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FACULTY OF COMPUTING
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SECV2223-02 WEB PROGRAMMING

ASSIGNMENT 1

COMPARATIVE EVALUATION OF WEBSITES

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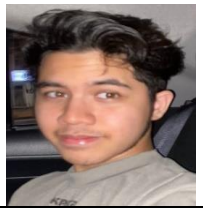
Danial Nur Irfan bin Azeze	A22EC0046	
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Top 6 Hospital Websites Performance Analysis Using Google Lighthouse Matrix

Abstract - In the 20th century where everything is digitalized. All online activities include learning, working, exercising, meeting, researching, etc. In addition to that, medical activity also got into online technology. This makes medical services easy to access for people around the world. We are using Google Lighthouse, a free Google tool and open-source software that can be used on any web page. This tool helps to improve the quality of the web pages. The Google Lighthouse checks the website's performance, accessibility, best practices, Search Engine Optimisation (SEO) and Progressive Web App (PWA). We decided to conduct a test with 6 hospital websites. Based on our evaluations, the highest score belongs to the Stanford Medicine website. Although it is the top among the 6 websites, there are still ample spots or ways to improve it.

Keywords—Hospital, Analysis, Website

1. Introduction

In this modern era, the significance of online platforms cannot be exaggerated. The Internet has become an integral part of our daily lives; no one can deny it. One particular area where this digital transformation is evident is in healthcare. With the proliferation of healthcare websites, individuals can now access medical information, book appointments, and even consult with healthcare professionals online. For our comparative evaluation, we have chosen healthcare websites due to their importance in providing vital information and services to the public. By leveraging web performance audit tools such as Google Lighthouse, we aim to assess the performance, accessibility, and search engine optimization (SEO) of these websites. By analyzing key metrics, we can gain insights into how effectively these platforms serve their users and identify areas for improvement. To ensure a comprehensive evaluation, we will compare multiple healthcare websites within the same domain and examine them from different aspects. Through this comparative analysis, we aim to provide valuable insights into the strengths and weaknesses of these websites, ultimately contributing to their enhancement and optimization for the benefit of users.

2. Literature Review

a. Website

A website known as a collection of web pages that include the content of that website's goal for user's needs and located on the World Wide Web (WWW) on the Internet that allows all resources to be accessed through the Internet by following policy on Hypertext Transfer Protocol (HTTP). Measuring consumers' perception of website quality is crucial when designing a website, and it depends on rigorous and comprehensive methods [1]. Websites are vital for accessing and gathering information because they act worldwide for news and knowledge, allowing users to spread information quickly and widely.

b. Hospital Websites

The hospital website serves as a virtual front door for patients and potential visitors, providing them with essential information about the hospital's services, specialities, and facilities [2]. A hospital website is created and maintained by a hospital or healthcare institution. Its primary purpose is to provide information and resources related to the hospital's services.

c. Google Lighthouse

Several studies have evaluated the effectiveness and utility of Google Lighthouse, an open-source tool for auditing web pages [3]. It is concluded that Lighthouse offers comprehensive performance audits with detailed optimization recommendations, making it valuable for web developers. Meanwhile, web developers also analyzed web performance trends using Lighthouse data, emphasizing its role in driving optimizations and the need for continuous refinement in interpreting results for optimal web development outcomes.

d. Mayo Clinic

Mayo Clinic, founded by William Worrall Mayo, is a nonprofit American academic medical centre focusing on health care, education and research. In the United States, Mayo Clinic has ranked number one in the Best Hospitals Honor Roll for seven consecutive years [4]. Mayo Clinic provides clinical activities such as primary, secondary, and tertiary care, depending on the appointment type, which includes comprehensive evaluations, focused consultations, limited exams, and continuing care. To provide the best consultant for patients, Mayo Clinic is committed to working towards its vision of transforming medicine to connect and cure every disease [5].

e. Cleveland Clinic

Cleveland Clinic was at the forefront of modern medicine when its founders opened it as a multi-speciality group practice in 1921. In its first century, Cleveland Clinic introduced many medical firsts, opened facilities around the world, and is proud to be ranked among the top hospitals in the country. Now, 100 years later, the founders' vision remains Cleveland Clinic's mission: caring for life, researching for health, and educating those who serve [6].

f. Massachusetts General Hospital

Massachusetts General Hospital was established to provide care to Boston's sick, regardless of socioeconomic status, and became the first teaching hospital of Harvard University's new medical school. We have remained at the forefront of medicine by fostering a culture of collaboration and education, pushing the boundaries of medical research, and maintaining an unwavering commitment to the diverse community we were created to serve [7].

g. Stanford Medicine

Stanford Medicine is an academic health system part of the Stanford University School of Medicine, Stanford Health Care and Stanford Children's Health. They aim to improve lives and advance knowledge using medical care, education and research. They are mainly known for innovative research, quality education, clinical excellence and community engagement. Stanford University was founded in 1885 in Palo Alto, California.

h. UCSF Health

UCSF Health is a healthcare network of the University of California, San Francisco (UCSF). UCSF is a top university for health research and higher education. They are known for their expertise in rare conditions, innovation leaders, comprehensive specialization,

medical advancement and collaborative care. The UCSF University was founded in 1864 by a South Carolina surgeon named Hugh Toland, and the UCSF Health was established later in 1990.

i. NewYork-Prebyterian

NewYork-Presbyterian Hospital is a world-class academic medical centre committed to excellence in patient care, research, education, and community service [8]. Its extensive literature encompasses various medical specialities, including cardiology, oncology, paediatrics, and transplantation. Research conducted at NewYork- Presbyterian Hospital has led to groundbreaking advancements in patient care, medical technology, and healthcare delivery systems.

3. Method

The procedures used in this evaluation are shown in Figure 1 below

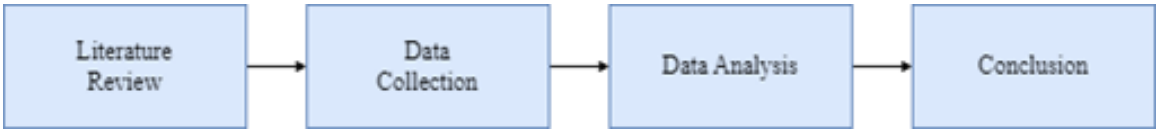

Figure 1: Evaluation Procedure

This evaluation of six hospital websites follows the procedures in Figure 1. The assessment starts with a literature review, a summary or an overview of the previously published works on a topic. It is supposed to provide a general image of the existing knowledge on the subject.

The data collection consists of taking the six hospital websites into Google Lighthouse to perform the audits based on the five main website optimization categories: performance, accessibility, best practices, search engine optimization (SEO), and progressive web app (PWA).

The data analysis is when the results from each category are taken and analyzed based on their marks. The explanation of the 5 categories is as follows:

Table 1: Information about Google Lighthouse Terms

Terms	Explanation
Performance	Measurement of how quickly a website loads and how quickly users can access it
Accessibility	Analyze how well people who use assistive technologies can use your website.
Best Practices	Check whether the website is built on a modern standards of web development
Search Engine Optimization	Test how well a website can be crawled by search engines and displayed in the search results. The test mainly looks at mobile friendliness

Progressive Web App	validates whether your web application uses modern web capabilities to provide an optimal user experience

Lastly, the conclusion on what the websites should be optimized for and what the websites should fix will be shown, and the overall evaluation result will be displayed.

4. Result and Discussion

Several results were gained from the evaluation, as shown in Figure 2 below.

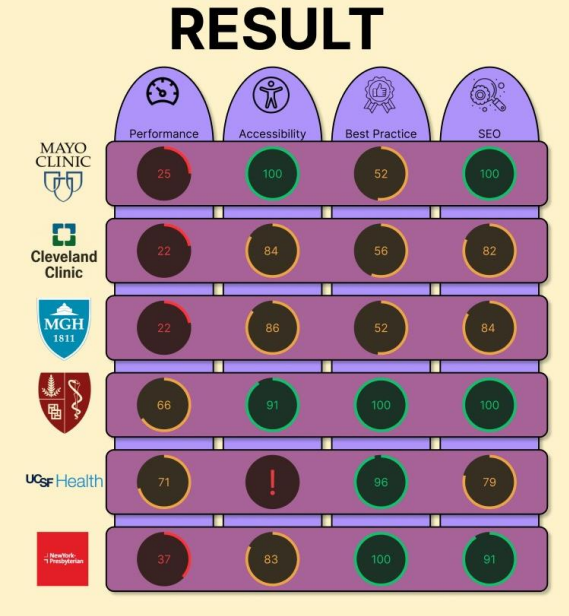

Figure 2: Collection of results from several hospital websites

a. Mayo Clinic

Results for the Mayo Clinic website reveal that the website is excellent in terms of accessibility and search engine optimization (SEO). Its strengths relied on these two categories. However, the website shows weaknesses in speed, where the page loads too slowly, with a performance score of 43 and a best practice score of 74. This indicates that it is vital to balance these aspects to ensure website effectiveness. For example, optimize page speed and enhance best practices such as using API that is not deprecated. In conclusion, the website needs to make some improvements to improve its effectiveness and satisfy the user experience.

b. Cleveland Clinic

The Google Lighthouse report for the Cleveland Clinic website shows that the website has slightly weak accessibility, best practices and Search Engine Optimization (SEO). The website's performance received low marks. Despite the low score, optimization opportunities are likely available to improve performance, such as optimizing images and reducing unnecessary scripts. Low performance can cause Inefficient Resource Loading and Poor Server Response Times. Compared to other websites, a performance score of 22 is relatively low and indicates significant room for improvement in load times and resource optimization. In summary, while the Cleveland Clinic website may have performance

issues impacting load times and user experience, there are opportunities to improve the weaknesses and enhance the performance.

c. Massachusetts General Hospital

Massachusetts General Hospital is similar to the Cleveland Clinic website; it also has a medium score on accessibility, best practices, and search engine optimization (SEO). And they received low marks on performance results. It can strengthen the website by optimizing opportunities. A medium mark on best practice shows it has a medium security level. The performance score of 22 indicates similar performance issues to the Cleveland Clinic website, suggesting that both websites may face load times and resource optimization challenges. In summary, while Massachusetts General Hospital's website may share similar performance challenges with the Cleveland Clinic's website, there are opportunities to address these weaknesses and enhance overall performance.

d. Standford Medicine

The Stanford Medicine website has an excellent score in accessibility, best practices, and SEO. The performance, on the other hand, received a medium score. The strength of this website lies in the best practices and SEO, which have a full mark indicating that the website is built on the modern standard of web development and has valid structured data. The weakness is the performance because of its slow loading time. The outstanding marks on the best practice show that the website's security is on top of the line, but it would be better to increase performance. In conclusion, the website is perfect in everything except performance, which is essential to website development.

e. UCSF Health

The UCSF Health website has good marks on best practices, a medium score on performance and SEO and an error on accessibility. The strength of the best practices shows that safety is the top priority, while the weakness in accessibility makes it hard for impaired users to understand the website's content. In comparison, the performance is average, but it may benefit if the accessibility is good, too, because it is fundamental to web design. In conclusion, there are many areas that this website can improve, especially its accessibility.

f. NewYork-Presbyterian

The Google Lighthouse results for the NewYork- Presbyterian website highlight several strengths and areas for improvement. The strengths include vital accessibility (88%) and excellent SEO (91%) scores, indicating a website that is accessible to users with disabilities and well-optimized for search engines, respectively. Additionally, the website performs well regarding best practices (78%), suggesting a solid foundation in web development standards. However, the performance score (69%) indicates a potential weakness, suggesting room for improvement in page loading speed and responsiveness. Addressing performance optimizations could enhance the website's user experience and overall effectiveness. While the website demonstrates notable strengths, optimizing performance could lead to a more seamless and efficient user experience.

5. Conclusion

In conclusion, based on results and discussion using Google Lighthouse on the Top 6 Hospital Websites, four metrics performance, accessibility, best practice and SEO were used to evaluate the website. As a result, Stanford Medicine is the best performance indicator with the most significant impact on users. Stanford Medicine's website achieves exemplary performance with a Google Lighthouse score 66, showcasing fast loading times and efficient resource loading. Its high accessibility score of 91 and perfect scores in best practices and SEO indicate meticulous attention to detail, keyboard navigation, and mobile friendliness. At the same time, best performance and accessibility indicate strong security and user-friendliness. Compared to other hospitals' websites, Stanford Medicine's holistic approach to website development ensures an outstanding user experience, positioning it as a leader in performance, accessibility, and search engine optimization.

References

[1] Loiacono, E. T., Watson, R. T., & Goodhue, D. L. (2002). WebQual: A measure of website quality. Marketing theory and applications, 13(3), 432-438.

[2] Marketing, N. (2024, March 21). 7 best hospital web development examples and expert tips. Kanopi Studios. https://kanopi.com/blog/hospital-web-development/#%3A~%3Atext%3DYour%20website%20serves%20as%20a%2Cservices%2C%20specialties%2C%20and%20facilities

[3] Shankhdhar, A. (2023, October 19). Lighthouse: A comprehensive tool for auditing and improving web pages. LinkedIn. https://www.linkedin.com/pulse/lighthouse-comprehensive-tool-auditing-improving-web-pages-arjun-iogzf

[4] America's best hospitals: The 2023-2024 honor roll and overview | U.S. News. (n.d.). https://health.usnews.com/health-care/best-hospitals/articles/best-hospitals-honor-roll-and-overview

[5] Mayo Foundation for Medical Education and Research. (n.d.). Mayo Clinic Mission and values. Mayo Clinic. https://www.mayoclinic.org/about-mayo-clinic/mission-values

[6] About Cleveland Clinic. Cleveland Clinic. (n.d.). https://my.clevelandclinic.org/about

[7] About Massachusetts General Hospital. Massachusetts General Hospital. (n.d.). https://www.massgeneral.org/about

[8] About Us. NewYork-Presbyterian. (n.d.). https://www.nyp.org/about