it is highly dependent on Google, which frequently changes its algorithms and techniques. Despite this, search engine optimization plays a vital role in digital marketing and many other fields, making it one of the most sorts after tools to carry out business smoothly and increase its reach.

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