Sheffield Hallam University

College of Business, Technology and Engineering

Department of Computing

Project (Technical Computing)

[55-604708]

2021/22

Author:	**Matthew Harry Shaw**
Student ID:	**29009500**
Year Submitted:	**2022**
Supervisor:	**Mick Marriott**
Second Marker:	
Degree Course:	**BSc Computer Science**
Title of Project:	**The Importance of Web Accessibility Standards and How they can be Implemented by Web Content Providers**

Confidentiality Required?

NO

I give permission to make my project report, video and deliverable accessible to staff and students on the Project (Technical Computing) module at Sheffield Hallam University.

YES

Acknowledgements

This project would not have been possible without the guidance of Mick Marriott and the participation of the RDaSH Information Systems Team

Abstract

This report investigates the nature of web accessibility, and how it can be implemented effectively. Legal standards and Guidelines are investigated to develop simplifications for less technically minded individuals to understand good practice web accessibility techniques, and how they can be implemented.

These simplifications are be used as content for a deliverable, this has the purpose of improving accessibility in situations with a divide between web system developers, and web content providers (primarily when using content management systems). This system was tested via several means including developers in the field to ensure the system is fit for purpose. This included ensuring the system itself is accessible and the content it contains is relevant.

It was concluded that with some small changes and adjustments the system could be suitable and fits its purpose. If further developed, it could greatly improve the landscape of large-scale web content production. This would allow for accessible sites to be generated due to content provider implementation rather than developer approval or issue fixing.

It was also evaluated that the system could be diversified to allow for more types of users to receive more advanced content generation information. Potentially spanning to both developers and content providers allowing all individuals in the web development process to effectively implement accessible content.

Contents

1 Introduction

1.1 Project Overview

Web Accessibility is very important in the modern world. The internet has become a widely used resource that more and more content is added to every day on the sites of both public and private bodies. This progression towards web-based content is due to reasons such as convenience and cost. It is therefore easy in these situations for accessibility to be overlooked. I believe one of the reasons for this widespread lack of web accessibility is a result of a lack of understanding of the importance of accessibility, and how it can be correctly implemented by the web content providers.

Materials available to provide these accessibility guidelines frequently contain complex wording and can cause misunderstanding or confusion in individuals with little to no technical knowledge. Due to this lack of understanding, accessibility issues arise frequently and can lead to sites being unintentionally in breach of the law. This will mainly occur in situations of separation between webpage developer and webpage content provider where although the technically minded web developer is aware of accessibility implementation techniques, this is not passed onto the web content providers in an understandable way.

Accessibility isn't just a term that refers to the assistance of those with disabilities. It refers to all people and ensures all users can use all webpages and receive the same content and information on a page. For this reason, its therefore so important that accessibility is implemented to cater for as larger group of people as possible. The widespread lack of understanding of accessibility and its implementation needs to be eradicated for this to occur, and the only way to do that is by making information regarding accessibility as accessible and understandable as possible.

1.2 Project Aims

The general goal of this project is to make the implementation of accessible content more understandable and therefore more widespread. I will attempt to do this by generation a deliverable which provides all the clear and concise information that could be needed to provide accessible web content to a website. To do this, I must for fill the following steps.

No.	Project Aim
1	Research the different types of accessibility issues e.g.(visual, auditory…).
2	Research factors that can affect accessibility besides disability (e.g., age, hardware).
3	Research WCAG and its legal implications.
4	Research common accessibility issues that occur on pages..
5	Research common issues that occur specific to web developer and web content provider separation situations.
6	Develop not technical summarisations of accessibility guidelines.
7	Develop a website to provide information to simplify the implication of good accessibility practice.
8	Ensure an easy-to-use interface that is as accessible as possible.
9	Improve the site based on feedback from web developer professionals.
10	Evaluate if pre-existing guidelines are accessible to those with limited technical knowledge.
11	Evaluate if any legal guidelines can be too erroneous to be implemented well.

2 Research

2.1 Web Accessibility Context

Accessibility within the web covers a vast amount of knowledge. To ensure this is understood, extensive context research has taken place (See Appendix 5). The content document should provide a suitable background to the issues and concepts discussed and assessed within this report, this includes:

- Types of Accessibility Issues
- Factors that Affect Accessibility
- Web Content Accessibility Guidelines (WCAG) and their Purpose

2.2 Common Accessibility Issues Linked to Web Content Providers

2.2.1 What is a Web Content Provider?

A Web content provider is an individual who generates content to be placed onto a website. This can be the developer themselves or a third party (usually with relevant domain knowledge). A bottleneck can be caused in situations where developers are provided content to review and publish manually, therefore a content management system can be used (Richard Vidgen, 2001).

2.2.2 Content Management Systems (CMS)

A CMS can be used to allow for non-developers to easily provide and publish content to a site, this removes the bottleneck of a developer however removes the element of human review. “It is important, then, that these systems take into account the needs of users with disabilities” (W3C, 2021). For a large business a CMS can be extremely useful as it can allow for many more individuals with no web programming skills to publish content. This can however be a risk, especially in the sector of accessibility. A CMS may not provide the correct or relevant tools to ensure accessibility on a page (Juan Miguel López A. P., 2011). In these situations, it therefore requires accessible content to be provided by the author.

2.2.3 Accessibility Issues Regarding Content Management Systems

A Study in Spain focused on the accessibility impact on web content published via a CMS (Juan Miguel López A. P., 2011). Six management systems (including WordPress) were selected to give a general investigation and the published content was evaluated using the WCAG criteria. The study concluded many pages didn’t even reach a Level A WCAG Compliance. In terms of specific criteria, “Most priority 1 errors were due to a lack of proper alternative text in images (WCAG 1.1)”, and pages “used absolute measures instead of relative ones to position page elements (WCAG 3.4)”. This Suggests CMS gives users control over page positions and the alt text provided to elements. This alone suggests CMS users should therefore understand alternative text and responsive design to correctly provide accessible content.

2.3 Simplifications of common Accessibility Issues (Regarding Web Content Providers)

The purpose of this section is to generate content for the deliverable, it is important all relevant accessibility issues are considered when deciding which to simplify. The issues I focus on will be directly regarding web content providers mainly within content management system environments. These will also be linked to their relevant WCAG 2.1 Criteria, because of this they will be broken down into sections as they will be on the deliverable (Web Accesibility Initiative, 2019). Examples of practice will be provided however may be subject to change on the deliverable. These can be found in Appendix 6.

2.4 Making the Deliverable Accessible

2.4.1 Design & Development

The initial design of a site is very important to ensure accessibility. As this report has previously discussed you can never have an accessible site by adding these features at the end of development. The Journal article, “Making It Work for Everyone: HTML5 and CSS Level 3 for Responsive, Accessible Design on Your Library's Web Site” discusses the stages required to build an accessible website. The webpage must be designed to be responsive (Baker, 2014).

A Responsive design approach will force the content of the site to be constructed first. This has already been mostly completed for the deliverable, in section “2.6 Simplifications of common Accessibility Issues (Regarding Web Content Providers)”. This will allow for content to be dropped into the site when required. My content will all follow a uniform layout due to the context of the site. The Article secondly states a basic html shell for the site should then be built, allowing for styles to then be placed onto it. This structure will be followed during site design and development.

The html elements of the site regarding content must also be considered. Although the content of the site focuses on the creation of accessible content, it is important the deliverable itself is a prime example of this. The information collected and generated for the deliverable will be used to ensure the deliverable itself is accessible. The Article, “Teaching Accessible Design: Integrating Accessibility Principles and Practices into an Introductory Web Design Course” contains a detailed description of a collection of main html elements and how then can be implemented with accessibility in mind (Whitney, 2020). This will be used also to ensure both the site content and the site itself exclusively convey accessibility.

The conference proceeding, “Accessible Content Generation an Integral Part of Accessible Web Design” discusses the process of accessible web design (Kerstin Matausch, 2012). The proceedings conclude that the use of WCAG guidelines in the design process can allow a site to handle a large array of possibilities and outcomes regarding a user’s interaction with a site, whether they’re disabled or not. However, this must be used in conjunction with accessibility and usability testing to catch any other issues the recognition of WCAG cannot fully achieve.

2.4.2 Testing

2.4.2.1 Importance & Methods of Accessibility Testing

Accessibility is a vital part of web development and should be considered at each stage. However, the goal of a perfectly accessible site is not easy to achieve, the best way to do this is to apply a suitable testing process (Moreno, 2013). As web accessibility is qualities process several techniques and methods should be used and combined to ensure accessibility. These tests should include conformance to standards & guidelines, expert evaluations, and the feedback of end users (Abou-Zahra, Web Accessibility Evaluation, 2008).

An article discussing “web accessibility evaluation methods” determines the strengths and weaknesses of an array of testing methods (Brajnik, A comparative test of web accessibility evaluation methods, 2008). Within this, Conformance reviews (“establish and document rules for testing the conformance of web content to accessibility standards, such as Web Content Accessibility Guidelines (WCAG). These test rules address automated, semi-automated, and manual testing” (W3C, 2020)) are compared to barrier walkthroughs (“for testing and assessment purposes, it is better to start from known types of problems rather than using general design guidelines. (This is the same approach you would follow when assessing security of a web site: you'll start from known

vulnerabilities.)" (Brajnik, Barrier Walkthrough, 2011)). This concluded available tools were much more suited to conformance reviews, and reviews also scored higher than barrier walkthroughs.

The deliverable produced will be thoroughly tested with these findings in mind. I will use questionnaires with accessibility experts and end users to ensure not just the accessibility and usability of the site but also the relevance of the site content (regarding accessibility). I will use accessibility tools to perform a conformance review and determine the compliance with WCAG criteria.

2.4.2.2 Accessibility Testing Tools

Manual verification of accessibility against guideline criteria can be time consuming and is result to human error, to test correctly automated computer tools must be used. There is an array of systems such as this available for use (Abascal J., 2019). To effectively test the deliverable against WCAG criteria I will use an automated tool to generate a report highlighting any accessibility issues.

2.4.2.2.1 WAVE

"WAVE can identify many accessibility and Web Content Accessibility Guideline (WCAG) errors, but also facilitates human evaluation of web content." (WAVE, 2021) This is a browser extension that can be used on any webpage, it explicitly shows page elements and errors via icons to the user to aid in manual accessibility checking, however does not produce a machine-readable report (Markel Vigo, 2013).

2.4.2.2.2 AChecker

"AChecker is used to evaluate HTML content for accessibility problems by entering the location of a web page, uploading an html file, or by pasting the complete HTML source code from a Web page." (ACHECKS, 2021) As AChecker is open source it can allow for now guidelines and regulations to be added meaning it can adapt to changing legislations, It can also generate an accessibility report splitting issues into, "Known Problems, Likely Problems, Potential Problems and CSS Validation" noting the issues on the page, this however does not show the issues on the page itself (Greg Gay, 2010).

2.4.2.2.3 Silktide

"an accessibility testing platform that breaks the issues down into bite-sized chunks and shows you how to fix them." (Silktide, 2021) The silktide system will map a website at each page checking for conformation to all up to date WCAG criteria. The site issues are sorted into sections allocated by their WCAG failures, the page can be shown with the issue and a suggestion for how to conform is given. All issues ln one page can also be show. Site stats regarding common types of issues and conformance are also provided.

2.4.2.2.4 Mauve

"a system to evaluate accessibility of websites by checking their HTML and CSS code through guidelines, it provides validation results for different types of stakeholders, and supports validation of W3C WCAG 2.1 guidelines." (Muave++, 2021) The Muave system can be used through a command line, a web interface or browser extension. It also allows for validation against custom guidelines. Because if this it is not specifically tailored to WCAG guidelines. The results are presented in a "code-oriented approach" (Antonio Giovanni Schiavone, 2015).

3 Design

3.1 Persona & Scenario

3.1.1 Persona

Fictional Name	Diane Dickinson
Occupation	Online Public Communications Officer
Demographics	• 32 Years old • Mother of 3 Children • Bachelor's Degree in Human Resources • Limited knowledge of IT • Works in Communications & Public Relations
Goals and tasks	She is a determined middle-aged woman who strives to advance in her career within her company. She works hard at her job and always tries to find the best way to improve her effectiveness and quality of work. She can usually be found: • Drafting public announcements on behalf of the company. • Updating the Social media accounts for the company • Spending time with her family • In communications meetings with various Departments
Environment	Diane spends most of her time at work, either in the office or working from home. Outside of this she spends time with her friends and family. She is highly acclaimed within her workplace, and it is known she strives for more responsibility. Diane has very limited technical knowledge which can sometimes impact on her job, she feels this could hold her back from future promotion. Her colleagues also have a similar lack of technical skills. She is regularly called into meetings with various departments to discuss company to public communications, this includes topics such as company recruitment, service advertisement and service announcement.
Quote	"Can you confirm the information to be published on the website?" "Have you seen the recent post about the job opening on Instagram?"

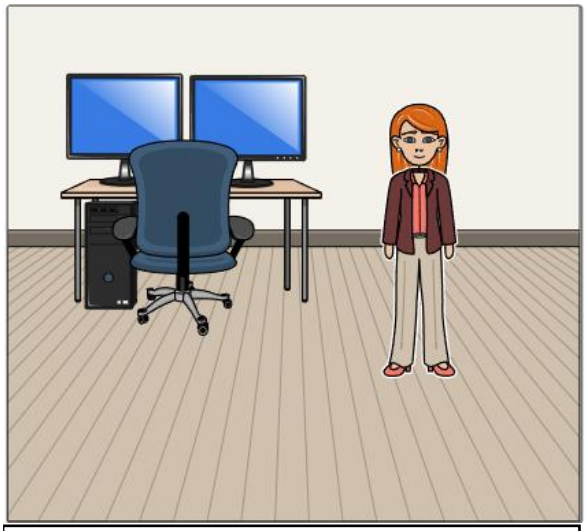
3.1.2 Scenario

Diane (See Persona) has just arrived at her office and prepares for a meeting with a service team which is offered by her company. During this meeting she is informed of some changes to the service and a series of promotional events which will be taking place. She is asked to update the services section of the company webpage with this new information. To do this a pre-made poster is provided. This is a poster image within a pdf. After the meeting, with this new information Diane opens her company's CMS (Content Management System), this allows her to create a new page and clearly states where to input a page title. She then opens the Web Accessibility Advice system for web content providers (The Deliverable) along with the pdf poster provided. She navigates to the image section of the deliverable to find immediately images of text should not be used as they are illegible to screen readers. Because of this she must then type up the information on the poster. She

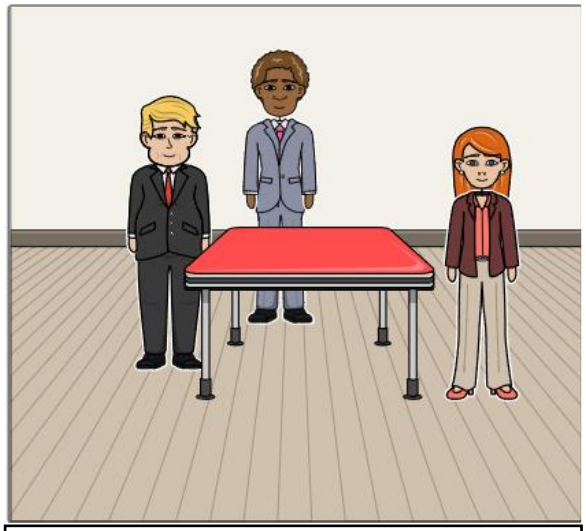
screen clips decorative images from the poster and adds them to the site via the CMS. Through "*the deliverable*" she identifies alternative text is not required in this situation. A link to an external site is also included on the poster as a URL. Dianne finds this is extremely inaccessible and due to this reformats the URL as a link on top of the site name onto which the link forwards. She then uploads the page to the public site.

3.2 Storyboard

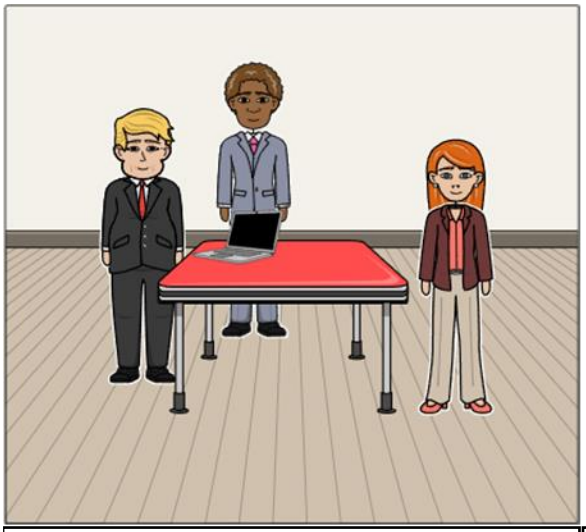
The following images depict a storyboard which follows the persona of Diane (see above) in the scenario described above.



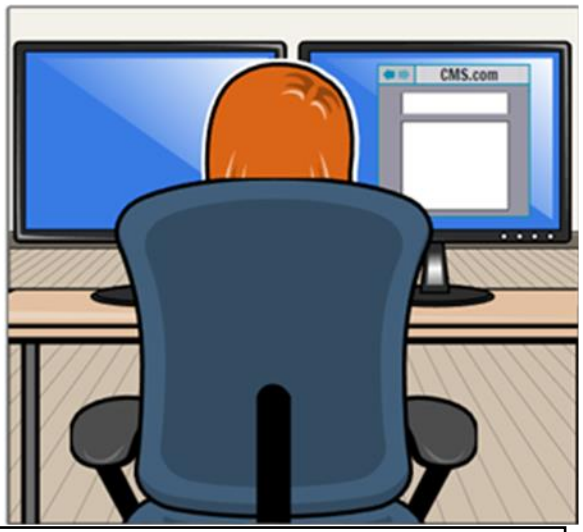
Diane (See Persona) has just arrived at her office and prepares for a meeting with a service team which is offered by her company



During this meeting she is informed of some changes to the service and a series of promotional events which will be taking place. She is asked to update the services section of the company webpage with this new information.

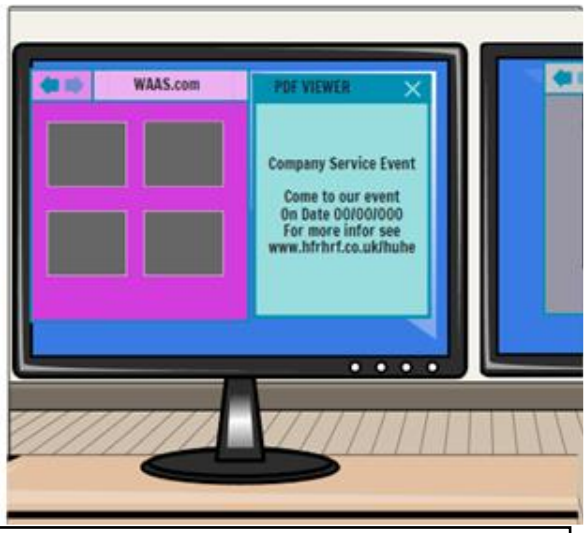


To do this a pre-made poster is provided by the service team via Company E-Mail. This is a poster image within a pdf.



After the meeting, with this new information Diane opens her company's CMS (Content Management System), this allows her to create a new page and clearly states where to put the page title.

She then opens the Web Accessibility Advice System for web content providers *("the deliverable"*).



She also opens the pdf poster provided. She navigates to the image section of the deliverable to find immediately images of text should not be used as they are illegible to assistive technologies.

She must then type up the information on the poster. She screen clips decorative images from the poster and adds them to the site via the CMS. Through *"the deliverable"* she identifies alternative text is not required in this situation.

A link to an external site is also included on the poster as a URL. Diane finds this to be extremely inaccessible and due to this reformats the URL as a link on top of the site name onto which the link forwards

She then uploads the page, it is now published to the public site.

3.3 Formal Requirements

The following requirements will be presented in a SMART format (Specific, Measurable, Achievable, Relevant, and Testable), will be generated for the final deliverable, these will consider the needs of

the project and all conducted research. These requirements will also be used to assist the determination of the project success. The requirements will also be relevant in all testing.

3.3.1 Functional Requirements

The following Functional Requirements will be used to help determine the system content is fit for purpose and meets the estimated needs of the target market.

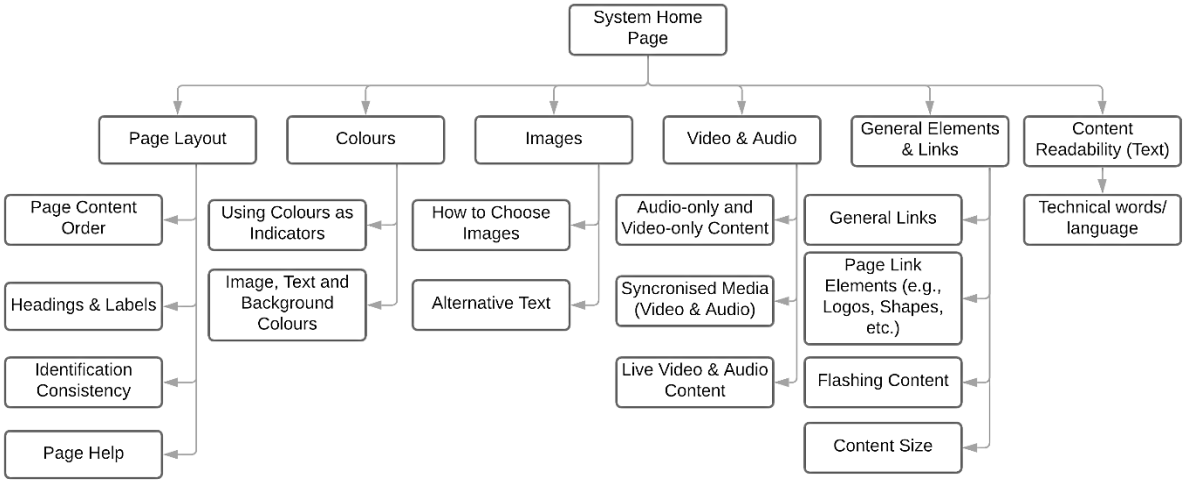
- Contain relevant accessibility information with reference to and inspired by WCAG 2.1 in a usable format for the target market specified (web content providers with limited technical knowledge) as judged by the majority of taken feedback. This should be 99.9% of the time under the assumption that any issues with the information is correctly identified and corrected via feedback and testing. This requirement will be delivered correctly provided that all dependencies on user device and software are working correctly (as anticipated).
- The system should have a simple and concise site navigation style for users to access relevant accessibility information easily as judged via positive feedback from majority of feedback providers. This should be 99.9% of the time at all resolutions and aspect ratios on common devices. This requirement must be delivered upon completion of the deliverable post feedback implementations assuming all third-party dependencies such as hardware and software are functioning as expected.

3.3.2 Non-Functional Requirements

The following requirements (system qualities) will be used to determine and ensure the operability of the system regardless of specific system elements or content.

- Transitions between pages and page states must be fast relative to other sites. This must be within 2 seconds of the trigger event (the event causing the page change or page state change). This must be 90% of the time assuming all network connectivity is working within average speeds. This requirement should be delivered throughout development at every iteration under the assumption all third-party hardware is functioning as expected.
- The deliverable content must be suitably responsive (all content to a readable and clear size) to all device sizes amongst standard devices (e.g., PC, Laptop, Smartphone). This should be 99.9% of the time assuming users' access through common browsers and hardware. This requirement will be delivered assuming all third-party software and hardware are functioning correctly.
- Be an accessible site, usable for all users, to do this all WCAG 2.1 criteria up to Level AA will must be satisfied in all testing scenarios. This must be 99.9% of the time on all commonly used web browsers being used on a standard user device. This should be met upon completion of the site after all (accessibility) testing and detection of required improvements by third parties. This is dependent on testing & development systems used working correctly to their description.

3.4 Functional Flowchart



The above flowchart shows the progression of a user throughout the system. There will be a simple dashboard inspired navigation style. A user will begin with 6 options, this will break down the accessibility information based on the nature of content. When selected a new age will open with the specific topics for that heading (e.g., page content order, alternative text). These when selected will then show a simplified description and good and bad practice for each.

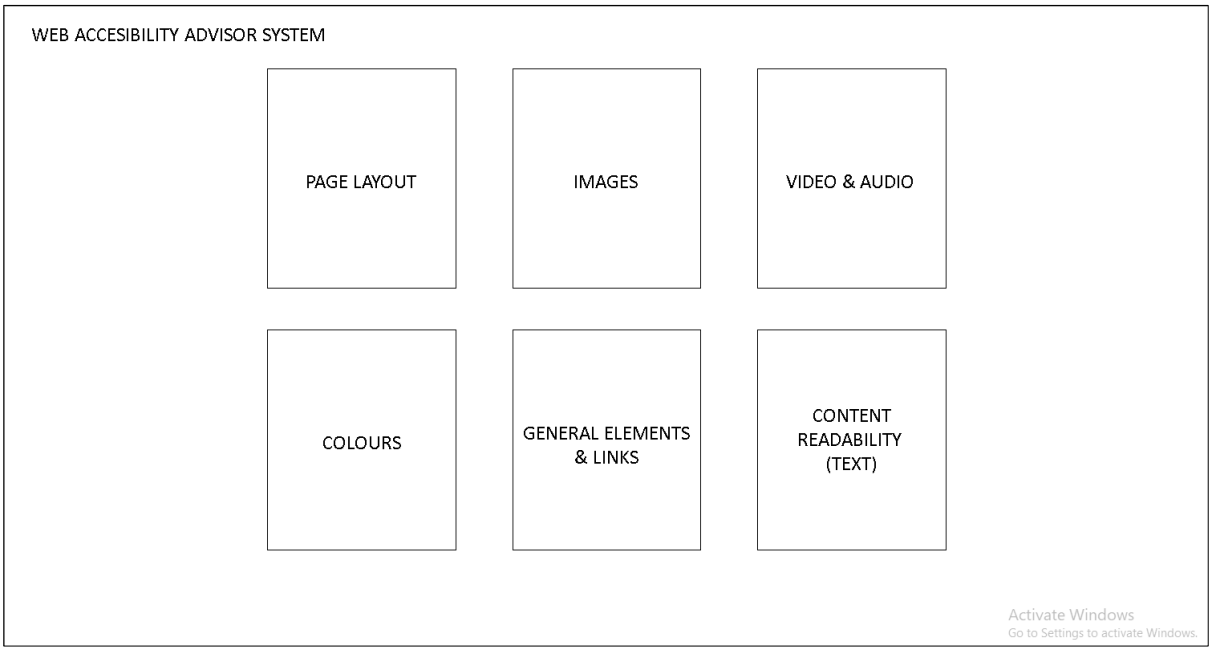
3.5 Wireframe Diagram

The following wireframes show a basic layout design and component locations for the site. These will incorporate designs for both desktop and mobile sites to demonstrate how the system will respond. As this site must also be accessible, the easiest way to do this is ensure only required content is given to a user in a friendly environment. I Fell the best way to do this is heavily base the site design around navigation. It must be easy and quick for users to access the information they need in a clear manner.

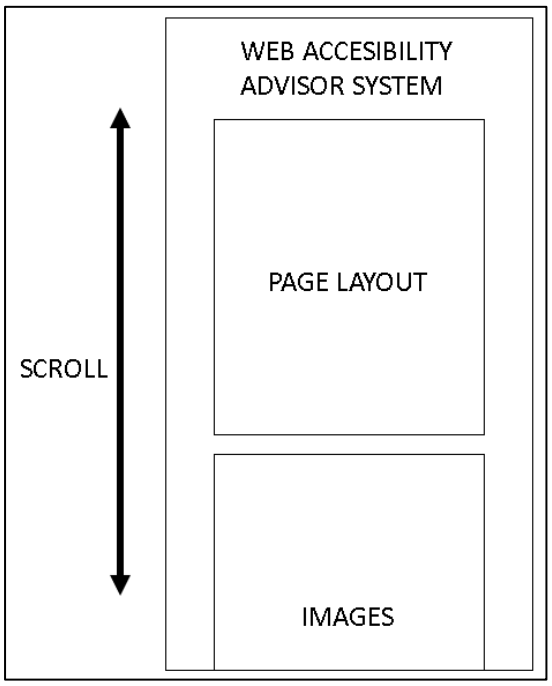
3.5.1 Home Page

This page will show all major accessibility sections (as shown in the functional flowchart). The headings are designed to allow a non-technical user to easily identify the needed section. When selected these sections will break down into the individual accessibility pointers. These Blocks will show in a 3 x 2 grid on desktop view, this however will respond to device size by scaling down to 1x6 where required.

3.5.1.1 Desktop View



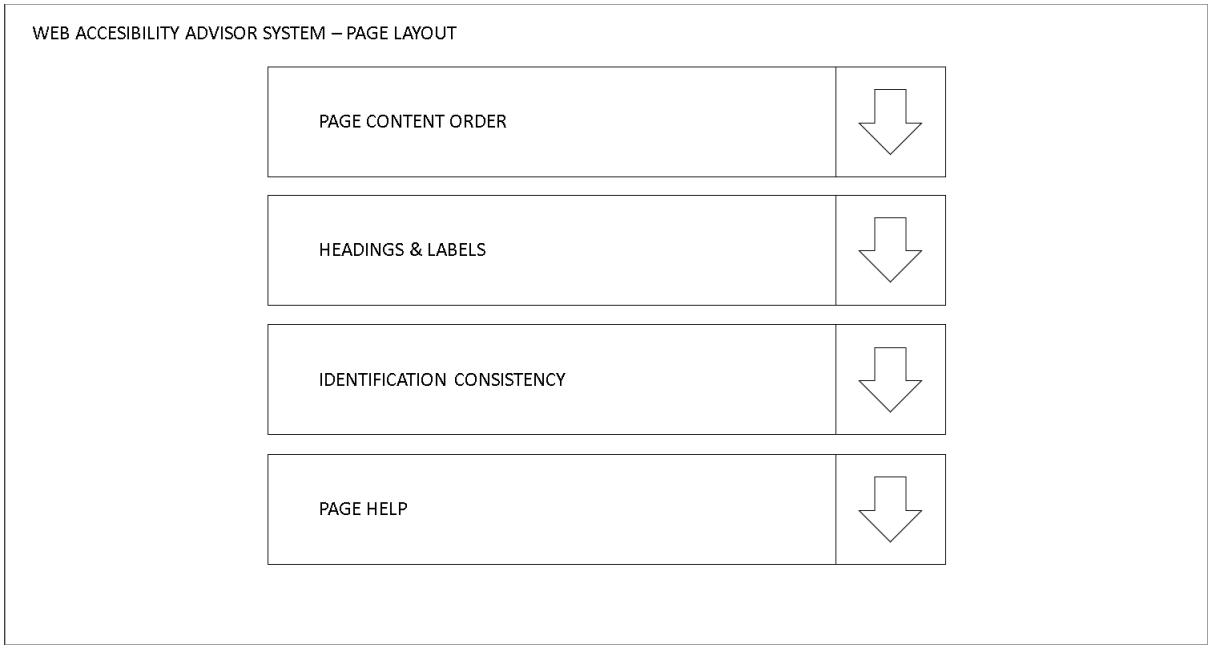
3.5.1.2 Mobile View



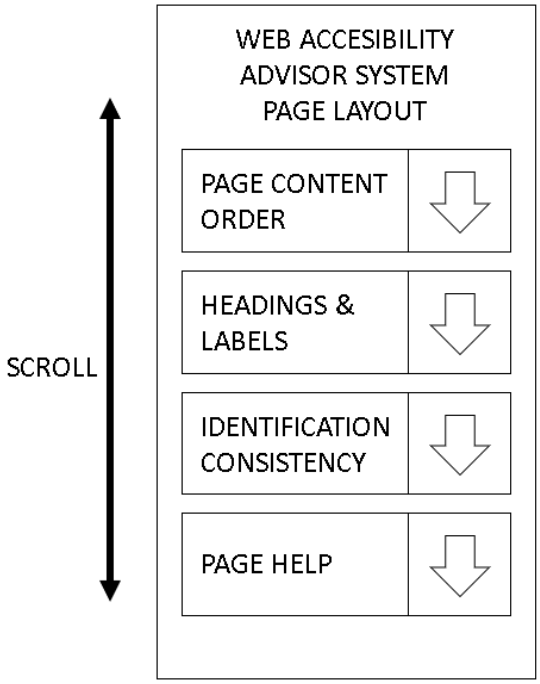
3.5.2 Accessibility Section Pages

These sections will show the major accessibility section breakdowns, here individual issues will be shown. These can be expanded (with the arrow) to show the issues themselves. Like the last page, all content is stored in the central reservation of the page and on a standard size scrolling is avoided (Where possible). These will be fixed with one block across the page width, this width will shrink with the page.

3.5.2.1 Desktop View



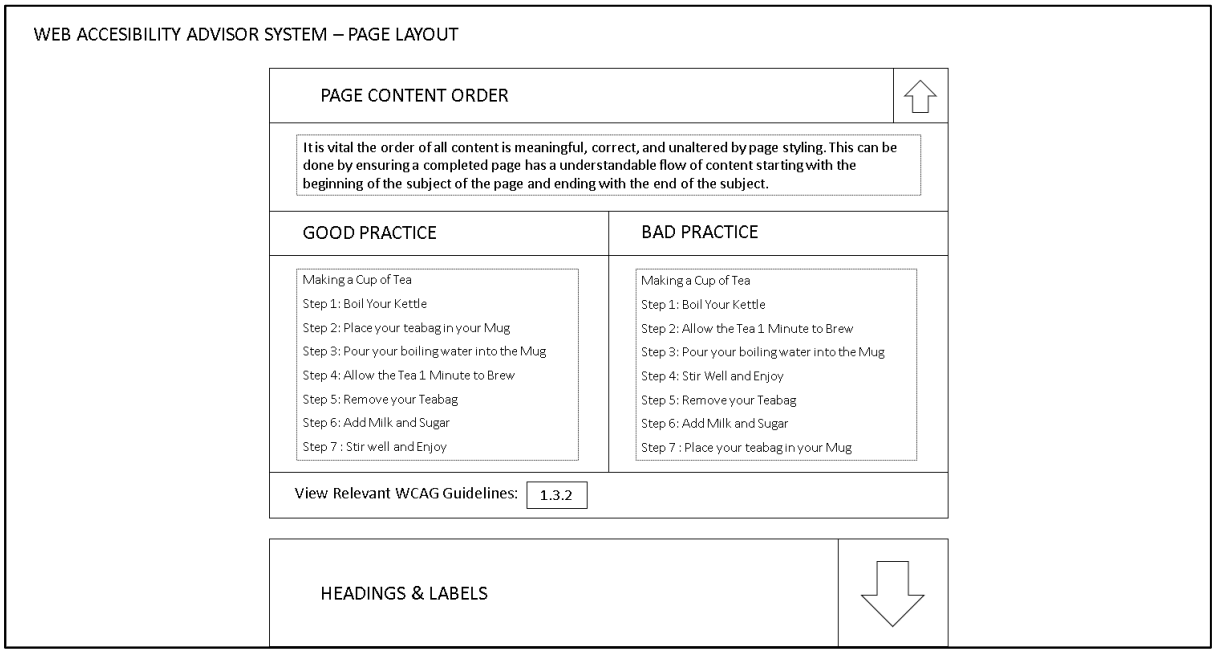
3.5.2.2 Mobile View



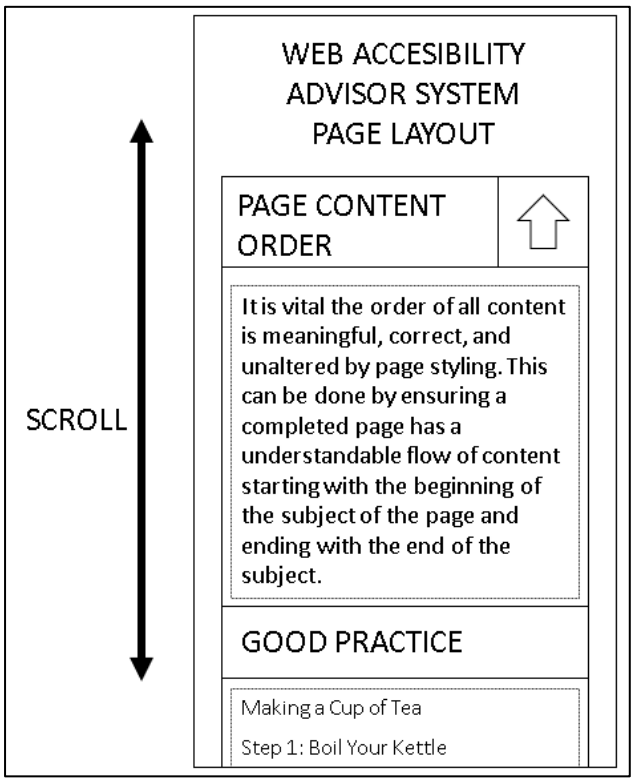
3.5.3 Issue Sections

This is kept on the same as the previous page, the issue sections are expanded to show a description, good and bad practices, and relevant WCAG links for more details. These sections will fill the full width of the container; however, the good and bad practice can be shown in a 1 x 2 or a 2 x 1 configuration depending on screen size.

3.5.3.1 Desktop View



3.5.3.2 Mobile View



3.5.4 Accessibility Implementation

3.5.5 Accessibility within System Design

Accessibility within the system design is extremely important, as dented in research the accessibility of a system must be planned from the very start of a systems development to ensure accessibility techniques are embedded correctly and not “shoehorned” in (Henry, 2006). The following section will explore the ways how the different aspects of my system will allow for accessibility techniques

to be implemented within the foundational stages of development (for simplicity these will be separated into the same categories as the accessibility information for the system).

3.5.5.1 Page Layout

The page content order will follow the flow as shown in the previous wireframes, due to this the page content will follow a clear and logical order. The accessibility section headings will break down to specific issues, each issue will consist of a description of the issue, an example of good and bad practice, and links to relevant WCAG Criteria. This allows for easy understanding due to a clear navigation method and a consistent layout between accessibility issue sections and accessibility issues.

Suitable headings and labels will be used, these can be identified via the functional flow chart, the issue sections will also be broken down using the correct headings, these will follow a sequential order, this will aid assistive technologies such as screen readers to break down page content. Link elements will also be used in a consistent fashion, an example of this will be the return to home page link will be identical across pages.

Page help will also be available and linked at the bottom of every page. This will be a consistent link across all pages due to the consistent and limited nature of content format & structure. The purpose of the help link is to provide more information relative to understanding page content and how to use the provided information.

3.5.5.2 Colours

Although colours on my system will be used to highlight good and bad practice (in reference to the individual accessibility issues), this will not be a substitution. Text will clearly be used for all indicators, any colours used will be in conjunction and purely for aesthetic reasons. No colours will be used as a primary indicator. This is to allow for users with any optical issues to receive equal content from a site.

A clear contrast will be used between Images, Text, and Background Colours. This is to ensure all content can be clearly seen and consumed by the user. This will be checked using an online tool. An example of this will be a darker coloured background with accessibility issue boxes having a white background.

3.5.5.3 Images

No informational images of any kind will be used on the site. Images will purely be used for decorative purposed. This is to ensure whether a user could correctly view an image or not, this does not affect their ability to consume site content. Due to this alternative text on images will not be required. Under the condition of an image requiring alternative text, this will be a very short summarisation and should provide equal content to that of which is displayed in the image.

3.5.5.4 Video & Audio

As shown on the wireframes, no video and audio content will be used, this is due to its unnecessary nature in the circumstances of this system. A possible use would've been in the video and audio section of good and bad practice; however, this would be too general and can be easily described in text format.

3.5.5.5 General Elements & Links

All page links will have relevant and descriptive labels, this includes internal links (such as a link to an accessibility issue section) and external links (such as the external links to the WCAG Criteria). All

links will also follow a consistent structure across the whole site. Page link elements such as shapes or logos will have suitable descriptive texts. An example of this will be the WCAG criteria links.

Only correct flashing content will be used on this site. For this reason, only a good example will be shown. If incorrect images are used this could be a serious medical risk. The bad example will however be aptly described.

No content on the site will have a fixed size, all content will be programmed to scale with the user's device. To do this, images and content boxes will reorganise their layout based on device size, this is done by defining sizes as page percentages.

3.5.5.6 Content Readability (Text)

All content on this site will be of low technical skill and a reading level of less than secondary educational level. The purposes of the descriptions are to simplify content. Any abbreviations used I'll be explained upon first use per page section. This ensures all content can be understood by the largest possible number of users.

3.6 User Stories

The following user stories are defined as simple points of call when developing the system, this will ensure functionality points expected by users is addressed and implemented. These stories can be used later in the project as a test suitability.

- "As a web content provider, I need to be able to identify what images I can use"
- "As a non-technical user, I need to be able to see what I need to change to be accessible"
- "As a content provider I need to be able to understand the accessibility information given"
- "As a communications manager I need to be able to easily navigate my staff to a relevant section"
- "As a user with limited pc ability I need to be able to access this using a mobile device"
- "As a colour-blind user, I must be able to see all the same content as my colleagues"
- "As a Blind user I need to be able to access this information using my screen reader"
- "As a busy user I need the system to load quickly in order to aid my content creation"

3.7 Help & About Content

As this site must be accessible, I must meet as many of the WCAG criteria as possible up to a minimum of WCAG 2.1 Level AA. To meet WCAG 3.3.5 I must provide help information. On my system this will be done on a sperate page teamed with information about the system. A link to this page will be placed on all pages to meet this WCAG Criteria, it is important the content must be suitably in depth. This will be written (shown below) taking into account all design and generated content up to this stage of the project.

3.7.1 About

This system was developed to assist content providers with varied technical knowledge when producing site content. Content types are broken down into relevant sections to allow for correct content selection and specific implementation advice. The information provided on this site is summarised from Web Content Accessibility Guidelines 2.1, This is a legal standard that all public bodies must conform to (up to level AA). Below each summarisation good and bad practice examples or information is provided to further assist in your own accessible content implementations. Any connected WCAG Criteria are also linked, these links provide more information on specific guidelines, however, may not be as understandable to individuals with a lesser technical knowledge.

3.7.2 Help

3.7.2.1 Finding what you need

To find your relevant section, first ask yourself what category your content fits into best out of those displayed on the home screen. Once you have found this, select this section. The page you are taken to will show a breakdown of more specific content elements or areas of implementations, out of the options provided select the one which suits your need. This will bring up an information window with the relevant assistance.

3.7.2.2 Understanding Accessibility Sections

These sections have four key components, General assistance and information, good practice, bad practice, and relevant WCAG guidelines. General assistance and information provide an overview of the section and what is required of content under this heading. Good and Bad practice sections will show either examples of the relevant content type in accessible and inaccessible ways and an accompanying description, or a explanation of what must be done and avoided to avoid the implementation of inaccessibility. The WCAG reference is a list of links to official accessibility guidelines, these guidelines may not be understandable to all individuals but could provide more information about what must be done to ensure content is implemented in an accessible way.

3.7.2.3 Ensuring your content is Accessible

Even by taking heed of the information this system provides it is understandable you may still be unsure of your contents accessibility. Possible actions currently are to ask another individual (possibly a colleague or individual with relevant technical knowledge in the field of accessibility) to check your content with the help of this site. Other possible ways may include online tools such as web accessibility checkers. These can come in many forms, usually these tools will scan through a website and show any accessibility issues generated by your content. Your content can then be altered accordingly.

3.7.2.4 What is Accessibility?

Web Accessibility is very important in the modern world. The internet has become a widely used resource that more and more content is added to every day on the sites of both public and private bodies. This progression towards web-based content is due to reasons such as convenience and cost. It is therefore easy in these situations for accessibility to be overlooked. I believe one of the reasons for this widespread lack of web accessibility is a result of a lack of understanding of the importance of accessibility, and how it can be correctly implemented by the web content providers.

Materials available to provide these accessibility guidelines frequently contain complex wording and can cause misunderstanding or confusion in individuals with little to no technical knowledge. Due to this lack of understanding, accessibility issues arise frequently and can lead to sites being unintentionally in breach of the law. This will mainly occur in situations of separation between webpage developer and webpage content provider where although the technically minded web developer is aware of accessibility implementation techniques, this is not passed onto the web content providers in an understandable way.

Accessibility isn't just a term that refers to the assistance of those with disabilities. It refers to all people and ensures all users can use all webpages and receive the same content and information on a page. For this reason, its therefore so important that accessibility is implemented to cater for as larger group of people as possible. The widespread lack of understanding of accessibility and its implementation needs to be eradicated for this to occur, and the only way to do that is by making information regarding accessibility as accessible and understandable as possible.

4 Development

4.1 Introduction

This section will follow the step-by-step development process of the deliverable. This will include justifications for implementations, any problems discovered and how they were overcome, limited informal testing to allow for a smoother development process, and the implementation of accessible content and techniques.

4.2 Ember Server

The web server will be hosted using the EmberJS Framework. This offers a wide range of tools allowing for a wide range of possibilities. A particular feature that lends itself to the development of the deliverable is the "Component" elements. This allows for HTML sections to be developed independently and placed into one or more webpages. This can be a powerful tool in accessible development as accessibility techniques can be implemented once and reused multiple times on the system. A simple server will be setup in order for the site to be developed onto it. To ensure this is completed correctly the EmberJS tutorial "Quick Start" pages will be used (EmberJS, 2022).

4.2.1 Basic Ember Server Setup

4.2.1.1 Installing Ember & Creating the Application

The following steps allow for Installation and the application generation.

"ember new Web-Accessibility-Advisor-System --lang en" – this command is ran in the relevant directory, this generates an ember project specifying the website language as English.

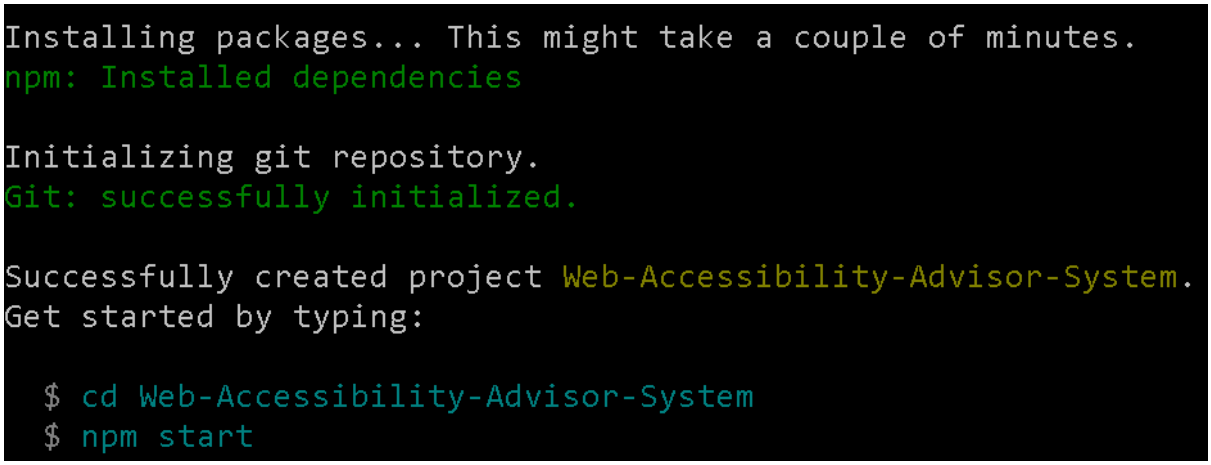


Figure 1Ember Project Successful Installation Report

4.2.1.2 Testing & Running the Server

Entering the directory and running the server (with the commands shown in Figure 1) to test the project will prove a suitable foundation on which the system can be built.

Figure 2 Ember Server Successful Run Report

4.2.2 Preparing the Server for Development

As shown above in (Figure 2) the server correctly runs, this can also be seen by accessing the localhost address and the EmberJS Template Page.

This landing page must be cleared to make way for the system home page, to do this the "app/templates/application.hbs" file must be edited to remove the "<WelcomePage />" tag. Once this is done a blank page will be shown.

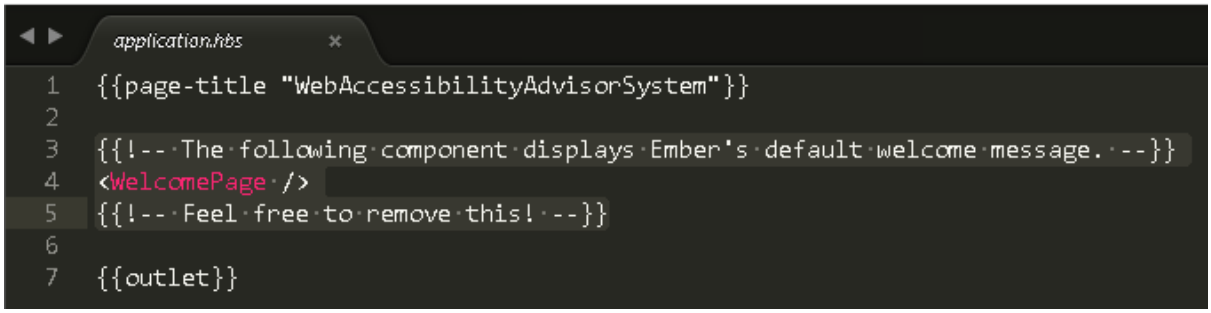


Figure 3 "application.hbs" File with removed code Highlighted

4.3 Empty System Elements

4.3.1 System Pages

As shown in the system wireframes there are several general system elements that must be generated, this includes system pages (not including the home page) and consistent system styles.

New system pages cannot just be added by the generation of new html files, these must be added correctly through the relevant ember commands. These commands will not only generate ".hbs" files for each but also generate supporting features such as routes. The pages to be added (as presented in the Functional Flowchart) Include:

- Page Layout
- Colours
- Images
- Video & Audio
- General Elements & Links
- Content Readability (Text)

There will also be a "Help & About" page generated. This will help to give background information concerning the system and assistance regarding site content. These pages can be added via the following ember command:

"ember generate route {page name}" – where "{page name}" is an element from the list above. This is completed for all pages. The generated pages to edit HTML appear in the "templates" directory.

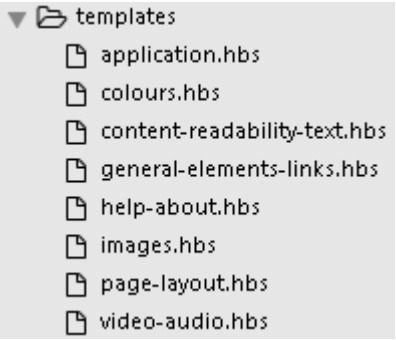


Figure 3 Templates Directory

4.3.2 Consistent Header & Footer

To increase the usability of the system it is important to create a familiar environment, to do this the minimum elements will be added to the header and footer, this focuses the user's attention on the "body" content. Header and footer components can be created, this will allow for consistency across the site.

Like the pages, in EmberJS components are generated through the command line interface, "ember generate component {component-name}" where "{component-name}" is a suitable reference name to the component object. The components added at this stage will be as follows:

- Header
- Footer

Executing these commands generates ".hbs" files within the "components" Directory.

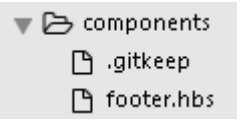


Figure 4 Components Directory

As the header will remain consistent, this can be added to all ".hbs" files before and after their main content, a simple test of this concept is shown below:

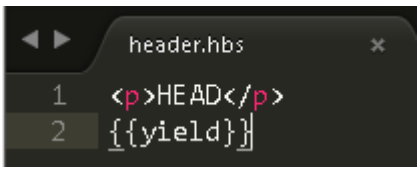


Figure 5 "header.hbs" File

Figure 6 "footer.hbs" File

```
application.hbs
1  {{page-title "WebAc
2  <Header />
3  <p>BODY</p>
4  <Footer />
5  {{outlet}}
```

Figure 7 "application.hbs" File

This simple test will demonstrate the header and footer components can be accurately rendered as part of the webpage. The “<Header />” and “<Footer />” component references will be added to all pages, this will allow their consistent appearance on all pages for these sections.

4.3.2.1 Header Content

To keep the page header simple, it will only carry the relevant and important content, this will consist of the system name “Web Accessibility Advisor”, To maintain accessibility this will carry a “h1” tag, as per WCAG this will be the only Heading One tag per page.

```
header.hbs                    application.hbs
1  <h1>Web Accessibility Advisor</h1>
2  {{yield}}
```

Figure 8 "header.hbs" File

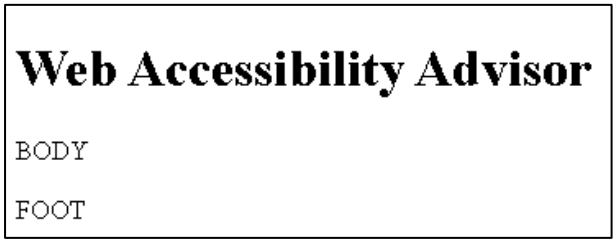


Figure 9 System Home Page Preview

To allow the user to return to the system home page a link to this can be added in the header component which is then shown on all pages. EmberJS allows for more advanced links, this allows for preloading meaning faster page loading for users. This makes the site more accessible as there is less discrimination for users with slower internet connections. EmberJS provides all generated pages (“templates”) with a route within “router.js”:

```
9  Router.map(function () {
10   this.route('PageLayout');
11   this.route('Colours');
12   this.route('Images');
13   this.route('VideoAudio');
14   this.route('GeneralElementsLinks');
15   this.route('ContentReadabilityText');
16   this.route('HelpAbout');
17 });
```

Figure 10 Page routes within "routes.js" File

As there is no route for the system home, “index” is used as the route, this returns to the “application.hbs” page.

```
1   <h1><LinkTo @route="index">Web Acessibility Advisor</LinkTo></h1>
```

Figure 11 EmberJS Link Code From "header.hbs" File

Figure 12 System Page Displaying Functioning Header Link

4.3.2.2 Footer Content

The footer of the page will also be kept simple and limited in content. This will exclusively include a button to the “help-about.hbs” File. This must be included to conform with WCAG 3.3.5. This will be added in a similar fashion to the header link. The code and rendering are shown below:

```
1   <LinkTo @route="HelpAbout">Help & About</LinkTo>
```

Figure 13 Help & About Link From "footer.hbs"

Figure 14 System Page Displaying Functioning Footer

4.3.3 Consistent System Styling

4.3.3.1 System-Wide Features

EmberJS auto generates the file “app.css” the styles in this document are applied to the all site pages. A gradient background will be added initially, this would allow for other styles to ensure suitable colour contrasts.

```
1  html{
2      height: 100%;
3      background: rgb(111,0,143);
4      background: linear-gradient(155deg, rgba(111,0,143,1) 0%, rgba(9,9,121,1) 47%, rgba(255,102,0,1) 100%);
5  }
```

Figure 15 Colour Background Code in "app.css" File

Figure 16 System Page Preview Snippet

As can be seen above, the colour contrast here is inaccessible, this will be addressed by styling the Heading 1 tag and the “Help & About” Links.

The site must have an accessible font pack, this must be easy to read win all text forms on the site. If a specialist font is used the fallback font is used must also be accessible. The font chosen was selected from google fonts as it was found easy to read this font is “Roboto Slab Regular 400” (Robertson, 2019). This font is linked to the system in the “index.html” file in the header section.

```
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Roboto+Slab&display=swap" rel="stylesheet">
```

Figure 17 Font Import Code Snippet From "index.html"

I must also make the system use this font. “font-family: 'Roboto Slab', serif;” will be added to the html tag in the CSS file “app.css”, this will apply the font to the whole system. It will also provide an accessible backup font of serif; this will be used when the chosen font cannot be retrieved.

Figure 18 System Page Preview Snippet

4.3.3.2 Consistent Element Styling

The styling here will focus on the header and footer elements previously added to each page. They are both links these will be responsive to hover actions, this will help to ensure users with assistive technology can identify when they are in the click region of the link. The styling will also promote a simple layout and adhere to colour contrasting guidelines.

```css
h1 a{
  color: white;
  background-color: transparent;
  padding: 0.25em;
  text-decoration:  none;
}
h1 a:hover{
  color: black;
  text-decoration: underline;
}
.footer-button:link, .footer-button:visited {
  background-color: transparent;
  color: white;
  padding: 0.3em 0.6em;
  border: 2px solid white;
  border-radius: 5px;
  text-align: center;
  display: inline-block;
  font-weight: bold;
  position: absolute;
  bottom:0px;
  right: 0px;
  margin: 1%;
  font-size: 120%;
  text-decoration:  none;
}
.footer-button:hover, .footer-button:active {
  color: black;
  border-color: black;
  text-decoration: underline;
}
```

Figure 19 CSS Code Snippet From "app.css"

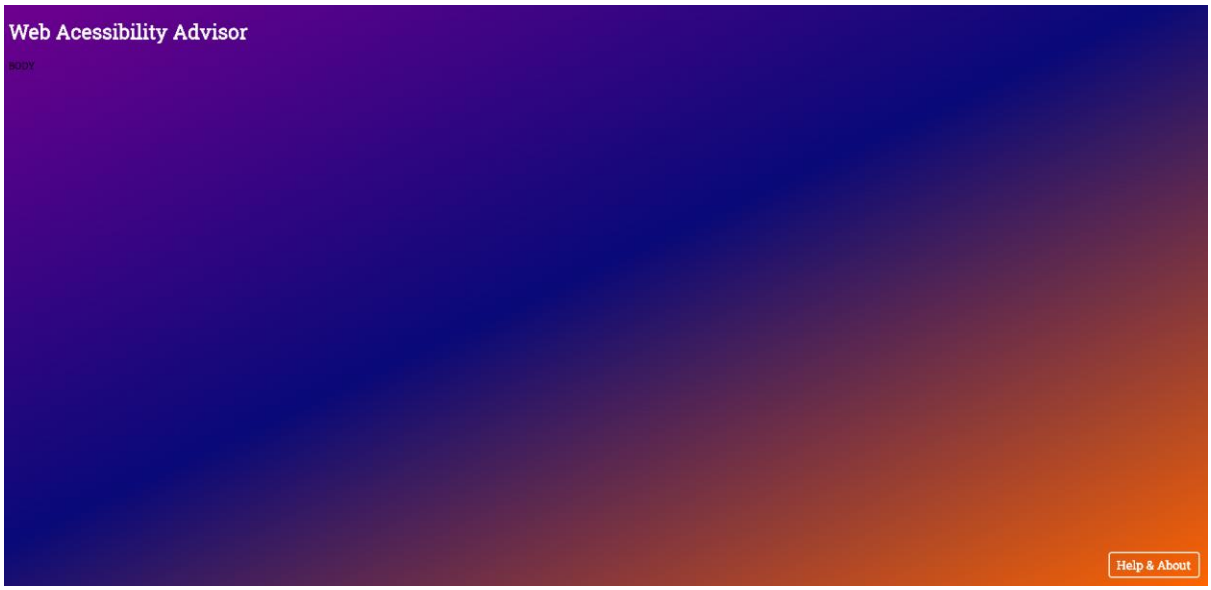


Figure 20 System Page Preview Exhibiting CSS

4.4 System Home Page

4.4.1 Page & Component Setup

The tiles linking to each accessibility section will be multiple versions of the same EmberJS component, this will be generated using, “ember generate component AccessibilitySection”. This will generate a relevant “.hbs” File.

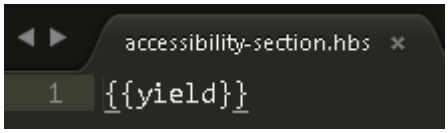


Figure 21 Empty "accessibillity-section.hbs" File

As this component will be called multiple times it is important to enable to pass values into the component. To test this the section title will be passed through and output. In the “accessibility-section.hbs” file “<h2>{{@title}}</h2>” will be printed. This must then be passed through from the “application.hbs” file for each section as follows:

```
1  {{page-title "WebAccessibilityAdvisorSystem"}}
2  <Header />
3  <Accesibility-section @title="Page Layout"/>
4  <Accesibility-section @title="Colours"/>
5  <Accesibility-section @title="Images"/>
6  <Accesibility-section @title="Video & Audio"/>
7  <Accesibility-section @title="General Elements & Links"/>
8  <Accesibility-section @title="Content Readability (Text)"/>
9  <Footer />
10 {{outlet}}
```

Figure 22 Accessibility Section Components Within "application.hbs" File

This is rendered successfully.

Before any styling is added to these elements it is important at this stage to centre the elements and main page content, this will be done by placing main page content within a page division (or “div”).

```
3  <div class="main-content">
```

Figure 23 Page Code Snippet

This page division will contain code to ensure content is kept central, this central approach allows for the site to be more responsive to various device sizes, more functionality regarding this will be added at a later stage of development.

```css
.main-content{
    width : 75%;
    margin: auto;
}
```

Figure 24 CSS Code Snippet

The following styling is added to the elements. This is done through a “div” elements containing a class within the components and a “div” around them in “application.hbs” to allow for flex CSS properties. The CSS below will define the accessibility section objects as “flex” objects this will allow for the objects to use flex flow properties. Additional styling can be added to better position the elements.

```css
.flex-container {
  display:flex;
  flex-wrap: wrap;
  height: 100%
}

.AccesibilitySec {
  background-color: white;
  padding: 1%;
  margin: 2% auto;
  min-width : 432px;
  width : 30%;
  max-width : 30%;  min-height: 60%;
}
.AccesibilitySec a{
    color: black;
    text-decoration:  none;
}
.AccesibilitySec a:hover{
  color: blue;
  text-decoration: underline;

}
```

Figure 25 CSS Code Snippet

Figure 26 Screen Clipping of System Section

The section components must then be linked to their individual pages. For this I can pass the link location into the object and place a link around the whole of each element. The links passed are taken from the “route.js” file.

```
<Accessibility-section @title="Page Layout" @link="PageLayout"/>
<Accessibility-section @title="Colours" @link="Colours"/>
<Accessibility-section @title="Images" @link="Images"/>
<Accessibility-section @title="Video & Audio" @link="VideoAudio"/>
<Accessibility-section @title="General Elements & Links" @link="GeneralElementsLinks"/>
<Accessibility-section @title="Content Readability (Text)" @link="ContentReadabilityText"/>
```

Figure 27 Code Snippet from "application.hbs"

```
<div class="AccesibilitySec">
<LinkTo @route="{{@link}}">
<h2>{{@title}}</h2>
</LinkTo>
</div>
```

Figure 28 Code Snippet from "accessibility-section.hbs"

At this point placeholder images will be added to each section, these can be added in the same way as the links before. By doing this it enables images to be changed easily in future.

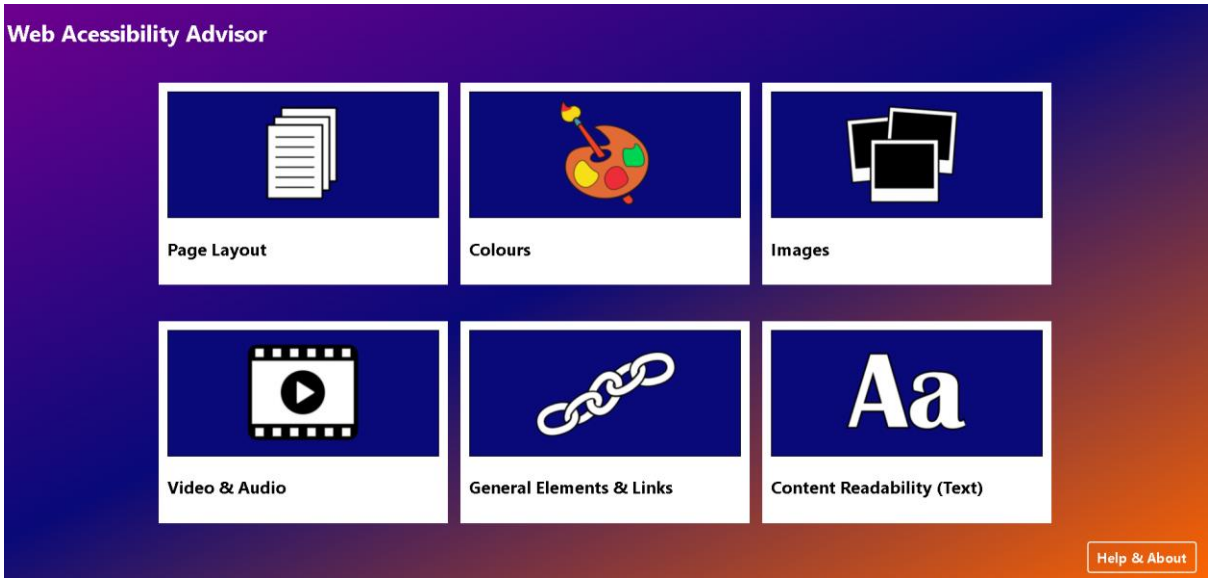


Figure 29 System Screen Clipping with added images

By clicking on the links, it becomes clear at this point in development an error has been made. The content shown on the home page is shown on all pages. This is an issue as only header and footer elements should be shown on other pages at this time. It is found that content within “application.hbs” is shown on all pages, this can be fixed by generating a system home page then routing the site to this as a home. Content independent to the homepage can be placed on this page. This will be called “index”. As the page is called index, this will be the default route of the system.

```
{{page-title "Index"}}
<div class="flex-container">
<Accessibility-section @title="Page Layout" @link="PageLayout" @img="pagelayout.png"/>
<Accessibility-section @title="Colours" @link="Colours" @img="colours.png"/>
<Accessibility-section @title="Images" @link="Images" @img="images.png"/>
<Accessibility-section @title="Video & Audio" @link="VideoAudio" @img="vidaud.png"/>
<Accessibility-section @title="General Elements & Links" @link="GeneralElementsLinks" @img="element.png"/>
<Accessibility-section @title="Content Readability (Text)" @link="ContentReadabilityText" @img="text.png"/>
</div>
{{outlet}}
```

Figure 30 Code snippet from "index.hbs"

```
{{page-title "WebAccessibilityAdvisorSystem"}}
 <Header />
<div class="main-content">
{{outlet}}
</div>
<Footer />
```

Figure 31 Code snippet of "application.hbs"

4.5 System Accessibility Section Pages

These pages will contain a various number of accessibility sub sections. These must all be uniform across the site; therefore, a component will be used as before. This will be developed allowing for interchangeable info to be added to the component allowing for its easy replication and reuse. For this a new component must be added, this is done with the following command.

```
n>ember generate component accesibillity-sub-sec
```

Figure 32 Command Line Input to generate ember component

To help design this component it is important to identify the unique inputs for each section. This information content can be passed as data values (the same as how image names were passed into the accessibility section components) or as the yield between the two component tags. This information is as follows:

- Section Title
- Section General Info
- Good Practice Example
- Bad Practice Example
- Relevant WCAG Points

In this situation, all values except the WCAG Points will be passed as data values, this is as they can have an unknown number of points depending on the sub section content.

This component must also collapse and reopen. This will be implemented first before content is built up. After this html for the basic template will be added. For the purposes of development, the first accessibility sub section from the page layout section will include passed details.

```
<button type="button" class="collapsible"><h2>{{@title}}</h2></button>
<div class="dropcontent">
    <p>{{@info}}</p>
    <div class="flex-container">
        <div class="practice-container">
            <h3>Good Practice</h3>
            <p>{{@good}}</p>
        </div>
        <div class="practice-container">
            <h3>Bad Practice</h3>
            <p>{{@bad}}</p>
        </div>
    </div>
    <div class="flex-container">
        <h3>Relevant WCAG Section(s):</h3>
        {{yield}}
    </div>
</div>
```

Figure 33 HTML for Accessibility Section

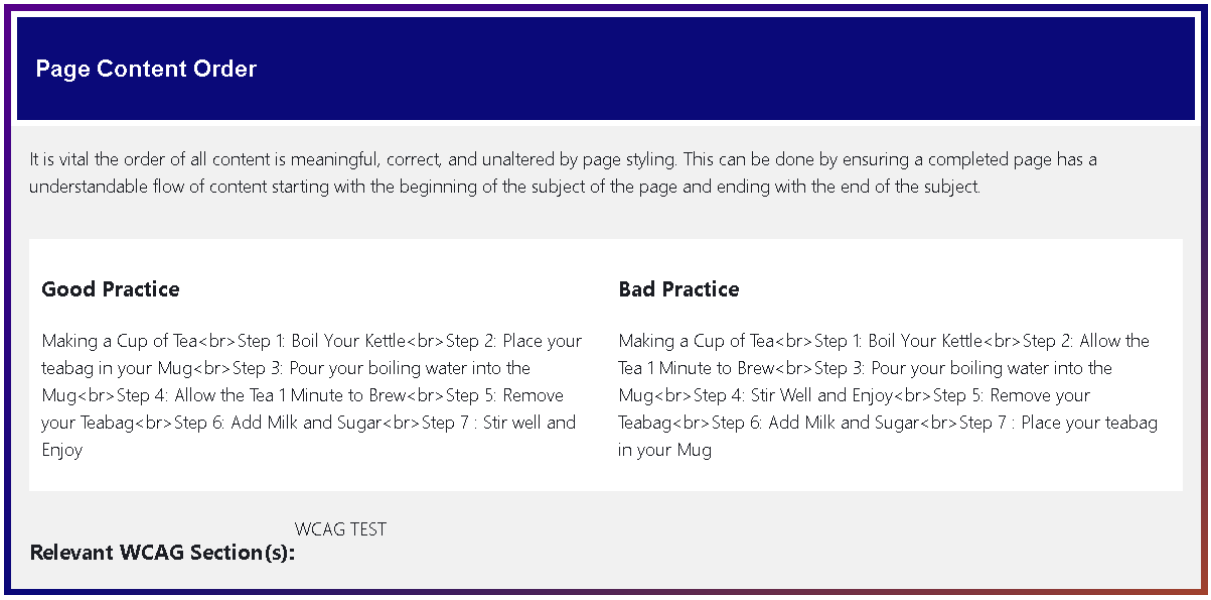


Figure 34 System Clipping for accessibility sub section

As seen above the content is correctly passed using the parameters in Ember. The good and bad accessibility sections seem to pass the data through as plain text, this can be inputted as correct html code through JavaScript for all passed data.

```
document.getElementById("info").innerHTML = document.getElementById("info").textContent;
document.getElementById("good").innerHTML = document.getElementById("good").textContent;
document.getElementById("bad").innerHTML = document.getElementById("bad").textContent;
```

Figure 35 Code snippet from "accessibility-sub-section.hbs"

The component must then be made collapsible, this can be done through JavaScript also using the class info already within the HTML.

```
var coll = document.getElementsByClassName("collapsible");
var i;
for (i = 0; i < coll.length; i++) {
    coll[i].addEventListener("click", function() {
        this.classList.toggle("active");
        var dropcontent = this.nextElementSibling;
        if (dropcontent.style.display === "block") {
            dropcontent.style.display = "none";
        } else {
            dropcontent.style.display = "block";
        }
    });
}
```

Figure 36 JavaScript Screen Clip for Collapsible boxes

The correct execution of this can be shown below, this also exhibits the fix for the content parameters issue previously addressed (the window is toggled by selecting the “Page Content Order” button).

Figure 37 Accessibility sub section (untoggled)

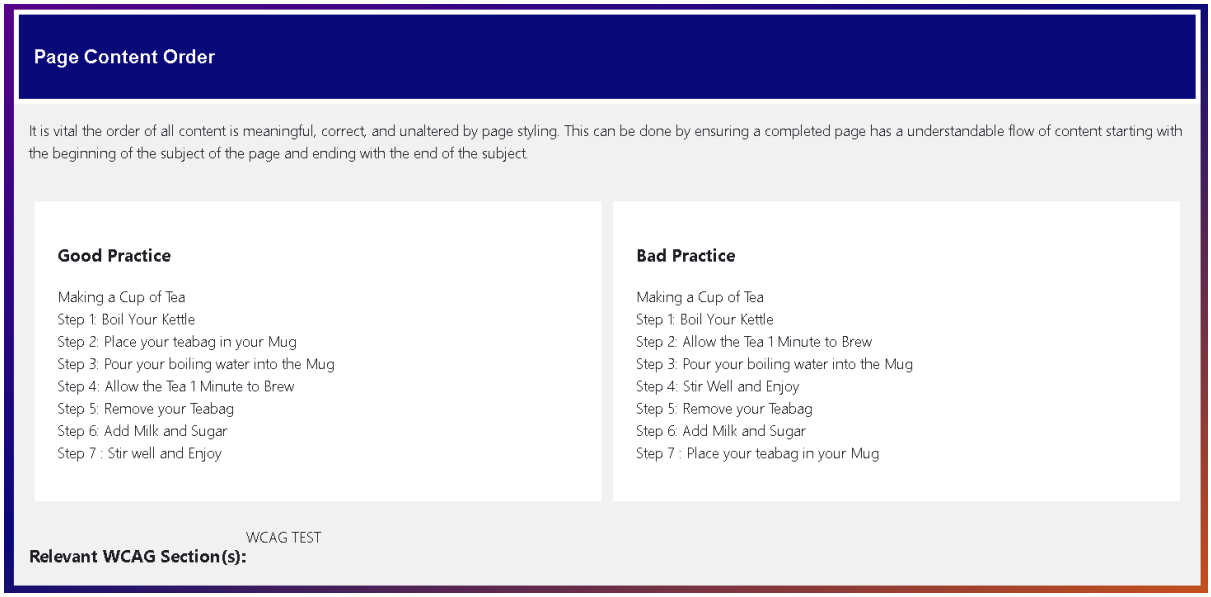


Figure 38 Accessibility sub section (toggled)

Next the buttons linking to the WCAG Info must be added. These will be linked directly to the WCAG website. This section is for the purpose of providing further information regarding more specific guidance points and to reassure the user of the legal standard the information on the site pertains to.

```
<a href="https://www.w3.org/TR/WCAG21/#meaningful-sequence" class="wcag-link" target="_blank">1.3.2</a>
```

Figure 39 Example code for WCAG Link

```css
.wcag-link:link, .wcag-link:visited {
  background-color: transparent;
  color: black;
  padding: 0.3em 0.6em;
  border: 2px solid black;
  border-radius: 5px;
  text-align: center;
  margin: 1%;
  font-size: 120%;
  text-decoration:  none;
}
.wcag-link:hover, .wcag-link:active {
  color: blue;
  border-color: blue;
  text-decoration: underline;
}
```

Figure 40 CSS Screen Clip for WCAG Link

The section is now complete. This will be repeated for all other sub sections within the "Page Layout" section. This will ensure all functionality works correctly when multiple of the object is included within the page. This was first tested by completing the next section on the "Page layout" page.

First the previous section with the new parameter data was passed through. This posed some issues with the JavaScript. Due to then nature of EmberJS the code produced could not be placed in the individual Accessibility Sub Section component document. As EmberJS repeats this code block upon every call this caused issues. The code designed to allow for the collapsible content should be placed around all the collapsible content (not one block per code segment). The code designed to refactor the parameters to correctly display the HTML worked by identifying "id's" this was not feasible for scaling, instead classes were used, and all identified and handled individually. All this code was placed within the Section Document. CSS was also Edited accordingly. These changes are then expanded across all documents.

Figure 41 Example clipping of System with added Content

4.6 System “Help & About” Page

This page is required to provide users with background and supporting information about the system and its importance. This is also required to meet WCAG criteria to provide help information regarding the site, its content and use. This is met as it is linked on every page. To satisfy this properly the information provided must suitably provide site assistance. The information placed within this page is pre-generated to ensure its accuracy and compliance.

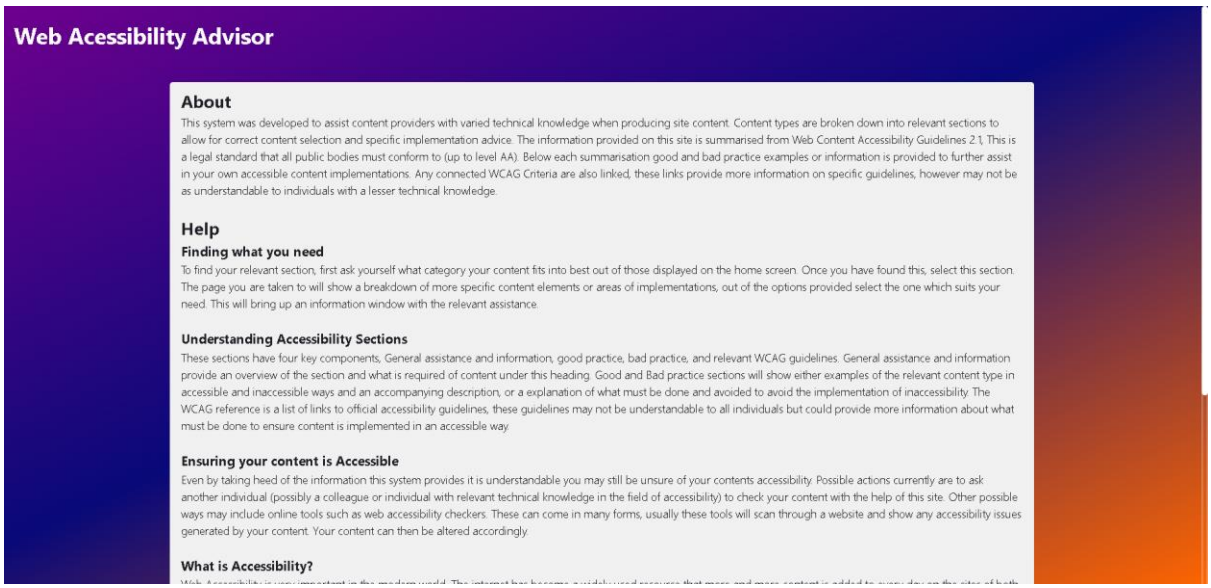


Figure 42 Screen Clip of Help & About Webpage

4.7 Responsive Development

It is very important for the system to be responsive to different sized devices, this must not be a factor of exclusion. During development to this point some styling has been added to allow for some responsive design on elements. This allows for responsive properties to be seen throughout development as components are added. There are however some issues that need to be addressed.

This will be done across the whole site, examples of these changes on the system home will be shown. To ensure the site is responsive within a reasonable degree at this stage of development, 3 sizes will be chosen to ensure responsiveness to common sizes, these will be, 1920x1080 (Desktop), 1024x600 (Tablet), and 393x851 (Smartphone).

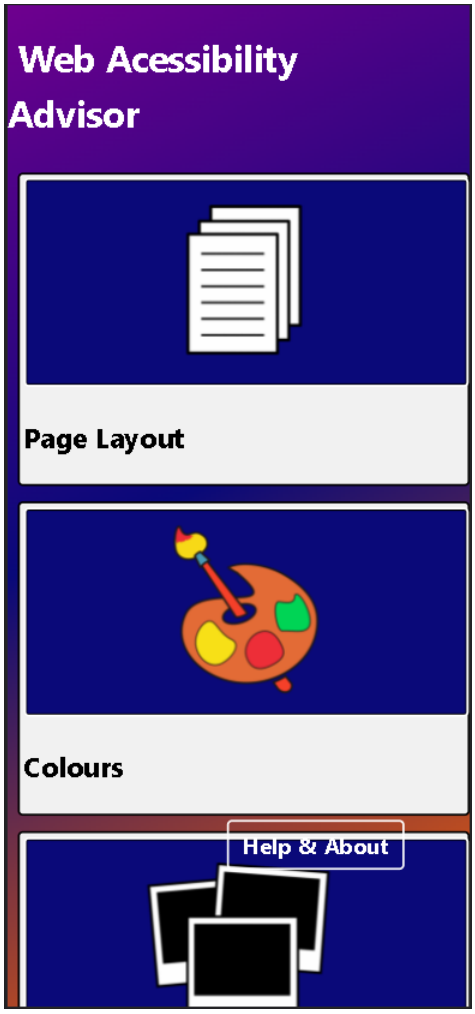


Figure 43 Smartphone Screen Display

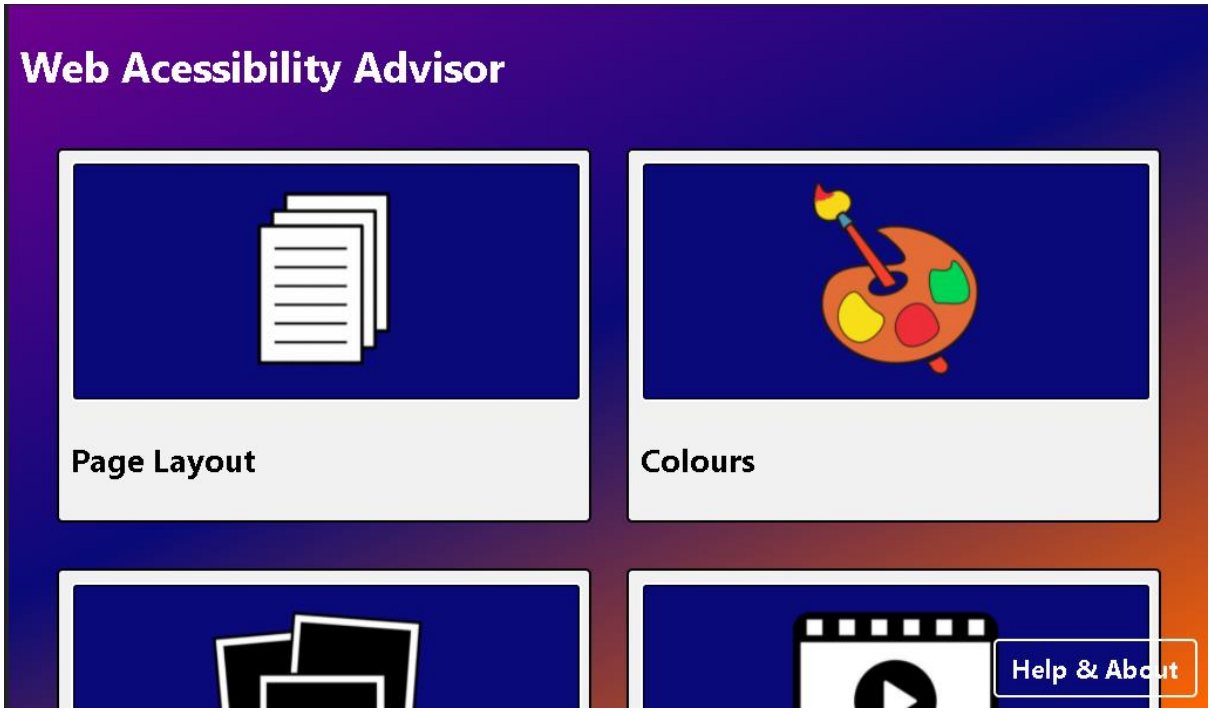


Figure 44 Tablet Screen Display

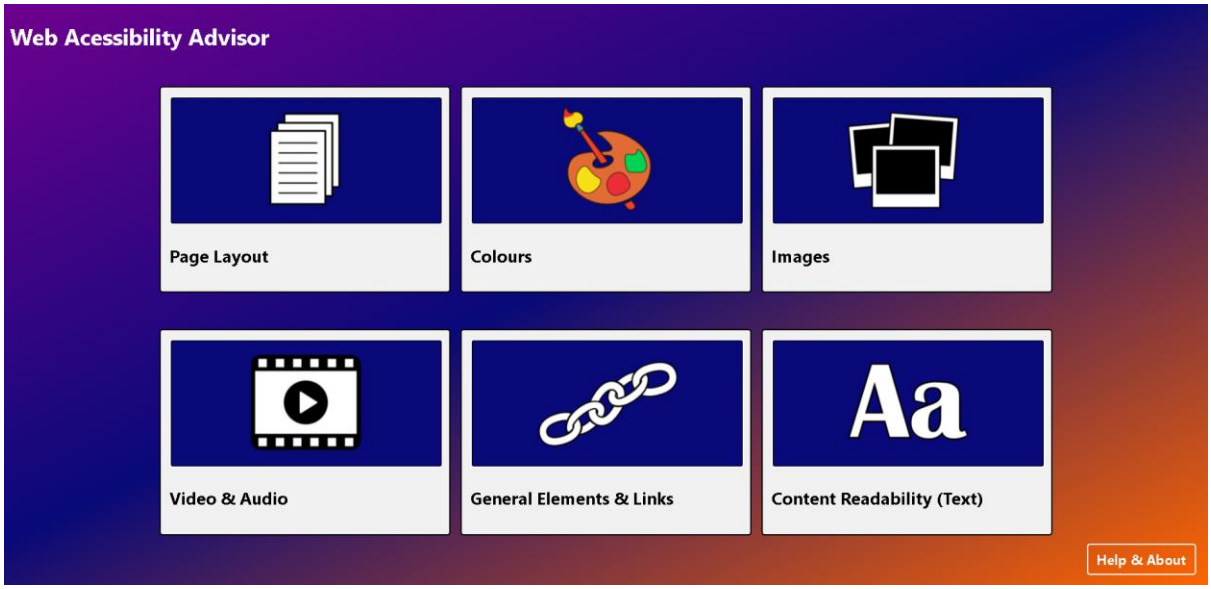


Figure 45 Desktop Screen Display

As can be seen the Desktop display shows correctly, this is mainly as the styling was primarily implemented with this view available to see. The tablet display allows the accessibility boxes to flow to fit the screen however the “Help & About” link seems to display above page elements. The phone display continues to correctly flow the accessibility sections and maintains the “Help & About” link issue, it also does not correctly centre the accessibility section boxes and has noticeably small padding. It is also noted in the phone display, when the heading text is overflowed to the next line, this does not display correctly and is against the edge of the display screen.

Using techniques such as media queries and adapting previous styling a suitable appearance across all 3 displays will be rendered.

Figure 46 Mobile Screen Display

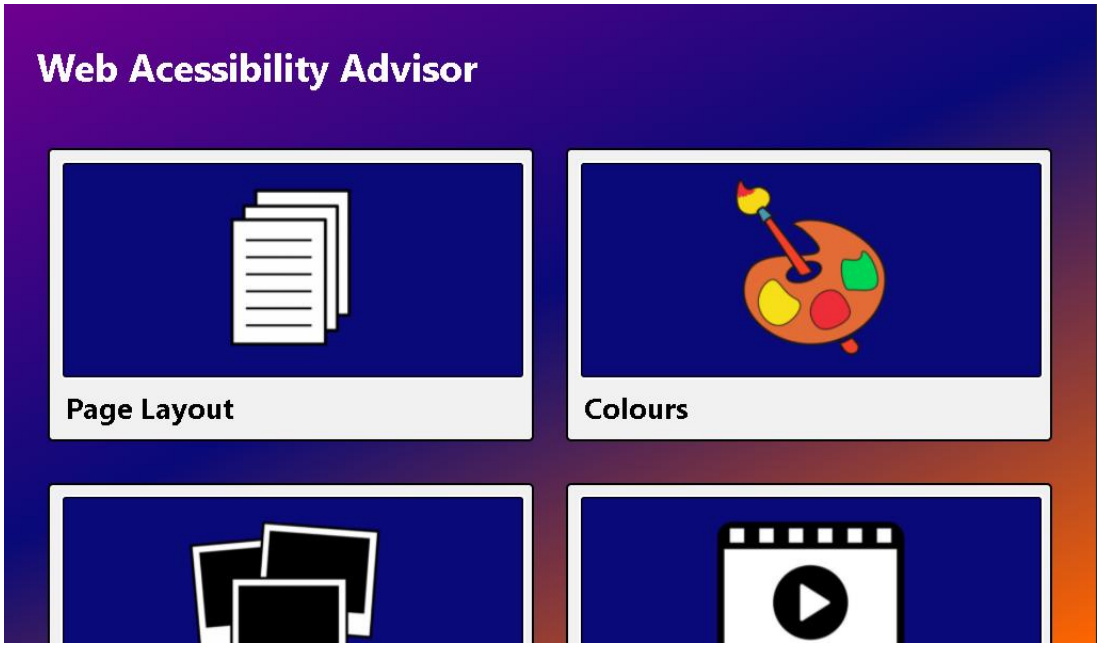


Figure 47 Tablet Screen Display

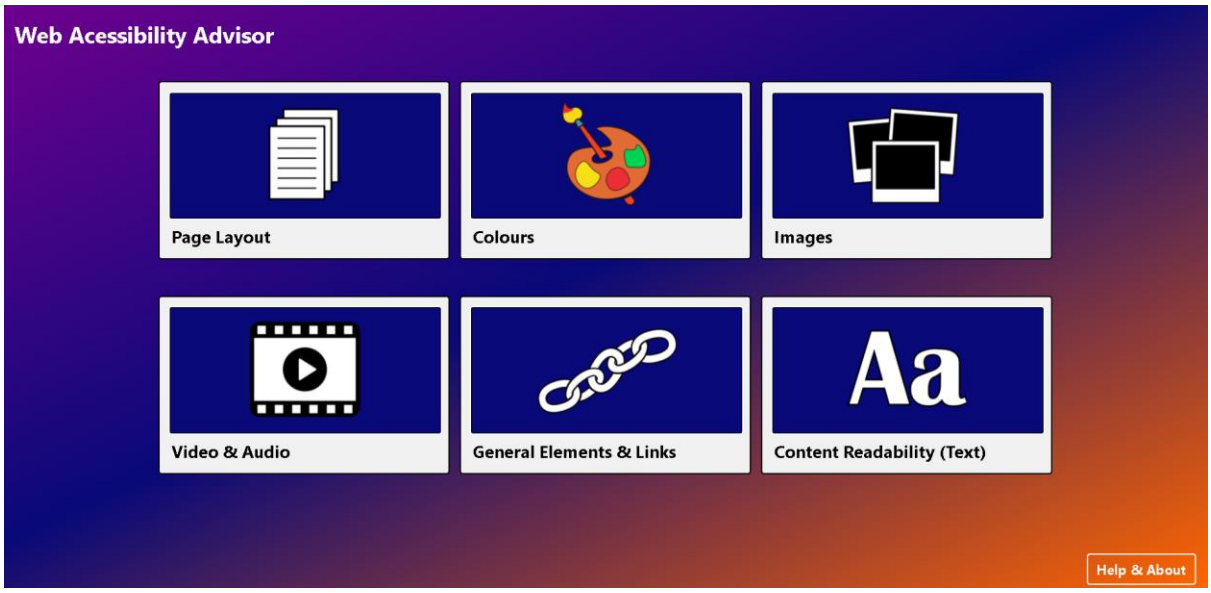


Figure 48 Desktop Screen Display

5 Testing

5.1 Automated Testing

EmberJS provides an automatic testing suite. This allows for the implementation of automated testing. These testing documents must be generated, and custom tests implemented. The fist testing file will be generated with the command “ember generate acceptance-test web-accessibility-advisor-system”.

```
installing acceptance-test
  create tests\acceptance\web-accessibility-advisor-system-test.js
```

Figure 49 Command Response

Information regarding the construction of the test harness can be found at Appendix 9.

5.1.1 Running Automated Tests

The previously developed test harness can now be run on the ember testing server. These tests will ensure all aspects of the system and its content are rendered correctly. This will allow for valid accessibility and user testing to take place. The ember test server can be executed with the command “ember t -s”, This opens a localhost page which builds and executes the pre-programmed tests.

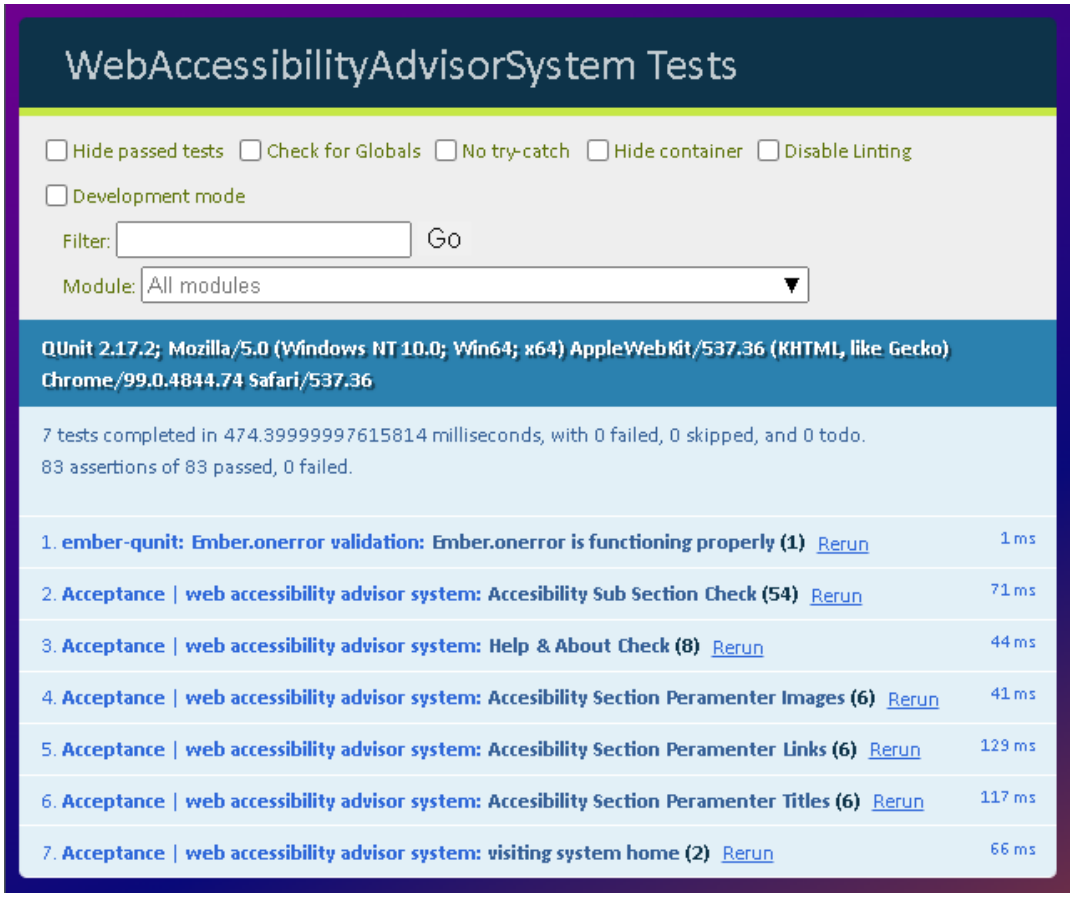


Figure 50 Screenshot of Test Server UI

As shown above all 83 Tests are ran and categorised into their individual pre-determined sections. This confirms all site content is rendered correctly onto the relevant pages.

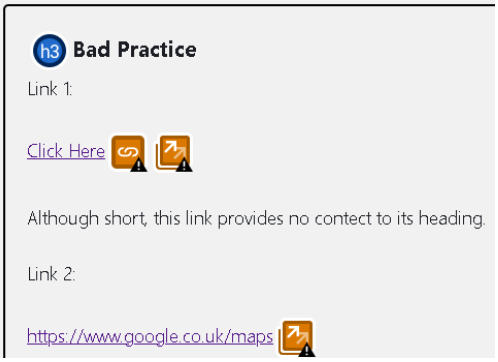
5.2 Accessibility Tool Testing

The following accessibility testing will be carried out using two accessibility checker tools, WAVE and Silktide. Both tools can test the system against the WCAG 2.1 AA Standard Criteria, this is the accessibility standard I aim to achieve for the system. Multiple checker tools have been used to ensure mutual accuracy and ensure requirements are met by all criteria definitions. For the following tests all pages on the system will be evaluated and any issues recorded along with possible solutions where applicable. Any issues found will be categorised regarding whether these must be implemented to comply with the legal standard of WCAG 2.1 Level AA.

5.2.1 WAVE

The WAVE System provides 6 categories of results (Errors, Contrast Errors, Alerts, Features, Structural Elements, and ARIA). The Recorded output for the following tests will only pertain to, Errors, Contrast Errors, and Alerts. These categories will inform of any accessibility issues or any areas which could pose possible accessibility problems that may need to be addressed. If any issues are found these will be addressed below the checker table via a reference number.

SYSTEM PAGE	WAVE OUTPUT	ISSUE/ WARNING REFERENCE
SYSTEM HOME	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
PAGE LAYOUT	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
COLOURS	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
IMAGES	Errors: 0 Contrast Errors: 0 Alerts: 2	001
VIDEO & AUDIO	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
GENERAL ELEMENTS & LINKS	Errors: 0 Contrast Errors: 0 Alerts: 3	002
CONTENT READABILITY	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
HELP & ABOUT	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable

ISSUE/ WARNING REFERENCE	ACCESSIBILITY ISSUE / WARNING	FUTURE ACTIONS/ SOLUTIONS	REQUIRED FOR WCAG 2.1 AA
001	The two alerts are due to "Suspicious Alternative Text". This is for two instances of the same image (see below) with alternative text, "An example of a decorative Image".  *Figure 1 Copy of Image causing WAVE Alerts*	It is hypothesised WAVE found this to be a possible issue as the alternative text included the phrase, "decorative image". Under normal circumstances a decorative image should be left blank however within the context of the site this is suitable alternative text and therefore not an issue.	Not Applicable
002	The alerts here are cause by the "Bad Practice" Section of one of the Accessibility Sub Sections. This is highlighted by WAVE (as shown below).  *Figure 2 Screen Clipping of WAVE Tool Markers* The Alerts given are, "Suspicious link text", and "Redundant link". The suspicious link text is caused by the "Click Here" Link text. The redundant link issue is caused by the adjacent links and the two bad link examples direct to the same place.	Due to the context of the "Suspicious link text" it is important the text reads as "Click Here", The link destination itself is not important. This is also the case with the repeated link, as it simply provides an alternative example, and the destination is not relevant.	Not Applicable

5.2.2 Silktide

The Silktide system will scan an entire site providing values relating to the completeness regarding several groupings such as accessibility, user experience, content, and marketing. The point of focus will be the accessibility section. A Dashboard is provided showing compliance with all three levels of the WCAG 2.1 Criteria. For Level AA this provides a score of 65.7%, this suggests at this stage improvement is required. The overall accessibility score however is 71%, described by the system as "Good".

The system splits all issues into two categories, “Automated Checks”, and “Assisted Checks”. Assisted checks may require input from a user to determine if an issue is present. To ensure all site issues are correctly documented Issues and Warnings of all levels will be listed in the table below and inspected afterwards.

ISSUE NAME	ISSUE/ WARNING TYPE	CHECK TYPE	WCAG NUMBER/ LEVEL		ISSUE REFERENCE NUMBER
Allow users to quickly skip to content	Issue	Automated	2.4.1	A	003
Ensure controls change appearance when they are selected	Issue	Automated	2.4.7	AA	004
Ensure links explain their purpose	Issue	Automated	2.4.4	A	005
Ensure content is not too difficult to understand	Issue	Automated	3.1.5	AAA	006
Ensure text placed over images or gradients has sufficient contrast	Issue	Assisted	1.4.3	AA	007
Check that each page has an appropriate title	Issue	Assisted	2.4.2	A	008
Ensure HTML is in a meaningful sequence	Issue	Assisted	1.3.2	A	009
Ensure users can pause or hide animated content	Warning	Assisted	2.2.2	A	010
Ensure pages with inactivity time limits do not cause data loss	Warning	Assisted	2.2.5	AAA	011
Ensure users can find definitions of unusual words	Warning	Assisted	3.1.3	AAA	012
Check images have been correctly defined as decorative	Warning	Assisted	1.1.1	A	013
Ensure users can control the visual presentation of text	Warning	Assisted	1.4.8	AAA	014
Ensure pages with interruptions can be postponed or suppressed by the user	Warning	Assisted	2.2.4	AAA	015

The following inspections will be separated into Automated and assistive checks. This is because assistive checks may have no issues at all, these are just suggestions of where possible issues could occur. Once reviewed it will be decided if they are a valid issue or not.

ISSUE/ WARNING REFERENCE	ACCESSIBILITY ISSUE / WARNING	VALID?	FUTURE ACTIONS/ SOLUTIONS	REQUIRED FOR WCAG 2.1 AA
003	This issue appears on all pages, its purpose is to ensure in situations with assistive technology users do not have to search through all page content before finding their needed content.	Yes	Providing links to skip over accessibility sub sections could be beneficial, a second approach could be only adding sub sections as html when their buttons are pressed, this would allow for section headings to be listed back-to-back without the need to go through all section content first.	Yes
004	This issue is generated by the buttons for all collapsible accessibility sub sections. This is due to the display of the button not changing when pressed.	Possibly	It could be argued the button appearance does not need to change as its selection status can be determined by the visibility of the collapsible section. However, this could be resolved also with a colour change within the button.	Yes
005	This issue is generated due to a “Click Here” Link on the site found in the “Bad Practice” part of an Accessibility sub section. This does not describe the link destination and therefore causes an issue.	No	Within the context of the page this link should make sense to all content consumers. Potentially this could be removed however would affect the quality of system content.	Not Applicable
006	On the Help & About page it is shown some content has a reading age of 17.7, by WCAG standard a page should not have a reading age of over 16.	Yes	System content should be reviewed ensuring it has a reading age of 16 or below. It is possible some content cannot be brought to this level. It is for reasons like this Level AAA is aspirational and not required. Content should not be removed due to these guidelines.	No

ISSUE/ WARNING REFERENCE	ACCESSIBILITY ISSUE / WARNING AND ASSISTED CHECK	VALID?	FUTURE ACTIONS/ SOLUTIONS	REQUIRED FOR WCAG 2.1 AA
007	These possible issues occur on all pages and are caused by the "Help & About" and "Web Accessibility Advisor" Links. A Manual check must be completed to ensure the contrast between this text and the background is suitable. To the naked eye it is clear what this text says over the background image. To ensure accuracy an online tool, Colour Contrast Accessibility Validator (a11y, 2022), was used. This checker found no issues with the site contrast.	No	Not Applicable	Not Applicable
008	This possible issue is cause if pages are not titled correctly. The system is built from 8 pages, and it is important all must have relevant titles. Silktide provides criteria for what a title should include to be accessible: • Identify the subject of the web page • Make sense when read out of context • Be short It is judged these criteria are fulfilled by all page titles.	No	Not Applicable	Not Applicable
009	This possible issue can be caused when content is not placed onto a site in a way whereby simply observing the html, the content would make sense. As shown during development all HTML follows a meaningful sequence. This allows it to be easily deciphered by assistive technology.	No	Not Applicable	Not Applicable

010	**THIS POSSIBLE ISSUE IS CAUSED BY ANY ANIMATED CONTENT THAT DOES NOT HAVE THE ABILITY TO BE HIDDEN OR PAUSED WITHIN 5 SECONDS. ONLY ONE SITE PAGE CONTAINS ANIMATED CONTENT, THIS IS A GIF IMAGE. THIS IMAGE CAN BE HIDDEN WITHIN 5 SECONDS BY CLOSING THE ACCESSIBILITY SUB SECTION.**	**NO**	**IT COULD BE ARGUED THIS WOULD TAKE AWAY FROM THE CONTENT OF THE SITE AS WHEN THE SUB SECTION IS CLOSED ITS CONTENT CANNOT BE CONSUMED. THEREFORE, A MECHANISM TO HIDE THE IMAGE ITSELF NOT JUST THE SURROUNDING SECTION COULD BE IMPLEMENTED.**	**NOT APPLICABLE**
011	This possible issue is caused when any page has stored data that could be lost due to inactivity. No site pages have an inactivity time limit and therefore will not cause this issue.	No	Not Applicable	Not Applicable
012	This possible issue is caused by any unusual words not being specifically defined meaning a user may not understand content correctly. It is not believed this site contains any “unusual” words and therefore poses no issues.	No	It could be argued some words could be considered “unusual” by reasonable standards. These should be identified in user testing. If found these would require defining.	Not Applicable
013	This issue could occur if decorative images are defined as such. Alternative text must be left blank for these images only. If left blank assistive technologies will “skip over” this content. All images on the site have been reviewed and it is considered all contain reasonable alternative text.	No	Not Applicable	Not Applicable
014	Users must be able to control the presentation of text on the system. This includes aspects such as colour, line spacing and font size. On the system no text can be controlled by the user in this way.	Yes	Measures must be taken to allow for user-based control of text presentation within the system. This must be done without causing any other accessibility issues.	No

015	**THIS ISSUE IS CAUSED WHEN PAGES WITH INTERRUPTIONS CANNOT BE SUPPRESSED BY A USER. NO INTERRUPTIONS ARE GENERATED BY THE SYSTEM AND THEREFORE THIS IS NOT AN ISSUE.**	**NO**	**NOT APPLICABLE**	**NOT APPLICABLE**

After the review of the system through Silktide several issues are found which need to be addressed to allow for WCAG 2.1 Level AA Compliance:

- Allow users to quickly skip to content
- Ensure controls change appearance when they are selected

However, through assistive checks it is identified most did not cause issues. When this is selected on the Silktide system the Accessibility score for WCAG 2.1 AA Increases to 75.7%. This also moves the overall Accessibility Score to 80%, describes as, “Great”.

5.3 Survey & Results (User Testing)

To ensure the deliverable is fit for purpose and identify any areas of issue or improvement user testing is a must. Survey questions (found in appendices) were given to computer science professionals with varied experience in web accessibility to identify the usefulness and practical impacts of the system.

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?	All responses suggested a system of this nature is needed within the landscape. This would allow for guidelines to be understood and clarified easily to allow for more universal access to content across the web. One response suggested however the system is potentially the incorrect solution to this problem and by removing less technically skilled individuals from the web process could be the solution.

Do you feel the general system provides a clear and usable interface?	Responses ranged between 7 and 9 with an average of 7.8. This suggests the interface does present as clear and usable however some improvements may be required.

Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?	Responses ranged between 6 and 10 with an average of 8. This suggests the summarisations are to a high quality but could require improvement. The range of results was large suggesting due to experience and potentially other factors the understanding can vary and may require more in-depth testing and improvement.

Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?	Responses appear positive with 60% of responses suggesting the system could make a difference in its current state noting that it is simplistic, easy to understand and meets a need that isn't currently being met. Other responses suggest the system could make an impact with some improvement and further development noting its possible use as a cheat sheet however there is a requirement for greater depth and complexity.

Do you feel the website itself is to a suitable accessibility?	The responses ranged from 6 to 10 with an average of 7.8. This suggests the website is itself mostly accessible however some improvements may be required to ensure this standard is met. The large range of results however suggest formal accessibility testing did not take place. This could be completed in future developments.

Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?	• A more explicit home page link • Navigation menu on inner pages directing to accessibility sections and sub sections to speed up transactions between content. • Search function to quickly access and find information (It is noted this could work better with more content on the site) • Improve site colour schemes • Text could be made clearer (possibly with thickness) for readability.

Could you suggest any improvements or changes to the site content that would make it better fit its purpose?	• Focus style to accordion buttons
	• Greater range of common accessibility issues such as:
	  o Bullet lists
	  o Emphasis
	  o Tables
	  o Forms
	  o Keyboard navigation
	  o Titles for iframes
	  o Content skip links
	• Change alternative text on contrast example images (this is potentially not accessible)
	• Offer more advice regarding implementation in content and design (possibly with external tools)
	• Cover a more exhaustive breadth of content
	• Breakdown and verify what is needed for AA and AAA as users may have to meet specific standards
	• Add more content regarding accessibility within the full web process and view information via job role or position
	• Examples of video and audio content to clarify the advice provided

What do you believe are the best/worst features of the system?	Best: • Content is well sectioned • Clear text and font • Links to WCAG can be very helpful • It is an overall simple to understand guide • Easy to navigate with the accordion style layout which is especially good for new users • The systems well set accessible example Worst: • No navigable menu • System home images appear dated (site design requires improvement especially regarding colour schemes) • No Search Ability for specific issues and content item types • Some inaccessible features (these potentially include text size) • Some unclear navigation (there is no explicit link to return to the home page) • Only covers a small demographic of accessibility needs

Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?	Responses varies between not recommending and recommending the use in a professional setting however all suggested improvements were required to allow the system to fill its full potential.

6 Critical Evaluation

6.1 Reflections

6.1.1 Research, Design, and Development Reflection

Research within this project allowed for a fair understanding of accessibility, the common issues within a web environment, and more specific issues relating to web content providers themselves. At this stage it is identified more in-depth research could've been conducted regarding web content provider environments and typical situations. The vague understanding the completed research granted resulted in a very general approach to the accessibility advice generated. The sections provided may not be as simple to navigate as expected.

Figure 51 Accessibility Sections from Functional Flowchart

This does not provide specific advice regarding the situations web content providers are in, or the specific advice for the content management system they could be using.

The summarisations of accessibility components on the deliverable were generated mainly with through inspection of the WCAG criteria allowing for easy links. However, it is clear more should've been done to ensure common webpage components are also covered. The deliverable provides no specific advice regarding elements such as tables or lists despite their common use. As a more general point the research conducted to generate the advice, although its need to satisfy guidelines should also have taken more inspiration from the user experiences of common sites and components. A typical user of the deliverable would be more familiar with these rather than guidelines potentially allowing for easier use and more familiar content.

During development the Framework "EmberJS" was used resulting in the successful production of the deliverable, although many of the features available were valuable it became apparent during development this may have been unnecessary. Many components of EmberJS were not used, it is suggested no framework, or a more suitable framework could have been used. Alternatively, more in-depth research into EmberJS could have highlighted how it could have been more effectively implemented to include other possible features to the system, some of which could help to increase system accessibility.

6.1.2 Testing Reflection

Several methods of testing were implemented during development. These were chosen as it is considered extremely important for web content providers to access accessibility information as effectively as possible and ensuring the system was fit for purpose was imperative. Testing yielded extremely in-depth review of the system in many ways. It is however felt the inclusion of automated testing was somewhat unnecessary. As the system contains limited pages and content due to its usable design techniques, there may have been a more effective way to test site content. This content could have been tested via preliminary user testing or developer lead device testing.

Two Accessibility tools were used to test the sites compliance with WCAG guidelines. This produced an effective list of errors and warnings using both tools (Shown in Appendix 10). When using the Silktide tool however, many issues were reliant of user input and directed user checks. To allow for a more independent and unbiased testing program, the recruitment of web accessibility professionals could have benefited the project. Accessibility professionals could have performed more rigorous and context specific tests and provided more actionable feedback.

User testing for the system was very successful. This provided many possible improvements, merits, and drawbacks of the system. This listed components to potentially be enhanced or implemented or removed entirely. It is however apparent the questions presented to users did not allow for in depth usability testing as there was a greater focus on general accessibility and the accessibility advice provided. More direct usability testing should be completed, this would highlight any general improvements to usability which is required and prove to users' websites can be both usable and accessible simultaneously.

6.2 Future Work

6.2.1 Accessibility Tool Testing Considerations

During testing using The WAVE and Silktide systems accessibility issues were made apparent, some of which it is imperative they're actioned immediately to conform to legal standards for public bodies, as my site should to show as an example.

- Users must be able to skip to specific sections of pages. This should be done by adding an accordion style sliding menu to the side of pages (or fill the page on mobile devices). When a link to a particular subsection is selected it must take the user to that section and expand (as if the collapsible button had been selected).
- Buttons used to expand accessibility sub sections must be shown to change colour when the button is "active". This can be done through adding to the JavaScript function which allows for the dropdown feature. This addition would change the colour when the sub section content is visible on the page.
- All content on the site must also be reviewed to ensure it is of suitable reading age. This should be done in an iterative fashion with each iteration of content being reviewed to ensure it meets its purpose but is also understandable and meets accessibility requirements. This should allow for continuous improvement of site content.

6.2.2 User Feedback Considerations

As mentioned in section "5.3 Survey & Results (User Testing)" several suggestions for improvement and enhancement to the site were made. These would allow for improved user experience and accessibility. Some of these suggestions were fore frequently noted and should be considered the next steps for the system, these include:

- Improved and expanded site accessibility information
- Improved system artwork and colour design
- Improved system navigation and search functionality.

6.2.3 General Ideas for Improvement

Currently the system provides general advice to improve accessibility. In future it would be a beneficial improvement to add a chat feature which could connect to either a programmed responder or a real person to gain advice on either where to find relevant information or for a specialist to provide advice directly. This would allow for more context specific advice. This would also allow for the system to ensure users can understand the accessibility techniques through the personalised approach. This would be highly beneficial as accessibility was found to be not well understood generally.

In future this system could be paired with an external accessibility checker or have its own implemented. This would allow a user to check their content and identify any accessibility issues. This would further help a user to ensure accessibility within their content and understand the issues,

directing a user to the relevant advice within the current system to identify what must be done to improve accessibility.

7 Conclusion

7.1 Personal & Professional Development

During this project the researcher has advanced in both technical skills and personal understanding. Skills regarding the consumption and filtering of previous studies and projects has been greatly developed as the researched did not have a realistic scope for the sheer breadth of work available on both general and web-based accessibility.

As the project began, he was naive to the importance of accessibility and its widespread ignorance on modern websites. He has gained a great insight into the difficulties there must be for users who require assistive technologies or have general web accessibility issues when accessing web content. Throughout this project many accessibility skills for web development have been learned and the importance of varied accessibility testing has been understood. The researcher will continue to improve and develop these skills as through research it is understood much more can be done to accommodate all users to a system and as a developer it should be a primary goal to do so.

The researcher also came to acknowledge their own personal shortcomings. Although the EmberJS web framework was not the sole focus of this project he has learned to fully evaluate the correct tools to use when planning a project whether this be a primary or secondary focus. The chosen framework was selected without proper evaluation and may or may not have been the most suitable fit for the project.

7.2 Ethical Impacts & Considerations

As this system provides advice regarding good practice accessibility it is imperative this is correct. If the provided advice is implemented by a third party this cannot subsequently cause accessibility issues prompted by the advice. This could restrict use of a site to a user, in some situations causing distress (most likely due to flashing images). Incorrect advice could also lead to third parties receiving legal penalties if accessibility standards are enforced by law. Due to these reasons extensive research and professional user testing took place to ensure the accuracy of advice provided on the site. Other forms of testing were also implemented and assessed to ensure the system itself sets a high quality and accurate example of accessible web design.

8 References

a11y. (2022, 03 21). *Color Contrast Accessibility Validator*. Retrieved from Color Contrast Accessibility Validator: https://color.a11y.com/

Abascal J., A. M. (2019). Tools for Web Accessibility Evaluation. In H. S. Yesilada Y., *Web Accessibility. Human–Computer Interaction Series* (pp. 479-503). Donostia: Springer.

Abou-Zahra, S. (2008). Web Accessibility Evaluation. In Y. Y. Harper S., *Web Accessibility. Human-Computer Interaction Series* (pp. 79-106). London: Springer.

Abou-Zahra, S. (2016, September 15). *Web Accessibility Perspectives: Large Links, Buttons and Controls*. Retrieved from Web Accesibility Initiative: https://w3c.github.io/wai-showcase-examples/controls.html

ACHECKS. (2021, 12 16). *Measure Web Accessibillity*. Retrieved from ACHECKS: https://achecks.ca/

Afra Pascual, M. R. (2015). Impact of web accessibility barriers on users with hearing impairment. *SciELO*, 233-240.

Antonio Giovanni Schiavone, F. P. (2015). *An extensible environment for guideline-based accessibility evaluation of dynamic Web applications.* Universal Access in the Information Society.

Arch, A. (2009). Web accessibility for older users: successes and opportunities. *W4A '09: Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibililty (W4A)* (pp. 1-6). New York: Association for Computing Machinery.

Baker, S. C. (2014). Making It Work for Everyone: HTML5 and CSS Level 3 for Responsive, Accessible Design on Your Library's Web Site. *Journal of Library & Information Services in Distance Learning*, 118-136.

Balázs Csontos, I. H. (2020). *Improving accessibility of CMS-based websites using automated methods.* Springer.

BIS. (2009). *Digital Britan Report.* Depoartment for Business Innovation and Skills.

Brajnik, G. (2008). A comparative test of web accessibility evaluation methods. *Proceedings of the 10th international ACM SIGACCESS conference on Computers and accessibility* (pp. 113-120). New York: Association for Computing Machinery.

Brajnik, G. (2011, Febuary 18). *Barrier Walkthrough.* Retrieved from University of Udine Department of Mathmatics and Computer Science: https://users.dimi.uniud.it/~giorgio.brajnik/projects/bw/bw.html

Bureau of Internet Accesibility. (2018, April 26). *Why Language is Important for web accesibility*. Retrieved from Bureau of Internet Accesibility: https://www.boia.org/blog/why-language-is-important-for-web-accessibility

Bureau of Internet Accesibility. (2019, March 28). *How widely used is WCAG?* Retrieved from Bureau of Internet Accesibility: https://www.boia.org/blog/how-widely-used-is-wcag

Caio C. S. Sousa, L. M.-N. (2020). Web Accessibility Testing for Deaf: Requirements and Approaches for Automation. *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 2734-2739). Toronto: IEEE.

Carolyn Bruce, C.-T. T. (2012). Accent on communication: the impact of regional and foreign accent on comprehension in adults with aphasia. *Disability and Rehabilitation Volume 34 - Issue 12*, 1024-1029.

Central Data Office. (2021, July 9). *Understanding accessibility requirements for public sector bodies*. Retrieved from GOV.UK: https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps#:~:text=The%20accessibility%20regulations%20came%20into,accessibility%20statement%20on%20your%20website.

Coward, E. (2021, November 04). *Multi-lingual Website Accessibility - 7 Tips and Techniques*. Retrieved from Nomensa: https://www.nomensa.com/blog/7-tips-for-multi-lingual-website-accessibility

Doush, I. A. (2014). Web Accesibility for Persons with Motor Limitations. In G. Kouroupetroglou, *Disability nformatics and Web Accesibility for Motor Limitations* (pp. 234-262). Athens: IGI Global.

Dunham, D. (2016, September 11). *Designing Websites for Motor-Skill Disabilities*. Retrieved from WeCO: https://theweco.com/designing-websites-for-motor-skill-disabilities/

EmberJS. (2022, 02 03). *Quick Start*. Retrieved from EmberJS: https://guides.emberjs.com/release/getting-started/quick-start/

G Regehr, G. R. (1996). Issues in cognitive psychology. *Journal of the Association of American Medical Colleges*, 988-1001.

Gardner, B. S. (2011, October). Responsive Web Design: Enriching the User Experience. *Sigma: Inside the Digital Ecosystem*, pp. 13-19.

Giorgio Brajnik, Y. Y. (2010). Testability and validity of WCAG 2.0: the expertise effect. *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility* (pp. 43-50). New York: Association for Computing Machinery.

Greg Gay, C. Q. (2010). AChecker: open, interactive, customizable, web accessibility checking. *Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility* (pp. 1-2). New York: Association for Computing Machinery.

Helsper, E. J. (2021). A Corresponding Fields Model for the Links Between Social and Digital Exclusion. *Communication Theory Volume 22 Issue 4*, 403-426.

Henry, S. L. (2006). Understanding Web Accessibility. In M. R. Jim Thatcher, *Web Accessibility, Web Standards and Regulatory Compliance* (pp. 1-51). Web Standards and Regulatory Compliance.

Her Majesty's Government of the United Kingdom of Great Britain and Northern Ireland. (2018, August 29). *The Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018.* Retrieved from legislation.gov.uk: https://www.legislation.gov.uk/uksi/2018/952/introduction/made

Interaction Design Foundation. (2021, 10 26). *Accessibility*. Retrieved from Interaction Design Foundation: https://www.interaction-design.org/literature/topics/accessibility

Jonathan Lazar, A. D.-S.-D. (2004, March). Improving web accessibility: a study of webmaster perceptions. *Computers in Human Behavior Volume 20 Issue 2*, 269-288.

Juan Miguel López, A. P. (2011). Influence of Web Content Management Systems in Web Content Accessibility. *Human-Computer Interaction – INTERACT 2011* (pp. 548-551). Springer.

Juan Miguel López, A. P. (2011). Methodology for identifying and solving accessibility related issues in Web Content Management System environments. *Proceedings of the International Cross-Disciplinary Conference on Web Accessibility.* ACM PUB27.

Kerstin Matausch, B. F. (2012). Accessible Content Generation an Integral Part of Accessible Web Design. *Procedia Computer Science* (pp. 274-282). Linz: Elsevier B.V.

Loretta Guarino Reid, A. S.-W. (2008). WCAG 2.0: a web accessibility standard for the evolving web. *W4A '08: Proceedings of the 2008 international cross-disciplinary conference on Web accessibility (W4A)* (pp. 109-115). Association for Computing Machinery.

Markel Vigo, J. B. (2013). enchmarking Web Accessibility Evaluation Tools:Measuring the Harm of Sole Reliance on Automated Tests. *Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility* (pp. 1-10). New York: Association for Computing Machinery.

Milton Campoverde-Molina, S. L.-M. (2021). Process Model for Continuous Testing of Web Accessibility. *IEEE Access Volume 9*, 139576 - 139593.

Mohammad Bajammal, A. M. (2021). Semantic Web Accessibility Testing via Hierarchical Visual Analysis. *2021 IEEE/ACM 43rd International Conference on Software Engineering (ICSE)* (pp. 1610-1621). Madrid: IEEE.

Moreno, M.-L. S.-G. (2013). Toward an Integration of Web Accessibility into Testing Processes. *Procedia Computer Science* (pp. Pages 281-291). Leganés: Elsevier B.V.

Mozilla. (2021, October 26). *Web accessibility for seizures and physical reactions*. Retrieved from MDN Web Docs: https://developer.mozilla.org/en-US/docs/Web/Accessibility/Seizure_disorders

Muave++. (2021, 12 26). *About*. Retrieved from Muave++: https://mauve.isti.cnr.it/about.jsp

My Accessible Website. (2022, March 28). *WCAG Levels, What's the difference?* Retrieved from My Accessible Website: https://myaccessible.website/blog/wcaglevels/wcag-levels-a-aa-aaa-difference

NHS . (2020). *Epilepsy - Seizures*. Retrieved from National Health Service: https://www.nhs.uk/conditions/epilepsy/symptoms/#triggers

NHS Digital. (2021, September 29). *What we mean by digital inclusion*. Retrieved from NHS Digital: https://digital.nhs.uk/about-nhs-digital/our-work/digital-inclusion/what-digital-inclusion-is

Nunn, J. &. (2001). Browsing the Web from a Speech-Based Interface. *INTERACT*, 302-309.

Paciello, M. G. (2000). *Web Accesibility for People with Disabilities.* CRC Press.

Paternò, B. L. (2004, Febuary 24). Increasing usability when interacting through screen readers. *Universal Access in the Information Society*, pp. 57-70.

Peter Brophy, J. C. (2007). Web Accessibility. *Library Trends Volume 55, Number 4*, 950-972.

Popescu, A. (2018, August 17). *Web accessability for hearing impairments*. Retrieved from UX Collective: https://uxdesign.cc/web-accessibility-for-hearing-impairment-3f49fc7b5a34

Richard Vidgen, S. G. (2001). Web Content Management. *14th Bled Electronic Commerce Conference*, (pp. 1-16). Bled.

Robertson, C. (2019, November). Roboto Slab. Apache License.

Sandra Sanchez-Gordon, S. L.-M. (2017). A Method for Accessibility Testing of Web Applications in. *Proceedings of the 7th World Congress for Software Quality (WCSQ).*

Sébastien Rainville-Pitt, J.-M. D. (2007). Using a CMS to create fully accessible websites. *W4A '07: Proceedings of the 2007 international cross-disciplinary conference on Web accessibility (W4A)* (pp. 130–131). Banff: Association for Computing Machinery.

Shawn Lawton Henry, A. A. (2012, September 7). *Social Factors in Developing a Web Accessibility Business Case for Your Organization*. Retrieved from Web Accessibility Initiative: https://www.w3.org/WAI/business-case/archive/soc

Silktide. (2021, 12 16). *Accessibility made easy*. Retrieved from Silktide: https://silktide.com/solutions/accessibility/

Simon Harper, A. Q. (2011). *Web accessibility guidelines: A lesson from the evolving Web.* Manchester: Sriinger.

Springer International Publishing. (2017). Non-visual Web Browsing: Beyond Web Accessibility. In M. S. Antona, *Universal Access in Human–Computer Interaction. Designing Novel Interactions* (pp. 322-334). Cham Springer.

UK Government. (2021, July 9). *Understanding accessibility requirements for public sector bodies*. Retrieved from GOV.UK: https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps#how-the-accessibility-regulations-will-be-monitored-and-enforced

W Arasid, A. G. (2018). An Analysis of Website Accessibility in Higher Education in Indonesia Based on WCAG 2.0 Guidelines. *IOP Conf. Series: Materials Science and Engineering 306.* IOP Publisher.

W3C. (2010, August 12). *Benifits of WCAG 2.0.* Retrieved from Web Accesibility Iniative: https://www.w3.org/WAI/presentations/WCAG20_benefits/WCAG20_benefits.html

W3C. (2016). *Understanding Conformance*. Retrieved from W3C: https://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html#uc-levels-head

W3C. (2018, June 05). *Web Content Accessibility Guidelines (WCAG) 2.1.* Retrieved from World Wide Web Consortium: https://www.w3.org/TR/WCAG21/

W3C. (2020, October 30). *Accessibility Conformance Testing (ACT) Overview*. Retrieved from Web Accessibillity Initiative: https://www.w3.org/WAI/standards-guidelines/act/

W3C. (2021). *Accesibility and Content Management Systems.* Retrieved from W3C: https://www.w3.org/People/Matt/Papers/XML2003.html

W3C. (2021, March 11). *Developing an Accessibility Statement*. Retrieved from Web Accesibility Initiative: https://www.w3.org/WAI/planning/statements/

Wan Abdul Rahim Wan Mohd Isa, N. M. (2016). Accessibility evaluation using Web Content Accessibility Guidelines (WCAG) 2.0. *2016 4th International Conference on User Science and Engineering (i-USEr)* (pp. 1-4). Institute of Electrical and Electronic Engineers.

WAVE. (2021, 12 16). *WAVE Web Accessibility Evaluation Tool*. Retrieved from WAVE: https://wave.webaim.org/

Web Accesibility Initiative. (2019, October 4). *How to Meet WCAG (Quick Reference)*. Retrieved from W3C: https://www.w3.org/WAI/WCAG21/quickref/

Whitney, M. (2020). Teaching Accessible Design: Integrating Accessibility Principles and Practices into an Introductory Web Design Course. *Information Systems Education Journal*, 4-13.

9 Appendices

9.1 Appendix 1 – Project Specification

Student:	**Matthew Harry Shaw**
Date:	**21/10/2021**
Supervisor:	**Michael Marriott**
Degree Course:	**BSc Computer Science**
Title of Project:	**The Importance of Web Accessibility Standards and How they can be Implemented by Web Content Providers**

Elaboration

Web Accessibility is very important in the modern world. The internet has become a widely used resource that more and more content is added to every day on the sites of both public and private bodies. This progression towards web-based content is due to reasons such as convenience and cost. It is therefore easy in these situations for accessibility to be overlooked. I believe one of the reasons for this widespread lack of web accessibility is a result of a lack of understanding of the importance of accessibility, and how it can be correctly implemented by the web content providers. Materials available to provide these accessibility guidelines frequently contain complex wording and can cause misunderstanding or confusion in individuals with little to no technical knowledge. Due to this lack of understanding, accessibility issues arise frequently and can lead to sites being unintentionally in breach of the law. This will mainly occur in situations of separation between webpage developer and webpage content provider where although the technically minded web developer is aware of accessibility implementation techniques, this is not passed onto the web content providers in an understandable way.
Accessibility isn't just a term that refers to the assistance of those with disabilities. It refers to all people and ensures all users can use all webpages and receive the same content and information on a page. For this reason, its therefore so important that accessibility is implemented to cater for as larger group of people as possible. The widespread lack of understanding of accessibility and its implementation needs to be eradicated for this to occur, and the only way to do that is by making information regarding accessibility in itself as accessible and understandable as possible.

Project Aims

- Research the different types of accessibility issues e.g.(visual, auditory…)
- Research factors that can affect accessibility besides disability (e.g., age, hardware)
- Research WCAG and its legal implications
- Research common accessibility issues that occur on pages.
- Research common issues that occur specific to web developer and web content provider separation situations
- Develop not technical summarisations of accessibility guidelines.
- Develop a website to provide information to simplify the implication of good accessibility practice
- Ensure an easy-to-use interface that is as accessible as possible
- Improve the site based on feedback from web developer professionals
- Evaluate if pre-existing guidelines are accessible to those with limited technical knowledge.
- Evaluate if any legal guidelines can be too erroneous to be implemented well.

Project deliverable(s)

I am going to produce a website containing all the information that could be needed to provide accessible web content to a website. This will be targeted towards web content providers who do not have the knowledge or understanding of good practice web design to make content accessible. This website will not only provide simplifications for common accessibility issues but also examples of good and bad practice, along with the importance of those points and the legal guideline that backs this up.

The website will also in itself be made to be as accessible as possible, by this I plan to make it work with all commonly used web browsers and have very little hardware dependencies. It should be able to exhibit good accessibility across the site as an example for general good implementation of accessible content.
To reduce hardware dependencies this site will be made primarily with HTML and CSS built onto an EmberJS Framework. I have chosen EmberJS as it has a wide range of built-in best practices as a strong foundation for the site, this will allow for the site to be both accessible and useable.
I'm going to take an agile approach to the development as it will allow me to continually ensure the deliverable can be revaluated and made as accessible as possible with every addition. I will be using the Kanban approach as it will allow for continuous flow and any changes upon revaluation to be added when needed. It will also allow me to visualise my work leading to a quick and effective development.

Action plan

Task	Deadline Date
Find a supervisor	09/10/2021
Project Specification, Ethics Form and Supporting Materials	23/10/2021
Research Different types of Accessibility Issues	30/10/2021
Research Factors that affect Accessibility	
Research WCAG guidelines and the issues they are in place to prevent.	06/11/2021
Research most common issues linked to web content providers	13/11/2021
Generate simplifications of common accessibility issues and pair with their corresponding WCAG legal guidelines	20/11/2021
Generate good and bad practice examples for each issue	27/11/2021
Research how I can make my deliverable Accessible	04/12/2021
Information Review	04/12/2021
Design Deliverable Concurrent Styles	18/12/2021
Design Deliverable Navigation Layout	
Design Deliverable Issue Pages	
Convert Designs into EmberJS Object Module Designs	
Develop Empty Site based on Designs	15/01/2022
Add Pre-made Content	29/01/2022
Collect Feedback Data from Professionals	05/02/2022
Implement relevant Changes based on feedback	12/02/2022
Agree Contents Page with Supervisor	19/02/2022
Draft Critical Evaluation	19/03/2022
Report Turnitin Submission	15/04/2022
Report Submission	15/04/2022
Video Demonstration Submission	15/04/2022
Deliverable Submission	15/04/2022
Project Demo	29/04/2022

BCS Code of Conduct

I confirm that I have successfully completed the BCS code of conduct on-line test with a mark of 70% or above. This is a condition of completing the Project (Technical Computing) module.
Signature: 

Publication of Work

I confirm that I understand the "Guidance on Publication Procedures" as described on the Bb site for the module.

Signature: 

GDPR

I confirm that I will use the "Participant Information Sheet" as a basis for any survey, questionnaire, or participant testing materials. The participant information sheet form is available on the Bb site for the module and as an appendix in the handbook.

Signature: 

9.2 Appendix 2 – Ethics Form

UREC2 RESEARCH ETHICS PROFORMA FOR STUDENTS UNDERTAKING LOW RISK PROJECTS WITH HUMAN PARTICIPANTS

This form is designed to help students and their supervisors to complete an ethical scrutiny of proposed research. The University Research Ethics Policy should be consulted before completing the form. The initial questions are there to check that completion of the UREC 2 is appropriate for this study. The final responsibility for ensuring that ethical research practices are followed rests with the supervisor for student research.

Note that students and staff are responsible for making suitable arrangements to ensure compliance with the General Data Protection Act (GDPR). This involves informing participants about the legal basis for the research, including a link to the University research data privacy statement and providing details of who to complain to if participants have issues about how their data was handled or how they were treated (full details in module handbooks). In addition the act requires data to be kept securely and the identity of participants to be anonymized. They are also responsible for following SHU guidelines about data encryption and research data management. Information on the Ethics Website.

The form also enables the University and College to keep a record confirming that research conducted has been subjected to ethical scrutiny.

The form may be completed by the student and the supervisor and/or module leader (as applicable). In all cases, it should be counter-signed by the supervisor and/or module leader, and kept as a record showing that ethical scrutiny has occurred. Some courses may require additional scrutiny. Students should retain a copy for inclusion in their research projects, and a copy should be uploaded to the relevant module Blackboard site.

Please note that it may be necessary to conduct a health and safety risk assessment for the proposed research. Further information can be obtained from the College Health and Safety Service.

Checklist Questions to ensure that this is the correct form

1. Health Related Research with the NHS or Her Majesty's Prison and Probation Service (HMPPS)or with participants unable to provide informed consent

Question	Yes/No
1. Does the research involve? • Patients recruited because of their past or present use of the NHS	No
• Relatives/careers of patients recruited because of their past or present use of the NHS	No
• Access to data, organs or other bodily material of past or present NHS patients	No

• Foetal material and IVF involving NHS patients	No
• The recently dead in NHS premises	No
• Prisoners or others within the criminal justice system recruited for health-related research*	No
• Police, court officials, prisoners or others within the criminal justice system*	No
• Participants who are unable to provide informed consent due to their incapacity even if the project is not health related	No
2. Is this a research project as opposed to service evaluation or audit? *For NHS definitions of research etc. please see the following website* http://www.hra.nhs.uk/documents/2013/09/defining-research.pdf	No

If you have answered **YES** to questions **1 & 2** then you **MUST** seek the appropriate external approvals from the NHS, Her Majesty's Prison and Probation Service (HMPPS) under their independent Research Governance schemes. Further information is provided below.
https://www.myresearchproject.org.uk

NB College Teaching Programme Research Ethics Committees (CTPRECS) provide Independent Scientific Review for NHS or HMPPS research and initial scrutiny for ethics applications as required for university sponsorship of the research. Applicants can use the IRAS proforma and submit this initially to their CTPREC.

1. Checks for Research with Human Participants

Question	**Yes/No**
1. Will any of the participants be vulnerable? *Note: Vulnerable' people include children and young people, people with learning disabilities, people who may be limited by age or sickness, people researched because of a condition they have, etc. See full definition on ethics website*	No
2. Are drugs, placebos or other substances (e.g., food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?	No
3. Will tissue samples (including blood) be obtained from participants?	No
4. Is pain or more than mild discomfort likely to result from the study?	No
5. Will the study involve prolonged or repetitive testing?	No
6. Is there any reasonable and foreseeable risk of physical or emotional harm to any of the participants? *Note: Harm may be caused by distressing or intrusive interview questions, uncomfortable procedures involving the participant, invasion of privacy, topics relating to highly personal information, topics relating to illegal activity, or topics that are anxiety provoking, etc.*	No
7. Will anyone be taking part without giving their informed consent?	No
8. Is it covert research? *Note: 'Covert research' refers to research that is conducted without the knowledge of participants.*	No
9. Will the research output allow identification of any individual who has not given their express consent to be identified?	No

If you have answered **YES** to any of these questions you are **REQUIRED** to complete and submit a UREC 3 or UREC4). Your supervisor will advise. If you have answered **NO** to all these questions, then proceed with this form (UREC 2).

General Details

Name of student	Matthew Harry Shaw
SHU email address	b90096500@my.shu.ac.uk
Course or qualification (student)	BSc Computer Science
Name of supervisor	Michael Marriott
email address	mm7888@my.shu.ac.uk
Title of proposed research	The Importance of Web Accessibility Standards and How they can be Implemented by Web Content Providers
Proposed start date	23/10/2021
Proposed end date	15/04/2022
Background to the study and scientific rationale for undertaking it.	Web Accessibility is very important in the modern world. The internet has become a widely used resource that more and more content is added to every day on the sites of both public and private bodies. This progression towards web-based content is due to reasons such as convenience and cost. It is therefore easy in these situations for accessibility to be overlooked. I believe one of the reasons for this widespread lack of web accessibility is a result of a lack of understanding of the importance of accessibility, and how it can be correctly implemented by the web content providers. Materials available to provide these accessibility guidelines frequently contain complex wording and can cause misunderstanding or confusion in individuals with little to no technical knowledge. Due to this lack of understanding, accessibility issues arise frequently and can lead to sites being unintentionally in breach of the law. This will mainly occur in situations of separation between webpage developer and webpage content provider where although the technically minded web developer is aware of accessibility implementation techniques, this is not passed onto the web content providers in an understandable way. Accessibility isn't just a term that refers to the assistance of those with disabilities. It refers to all people and ensures all users can use all webpages and receive the same content and information on a page. For this reason, its therefore so important that accessibility is implemented to cater for as larger group of people as possible. The widespread lack of understanding of accessibility and its implementation needs to be eradicated for this to occur, and the only way to do that is by making information regarding accessibility in itself as accessible and understandable as possible.

Aims & research question(s)	• Research the different types of accessibility issues e.g. (visual, auditory…) • Research factors that can affect accessibility besides disability (e.g., age, hardware) • Research WCAG and its legal implications • Research common accessibility issues that occur on pages. • Research common issues that occur specific to web developer and web content provider separation situations • Develop not technical summarizations of accessibility guidelines. • Develop a website to provide information to simplify the implication of good accessibility practice • Ensure an easy-to-use interface that is as accessible as possible • Improve the site based on feedback from web developer professionals • Evaluate if pre-existing guidelines are accessible to those with limited technical knowledge. • Evaluate if any legal guidelines can be too erroneous to be implemented well.
Methods to be used for: 1. recruitment of participants, 2.data collection, 3. data analysis.	A small selection of relevant professionals (3-5) will be recruited. The method of data collection will be to complete an open-ended qualitative questionnaire based around the evaluation of a produced deliverable. This data will be used to suggest possible improvements or additions that could be used to further develop the system and evaluate its usefulness within the given context.
Outline the nature of the data held, details of anonymization, storage and disposal procedures as required.	Identification of participants will not be on the questionnaire to keep responses anonymous Responses will be submitted as .docx files and are to be deleted at the end of the project, the only remaining data from the study will be potential quotes or interpretations included within the report.

3. Research in Organisations

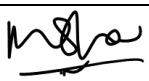
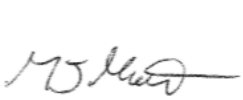
Question	**Yes/No**

1. Will the research involve working with/within an organisation (e.g., school, business, charity, museum, government department, international agency, etc.)?	No
2. If you answered YES to question 1, do you have granted access to conduct the research? *If YES, students please show evidence to your supervisor. PI should retain safely.*	N/A
3. If you answered NO to question 2, is it because: A. you have not yet asked B. you have asked and not yet received an answer C. you have asked and been refused access. *Note: You will only be able to start the research when you have been granted access.*	N/A

4. Research with Products and Artefacts

Question	**Yes/No**
1. Will the research involve working with copyrighted documents, films, broadcasts, photographs, artworks, designs, products, programmes, databases, networks, processes, existing datasets or secure data?	Yes
2. If you answered YES to question 1, are the materials you intend to use in the public domain? *Notes: 'In the public domain' does not mean the same thing as 'publicly accessible'.* • *Information which is 'in the public domain' is no longer protected by copyright (i.e., copyright has either expired or been waived) and can be used without permission.* • *Information which is 'publicly accessible' (e.g., TV broadcasts, websites, artworks, newspapers) is available for anyone to consult/view. It is still protected by copyright even if there is no copyright notice. In UK law, copyright protection is automatic and does not require a copyright statement, although it is always good practice to provide one. It is necessary to check the terms and conditions of use to find out exactly how the material may be reused etc.* *If you answered YES to question 1, be aware that you may need to consider other ethics codes. For example, when conducting Internet research, consult the code of the Association of Internet Researchers; for educational research, consult the Code of Ethics of the British Educational Research Association.*	Yes
3. If you answered NO to question 2, do you have explicit permission to use these materials as data? *If YES, please show evidence to your supervisor.*	N/A
4. If you answered NO to question 3, is it because: A. you have not yet asked permission B. you have asked and not yet received and answer C. you have asked and been refused access. *Note You will only be able to start the research when you have been granted permission to use the specified material*	**A/B/C**

Adherence to SHU policy and procedures

Personal statement	
I can confirm that: • I have read the Sheffield Hallam University Research Ethics Policy and Procedures • I agree to abide by its principles.	
Student	
Name: Matthew Shaw	Date: 14/10/2021
Signature: 	
Supervisor or other person giving ethical sign-off	
I can confirm that completion of this form has not identified the need for ethical approval by the FREC or an NHS, Social Care or other external REC. The research will not commence until any approvals required under Sections 3 & 4 have been received and any necessary health and safety measures are in place.	
Name: Mick Marriott	Date: 14/10/2021
Signature: 	
Additional Signature if required by course:	
Name:	Date:
Signature:	

Please ensure the following are included with this form if applicable, tick box to indicate:

	Yes	**No**	**N/A**
Research proposal if prepared previously	☒	☐	☐
Any recruitment materials (e.g., posters, letters, etc.)	☐	☐	☒
Participant information sheet	☒	☐	☐
Participant consent form	☒	☐	☐
Details of measures to be used (e.g., questionnaires, etc.)	☒	☐	☐
Outline interview schedule / focus group schedule	☐	☐	☒
Debriefing materials	☐	☐	☒
Health and Safety Project Safety Plan for Procedures	☐	☐	☒

9.3 Appendix 3 – Information Review

Web Accessibility Issues

Improving web accessibility: a study of webmaster perceptions

(Jonathan Lazar, 2004)

This study focuses on the reason why websites are inaccessible despite the tools and guidelines available. A model was presented to assist in addressing the commonly forgotten areas of accessibility incorporation. It was found that webmasters do support the implementation of accessible content however found there to be roadblocks preventing this such as software tools and inability to easily understand guidelines.

Library Trends: Web Accessibility

(Peter Brophy, 2007)

This study identifies accessibility issues, how they can be assessed and the underlying reasons for these in an eBook library setting. They found library researchers have been identifying ways to improve web accessibility and a combination of factors such as staff training, general awareness, and adoption of “design for all” principles can have significant positive results in this setting.

Web Accessibility for people with Disabilities

(Paciello, 2000)

This book talks about all the initial ways developers could identify what was and wasn’t accessible for people with disabilities on their sites. It also provides information on what they can do to implement good practice accessible content on their sites. Its aim is to provide the perspective of a disabled user interacting with the web to allow developers to understand the importance of implementing accessibility and help them develop with disabled users in mind.

Web Accessibility Guidelines

(Simon Harper, 2011)

The conducted study begins with the principle that guidelines and advice on accessibility take too long to be adopted, and the implementation of changes should be considered a much higher priority. The study identifying these adoptions of accessibility considered six thousand homepages. They found only a small percentage of webpages adopted these guidelines within a three-year period and most were ignored after 10 years. They conclude accessibility guidelines should consider not just the corrections made in the past but also the prospect of future additions to web technology.

Testing of Web Accessibility

Process Model for Continuous Testing of Web Accessibility

(Milton Campoverde-Molina, 2021)

This Article develops and tests a model to allow for continuous testing of web accessibility to ensure from the start a page is developed and improved with accessibility in mind. The cycle is derived from existing models, Deming cycle, Website Accessibility Conformance Evaluation Methodology (WCAG-EM), and Total Quality Management. The model allows for quantitative testing of up to date WCAG criteria via automatic evaluation tools. It is concluded their model can effectively provide accessibility via continuous accessibility testing.

Semantic Web Accessibility Testing via Hierarchical Visual Analysis
(Mohammad Bajammal, 2021)

The paper attempts to generate a system to automatically test semantic accessibility requirements. This is based on visual analysis to structure and semantic groupings on a web page. This will determine the Hierarchy of websites. The solution was tested on 30 websites and found a high accuracy in detecting accessibility issues of 85%.

Web Accessibility Testing for Deaf: Requirements and Approaches for Automation
(Caio C. S. Sousa, 2020)

This study sets out to identify the accessibility requirements for those with auditory disabilities and attempts to define automation approaches for accessibility testing regarding those requirements. The study found they could successfully test for requirements found in an automated way, this provided insights about validating accessibility through automated software.

A Method for Accessibility Testing of Web Applications in Agile Environments
(Sandra Sanchez-Gordon, 2017)

This study proposes accessibility testing using human and computer-based techniques. The method used consist of five stages, ": test planning and control; test analysis and design; test implementation and execution; evaluating exit criteria and reporting; and test closure activities". All of these are done in the context of agile developments. The study found automated tools and simulators cannot detect all accessibility problems. Tools should be used alongside expert testers to allow for all issues to be correctly identified.

Content Management Systems

Using a CMS to create fully accessible websites
(Sébastien Rainville-Pitt, 2007)

This report demonstrates the way in which accessibility can be implemented via a content management system. The study uses the CMS 'Edimaster Plus™'. This elaborates on the issues present with users who do not provide accessible content to be converted into code. They concluded the way to resolve this is with preformatted accessible functions to be implemented by users, when used together this will create an accessible page.

Improving accessibility of CMS-based websites using automated methods
(Balázs Csontos, 2020)

This paper focuses on the ways how accessible content can be implemented when using a CMS (specifically WordPress and Joomla!). They suggest the use of three methods, CSS/SCSS class override, MVC-based extension override, and HTML output override. Detailed guides for the use of these methods were presented. It is concluded that with the implementation of these methods WCAG criteria can be met effectively.

Legal Guidelines (WCAG)

Web Content Accessibility Guidelines (WCAG) 2.1
(W3C, 2018)

This document contains criteria to make webpages and their content more accessible. The criteria are all testable statements that are non-technology specific. The criteria also cover a wide range of

accessibility issues to cater for all people and are evolving when applicable. This document is advised to be considered when developing or updating any new web content to ensure accessibility.

Testability and validity of WCAG 2.0: the expertise effect

(Giorgio Brajnik, 2010)

This is an empirical study to determine the realistic testability of the WCAG 2.0 criteria and the validity of these test outcomes. These validations are made by a selection of experts and non-experts. It was concluded WCAG criteria were not completely testable as less than 80% of accessibility experts agreed on their individual testability.

9.4 Appendix 4 – Project Aims

No.	Project Aim
1	Research the different types of accessibility issues e.g.(visual, auditory…).
2	Research factors that can affect accessibility besides disability (e.g., age, hardware).
3	Research WCAG and its legal implications.
4	Research common accessibility issues that occur on pages..
5	Research common issues that occur specific to web developer and web content provider separation situations.
6	Develop not technical summarisations of accessibility guidelines.
7	Develop a website to provide information to simplify the implication of good accessibility practice.
8	Ensure an easy-to-use interface that is as accessible as possible.
9	Improve the site based on feedback from web developer professionals.
10	Evaluate if pre-existing guidelines are accessible to those with limited technical knowledge.
11	Evaluate if any legal guidelines can be too erroneous to be implemented well.

9.5 Appendix 5 – Accessibility Background Context

Types of Accessibility Issues

Ensuring web accessibility is the process of implementing features so that all users can access a site and access the same content, this means addressing situations that can be caused by all the different issues that affect the way a person would consume the provided content on a site. These issues are Visual, Motor, Auditory, Seizures and Learning/cognitive (Interaction Design Foundation, 2021).

Visual

Visual problems mean a user may not be able to view a page at all or only partially, the most common and dominant way to address this issue is with the use of screen readers (Springer International Publishing, 2017). A Screen reader is a piece of assistive technology that reads through a webpage and outputs the content as speech or braille. Screen readers are helpful; however, unless a page is designed, constructed and formatted correctly it can never be ensured that content is delivered in a correct way. This can include simple things such as the correct use of headings, alt tags and text links (Paternò, 2004). Another potential less common way to address this issue is using a speech-based interface. Systems such as this have three main elements, a voice driven interface, a HTML translator, and a command processor (Nunn, 2001). This works by a user selecting an element of a page to further inspect via speech. Alike the Screen reader, speech-based browsing must also have robust html and web content for it to be correctly translated into the suitable format. If the content is formatted incorrectly the content will not be presented in the correct format.

Motor

Motor problems are those related to users who may not have the ability to control the hardware that interfaces with a site in the same way regular users do. Common Issues caused by this are related to an inability to reliably use the mouse and keyboard (Doush, 2014). These issues can be tackled in several ways. A website can be made to be keyboard accessible, this means the whole website can be used and navigated just with the keyboard alone, this is because most assistive devices for people with motor skill problems require the use of a keyboard (Dunham, 2016). A speech-based interface can be used as this would remove the element of motor use entirely (See "2.1.1 Visual" for more details). Large Buttons and web features can also be implemented to cater for those who may be able to use a mouse or touchscreen however have limited precision when selecting (Abou-Zahra, Web Accessibility Perspectives: Large Links, Buttons and Controls, 2016).

Auditory

Auditory problems are those related to any web content that is presented via audio, this is due to a user having reduced or no hearing ability. It can also be related to users who may not speak the language used on a site to a fluent level causing understanding difficulties in situations of unclear audio (Afra Pascual, 2015). These issues can be catered for with the implementation of several factors. Text transcripts or sign language against audio recordings or videos with audio can be provided to ensure audio with speech can be presented in a visual way. This removes the auditory element completely. It is also important that all audio on the site is clear and understandable, the purpose of this is so users who only have limited hearing problems can still take advantage of auditory content on a page (Popescu, 2018).

Seizures

Seizures are episodes of uncontrolled electrical signals in the brain. There are several causes of seizure, only one cause is relevant to web content, flashing lights (NHS , 2020). A simple way to avoid this is based on content control. It is important content such as videos or any type of animation does not contain flashing images which could induce seizures. Static images can also cause in some cases, it is therefore also important to avoid complex images such as patterns (Mozilla, 2021). By taking these steps it will not only make users be able to access content more easily but also safer from a public health perspective.

Learning/Cognitive

Learning and cognitive issues both can have impacts on a person's learning and memory, this can be caused by many factors such as learning disabilities (G Regehr, 1996). Complex web content can therefore be difficult to interpret and understand rendering it useless to the user. This makes it so important that page content is made readable and understandable to all users (where possible). This can be done via simpler language and relevant explanation of technical terms. Doing this it will allow the content to reach more users and more specifically include users with less technical (or domain specific) knowledge (Interaction Design Foundation, 2021).

Factors that Affect Accessibility

Social Factors

Accessibility to a site can not only be affected by disability. Social factors can also affect this. Factors such as age, Language, Internet connection or accessing device can cause issues (Shawn Lawton Henry, 2012). Social factors within accessibility prove it isn't only focused on disability and makes accessibility important for all.

Age

Age can affect web usage at both ends, this can be a younger person or an older person, younger people are more likely to have issues relating to the complexity of web content and the reading level on a page, therefore it is important to ensure web content is no more complex than it needs to be. The Web Accessibility Initiative: Ageing Education and Harmonisation (WAI-AGE) project found in older people web accessibility are more hindered by physical factors as discussed before, however Digital exclusion is also a primary factor (Arch, 2009).

Language

Across the world there are many spoken and written languages, for websites with an international scope it is important they are written in multiple languages for content to be consumed in the way the content provider intended. This can be specified via a language tag on a page, this can also specify secondary languages (Coward, 2021). The language(s) a page should be written in can depend on the target market and the most common language of users of a page/site. In a situation where a user may not be fully fluent or comfortable using the sites language it is important to accommodate this as much as possible. Doing this would include things such as using simple language, this is advised to be no higher than secondary education level and where this cannot be done in situations such as important technical terms, accommodations must be made. These accommodations could consist of an in-depth explanation possibly aided by visual components such as diagrams (Bureau of Internet Accesibility, 2018). Only using technical terms where needed and to avoid using regional phrases that may not be understood. Using subtitles where possible over audio of speech is also very important especially in the case of a strong regional accent, it is shown that people both with and without hearing impairment can struggle with understanding when listening to a non-native accent (Carolyn Bruce, 2012).

Technical Equipment

Technical equipment is always important to consider as this is the device in which a user will view your web content therefore considerations must be made for how different devices interpret your web content. The main issue that is caused by different devices is due to their screen size. Responsive web design can be used to ensure in all situations content can be displayed to the user in the intended way. This includes implementing techniques such as media queries and responsive size declarations within CSS (Gardner, 2011). By implementing this it will make the device a user views your web content with unimportant as content will be inclusive across all devices.

Digital Exclusion

Large amounts of content is placed on the web in all forms every day and this continues to grow. Digital exclusion refers to the section of people who due to their inability to participate in the web are also unable to fully participate in modern society. Some groups are more likely to be in these digitally excluded. Examples of these would be older people, disabled people, and people in low-income groups (NHS Digital, 2021). This is because they have restricted ability to use digital technology, this could be due to a lack in knowledge or an inability to use technology due to disability.

In some cases, digital exclusion can be less a factor of whether an individual uses technology and more a case of whether they feel the use would improve their life (Helsper, 2021). If an individual does not see the advantage in digital technology, they are less likely to teach themselves what they need to benefit. Industries such as government and healthcare are advancing into the digital world, if accommodations are not made for the digitally excluded it could mean eventually, they lose access to these important services (BIS, 2009). For this reason, it is essential to ensure online content is

accessible as the easier content is to access the less knowledge of the web is required to access it comfortably and therefore less individuals become excluded where possible.

Web Content Accessibility Guidelines (WCAG) and their Purpose

What are WCAG Guidelines

Web Content Accessibility Guidelines (WCAG) by the Web Accessibility Initiative are a collection of guidelines that if followed correctly can make websites considerably more accessible. They are split into three different levels of conformance based on desirability (My Accessible Website, 2022):

Level A	The most desirable and easiest to implement with negligible impact on website design or structure, most basic sites would pass this already assuming general good practice was used during development.
Level AA	More commitment is required to achieve this however does result in a more accessible site; most websites do not meet this standard.
Level AAA	These rules are much stricter. The average website would not target this level of accessibility for full compliance, this is usually only for specialist sites. This level is classed more as aspirational as content can sometimes be negatively affected.

All the criteria within WCAG are assigned one of these levels, these are necessary as:

- Not all criteria are considered 'Essential'.
- There is not always the possibility of implementing all criteria in all situations.
- The skill levels required to implement are higher.
- The criteria may impose restrictions on the design of a site.
- Workarounds if criteria are not met.

These guidelines can be helpful from the perspective of a web developer wishing to make a site as all guidelines are testable allowing for a quantitative test result for levels of accessibility. All criteria also all directly relate to "important access issues for people with disabilities", this ensures all individual criteria are valid (W3C, 2016).

Legal Implications within the United Kingdom

Accessibility regulations in the UK changed in September 2018 giving specific regulations for public bodies (Her Majesty's Government of the United Kingdom of Great Britain and Northern Ireland, 2018). Public bodies refer to all UK public sector organisations. These requirements were built on top of the Equality Act 2010 (or the Disability Discrimination Act 1995 in Northern Ireland) (Central Data Office, 2021). Public bodies consist of central and local government organisations, Some charities, and some non- government organisations. This was recently changed, and legislation now clearly states all public sector bodies must conform to an accessibility standard of WCAG 2.1 Level AA. As WCAG 2.1 is the legal standard this is what my report will focus on. An Accessibility statement must also be published. This must be implemented by September 2020 at the latest.

The purpose of an accessibility statement is to provide in depth information about the accessibility of content on your site, it can also be used to demonstrate your organisations commitment to accessibility and your users. It must include information such as (W3C, 2021):

- An Accessibility commitment.
- The standard your content complies too (e.g., WCAG 2.1 AA).
- Contact information for accessibility enquires by users.

Advisable content to include are:

- Known Accessibility limitations.
- Measures your organisation take to ensure accessibility.
- Technical Environments your content should be accessible within.
- References to applicable laws and policies.

Organisations that fail to provide accessible content will be considered in breach of The Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018 Act and therefore the Equality Act 2010 and the Disability Discrimination Act 1995. The Equality and Human Rights Commission (or the Equality Commission for Northern Ireland where applicable) can use their legal powers against offending organisations (UK Government, 2021).

Usefulness of WCAG Guidelines

WCAG is internationally recognised by many countries as an effective standard for web accessibility. Various versions and iterations of WCAG have been implemented as a legal standard in some of the worlds most developed nations such as the United Kingdom, United states of America and Australia (Bureau of Internet Accesibility, 2019).

WCAG is also shown to evolve with times and current assistive technology needs. The web changed a vast amount during the time of development of WCAG 2.0 guidelines, when published these guidelines still took modern problems into account and catered to the needs of the assistive technology at the time (Loretta Guarino Reid, 2008).

A study in Malaysia based on determining the accessibility of homestay websites found via the use of WCAG and a sample size of 328 sites that most of these sites were not accessible (Wan Abdul Rahim Wan Mohd Isa, 2016). The use of WCAG as criteria revealed these sites commonly lack implementations that are necessary for the use of content by people with disabilities. These include the lack of alternative text on non-text content, the incorrect contrast of colours on a page and text links with improper formatting. These issues alone will prevent the effective use of screen readers and prevent those with vision issues from using the site. This highlights that the implementation of these guidelines will allow for more customers to access these sites and therefore bring more profits to a business.

Another study in Indonesia analyses and improves the accessibility of university websites via the implementation of WCAG (W Arasid, 2018). The TAW evaluation tool was used to draw results of accessibility from the websites of 13 State Universities. All sites had a range of accessibility issues that would not have been identified without the use of the WCAG criteria. Overall, 70 issue occurrences were identified. This concluded the use of WCAG to improve the sites can lead to an uptake in prospective students, and higher webometrics (ranking of university websites internationally).

9.5.1 Benefits of Using WCAG

Many sources note the beneficial impact of the guidelines, W3C themselves state several benefits pertaining to the guidelines themselves (W3C, 2010):

- Cooperatively developed international standard
- Applies to more advanced Web technologies current, future, non-W3C
- Clearer criteria, more precisely testable
- Adaptable, flexible for different situations, and developing technologies and techniques
- Extensive supporting materials, practical implementation guidance

9.6 Appendix 6 – Simplifications of Common Accessibility Issues

Page Layouts

Page Content Order

It is vital the order of all content is meaningful, correct, and unaltered by page styling. This can be done by ensuring a completed page has a understandable flow of content starting with the beginning of the subject of the page and ending with the end of the subject. (WCAG 1.3.2)

Correct Page Sequence	Incorrect Page Sequence
Making a Cup of Tea Step 1: Boil Your Kettle Step 2: Place your teabag in your Mug Step 3: Pour your boiling water into the Mug Step 4: Allow the Tea 1 Minute to Brew Step 5: Remove your Teabag Step 6: Add Milk and Sugar Step 7 : Stir well and enjoy	Making a Cup of Tea Step 1: Boil Your Kettle Step 2: Allow the Tea 1 Minute to Brew Step 3: Pour your boiling water into the Mug Step 4: Stir Well and Enjoy Step 5: Remove your Teabag Step 6: Add Milk and Sugar Step 7 : Place your teabag in your Mug

Headings & Labels

When designing the structure of a page it is vital headings are used correctly. Every page and topic section must have a suitable heading. The main purpose of headings is to segment content on a page, this is helpful for assistive technology as it can allow users to skip to sections rather than having to consume all content on the page. It is important all headings are clear and concise. This must be thought of as a hierarchy. A 'Heading 1' must always be used and followed by a 'heading 2' and '3' where relevant. (WCAG 2.4.2, 2.4.6, 2.4.10)

Correct use of headings	Incorrect use of Headings
○ Heading 1 - Heading 2 ○ Heading 3 ○ Heading 3 - Heading 2 ○ Heading 3 ▪ Heading 4	○ Heading 1 - Heading 2 ▪ Heading 4 ○ Heading 3 • Heading 5 ○ Heading 3 - Heading 2

Identification Consistency

Page elements such as links, interactive elements and headings should all have consistent identification if they have the same purpose. This means you should never have multiple elements that complete the same function under different identities. (WCAG 3.2.4)

Correct use of consistent Identification	Incorrect use of consistent identification
Page 1: Next Page ->> Page 2: Next Page ->	Page 1: Go to Page 2->> Page 2: Next Page->

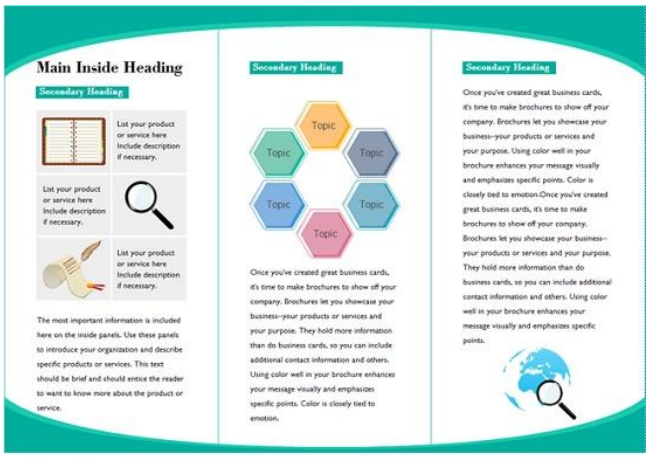
Page Help

Detailed help and instructions should be provided for every site page. This should relate to the page context. This could be done via a help link, help assistant on the webpage or any other assistive technique relevant to the content on the page. (WCAG 3.3.5)

Images

How to choose Images

Images should not contain large amounts of text or information as these cannot be interpreted by screen readers and other assistive technologies. Images of text also can cause scale issues across different devices. Images of text should never be used. (WCAG 1.4.5, 1.4.9)

Correct use of Images	Incorrect use of Image
Sheffield Hallam University 	 source: edrawsoft

Alternative Text

The purpose of accessibility is to ensure all content can be accessed by all people; in the context of images this can be done by ensuring all images used provide suitable text alternatives. This means alternative text must be a suitable substitution for whatever the image contains. This allows for users who cannot view the image but do have access to the alternative text to have equal access to the provided content. (WCAG 1.1.1)

If an image is being used as a link it must have alternative text, however it is usually best practice where possible to use text links instead. If an image is purely decorative or contains a suitable caption, alternative text should be left blank.

Correct use of Alternative Text	Incorrect use of Alternative Text
Sheffield Hallam University	

“Sheffield Hallam University”	“Woman Surrounded by books” CORRECTION – “” (Left blank as is decorative)

Videos & Audio

Audio-only and Video-only Content

Content such as this only has one way of being interpreted by itself, either audio only or video only and must have another way of being received by users such as a text Alternative and text description. This does not apply in situations of it being an alternative to other content however should be clearly labelled as such. In these situations, alternatives should be provided giving equivalent content. There should also be low or no background audio on audio-only clips. (WCAG 1.1.1, 1.2.1,1.2.3, 1.2.5, 1.2.8, 1.4.7)

Synchronised Media (Audio & Video)

Content with both audio and video should include alternatives to cater for both visual and auditory issues. This should include captions for audio and text description. These must be correctly synchronised with audio. When content is Live captions should also be provided. For Video content an audio description or other suitable description must be provided where relevant to ensure visual content can be provided in another way. Where possible sign language translations should be provided. (WCAG 1.2.2, 1.2.3, 1.2.5, 1.2.6, 1.2.7, 1.2.8)

Live Video & Audio Content

Live content can prove to be unpredictable on a webpage. This however does not mean it should not be accessible. Captions for audio must be provided for live content. This can be with pre-planned transcripts, live transcripts or auto generated transcripts. (WCAG 1.2.4, 1.2.9)

General Elements & Links

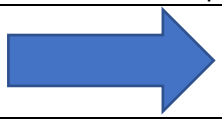
General Links

All links on a page, regardless of their form (e.g., text, image…), should show a clear and unique description of the links purpose. For web links this does not mean using the URL text as using this directly on the page display can be problematic for some assistive technology. (WCAG 2.4.4)

Correct use of links	Incorrect use of links
Go to Google Maps	Click Here https://www.google.co.uk/maps/@53.5697072,-1.0593797,14z

Page Link Elements (e.g., Logos, Shapes, etc.)

Links within a page should clearly describe the purpose of the image both with textual description and alternative text where relevant. This allows for a clear understanding of the purpose of a link or page control. Where possible the purpose of all links should be clear from its text. (WCAG 1.3.3, 1.1.1, 2.4.9)

Correct Use of page link element	Incorrect Use of page link element
	

Flashing Content

It is very important to control flashing content on a page, this is due to users with medical conditions such as seizures. For this reason, no page content should flash more than 3 times per second. For obvious reasons only a good example will be shown. (WCAG 2.3.1, 2.3.2)

Correct use of flashing content
 (This image is a flashing GIF)

Content Size

Content elements such as images should never have a fixed size. A large, fixed size of elements could cause for the need of unwanted scrolling in either the horizontal or vertical direction. Item size should always be defined as scalable units such as percentages. This allows for a wider range of devices to access the content clearly. (WCAG 1.4.10)

Correct use of element sizing/scaling	Incorrect use of element sizing/scaling
	

Content Readability

Technical words/language

Content using technical language is not always accessible to people of varied reading ability or limited subject knowledge. To improve the accessibility of this, simplifications should be used, or definitions of technical terms should be provided where possible. Where abbreviations are used the full definition should also be provided. The reading level of content should be no higher than secondary educational level or a lower reading level version of content should be provided. Where possible the pronunciation of ambiguous words should be provided if this cannot be implied from context. (WCAG 3.1.3, 3.1.4, 3.1.5, 3.1.6)

Correct wording of text content	Incorrect wording of text content

Newton's second law is a quantitative description of the changes that a force can produce on the motion of a body. It states that the time rate of change of the momentum of a body is equal in both magnitude and direction to the force imposed on it. Quantitative – numerical measure or value (e.g., 25 kilograms) Force - strength or energy as an attribute of physical action or movement Motion of a body - the action or process of moving or of changing place or position. Momentum - he quantity of motion of a moving body, measured as a product of its mass and velocity. Magnitude - the great size or extent of something.	Newton's second law is a quantitative description of the changes that a force can produce on the motion of a body. It states that the time rate of change of the momentum of a body is equal in both magnitude and direction to the force imposed on it.

Colours

Using Colours as Indicators

Colour must be used very carefully within page content, it should purely be used for design purposes, this means when used as an indicator suitable text must also be used to identify the purpose in the difference of colour. (WCAG 1.4.1)

Incorrect use of colours	Correct use of colours
Math Questions: Correct answers are shown in green! 1+1 = 2 2+3 = 4 4+4 = 8 8-2 = 4 Total 2/4	Math Questions: 1+1 = 2 – Correct! 2+3 = 4 4+4 = 8 – Correct! 8-2 = 4 Total 2/4

Image, Text, and Background Colours

For users with visual issues, it is important to ensure a clear contrast between colours. This should be a ratio of 4.5:1 between text and background (if possible 7:1) and 3:1 in elements and their adjacent colours. This can be checked with Web AIM Contrast Checker. (WCAG 1.4.3, 1.4.6, 1.4.11)

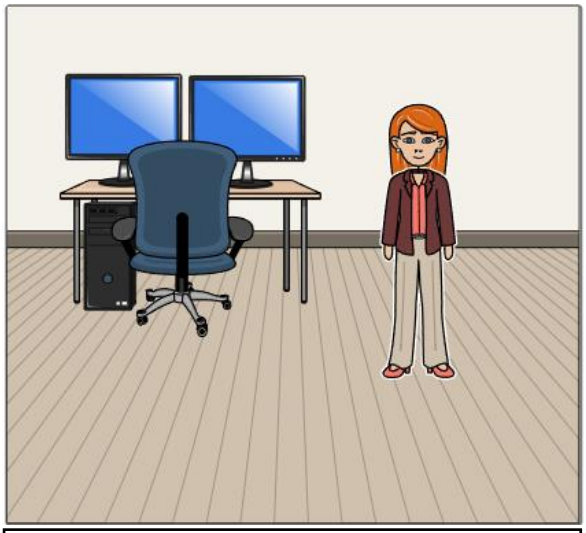
Good and Bad Use of Colour Contrasts

9.7 Appendix 7 – Persona

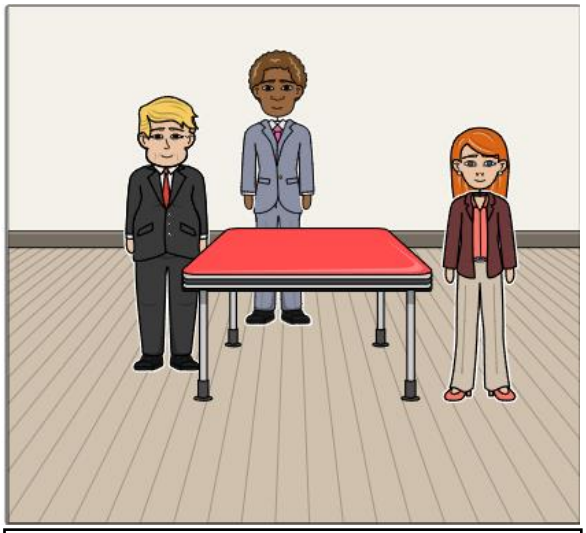
Fictional Name	Diane Dickinson
Occupation	Online Public Communications Officer
Demographics	• 32 Years old • Mother of 3 Children • Bachelor's Degree in Human Resources • Limited knowledge of IT • Works in Communications & Public Relations
Goals and tasks	She is a determined middle-aged woman who strives to advance in her career within her company. She works hard at her job and always tries to find the best way to improve her effectiveness and quality of work. She can usually be found: • Drafting public announcements on behalf of the company. • Updating the Social media accounts for the company • Spending time with her family • In communications meetings with various Departments
Environment	Diane spends most of her time at work, either in the office or working from home. Outside of this she spends time with her friends and family. She is highly acclaimed within her workplace, and it is known she strives for more responsibility. Diane has very limited technical knowledge which can sometimes impact on her job, she feels this could hold her back from future promotion. Her colleagues also have a similar lack of technical skills. She is regularly called into meetings with various departments to discuss company to public communications, this includes topics such as company recruitment, service advertisement and service announcement.
Quote	"Can you confirm the information to be published on the website?"

	“Have you seen the recent post about the job opening on Instagram?”

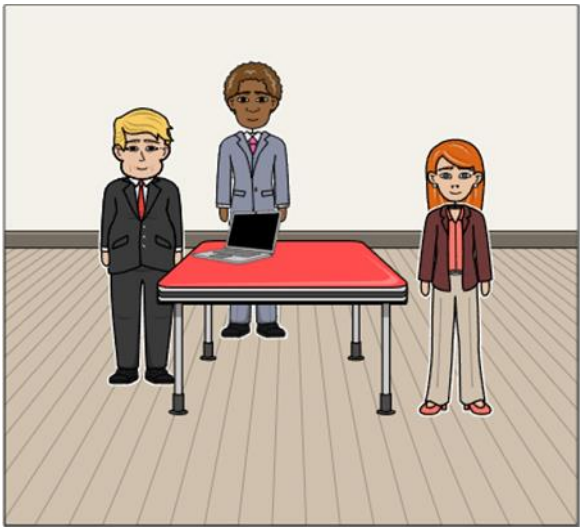
9.8 Appendix 8 – Storyboards



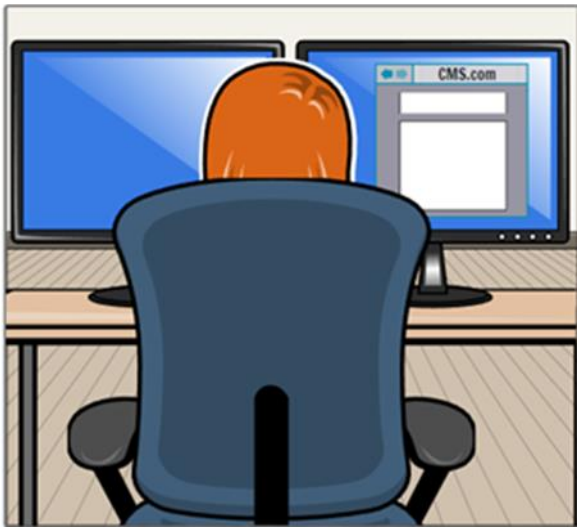
Diane (See Persona) has just arrived at her office and prepares for a meeting with a service team which is offered by her company



During this meeting she is informed of some changes to the service and a series of promotional events which will be taking place. She is asked to update the services section of the company webpage with this new information.

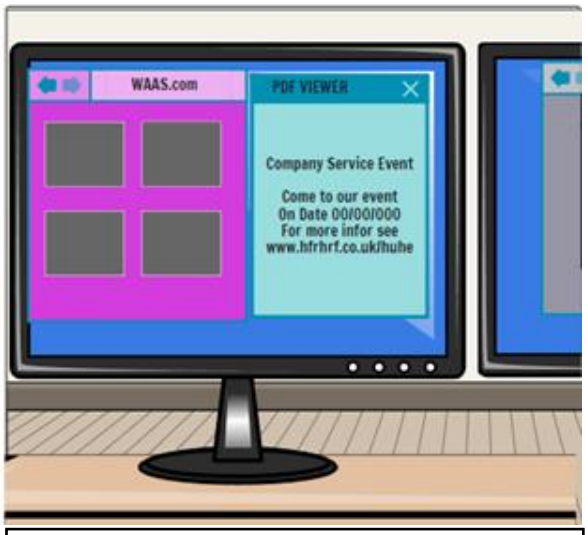


To do this a pre-made poster is provided by the service team via Company E-Mail. This is a poster image within a pdf.



After the meeting, with this new information Diane opens her company’s CMS (Content Management System), this allows her to create a new page and clearly states where to put the page title.

She then opens the Web Accessibility Advice System for web content providers *("the deliverable"*).



She also opens the pdf poster provided. She navigates to the image section of the deliverable to find immediately images of text should not be used as they are illegible to assistive technologies.

She must then type up the information on the poster. She screen clips decorative images from the poster and adds them to the site via the CMS. Through *"the deliverable"* she identifies alternative text is not required in this situation.

A link to an external site is also included on the poster as a URL. Diane finds this to be extremely inaccessible and due to this reformats the URL as a link on top of the site name onto which the link forwards

She then uploads the page; it is now published to the public site.

9.9 Appendix 9 – Building the test Harness

This generates boilerplate code which can be added to, these additions will implement the tests. The first major test is to ensure the system home will load and minimal content is correctly rendered. This is done by navigating to the "/" directory and identifying a valid URL along with ensuring the presence of a simple DOM element. Th this case the DOM element will be the page heading.

```
test('visiting system home', async function (assert) {
  await visit('/');
  assert.equal(currentURL(), '/');
  assert.dom('h1 a').hasText('Web Acessibility Advisor');
 });
```

Figure 52 Visiting System Home Testing Harness Code

I must now build tests to determine if each accessibility section displays and links the correct information. To identify individual sections, id's will be added to those items to select and evaluate them. This will allow for testing of Titles, Images, and Links.

```
test('Accesibility Section Peramenter Titles', async function (assert) {
  await visit('/');
  assert.dom('#section-one a h2').hasText('Page Layout');
  assert.dom('#section-two a h2').hasText('Colours');
  assert.dom('#section-three a h2').hasText('Images');
  assert.dom('#section-four a h2').hasText('Video & Audio');
  assert.dom('#section-five a h2').hasText('General Elements & Links');
  assert.dom('#section-six a h2').hasText('Content Readability (Text)');
 });
```

Figure 53 Code Snippet for Title Checks on Sections

```
test('Accesibility Section Peramenter Links', async function (assert) {
  await visit('/');
  await click('#section-one a');
  assert.equal(currentURL(), '/PageLayout');
  await visit('/');
  await click('#section-two a');
  assert.equal(currentURL(), '/Colours');
  await visit('/');
  await click('#section-three a');
  assert.equal(currentURL(), '/Images');
  await visit('/');
  await click('#section-four a');
  assert.equal(currentURL(), '/VideoAudio');
  await visit('/');
  await click('#section-five a');
  assert.equal(currentURL(), '/GeneralElementsLinks');
  await visit('/');
  await click('#section-six a');
  assert.equal(currentURL(), '/ContentReadabilityText');
 });
```

Figure 54 Code Snippet for Link Checks on Sections

```
test('Accesibility Section Peramenter Images', async function (assert) {
  await visit('/');
  let pagelayoutImg = this.element.querySelector('#section-one img').getAttribute('src');
  assert.strictEqual(pagelayoutImg, '../assets/images/pagelayout.png');
  let coloursImg = this.element.querySelector('#section-two img').getAttribute('src');
  assert.strictEqual(coloursImg, '../assets/images/colours.png');
  let imagesImg = this.element.querySelector('#section-three img').getAttribute('src');
  assert.strictEqual(imagesImg, '../assets/images/images.png');
  let videoAudioImg = this.element.querySelector('#section-four img').getAttribute('src');
  assert.strictEqual(videoAudioImg, '../assets/images/vidaud.png');
  let elementsImg = this.element.querySelector('#section-five img').getAttribute('src');
  assert.strictEqual(elementsImg, '../assets/images/element.png');
  let contentImg = this.element.querySelector('#section-six img').getAttribute('src');
  assert.strictEqual(contentImg, '../assets/images/text.png');
 });
```

Figure 55 Code Snippet for Image Checks on Sections

A test must also be added to ensure the Help & About page is displayed correctly and is linked accurately from the system home page. It is very important this is rendered correctly to meet

accessibility guidelines. These will check the link text, the link itself, and content displayed on the page itself. This content will be checked by validating the headings of the page are correctly rendered.

```
test('Help & About Check', async function (assert) {
  await visit('/');
  let HelpAboutLink = this.element.querySelector('footer a');
  assert.dom(HelpAboutLink).hasText('Help & About');
  await click(HelpAboutLink);
  assert.equal(currentURL(), '/HelpAbout');
  let HelpAboutHeading2s = this.element.querySelectorAll('h2');
  assert.dom(HelpAboutHeading2s[0]).hasText('About');
  assert.dom(HelpAboutHeading2s[1]).hasText('Help');
  let HelpAboutHeading3s = this.element.querySelectorAll('h3');
  assert.dom(HelpAboutHeading3s[0]).hasText('Finding what you need');
  assert.dom(HelpAboutHeading3s[1]).hasText('Understanding Accessibility Sections');
  assert.dom(HelpAboutHeading3s[2]).hasText('Ensuring your content is Accessible');
  assert.dom(HelpAboutHeading3s[3]).hasText('What is Accessibility?');

});
```

Figure 56 Code Snippet of Help and About Tests

A test must now be made to check and validate content within the relevant sections and sub section pages. The following will ensure all sections display the relevant content and is rendered correctly. This will be done by checking headings of each section. There is also a test to check and ensure all links to external WCAG information has the correct target destination. These tests check for the correct passing of parameter and yield content through EmberJS.

```
test('Accesibility Sub Section Check', async function (assert) {
  function checkLinks(list)
  {for (var i = list.length - 1; i >= 0; i--) {
      assert.strictEqual(list[i].getAttribute('href').includes('https://www.w3.org/TR/WCAG21/'),true); }}
  await visit('/PageLayout');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let PageLayoutHeading2s = this.element.querySelectorAll('h2');
  assert.dom(PageLayoutHeading2s[0]).hasText('Page Content Order');
  assert.dom(PageLayoutHeading2s[1]).hasText('Headings & Labels');
  assert.dom(PageLayoutHeading2s[2]).hasText('Identification Consistency');
  assert.dom(PageLayoutHeading2s[3]).hasText('Page Help');
  await visit('/Colours');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let ColoursHeading2s = this.element.querySelectorAll('h2');
  assert.dom(ColoursHeading2s[0]).hasText('Using Colours as Indicators');
  assert.dom(ColoursHeading2s[1]).hasText('Image, Text, and Background Colours');
  await visit('/Images');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let ImagesHeading2s = this.element.querySelectorAll('h2');
  assert.dom(ImagesHeading2s[0]).hasText('How to choose Images');
  assert.dom(ImagesHeading2s[1]).hasText('Alternative Text');
  await visit('/VideoAudio');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let VideoAudioHeading2s = this.element.querySelectorAll('h2');
  assert.dom(VideoAudioHeading2s[0]).hasText('Audio-only and Video-only Content');
  assert.dom(VideoAudioHeading2s[1]).hasText('Synchronised Media (Audio & Video)');
  assert.dom(VideoAudioHeading2s[2]).hasText('Live Video & Audio Content');
  await visit('/GeneralElementsLinks');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let GeneralElementsLinksHeading2s = this.element.querySelectorAll('h2');
  assert.dom(GeneralElementsLinksHeading2s[0]).hasText('General Links');
  assert.dom(GeneralElementsLinksHeading2s[1]).hasText('Page Link Elements (e.g., Logos, Shapes, etc.)');
  assert.dom(GeneralElementsLinksHeading2s[2]).hasText('Flashing Content');
  assert.dom(GeneralElementsLinksHeading2s[3]).hasText('Content Size');
  await visit('/ContentReadabilityText');
  checkLinks(this.element.getElementsByClassName('wcag-link'));
  let ContentReadabilityTextHeading2s = this.element.querySelectorAll('h2');
  assert.dom(ContentReadabilityTextHeading2s[0]).hasText('Technical words/language');
});
```

Figure 57 Code Snippet for Accessibility Sub Section Tests

9.10 Appendix 10 – Testing Tables

WAVE Tool Testing

SYSTEM PAGE	WAVE OUTPUT	ISSUE/ WARNING REFERENCE
SYSTEM HOME	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
PAGE LAYOUT	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
COLOURS	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
IMAGES	Errors: 0 Contrast Errors: 0 Alerts: 2	001
VIDEO & AUDIO	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
GENERAL ELEMENTS & LINKS	Errors: 0 Contrast Errors: 0	002

	Alerts: 3	
CONTENT READABILITY	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable
HELP & ABOUT	Errors: 0 Contrast Errors: 0 Alerts: 0	Not Applicable

ISSUE/ WARNING REFERENCE	ACCESSIBILITY ISSUE / WARNING	FUTURE ACTIONS/ SOLUTIONS	REQUIRED FOR WCAG 2.1 AA
001	The two alerts are due to "Suspicious Alternative Text". This is for two instances of the same image (see below) with alternative text, "An example of a decorative Image".  *Figure 58 Copy of Image causing WAVE Alerts*	It is hypothesised WAVE found this to be a possible issue as the alternative text included the phrase, "decorative image". Under normal circumstances a decorative image should be left blank however within the context of the site this is suitable alternative text and therefore not an issue.	Not Applicable
002	The alerts here are cause by the "Bad Practice" Section of one of the Accessibility Sub Sections. This is highlighted by WAVE (as shown below).  *Figure 59 Screen Clipping of WAVE Tool Markers* The Alerts given are, "Suspicious link text", and "Redundant link". The suspicious link text is caused by the "Click Here" Link text. The redundant link issue is caused by the adjacent links and the two bad link examples direct to the same place.	Due to the context of the "Suspicious link text" it is important the text reads as "Click Here", The link destination itself is not important. This is also the case with the repeated link, as it simply provides an alternative example, and the destination is not relevant.	Not Applicable

Silktide Tool Testing

ISSUE NAME	ISSUE/ WARNING TYPE	CHECK TYPE	WCAG NUMBER/ LEVEL		ISSUE REFERENCE NUMBER
Allow users to quickly skip to content	Issue	Automated	2.4.1	A	003
Ensure controls change appearance when they are selected	Issue	Automated	2.4.7	AA	004
Ensure links explain their purpose	Issue	Automated	2.4.4	A	005
Ensure content is not too difficult to understand	Issue	Automated	3.1.5	AAA	006
Ensure text placed over images or gradients has sufficient contrast	Issue	Assisted	1.4.3	AA	007
Check that each page has an appropriate title	Issue	Assisted	2.4.2	A	008
Ensure HTML is in a meaningful sequence	Issue	Assisted	1.3.2	A	009
Ensure users can pause or hide animated content	Warning	Assisted	2.2.2	A	010
Ensure pages with inactivity time limits do not cause data loss	Warning	Assisted	2.2.5	AAA	011
Ensure users can find definitions of unusual words	Warning	Assisted	3.1.3	AAA	012
Check images have been correctly defined as decorative	Warning	Assisted	1.1.1	A	013
Ensure users can control the visual presentation of text	Warning	Assisted	1.4.8	AAA	014
Ensure pages with interruptions can be postponed or suppressed by the user	Warning	Assisted	2.2.4	AAA	015

ISSUE/ WARNING REFERENCE	ACCESSIBILITY ISSUE / WARNING	VALID?	FUTURE ACTIONS/ SOLUTIONS	REQUIRED FOR WCAG 2.1 AA
003	This issue appears on all pages, its purpose is to ensure in situations with assistive technology users do not have to search through all page content before finding their needed content.	Yes	Providing links to skip over accessibility sub sections could be beneficial, a second approach could be only adding sub sections as html when their buttons are pressed, this would allow for section headings to be listed back-to-back without the need to go through all section content first.	Yes
004	This issue is generated by the buttons for all collapsible accessibility sub sections. This is due to the display of the button not changing when pressed.	Possibly	It could be argued the button appearance does not need to change as its selection status can be determined by the visibility of the collapsible section. However, this could be	Yes

			resolved also with a colour change within the button.	
005	This issue is generated due to a “Click Here” Link on the site found in the “Bad Practice” part of an Accessibility sub section. This does not describe the link destination and therefore causes an issue.	No	Within the context of the page this link should make sense to all content consumers. Potentially this could be removed however would affect the quality of system content.	Not Applicable
006	On the Help & About page it is shown some content has a reading age of 17.7, by WCAG standard a page should not have a reading age of over 16.	Yes	System content should be reviewed ensuring it has a reading age of 16 or below. It is possible some content cannot be brought to this level. It is for reasons like this Level AAA is aspirational and not required. Content should not be removed due to these guidelines.	No

ISSUE/ WARNING REFERENCE	**ACCESSIBILITY ISSUE / WARNING AND ASSISTED CHECK**	**VALID?**	**FUTURE ACTIONS/ SOLUTIONS**	**REQUIRED FOR WCAG 2.1 AA**
007	These possible issues occur on all pages and are caused by the “Help & About” and “Web Accessibility Advisor” Links. A Manual check must be completed to ensure the contrast between this text and the background is suitable. To the naked eye it is clear what this text says over the background image. To ensure accuracy an online tool, Colour Contrast Accessibility Validator (a11y, 2022), was used. This checker found no issues with the site contrast.	No	Not Applicable	Not Applicable
008	This possible issue is cause if pages are not titled correctly. The system is built from 8 pages, and it is important all must have relevant titles. Silktide provides criteria for what a title should include to be accessible:	No	Not Applicable	Not Applicable

	• Identify the subject of the web page • Make sense when read out of context • Be short It is judged these criteria are fulfilled by all page titles.			
009	This possible issue can be caused when content is not placed onto a site in a way whereby simply observing the html, the content would make sense. As shown during development all HTML follows a meaningful sequence. This allows it to be easily deciphered by assistive technology.	No	Not Applicable	Not Applicable
010	This possible issue is caused by any animated content that does not have the ability to be hidden or paused within 5 seconds. Only one site page contains animated content, this is a gif image. This image can be hidden within 5 seconds by closing the accessibility sub section.	No	It could be argued this would take away from the content of the site as when the sub section is closed its content cannot be consumed. Therefore, a mechanism to hide the image itself not just the surrounding section could be implemented.	Not Applicable
011	This possible issue is caused when any page has stored data that could be lost due to inactivity. No site pages have an inactivity time limit and therefore will not cause this issue.	No	Not Applicable	Not Applicable
012	This possible issue is caused by any unusual words not being specifically defined meaning a user may not understand content correctly. It is not believed this site contains any “unusual” words and therefore poses no issues.	No	It could be argued some words could be considered “unusual” by reasonable standards. These should be identified in user testing. If found these would require defining.	Not Applicable
013	This issue could occur if decorative images are defined as such. Alternative text must be left blank for these images only. If left blank assistive technologies will “skip over” this content. All images on the site have been reviewed and it	No	Not Applicable	Not Applicable

	is considered all contain reasonable alternative text.			
014	Users must be able to control the presentation of text on the system. This includes aspects such as colour, line spacing and font size. On the system no text can be controlled by the user in this way.	Yes	Measures must be taken to allow for user-based control of text presentation within the system. This must be done without causing any other accessibility issues.	No
015	This issue is caused when pages with interruptions cannot be suppressed by a user. No interruptions are generated by the system and therefore this is not an issue.	No	Not Applicable	Not Applicable

9.11 Appendix 11 – Survey Questions

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?
Do you feel the general system provides a clear and usable interface?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☐ (10) ☐
Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☐ (10) ☐
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☐ (10) ☐
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?

What do you believe are the best/worst features of the system?
Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?

9.12 Appendix 12 – Survey Responses

Response 1

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?
Yes, I do believe web accessibility should be made easier for less technical developers to implement, I believe web accessibility is a very useful feature that is becoming more and more important as more people are being forced into an online world. This would mean that more websites need the ability to accommodate to specific types of people allowing them to be universally understood. Creating a system that allows people to understand how to implement web accessibility will strive more websites to become universally accessible.
Do you feel the general system provides a clear and usable interface?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☒ (8) ☐ (9) ☐ (10) ☐
Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☒ (9) ☐ (10) ☐
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
I believe that for a less technical web developer a lot of these techniques and web standards would become very useful and easy to understand. The descriptions are very short and to the point and the diagrams give a clear understanding of the methods being explained. I do however believe that in terms of general web accessibility, there should be means for showing more advanced and technical understandings of more complex web accessibility types.
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☒ (8) ☐ (9) ☐ (10) ☐

Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
The overall style of the website is quite consistent, using a consistent colour scheme and theme, however in some parts like the highlighting of certain words like in the Using Colour as Indicators tab uses a garish green colour for highlighting, which isn't very graphically attractive and can be a bad example to show people who may not have any graphic design experience. The descriptive text is also quite small and could prove to be harder to read for certain users like the Elderly or partially blind, boldening the text or perhaps even changing the colour could be beneficial for allowing for easier readability on the web page. The layout is also consistent and is very easy to traverse other than going back to the previous space, going back a space is currently accessible through using the back space in the browser or using the home button to go back to the home page. It would be better and more accessible to give a clear and readable method of going back and forth between pages.
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?
The current scope of the web site current offers acceptable amount of different accessibility methods, but a change that I would suggest is offering examples or techniques in implementing techniques, for instance when demonstrating colour schemes the website could offer useful external web services for finding suitable colour schemes and styles to follow or even going into a more technical design, showing the reader very simple instructions to implementing these changes.
What do you believe are the best/worst features of the system?
This system offers a quick and easy guide to creating easily accessible systems as well as allowing for a simple and easy to use navigation system that offers decent accessibility to itself. However, the website does exhibit a few inaccessible features of its own, using difficult text sizes and colours as well as being unclear in some navigation options such as moving back pages.
Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?
With improvements and perhaps more detailed descriptions of how to use accessibility features, I think this webpage would be useful to people with little to no web development experience. Although in a professional business it would be more professional to offer more information about the web page, including its purpose and how this web page would be used, with some examples.

Response 2

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?
Yes, because guidelines can become quite difficult for web providers as they may not understand all the jargon and can be quite daunting to new web content providers.
Do you feel the general system provides a clear and usable interface?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☒ (10) ☒

Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☐ (10) ☒
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
Yes, this system would make a difference, as it breaks down the key concepts of accessibility into a more understandable manner. I like how the information is simplistic and includes picture examples to further help the user understand the information easier. I also like how the website adjusts it size according to the device.
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☒ (9) ☐ (10) ☐
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
Potentially use lighter colours as the colour contrast is quite strong can be quite exhausting to the eye over time. The text in the text boxes could be thicker and slightly larger, because its thin it could potentially strain the eyes of those who have poorer eyesight.
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?
The site content is very good. Understandable jargon is used. No changes.
What do you believe are the best/worst features of the system?
The best features are the big boxes with drop downs, easy to select and the information on the website is easy to understand. The worst features are the colour scheme – bit straining on the eye.
Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?
Absolutely. This would be beneficial as it summarises the necessary components required to make a website accessible. I like that it also links the WCAG sections beneath if the user wanted to check for more information on guidelines.

Response 3

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?

Yes. As the internet becomes more widely used and required by the general public, it is imperative that usage of it become easier and simpler to prevent the restriction of people regardless of capability (physical, mental etc) from accessing a vital part of modern living
Do you feel the general system provides a clear and usable interface?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☒ (9) ☐ (10) ☐
Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☒ (10) ☐
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
As stated in question 1. The importance to the ability to interact with online features in the modern age has become so important to approach necessity. Just as a workplace or store should be accessible via wheelchair, so too should a website be usable by people with various physical or mental restrictions.
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☐ (9) ☐ (10) ☒
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
None, the site was very accessibility friendly.
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?
Possibly an example of audio subtitling or video alternatives. Possibly an extended examination of colour schemes
What do you believe are the best/worst features of the system?
Expandable headers neaten page size nicely. Could do with a dedicated back button instead of the top header for people less versed in web navigation
Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?
Using it as a guide would be a very positive development for website development.

Response 4

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?
Due to the importance of accessibility and the legal requirement for public sector websites, less technical people should not be putting content on websites. However, having a system that can simplify WCAG requirements and present clear steps on how to improve accessibility, could be a useful tool.
Do you feel the general system provides a clear and usable interface?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☐ (8) ☒ (9) ☐ (10) ☐
Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☒ (8) ☐ (9) ☐ (10) ☐
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
Not sure. It could be useful as a general cheat sheet type tool but would need to be more in depth.
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☒ (8) ☐ (9) ☐ (10) ☐
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
A home page button or link could improve navigation. It was difficult to see how to get back to the home page for the other options. A menu could be helpful on the inner pages otherwise the user has to go back to the home page to access the other sections. Add a search function to allow users to find info specific to certain keywords. This may not be useful at present but could be if more information is added.
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?
Add focus style to accordion buttons. Currently no change when using Tab to navigate. Add more possible accessibility issues like: • bullet lists • emphasis (bold, italics, capitals and underline) • tables • forms

- keyboard navigation (e.g., tab focus)
- title attribute for iframes
- skip links

On the **Image, Text and Background Colours** section, serve the contrast image examples as HTML and CSS as they contain important information. It could be argued that these images are not accessible as the foreground and background colours are not stated in the text or alt text.

The **How to choose Images** section explains that the **Bad Practice** image is difficult to read but should probably emphasise that anyone relying on a screen reader will not be served the information at all.

What do you believe are the best/worst features of the system?

Pros

- home page sections are prominent and well categorised
- fonts are clear and easy to read
- links to WCAG info

Cons

- no search facility
- no menu
- clip art images look a bit dated

Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?

Not in its current form. It would benefit from some more thorough explanations and adding further potential accessibility issues as mentioned above.

Response 5

Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?

I believe that any tool to increase awareness and understanding of accessibility is welcome in the space as there is still a great amount of apathy, ignorance and confusion around accessibility evident across the industry. Currently I am not aware of a good, centralised resource to direct users to without subscription/costs involved or being overly technical and difficult for a layperson to understand.

Do you feel the general system provides a clear and usable interface?

(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☐ (7) ☒ (8) ☐ (9) ☐ (10) ☐

Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?

(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☒ (6) ☒ (7) ☐ (8) ☐ (9) ☐ (10) ☐

Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?
Yes, I feel one of the most significant opponents to accessibility is ignorance and many users involved in implementing content online don't have any knowledge or understanding of the basics before given the task of posting information. This system would give one a resource you can provide an end user to provide an initial overview of the key aspects of accessibility.
Do you feel the website itself is to a suitable accessibility?
(1) ☐ (2) ☐ (3) ☐ (4) ☐ (5) ☐ (6) ☒ (7) ☐ (8) ☐ (9) ☐ (10) ☐
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?
Some areas where accessibility is not great could be improved such as the title/footer text over a coloured background displaying both white and black so is unlikely to accessible in both states. There is no clear navigation back to the homepage or functionality to allow going from section to section directly without back through the main page. Some image use is not fully accessible (e.g., colour contrast images not having alternative display, flashing image not having option to pause/stop). (Note: testing was done in a mobile browser so issues may differ on a desktop environment).
Could you suggest any improvements or changes to the site content that would make it better fit its purpose?
Given the large breadth of information there is on accessibility expanding all the sections to be more exhaustive and cover a wider array of information on the subject would be beneficial. In its current state the information is useful, but probably not exhaustive enough for someone to actual use it as a full guide on publishing content on a website. Being able to break down the advice by WCAG conformance levels would be useful as most users will only need to comply with AA and once you get into the realm of AAA it gets a lot more subjective and static advice like this system provides may give a false sense of adherence without being able to provide context. Alternative structure options for the structure of the information could be useful for different contexts – e.g., if there was an option to view the relevant sections from all the existing categories based on job role, so someone that posts news articles to a CMS can see a subsection of the relevant sections for them which will be different sections to a web designer.
What do you believe are the best/worst features of the system?
The simple design and clear presentation of the information provided makes the system both a good example of accessible design and easy to use for a new user. The worst feature of the site is the fact it only covers a small portion of accessibility and may give users the false impression that it is exhaustive when there is a lot more to cover to be fully compliant/accessible.

Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?
If the system expanded the content to be more exhaustive and include everything a given company requires for their platforms (it doesn't need to necessarily be exhaustive as long as it covers what an organisation/user requires) then I believe it could have utility as something to provide training and reference for accessibility to relevant system users.

9.13 Appendix 13 – Survey Results

Question	Response summary
Do you feel there is a need for a system which makes accessibility easier to understand for less technical web content providers? If so, why?	All responses suggested a system of this nature is needed within the landscape. This would allow for guidelines to be understood and clarified easily to allow for more universal access to content across the web. One response suggested however the system is potentially the incorrect solution to this problem and by removing less technically skilled individuals from the web process could be the solution.
Do you feel the general system provides a clear and usable interface?	Responses ranged between 7 and 9 with an average of 7.8. This suggests the interface does present as clear and usable however some improvements may be required.
Do you believe the summarisations of the accessibility issues are suitable to allow for suitable implementation?	Responses ranged between 6 and 10 with an average of 8. This suggests the summarisations are to a high quality but could require improvement. The range of results was large suggesting due to experience and potentially other factors the understanding can vary and may require more in-depth testing and improvement.
Do you believe this system could make a difference to general web accessibility if used widespread? If so, why?	Responses appear positive with 60% of responses suggesting the system could make a difference in its current state noting that it is simplistic, easy to understand and meets a need that isn't currently being met. Other responses suggest the system could make an impact with some improvement and further development noting its possible use as a cheat sheet however there is a requirement for greater depth and complexity.
Do you feel the website itself is to a suitable accessibility?	The responses ranged from 6 to 10 with an average of 7.8. This suggests the website is

	itself mostly accessible however some improvements may be required to ensure this standard is met. The large range of results however suggest formal accessibility testing did not take place. This could be completed in future developments.
Could you suggest any improvements or changes to the style or layout of the site that you feel would improve user experience?	• A more explicit home page link • Navigation menu on inner pages directing to accessibility sections and sub sections to speed up transactions between content. • Search function to quickly access and find information (It is noted this could work better with more content on the site) • Improve site colour schemes • Text could be made clearer (possibly with thickness) for readability.

Could you suggest any improvements or changes to the site content that would make it better fit its purpose?	• Focus style to accordion buttons
	• Greater range of common accessibility issues such as:
	  ○ Bullet lists
	  ○ Emphasis
	  ○ Tables
	  ○ Forms
	  ○ Keyboard navigation
	  ○ Titles for iframes
	  ○ Content skip links
	• Change alternative text on contrast example images (this is potentially not accessible)
	• Offer more advice regarding implementation in content and design (possibly with external tools)
	• Cover a more exhaustive breadth of content
	• Breakdown and verify what is needed for AA and AAA as users may have to meet specific standards
	• Add more content regarding accessibility within the full web process and view information via job role or position
	• Examples of video and audio content to clarify the advice provided

What do you believe are the best/worst features of the system?	Best: • Content is well sectioned • Clear text and font • Links to WCAG can be very helpful

	• It is an overall simple to understand guide • Easy to navigate with the accordion style layout which is especially good for new users • The systems well set accessible example Worst: • No navigable menu • System home images appear dated (site design requires improvement especially regarding colour schemes) • No Search Ability for specific issues and content item types • Some inaccessible features (these potentially include text size) • Some unclear navigation (there is no explicit link to return to the home page) • Only covers a small demographic of accessibility needs
Would you recommend the system for use in a professional setting to reduce accessibility issues in situations with less technical web content provides?	Responses varies between not recommending and recommending the use in a professional setting however all suggested improvements were required to allow the system to fill its full potential.