# DELIVERABLE 6.6.1

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## Work Package 6

## Design and Development of an accessible Mobile Application

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| PU | Public | |
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**Abstract:**

Innovogy was the partner responsible for the design and development of the Mobile Application in the iAccess project. This document outlines the main contribution of Innovogy Ltd that start with the design process that included a design sprint and the analysis of existing standards. This then followed to the design and development of the mobile application and its final realization. The document is concluded with an evaluation of the app with the detailed evaluation presented in the appendix of this report.

**Keywords:**

Mobile Applications, User Experience Design

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# Introduction

One of the I-Access project deliverables is a mobile application developed to serve as a tourist information point for Valletta in Malta and Palermo in Sicily. This project was set up to address the accessibility challenges in cultural heritage sites. The mobile application intended to present information about accessible cultural heritage also needed to be accessible by design. International accessibility standards were studied and observed o ensure the best approaches in the design. The mobile application was built based on these guidelines and also evaluated against them. This article provides a detailed overview of this process.


*Figure 1: Design Sprint organised by Innovogy in Malta on the 30th March 2019 that included iAccess project partners and stakeholders in the sector.*

# Accessibility Standards

The first stage of the design process was the study of existing guidelines that enable accessible design. The international standards in the area focus on developing websites. These guidelines were therefore adopted and adapted to address the needs of this project. The Web Accessibility Guidelines (WCAG) are regarded as the standard within the industry [1]. The first version of these guidelines was introduced in May 1999 [2], and the latest update took place in 2018 when version 2.1 was released [1].

Each guideline is thought of as a success criterion that has to be fulfilled for the content to be accessible.

WCAG has been developed by the Web Accessibility Initiative (WAI) at the World Wide Web Consortium (W3C) [1]. WAI not only promotes web accessibility by creating international standards such as WCAG but also provides supporting materials to help designers and developers understand these standards and implement them [3, 4].

Another accessibility tool utilised in this project is WAVE, a free browser extension that evaluates accessibility. WAVE can identify accessibility issues and the lack of compliance to WCAG. These identified issues are grouped into the following three categories:

- Errors that must be repaired
- Contrast errors that bring to light elements with insufficient colour contrast between foreground and background
- Alerts that need to be checked

For each of these, the user is presented with an explanation of the issue and its solution. Moreover, this tool extracts positive elements of the website such as structural elements, features and ARIA tags used.

Each success criteria in WCAG is assigned one of three levels of conformance: Level A, Level AA and Level AAA. In order to determine the level assigned, each criterion was evaluated against a set of factors. These include whether its implementation is essential and possible in all types of systems. The table below shows a subset of guidelines to expose the contrast between guidelines at varying levels and how guidelines of a lower level are more important and easy to implement than those at higher levels.

| Success | Level of Con- | Requirement description |
|---|---|---|

| Criteria | formance | |
|---|---|---|
| 1.2.2 | A | Captions are provided for all pre recorded audio content in synchronized media |
| 1.2.6 | AAA | Sign language interpretation is provided for all prerecorded audio content in synchronized media |
| 1.4.3 | AA | The visual presentation of text and images of text has a contrast<br>ratio of at least 4.5:1 |
| 1.4.6 | AAA | The visual presentation of text and images of text has a contrast ratio of at least 7:1 |
| 3.3.1 | A | If an input error is automatically detected, the item that is in error is identified and the error is described to the user in text |
| 3.3.5 | AAA | Context-sensitive help is available such that the text provides information related to the function currently being performed |

When all level A success criteria are met, the website has reached a minimum level of accessibility but is not accessible in all situations in which it will be used. Therefore, these are regarded as the most important criteria to be met. A website must meet all Level A and Level AA criteria to reach a Level AA of conformance. Level AAA conformance is the Highest Level of conformance a website can reach with regards to WCAG. For the highest conformity, all Level A, Level AA and Level AAA guidelines must be followed.

# Accessibility in Mobile Apps

WCAG is the standard when developing accessible content. However, these guidelines are mainly targeted to web content displayed on a desktop. Nonetheless, they can also be applied to some extent to mobile applications. In addition to this, WAI has released a set of best practices for accessible mobile development [2]. These recommendations take into consideration the small screen size, gestures and orientation, among other aspects. Moreover, each recommendation is linked to the relevant guidelines in WCAG for further support. An example of the recommendations made by WAI concerning the small screen size is that the information displayed on a single mobile page should be less than that on a desktop, link text should be shortened, and form fields should be below their label rather than beside their labels.

Previous research has extracted some noteworthy recommendations to guide the accessible design of content displayed on mobile devices. The primary considerations in all accessible software design are mobility, visibility, hearing and cognitive [5]. These are respective to the four main disability groups: physical impairment, visual impairment, auditory impairment and cognitive impairment. Nonetheless, this research highlights one of the main benefits of accessibility which is that accessibility is advantageous to all users, especially in the wide range of scenarios mobile devices are used in. For instance, font and colour customisation reduce eye strain for all users.

Funka [6] provides an additional set of guidelines to WCAG specifically for mobile devices. A number of these guidelines are related to layout and design. Some examples of these are grouping elements that belong together, minimising unnecessary items and placing essential components at the top of the page to be visible without the need to scroll. Another set of guidelines provided by Funka is related to interaction. The use of consistent and straightforward concepts is accentuated, primarily for navigation.

Other essential points of the research in [6] include that all controls should only require one finger and that text input should be minimised. This study also highlights the importance of providing methods for the users to set the application to their preference. The main settings mentioned are zooming, colour inversion and font alteration.

Accessibility can also be studied and evaluated using saliency ranking methods such as [7]. Such an approach would provide insights on which regions of the interface draw most attention based on changes in colour, location on the screen and contrast.

## Design

To ensure that the final product is usable by all, accessibility was considered from the initial design steps. After studying WCAG 2.1, the relevant guidelines were extracted and the initial designs for the user interface of the application could be drawn up. The first designs were low fidelity wireframes which held the accessibility guidelines at their core.

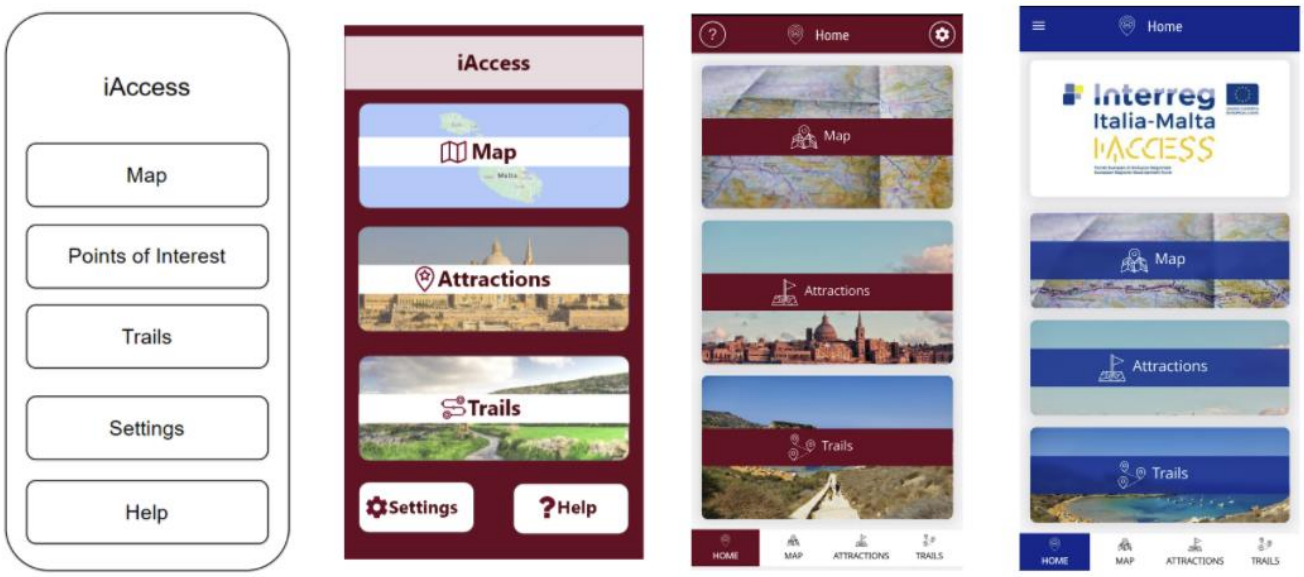


*Figure 2: Evolutionary Design of the Home Screen*

The next step was designing the mid-fidelity designs. Adobe XD was the tool chosen for this part of the design process. While these designs were closer to life than the wireframes, the accessibility guidelines and best practices were still a primary concern during the drawing process. These designs were given to the development team so that they could start building the application. The development team released a series of debug versions for the iAccess application based on the mid fidelity prototype. A subset of these versions were tested for accessibility and the results were used to give constructive feedback to the developers so that the application could be improved.


*Figure 3: Evolutionary Design of the Attractions Listing*

After a series of refinements, the application was ready for release. The iterative development of the debug versions ensures that this final product is accessible and usable to the widest audience possible. It is important to note that other important aspects, such as aesthetics and functionality, were not sacrificed. This version was subject to two different methods of evaluation. First, it was assessed for compliance with WCAG. It was found that the vast majority of the Level A and Level AA success criteria were met. The developers were given a list of fixes to implement so that the remaining few criteria could be met to ensure that the application is accessible to users in most scenarios. This version of iAccess was also evaluated by the director at the Foundation of Information Technology Accessibility (FITA). The expert was given a demonstration of the app and he provided some insight as to how accessibility could be improved. These recommendations were added to the list of fixes which was passed over to the developers. The evaluator stated that most of his recommendations would enhance accessibility but are not crucial, therefore it is up to the designers and developers to see if the

fixes are feasible. Furthermore, the evaluator suggested that the application is tested using various accessibility settings. Any issues identified during these tests were also added to the list of fixes.

## Mobile Application Flow

The developed application aims to showcase attractions in Valletta and Palermo to a general audience, including people with disabilities. Several features within the application have been implemented to help users make efficient use of the application and motivate them to visit the attractions. These will be discussed below, along with the general functionality of the application.

The first time the application is launched after being downloaded, users are asked to set up the application according to their preferences. Users are asked to choose their preferred language, text size and a dark or light theme. These preferences can be changed through the settings screen at a later stage. This process ensures that the application is accessible to people with visual impairments. Upon completing the setup process, the user is redirected to the home screen. If this is not the first time the application is loaded, the user is shown the home screen right after the splash screen. Adaptability is an important design approach in modern applications, particularly targeting the emerging needs of different audiences [8].

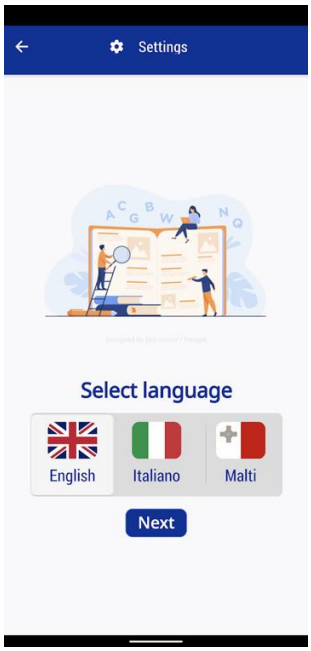


*Figure 4: Choosing the language*

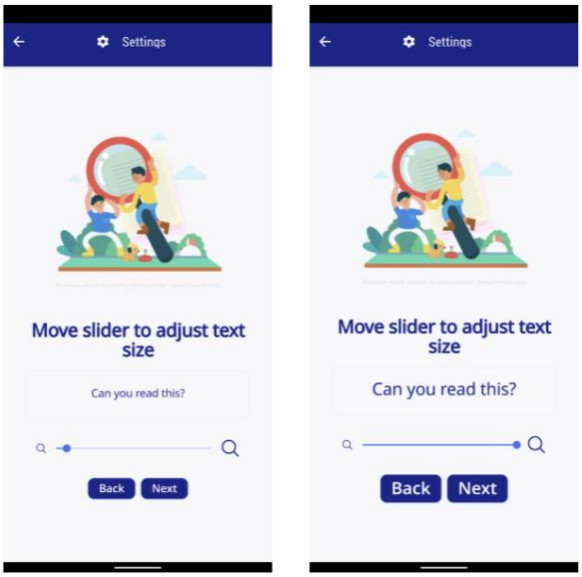


*Figure 5: Choosing the text size*

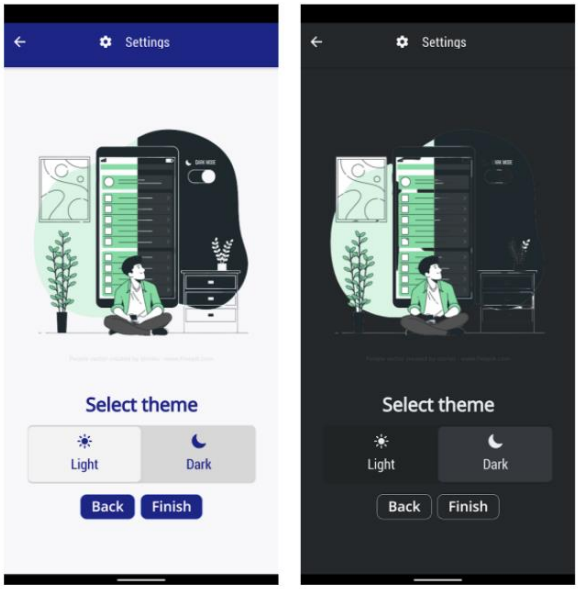


*Figure 6: Choosing the contrast configuration in the mobile app*

From the home screen, users can access all other pages in the application. The main pages can be accessed through the three large buttons displayed in the main section of the screen. These pages are the map, attractions and trails pages. They can be accessed easily from anywhere in the application through the navigation tab. For ease of access, this is statically located at the bottom of the screen. The rest of the pages are accessed from the menu, accessed by the hamburger button at the top left of the screen. In addition to the main pages, the user can access the settings, partners and feedback pages from this menu. A few links to the project website and the language setting have also been included here.

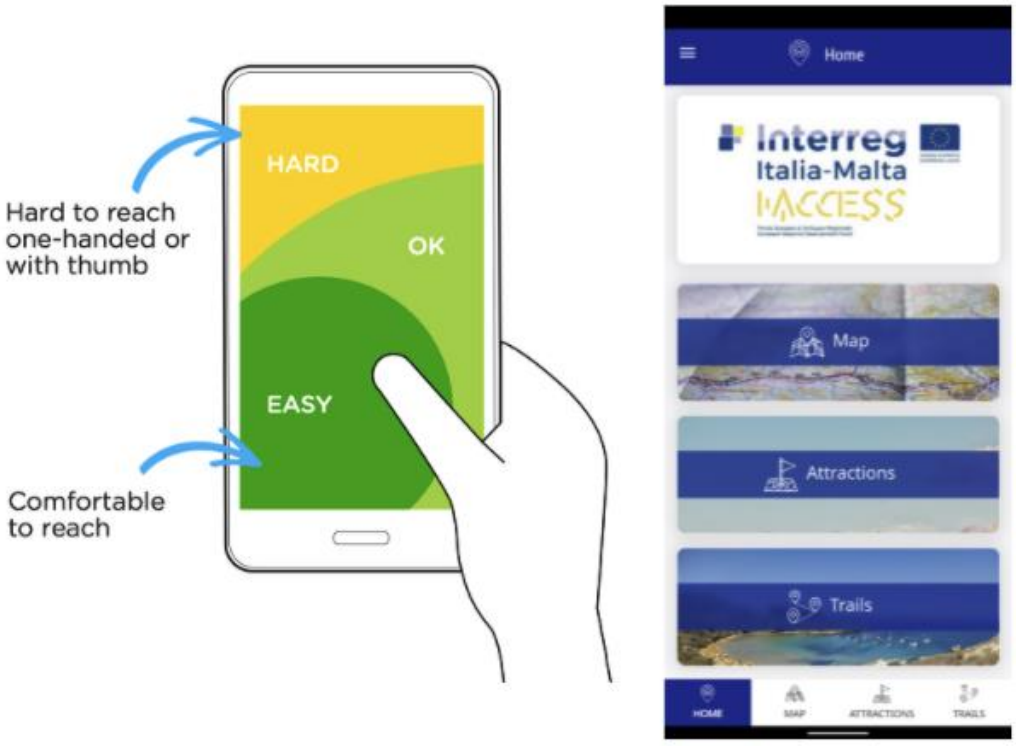


*Figure 7: The Main Screen of the mobile app designed in an accessible layout*

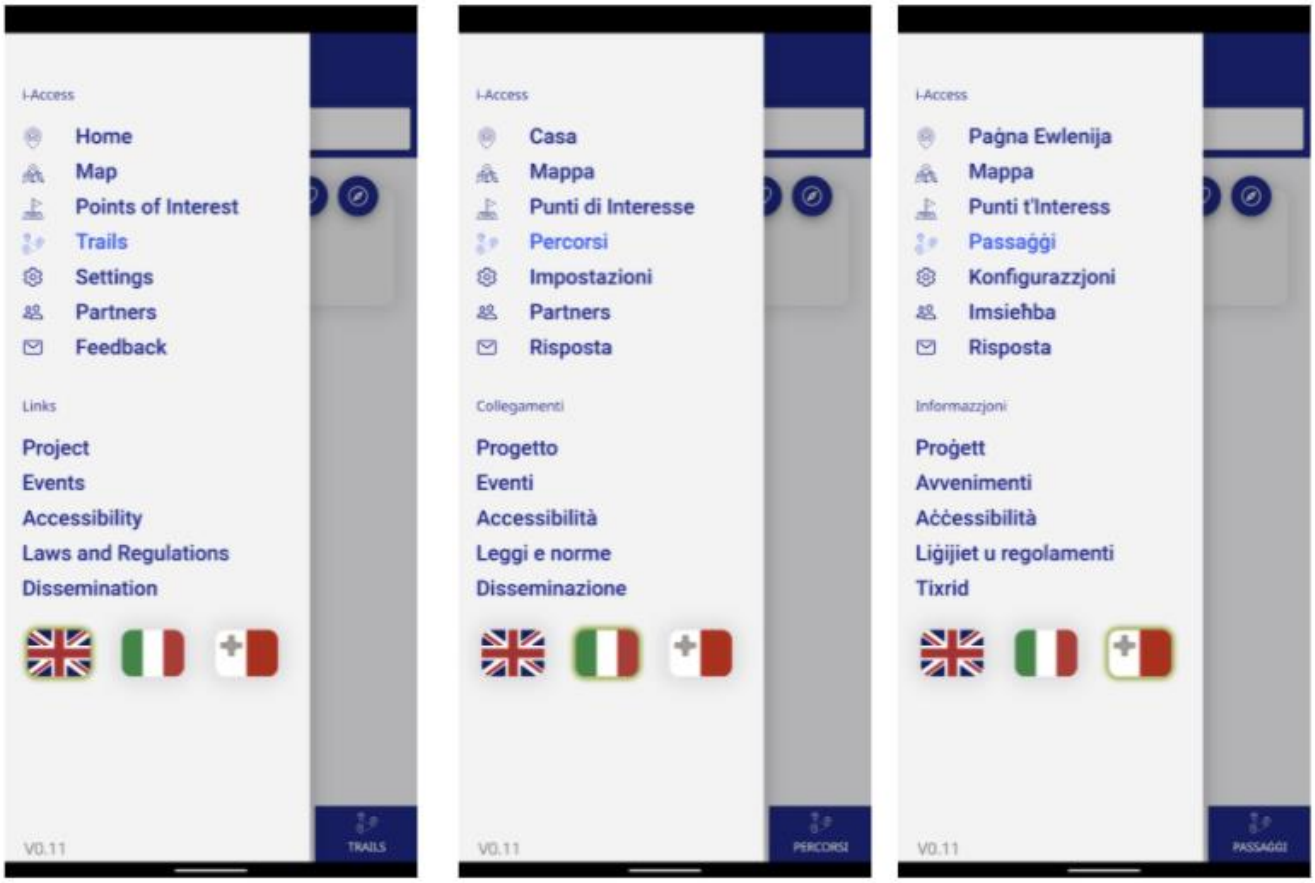


*Figure 8: Side Menu of the mobile app with dynamic changing of language*

The map screen is straightforward as it only shows the map itself and three other buttons. Two of these buttons are located at the top left of the map and locate Valletta or Palermo. The other button is at the bottom left of the map and is used to search for attractions. Users will see their location on the map if they turn on location services and give the application permission to the device's location.

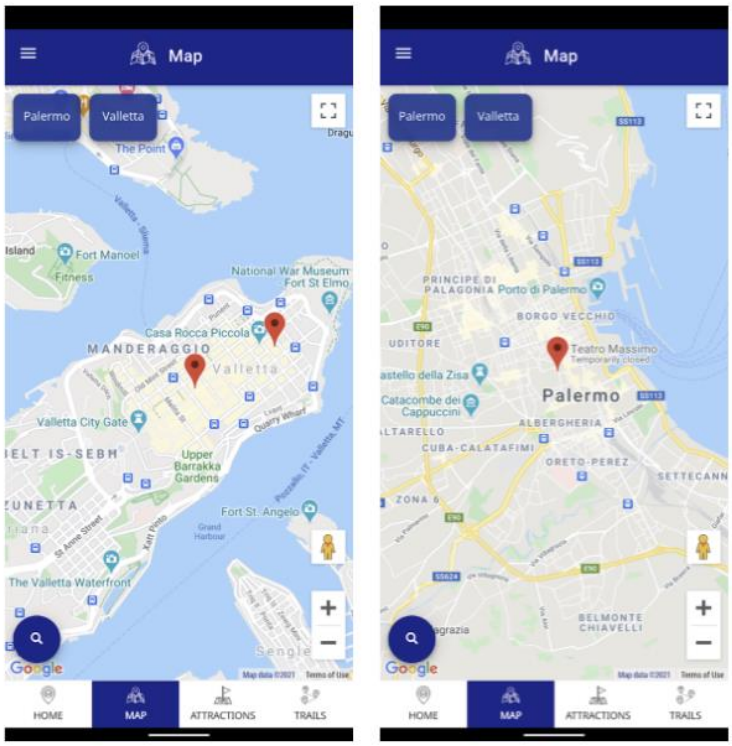


*Figure 9: The map screens in the mobile application*

When the attractions screen is loaded, the user is met with a list of attractions in Valletta and Palermo. For each of these attractions, some basic information is shown along with a photo. Since this application has been designed with the disabled community in mind, the user will find the general level of accessibility for that attraction among this information. Furthermore, the user can tap the compass icon to get directions to the attraction's location and tap the heart icon to like the attraction. The latter feature comes in handy when the user uses the filtering functionality found at the top of the page next to the search bar. The filter function allows the user to see only his liked attractions, those in a particular city or category. When one of the attractions on the screen is tapped, a new screen is shown with more information about the attraction chosen. This layout includes a brief description, opening hours, entrance

fee and a rating out of five stars. The general level of disability is shown once more, and it is broken down into levels of accessibility for people with physical, visual and hearing disabilities individually.

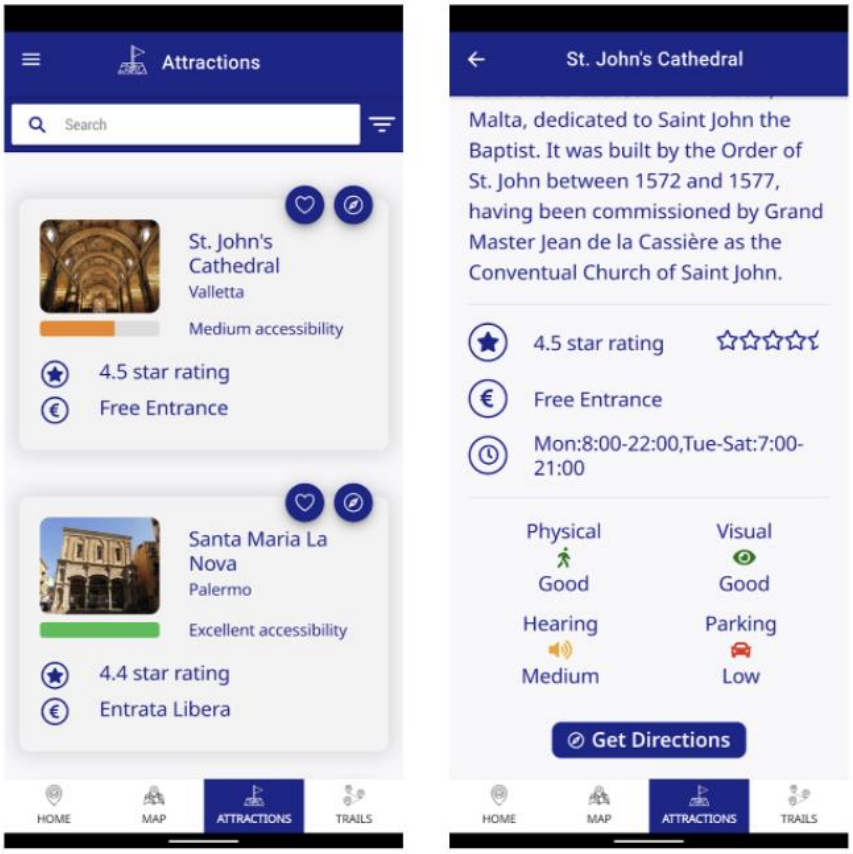


*Figure 10: Listing of points of interests (POIs) in the app*

Similarly, the trails screen shows a list of available trails in Valletta and Palermo. Each trail shown has the same compass and heart icon as for the attractions. When tapping on one of the trails available, the user is presented with a new screen containing information about each stop on the trail.

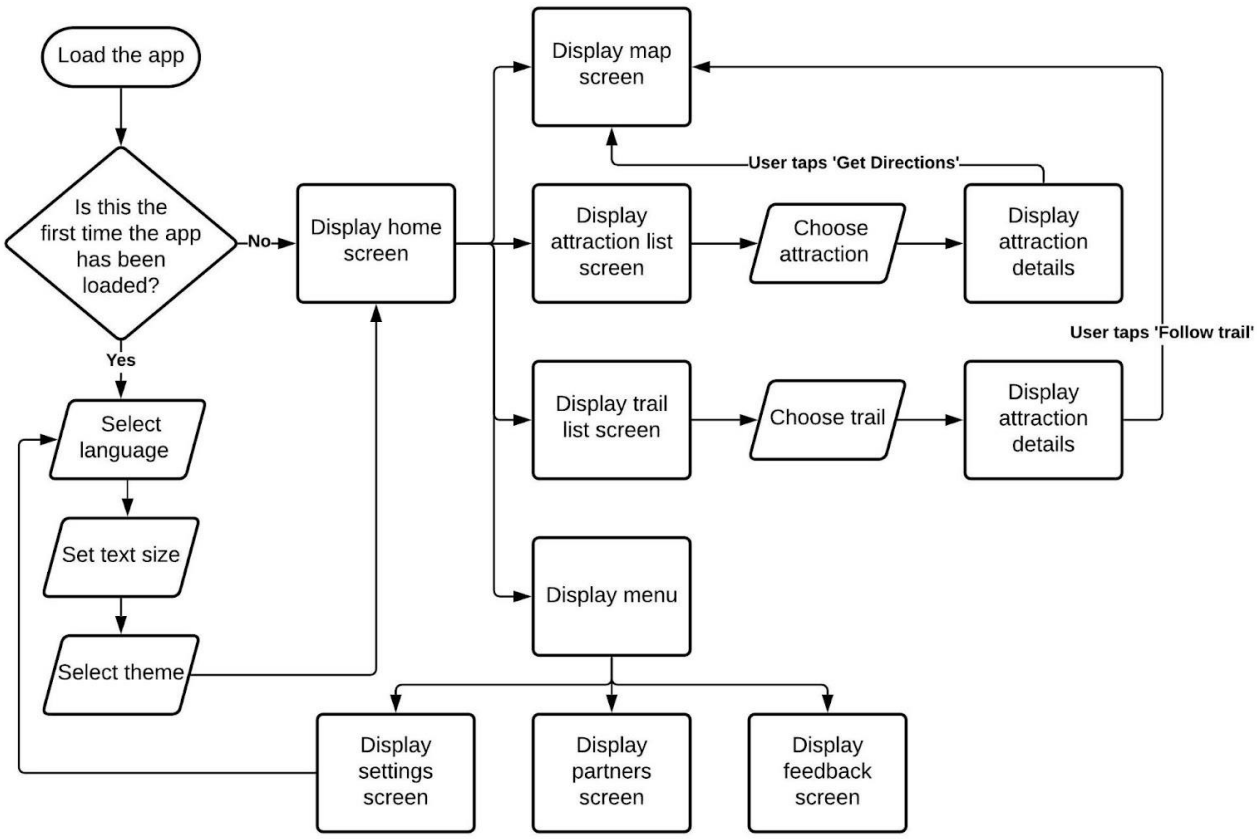


*Figure 11: Mobile Application Interaction Flow*

# Evaluation

This application was created to address the shortcomings of mobile cultural applications. The app was built to be accessible to users with various disabilities to improve usability and achieve its goals. This

section highlights the accessibility considerations taken while building i-Access and how WCAG was applied throughout the application. The relevant subset of the guidelines implemented will be discussed.

## Considerations for the Visually Impaired

One of the primary considerations is the configuration wizard, which has been implemented to guide users to set up the application to cater to their needs. The user encounters this wizard as soon as the app is launched for the first time. This ensures that it is accessible to the user straight away. Since the need to navigate the app and locate the settings page while it is inaccessible to the user has been eliminated, no one should feel discouraged to continue using iAccess. The functionality of the wizard has been discussed above.

People with visual impairments make use of screen readers to traverse applications. A screen reader is an assistive technology that converts the text and elements displayed on screen into speech so that the user is made aware of what is being displayed and, hence, perceive and use the content like any other user [9]. In order for a screen reader to give the best representation of what is being displayed, the HTML needs to be modular and include the appropriate tags and attributes. Various guidelines can assist developers in writing code that is comprehensive to the screen reader and, in turn, understandable to the visually impaired people using it. An example is guideline 2.4.6, which requires that clear and descriptive heading and label tags are used. This guarantees that the content is organised and that components can be understood within their context. The correct use of the heading tags is essential because when users have the screen reader turned on, they can traverse the headings with one gesture. Therefore, if the headings are informative and form a good hierarchy, the user will understand the contents of the page and locate specific information with less effort. Each screen in iAccess has been checked for its use of headings and labels to make sure that this success criterion is fulfilled. Another guideline

aimed to improve users' experience of screen readers is guideline 1.3.6, which states that the elements on a page must have their purpose programmatically determined. This was done by using the appropriate HTML tags for all elements. For instance, using <*button*> for clickable elements. Furthermore, ARIA landmarks, such as *aria-labelled*, *aria-hidden* and *aria-disabled*, were also used to provide further information to the screen reader to provide the clearest perception to screen reader users.

Some other elements which are helpful to users with low vision are highly contrasting colours and adjustable text size. The chosen primary colour is a dark powder blue with a contrast ratio greater than 9:1 when matched with the white and light grey colours used as the foreground of the header and the background of the main section. This confirms that all success criteria in WCAG related to colour contrast have been met.

| Success Criteria | Brief Description | How it was implemented (examples) |
|---|---|---|
| 1.3.5 | The purpose of a form input can be programmatically determined, so that user agents can present this purpose to users | The search input has its type set to search |
| 1.3.6 | The purpose of elements on a page can be programmatically determined, so that user agents can present that purpose to users | Use of ARIA attributes<br>Use of appropriate tags such as <*main*> |
| 1.4.3 | Text has contrast ratio of at least 4.5:1 | The colour scheme chosen produces a contrast ratio of 9:1 between text and its background |
| 1.4.4 | Text can be resized without assistive technology | Users can set the text size from the settings page |
| 1.4.6 | Text has contrast ratio of at least 7:1 | The colour scheme chosen produces a contrast ratio of 9:1 between text and its background |

| | | |
|---|---|---|
| 2.4.6 | Use of descriptive headings and labels such that users can find the information they need easily and the relationships between different parts of the context are clear | The headings are populated with attraction names so that users can quickly find the attraction they are looking for |
| 3.1.1 | The default human language of each web page can be programmatically determined | The html tag of each page includes the *lang* attribute |
| 3.2.3 | Web pages appear in the same order when the same actions are repeated | The sequence of pages is always attractions list to attraction page or trails list to trail page<br>Icons used on different pages will always lead to the same page |

## Considerations for intellectually impaired users

Various guidelines in WCAG make the content easily understandable to all users, including people with intellectual and cognitive disabilities. For instance, guideline 2.4.8 requires that the user's location within the app is clearly defined. To achieve this, the page name and icon are shown in the header and highlighted in the navigation bar in the footer. Another example is guideline 3.2.1, which states that elements on a page must not change when they receive focus. While using iAccess, one will notice that elements remain static when they receive focus.

Additionally, guideline 2.4.5 requires that users are offered different ways of navigation through the application. When using iAccess, the user can change pages through the navigation bar in the footer, and the pop-out menu is displayed when tapping the burger menu icon at the top left corner of the screen. This is also helpful for people with physical disabilities as they can choose which navigation option is most comfortable.

Consistency is advantageous to all users, but it is invaluable for people with intellectual disabilities. Guidelines 3.2.3 and 3.2.4 cater for this, and they require that menus and on-screen components, such as buttons and icons, are used consistently. The footer and the pop-out menu are always available to the user at the exact location on the screen. Furthermore, icons are used consistently throughout the application. Users will notice that the main pages have each been assigned an icon always displayed in front of the page name. In addition to this, the same set of icons are used in the attractions and trails pages to identify the same elements. All buttons in the main section have been styled identically using a blue background and white text to help users identify that they are clickable instead of the rest of the elements with a white background and blue text.

| Success Criteria | Brief Description | How it was implemented (examples) |
|---|---|---|
| 2.3.2 | Web pages do not contain anything that flashes more than three times in any one second period | No flashing elements can be found in the application |
| 2.4.5 | More than one way is available to locate a page within a set of pages | Users can use the pop out menu or the tabs in the footer to navigate to a page |
| 2.4.8 | Information about the user's location within the app is available | The header of each screen shows the page the user is currently on The tab in the footer which corresponds to the page the user is currently on is highlighted |
| 2.5.1 | All functionality that uses multipoint or path-based gestures for operation can be operated with a single pointer without a path-based gesture | The only operations required to use the app are tapping and scrolling with a single finger |
| 3.2.1 | UI components do not change when they receive focus | Actions are only triggered when a clickable component is tapped Styling and context does not change when a component receives focus |

| | | |
|---|---|---|
| 3.2.3 | Web pages appear in the same order when the same actions are repeated | The sequence of pages is always attractions list to attraction page or trails list to trail page<br>Icons used on different pages will always lead to the same page |
| 3.2.4 | Components that have the same functionality are identified consistently | The same styling is used for buttons throughout all pages |

## Considerations for physically impaired users

Some of the guidelines aim to make content accessible to people with physical disabilities. An example of this is guideline 1.4.10, which explains that scrolling should be minimised. I-Access only needs vertical scrolling in some pages where the contents would be cramped otherwise. Any horizontal scrolling has been eliminated. Another example is guideline 2.5.1, which requires that users are presented with alternatives to multipoint or path-based gestures with single pointer actions. All actions required to use iAccess are single pointer actions. This means that all users, including people with motor impairments, will only have to tap and scroll with a single finger when using the app. In conjunction with this, guideline 2.5.2 requires that single pointer actions be cancelled in case of accidental pointer input. This was achieved by having all buttons in the app triggered on the up-event. When a user taps on a button, the related action is triggered when the user releases his finger from the screen within the same target area. If a user taps on a button by accident, he can move his finger out of the target area before release so that the action is not triggered.

| Success Criteria | Brief Description | How it was implemented (examples) |
|---|---|---|
| 1.3.4 | Content can be viewed in both portrait and landscape modes | The app can be viewed in both portrait and landscape without any information being lost |
| 1.4.10 | Pages do not require scrolling in two dimensions | At most, only vertical scrolling is required |
| 2.4.5 | More than one way is available to locate pages | Pages can be opened from the tabs in the footer or the pop-out menu |
| 2.5.1 | All functionality that uses multipoint or path-based gestures for operation can be operated with a single pointer without a path-based gesture | The only operations required to use the app are tapping and scrolling with a single finger |
| 2.5.2 | Single pointer functions (i.e. clicking and tapping) can be cancelled | Actions are only triggered when a user taps and releases his finger within the same target area |
| 3.2.1 | UI components do not change when they receive focus | Actions are only triggered when a clickable component is tapped Styling and context does not change when a component receives focus |

# Conclusion

This article presented the design and development methodology adopted in the development of the I-Access mobile application. International accessibility standards in the use of software were investigated and adopted in the design of this mobile application. The presentation of different historical sites featured in the I-Access project is done through the latest approaches of mobile development methods. The source code of these mobile applications is available on the official website of the I-Access project to facilitate the reuse of the findings of this project.

# References


1. S. Lawton Henry, "Web Content Accessibility Guidelines (WCAG) Overview", Web Accessibility Initiative (WAI), 2005. [Online]. Available: https://www.w3.org/WAI/standards-guidelines/wcag/. [Accessed: 01- May- 2021].
2. W. Chisholm, G. Vanderheiden and I. Jacobs, "Web Content Accessibility Guidelines 1.0", W3.org, 1999. [Online]. Available: https://www.w3.org/TR/WAI-WEBCONTENT/. [Accessed: 01- May- 2021].
3. S. Lawton Henry and J. Green, "Resources for Designers", Web Accessibility Initiative (WAI), 2018. [Online]. Available: https://www.w3.org/WAI/roles/designers/. [Accessed: 01- May- 2021].
4. S. Lawton Henry, "Resources for Developers", Web Accessibility Initiative (WAI), 2018. [Online]. Available: https://www.w3.org/WAI/roles/developers/. [Accessed: 01- May- 2021].
5. A. Kavcic, "Software Accessibility: Recommendations and Guidelines", EUROCON 2005 - The International Conference on "Computer as a Tool", pp. 1024-1027, 2005.
6. A. B. Funka Nu, "Guidelines for the development of accessible mobile interfaces", Riktlinjer för mobilgränssnitt, 2012. Available: https://www.funka.com/contentassets/9131835638b640cf96baf2ef62a2fba4/guidelines_for_the_development_of_accessible_mobile_interfaces.pdf. [Accessed 15 May 2021].
7. D. Seychell and C. J. Debono, "Ranking Regions of Visual Saliency in RGB-D Content," *2018 International Conference on 3D Immersion (IC3D)*, 2018
8. Alexiei Dingli and Dylan Seychell, "*The New Digital Natives - Cutting the Chord*", Springer-Verlag Berlin, March 2015.
9. D. Göransson, "What is a screen reader?", Axess Lab, 2019. [Online]. Available: https://axesslab.com/what-is-a-screen-reader/. [Accessed: 01- May- 2021].

# Appendix:

# iAccess App Accessibility Evaluation

**Martina Gauci & Dylan Seychell**

# Introduction

iAccess is a mobile application that has been developed as a cultural guide to the cities of Valletta and Palermo with a special focus on accessibility. The app provides a list of points of interest in these cities and their accessibility ratings. In order for this application to be useful, it must be usable by people with disabilities.

During development, the application was checked for accessibility at regular intervals. To do this, compliance to WCAG was checked, a website version of the app was inspected by WAVE and experts provided their feedback.

This report will focus on the evaluation of the final version of the application. At this stage, the application is checked for compliance with WCAG in an attempt to verify whether the application is truly accessible. WCAG is broken down into 4 categories: perceivable, operable, understandable and robust. Thirteen guidelines are divided among these categories and each guideline is made up of one or more testable success criteria. Furthermore, each success criteria is assigned one of three compliance levels: level A for basic, level AA for intermediate and level AAA for advanced accessibility.

# Challenges

A few challenges have been encountered while verifying accessibility.

WCAG is a set of guidelines widely regarded as the shared standard for accessibility. However, these are targeted towards web content rather than mobile applications. This implies that some guidelines will be more complicated to apply to a small touchscreen device. W3C, the developers of WCAG, have released some recommendations on how these guidelines can be applied to mobile. Each guideline, compliance and its relevance to mobile applications will be discussed in the next section.

Another challenge is that the evaluator did not have direct access and a comprehensive understanding of the code. Chrome's developer tools were used to view elements of the code when necessary.

For a more faithful evaluation, it is recommended that the application is tested by users. User testing can clearly bring out accessibility hindrances in the application. Due to the pandemic and time restrictions this could not be done. This can still be done in the future and the improvements noted during such an exercise would be implemented in upcoming versions.

# Compliance to WCAG

## Basic Accessibility

The guidelines listed below assure a minimum level of accessibility.

### Guideline 1.1 Text Alternative

#### *Success Criteria 1.1.1 Non text content*

| | |
|---|---|
| Description: | All non-text content that is presented to the user has a text alternative that serves the equivalent purpose |
| Comments: | The alt attribute has been used for images and aria-label has been used for the like and navigation buttons since they do not have labels |
| Compliance: | **Pass** |

## Guideline 1.2 Time-based media

### *Success Criteria 1.2.1 Audio-only and video-only (pre-recorded)*

| | |
|---|---|
| Description: | Provide an alternative time-based media for pre-recorded audio-only and video-only media |
| Comments: | The application does not contain any video or audio content |
| Compliance: | N/A |

### *Success Criterion 1.2.2 Captions (Prerecorded)*

| | |
|---|---|
| Description: | Provide captions for all pre-recorder audio content |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

### *Success Criterion 1.2.3 Audio Description or Media Alternative (Prerecorded)*

| | |
|---|---|
| Description: | An alternative for time-based media or audio description of the prerecorded video content is provided for synchronized media |
| Comments: | The application does not contain such media |
| Compliance: | N/A |

## Guideline 1.3 Adaptable

### *Success Criterion 1.3.1 Info and Relationships*

| | |
|---|---|
| Description: | Information and relationships that are implied by visual or auditory formatting are preserved when the presentation format changes |
| Comments: | The visual structure of the application is very similar to that conveyed by the screen reader |
| Compliance: | **Pass** |

### *Success Criterion 1.3.2 Meaningful Sequence*

| | |
|---|---|
| Description: | Reading order must be preserved when using alternative content presentation |
| Comments: | The visual reading order is identical to that conveyed by the screen reader |
| Compliance: | **Pass** |

### *Success Criterion 1.3.3 Sensory Characteristics*

| | |
|---|---|
| Description: | Instructions provided for understanding and operating content do not rely solely on sensory characteristics of components such as shape, colour, size, visual location, orientation, or sound |
| Comments: | The application is simple, hence, no instructions are provided |

Compliance: N/A

## Guideline 1.4 Distinguishable

### *Success Criterion 1.4.1 Use of Color*

Description: Colour is not used as the only visual means of conveying information

Comments: Colour, icons and location have been used to help users identify elements

Compliance: **Pass**

### *Success Criterion 1.4.2 Audio Control*

Description: If any audio on a web page plays automatically for more than 3 seconds, either a mechanism is available to pause or stop the audio, or a mechanism is available to control audio volume

Comments: The application does not contain audio content

Compliance: N/A

## Guideline 2.1 Keyboard Accessible

### *Success Criterion 2.1.1 Keyboard*

Description: All functionality of the content is operable through a keyboard interface without requiring specific timings for individual keystrokes

Comments: To test this, the website version of the application was traversed using a keyboard and the following issues were identified:

- Filter button is skipped
- Selecting the like icon redirects user to the attraction details screen
- When activating the side menu, the focus remains in the previous screen (i.e. outside of the menu)

Compliance: **Fail**

### *Success Criterion 2.1.2 No Keyboard Trap*

Description: If keyboard focus can be moved to a component of the page using a keyboard interface, then focus can be moved away from that component using only a keyboard interface

Comments: To test this, the website version of the application was traversed using a keyboard and when the side menu was activated, the focus was kept on the elements outside the side menu

Compliance: **Fail**

### *Success Criterion 2.1.4 Character Key Shortcuts*

Description: Keyboard shortcuts can be turned off, remapped or activated only on focus

Comments: The application does not use any keyboard shortcuts

Compliance: N/A

## Guideline 2.2 Enough Time

### *Success Criterion 2.2.1 Timing Adjustable*

Description: Time limits can be turned off, adjusted or extended

Comments: The application does not feature any actions with time limits

Compliance: N/A

### *Success Criterion 2.2.2 Pause, Stop, Hide*

Description: Moving, blinking, scrolling or auto updating information can be stopped, paused or hidden

Comments: The search functionality updates the content automatically but the user can press the ‘x’ in the search bar to go back to the screen’s initial state

Compliance: **Pass**

## Guideline 2.3 Seizures and Physical Reactions

### *Success Criterion 2.3.1 Three Flashes or Below Threshold*

Description: Web pages do not contain anything that flashes more than three times in any one second period

Comments: The application does not contain any flashing components

Compliance: N/A

## Guideline 2.4 Navigable

### *Success Criterion 2.4.1 Bypass Blocks*

Description: A mechanism is available to bypass blocks of content that are repeated on multiple web pages

Comments: The application does not have any blocks of content which are repeated at different screens

Compliance: N/A

### *Success Criterion 2.4.2 Page Titled*

Description: Web pages have titles that describe topic or purpose

Comments: iAccess is a mobile app not a website

Compliance: N/A

### *Success Criterion 2.4.3 Focus Order*

Description: If a web page can be navigated sequentially and the navigation sequences affect meaning or operation, focusable components receive focus in an order that preserves meaning and operability

Compliance: **Pass**

### *Success Criterion 2.4.4 Link Purpose (In Context)*

Description: The purpose of each link can be determined from the link text alone

Compliance: **Pass**

## Guideline 2.5 Input Modalities

### *Success Criterion 2.5.1 Pointer Gestures*

| | |
|---|---|
| Description: | All functionality that uses multipoint or path-based gestures for operation can be operated with a single pointer without a path-based gesture |
| Comments: | The application only requires single taps to operate |
| Compliance: | N/A |

### *Success Criterion 2.5.2 Pointer Cancellation*

| | |
|---|---|
| Description: | For functionality that can be operated using a single pointer, the down-event of the pointer does not execute any part of the function |
| Comments: | This is true for the vast majority of the application, however, there are some issues with the sliders in the configuration wizard but this can easily be undone by selecting the previous choice again |
| Compliance: | **Pass** |

### *Success Criterion 2.5.3 Label in Name*

| | |
|---|---|
| Description: | For user interface components with labels that include text or images of text, the name contains the text that is presented visually |

Comments: Some of the ion-label elements are missing the name attribute but the aria-label is used and when checked with the screen reader turned on, the label was announced as written

Compliance: **Pass**

### *Success Criterion 2.5.4 Motion Actuation*

Description: Functionality that can be operated by device motion or user motion can also be operated by user interface components and responding to the motion can be disabled to prevent accidental actuation

Comments: The application does not contain functions that are triggered by device motion or user motion

Compliance: N/A

## Guideline 3.1 Readable

### *Success Criterion 3.1.1 Language of Page*

Description: The default human language of each web page can be programmatically determined

Compliance: **Pass**

## Guideline 3.2 Predictable

### *Success Criterion 3.2.1 On Focus*

Description: When any user interface component receives focus, it does not initiate a change of context

Compliance: **Pass**

### *Success Criterion 3.2.2 On Input*

Description: Changing the setting of any user interface component does not automatically cause a change of context unless the user has been advised of the behavior before using the component

Comments: The settings screen automatically updates on user input, however, the user is warned at the top of the screen
The displayed content updates instantly when a user is using the search functionality but this is predictable

Compliance: **Pass**

## Guideline 3.3 Input Assistance

### *Success Criterion 3.3.1 Error Identification*

| | |
|---|---|
| Description: | If an input error is automatically detected, the item that is in error is identified and the error is described to the user in text |
| Comments: | The application only takes inputs at the settings screen which are predefined (e.g. radio buttons) and for the search functionality |
| Compliance: | N/A |

### *Success Criterion 3.3.2 Labels or Instructions*

| | |
|---|---|
| Description: | Labels or instructions are provided when content requires user input |
| Comments: | The application does not provide instructions because it is simple to use, however, some help could be added (e.g. explaining the like functionality) |
| Compliance: | **Fail** |

## Guideline 4.1 Compatible

### *Success Criterion 4.1.1 Parsing*

| | |
|---|---|
| Description: | In content implemented using markup languages, elements have complete start and end tags, elements are nested according to their specifications, elements do not contain duplicate attributes, and any IDs are unique, except where the specifications allow these features |
| Comments: | The evaluator did not have access to the code, however, it is assumed that the developers have made these checks |
| Compliance: | Assume that developers have checked for this |

### *Success Criterion 4.1.2 Name, Role, Value*

| | |
|---|---|
| Description: | For all user interface components, the name and role can be programmatically determined; states, properties, and values that can be set by the user can be programmatically set; and notification of changes to these items is available to user agents, including assistive technologies |
| Comments: | The evaluator did not have access to the code |
| Compliance: | Assume that developers have checked for this |

# Intermediate Accessibility

Compliance to this set of guidelines provides sufficient accessibility for most websites.

## Guideline 1.2 Time-based media

### *Success Criterion 1.2.4 Captions (Live)*

| | |
|---|---|
| Description: | Captions are provided for all live audio content in synchronized media |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

### *Success Criterion 1.2.5 Audio Description (Prerecorded)*

| | |
|---|---|
| Description: | Audio description is provided for all prerecorded video content in synchronized media |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

## Guideline 1.3 Adaptable

### *Success Criterion 1.3.4 Orientation*

Description: Content does not restrict its view and operation to a single display orientation, such as portrait or landscape

Comments: The only exception to this is the configuration wizard as it presents some limitations when in landscape mode

Compliance: **Pass**

### *Success Criterion 1.3.5 Identify Input Purpose*

Description: Input fields have the appropriate labels such that user agents can extract and present this to the user

Compliance: **Pass**

## Guideline 1.4 Distinguishable

### *Success Criterion 1.4.3 Contrast (Minimum)*

Description: The visual presentation of text and images of text has a contrast ratio of at least 4.5:1, except for large text, decoration and logotypes

Comments: The contrast between the yellow (#E8CF03) used for the trails page and white used as its foreground is 1:1.57

Compliance: **Fail**

### *Success Criterion 1.4.4 Resize text*

Description: Text can be resized without assistive technology up to 200 percent without loss of content or functionality

Comments: Text can be enlarged to its maximum capacity using both OS settings and in-app settings without losing any functionality

Compliance: **Pass**

### *Success Criterion 1.4.5 Images of Text*

Description: Use text alternatives for images of text

Compliance: **Pass**

### *Success Criterion 1.4.10 Reflow*

Description: Content can be presented without loss of information or functionality, and without requiring scrolling in two dimensions

Compliance: **Pass**

## *Success Criterion 1.4.11 Non-text Contrast*

| | |
|---|---|
| Description: | The visual presentation of the user interface components and graphical objects have a contrast ratio of at least 3:1 against adjacent colour(s) |
| Comments: | The contrast between the yellow (#E8CF03) used for the trails screen and white used in the search text box is 1:1.57 |
| Compliance: | **Fail** |

## *Success Criterion 1.4.12 Text Spacing*

| | |
|---|---|
| Description: | No loss of content or functionality occurs by setting line height to 1.5, paragraph spacing to twice the font size, letter spacing to 0.12 times the font size and word spacing to 0.16 times the font size |
| Compliance: | **Pass** |

## *Success Criterion 1.4.13 Content on Hover or Focus*

| | |
|---|---|
| Description: | Content which becomes visible or hidden when receiving pointer hover or keyboard focus is dismissible, hoverable and persistent |
| Comments: | There are no changes in the user interface when a user puts his finger on any element of the screen |
| Compliance: | **Pass** |

## Guideline 2.4 Navigable

### *Success Criterion 2.4.5 Multiple Ways*

| | |
|---|---|
| Description: | More than one way is available to locate a web page within a set of web pages except where the web page is the result of, or a step in, a process |
| Comments: | Users can use the side menu or the navigation tabs at the bottom of the screen |
| Compliance: | **Pass** |

### *Success Criterion 2.4.6 Headings and Labels*

| | |
|---|---|
| Description: | Headings and labels describe topic or purpose |
| Comments: | Each attraction's title is enclosed in the h1 tag and the attractions details (i.e. general info and accessible info) are under the h2 tag<br>N.B. The evaluator does not have access to the code, the above has been extracted from Chrome Dev Tools |
| Compliance: | **Pass** |

### *Success Criterion 2.4.7 Focus Visible*

| | |
|---|---|
| Description: | Any keyboard operable user interface has a mode of operation where the keyboard focus indicator is visible |

Comments: To test this, the website version of the application was traversed using a keyboard and it was found that some elements are not highlighted when focused on

Compliance: **Fail**

## Guideline 3.1 Readable

### *Success Criterion 3.1.2 Language of Parts*

Description: The human language of each passage or phrase in the content can be programmatically determined

Comments: The language attribute is not set for text in a different language but it would be difficult to set the language of a part which is dynamically load through API

Compliance: **Fail**

## Guideline 3.2 Predictable

### *Success Criterion 3.2.3 Consistent Navigation*

Description: Navigational mechanisms that are repeated on multiple web pages within a set of web pages occur in the same relative order each time they are repeated

Compliance: **Pass**

### *Success Criterion 3.2.4 Consistent Identification*

| | |
|---|---|
| Description: | Components that have the same functionality within a set of web pages are identified consistently |
| Compliance: | **Pass** |

## Guideline 3.3 Input Assistance

### *Success Criterion 3.3.3 Error Suggestion*

| | |
|---|---|
| Description: | If an input error is automatically detected and suggestions for correction are known, then the suggestions are provided to the user |
| Comments: | The application only takes inputs at the settings screen which are predefined (e.g. radio buttons) and for the search functionality |
| Compliance: | N/A |

### *Success Criterion 3.3.4 Error Prevention (Legal, Financial, Data)*

| | |
|---|---|
| Description: | The user is able to reverse, check or confirm submissions of financial or legal data |
| Comments: | The application does not require the user to input legal or financial data |
| Compliance: | N/A |

## Guideline 4.1 Compatible

### *Success Criterion 4.1.3 Status Messages*

| | |
|---|---|
| Description: | In content implemented using markup languages, status messages can be programmatically determined through role |
| Comments: | When location services are disabled a popup is displayed on the map screen and the role attribute is set |
| Compliance: | **Pass** |

# Advanced Accessibility

The guidelines in this category are not required by most sites and may need to be applied for some content.

## Guideline 1.2 Time-based media

### *Success Criterion 1.2.6 Sign Language (Prerecorded)*

| | |
|---|---|
| Description: | Sign language interpretation is provided for all prerecorded audio content in synchronized media |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

### *Success Criterion 1.2.7 Extended Audio Description (Prerecorded)*

| | |
|---|---|
| Description: | Extended audio description is provided for all prerecorded video content in synchronized media |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

### *Success Criterion 1.2.8 Media Alternative (Prerecorded)*

| | |
|---|---|
| Description: | An alternative for time-based media is provided for all prerecorded synchronized media and for all prerecorded video-only media |
| Comments: | The application does not contain video content |
| Compliance: | N/A |

### *Success Criterion 1.2.9 Audio-only (Live)*

| | |
|---|---|
| Description: | An alternative for time-based media that presents equivalent information for live audio-only content is provided |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

## Guideline 1.3 Adaptable

### *Success Criterion 1.3.6 Identify Purpose*

| | |
|---|---|
| Description: | The purpose of User Interface Components, icons, and regions can be programmatically determined |
| Comments: | Flags in the side menu and the like and navigation buttons in the attractions list screen are not using the button tags, hence, the screen reader does not present them as clickable elements |
| Compliance: | **Fail** |

## Guideline 1.4 Distinguishable

### *Success Criterion 1.4.6 Contrast (Enhanced)*

| | |
|---|---|
| Description: | The visual presentation of text and images of text has a contrast ratio of at least 7:1 |
| Comments: | The contrast between the yellow (#E8CF03) used for the trails screen and white used as its foreground is 1:1.57 |
| Compliance: | **Fail** |

### *Success Criterion 1.4.7 Low or No Background Audio*

| | |
|---|---|
| Description: | Any non-speech sounds are low enough that a user who is hard of hearing can separate the speech from background sounds or other noise foreground speech content |
| Comments: | The application does not contain audio content |
| Compliance: | N/A |

### *Success Criterion 1.4.8 Visual Presentation*

| | |
|---|---|
| Description: | Visual presentation of blocks of text can be altered by the user |
| Comments: | The settings screen gives the user some control over the visual presentation |
| Compliance: | **Pass** |

### *Success Criterion 1.4.9 Images of Text (No Exception)*

| | |
|---|---|
| Description: | Images of text are only used for pure decoration or where a particular presentation of text is essential to the information being conveyed |
| Comments: | Logos are the only images of text used in the application and alt text is provided for these |
| Compliance: | **Pass** |

## Guideline 2.1 Keyboard Accessible

### *Success Criterion 2.1.3 Keyboard (No Exception)*

Description: All functionality of the content is operable through a keyboard interface without requiring specific timings for individual keystrokes

Comments: To test this, the website version of the application was traversed using a keyboard and the following issues were identified:

- Filter button is skipped
- Selecting the like icon redirects user to the attraction details screen
- When activating the side menu, the focus remains in the previous screen (i.e. outside of the menu)

Compliance: **Fail**

## Guideline 2.2 Enough Time

### *Success Criterion 2.2.3 No Timing*

Description: Timing is not an essential part of the event or activity presented by the content

Compliance: **Pass**

### *Success Criterion 2.2.4 Interruptions*

| | |
|---|---|
| Description: | Interruptions can be postponed or suppressed by the user, except interruptions involving an emergency |
| Comments: | The only interruption in this application is a pop up shown when going to the map screen with location services turned off, however this can be easily dismissed by tapping ‘OK’ or anywhere outside the popup |
| Compliance: | **Pass** |

### *Success Criterion 2.2.5 Re-authenticating*

| | |
|---|---|
| Description: | When an authenticated session expires, the user can continue the activity without loss of data after re-authenticating |
| Comments: | The application does not require logging in |
| Compliance: | N/A |

### *Success Criterion 2.2.6 Timeouts*

| | |
|---|---|
| Description: | Users are warned of the duration of any user inactivity that could cause data loss |
| Comments: | The application does not store any data |
| Compliance: | N/A |

## Guideline 2.3 Seizures and Physical Reactions

### *Success Criterion 2.3.2 Three Flashes*

| | |
|---|---|
| Description: | Web pages do not contain anything that flashes more than three times in any one second period |
| Comments: | The application does not contain any flashing components |
| Compliance: | N/A |

### *Success Criterion 2.3.3 Animation from Interactions*

| | |
|---|---|
| Description: | Motion animation triggered by interaction can be disabled |
| Comments: | The application does not contain any motion animation |
| Compliance: | N/A |

## Guideline 2.4 Navigable

### *Success Criterion 2.4.8 Location*

| | |
|---|---|
| Description: | Information about the user's location within a set of web pages is available |
| Comments: | The topmost area of the screen is used to display the title of the screen |
| Compliance: | **Pass** |

### *Success Criterion 2.4.9 Link Purpose (Link Only)*

| | |
|---|---|
| Description: | A mechanism is available to allow the purpose of each link to be identified from link text alone |
| Compliance: | **Pass** |

### *Success Criterion 2.4.10 Section Headings*

| | |
|---|---|
| Description: | Section headings are used to organize the content |
| Compliance: | **Pass** |

## Guideline 2.5 Input Modalities

### *Success Criterion 2.5.5 Target Size*

| | |
|---|---|
| Description: | The size of the target for pointer inputs is at least 44 by 44 CSS pixels |
| Comments: | Since these guidelines are aimed at web content displayed on larger devices it would be difficult to meet this criteria, however, only few elements fail this criteria which are the like and navigation buttons (40 by 40) and the filter button (29 by 32) |
| Compliance: | **Fail** |

### *Success Criterion 2.5.6 Concurrent Input Mechanisms*

| | |
|---|---|
| Description: | People can use and switch between different modes of input when interacting with web content |
| Comments: | The evaluator did not have the tools to test this |
| Compliance: | N/A |

## Guideline 3.1 Readable

### *Success Criterion 3.1.3 Unusual Words*

| | |
|---|---|
| Description: | A mechanism is available for identifying specific definitions of words or phrases used in an unusual or restricted way, including idioms and jargon. |
| Comments: | This criteria could not be tested because the application is populated with dummy date, however, due to the nature of the application, the text should be simple |
| Compliance: | N/A |

### *Success Criterion 3.1.4 Abbreviations*

| | |
|---|---|
| Description: | A mechanism for identifying the expanded form or meaning of abbreviations is available |

Comments: This criteria could not be tested because the application is populated with dummy date, however, due to the nature of the application, the text should not include abbreviations

Compliance: N/A

### *Success Criterion 3.1.5 Reading Level*

Description: When text requires reading ability more advanced than the lower secondary education level supplemental content, or a version that does not require reading ability more advanced than the lower secondary education level, is available.

Comments: This criteria could not be tested because the application is populated with dummy date, however, due to the nature of the application, the text should be simple

Compliance: N/A

### *Success Criterion 3.1.6 Pronunciation*

Description: A mechanism is available for identifying specific pronunciation of words

Comments: This mechanism would be helpful for the pronunciation of the attraction names

Compliance: **Fail**

## Guideline 3.2 Predictable

### *Success Criterion 3.2.5 Change on Request*

Description: Changes of context are initiated only by user request or a mechanism is available to turn off such changes

Compliance: **Pass**

## Guideline 3.3 Input Assistance

### *Success Criterion 3.3.5 Help*

Description: Context-sensitive help is available

Compliance: **Fail**

### *Success Criterion 3.3.6 Error Prevention (All)*

Description: Any data submitted can be reversed, checked or confirmed

Comments: The application only takes inputs at the settings screen which are predefined (e.g. radio buttons) where the user can undo by choosing the previous option and for the search functionality which can be canceled by tapping the ‘x’

Compliance: **Pass**

# Conclusion

Of the 78 success criteria listed in the latest version of WCAG, 46 could be applied to the iAccess mobile application. Guidelines 4.1.1 and 4.1.2 could not be checked as the evaluator did not have the entire code for the application. The table below shows the number of success criteria met at each level of compliance for the applicable guidelines. For details regarding why a particular criteria failed, refer to the Compliance to WCAG section.

| | Level A | Level AA | Level AAA |
|---|---|---|---|
| Pass | 12 | 12 | 9 |
| Fail | 3 | 4 | 6 |

# Additional notes

While using the application with the screen reader turned on the below issues were noticed. These should be addressed in future releases.

- The language flags in the side menu are not clickable items
- The slider in the configuration wizard does not announce the option (e.g. when choosing the theme, dark and light are not announced)

- Each attraction in the list of attractions groups together the title, details, like button and navigation button which makes it impossible for a blind user to press the like or navigation button

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End of Report

Dated 10th October 2021

| | |
|---|---|
| _____ | _____ |
| Dylan Seychell | Anna-Maria Dingil |
| Director | Director |