

Accessibility best practices and how they can be effectively applied when developing an application from scratch

MASTER THESIS EXPOSÉ

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Abstract

This exposé for a master thesis, challenges the current state of web accessibility in development and studies best practices during the development process as well as testing options for accessibility. The thesis aims to make parts of the web more accessible and reveal accessibility best practices for development particularly when developing from scratch.

By leveraging the existing guidelines and practices around accessibility as well as testing methods and development frameworks this study will bring forth comprehensive knowledge on accessibility best practices for the early stages of the delivery process. Within a practical study, literature will be reviewed, best practices will be identified, a landingpage will be migrated and the data will be analysed.

That specific landingpage is a product of SoSafe, a company operating in the field of cyber security. Their security training includes a landingpage which will in this study be migrated to a framework and therefore be the product used to evaluate accessibility best practices.

In conclusion, this work contributes to the field of accessibility by evaluating best practices for developers and making one part of SoSafe's products more accessible. Aiming to make the web more inclusive, piece by piece.

Introduction

“The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.” (Berners-Lee, [n.d.](#))

According to Berners-Lee ([n.d.](#)) the web was designed to be universally accessible. In practice this is rarely the case. As the internet continues to play an increasingly significant role in people’s everyday lives, accessibility to the internet has become more and more crucial. Websites and digital products must be accessible in order for everyone, including those with disabilities, to completely engage in society. Currently, there are still many websites and digital products that are not completely accessible, despite the abundance of guidelines and best practices available. Meanwhile “[web accessibility] is increasingly becoming a legal requirement that must be satisfied.” (Bajammal and Mesbah, [2021](#), abstract)

The Federal Ministry of Labour and Social Affairs of Germany has produced guidelines on the Barrier-Free Reinforcement Act (german: Barrierefreiheitsstärkungsgesetz). The Barrier-Free Reinforcement Act obliges private economic actors to be barrier-free for the first time. The Barrier-Free Reinforcement Act implemented the European Accessibility Directive: Directive (EU) 2019/882 of the European Parliament and of the Council on the accessibility requirements for products and services. The law was announced in July 2021 and takes effect on 28 June 2025. The law will oblige private economic operators to comply with accessibility requirements. (Bundesgesetzblatt-Archiv, [2022](#))

SoSafe GmbH operates in the field of cyber security, especially in the field of phishing simulation and awareness training. Their products and services are designed to help businesses train their employees to recognize and prevent phishing attacks. This is a common way for cybercriminals to steal sensitive information or gain unauthorized access to computer systems. SoSafe GmbH’s phishing simulation platform allows companies to simulate realistic phishing attacks and monitor the reactions of their employees to identify areas where additional training may be needed. The company is committed to helping businesses improve their cyber security and reduce the risk of data breaches and cyber attacks.

This thesis has two main goals. On the one hand, this thesis will make parts of SoSafe’s products more accessible. SoSafe’s phishing simulation includes a landingpage which displays information on phishing attacks and teaches common tactics in phishing mails. Within the thesis accessibility features and best practices will be identified and implemented. The implementation will take place throughout the migration of that landing page from vanilla JS to React. Thus improving user experience for people with disabilities. On the other hand the study will derive comprehensive knowledge on accessibility best practices for development and may contribute to existing practices and reveal recommendations. A practical study will be conducted in which literature is reviewed, best practices will be identified, the learning page will be migrated and the data will be analysed.

Chapter 1

Literature Review

1.1 Overview of Web Accessibility

According to the World Wide Web Consortium (W3C), “Web accessibility means that people with disabilities can use the Web. More specifically, Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web” (Caldwell et al., 2008). Quoting Alroobaea et al. (2013, p. 26), “A high-quality product is one that provides all the main functions in a clear format, and that offers good accessibility and a simple layout to avoid users spending more time learning how to use it than satisfying their need.”

As such, web accessibility is a critical aspect of web design. Mainly, it is important for ensuring inclusion. Along with that, improving accessibility has other positive impact. It can lead to an expanding user base, it is important for complying with legal and ethical considerations, as well as improving search engine optimization, as an improved structure is making it easier for search engines to crawl and index.

In order to achieve web accessibility standards, best practices and guidelines have been created for web developers to follow. This chapter describes a literature review with focus on web accessibility to identify these best practices and guidelines.

1.1.1 Laws and standards

By now many laws and regulations exist, that require websites to be accessible to people with disabilities, such as the European Accessibility Act. Failing to comply with these laws can lead to legal action and damage a company’s reputation.

“The European accessibility act is a directive that aims to improve the functioning of the internal market for accessible products and services, by removing barriers created by divergent rules in Member States.” European Commission, 2023. The EAA requires websites and mobile applications to comply with WCAG 2.1 Level AA. This means that websites and mobile applications must be designed and developed in a way that people with disabilities can access and use them, for example by providing alternative text for images, provide subtitles for videos, and ensure that the site can be navigated using the keyboard. European Commission, 2023

1.1.2 Web Content Accessibility Guidelines

The Web Content Accessibility Guidelines (WCAG) are a set of technical guidelines developed by the World Wide Web Consortium (W3C) to ensure that web content is accessible to everyone, including people with disabilities. The guidelines provide web developers with a framework for creating accessible web content, including websites, web applications, and digital content. The guidelines are categorized in the four principles: Perceptible, Actionable, Understandable, and Robust. (Caldwell et al., 2008)

1.2 WA and development

“At first glance, accessibility is mainly a quality of the user interface (UI). However, it influences the structure and functionality of the application including the underlying data model. Experts accentuate that accessibility requires less extra effort when respected from the beginning of the design process.” (Jeschke, Pfeiffer, and Vieritz, 2009). That being said, “it is necessary to start the conception process with the design of the UI. This so-called user-oriented approach adapts the structure and functionality of the application to the requirements of the UI.” (Jeschke, Pfeiffer, and Vieritz, 2009). This also implies that it is important to introduce accessibility features at the beginning of a developing process. That can include the decision for frameworks, supporting libraries and the way of development. Reichling and Cherfi, 2013 mention that “[Integrating] the users’ needs related to Accessibility early in the development process: [helps] to increase the relevance of the obtained product as well as the satisfaction of the end-users regarding the Accessibility criteria.”

1.2.1 Evaluation libraries for development

Not many publications have been published around the topic of accessibility while development as of yet. Tools to support the developing process during development are for example Linters like `eslint-plugin-jsx-ally`¹ and `axe Accessibility Linter`². Accessibility linters can examine the HTML, CSS, and JavaScript code of an application to identify elements that might cause accessibility barriers. They can also be integrated into the development process, next to code linters and testing frameworks. They can be set up to run automatically during the development cycle, catching accessibility issues early in the process and reducing the effort required to fix them later.

1.3 Post implementation WA evaluation methods

According to Akritidis and Katsanos (2021, p.117), a combination of automated testing tools, manual testing, checking accessibility guidelines, and conducting user testing, is recommended. Abascal, Arrue, and Valencia (2019, p. 482) Automated testing is performed by an application running locally or online. These tools analyze the code of a web page to confirm compliance with certain accessibility guidelines. Therefore, automated tests are often used as the first accessibility tests to identify and fix basic accessibility barriers. (Abascal, Arrue, and Valencia, 2019, p. 481) Although, automated evaluation tools can be helpful for website accessibility evaluation, they “can only provide a superficial impression of the accessibility status” (Kollotzek et al., 2021). Evaluators may need to use a variety of tools and aggregate the results as well as consider manual inspection.

¹<https://www.npmjs.com/package/eslint-plugin-jsx-ally>

²<https://marketplace.visualstudio.com/items?itemName=deque-systems.vscode-axe-linter>

Chapter 2

Research Question

This chapter focuses on the formulation of a research question. The question will guide this study on accessibility within the context of SoSafe. With the purpose of gaining practical experience in migrating a vanilla JS landing page to React while integrating accessibility features and providing valuable insights into the challenges and successes of integrating accessibility best practices during the migration process. The resulting findings may contribute to the accessibility community and developers by showcasing effective approaches for improving web accessibility in React projects.

Having this in mind, the following research question will be answered in this thesis:

“What are the best practices and guidelines for the integration of accessibility into SoSafes Learning page, and how can they be effectively applied during the migration process to React?”

Alongside this research question two hypotheses have been formulated:

1. During the migration to React, the established accessibility best practices will improve compliance with accessibility standards.
2. Migrating SoSafes Landingpage from vanilla JavaScript to React, while integrating accessibility best practices and guidelines, will result in a more accessible and user-friendly web application.

In order to be able to answer the research question and evaluate the hypotheses a self-conducted study is designed. In this study, the migration of SoSafes landingpage from vanilla JS to React will be performed and accessibility features following established guidelines will be added. In chapter 5, the steps and Roadmap will give more details about the progress. The following chapter will describe the methodology to answer the research question.

Chapter 3

Methodology

In this section the research design, the data collection methods and the data analysis techniques will be outlined. In this study, the integration and effectiveness of accessibility best practices on a landingpage will be investigated. The landingpage will be rebuild with the integration of accessibility principles and the transitioning to a framework.

3.1 Research Design

For this study, a qualitative approach is proposed. With this approach, a comprehensive understanding of the integration process can be gained and the impact of rebuilding the page using accessibility best practices and a framework is assessed.

3.2 Page Rebuilding and Selection

A landingpage in need of redevelopment and a focus on accessibility was selected as the subject of this study. The page was chosen based on the potential for impact, current accessibility challenges and development opportunities. The decision was made to rebuild the page from scratch to ensure a comprehensive integration of accessibility best practices and a seamless transition to the new framework. Best practices will be identified and established through the literature review.

3.3 Data Collection - Development Process

The redevelopment process will include iterative stages, including design, coding, and testing. During this iterative process, accessibility best practices will systematically be introduced to ensure compliance with established guidelines such as the WCAG.

3.4 Data Analysis - Qualitative Analysis

A qualitative analysis is used to examine the redevelopment process, its challenges, and the impact on accessibility. The analysis focuses on identifying recommendations for the integration of accessibility best practices, the migration to a new framework, and the perceived improvements in usability.

Chapter 4

Expected Outcomes

Following the methodology, this chapter outlines the expected outcomes of the proposed qualitative research. Next to contributing to a more accessible web by creating an accessible landing page, it focuses on possible findings, contributions, and impacts of the research. Results are based on the study design, data collection methods, and analysis techniques used.

4.1 Knowledge

One of the main outcomes of this research is expected to be a comprehensive understanding of accessibility best practices applied in the redevelopment of a landingpage. This aims to gain a holistic view beyond purely statistical analysis by using qualitative research methods to explore the experiences, perspectives and context surrounding this.

4.2 Theoretical Contributions

Another expected outcome of this study is the potential for theoretical contributions. By investigating best practices, frameworks and libraries surrounding the topic accessibility, the study aspires to contribute to existing concepts and practices that enhance our understanding of the research topic and improve the development process.

4.3 Recommendations

Based on the findings, practical recommendations and implications will surface. These recommendations may be of value to developers, or professionals in accessibility. The research aims to bridge the gap between theory and practice by providing actionable insights.

4.4 Further directions

Lastly, qualitative studies in general are expected to reveal possible areas for further research. Unanswered questions, and unexplored aspects of accessibility best practices can inspire future researchers to dig deeper into the topic and expand the knowledge in that area.

Chapter 5

Timeline

After providing insights about the Research question, the methodology and lastly the expected outcomes, this chapter reveals a proposed timeline in which this study may take place. After the following detailed description, a Roadmap (5) in form of a Gantt Chart (Gantt, 1974) is displayed. The last chapter (6) will show a preliminary outline.

Literature Review At the beginning, a review of existing research papers, documentation and accessibility guidelines will be conducted. That will reveal information on web accessibility, React and best practices for implementing accessibility, including automated and manual testing methods to assess the state of accessibility. This literature review will equip the study conductor with the knowledge to guide the migration process.

Identifying Best Practices Based on the findings from the literature review, a collection of recommended practices and guidelines for integrating accessibility into React projects will be created. These recommendations will be categorised according to their relevance, to React components, keyboard navigation, ARIA implementation, semantic HTML usage, color contrast considerations form accessibility techniques and other key aspects.

Accessibility Planning A detailed plan for the migration process will be developed, outlining the specific accessibility features to be implemented and the corresponding timeline. A checklist based on the identified best practices to serve as a guide during the migration will be created.

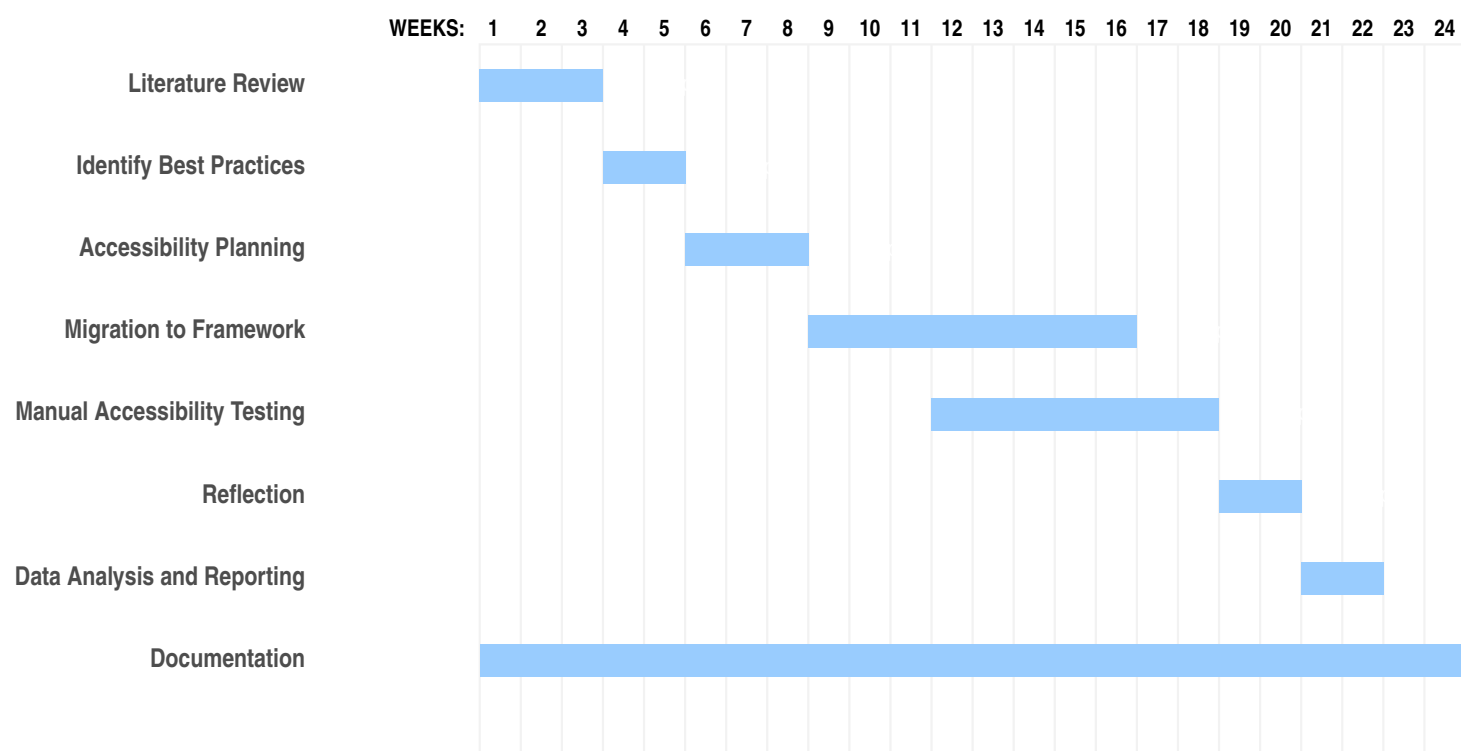
Migration to React After creating a migration plan in the previous step, the migration of the landing page from plain JavaScript to React is performed. Following the accessibility checklist while implementing the necessary features will ensure compliance with accessibility guidelines.

Manual Accessibility Testing When the migration is complete, an accessibility testing of the landing page using a combination of automated accessibility testing tools and manual evaluation will be conducted. Evaluate the learning page's accessibility compliance, identify any issues or barriers, and assess how well the best practices were applied during the migration.

Iterative Improvements Based on the results of the accessibility testing, iterative improvements can be done, to address any accessibility issues or gaps that were identified.

Reflection and Documentation After finishing the implementation, a reflection on the entire migration process and the application of accessibility features will be done. Challenges faced, the employed strategies, and the effectiveness of following the accessibility checklist will be documented.

Data Analysis and Reporting In the end, the results from the accessibility testing will be analysed. The findings and conclusions on the effectiveness of implementing accessibility best practices into React projects during the migration process will be presented in a conclusion.



Chapter 6

Preliminary Outline

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