FINAL YEAR PROJECT

Author: Victoria Szydlowska *Supervisor:* Dr Lance Putnam

Accessibility in web applications using front-end frameworks.

A thesis submitted in fulfillment of the requirements
for the degree of Bachelor of Science in Computer Science
May 6, 2022;

Declaration of Authorship

I, Victoria Szydlowska, declare that this thesis titled, “Accessibility in web application using front-end frameworks” and the work presented in it are my own. I confirm that:

- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.

Signed: Victoria Szydlowska
Date: May 6, 2022;

Computing Department

BSc Computer Science Degree

Accessibility in web applications using front-end frameworks.
By Victoria Szydlowska.

Abstract

The mumber of people with an access to internet is growing tremendously each year [24]. A significant number of people have access to computer and phone and use it on a daily basis. Almost 1 in 6 of these people might be expected to have some sort of disability and, possibly, could require accessibility adjustments in life [1]. Accessibility is defined as quality of being used or seen [42]. It emphasizes the importance of being aware of differences between people and being considerate of it. The needs of various people should not be ignored in any of life aspects. The effort to create a space accessible for everyone should be prioritised, especially in digital era, when social media and internet is very commonly used. It allows everyone to feel equally included in the society that sometimes forgets about minorities.

Keywords: disability, accessibility, interaction, web application, usability, design, framework

Acknowledgements

I would like to thank my supervisor, Dr Lance Putnam, for reassurance, guidance and support with my project throughout the process.
Finally, I would also like to thank my family for their continuous support during my education and degree.

Contents

1. Introduction

1.1 Overview

The project is focused on creating a product with the ability to be used by many people with different accessibility needs. People with different disabilities are a group of personas and target audience the project is mainly designed for.

1.2 Aim

The ultimate aim for this project is designing and delivering a product in the form of a web application focused on creating a product accessible to variety of different people with and/or without a disability. It is expected to include accessibility adjustments without downgrading and compromising its content. Project is focused on used methods and techniques while including the overall subject in its content. The product also performs an informative role. The purpose of the project is to create

a user-driven web application with a strong emphasis on User Experience design and accessibility.

1.3 Technologies

The project is built using front-end technologies like Vue.js [13], Tailwind CSS [14] and HTML (and HTML5 [56]), CSS and JavaScript commonly used in front end/web development.
The prototype and illustrations are created using Adobe products [57]. User feedback is collected through Google Forms [9]. The final product is deployed on GitHub [19] and deployed with Heroku [40] as a live server.

2. Background research

2.1 Statistics

As of January 2022, there are currently 4.95 billion internet users worldwide and this number increases by hundreds of thousands of people every day [24].

The web application should be done with the intention to make website or web application accessible and usable for as many people as it is realistically possible. It includes people with different disabilities, often not visible at first glance.
I believe this group of people is often forgotten and some things, seemingly invisible, might be an obstacle in an everyday situation. Carefully planned functionality and appearance of the web page can make a huge difference in someone's life. In my opinion, it is extremely important for developers to be aware of, not only its technical implementation and how it should work from the functional perspective, but also how the product is delivered to users and who is able to use it freely without any problems. My aim is to create a product which will include as many adaptations to different disabilities as it is possible while still being realistic about it.
Four main principles of accessibility are: perceivable, operable, understandable and robust [6].
Over 1 billion people worldwide suffer from various disabilities[1]. It is estimated that 71% of people with access needs will leave a website if it is not accessible for them or which they have difficulty using [16].
Subtitles are a perfect example of accessibility adjustment. They are commonly used while watching any available video, movie, TV series or scrolling through social media. They are not only useful for people with hearing problems but also for people living or accessing websites in loud environment, having difficulties understanding language and for people who want to practise and learn new language as well [10].
Older age is also another example when accessibility can be crucial for some people. Elderly people are more prone to different disabilities. In group of people

aged 65 and above, every 2 in 5 people has a disability [26]. This is an age group with the highest prevalence of disabilities in United States [27].
Users with slow internet connection or the ones using mobile devices can also benefit from using a web application focused on maintaning a high level of accessibility [2]. As mentioned before, sometimes disability can be just temporary (broken bone, operation/surgery etc) when people during this time need to adjust their current habits and try to find new solutions.

There are 3 types of disabilities: permanent, temporary and situational [11]. Disabilities can last for different period of time and each situation and individual is different. It can be chronic disability as well as the one that last for a day, a month, a year or any other period of time.
Moreover, disability does not have to be always visible or even noticeable at first glance [12]. Focusing on accessibility while creating a web application can be equally significant for everyone and benefit people with or without disabilities.

2.2 Technologies

The project will be implemented using Vue.js [13], Tailwind CSS [14] and basic tools used in front end/web development like HTML (and HTML5 [56]), CSS and JavaScript what I believe will be appropriate and accurate for what final result I am trying to achieve. During the testing stage I will use Google Forms [9] to gather data and Adobe XD [57] to create a clickable, high fidelity prototype.

Technologies used for this project include: HTML, CSS, JavaScript which are quite popular choice when building a web application/website. The choice is based on the previous knowledge and experience gathered throughout the past years, previous modules I have studied as well as project's requirements.

When it comes to more advanced software, frameworks/libraries for the project I have chosen to use are Vue.js [13] and Tailwind CSS [14]. I have chosen to use frameworks and libraries outside of „basic" and most popular technologies (HTML, CSS, JavaScript) because, in my opinion, it will allow me to achieve the objectives pursued with fewer possible limitations and it does, hopefully, make coding easier and more enjoyable for me during a building process. Usage of frameworks and libraries is also significantly improving performance and it allows building more complex things thanks to its flexibility [15].

Vue.js is one of the newest and most competitive frameworks currently available. I decided to use this framework because I wanted to learn more about it, get more comfortable with its structure and I believe it will be very beneficial for me in the future. Vue.js [13] is a progressive framework focused on view later and created to build user interfaces [20]. Smaller size of this framework makes it very fast and efficient what, as an end result, provides better performance overall [22].

Moreover, it is also one of the fastest frameworks [21]. The choice was also dictated by its documentation and how well written it is. It is very straightforward with great explained information. It does also have GUI tool which is another example of how easy it is to use, even for people without much previous experience and beginners in the field [23].

The most popular JavaScript frameworks out there are: Angular.js, React.js, Vue.js based on the search volume in 2020 [3]. I found other minimal js frameworks like: min.js, AuraJS, Kraken, Stapes.js, spine and many other [7], but because of the fact that I would really love to expand my knowledge and gain more understanding in this specific framework as well as improve my own skills. On top of that, Vue.js and TailwindCSS is quite a poweful duet for building a web app, in my opinion. It is also an option and combination chosen by many developers in the industry [8].

Library that I have chosen is Tailwind CSS which is highly customizable CSS framework [5]. It also allows to avoid opinionated styles while writing CSS [5]. It was definitely a huge bonus for me and for now, I find it very appealing to use.
The only disadvantage for some people is mixing HTML with CSS which argues with popular „seperation of concerns" idea [25]. For me it actually made writing CSS more straightforward without having to constantly check or try to find things in different files.

It is also faster to write than pure CSS [4]. Even though it was not the most important thing, time saving is another advantage of this library what helped me decide and make my final choice.
I believe that it would be a perfect fit for this specific project considering its goal and list of requirements.

Code editor I have chosen is Visual Studio Code [17]. The reason behind my choice is the fact that it has many very useful extensions, which makes coding even easier, its Git integration and simple and minimal design with the possibility to choose between different themes depending on current need, on top of that, it is mostly an open-source editor what makes it a perfect option for front-end projects [18]. I find this code editor to be aesthetically pleasant and very easy to use.

I decided to choose GitHub as my version control solution [19]. It was used in my previous projects in and outside of university work. It is also a very valuable skill to have to add to my resume in future after graduation. It is often one of the requirements listed on job offers related to web development and many more.

2.3 Background research conclusion

The statistics reassured me about the importance of the subject and allowed me to understand it even better. On the other hand, background research made into tools and technologies that are currently available, helped me choose the best way to deliver the product.

Based on the research results, I will focus on implementing accessibility adjustments presented below:

- font size (dyslexia, visual impairments and others)
- font group (dyslexia, visual impairments and others)
- contrast (dyslexia, visual impairments and others)
- spacing (dyslexia, visual impairments and others)
- paragraph length (dyslexia, visual impairments and others)
- easily navigated (physical impairments, temporary disability and many other disabilities)
- colour (dyslexia, epilepsy, physical impairments and visual impairments and others)
- eventually also being mobile friendly (people without access to computer or other device, hearing problems, visual impairments, physical limitation and older people with or without any disability)
- semantic tags (hearing problems, SEO and others)

and some others not listen above.

3. Methods

3.1 Data collection

3.1.1 Survey- statistics

The results of literature review showcased some of the statistics that includes target group of this project. To examine it further with potential users, a survey with three very basic questions was created and sent via different social media platforms. It was aimed to explore the proportion of people with disabilities, their age group and the exact disability that occurs.
To maximilise the chance of succeeding and receiving useful infomation, I did my best to differentiate the research group. I included people from all age groups, different backgrounds, cultures, countries and genders.
Survey was created using Google Forms [9]. The results and their details are presented below.

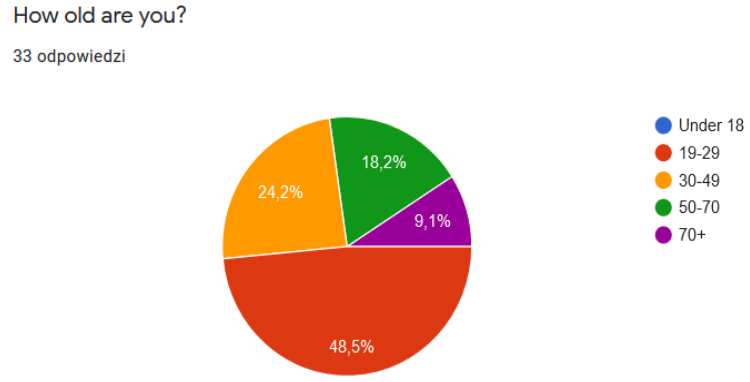

Figure 1. Survey result of participant's age.

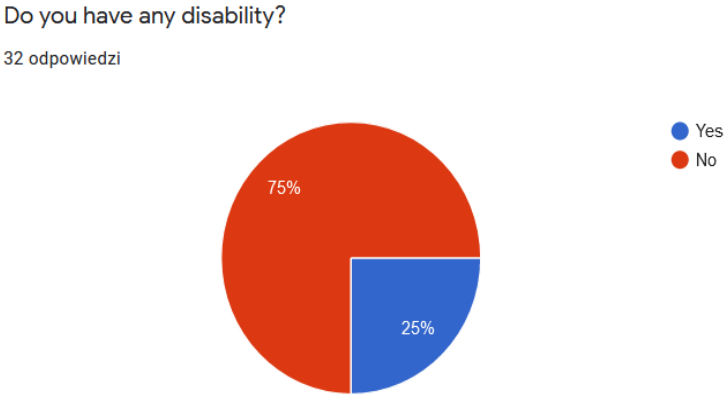

Figure 2. Disability prevalence among participants.

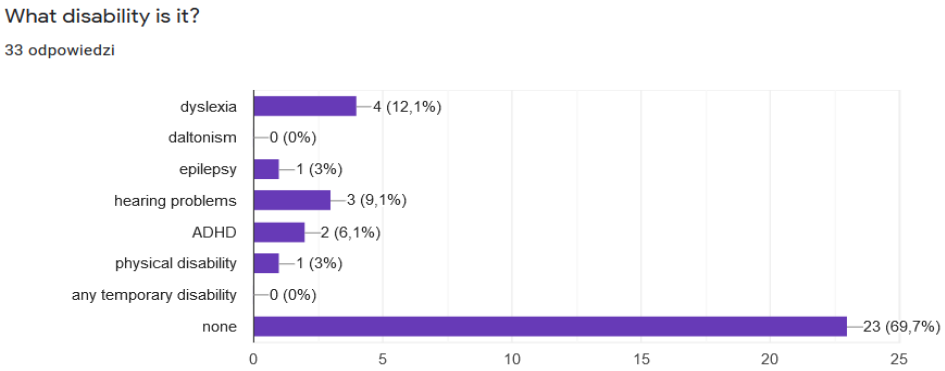

Figure 3. Type of disability and frequency of disability occurence within the group of responders.

Overall, I have managed to receive 33 answers from different age groups (Figure 1). One answer was invalid and is not included in the statistics. The results were not very surprising and I think it was somehow what I was expecting while creating a survey. Majority of them (more than 48%) came from people age 19-29. Exactly 25% of responders are living with some type of disability (Figure 2). It shows that 1 in

every 4 people can benefit from making a website or web application more accessible.
According to World Health Organisation (WHO) 15% of the population is estimated to experience disability [1]. While being a slightly lower percentage than the result of my survey, it proves with no doubt how important the subject is.

Afterwards, people were asked about the exact type of disability (Figure 3). Four people answered that they have dyslexia. Hearing problems was a common option with three people choosing it. ADHD was chosen twice and both, epilepsy and physical disability selected once. Daltonism and any temporary disability were not chosen at all. Majority of people (69,7%) 23 people answered that they do not have any disability. Not every disability was listed but there was an option available that allowed to add custom answer (other type of disability).

Survey was done using information from a relatively small amount of people what could have an impact on the final results. I tried to have more control over diversity (especially when it comes to age and background), so I avoided sending or adding a link in many different places. This is why number of people was significantly lower. The majority of respondents came from one age group as well. Even taking this into consideration, in the worst case scenario, it clearly shows how important and useful it is to make sure that website is accessible. The number of end users who could potentially benefit from accessibility adjustments within a web page is strongly visible.

3.1.2 Survey-prototype's feedback

A survey was done to gather potential users' opinions and feedback about the product's initial prototype (section 3.3.2, figure 40). Responders were informed about the motivation behind the product without giving insight into choices that were made to minimise the risk of influencing their survey's answers.
Links to a prototype and survey was shared with users using different social media platforms. It was published on group forums, as well as sent privately with the aim of reaching more people. Choice of social media platforms and users' groups were carefully chosen to make sure feedback is received from the intended audience.
Responders were asked 16 questions about the design choices, overall appearance and usability of the prototype.
Survey created using Google Forms [9],

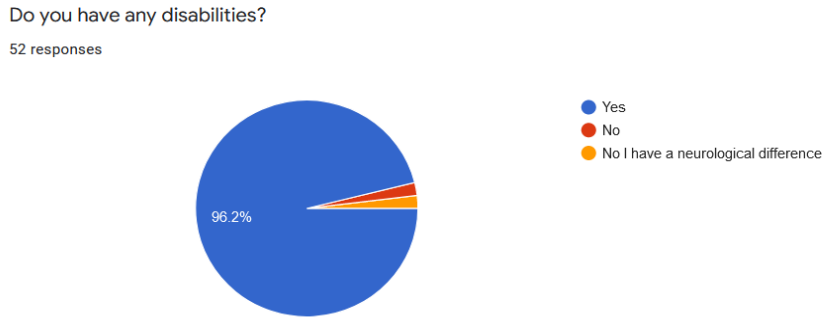

Figure 4. Proportion of people with and without disabilities who have taken a survey.

Vast majority of people were diagnosed with some form of disability (Figure 4). It makes the feedback received especially valuable for the overall result of the survey.

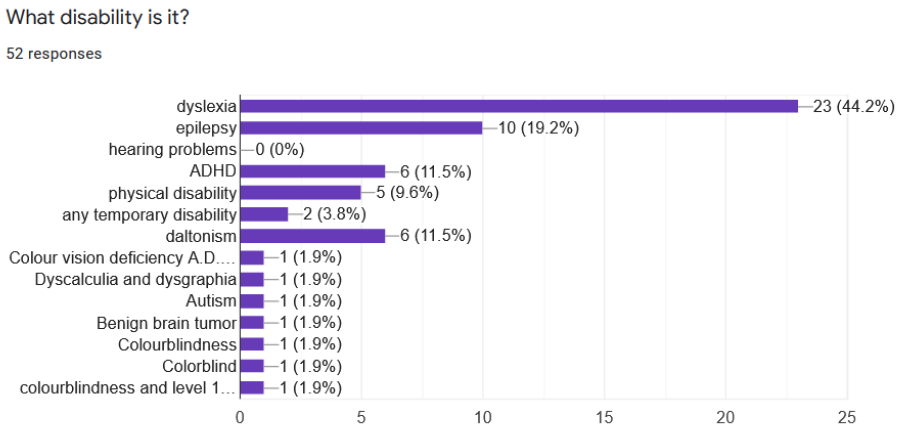

Figure 5. Type of disability chosen by responders.

Over 40% of responders were diagnosed with dyslexia (Figure 5). It was followed by epilepsy, ADHD and daltonism with ten, six and six answers, respectively. Almost 10% of survey answers were submitted by people with some sort of physical disability. A considerable amount of people created their own custom answers, which mostly included different types of colour blindness as well as autism, brain tumor, dyscalculia and dysgraphia.

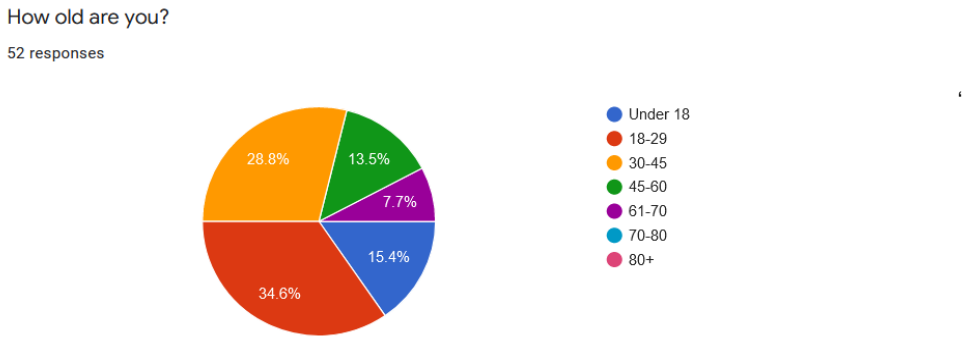

Figure 6. Survey results of age group that people belong to.

The answers were received from people in various age groups (Figure 6). Over third of people who participated in the survey were aged 18-29. More than 28% of people were between 30 and 45 years of age. The rest of the answers belong to children and teenagers under 18 years old and people in 45-60 and 61-70 age group.

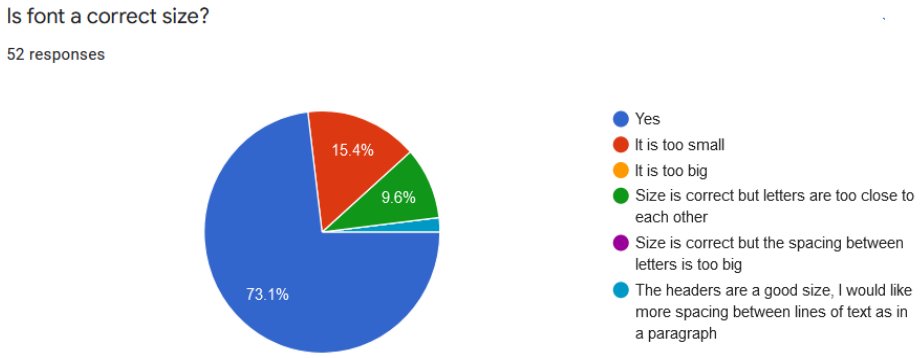

Figure 7. Participants' answers to question about size of the font

Almost three-quarters of participants were satisfied with size of the font {Figure 7). Over 15% of people stated that the font is too small and some of the answers pointed to spacing between letters being not enough. Interestingly, after checking answers separately, most of the people who answered that the font is too small were dyslexic people.
One person created their own answer highlighting importance of spacing between lines of text in a paragraph.

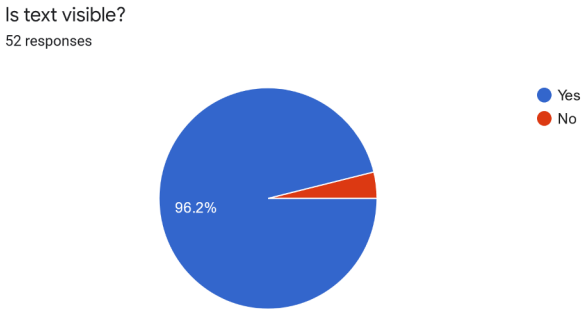

Figure 8. People's feedback about visibility of font.

The large majority of people were comfortable with font's visiility across the prototype (Fiigure 8).

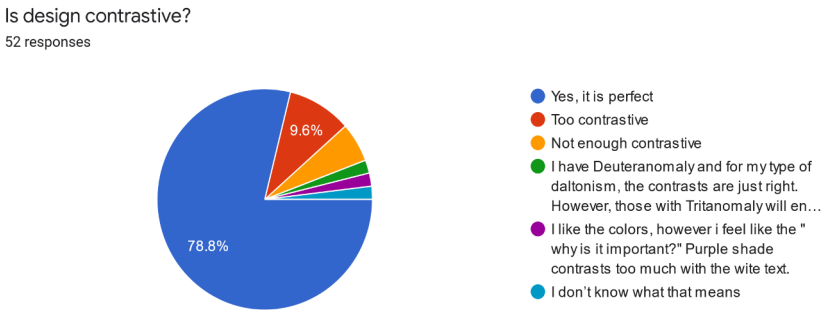

Figure 9. People's opinion about level of contrast.

Overall, the level of contrast of the prototype was corrrect for most people who provided feedback (Figure 9). A similar amount of people thought it was either too contrastive or not contrasting enough. Suprisingly, both of these answers came from people with dyslexia. One of the custom answer revealed the fact that people within the same disability group might have or have not problem with given contrast and it is dependent on the type of disability (daltonism in this case). One answer suggested changing one of the purple shade within the prototype.

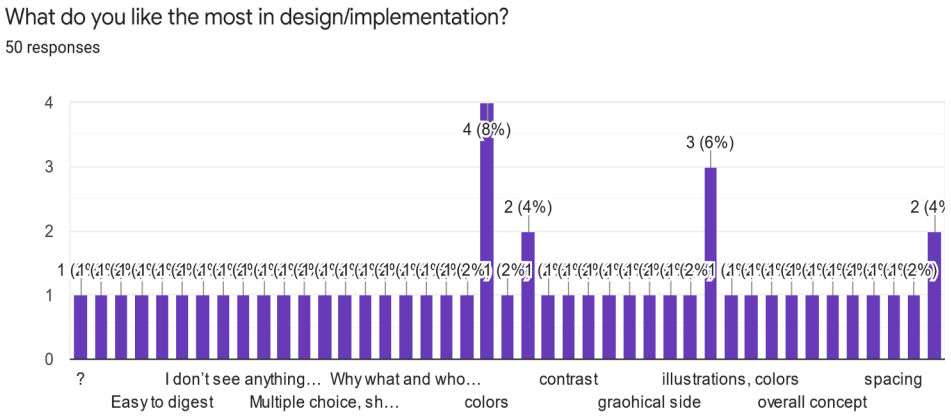

Figure 10. People answer's to question about their favourite thing within prototype and its implementation.

There were many various answers when participants were asked about what they liked the most about the overall design and/or implementation (Figure 10). Among a few of the most popular responses were colours and illustrations, which was the choice of four and three people, respectively. Some of the other answers included: clarity, visibility, spacing, overall look and how easy it was to navigate it. On the other hand, one person had difficulty navigating on the phone. One of the participants liked how pleasant and attractive the prototype looked as well as using colours to divide different sections of page what, in their opinion, resulted in the web page's content being easier to understand. Some of the people skipped this question and/or decided not to answer it.

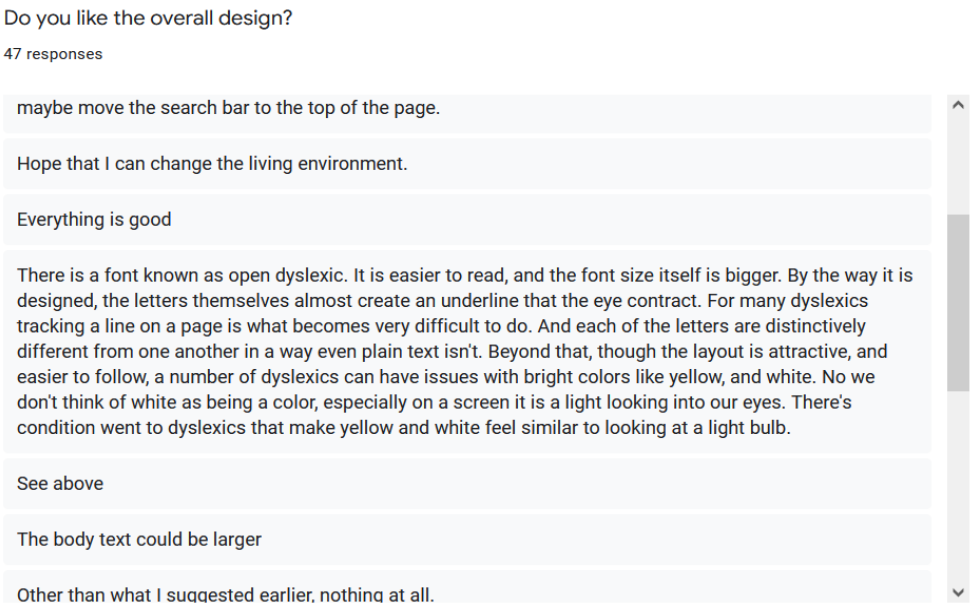

Figure 11. Survey results of people's answers about potential changes needed.

Paragraph type answer helped to examine what participant would change or add to a prototype (Figure 11). Most of the people did not need any adjustment to the current design. Answers suggested some specific size adjustments and moving the search bar to a different place. One long answer suggested a specific font, change to font's size and colour change.

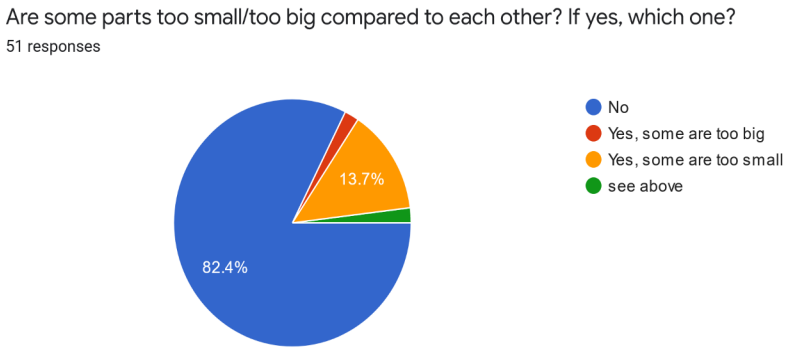

Figure 12. Result of people's answers about the size of some sections compared to other.

Majority of people (over 82%) were satisfied with the overall size and proportions of different sections, although there were some answers suggesting to increase the size (Figure 12). This answer was mostly chosen by participants with dyslexia. One person with physical disability mentioned some parts being too big what might be potentially caused by the necessity to do bigger movements what can be limited with some sort of physical disability.

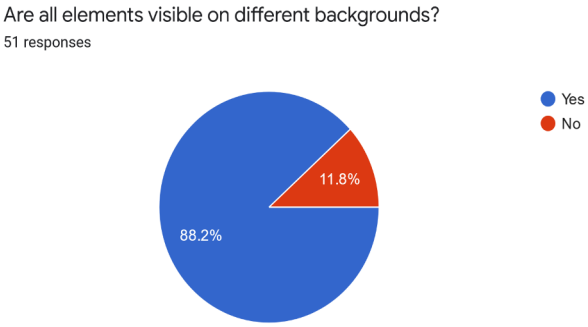

Figure 13. Participants' answers about visibility of elements on different backgrounds.

Visibility of elements was satisfying for more than 88% of participants (Figure 13) . A small number of people (11.8%) found some parts less visible than ideal.

Figure 14. People's opinion about navigation within prototype.

Overwhelming majority of people (92.2%) found navigation to be straightforward (Figure 14). It was clear what pages were about and what they were asked to do.

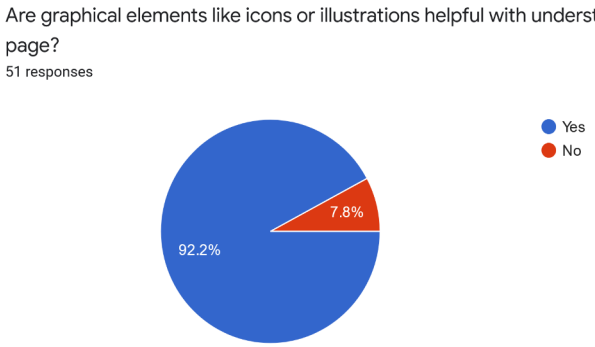

Figure 15. Survey results of people's opinion about the usage of icons and illustrations with an intention to understand page's content better.

Most of the people (47 out of 51 people) find graphical elements to be relevant and helpful in understanding the content of the web page (Figure 15). Almost 8% of people did not find it necessary to include it on the web page.

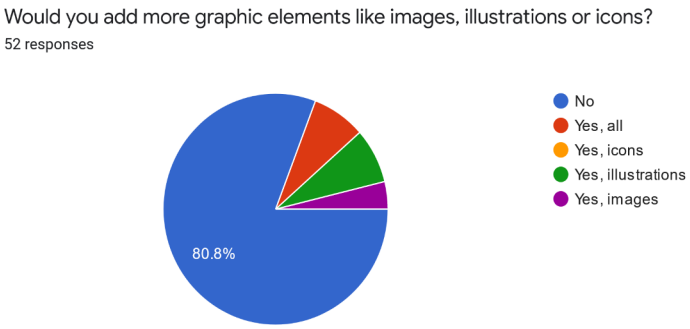

Figure 16. Survey results of people's opinion about necessity to add more graphic elements to the prototype.

Over 80% of responders did not find it necessary to add any more graphic elements to the product's design (Figure 16). Four of the participants suggested adding more illustrations, icons and pictures. Equal number of people found adding illustrations to be beneficial, while two persons thought that prototype would greatly benefit from adding images.

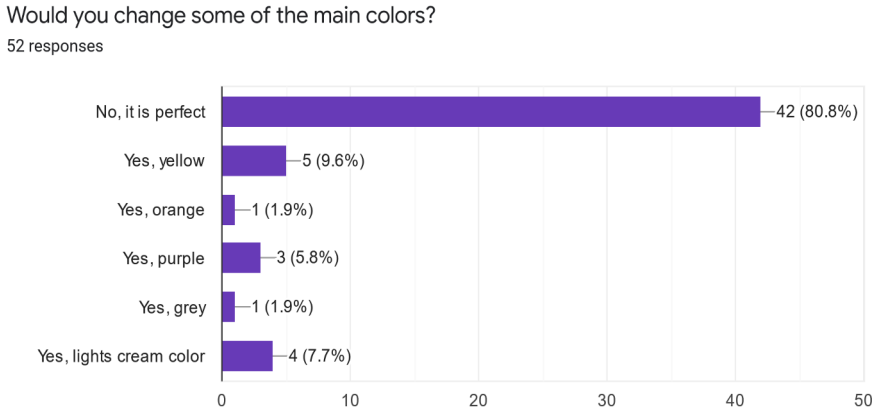

Figure 17. Participants' opinion about colour changes in overall design.

Significant amount of people (80.8%) would not change any of the colours used in prototype (Figure 17).
Some people have chosen yellow, orange, purple, grey and light cream as colours that needed to be changed. Each of mentioned before colours were chosen by five, one, three, one, four people respectively.

Overall, most responders were satisfied with the general design, look, functionality and content of the presented product.
Feedback received were taken into consideration while building a final product. It made an influence on design changes and further choices. Although, there were some answers who contradicted each other even within same disability group what

could potentially be caused by personal preferences. The survey was made with the possibility to add custom answer by participant in all type of questions. It provided an opportunity to leave feedback and answer questions in the most preferable way. Based on the participants' feedback, there were changes in yellow and purple shades which were adjusted according to will of responderts. Open dyslexic font suggested by participant (Figure 11) were added to list of font selection in the footer. Font size and spacing were increased to help make web application even more accessible. The search bar was moved and placed on main, yellow background to minimise the occurrence of black text/elements on white background shown to be too contrastive resulting in decreased readibility for people with dyslexia [43].
The data gathered helped to examine needs of target audience, which had a significant impact on the design choices and ultimate look of the final product.

3.2 Code implementation

URL to this project's code repository and instructions about how to run a downloaded code are available in Appendix A.
URL: https://victoria-szyd.herokuapp.com/#/ [40]

3.2.1 Set up

3.2.1.1 Vue JS installation

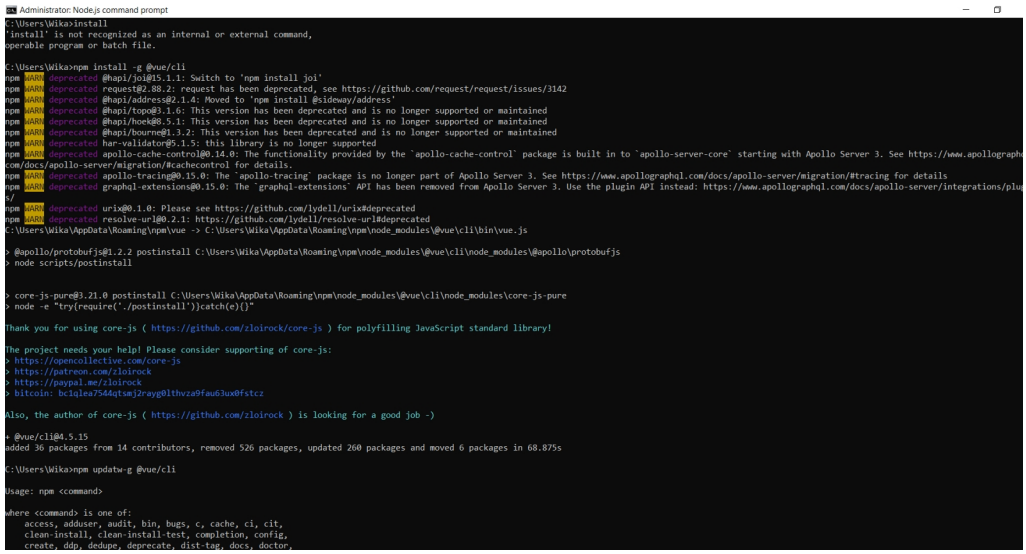

Figure 18. Installing Vue in terminal.

The project required installing Vue js globally (Figure 18).

Setting up Vue and creating new project was performed following official Vue js documentation [20].

Figure 19. Opening GUI.

Vue allows user to choose between running a command in terminal or opening Graphical User Interface in order to create a project (Figure 19).

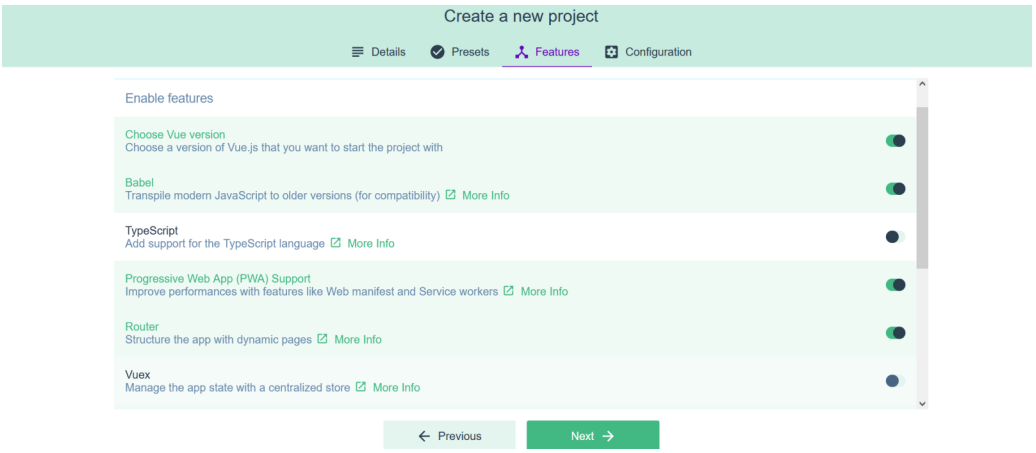

Figure 20. Creating new project using GUI.

In order to create a project, developer has to choose its name, location and plugins necessary (Figure 20). The plugins' choice is based on the personal preferences and it depends on goal and what is needed for given project.

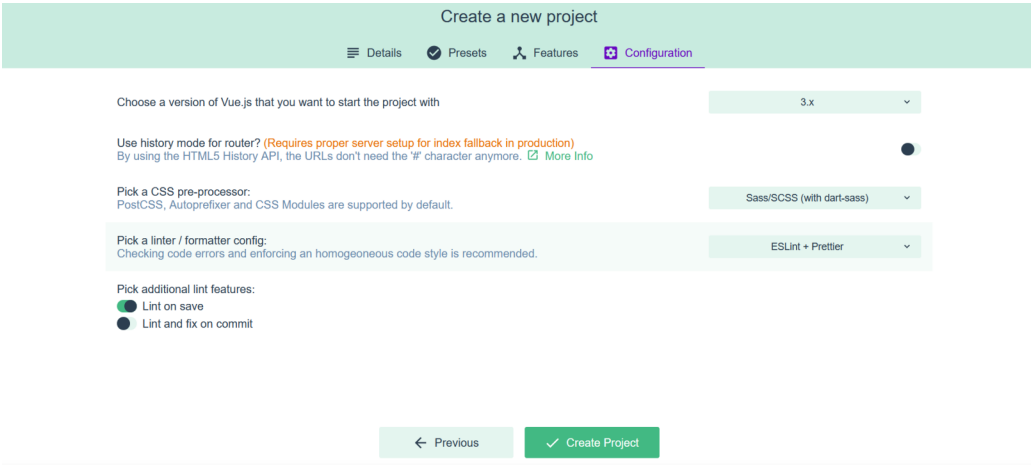

Figure 21. Final steps during creating a project.

Creating project requires making decision about few different features. It asks for formatter configuration, vue version and css pre-processor required. GUI suggests most popular and desirable option, which is especially helpful at the beginning (Figure 21).

Freshly created Vue project has some initial, styled code located in App.vue, HomeView.vue and AboutView.vue file and HelloWorld.vue component which, after running development server, outputs Vue logo, installed plugins, ecosystem, essential links and a link to official documentation.

3.2.1.2 Tailwind CSS installation

Tailwind CSS installation was performed on a previously created Vue project. It required installing it through terminal, making changes to the configuration file and main CSS file in order to make it work. It was done by following the instructions on Tailwind CSS documentation page in Installation section [35].
Some of the initial problems that occurred at this stage of development process included Eslint and End of Line errors. Eslint error was caused by wrong code formatting (mistakes in use of spacebar and tap) and was solved using CTRL + SHIFT +P followed by SHIFT +ALT +F to format code. The end of line error was shown because of the difference in End of Line sequence between Unix systems and Windows what was resolved by changing CRLF to LF.

3.2.2 Code overview

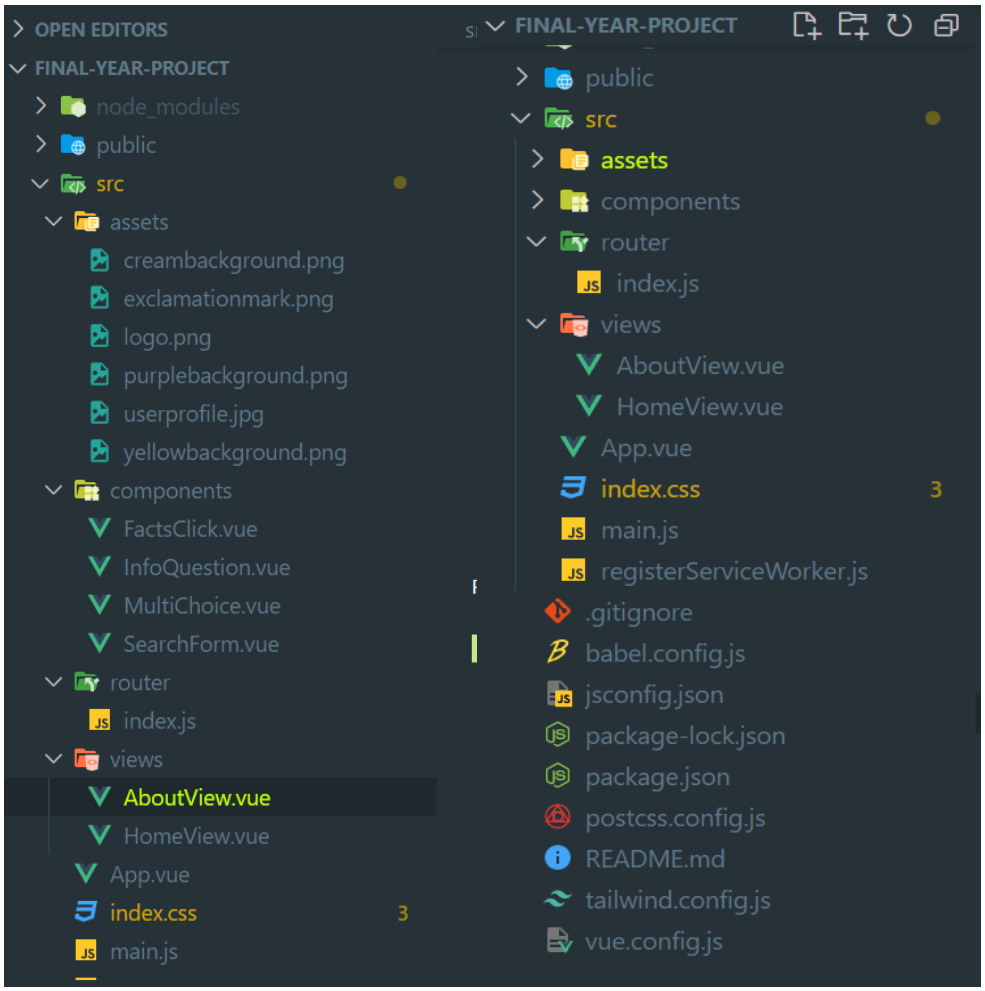

Figure 22. Project's structure.

The code is added to existing App.vue, AboutView.vue, HomeView.vue files and created components: SearchForm.vue, MultiChoice.vue, InfoQuestions.vue and FactsClick.vue that are located in "component" folder (Figure 22). The pictures and graphics are saved in "assets" folder and are saved in png format in order to maintain theirs transparent background, which remove the possible differences in background colours between elements.

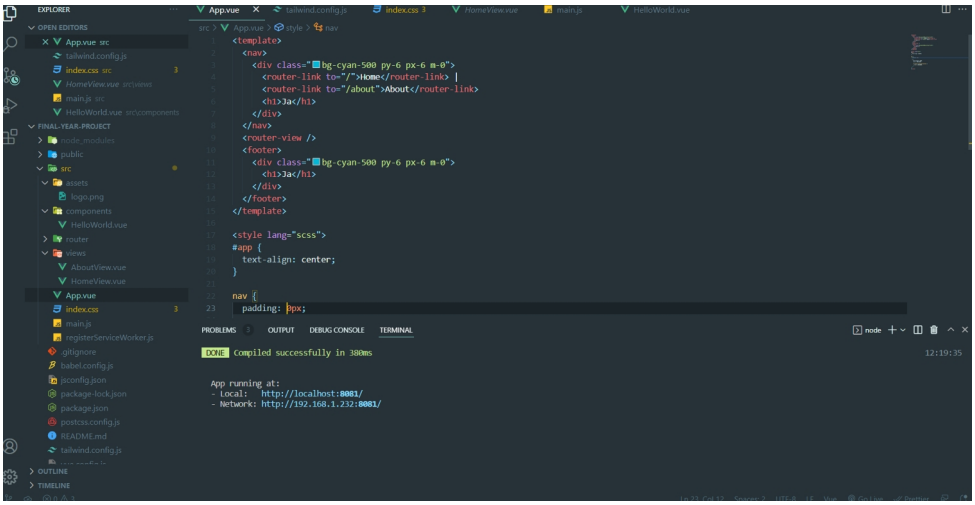

Figure 23. First changes added to freshly created project.

Some of the initial changes made and the terminal output after “npm run serve” was typed to run the code (Figure 23).

```
#app {
  text-align: center;
  font-family: Arial, Helvetica, sans-serif;
  color: white;
  letter-spacing: 0.15em;
}

nav {
```

Figure 24. CSS applicable to the entire application.

CSS code applied to all of the .vue files as an external CSS (Figure 23). It aligns text in center, changes font-family and text colour. It also sets certain, increased spacing that will be applied to all texts across web pages added in the project.

```
        <FactsClick />
      </div>
    </div>
  </template>

  <script>
  import FactsClick from "../components/FactsClick.vue";
  import InfoQuestion from "../components/InfoQuestion.vue";

  export default {
    name: "AboutView",
    components: {
      InfoQuestion,
      FactsClick,
    },
  };
  </script>
```

Figure 25. Importing and registering components.

FactsClick.vue and InfoQuestion.vue are Vue reusable instances. Components are imported to a file and can be used as a <ComponentName /> within template part of the file (Figure 25).

Export default exports page content with added external component what makes it component itself that can be now imported and used in different files.

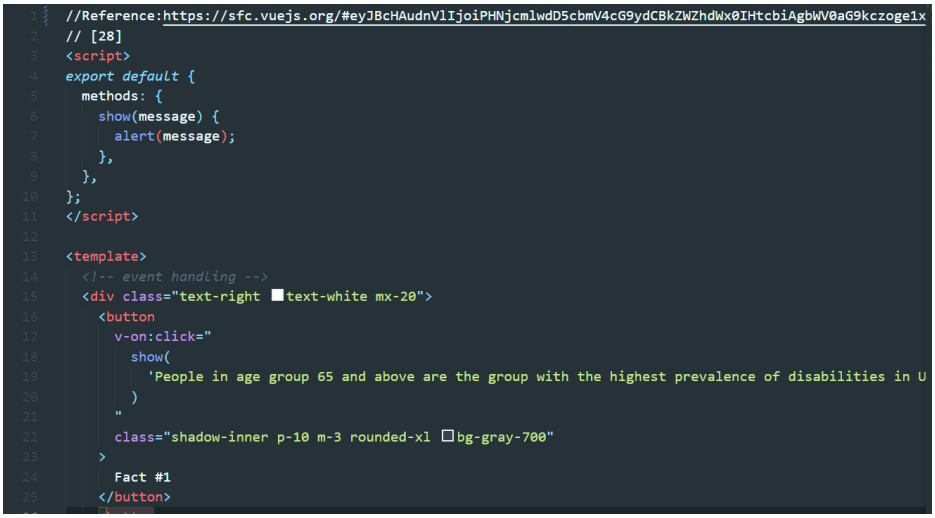

Figure 26. FactsView.vue component explanation [28].

FactsView.vue is a component that includes code for clickable, contrastive buttons with extra paddings added to increase the size and clickable area of the element (Figure 26). The buttons are positioned close to the text to minimise the movement required to navigate through page. This adaptation is valuable for people with physical disabilities.
V-on is responsible for binding and showing the content when user clicks on the button. It is displayed as a popup window in the middle of the screen.

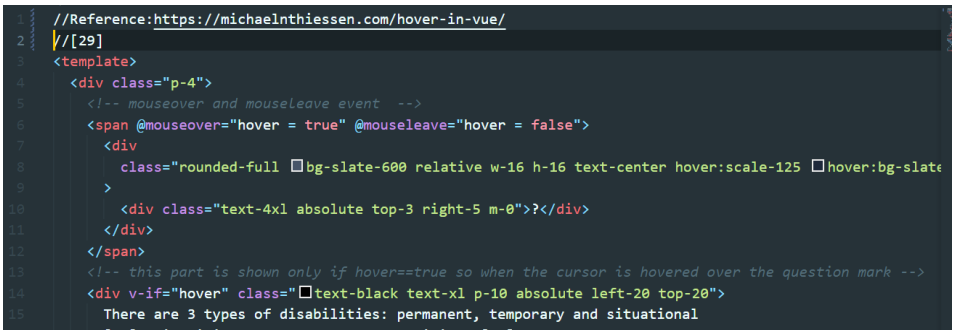

Figure 27. InfoQuestion.vue component explanation [29].

Mouseover is an event listener that checks if the mouse courser is placed within the element (Figure 27). It uses the directive “v-if“ and display the content of the tag if hover is ==true. Otherwise (when cursor is outside of the element’s scope), the content is not visible.

```
//Reference:https://sfc.vuejs.org/#eyJBcHAudnVlIjoiPHNjcmlwdD5cbmV4cG9ydCBkZWZhdWx0IHtcbiAgZGF0YSgpIHtcbiA
//[30]
<script>
export default {
  data() {
    return {
      font: "",
    };
  },
};
</script>

<template>
  <!-- event handling -->
  <span> CHOOSE YOUR FONT: {{ font }}</span>
  <select class="p-2 text-black rounded-2xl" v-model="font">
    <option value="">Please select your font:</option>
    <br />
    <option>Arial</option>
    <option>Courier</option>
```

Figure 28. MultiChoice.vue component explanation [30].

Styling includes adding hover effect and background colour change to an element what results in extra interactivity being added (Figure 28).
User input (in this case one of the options chosen) is collected through data binding, added as an HTML element (double curly braces) and displayed on a page.

```
//Reference:https://sfc.vuejs.org/#eyJBcHAudnVlIjoiPHNjcmlwdD5cbmV4cG9ydCBkZWZhdWx0IHtcbiAgZGF0YSgpIHtcbiA
//[31]
<template>
  <h1 class="p-5 rounded-lg">Your search: {{ search }}</h1>
  <input
    v-model="search"
    placeholder="to search type here"
    class="bg-white px-10 py-4 text-black"
    input="search"
    id="search"
  />
</template>
```

Figure 29. SearchForm.vue component explanation [31].

Similarly, “v-model” collects user input in form of text and displays it (Figure 29). The input can be changed what will simultaneously change the output without reloading the page.
Placeholder attribute (HTML5 [56]) is an example text that is visible before any user’s input is provided.

```
<template>
  <div class="about">
    <div class="bg-amber-100">
      <InfoQuestion />
    </div>
    <div class="relative">
      <img
        class="w-full"
        src="../assets/creambackground.png"
        alt="Cream illustration background with three people."
      />
      <div class="absolute bottom-20 left-40 text-6xl text-black p-20">
        <h1>Inclusive design</h1>
        <p class="text-2xl">for everyone</p>
      </div>
```

Figure 30. Adding and using a component in web application.

Example of component call that was previously imported in <script> section (Figure 30).

```
  <div class="relative">
    <img
      class="w-full"
      src="../assets/purplebackground.png"
      alt="Purple illustration background. Book and school kit illustration"
    />
    <!-- //Reference:
https://stackoverflow.com/questions/60362442/cant-center-absolute-position-tailwind-css
//[33] -->
    <div
      class="absolute w-full transform -translate-x-1/2 -translate-y-1/2 top-1/2 left-1/2 text-white"
    >
      <div class="right-44 bottom-0 p-30 absolute max-w-3xl text-left">
        <h1 class="text-6xl p-3">For who?</h1>

        <p class="text-xl">
          Web page focused on accessibility adjustments for people with
          different disabilities like: dyslexia, epilepsy and color blindness.
        </p>
```

Figure 31. Absolute and relative positioning of some of the elements.

Using absolute and relative positioning of element to achieve text within the image that be responsive (Figure 31). Using div as a containers to group and style elements. Transform allows to properly position text in this case.

```
<template>
  <header>
    <!-- //Reference:https://tailwindcss.com/docs/flex
    //[34] -->
    <!-- using flexbox for navigation bar -->
    <nav class="flex justify-between bg-gray-600 px-6 py-3 m-0">
      <div class="flex-1 flex-nowrap">
        <!-- navigating between pages -->
        <router-link to="/">
          <img class="max-h-16" src="./assets/logo.png"
        /></router-link>
      </div>
      <router-link to="/" class="flex px-8 pt-4 text-xl">Home</router-link>
      <router-link to="/about" class="flex px-8 pt-4 text-xl"
        >About</router-link
      >
    </nav>
    <router-view />
  </header>

  <!--  footer onthe  bottom of the page -->
  <footer class="bottom-0">
    <div class="bg-gray-600 py-6 px-6 m-0 absolute bottom w-full">
```

Figure 32. Flexbox positioning and router links.

Using flexbox is another way to successfully position elements (Figure 32). In this case, flexbox was used to create a navigation bar and helped to align and position elements correctly.
Router plugin creates <router-link> tag which is responsible for navigation and styled as other elements. Usage of router makes a project a single-page application which allows to navigate between pages without reloading, what positively impacts the speed of the entire application. Logo is included as one of the router links what is another way that enables user to go back to home page.

src > main.js

```
/* eslint-disable */
import { createApp } from "vue";
import App from "./App.vue";
import "./registerServiceWorker";
import router from "./router";
import './index.css';

createApp(App).use(router).mount("#app");
```

Figure 33. Main.js file.

Main.js is the starting point of the app that initialise the entire application (Figure 33).

src > index.css

```
@tailwind base;
@tailwind components;
@tailwind utilities;
```

Figure 34. Tailwind directives.

Tailwind directives required to install and be able to use Tailwind in the project (Figure 34).

```
    <h1>Inclusive design</h1>
    <p class="text-2xl">for everyone</p>
  </div>
```

Figure 35. Semantic tags.

The project includes many different semantic tags used to add hierarchy and structure to project (Figure 35).

```
<main>
  <article>
    <h1 class="text-5xl py-1 px-20">FACTS</h1>
    <p class="m-10">
      People in an age group 65 and above every 2 in 5 people has a
      disability [26].
    </p>
  </article>
  <article>
    <p class="m-10">
<aside>
  <h3 class="m-10 text-xl text-right text-black">
    read more facts below >>
  </h3>
</aside>
```

Figure 36. Article, aside and main tags.

Semantic tags help with SEO and accessibility (Figure 36). Main, aside, and article semantic tags were introduced in HTML5 [56]. Paragraphs are short and are not longer than two lines of text each.

```
<section>
  <div class="p-20 bg-purple-700 text-white">
    <h1 class="w-full text-4xl text-right px-10 py-4">
      Why is it important?
    </h1>
    <p class="px-10 w-full text-2xl text-right">
      Over 1 billion people worldwide suffer from variety of disabilities [1].
    </p>
  </div>
</section>
```

Figure 37. Different semantic tags within a section.

Section tag adds extra seperation to the page and is another HTML5 [56] semantic tag (Figure 37).

```
<!-- //Reference: https://v1.tailwindcss.com/components/forms //[32] -->
<div class="absolute bottom-20 left-40 text-xl p-20">
  <label for="search" class="text-7xl my-10 text-black"
    >Accessibility</label
  >
  <form class="max-w-lg bottom-0">
    <div class="flex items-center justify-center drop-shadow-lg">
      <SearchForm />
      <button class="bg-gray-600 px-10 py-4">Search</button>
    </div>
  </form>
</div>
```

Figure 38. Form, button, label tag.

Instead of constant use of div, semantic tags that were used are differentiated (form, button) (Figure 38). Form included label displayed on top of it. The text and buttons are have increased size and paddings for better visibility. Buttons are positioned directly next to related text to limit the movement and efford required to click it.

```
<div class="relative">
  <img
    class="w-full"
    src="../assets/yellowbackground.png "
    alt="Yellow illustration background on top of the page. Open book and arrow illustration."
  />
```

Figure 39. Alt tag added to all images.

Each of the images contains an alt tag with a detailed image description (Figure 39). It helps people with visual impairments to understand the image and what is being shown. It is also helpful when there is some kind of error or slow internet connection and image is not loading. There is are no images of text. Text is added on top of illustration/image allows people with low vision to scale it without loosing sharpness[54].

Another thing that I tried to implement was a button that would change a background of the current section. I tried to achieve it by accessing document queryselector that

would access CSS properties and change it to different value when user clicks the button,as well as I tried to implement it using getElementbyID, but unfortunately after many attemps, both of these methods were unsucessful.

3.3 Design

The subject of the project requires detailed and carefully chosen design choices. It makes it even more significant because of the impact it can leave on people's lives.

3.3.1 Font

Font choice, size and its spacing are especially important for dyslexic people. The font chosen for this project is Arial. Along with three other fonts: Helvetica, Courier and Verdana, it is being considered the best choice for people with this form of disability [44]. There is no use of any underlying text or italic font type. There is only minimal use of capital letters to differentate the content without distracting user from most important main elements. All of these things are shown to have negative impact on font readibility for people with dyslexia [44]. Arial belongs to Sans sarif family which,,together with Roman and monospaced font styles, is being considered as one of the most dyslexia-friendly group of fonts currently available [45]. Bigger character spacing and spacing between lines of text was also shown to improve readibility of text [46]. The font size is significantly increased in all parts of the application to make it more accessible for dyslexic and/or visually impaired people.

3.3.2 Prototype

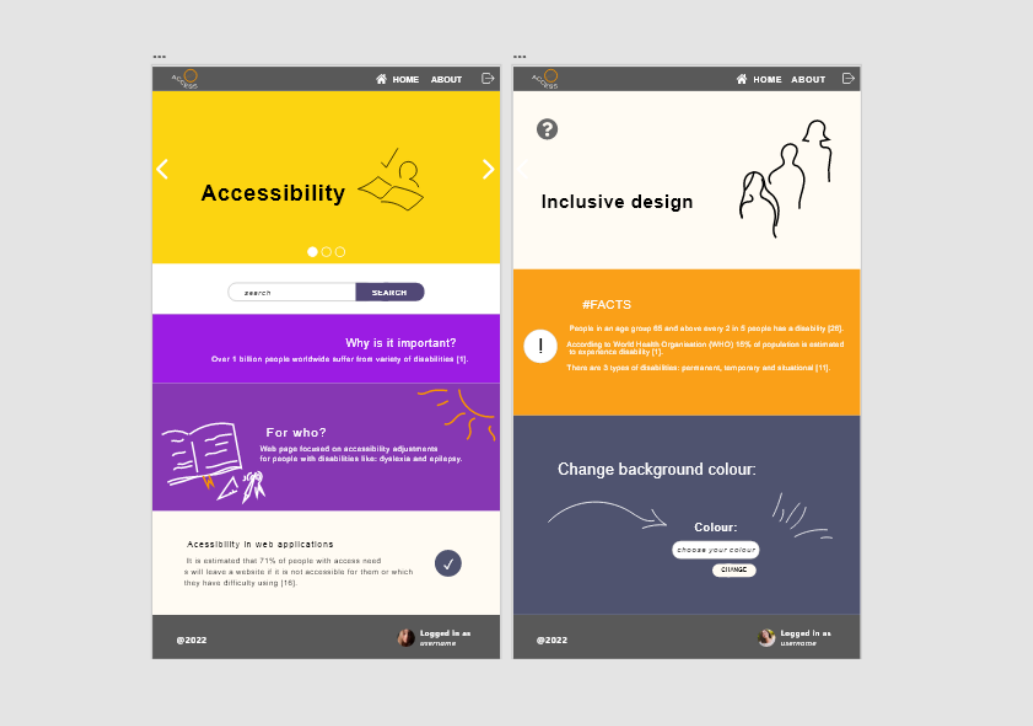

Figure 40. Prototype's initial design that was tested on users.

Prototype is made using Adobe XD [57] (Figure 40). Icons and other graphics used in the previous versions of the prototype were replaced by my own hand-drawn illustrations and pictures. High fidelity prototype was made with the goal to gather people's feedback about the design choices and its implementation.
The prototype's user testing results are explained in detail in section 3.1.2.

3.3.3 Illustrations

Figure 41. All of the illustrations used in product's design.

Illustrations were made using Adobe Illustrator [57] (Figure 41).
Using illustrations in web design is has its advantages for user interface and they can be used as a way to communicate ideas and values more successfully to user [36]. It is clearer and less distracting for user than using images and other visual tools. Illustrations are hand-drawn. It is shown that hand-drawing helps with stress relief, boosts creativity and strengthens the ability to focus [39]. Decrease in image usage can be especially beneficial for people suffering from epilepsy. Some of the pictures, even without any movement, can trigger seizures in people with this form of disability [37]. There is no use of vertical lines in any of them as it is believed to have a similar effect for people witth photosensitive epilepsy [38]. The illustrations are a visual representation and are expected to help with understanding the content of the web page. It can be helpful for people with different types of disabilities as well as regular users of the page. The illustrations are saved as png files in „assets" folder within the project.

3.3.4 Colour

Web application uses various colours in its design. There are mostly chosen by considering levels of contrast that is expected to be achieved, the visibility of the colour as well as the psychology behind it and overall effect it has on user. The other reason behind using different colours and shades is to divide and seperate the content to make it easier for potential user to understand.

The design of the product does not include colours like red//pink, blue and green that could potentially be expected to cause reading to be more problematic for people with dyslexia [48]. Red flicker is more likely to increases seizure threshold for people with epilepsy than some of the other colours [49].

Purple is also representing epilepsy awareness what, on top of the most important visibility benefits, makes it a perfect choice for this project [47].
Patterns with high level of contrast (e.g. black and white) could be more epileptogenic [50].

3.3.5 Contrast level

The dark buttons with white text are placed among less contrastive background with added shadows in some of them to make the transition between colour less problematic and contrastive. There is no use of black elements on pahe and are replaced by dark gray. White background is replaced with cream colour background to decrease the likelihood of being problematic. Another advantage of black and cream pair is the fact that it is the fastest to read among other pair of colours [51]. By contrast, black and yellow pair was preferred by biggest percentage of dyslexic people [51].

Contrarily, older people greatly benefit from really high and contrastive design [52]. Their clear vision and colour sensitivity is often decreased due to aging processes happening in the body. Similarly, people with other visual impairments tend to prefer higher level of contrast as well what makes it an important adjustment for both of these groups of people.

For people diagnosed with colour blindness, using meaning behind colours and trying to achieve certain effect with colour itself can turn out to be unsuccessful [53]. It depends on the type and degree to which it impacts person’s ability to perceive colours, hovewer all groups can benefit from colour and contrast adjustments. The inability to discern between a pair of colour can make it impossible to distinguish its elements as it all appears as one for people with this kind of disability [53].
The most popular pairs of colours include: red-green, blue-yellow and red-black [53]. None of this groups of colours was included in the project’s design. In case of total colour blindness, the accurate level of contrast is necessary in order to make elements of the web application visible and accessible.

Contrast is possibly one of the limitations of the project.

4. Results and discussion

4.1 Results

The overall goal of the project was achieved. I did manage to create a product which reached the expectations I had initially. The idea behind the project and goal was very broad which allowed me to be flexible in its implementation. This ability to remain open-minded during the process let me be creative but I had to still be realistic and not settle or become too comfortable with the results already obtained. I am satisfied with the final product. However there are some areas that, I believe, could be done better or differently when approached with more experience.

4.2 Limitations

In my judgement, the project ended up being mainly focused on creating a product accessible for people with dyslexia, epilepsy and colour blindness. There were some adjustments for people with physical disabilities and elderly, but the final look and implementation of project was mostly focused on three groups of people above-mentioned. Those were the groups of people that I managed to reach and find out about the most. The initial idea was to include realistically as many different people as a target audience as possible. It was very unspecific, but it is also understandable due to the fact that I could not possibly know without gathering more information about these groups of people, their feedback and who specifically and to what extent I will be able to reach them. It is very hard to tell if it was success or not because of, in my opinion, it fully depends on the point of view. I wanted to include many different groups of people with different disabilities while also being realistic about it and see how far I can possibly go which, ultimately, was achieved.
Open-mindedness and curiosity behind this project was incredibly helpful and allowed me to experiment and try many different paths, but without setting goals and maintaining discipline, it could potentially lead to worse results. This was the part I had to push through and be aware of.

The technical level of this project and coding that I was able to implement was definitely on much higher level than presented in submitted prototype, although there were some of the ideas and goals I was not able to achieve due to my limited knowledge and usage of new tools that I did not previously had opportunity to work with much. The choice was very accurate and I am glad it turned to be exactly what I was expecting it to be, although the time and my current abilities at the level I am at were not enough in some cases like: background change when button is clicked, change of font on entire website and even more advanced, text to voice function what would be especially important for groups of people I did not manage to fully focus on. Setting up, the initial stage of coding and errors I encountered provided me with the opportunity to learn more about how these specific frameworks and libraries work. I needed to change some of the things in node_modules folder of the project because of the problems with downloaded packages. Some of the packages were

installed globally and not locally and vice versa, which led to errors displayed in terminal and inability to run code properly. I had to make sure the code formatting was correct every time project was saved in order to make it work, which was caused by the option that was chosen as a default while creating a project in GUI. End of Lines error were caused by differences between Unix systems and Windows which is not a limitation as such, but a thing to be aware of that could potentially make it more difficult to open and run the code on different computers. In general, the errors that occurred were handled regularly and often without letting them build up.

The colours and contrast level was another limitations of the project. As being one of the most important things I had to consider, there was a lot of reasoning behind it. People's feedback and research showed very similar results. I think the colours adjustment and choosing between them was still relatively within the scope of my abilities as I could find a middle ground and overlap between colours preferred by each one of the groups that product focuses on. Even though it required minimal compromise and I could still accomplish whatever I needed to at the moment, I was still forced to choose between focus groups and sometimes had to prioritise one over the other.

On the other hand, level of contrast was much more difficult. It did become purely a choice between people's needs and their preferences. Different groups of people required different contrast levels. There is a possibility to find some of the groups of people with disabilities that would find the same level of contrast to in app to be helpful, however, even considering only these three/four groups, it was overly impossible. It is especially visible in case of people with dyslexia, epilepsy and colour blindness. Preferences regarding both, contrast and colours, differed within not only groups of people, but sometimes even within the same disability group and contradicted one another. Dyslexic people and people with epilepsy were expected to benefit from using cream background with black text to decrease the contrast to be easier to read or potentially less triggering, while for people with colour blindness and even elderly (which is not a disability itself but they often require some sort of accessibility adjustments) choosing white background would be much better option as it increases the contrast. There are a few elements (like white text on yellow background) which potentially can be invisible for some people (achomats/colour blind) but because of the fact that it was not something user should focus on, I chose to implement it this way. Otherwise, it could become too distracting from the main content. This is why, as far as I'm concerned, choosing level of contrast should be based strongly on type of content, the message that is expected to be conveyed and prioritising some of the target groups over the others could be inevitable.

4.3 Future work

Even though there was quite a lot of feedback at different stages that was received from people the application focuses on, I think there is still a lot of details that could use second opinion from different, bigger group of people. The late stage evaluation would most probably show some areas that would require changes.

As described before, I think most important thing I would love to implement now, is text to voice, change of font and change of background which would add option to customise the website even more. It would be my priority for now before all of the other ideas for future work.

4.4 Self-evaluation

The project required to broaden my knowledge in both, practical and theoretical knowledge. It was necessary in order to achieve previously set goals. It was especially important to become more comfortable with chosen softwares and frameworks. The coding part was especially difficult for me and was probably the most time consuming as well. The final product is just how it look and behave at the end but all of the research, preparing, decision and, most importantly, effort cannot be seen through looking at it alone.
On top of that, planning and setting realistic deadlines were important. Except for the technical requirements for this project, discipline and time management were probably one of the most difficult parts that required a great amount of focus.
Overall, the project taught and challenged me a lot on many different levels. The skills and abilities I gained during the entire process will definitely be beneficial in work-related, career aspect. However, it will have a positive impact in personal growth and self-development and as well. As a person without any form of disability, the project was not only educational for me, but also allowed me to find a new perspective and look at things from different points of view.
It was the biggest, most demanding project up to now which highlighted deficiency I was not aware before. Even though project has its limitations and things I was not able to implement on my current level of experience, awareness about these gaps and new knowledge and skills learned were the ultimate success that, I believe, I will greatly benefit from in the future.

5. Conclusion

Ultimately, it is the awareness about different needs that provides an opportunity to choose if it is the best option to include accessibility adjustments.
The entire process shown that there are types of adjustments that are often overlooked and do not require any type of overall concept or content change in order to include them. Colour changes and using semantic tags are one of the examples of this kind of adjustments.
I believe the best choice would be to include option to customise website based on users' needs. However, depending on the way it would be implemented, it could become exhausting and distract user from main content if there would be a lot of choices needed to be made within the page constantly. One of the possible solutions to it would be to create it in hidden, universal place that is similar in all web applications.

Sometimes the choice between reaching different groups of people or compromising content in order to broaden the audience will be inevitable but, at the end of day, this is the awareness of differences between all of us and going the extra mile to make website accessible that matters, even if it means making choices that will exclude someone, but benefit the other group of people in much bigger way. Trying to reach everyone may results in not reaching anyone at all if it means that there are big adjustments needed to be made resulting in content being utterly useless at the end. Any step towards making web application more accessible taken by web developers, designers or people involved in decision making, is worth the effort.
To the best of my knowledge, accessibility in web applications is still a relatively new concept and there are many more ways in which it can be improved in the future.

There is also a thin line between people's needs and theirs preferences which makes the entire concept even more complex and complicated without a simple, straightforward answer.

While this project proved it is unrealistic to make a web application accessible for everyone and, as wholehearted and thoughtful as the idea is, there are still many examples of accessibility adjustments that can be included without any compromises needed.

Bibliography:

The project was written using LibreOffice Writer [55].

Code was written based on official Tailwind CSS [35] and Vue JS [20] documentation. If there was any code copied and/or used from other source, it was acknowledged within the code and references were provided in this paper and README file available in the project folder.
Prototype is done using Adobe XD and illustrations are created using Adobe Illustrator. Both of these Adobe products [57] are using licence provided by Goldsmiths, University of London.

[1]
Disability and health
Published by World Health Organization; Published on 24 November 2021 ,
Available at:https://www.who.int/news-room/fact-sheets/detail/disability-and-health

Accessed: January 19, 2022;
[2]
What is accessibility?
Published by MDN contributors, no publication date, last modified: Oct 8, 2021,
Available at:
https://developer.mozilla.org/en-US/docs/Learn/Accessibility/What_is_accessibility
Accessed: January 28, 2022;
[3]
Top JavaScript Frameworks and Tech Trends for 2021
Published by Eric Elliott, Published on Dec 31, 2020
Available at: https://medium.com/javascript-scene/top-javascript-frameworks-and-tech-trends-for-
2021-d8cb0f7bda69
Accessed: January 20, 2022;
[4]
Why Use Tailwind CSS for Your Next Project
Published by Jose Felix, Published on Nov 17, 2020
Available at:https://dev.to/joserfelix/why-use-tailwind-css-for-your-next-project-39hp
Accessed: January 20, 2022;
[5]
Introduction to Tailwind CSS
No author, No publication date; Last updated: 03 Jul, 2021; Article contributed by: Sapna2001
Available at:https://www.geeksforgeeks.org/introduction-to-tailwind-css/
Accessed: January 20, 2022;
[6]
Introduction to Understanding WCAG
Authors: Accessibility Guidelines Working Group; No publication date; Updated 12 January 2022
Available at: https://www.w3.org/WAI/WCAG21/Understanding/intro#understanding-the-four-
principles-of-accessibility
Accessed: January 20, 2022;
[7]
11 Minimal JavaScript Frameworks You Need To Know
Published by Sufyan bin Uzayr; Published on Apr 04, 2016; Updated on Jul 14, 2020
Available at: https://www.jotform.com/blog/11-minimal-javascript-frameworks-96416/
Accessed: January 20, 2022;
[8]
Setting up Tailwind with Vue.js
Published by James Perkins; Published on March 31, 2021
Available at: https://www.sanity.io/guides/tailwind-css-with-vue-js
Accessed: January 20, 2022;
[9]
Form created with Google Forms
https://docs.google.com/forms/u/0/?tgif=d
Accessed: January 21, 2022;
[10]
Accessible design is for All!
Published by Kartik Malviya; Published on Nov 11, 2020
Available at:https://uxplanet.org/accessible-design-is-for-all-bb83bb2b4b2f

Accessed: January 21, 2022;
[11]
Inclusive Web Design - Why Our Websites Should Be More Accessible
Published by Dave Redfern ; Published on 7th October 2016
Available at: https://www.iweb.co.uk/2016/10/inclusive-design-why-our-websites-should-more-
accessible/
Accessed: January 21, 2022;
[12]
Not All Disabilities Are Visible: Improve Awareness and Access
Published by: Daisy Ein; Published on Dec 3, 2020
Available at: https://business.tutsplus.com/articles/hidden-disabilities-workplace-access--cms-36222
Accessed: January 21, 2022;
[13]
Official Vue.js page (GitHub: https://github.com/vuejs/)
by Evan You
Available at: https://vuejs.org/
Accessed: January 22, 2022;
[14]
Official Tailwind CSS page (GitHub:https://github.com/tailwindlabs/tailwindcss)
Available at: https://tailwindcss.com/
Accessed: January 22, 2022;
[15]
What Are The Reasons We Use Libraries & Frameworks In Web Development
Published by Vivek Naskar; Published on Sep 15, 2021;
Available at: https://medium.com/quick-code/what-are-the-reasons-we-use-libraries-frameworks-in-
web-development-6853773686f7
Accessed: January 22, 2022;
[16]
The Click-Away Pound Report 2016
Assessing the online shopping experience of customers with
disabilities, and the costs to business of ignoring them.
Published by: Rick Williams and Steve Brownlo; Published on December 1st 2016
Available at: http://www.clickawaypound.com/cap16finalreport.html
PDF link: http://www.clickawaypound.com/downloads/cap16final2711.pdf
Accessed: January 22, 2022;
[17]
Official page of Visual Studio Code (GitHub: https://github.com/Microsoft/vscode/)
by Microsoft
Available at: https://code.visualstudio.com/
Accessed: January 22, 2022;
[18]
The Reasons why you Must Use Visual Studio Code
Published by Denis Cangemi; Published on Jul 29, 2020
Available at: https://blog.devgenius.io/the-reasons-why-you-must-use-visual-studio-code-
b522f946a849
Accessed: January 22, 2022;
[19]

Official Github page
Available at: https://github.com/
Accessed: January 22, 2022;
[20]
Official Vue.js documentation (GitHub: https://github.com/vuejs/)
by Evan You
Available at: https://vuejs.org/v2/guide/
Accessed: January 28, 2022;
[21]
Which Modern Frontend is the Fastest: React, Angular, Vue.js, Next.js, or Nuxt.js?
Published by Lauren Bradley; Published on September 2, 2020
Available at: https://www.layer0.co/post/fastest-frontend-react-angular-vue-next-nuxt
Accessed: January 28, 2022;
[22]
Vue vs. React: Performance, Speed, Use Cases
Published by: Vitaliy Ilyukha; No publication date
Available at: https://jelvix.com/blog/js-frameworks-is-vuejs-better-than-react
Accessed: January 28, 2022;
[23]
9 reasons to choose Vue.js for your business
Published by: Piotr Karwatka; Published on: May 5, 2021
Available at: https://www.divante.com/blog/9-reasons-to-choose-vue-js-for-your-business
Accessed: January 28, 2022;
[24]
Digital Around the World
No author; No publication date;
Available at: https://datareportal.com/global-digital-overview
Accessed:January 31,2022;
[25]
The Pros and Cons of Tailwind CSS
Published by Nancy Young; Published on September 24, 2021
Available at: https://www.webdesignerdepot.com/2021/09/the-pros-and-cons-of-tailwind-css/
Accessed: January 31, 2022;
[26]
Prevalence of Disabilities and Health Care Access by Disability Status and Type Among Adults —
United States, 2016
No author; No exact publication date (year 2016); Page last reviewed: September 16, 2020
Available at: https://www.cdc.gov/ncbddd/disabilityandhealth/features/kf-adult-prevalence-
disabilities.html
Accessed: January 31, 2022;
[27]
Published by: Kraus, L., Lauer, E., Coleman, R., and Houtenville, A. (2018). 2017 Disability
Statistics Annual Report. Durham,
NH: University of New Hampshire.
Available at: https://disabilitycompendium.org/sites/default/files/user-uploads/

2017_AnnualReport_2017_FINAL.pdf
Accessed: January 31, 2022;
[28]
Code reference for code used in FactsClick.vue
Posted by user:yyx990803 (Evan You)
Available at:
https://sfc.vuejs.org/#eyJBcHAudnVlIjoiPHNjcmlwdD5cbmV4cG9ydCBkZWZhdWx0IHtcbiAgbWV0aG9kczoge1xuXHQgIHNheShtZXNzYWdlKSB7XG4gICAgXHRhbGVydChtZXNzYWdlKVxuICBcdH1cblx0fVxufVxuPC9zY3JpcHQ+XG5cbjx0ZW1wbGF0ZT5cblx0PGJ1dHRvbiBAY2xpY2s9XCJzYXkoJ2hpJylcIj5TYXkgaGk8L2J1dHRvbj5cbiAgPGJ1dHRvbiBAY2xpY2s9XCJzYXkoJ3doYXQnKVwiPlNheSB3aGF0PC9idXR0b24+XG48L3RlbXBsYXRlPiIsImltcG9ydC1tYXAuanNvbiI6IntcbiAgXCJpbXBvcnRzXCI6IHtcbiAgICBcInZ1ZVwiOiBcImh0dHBzOi8vc2ZjLnZ1ZWpzLm9yZy92dWUucnVudGltZS5lc20tYnJvd3Nlci5qc1wiXG4gIH1cbn0ifQ==
Accessed on: May 1, 2022;
[29]
Code reference for code used in InfoQuestion.vue
Title: How to Implement a Mouseover or Hover in Vue
Published on: November 2018, Unsigned author; Website owner: Michael Thiessen;
Available at: https://michaelnthiessen.com/hover-in-vue/
Accessed: May 1, 2022;
[30]
Code reference for code used in MultiChoice.vue
Posted by user: yyx990803 (Evan You)
Available at:
https://sfc.vuejs.org/#eyJBcHAudnVlIjoiPHNjcmlwdD5cbmV4cG9ydCBkZWZhdWx0IHtcbiAgZGF0YSgpIHtcbiAgICByZXR1cm4ge1xuICAgICAgc2VsZWN0ZWQ6ICcnXG4gICAgfVxuICB9XG59XG48L3NjcmlwdD5cblxuPHRlbXBsYXRlPlxuICA8c3Bhbj4gU2VsZWN0ZWQ6IHt7IHNlbGVjdGVkIH19PC9zcGFuPlxuICA8c2VsZWN0IHYtbW9kZWw9XCJzZWxlY3RlZFwiPlxuICAgIDxvcHRpb24gZGlzYWJsZWQgdmFsdWU9XCJcIj5QbGVhc2Ugc2VsZWN0IG9uZTwvb3B0aW9uPlxuICAgIDxvcHRpb24+QTwvb3B0aW9uPlxuICAgIDxvcHRpb24+Qjwvb3B0aW9uPlxuICAgIDxvcHRpb24+Qzwvb3B0aW9uPlxuICA8L3NlbGVjdD5cbjwvdGVtcGxhdGU+IiwiaW1wb3J0LW1hcC5qc29uIjoie1xuICBcImltcG9ydHNcIjoge1xuICAgIFwidnVlXCI6IFwiaHR0cHM6Ly9zZmMudnVlanMub3JnL3Z1ZS5ydW50aW1lLmVzbS1icm93c2VyLmpzXCJcbiAgfVxufSJ9
Accessed: May 1, 2022;
[31]
Code reference for code used in SearchForm.vue
Posted by user: yyx990803 (Evan You)
Available at:
https://sfc.vuejs.org/#eyJBcHAudnVlIjoiPHNjcmlwdD5cbmV4cG9ydCBkZWZhdWx0IHtcbiAgZGF0YSgpIHtcbiAgICByZXR1cm4ge1xuICAgICAgbWVzc2FnZTogJydcbiAgICB9XG4gIH1cbn1cbjwvc2NyaXB0PlxuXG48dGVtcGxhdGU+XG4gIDxwPk1lc3NhZ2UgaXM6IHt7IG1lc3NhZ2UgfX08L3A+XG5cdDxpbnB1dCB2LW1vZGVsPVwibWVzc2FnZVwiIHBsYWNlaG9sZGVyPVwiZWRpdCBtZVwiIC8+XG48L3RlbXBsYXRlPiIsImltcG9ydC1tYXAuanNvbiI6IntcbiAgXCJpbXBvcnRzXCI6IHtcbiAgICBcInZ1ZVwiOiBcImh0dHBzOi8vc2ZjLnZ1ZWpzLm9yZy92dWUucnVudGltZS5lc20tYnJvd3Nlci5qc1wiXG4gIH1cbn0ifQ==
Accessed: May 2, 2022;
[32]

Code reference for code used in HomeView.vue
(Official Tailwind CSS website)
Available at: https://v1.tailwindcss.com/components/forms
Accessed on: May 2, 2022;
[33]
Code reference for code used in HomeView.vue
Posted by:Adharsh M
Posted on: April 2, 2021
Available at: https://stackoverflow.com/questions/60362442/cant-center-absolute-position-tailwind-css
Accessed: May 2, 2022;
[34]
Code reference for flexbox use in App.vue
(Official Tailwind CSS documentation)
Available at:https://tailwindcss.com/docs/flex
Accessed: May 2, 2022;
[35]
Official Tailwind CSS documentation (GitHub: https://github.com/tailwindlabs/tailwindcss)
Available at: https://tailwindcss.com/docs/installation
Accessed: May 4, 2022;
[36]
Hand-Drawn Illustration to Boost Your Design Project
Published by: Mariana Published on: 15 November 2019
Available at: https://monsterspost.com/hand-drawn-illustrations/
Accessed: May 4, 2022;
[37]
Gamma oscillations and photosensitive epilepsy
Published by: Dora Hermes, Dorothee G.A Kasteleijn-Nolst Trenite, Jonathan Winawer
Published on: May 08, 2017
Available at: https://www.cell.com/current-biology/fulltext/S0960-9822(17)30406-2?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0960982217304062%3Fshowall%3Dtrue
Accessed: May 4, 2022;
[38]
Why vertical stripes might trigger seizures in photosensitive epilepsy
Published on: May 2017; Published by Epilepsy Action 2021;
Available at:https://www.epilepsy.org.uk/news/news/why-vertical-stripes-might-trigger-seizures-photosensitive-epilepsy-67318
Accessed : May 4, 2022;
[39]
The Science-Backed Ways that Sketch Drawing Improves Mood
Last updated on: March 14, 2019; No published author;
Available at: https://www.invaluable.com/blog/sketch-drawing/
Accessed: May 4, 2022;
[40]
Official Heroku page
Available at: https://devcenter.heroku.com/
Accessed: May 4, 2022;
[41]

Deploy a Vue.js App to Heroku
Published by: Marouen Helali
Published on: February 14, 2020;
Available at:https://dev.to/marwan01/deploy-a-vue-js-app-to-heroku-30m
Accessed: May 4, 2022;
[42]
Accessible.
Dictionary,
Published by: Merriam-Webster, No publication date;
Available at: https://www.merriam-webster.com/dictionary/accessible
Accessed: May 4, 2022;

[43]
What is the most dyslexia friendly colour combination
Published by:Toni Leigh
Published on February 20, 2015;
Available at: https://ux.stackexchange.com/questions/73916/what-is-the-most-dyslexia-friendly-colour-combination
Accessed: May 4, 2022;
[44]
Dyslexia Font and Style Guide
Published by: Michael Bates; No publication date;
Available at: https://www.dyslexia-reading-well.com/dyslexia-font.html
Accessed: May 4, 2022;
[45]
Good Fonts for Dyslexia
Published by: Ricardo Baeza-Yates, Luz Rello; No publication date;
http://dyslexiahelp.umich.edu/sites/default/files/good_fonts_for_dyslexia_study.pdf
Accessed: May 4, 2022;
[46]
Dyslexia Style Guide 2018: Creating Dyslexia Friendly Content
Pulished by:British Dyslexia Association
Published in 2018
Available at: https://cdn.bdadyslexia.org.uk/uploads/documents/Advice/style-guide/Dyslexia_Style_Guide_2018-final-1.pdf?v=1554827990
Accessed: May 4, 2022;
[47]
Paint the world purple: the need for focus on epilepsy and older people.
Published by: Donald Macaskill; Published on March 26, 2022;
Available at: https://scottishcare.org/paint-the-world-purple-the-need-for-focus-on-epilepsy-and-older-people/
Accessed: May 4, 2022;
[48]
Dyslexia Study Raises Questions About Eye Differences
Published by: Julie Rawe; Published on:October 31, 2017;
Available at: https://www.understood.org/en/articles/dyslexia-study-finds-differences-in-eye-anatomy
Accessed: May 4, 2022;
[49]
Colour and photosensitive epilepsy

Published by:Binnie CD, Estevez O, Kasteleijn-Nolst Trenité DG, Peters A.;
Published on: November 1984
Available at: https://pubmed.ncbi.nlm.nih.gov/6208004/
Accessed: May 4, 2022;
[50]
Photosensitive Epilepsy
Published by: Hedy Marks; Published on :2020;
Available at: https://www.webmd.com/epilepsy/guide/photosensitive-epilepsy-symptoms-causes-treatment
Accessed: May 4, 2022;
[51]
Optimal Colors to Improve Readability for People with Dyslexia
Published by: Luz Rello, Ricardo Baeza-Yates;
Published on:November 19, 2012;
Available at:https://www.w3.org/WAI/RD/2012/text-customization/r11
Accessed: May 4, 2022;
[52]
Cool and Accessible: Successful Design for Senior Users
Published by: Mateusz Kłosiński; Published on: Feb 7, 2022 ;
Available at:https://www.netguru.com/blog/accessible-design-senior-users
Accessed: May 4, 2022;
[53]
How to Make Your Website Accessible for Color-Blind People
No author; Published on: October 17, 2021;
Available at: https://equalizedigital.com/website-accessibility-color-blind/
Accessed: May 4, 2022;
[54]
Why you need to stop putting text on images on your website!
No author; Published on: April 20, 2020;
Available at: https://hollypryce.com/text-images/
Accessed: May 6, 2022;
[55]
Official LibreOffice website
Available at:https://www.libreoffice.org/
Accessed: May 6, 2022;
[56]
HTML5 Basics For Everyone Tired Of Reading About Deprecated Code
Published by: Adam Wood; No publication date;
Available at: https://html.com/html5/;
Accessed: May 6, 2022;
[57]
Official Adobe website
Available at: https://www.adobe.com/uk/products/xd.html
Accessed: May 6, 2022;

Appendix A

The project is deployed with Heroku [40] following the instructions from this website [41].

Github repository: https://github.com/vszyd001/final-year-project

Hosted on server: https://victoria-szyd.herokuapp.com/#/ [40]

How to run:

1. Download GitHub code from respiratory linked above
2. Unpack downloaded zip file
3. Open folder in Visual Studio Code [17]
4. Run npm install in terminal
5. Run npm run serve

-Visual Studio Code[17] will show what plugins and extensions are necessary to install
-in case of post css error run: npm install --save-dev postcss-import
-in case of CR error, check if all of the files that were edited (App.vue, HomeView.vue, AboutVue.vue, SearchForm.vue, MultiChoice.vue, InfoQuestion.vue, FactsClick.vue are set to LT(not CRLF) as a End of Line sequence (option in bottom right corner, between „UTF” and „Vue”). This is caused by difference between line endings of Unix systems and Windows.